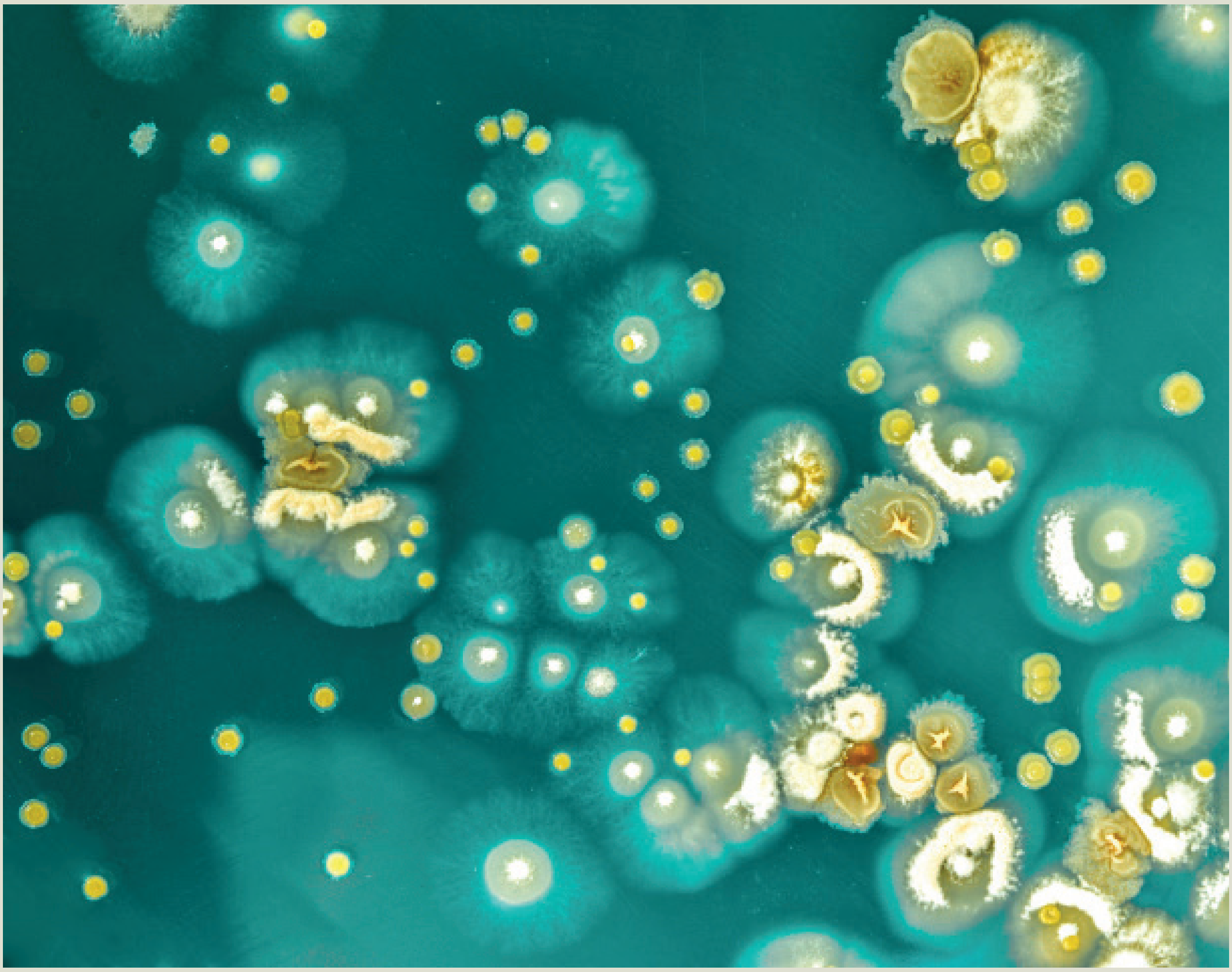
# Annual Report on Antimicrobial Agents Intended for Use in Animals

## 8th Report



World Organisation for Animal Health

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# Foreword

**Dr Monique Éloit**
Director General
World Organisation for Animal Health

As we approach the Second High-Level Meeting on Antimicrobial Resistance (AMR) to take place alongside the United Nations General Assembly, WOAH releases its eighth Annual Report on Antimicrobial Agents Intended for Use in Animals (AMU). This proof of our commitment to 'build and maintain a global database on the use of antimicrobial medicines in animals', in alignment with the Global Action Plan on Antimicrobial Resistance, continues to have a consistent and significant level of participation year after year, since its first publication in 2016. This report presents the progress achieved by 152 Members, including an increase of 30% in the number of those reporting antimicrobial quantities by type of use and route of administration. Such an increase is a tribute to the efforts of Delegates, National Focal Points for Veterinary Products and other national authorities, particularly those from the aquaculture sector, in their contribution to this extraordinary undertaking. The annual report continues to provide an essential global and regional analysis of antibiotic use in animals over time. In that respect, I would like to highlight two major findings.

First, the downward trend observed over the last six years in the use of antimicrobials in food-producing animals (when assessed per kilogram of estimated animal biomass) has ended. This eighth report shows an increase of two per cent in the global analysis. This can undoubtedly be attributed to a range of factors, such as a deceleration in the reduction trend in regions such as Europe, the Americas, and Asia and the Pacific, and an improvement in reporting accuracy from some African Members. Second, the use of antimicrobial agents for growth promotion in animals is still reported by one quarter of our Members; 76% of them without any preliminary risk analysis as required by our international standards.

After eight years of continuous progress and strong commitments, our next steps should be guided by these and other reported data. Each of our Members must take a deep look into their own data, establish their own trend analysis, and begin action to optimise their use of antimicrobials, discussing plans and results within their respective multisectoral coordination mechanisms. Moreover, I would like to call upon our Members to restrict their use of antimicrobials solely to those needed for veterinary medical purposes, and to actively work with all parties to achieve a total ban on the use of antimicrobials as growth promoters, starting with those that are critically important for human health.

All Members can count on WOAH to support the implementation of our international standards and guidance on the responsible and prudent use of antimicrobials. WOAH emphasises the importance of institutionalising surveillance systems, as well as the use of data in decision-making at national and regional levels. The strengthening of our data-gathering system and its integration with other AMR data sources is essential.

As part of the Quadripartite Alliance, WOAH will continue to support all its Members in retaining their ownership of data collection, analysis and reporting, despite challenges from the competing priorities that Members have to deal with.

I hope that this report will further encourage Members and non-Members alike to continue their participation. Your constant support and involvement will not only increase data accuracy and robustness in understanding the global use of antimicrobial agents in animals; it will also provide solid, evidence-based data for the successful implementation of your national action plan on AMR.

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# Executive summary

The World Organisation for Animal Health (WOAH) Annual Report on Antimicrobial Agents Intended for Use in Animals gathers data provided voluntarily by Veterinary Services on the use of antimicrobials in animals. The present report has three main sections: (1) interpretation of the global and regional situation from data collected during the eight annual data collection rounds (September 2022 to May 2023); (2) detailed analyses for 2021 (total amount of antimicrobial agents, normalised using an estimated animal biomass indicator); (3) trend analyses for the years 2019 to 2021, after adjustment to the estimated animal biomass indicator.

## Methods

In September 2022, WOAH invited its 182 Members and 11 non-Members to contribute to the eighth annual round of data collection on antimicrobial agents intended for use in animals. A Microsoft Excel form for direct uploading onto ANIMUSE was sent by email, with a series of accompanying guidance documents. This template included four worksheets, in which participants were invited to provide baseline information or quantitative data. The template allows participants to report data by type of use[1], animal group[2] and route of administration[3]. In addition to this form, a complementary Excel Calculation Tool was provided to countries that had used it in previous years to facilitate the reporting of comprehensive quantitative data sets; this support was also available in ANIMUSE through its Calculation Module.

These data come mainly from sales and import figures of antimicrobial agents reported at the class or subclass level, following the recommendations specified by Chapter 6.9. of the *Terrestrial Animal Health Code* [1] and Chapter 6.3. of the *Aquatic Animal Health Code* [2].

For the purposes of reporting and comparing data across Members, among different sectors and over time, antimicrobial quantities are normalised by the use of an estimated animal biomass indicator, which can vary in size and composition over time. This indicator represents the total weight of live domestic animals in a given population in a specific area during a year and is used as a proxy to represent those animals that have probably been exposed to the quantities of antimicrobial agents reported. Animal biomass was calculated for food-producing species of Members who reported quantitative data for 2021, primarily using data from our World Animal Health Information System (WAHIS) and the Food and Agriculture Organization of the United Nations Statistical Database (FAOSTAT). Normalised results are expressed in milligrams (mg) of antimicrobial quantities reported per kilogram (kg) of estimated animal biomass. Further details on the methodologies used for this report are available in published references [3] [4].

