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From OIE standards to responsible and prudent use of antimicrobials: supporting stewardship for the use of antimicrobial agents in animals

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The global action plan (GAP) on antimicrobial resistance (AMR) advocated the development of national action plans on AMR and the implementation of plans aimed at preventing, combating and monitoring AMR. The World Organisation for Animal Health (OIE)'s strategy on AMR and the prudent use of antimicrobials is aligned with the GAP and recognizes the importance of a One Health approach. This paper reviews the goals, tools and strategies that the OIE has in place to support its Members, envisioning an increased awareness of them and ultimately an increased implementation of the OIE standards. The OIE standards are endorsed by vote of all the 182 Members and are recognized by the World Trade Organization (WTO). The OIE List of Antimicrobial Agents of Veterinary Importance, which includes specific recommendations on the use of antimicrobial agents, is also of particular importance for antimicrobial stewardship. OIE's antimicrobial use (AMU) data collection started in 2015 and has been developed in particular to measure trends in AMU. An annual report is published as an output of this data collection. An AMU IT database system is being developed. The OIE provides assistance to its 182 Members to strengthen the implementation of OIE standards via its support of good governance, the Performance of Veterinary Services (PVS) Pathway, PVS Veterinary Legislation Support Program and training of veterinarians and veterinary paraprofessionals. In parallel, the OIE Observatory is a recent initiative, specifically targeting the monitoring of the implementation of the OIE standards. Cooperation agreements between the OIE and intergovernmental organizations and non-governmental organizations are instrumental for the increase of the dissemination and implementation of the OIE standards and guidelines.

1. Introduction

In the framework of the global action plan on antimicrobial resistance (GAP) adopted in 2015, all countries, through the decisions of the WHO World Health Assembly, the FAO Conference and the World Assembly of OIE Delegates, agreed to support the development of national action plans (NAPs) on antimicrobial resistance (AMR) in line with the GAP and to implement policies and plans aimed at preventing, combating and monitoring AMR.[1–3]

Harmonization, through the implementation of international standards, provides a common approach[4] and a point of reference for more consistent development and decision-making,[5] and enables reporting on progress while achieving the objectives of the GAP.

While recognizing the importance of and need for animal disease prevention, the focus of this paper is on the World Organisation for Animal Health (OIE) support for implementation of stewardship by Members regarding the responsible and prudent use of antimicrobials. It was written as part of the authors' routine work with the purpose of describing a summary of the standards, tools and activities that the OIE makes available for its Members regarding AMR and antimicrobial use (AMU). The overall goal is to provide a higher awareness of them, and ultimately an increased implementation of the OIE AMR/AMU standards, envisioning a better stewardship of antimicrobials, as a common global good.

The activities and outputs of international organizations are sometimes not well known by different stakeholders. To counteract this, our paper outlines the OIE AMR/AMU standards, what they mean and how they can support Members to quantify their AMU and control AMR. It then provides a brief explanation on how the OIE evaluates the performance of veterinary services. The final sections focus on the OIE Observatory (on the implementation of the standards), and finally on the OIE List of Antimicrobial Agents of Veterinary Importance, and its recommendations—important stewardship guidance. The final section features some of the positive consequences that can take place

when standards are implemented, namely an increased granularity of AMU data and legislative changes.

1.1 OIE international standards to control AMR

The OIE international standards provide, among other goals, a framework for responsible and prudent use of antimicrobial products in animals and for the surveillance and monitoring of the quantities used.

The OIE international standards are, once adopted by the 182 Members, published in the 'Terrestrial Animal Health Code'[6] (Terrestrial Code), the 'Aquatic Animal Health Code'[7] (Aquatic Code), the 'Manual of Diagnostic Tests and Vaccines for Terrestrial Animals'[8] (Terrestrial Manual) and the 'Manual of Diagnostic Tests for Aquatic Animals'[9] (Aquatic Manual).

Chapters 6.8 to 6.11 of the Terrestrial Code and Chapters 6.2 to 6.5 of the Aquatic Code provide methodologies for OIE Members to appropriately address the emergence and spread of resistant bacteria from the use of antimicrobial agents in animals and to contain AMR through controlling the use of antimicrobial agents.