It is important to note that the information provided belongs to our Members, and is made available to WOAH for the purpose of better understanding the global and regional situation. While no national or participant-level data are presented in this report, the supplied data are systematically sent back to Members, after validation and analysis by WOAH staff, for their own monitoring and surveillance purposes, including suggested areas for evidence-based development of their National Action Plan on AMR. For those who make their data publicly available, as indicated in Chapter 6.9 from the *Terrestrial Animal Health Code* [1], they are presented at the ANIMUSE public interface.

## Overall findings of the eighth data collection round

A total of 152 reports were submitted during the eighth round of data collection (152 out of 193; 79%). None of the non-Member invitees participated in this round of data collection; all contributions came from WOAH Members (152 out of 182; 84%).

Twenty-three Members provided baseline information only (23 out of 152; 15%). Nineteen Members provided further information on the barriers faced when collecting and reporting quantitative data, the two most common being lack of information technology (IT) tools and human resources, and a lack of coordination/cooperation among national authorities, particularly with the Ministry of Health.

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1 'Veterinary medical use' – to treat, control or prevent disease; 'non-veterinary medical use' – including use for growth promotion.

2 Terrestrial food-producing, aquatic food-producing, or companion animals.

3 Oral, injection and other routes.

The launch of ANIMUSE, together with combined action from other Quadripartite partners, including the World Health Organization (WHO), is expected to provide the necessary support to overcome these barriers and increase the accuracy and quality of reported data.

One hundred and twenty-nine WOAH Members (129 out of 152; 85%) included quantitative data reported for at least one year within the time frame of 2020 to 2022. Thirty-nine (39 out of 129; 30%) made their reports publicly available; the vast majority of these (31 out of 39; 79%) being European Members. This figure has remained relatively steady over the years, despite the best practice guidance given in our international standards, which recommends that Members transparently report their data. Ninety-six Members (96 out of 129; 74%) reported antimicrobial quantities by type of use and route of administration (Reporting Option 3), which represented a 30% increase from the previous annual report, confirming the useful assistance provided by the Calculation Module in ANIMUSE. It is worth emphasising that, while all WOAH regions have made progress in terms of the number of Members reporting antimicrobial quantities and the use of Reporting Option 3, Europe and Africa have shown the most significant progress during the eighth round.

In 2021, the use of antimicrobial agents in animals for growth promotion was still reported as uncommon in nearly three-quarters of Members (109 out of 152; 72%), either with or without legislation/regulation around their use. However, the use of growth promoters is still reported by one quarter of Members (36 out of 152; 24%), with 75% of those concentrated in two regions: the Americas and Asia and the Pacific. Of 36 countries, it is estimated that 76% have not carried out any preliminary risk analysis. This is contrary to the guidance given in the WOAH international standards and the Global Action Plan on Antimicrobial Resistance (AMR).

Thirty-five Members provided a list of antimicrobial agents used as growth promoters. The three molecules most frequently listed were tylosin (n = 18 participants), flavophospholipol (n = 14 Members) and bacitracin (n = 14 participants). While flavophospholipol and bacitracin were listed as not used in humans, according to the WHO List of Critically Important Antimicrobials for Human Medicine that applied during the data collection period [5], bacitracin and tylosin are classified as critically important for use in humans in the recently released WHO List of Medically Important Antimicrobials (MIAs) [6]. Colistin, considered as a highest priority critically important antimicrobial for use in humans, is still reported as being used by four participants. It is vital to note that the number of those reporting the use of colistin as a growth promoter has decreased by more than half during the five years up to 2021. Fosfomycin, also classified as highest priority in the recent MIA list, was mentioned by one Member.

## Focused analyses for 2021

The eighth report presents analyses with a special focus on the antimicrobial quantities reported to have been used in 2021 by 94 participants. According to the data reported (in most cases, from sales and imports), WOAH estimates that the total amount of antimicrobial agents intended for use in animals in 2021 came to 81,084 tonnes. Acknowledging the different data sources, and bearing in mind that these data covered, on average, 90% of the total amount of antimicrobials present in the field (as estimated by each participant), we estimate that the adjusted total amount could be as high as 88,927 tonnes.

Almost half of these are tetracyclines, which remain the most used antimicrobial agent in animal health across the globe (35.6% of the total amount), and penicillins (12.56% of the total amount). Both are part of the Veterinary Critically Important Antimicrobial (VCIA) classes in WOAH's List of Antimicrobials of Veterinary Importance [7], but are not listed among the highest priority critically important antimicrobial agents for human health, according to WHO [5]. Among those that are listed in this category by WHO, fluoroquinolones and third- and fourth-generation cephalosporins represent 3.3% and only 0.6% of the total amount, respectively.

The analysis of antimicrobial agents normalised by estimated animal biomass was performed on data provided by 94 Members. This is considered to represent 65% of the total animal biomass around the world, encompassing terrestrial and aquatic food-producing animals, with companion animals excluded from the analysis. Bovine species accounted for 41% of the total coverage, followed by swine (21%) and poultry (18%). Aquatic animals accounted for 9% of the total coverage, with fish representing almost two-thirds. With all of this taken into consideration, WOAH estimates that, in 2021, a total of 112 to 116 milligrams of antimicrobial agents were used per kilogram of animal biomass, depending on how coverage estimates were adjusted among the 94 participants.

The number of Members reporting differentiated data for aquatic food-producing animals increased by 55% from the seventh annual report. These 17 countries represent 63% of global aquaculture production.

The number of participants who included ornamental fish in the group of non-food-producing animals increased by 54% when compared to the seventh annual report.

## Trends (2021–2019)

Analysis of these data over time was performed with data from 81 participants who consistently provided quantitative information for the period 2019 to 2021, using the normalised amount of milligrams of antimicrobials used per kilogram of estimated animal biomass. Collected data, representing 65% of the global animal biomass, showed an overall increase of 2% in mg/kg at the global level, moving from 107.3 mg/kg in 2019 to 109.7 mg/kg in 2021. While a decrease was observed in regions like the Americas (–9%), Europe (–6%) and Asia and the Pacific (–0.7%), an increase was observed in Africa (+179%). When looking at this trend by antimicrobial class, it is worth noting that an increase was observed for tetracyclines (10%, the most used antimicrobial class in animal health), as well as in penicillins and macrolides (12% and 19%, respectively).

## Conclusions and perspectives

The overall participation rate in the eight data collection rounds has changed very little over time, despite all the resilience challenges and competing priorities WOAH Members have to face. Four out of five submitted reports containing quantitative data.

Tetracyclines remain the most used antimicrobial class globally in animal health, and while some antimicrobial classes considered as critically important for use in humans are still in use, they represent a small part of the global picture in food-producing animals (17% if analysed by the sixth edition of the WHO List of Critically Important Antimicrobials for Human Medicine and 7% by the recent WHO Medically Important Antimicrobial List). Additionally, there is a shared commitment among Members to decrease antimicrobial consumption in the animal health sector as 51 out of 81 Members reduced their quantities from 2019 to 2021.

An analysis of these data over time shows an increase of 2% in the indicator used to track trends among the 81 reporting Members who have consistently provided data from 2019 to 2021. Africa presented a staggering 179% rise during this period, while the Americas, Europe and Asia decreased by 9%, 6%, and 0.7%, respectively. While Africa's increase appears remarkable, deeper analysis of the reported data seems to point to a significant refinement of antimicrobial usage monitoring systems and, therefore, higher accuracy in the estimations. On a global scale, Africa's increase does not significantly impact this indicator, as it represents only 10% of biomass and 2% of antimicrobial quantities for the 81 countries analysed. On the contrary, the Americas and Asia and the Pacific hold greater importance, even bearing in mind their respective decreases are only 9% and 0.7%, respectively.

Even though significant progress has been made in reducing the use of antimicrobials as growth promoters, this practice is still reported by almost 20% of our Members. More worryingly, no fewer than 11% of WOAH Members still use at least one of the highest priority critically important antimicrobials for human medicine, such as colistin, for growth promotion. In December 2023, only 11% of our Members made their antimicrobial use data publicly available through the public portal of ANIMUSE. As compliance with WOAH's international standards remains a pillar of WOAH's AMR Strategy, this report represents an evidence-based reminder to all Members to restrict the use of antimicrobials to veterinary medical use only and to continue on this path until they can enforce a total ban on the use of antimicrobials as growth promoters. This process must start with those antimicrobials that are critically important for human health. In addition, we ask Members to report data with transparency, to allow all interested parties to assess trends and perform risk assessments, as well as for risk communication purposes.

On an annual basis, and thanks to continuous work from WOAH Members, ANIMUSE has become the most comprehensive and reliable representation of the global situation of antimicrobial agents intended for use in animals, representing almost 80% of global geography and 65% of the total animal biomass on Earth. As data collection systems develop further, this annual report will continue to provide an essential global and regional analysis of antibiotic use in animals, and changes in such use over time. Furthermore, WOAH aims to strengthen communication with other national agencies, beyond Veterinary Services, which are involved in antimicrobial use data collection in the animal health sector, in collaboration with WHO. It is only through collaborative efforts and interdisciplinary cooperation that we will be successful in addressing antimicrobial resistance and promoting responsible antimicrobial use practices.