1.2 Implementation of OIE international standards and guidelines: a crucial step

Standards, in this case OIE standards, are only as useful as they are implemented. Veterinary Services (either private or public) are instrumental for the implementation of the OIE standards. Section 3 of the Terrestrial Code and Aquatic Code includes standards on the quality of Veterinary Services and aquatic animal health services. In particular, Chapter 3.4 of the Terrestrial Code provides recommendations on veterinary legislation that is prerequisite to support good governance and provide the legal framework for all key activities.

The implementation of OIE international standards relevant to the control of AMR requires good governance and national legislation that should provide a clear distribution of roles and responsibilities between the Competent Authorities and the other key players in the sector, i.e. the veterinary pharmaceutical industry, wholesale and retail distributors, pharmacists, veterinarians, food animal producers and animal feed manufacturers. This national legislation should also provide the basis for Competent Authorities to develop sanitary measures as defined in the Codes.

According to the implementation of OIE international standards, OIE Members are encouraged to develop national AMR surveillance programmes. Surveillance/monitoring of AMR and AMU are important sources of information that can be used for the assessment and management of risks related to AMR.[10–14] Toward standardization of surveillance and monitoring data worldwide, the OIE developed standards on monitoring of the quantities and usage patterns of antimicrobial agents used in food producing animals in Chapter 6.9 of the Terrestrial Code and Chapter 6.3 of the Aquatic Code.

In addition, the 'OIE List of Antimicrobial Agents of Veterinary Importance',[15] a guideline document, includes recommendations for the restriction of use to preserve the efficiency of antimicrobials essential to preserve human and animal health.

Section 2.3 of this paper focus in more detail on this topic of implementation of standards, presenting the Observatory, a recent OIE initiative.

2. Stewardship support

2.1 Monitoring of the quantities and usage patterns of antimicrobial agents used in animals: AMU data collection

In line with the GAP, the OIE is leading AMU data collection in animals, at the global level.

The OIE ad hoc Group on Antimicrobial Resistance developed a template for harmonized AMU data collection in animals, in accordance with Chapter 6.9 of the Terrestrial Code (monitoring of the quantities and usage patterns of antimicrobial agents used in food-producing animals) and with Chapter 6.3 of the Aquatic Code (monitoring of the quantities and usage patterns of antimicrobial agents used in aquatic animals).

Each year in September, a template and accompanying guidance documents are sent to all 182 OIE Members[16–18] and selected non-OIE Members that requested to be part of the global AMU data collection. Data are received and checked for completeness until mid-May of the following year.

The template can be answered by any country and collects general information on topics including the use of antimicrobials as growth promoters and any barriers to reporting quantitative data on antimicrobial agents used in animals.

This general information is useful for guiding discussion on overcoming barriers during training seminars of National Focal Points for Veterinary Products (those who most frequently complete the OIE template) and increasing availability of quantitative data in the future. This information reflects challenges in NAP implementation that can also be assessed using the OIE Performance of Veterinary Services (PVS) Pathway evaluation, explained later in this paper. The barriers highlighted by responding countries are grouped into five main categories (lack of regulatory framework; lack of coordination/cooperation between national authorities and with private sector; lack of tools and human resources; insufficient regulatory enforcement; and circumstances that prevent monitoring antimicrobial agents).

For countries able to provide quantitative data on antimicrobial agents intended for use in animals, information relevant to the data collection such as data sources, year, animal species covered and national reports available online are gathered. Currently, countries report data mainly from sales or imports of antimicrobial agents considering the OIE List of Antimicrobial Agents of Veterinary Importance, which prioritizes antimicrobials critical to maintaining the health and welfare of animals worldwide.

The actual quantities of antimicrobial agents intended for use in animals are reported by antimicrobial class/subclass level through different levels of specificity: reporting options 1, 2 and 3. The three reporting options represent increasing levels of detail of quantitative data on antimicrobial classes intended for use in animals, with the possibility of separating amounts reported by type of use (veterinary medical use, which includes use to treat, control or prevent disease; and non-veterinary medical use, which includes use for growth promotion), animal groups (terrestrial food-producing, aquatic food-producing or companion) and routes of administration (oral, parenteral and others).

The OIE reviews all reported information and systematically comes back to responding countries to clarify some issues and to strengthen the analysis of the data provided.

Whenever possible, the data reported by countries are checked by the OIE against existing reference sources, using the previous year's reported data and/or national reports available online.

Once countries submit their data, the OIE ensures that the following components are validated with the countries (communication occurs through e-mail exchanges, phone calls or videoconferences):

- Data sources: the OIE engages with countries where data duplication or over-estimation is considered to be a risk. The OIE highlights its concerns and clarifies with the country the data collection procedure. The OIE works closely with the countries to understand their systems and to support them to address limitations in their data.
- Data coverage: all countries are asked to estimate the extent to which their data represent overall quantities of antimicrobial agents intended for use in animals and to identify inaccessible quantities. The figures provided by the countries are interpreted with caution, as data coverage estimations are made subjectively by each country. When necessary, the OIE provides countries with data visualization tools or interacts with them in order to reduce subjective estimations.
- Animal groups: for OIE AMU data collection purposes, the animal groups are (i) terrestrial food-producing animals; (ii) aquatic food-producing animals; and (iii) companion animals. The OIE makes sure that the three groups are covered, reminding countries that veterinary products for aquaculture should be also covered.
- Trends over time: in the countries with high percentages of unexplained change (>25%) from one year to another, the OIE inquires how the calculations to obtain kilograms of antimicrobial agents are carried out. Through this process, errors in the calculations have been discovered where countries did not follow or misinterpreted the procedure provided by the OIE.
- Calculations of kilograms of active ingredients: the OIE developed and piloted a tool to assist countries that have difficulties in performing calculations to obtain kilograms of active ingredients or that do not have an IT system to perform automatic calculations. The tool takes into account the different rules when reporting to the OIE: it includes different units of measurement (mg, g, mL, IU, etc.), provides conversion factors, identifies the product data (e.g. molecule names, purpose of use, target animals and routes of administration as declared on the product label) and allocates them under the different antimicrobial classes of the OIE reporting options 1, 2 and 3. While using the tool for the first time, most of the countries realized that errors had occurred in the past. The tool also provides tables and graphs that countries use for different activities at national level.

When the responses of each round have been validated, the OIE proceeds with analysis toward preparation of the annual report. The amounts of antimicrobials sold/used are calculated by country, by region, by animal groups, type of use, and pharmaceutical forms.

As all the countries do not provide the same level of detail, some calculations are done on only a part of the countries providing quantitative data.

To compare the quantitative data reported on antimicrobial agents intended for use in animals between regions and over time, an indicator is necessary to evaluate these data in the context of the relevant animal populations, which may vary in size and composition. This analysis is achieved by adjusting the quantity of antimicrobial agents reported by the countries (mg) with an animal biomass denominator (kg).

While several methodologies have been developed for the calculation of animal biomass, none could be directly used for the OIE global database on antimicrobial agents intended for use in animals. The OIE animal biomass methodology was developed with the goal of best representing animal biomass in all OIE regions, with different animal populations and production systems, and data collection systems, using the data available at the international level, mainly the OIE World Animal Health Information System (WAHIS) and the UN Food and Agriculture Organization Statistics (FAOSTAT).

Animal biomass is calculated as the total weight of the live domestic animals in a given population present during a specific year, used as a proxy to represent those likely exposed to the quantities of antimicrobial agents reported by the countries. The methodology for the animal biomass calculation was developed with the support and validation of the OIE ad hoc Group on Antimicrobial Resistance and shared with countries as well as being published as an article in *Frontiers in Veterinary Science* in September 2019.[19]

2.2 Strengthening the performance of veterinary services: the OIE PVS Pathway

The OIE has developed the PVS Pathway, a voluntary assessment and capacity-building programme for the sustainable improvement of national veterinary services, based on OIE international standards. The PVS Pathway is comprised of several components organized in a four-stage cycle[20] of orientation, evaluation, planning and targeted support. Among these components, the PVS Evaluation and the Veterinary Legislation Support Programme (VLSP—a component of targeted support), have recently been enriched with a view to playing a key role in reinforcing the scope of OIE standards for the responsible and prudent use of antimicrobials.

2.2.1 PVS Evaluations

PVS Evaluations[21] are structured around a methodology assessing 45 critical competencies presented in the PVS Tool[22] and based on Chapters 3.1 and 3.2 of the OIE Terrestrial Code[23] on the quality of veterinary services.