# Acknowledgements

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WOAH also acknowledges the continuous support provided by its Technical Officers from WOAH Regional and Sub-regional Representations during the WOAH AMU data collection rounds and in maintaining relationships with its Members.

WOAH would also like to thank all its Members, Delegates, National Focal Points for Veterinary Products and other government officials who contributed to the eighth annual collection of data on antimicrobial agents used in animals. Without their help, the knowledge and insight presented in this report could not have been gained.

Finally, WOAH would like to thank its Working Group on Antimicrobial Resistance for its guidance in the development of the global database and methodology for calculating animal biomass for the eighth round of global data collection on antimicrobial agents intended for use in animals.

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# Acronyms and abbreviations

| | |
|---|---|
| AMR | Antimicrobial resistance |
| AMU | Antimicrobial use |
| ANIMUSE | ANImal antiMicrobial USE Global Database |
| CIPARS | Canadian Integrated Program for Antimicrobial Resistance Surveillance |
| ESVAC | European Surveillance of Veterinary Antimicrobial Consumption |
| FAO | Food and Agriculture Organization of the United Nations |
| FAOSTAT | Food and Agriculture Organization of the United Nations Statistical Database |
| UNEP | United Nations Environment Programme |
| WAHIS | World Animal Health Information System |
| WHO | World Health Organization |
| WOAH | World Organisation for Animal Health |

# WOAH Glossary

**Antimicrobial agent:** means a naturally occurring, semi-synthetic or synthetic substance that exhibits antimicrobial activity (kill or inhibit the growth of micro-organisms) at concentrations attainable in vivo. Anthelmintics and substances classed as disinfectants or antiseptics are excluded from this definition.

**Aquatic Animal Health Services[4]:** means the combination of governmental and non-governmental individuals and organisations that perform activities to implement the standards of the *Aquatic Code*.

**Growth promotion, growth promoters:** means the administration of antimicrobial agents to animals only to increase the rate of weight gain or the efficiency of feed utilisation.

**Monitoring:** means the intermittent performance and analysis of routine measurements and observations, aimed at detecting changes in the environment or health status of a population.

**Surveillance:** means the systematic ongoing collection, collation, and analysis of information related to animal health and the timely dissemination of information so that action can be taken.

**Veterinary Authority:** means the Governmental Authority of a Member Country having the primary responsibility in the whole territory for coordinating the implementation of the standards of the *Terrestrial Code*.

**Veterinary legislation:** means laws, regulations and all associated legal instruments that pertain to the veterinary domain.

**Veterinary medicinal product:** means any product with approved claims to having a prophylactic, therapeutic or diagnostic effect or to alter physiological functions when administered or applied to an animal.

**Veterinary medical use:** means the administration of an antimicrobial agent to an individual or a group of animals to treat, control or prevent disease:

- to treat means to administer an antimicrobial agent to an individual or a group of animals showing clinical signs of an infectious disease;
- to control means to administer an antimicrobial agent to a group of animals containing sick animals and healthy animals (presumed to be infected), to minimise or resolve clinical signs and to prevent further spread of the disease;
- to prevent means to administer an antimicrobial agent to an individual or a group of animals at risk of acquiring a specific infection or in a specific situation where infectious disease is likely to occur if the drug is not administered.

**Veterinary Services:** means the combination of governmental and non-governmental individuals and organisations that perform activities to implement the standards of the *Terrestrial Code*.

[4] For the purposes of this report, when Veterinary Services are mentioned, they include the definition for Veterinary Services and for Aquatic Animal Health Services.

# 1. Introduction

## 1.1. Background

### WOAH activities on antimicrobial resistance

In May 2015, during the 83rd General Session of the World Assembly of WOAH Delegates, WOAH Members officially committed to combating antimicrobial resistance (AMR) and promoting the prudent use of antimicrobials in animals. Moreover, they stated their full support for the Global Action Plan on AMR, developed by the World Health Organization (WHO) in close collaboration with WOAH and the Food and Agriculture Organization of the United Nations (FAO) [10]. One year later, during the 84th General Session, the World Assembly of Delegates directed WOAH to compile and consolidate all actions to combat AMR [11], leading to the establishment of WOAH's Strategy on AMR and the Prudent Use of Antimicrobials, which was published in November 2016 [12].

Its structure supports the objectives established in the Global Action Plan, and reflects the mandate of WOAH as described in its Basic Texts and Strategic Plans through four main objectives:

(1) Improve awareness and understanding.

(2) Strengthen knowledge through surveillance and research.

(3) Support good governance and capacity building.

(4) Encourage the implementation of international standards.

With the aim of achieving these objectives, WOAH engages with its Members through National Focal Points for Veterinary Products, who are responsible for providing technical assistance to improve and harmonise national policies to control veterinary products at the national level. Moreover, WOAH regularly organises seminars to support good governance and capacity building, and the harmonised implementation of its international standards on the responsible and prudent use of antimicrobials:

- The *Terrestrial Animal Health Code (Terrestrial Code)*, Chapter 6.8., 'Harmonisation of national antimicrobial resistance surveillance and monitoring programmes', includes examples of target animal species and animal bacterial pathogens that may be included in resistance surveillance and monitoring programmes [13].
- The *Aquatic Animal Health Code (Aquatic Code)* includes a corresponding chapter, Chapter 6.4., 'Development and harmonisation of national antimicrobial resistance surveillance and monitoring programmes for aquatic animals' [14].
- The *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*, Chapter 2.1.1., 'Laboratory methodologies for bacterial antimicrobial susceptibility testing', provides the laboratory methods that support surveillance and monitoring [15].

### WOAH activities on antimicrobial use

Monitoring antimicrobial use is crucial to understand possible areas of risk for the development of resistance. Moreover, it links with objective number four within the Global Action Plan on AMR, 'Optimize the use of antimicrobial medicines in human and animal health' [10].

In 2012, WOAH developed a questionnaire with the aim of enhancing its engagement in the initiative to prevent antimicrobial resistance; to understand Members' implementation of the WOAH *Terrestrial Code* chapter on 'Monitoring of the quantities and usage patterns of antimicrobial agents used in food-producing animals' [1]; to improve awareness of antimicrobial use in animals by its Members; and to determine what actions were needed to help WOAH to develop its strategy in this field. In 2012, only 27% of respondents had an official system for collecting quantitative data on antimicrobial agents used in animals.

The results were presented at the first WOAH Global Conference on the Responsible and Prudent Use of Antimicrobial Agents for Animals held in March 2013 in Paris, France. The recommendations to WOAH Members that resulted from the conference included establishing an official harmonised national system for collecting data on quantities of antimicrobial agents used in food-producing animals and contributing to WOAH's initiative of collecting data on antimicrobial agents used in animals, with the ultimate aim of creating a global database hosted by WOAH.

Following these recommendations, WOAH's World Assembly in 2015 unanimously adopted Resolution No. 26 during the 83rd General Session, officially mandating WOAH to collect data on the use of antimicrobial agents in animals worldwide [16]. As a result, this global database was created in compliance with the relevant chapters of the *Terrestrial Code* [1] and the *Aquatic Code* [2].

Under the framework of the Global Action Plan on AMR [10], WOAH has led the global database on antimicrobial agents intended for use in animals since 2015, supported by FAO, WHO and, more recently, the United Nations Environment Programme (UNEP), within the Quadripartite collaboration.

In September 2022, WOAH transitioned from collecting data through spreadsheets to an automated system called: **ANI**mal anti**M**icrobial **USE** Global Database (**ANIMUSE**)[5].

ANIMUSE's first interactive report was released in May 2023 and provided a user-friendly interface for interacting with the results presented in this report. Please note that some charts in this document may differ from those in ANIMUSE, as the database continuously updates its charts in real time to present the most recent data.

## 1.2. Scope

This report presents the results of the eighth round of the annual collection of data on antimicrobial agents intended for use in animals. This data collection updates the situation of governance of veterinary antimicrobials in those who take part and includes submissions of quantitative data when participants are able to provide them for inclusion in the global database. The report also highlights the barriers that countries face when collecting, analysing and reporting these data.

In addition to qualitative analysis of the eighth round of data collection, this report includes a global analysis of quantitative data on antimicrobial agents intended for use in animals, adjusted by animal biomass. The focus year of this quantitative analysis is 2021; for data sets from previous years, readers should refer to the ANIMUSE Interactive Report, which presents the latest comprehensive historical data.

Participants report data mainly from sales or imports of antimicrobial agents from the WOAH List of Antimicrobial Agents of Veterinary Importance[6], which prioritises antimicrobials crucial to maintaining the health and welfare of animals worldwide. The data collection template and resulting report were developed while taking into account the differences between WOAH Members in their governance and surveillance of veterinary antimicrobials.

For participants reporting quantitative data, the amounts of antimicrobial agents intended for use in animals that were sold, purchased or imported were provided to WOAH in kilograms (kg) of antimicrobial agent (chemical compound as declared on the product label). These reported figures were calculated according to the guidance provided to Members at the ANIMUSE public portal.