To address the growing AMR global concern, a dedicated critical competency on AMR/AMU, developed by an OIE ad hoc Group (2018), was added in the seventh edition of the PVS Tool (2019). This new critical competency (CC II-9) assesses 'the authority and capability of the Veterinary Services to manage AMR and AMU, and to undertake surveillance and control of the development and spread of AMR pathogens in animal production and animal origin food products, via a One Health approach'. There are five levels of advancement from no or limited capacity to manage AMR to full capacity. Since August 2018 (including the piloting phase of this seventh edition), countries hosting a PVS Evaluation mission (initial or follow-up) have received this

assessment along with specific recommendations. And a second edition (under preparation) of the OIE PVS Tool-Aquatic will add a similar new critical competency, applicable to aquatic animal health services. In addition, through other critical competencies, PVS Evaluations assess AMR-relevant technical competencies such as regulation of veterinary medicinal products, microbial surveillance and intersectoral collaboration: e.g. PVS Evaluations, conducted in 137 OIE Member countries since the PVS Pathway birth (2007), show that almost three-quarters of assessed countries cannot regulate veterinary products or have only some capacity to exercise regulatory control (24% and 47% of countries, respectively).

In a subsequent ad hoc Group (2019), major updates to Chapters 3.1 and 3.2 of the OIE Terrestrial Code were proposed to the OIE Code Commission and circulated for comments from OIE Members. The proposed revised chapters were adopted by the Assembly of OIE Delegates in May 2021 and include specific guidance on the regulation of veterinary medicinal products, including on the monitoring of AMU and AMR and management of related risks.

2.2.2 PVS Veterinary Legislation Support Programme (VLSP)

Legislation is a fundamental structural block when it comes to the antimicrobial stewardship efforts in any country, and it is the focus of the PVS VLSP.[24]

The VLSP is centred on Chapter 3.4 on veterinary legislation of the OIE Terrestrial Code (for the purposes of the code, veterinary legislation comprises all legal instruments necessary for the governance of the veterinary domain). The objectives of this programme are to obtain a detailed picture of veterinary legislation in a country, develop recommendations for legislation reform and modernize OIE Members' veterinary legislation.

The VLSP standard methodology has always addressed AMR-relevant legislation, systematically assessing e.g. legislation on regulation of veterinary medicinal products and food safety. An analysis conducted in 2018 on VLSP mission reports showed that more than one-third of them explicitly identify weaknesses regarding AMR and/or antibiotics—and even when reports do not include such explicit mention, most of them identify weaknesses that may have an impact on AMR, in particular gaps in the legislation governing: (i) veterinary medicinal products; (ii) clear identification, as well as appropriate expertise, responsibilities and powers of the Competent Authority for these products; (iii) withdrawal times and maximum residue limits; and (iv) the veterinary profession (in particular a lack of legislation requiring that antimicrobials used in animals be administered by a veterinarian, or under the supervision of a veterinarian, or by another authorized person).

From 2019, the VLSP undertook additional efforts to strengthen the focus on legislation relevant for AMR. Updates of Chapter 3.4, notably referring to OIE recommendations for controlling AMR that appear in Chapters 6.7 to 6.11, were adopted by the Assembly of OIE Delegates in May 2021. Further, in the context of the Tripartite collaboration on mitigation of AMR, the OIE VLSP: (i) provided inputs to the FAO Methodology to analyse AMR-relevant legislation in the food and agriculture sector; and (ii) developed a new questionnaire aiming to assess, in depth, a country's AMR-relevant legislation in the veterinary domain. This new questionnaire was piloted in the Philippines in a joint OIE-FAO VLSP mission and uses precise references to chapters/articles of the OIE Terrestrial Code relevant for AMR in order to enable the veterinary services to refer to them when they work on and advocate for further compliance.

These chapters are those dedicated to the control of AMR arising from the use of antimicrobials in animals (6.7, 6.8, 6.9, 6.10 and 6.11), as well as, in areas relevant to AMR, the chapters for the veterinary services (3.1 and 3.2) and for veterinary legislation (3.4).

In 2020, as a continuation of this Tripartite collaboration, the FAO, OIE and WHO designed a 2 year global project for the development and piloting of a Tripartite One Health assessment tool for AMR-relevant legislation. This project, funded by the Multi-Partner Trust Fund (MPTF), is intended to identify countries' AMR-relevant legal gaps and options for legal reform across all One Health sectors. It will be built on the abovementioned FAO Methodology, will develop the animal health component further from the OIE VLSP pilot AMR questionnaire, and will incorporate human health aspects. Because of its One Health approach, and because legislation provides the powers and authorities necessary to support good governance, such a tool can help stem the AMR phenomenon worldwide.

2.3 For a better understanding of the implementation of OIE standards: OIE Observatory

Knowing to what extent countries implement international standards and in which way they do it is an important step to strategically focus OIE activities. In May 2018, the World Assembly of OIE Delegates adopted a resolution[25] recommending the establishment of an observatory to monitor the implementation of OIE standards.

Monitoring the implementation of OIE standards will enable the OIE to identify and analyse the difficulties faced by OIE Members and better support them by targeting its capacity building activities to identified needs. In addition, monitoring implementation will enable the OIE to improve its international standard-setting process by maintaining the relevance and consistency of its standards with the realities faced by its Members.[26]

The OIE Observatory is a continuous and systematic mechanism of observation and analysis of Members' practices in implementing OIE standards. Using a data-based approach, the OIE Observatory collects data from different sources of information, analyses these data and disseminates analytical reports on the implementation of OIE standards. The results are aggregates at the global and regional levels.

Given that the OIE Observatory scope covers all OIE standards, a gradual approach has been developed starting with the implementation of a pilot phase. One of the objectives of the pilot phase is to identify the existing mechanisms that generate insights on the implementation of OIE standards and challenges for OIE Members.

2.3.1 Monitoring the implementation of OIE standards relevant to the control of animal AMR

Several mechanisms contribute to the monitoring of the implementation of OIE standards relevant to the control of AMR.

According to the GAP adopted in 2015, countries committed to develop AMR NAPs. The monitoring of these NAPs by countries is done via the Tripartite AMR Country Self-Assessment Survey

(TrACSS)[27] tracking annually the progress in addressing AMR by covering areas of human health, animal health and production aspects, plant production, the environment, and food safety concerns.

The survey makes direct references to OIE standards by providing links to the relevant chapters of the codes:

- Terrestrial Code: Chapter 3.1 on quality of veterinary services; Chapter 6.9 on monitoring of the quantities and usage patterns of antimicrobial agents used in food producing animals; and Chapter 6.10 on responsible and prudent use of antimicrobial agents in veterinary medicine.
- Aquatic Code: Chapter 6.2 on principles for responsible and prudent use of antimicrobial agents in aquatic animals and Chapter 6.3 on monitoring of the quantities and usage patterns of antimicrobial agents used in aquatic animals.

The responses provided by responding countries rely merely on a self-assessment but enable the tracking of progress as well as the identification of challenges faced by countries in terms of governance, legislation, technical capacity and interaction with stakeholders.

Three rounds of survey have been completed (2016–17, 2017–18 and 2018–19) and the results are presented by individual country in a global database.[28]

Since 2016, aligned with the GAP, the OIE publishes an annual report on the use of antimicrobial agents intended for use in animals as required in Chapter 6.9 of the Terrestrial Code and Chapter 6.3 of the Aquatic Code. The results are aggregated at the global and regional levels, not by individual country.[29] It is planned that in the upcoming years, these results will be displayed on the Tripartite Integrated System for Surveillance on AMR and AMU (TISSA).

During the 2016 OIE General Session, OIE Members adopted Resolution No. 36,[30] 'Combating Antimicrobial Resistance through a One Health Approach: Actions and OIE Strategy', agreeing to the recommendation that: 'OIE Member Countries fulfil their commitment under the Global Action Plan to implement policies on the use of antimicrobials in terrestrial and aquatic animals, respecting OIE intergovernmental standards and guidelines on the use of critically important antimicrobial agents, and the phasing out of the use of antibiotics for growth promotion in the absence of risk analysis.'

The use of antimicrobial agents as growth promoters is the subject of specific questions, both in the TrACSS and the OIE general survey on the use of antimicrobial agents intended for use in animals.