The information provided belongs to the country concerned, and is reported to WOAH in confidence to better understand the global and regional situation of the use of antimicrobial agents in animals. Therefore, this report does not present data at the national level. WOAH encourages all countries to generate a national report for their own use when implementing and adapting their National Action Plan on AMR, and so emphasises the value in publishing national reports. The list of publicly available national reports on veterinary antimicrobial usage can be found in the ANIMUSE Interactive Report, when those countries have agreed to their release through ANIMUSE[7].

[5] https://amu.woah.org
[6] https://www.woah.org/en/document/list-of-antimicrobial-agents-of-veterinary-importance/
[7] https://amu.woah.org/amu-system-portal/amu-data

# 2. Results of the eighth round of data collection

## 2.1. General information

### WOAH activities on antimicrobial resistance

This data collection round was launched in September 2022 to collect data on antimicrobial agents intended for use in animals in the year 2021, but also accepted data from 2019 or 2020 as optional years. In the eighth round, 152 reports were submitted to WOAH ($n$ = 193; 79%). None of the non-Member invitees took part in this round of data collection; all contributions came from WOAH Members (152 out of 182; 84%).

The proportion of responses received from the different WOAH regions varied from 74% to 92% (**Table 1**).

For specific information on WOAH regions, please refer to the interactive report available at the ANIMUSE public portal at: [https://amu.woah.org](https://amu.woah.org).

**Table 1**. Number of participants who responded to the WOAH survey in the eighth round of data collection, by WOAH region

| WOAH region | Number of participants who submitted reports, by WOAH region | Number of WOAH Members* | Proportion of response (%) |
|---|---|---|---|
| Africa | 44 | 54 | 81% |
| Americas | 23 | 31 | 74% |
| Asia and the Pacific | 28 | 32 | 88% |
| Europe | 46 | 53 | 87% |
| Middle East | 11 | 12 | 92% |
| **Total** | **152** | **182** | **84%** |

*Distribution of Members by WOAH region is in accordance with the WOAH *Note de service* 2010/22 (available in the Annex to this report).

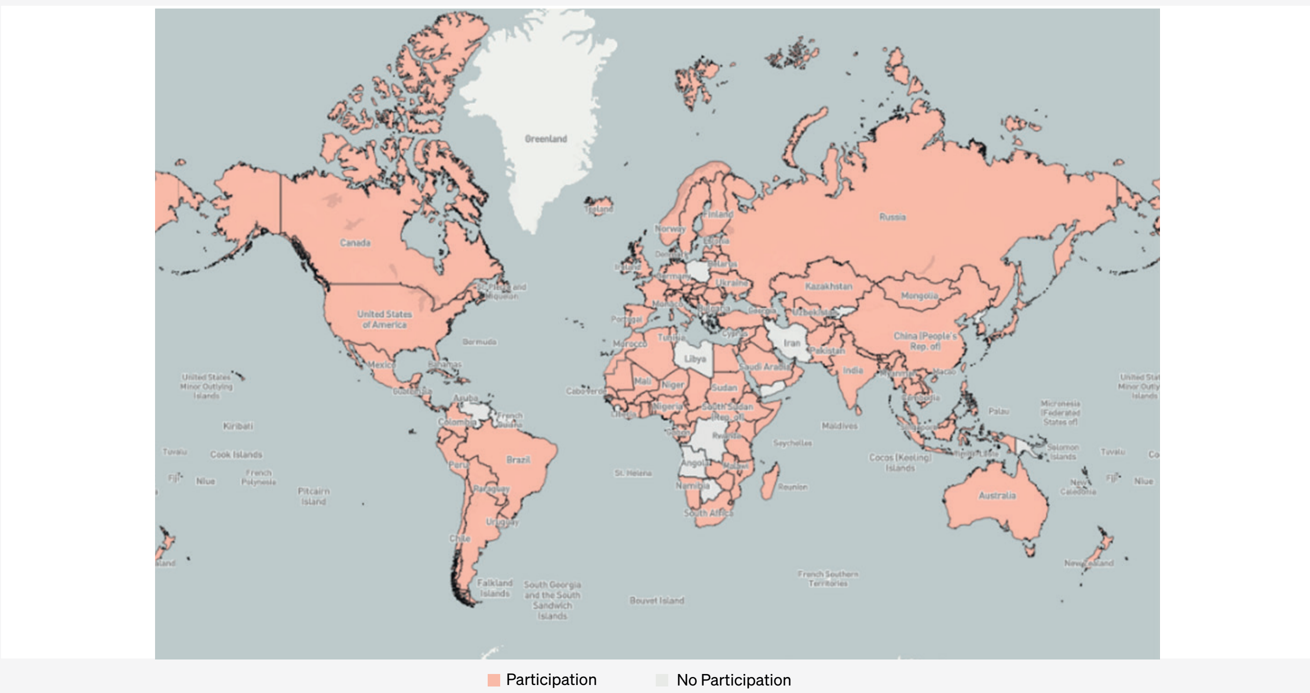



**Figure 1.** Geographical distribution of participants who responded to the WOAH survey in the eighth round of data collection

## 2.2. Reporting options

In the eighth round of data collection, 'Baseline Information' (parts A and B of WOAH's questionnaire) was completed by 152 participants.

The ability of a participant to provide quantitative information reflects that Member's capacity to collect detailed data on antimicrobial agents intended for use in animals. In this eighth round, 129 participants (*n* = 152; 85%) reported quantitative data, demonstrating their commitment to the development of monitoring systems for veterinary antimicrobial agents (**Figure 2**). From the 129 Members providing quantities, 96 (*n*= 129; 74%) used Reporting Option 3, giving the highest level of detail in the WOAH template. This means that most of the Members were able to determine data by type of use (veterinary medical use versus growth promotion), by animal group and by route of administration. Furthermore, 51 Members used the Calculation Module (*n* = 96; 53%) to report in Option 3; with this tool they were able to make further analysis at the molecule level and by veterinary product. WOAH is supporting those Members who used the Calculation Module by providing them with data visualisation skills and training, enabling them to prepare reports to key national stakeholders.

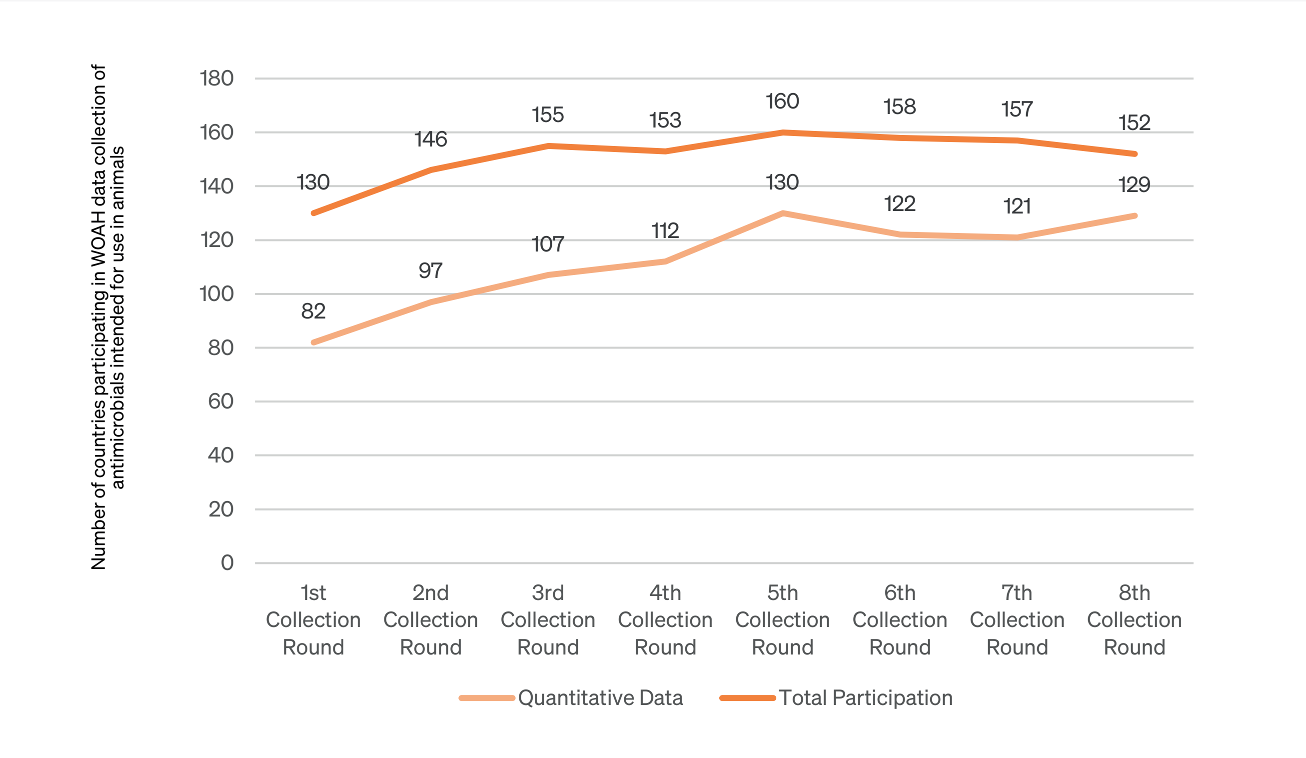



**Figure 2.** Number of participants over different data collection rounds

## 2.3. National reports available online

The WOAH template asks participants if a national report on the antimicrobial agents used in animals is available online. In the eighth round of data collection, 90 participants (*n* = 129; 70%) did not publish online national reports (**Figure 3**). After eight years, Europe is still the only region where more than 50% of Members' national reports are available online.

WOAH encourages all participants to publish their own national reports on the sales or use of antimicrobial agents in animals, to ensure transparency and to assess trends.

The list of participants with public national reports on antimicrobial agents intended for use in animals can be found at the ANIMUSE public portal (https://amu.woah.org), along with the relevant links.

The list of participants making their data publicly available at the ANIMUSE public portal, regardless of whether a national report has been produced, can be found here: https://amu.woah.org/amu-system-portal/amu-data.

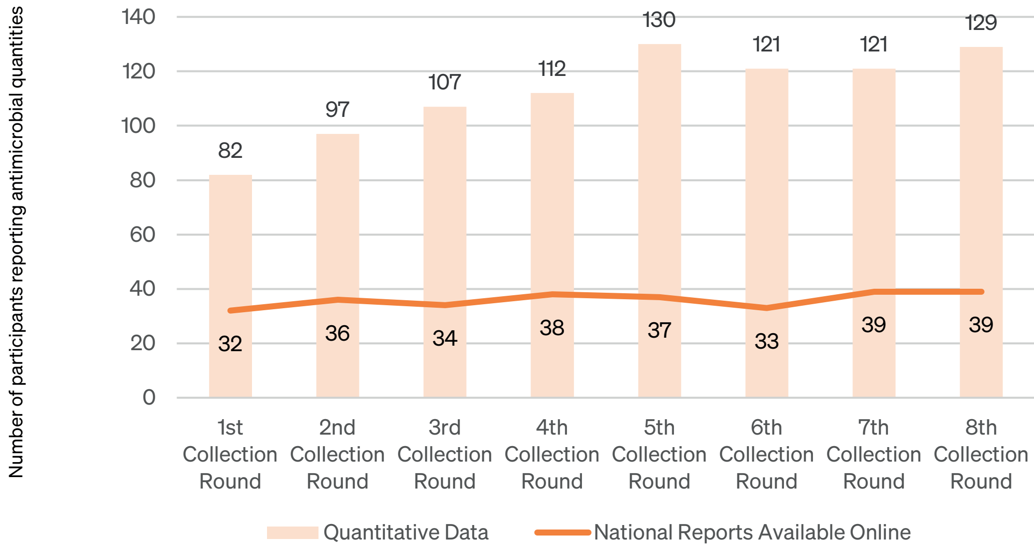



**Figure 3.** Number of participants in all rounds of WOAH data collection with national reports available online

## 2.4. Barriers to participants providing quantities of antimicrobial agents in animals

Some participants who had previously reported barriers during the seventh round were seen to have made progress. Eleven of these participants progressed from reporting baseline information to reporting antimicrobial quantities in the eighth round.

Twenty-three of the Members (*n* = 152; 15%) provided baseline information only. Of these, 19 participants (*n* = 23; 83%) outlined their barriers to reporting antimicrobial quantities. The barriers have been grouped into four categories (**Figure 4**). Sixteen participants reported one main barrier, and three participants reported two barriers. The relative importance of these categories may change when the results are analysed on a regional level. Of the 19 Members, 11 were from Africa, 4 from the Americas, 1 from Asia and the Pacific and 4 from the Middle East.

For a description of the barrier categories, see the following explanatory section.

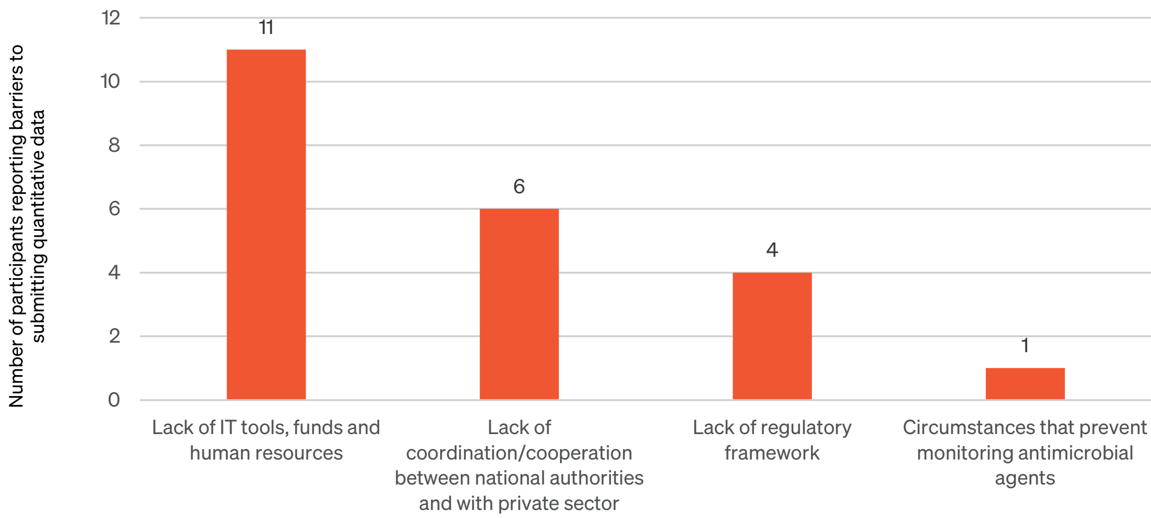



**Figure 4.** Barriers to reporting quantitative data on antimicrobial agents intended for use in animals reported by 19 participants during the eighth round of data collection

## Lack of IT tools, funds and human resources

Six participants described their main problem in data collection as the fact that their records (mainly imports of veterinary products and information related to their authorisation) were not yet digitised, or that they had experienced IT issues. Two of these countries had previously provided antimicrobial quantities to WOAH using the Calculation Tool and expected to resolve their problems before the ninth round took place.

Five participants explained that additional staff resources were needed for the collection and collation of data. Most of these countries had previously reported staffing as their key constraint. This may indicate that their Veterinary Services have not been able to prioritise the monitoring of antimicrobials against other competing pressures in the veterinary sector.

## Lack of coordination/cooperation between national authorities and with the private sector

Within this category, four participants reported that they faced obstacles when working with entities outside Veterinary Services. Three of them have indicated for many years that antimicrobial quantities intended for use in animals come under the legal authority of the Ministry of Health. They further explained that the Ministry of Health has legal competency for the authorisation and importation of veterinary medicinal products, and that these data are not shared with the Veterinary Authority, even if it is in charge of their responsible use in the field, and despite attempts to collaborate.

Two Members reported difficulties working with the pharmaceutical industry. In the absence of mandatory data collection of antimicrobial quantities, these stakeholders are reluctant to share their data with Veterinary Services.

## Lack of regulatory framework

Two out of the four participants who do not have regulatory frameworks also reported a lack of cooperation with the private sector. These countries explained that, despite having no regulatory framework, they attempted to approach the pharmaceutical industry without success.

One participant explained that the lack of legislation is due to the country not prioritising AMR/AMU, with no budget or human resources allocated to this activity.

One country that has no regulatory framework for the manufacture, registration, distribution, commercialisation and pharmacovigilance of veterinary products is exploring ways to overcome this issue with WOAH. It is believed that this particular country will be able to provide data in upcoming rounds, using a different approach. If the country succeeds in providing data, WOAH aims to replicate this approach in countries with similar obstacles.

## Circumstances that prevent the monitoring of antimicrobial agents

One participant reported political instability as the main reason for not reporting antimicrobial quantities in animals.

## Summary of barriers

Most of the barriers reported for the eighth round consisted of a lack of IT tools or digitised data that enable data collection on sales or imports of veterinary products. WOAH has begun a series of regional training sessions to introduce the ANIMUSE Global Database, since ANIMUSE includes a dedicated module to assist with the calculations needed to overcome this barrier. Another significant obstacle is the lack of funds and human resources needed to monitor antimicrobial quantities in animals. This is an important message for WOAH, since it indicates that some countries do not or cannot prioritise the collection of national antimicrobial data in animals and therefore cannot make evidence-based decisions on AMR.

Another recurring barrier happens when the Ministry of Health has legal authority for registering veterinary products but does not share these data with Veterinary Services. WOAH has begun discussions with WHO to address this lack of collaboration between national authorities. This hurdle should not hinder countries, since combating antimicrobial resistance falls within the realm of One Health and demands unified solutions. Moreover, it is often a specific objective of a country's AMR National Action Plan.