2.4 OIE list of antimicrobial agents of veterinary importance

An FAO/OIE/WHO Expert Workshop on Non-Human Antimicrobial Usage and Antimicrobial Resistance held in Geneva, Switzerland, in December 2003 (Scientific Assessment) and in Oslo, Norway, in March 2004 (Management Options) recommended that the OIE should develop a list of critically important antimicrobial agents in veterinary medicine and that WHO should also develop such a list of critically important antimicrobial agents in human medicine. Responding to this recommendation, the OIE decided to address this task through its ad hoc Group on Antimicrobial Resistance.

The OIE List of Antimicrobial Agents of Veterinary Importance: addresses antimicrobial agents authorized for use in food-producing animals; does not include antimicrobial classes/sub classes only used in human medicine; does not include antimicrobial agents only used as growth-promoters; and focuses currently on antibacterials and other important antimicrobials agents used in veterinary medicine.

In the OIE List of Antimicrobial Agents of Veterinary Importance, antimicrobial classes are categorized as Critically Important (VCIA), Highly Important (VHIA) and Important (VIA).

Among the VCIA in the OIE List, some are considered to be critically important both for human and animal health; this is currently the case for fluoroquinolones and for the third and fourth generation of cephalosporins. Colistin was moved in 2016 to the WHO category of Highest Priority Critically Important Antimicrobials. Therefore, these two classes and colistin should be used according to the following recommendations:

- Not to be used as preventive treatment applied by feed or water in the absence of clinical signs in the animal(s) to be treated.
- Not to be used as a first-line treatment unless justified, when used as a second-line treatment, it should ideally be based on the results of bacteriological tests.
- Extra-label/off-label use should be limited and reserved for instances where no alternatives are available. Such use should be in agreement with the national legislation in force.
- Urgently prohibit their use as growth promotors.

The classes in the WHO category of Highest Priority Critically Important Antimicrobials should be the highest priorities for countries in phasing out use of antimicrobial agents as growth promotors.

The OIE List of Antimicrobial Agents of Veterinary Importance is based on expert scientific opinion and is regularly updated when new information becomes available.

Antimicrobial classes/sub-classes used only in human medicine are not included in this OIE List. Recognizing the need to preserve the effectiveness of the antimicrobial agents in human medicine, careful consideration should be given regarding their potential use (including extra-label/off-label use)/authorization in animals.

Animal species-specific technical reference documents listing antimicrobial agents of veterinary importance are being developed, namely, initially, for poultry, swine and aquatic species. These documents are appendixes to the OIE List of Antimicrobial Agents of Veterinary Importance. Their objective is to provide additional, species-specific information without serving as a treatment guideline. By identifying antimicrobial agents used in the different species, they can contribute to the development and update of national treatment guidelines and advise on prevention and best practice management, risk management and risk prioritization to minimize and contain AMR.

3. Positive consequences after the implementation of the previously mentioned tools, activities, standards and guidelines

Table 1 summarizes some of the main OIE AMR/AMU stewardship activities, results and outputs.

Table 1. Summary of the OIE AMR/AMU stewardship activities, outputs and results

OIE activity	Results	Output
National AMU data collected from Members, reported within the global OIE AMU database. Publication and dissemination in the OIE AMU annual report	Participation of 160 countries globally in the fifth round of data collection. Increasing level of granularity of the data submitted by the countries	Improved understanding, monitoring, reporting and use of AMU data by Members, leading to better decisions and national policy (in NAPs)
Members' Veterinary Services engaged in the OIE PVS Pathway to improve Veterinary Service governance and technical capacities linked to AMR and AMU—development of the VLSP to strengthen the focus on legislation relevant for AMR	Improved collaboration between Competent Authorities, increased staff and expanded veterinary expertise in the regulation of veterinary medicinal products, and AMR-relevant legislation sent for adoption and adopted (e.g. Gabon)	Members' Veterinary Services' governance and capacities are increased to provide an enabling environment for AMU and AMR management
Monitoring Members' AMR NAP implementation aligned with OIE standards and within the GAP	Development of the OIE Observatory to propose a pathway to tailor capacity-building activities on identified needs	Encouraged implementation of international standards and guidelines
Dissemination of the OIE List of Antimicrobial Agents of Veterinary Importance	Contributed to the development and update of national treatment guidelines and advice on prevention and best practice management, risk management and risk prioritization to minimize and contain AMR	Increased veterinary competence in Members, leading to greater veterinary oversight of AMU and control of AMR

3.1 AMU

The OIE fifth AMU annual report, published in April 2021, featured the participation of 160 countries: 156 (86%) OIE Members, 1 non-continuous territory and 3 non-OIE Members. Additionally, reported data granularity has also increased: 133 countries (83%) reported quantities of antimicrobial agents intended for use in animals, an increase of nearly 50% of countries when compared with the first round (launched in 2015).