## 2.5. Antimicrobial agents used for growth promotion

During the 2016 WOAH General Session, WOAH Members adopted Resolution No. 36, '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.' [11]

The WOAH List of Antimicrobial Agents of Veterinary Importance also states that the '**responsible and prudent use of antimicrobial agents does not include the use of antimicrobial agents for growth promotion in the absence of risk analysis**' [7]. Risk analysis is defined as the 'process composed of hazard identification, risk assessment, risk management and risk communication' and should follow the procedure specified in Chapter 6.11. of the *Terrestrial Code*[8].

In this eighth round of data collection, as presented in **Figure 5,** a total of 109 (*n* = 152; 72%) responding participants report not using antimicrobial agents for growth promotion in animals, either with or without legislation and regulations. Thirty-six participants (*n* = 152; 24%) reported the use of antimicrobials for growth promotion. Seven remaining participants indicated that they were unsure if antibiotics were being used in the field or not. These seven Members did not have legislation related to growth promotion.

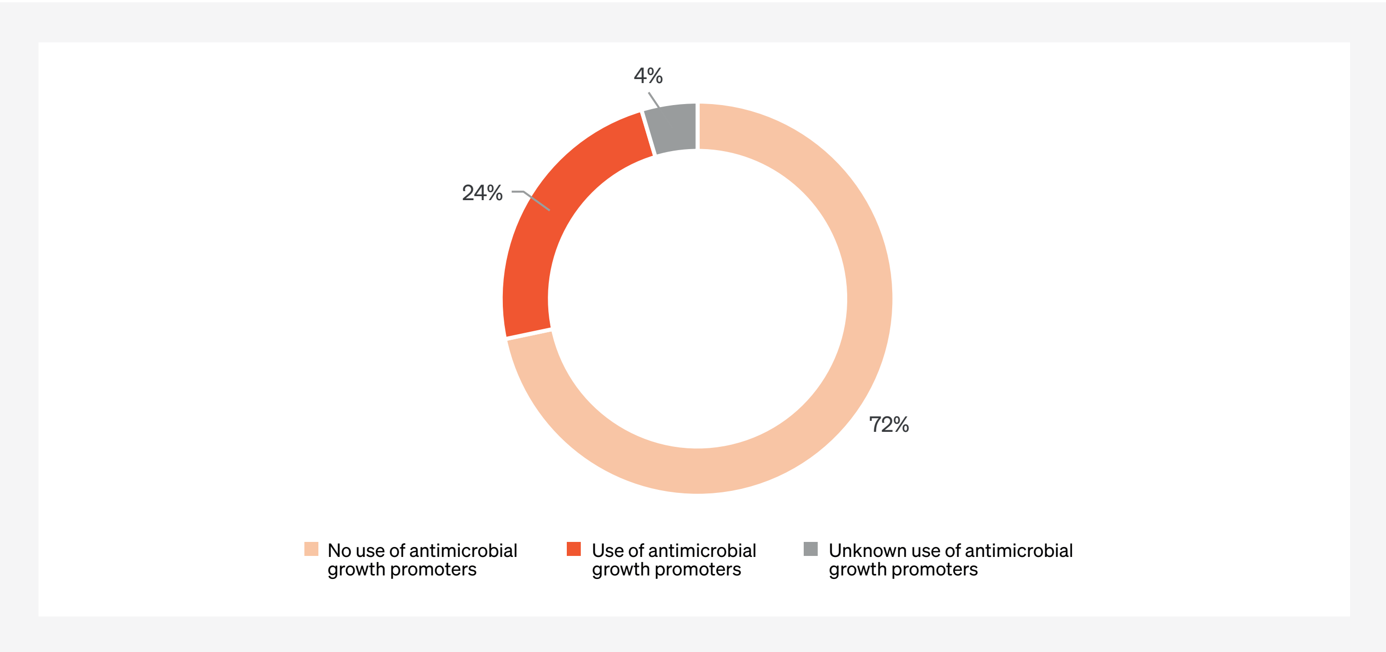



**Figure 5.** Use of antimicrobial growth promoters by 152 participants in 2022

When differentiated by WOAH region, the Americas had the highest proportion of participants using antimicrobials as growth promoters (**Figure 6**). The European Union has banned growth promoters since 2006 and this was reflected in its responses, with Europe being one of the regions with the lowest use (1 out of 46; 2%) and authorisation of antimicrobial growth promoters.

[8] https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/current/chapitre_antibio_risk_ass.pdf

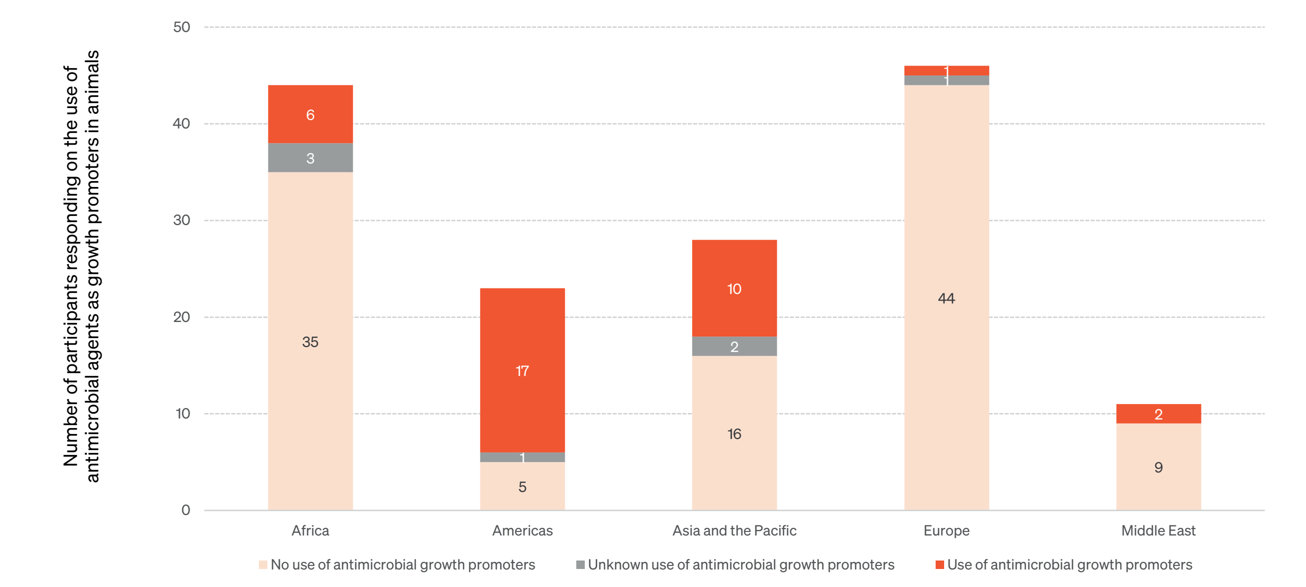



**Figure 6.** Number of participants using antimicrobial agents for growth promotion in animals in 2022, of 152 responding participants, by WOAH region

## Regulatory framework for antimicrobial agents used as growth promoters

In the WOAH template and guidance, all participants, regardless of their response to the use of antimicrobials as growth promoters, were asked the following question: 'Does your country have legislation/regulations on the use of antimicrobial growth promoters in animals?'

The 89 participants who answered 'Yes' to this question were asked to indicate what type of legislation/ regulations existed. In most cases, where legislation/ regulation exists, the regulatory frameworks ban the use of antimicrobials as growth promoters (**Figure 7**).

As presented in **Figure 7**, 38 participants stated that they do not use antimicrobials as growth promoters even though no regulatory framework exists. Twenty-five out of 38 Members (66%) are from Africa.

Half of the participants reporting the use of antimicrobials as growth promoters do not have a regulatory framework; 11 out of these 18 participants (61%) are from the Americas.

Of those 18 Members using antimicrobials as growth promoters within a regulatory framework ($n$ = 36; 50%), the legislation in place either provides a list of molecules that should not be used as growth promoters ($n$ = 9) or a list of antimicrobials that can be used ($n$ = 5). In some cases, both lists have been established ($n$ = 4) (**Figure 8**).

For specific information on WOAH regions, please refer to the [interactive report in ANIMUSE](https://).

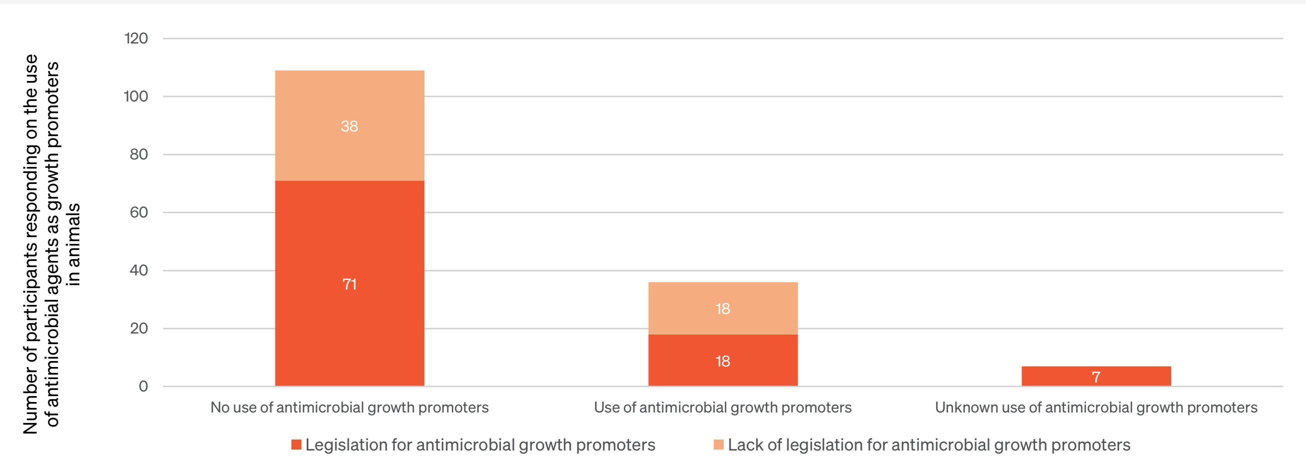



**Figure 7.** Use of antimicrobial growth promoters by legislation in 152 participants in 2022

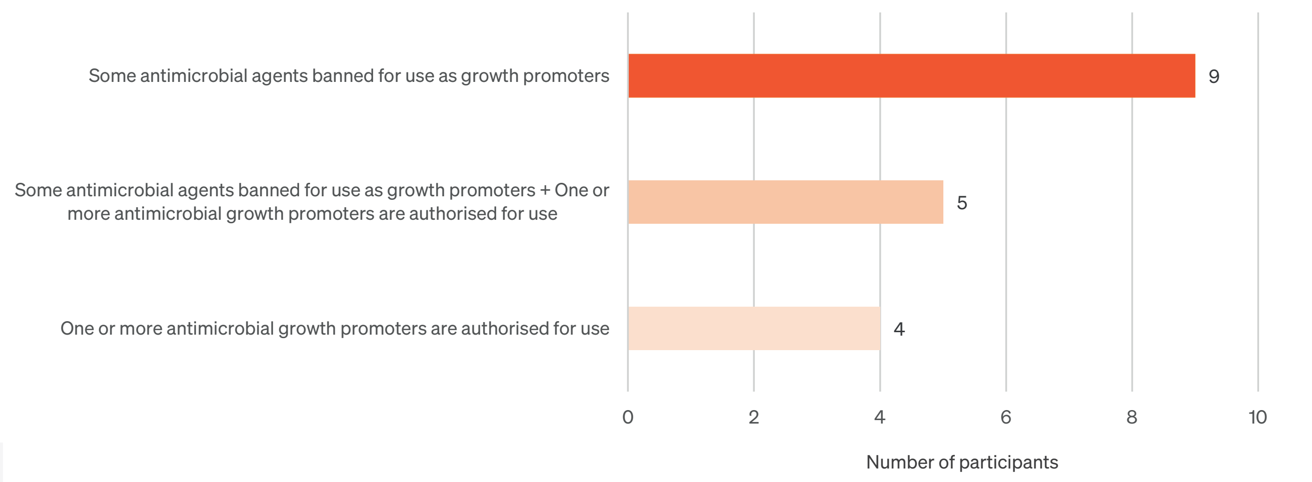



**Figure 8.** Type of growth promotion legislation in 18 participants who reported the use of growth promoters in 2022

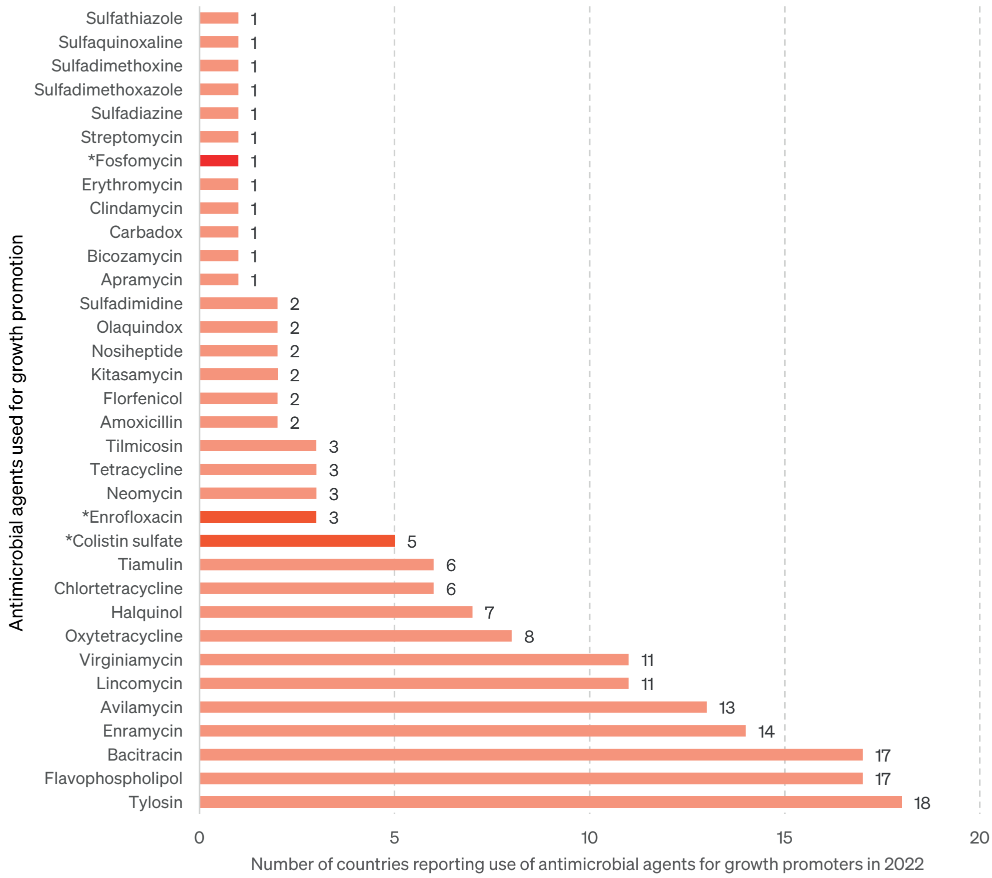
## List of antimicrobial agents used for growth promotion

The 'Baseline Information' section of the WOAH template includes a question for participants to report any antimicrobial agent authorised or used in animals as a growth promoter. Ionophores were excluded from reporting as they are mostly used for parasite control and have different regulatory classifications in different countries. However, 12 Members reported the use of ionophores as growth promoters in addition to antibiotic molecules, and monensin and salinomycin (two specific ionophores) were mentioned by ten and six Members, respectively. According to the WHO List of Critically Important Antimicrobials, ionophores are not used in humans [5].

The 36 participants reporting the use of antimicrobial agents for growth promotion were further asked for a list of antimicrobial agents (by active ingredient) either authorised as growth promoters or known to be used in cases where legislation on this issue does not exist.

Thirty-five participants (*n* = 36; 97%) responded with a list of antimicrobial agents used for growth promotion. The most frequently listed antimicrobial agent was tylosin, followed by flavophospholipol and bacitracin. While flavophospholipol and bacitracin are not used in humans, according to the WHO List of Critically Important Antimicrobials for Human Medicine that applied during the data collection period [5], bacitracin and tylosin are classified as critically important for use in humans in the recently released WHO Medically Important Antimicrobial List [6]. Colistin was mentioned by only five participants. Based on this result, and compared with the second round of data collection in 2016 in which 13 participants reported using colistin, countries are making progress in phasing out the use of colistin. Twenty-one Members (*n* = 35; 60%) used antimicrobials appearing in the highest priority category of the WHO List of Critically Important Antimicrobials for Human Medicine applicable for that period, and eight Members (*n* = 35; 23%) used antimicrobials from the highest priority category of the most recent WHO List of Critically Important Antimicrobials (**Figure 9**).

Thirty participants using antimicrobial agents as growth promoters (*n* = 36; 83%) provided quantitative data on antimicrobial agents intended for use in animals. Sixteen of these participants (*n* = 30; 53%) could distinguish these quantities by use (i.e. for growth promotion or veterinary medical purposes). During the eighth round, most of the participants who used the Calculation Tool and also used growth promoters indicated the use of veterinary products for both veterinary medical use and growth promotion purposes. Those products with dual indications provided different dosage instructions according to the type of use. As participants are still using mainly sales and import figures as data sources, it would be difficult for them to distinguish quantities by type of use for these products, unless data are collected in the field.




* The classes in the WHO Medically Important Antimicrobial List should be the highest priority for Members when phasing out the use of antimicrobial agents as growth promoters.