Regular training sessions have resulted in an increased number of countries inducted in the OIE AMU Calculation Tool; the tool assists with the calculation of kilograms of active ingredients and offers to visualize graphs for use at a country level. This approach was well received by the countries and an increased number of them have since contacted the OIE to have further guidance on the use of the OIE AMU Calculation Tool. During the piloting phase of this tool, 32 countries officially submitted data derived from its use. A third of these countries (11 out of 32) were reporting antimicrobial quantities for the first time and in the large majority moved from reporting baseline information only to the highest level of granularity of data, reporting option 3.

3.2 PVS pathway

As the PVS Pathway has explicitly dedicated assessment to AMR since 2019, it is too early to present success stories related to this recent development. However, it is worth mentioning that, since the PVS Pathway, including the PVS VLSP, has always addressed AMR-relevant topics (notably on veterinary medicinal products and food safety), all countries having hosted the PVS Pathway have benefitted from the OIE's recommendations and support to improve their national veterinary services in these areas. Among these countries, mid- and long-term successes can be highlighted, such as improved collaboration between Competent Authorities that are involved in regulation of the drug supply, increased staff and expanded veterinary expertise in the regulation of veterinary medicinal products, and AMR-relevant legislation sent for adoption and adopted. For instance, in Gabon, following the assessment and recommendations of the 2010 VLSP Identification mission, a 1 year VLSP agreement was implemented in 2016–17 to support the modernization of the national veterinary legislation, with a focus notably on two draft laws relevant for the control of AMR: one on the veterinary profession and the other on veterinary medicinal products. In January 2021, the OIE was informed that the first law has been adopted by Parliament, and the second law has been adopted by Parliament and the Senate and is about to be promulgated. The example of Gabon highlights that legislation reform is a long-term process and successes may come after several years of PVS Pathway support and, most of all, the deep commitment of a country to follow up on this support. The PVS Pathway 'illuminates the path' with assessment and recommendations to enhance OIE Members' governance and capacity to build robust plans, policies, and legislation to control AMR. However, countries play the key role—and, when successful, the final outcome is worth all the efforts.

3.3 Observatory

Dealing with the required competencies of veterinary services in the context of international trade, the 2020 OIE technical item served as small-scale study for the pilot phase of the OIE Observatory. This study aimed at monitoring the implementation of horizontal chapters of the Terrestrial Code on quality of veterinary services (Section 3) and trade measures (Section 5).

The technical item 2020[31] was composed of five parts:

- Parts I and II describe the international trade regulatory framework, including OIE international standards and WTO

agreement on the application of sanitary and phytosanitary measures (SPS agreement), and explain how to implement OIE standards before trade negotiation, during the negotiation process and when trade is occurring.
- Part III provides an in-depth analysis on the challenges facing Veterinary Services in relation to imports and exports across the three phases of the trade process. Based on an analysis of PVS Pathway reports and other sources of information, this part III highlights the difficulties faced by Members in implementing OIE standards, before, during and after trade negotiation. These difficulties fall into three broad categories: legislation and enforcement, interaction with stakeholders and technical capacity.
- Parts IV and V identify the competencies of Veterinary Services to strengthen in accordance with challenges identified through the analysis and propose a pathway to tailor capacity building activities on identified needs.

4. Conclusions

The COVID-19 pandemic has highlighted how interconnected our world is. In fact, indirectly, it can potentially increase the AMR threat in the future. More than ever, responsible and prudent use of antimicrobials is essential for the achievement of control of AMR. The OIE supports its Members via the standards and guidelines, antimicrobial stewardship tools and procedures outlined in this paper. An increased awareness and implementation of these globally agreed standards seems essential. While it is rewarding to feature the presented success stories, it is also clear that an international One Health collaboration, fostered by the Tripartite organizations, is of upmost importance, to control AMR and preserve the efficiency of antimicrobial agents for future generations.

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