**Figure 9.** Antimicrobial agents used for growth promotion in animals in 35 Members in 2022

## Use of growth promotion in the absence of risk analysis

More than five years have passed since WOAH Members adopted Resolution No. 36 agreeing to phase out the use of antibiotics for growth promotion in the absence of risk analysis. During the eighth round, 34 out of 36 Members who reported the use of growth promoters were further asked if they had performed a risk analysis (as recommended in Chapter 6.11. of the *Terrestrial Code*) for the use of antibiotics as growth promoters.

From this survey of 14 Members (*n* = 34; 41%), three Members had a risk analysis in place and shared their protocols with WOAH. None of these three had authorised molecules in the highest priority category of the WHO List of Critically Important Antimicrobials for Human Medicine. The 11 remaining countries confirmed that no risk analysis was in place for the use of antibiotics as growth promoters. Six out of these 11 countries confirmed that they were using molecules in the highest priority category of the WHO List of Critically Important Antimicrobials.

Twenty Members did not answer the further question but did report the use of growth promoters. It was observed that 15 of these (*n* = 20; 75%) were using molecules from the highest priority category of the WHO List of Critically Important Antimicrobials for Human Medicine [5]. Even though these Members did not answer the question on risk analysis, it is very likely that they had no protocol for risk analysis as no risk analysis would approve the use of such molecules.

In conclusion, from the 34 Members using growth promoters during the eighth round of data collection, and from the evidence of the survey on risk analysis, we can estimate that 26 Members (*n* = 34; 76%) did not have a risk analysis for their use of growth promoters.

- 11 Members formally confirmed that there was no risk analysis.
- 15 Members who did not answer the question were using molecules in the highest priority category of the WHO List of Critically Important Antimicrobials for Human Medicine [5].

Although WOAH Members adopted Resolution No. 36 in the 2016 General Session, 26 Members have not implemented any risk analysis for the use of antibiotics as growth promoters and should therefore stop the use of antimicrobials for growth promotion in their countries.

# 3. 2021 analysis of antimicrobial quantities

This section provides an analysis of globally reported quantitative data on antimicrobial agents intended for use in animals, adjusted by animal biomass, focusing on 2021. Data from previous years can be found in the ANIMUSE Interactive Report at: https://amu.woah.org.

This section is presented on the understanding that many participants contributing to ANIMUSE are making continuous progress in the development of national monitoring systems for antimicrobial use in animals. Even where participants are able to provide quantitative information, some data resources may be currently inaccessible. In addition, calculation errors, where present, are still being resolved by the participants. Data collection on animal populations is also progressing on the global level. Consequently, **it is expected that these estimates will be refined over time, and thus should be interpreted with caution.** The data presented in this report were extracted and analysed from ANIMUSE in October 2023. The most up-to-date figures can be found at the ANIMUSE public portal.

## 3.1. Antimicrobial quantities

### Regional representation of participants included in the 2021 analysis

The focus of this section covers all 2021 data provided during any round of data collection that have been validated by WOAH. Therefore, the results presented in this section differ from those presented in Section 2, in which only the data collected during the eighth round were included.

For all rounds from which data were compiled, 94 participants provided validated antimicrobial quantities intended for use in animals for 2021.

The limited number of Members with validated data from the Middle East did not allow for the inclusion of this region's data in the regional 2021 analysis, due to confidentiality issues. But the validated data submitted by this region's participants were included in the global analysis. Increased data submissions from this region may permit the analysis of antimicrobial quantities in future reports.

### Period of time covered

The average time period covered was 362 days for 94 Members who provided antimicrobial quantities. Impressively, 87% of these Members covered an entire calendar year.

### Quantitative data sources captured

In the guidance for completing the WOAH template for the collection of data, participants were asked to provide data as close to the point of use (i.e. administration) as possible. However, among the 94 participants who reported validated quantitative data, 'Antimicrobial use data – Farm records' – the category representing on-farm administration of antimicrobials – was only selected as a data source by two participants. They accompanied those quantities with sales and import data (**Figure 10**). All other data sources represent usage through what was sold, imported or manufactured for intended administration to animals.

For further details on the sub-categories of the data sources, please visit the ANIMUSE public portal or refer to the guidance on how to complete the questionnaire[9]. The most common sources of quantitative data were sales data, particularly from wholesalers and marketing authorisation holders, selected by 29 and 23 participants, respectively. After sales data, import data declared by Customs Authorities were the next most common source of reported quantities of antimicrobial agents intended for use in animals.

### Other data sources reported

Thirteen participants (*n* = 94; 14%) reported 'other' sources of quantitative data from the list of provided options. When this response was selected, participants were asked to describe these other data sources; the responses were grouped by category and are shown in **Figure 10**.

Other commonly reported sources of quantitative data were mainly from other import control systems, apart from customs declarations. In a few cases, the source was data from manufacturers' reports. For some participants who do not confirm the importation of a product after issue of a permit, these quantities may not represent the antimicrobial agents that actually entered the country and were used in the animal population.

[9] Guidance for completing the questionnaire template for the collection of data on antimicrobial agents intended for use in animals

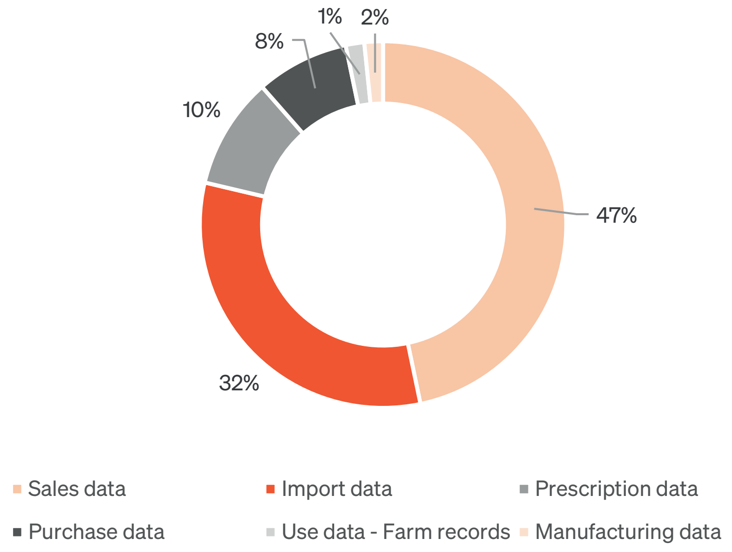



**Figure 10.** Validated data sources selected by 94 participants reporting quantitative data in 2021

## Data coverage

In the WOAH template for quantitative data collection, participants were asked to estimate the extent to which their data represented overall sales of antimicrobial agents intended for use in animals, as a percentage of the total estimated sales in their country. For example, a hypothetical participant may report that the quantitative data reported covers only 80% of all estimated national sales of antimicrobial agents used in animals, based on known sources of missing data. All 94 participants who provided quantitative data with validated data responded to this question.

The global average for achieved quantitative data coverage was 90% (**Table 2**). This average quantitative data coverage shows that, for several participants, surveillance systems do not capture the totality of antimicrobial agents intended for use in animals. **However, this figure should be interpreted with caution, as data coverage estimations are made subjectively by each participant.** By definition, this question aims to identify quantitative data that are inaccessible, and therefore the responses can vary in accuracy.

**Table 2**. Reported percentage of antimicrobial quantity coverage by WOAH region, 2021

| WOAH region | Number of participants | Mean (%) | Median (%) | Standard deviation (%) | Minimum (%) | Maximum (%) |
|---|---|---|---|---|---|---|
| Africa | 25 | 87 | 90 | 13 | 50 | 100 |
| Americas | 10 | 95 | 100 | 9 | 70 | 100 |
| Asia and the Pacific | 17 | 91 | 95 | 10 | 70 | 100 |
| Europe | 39 | 92 | 100 | 19 | 10 | 100 |
| Global* | 94 | 90 | 99 | 16 | 10 | 100 |

*Data from the Middle East are included here.

### Sources not captured by the data

Of the 94 participants who estimated the coverage of their data with validated data sources, 43 stated that they covered 100% of the data sources used to report the data. The 51 participants who did not cover 100% of the available quantitative data were asked to provide further information on uncaptured data sources.

Forty-eight participants ($n$ = 51; 94%) responded with an explanation on uncaptured data sources. Responses were grouped by category (a response could come under more than one category). All participants' uncaptured data sources were analysed and, if needed, further questions were asked about their data collection systems. After the analysis, the uncaptured data sources were validated for all 48 participants. Most uncaptured data sources derived from sales data that had not been provided (27 Members), particularly those from relevant wholesalers, reported by eight participants. Illegal or unofficial veterinary products that enter a country were also a significant contributor to uncaptured data, reported by 12 participants. More information on uncaptured data sources can be found at the ANIMUSE public portal.

## Antimicrobial quantities reported in 2021

**Table 3** shows the total tonnage of antimicrobial agents intended for use in animals in 2021, as reported to WOAH during the seventh and eighth rounds of data collection.

When the antimicrobial quantities reported were adjusted for these coverage estimates (i.e. extrapolation to annual coverage from all data sources to account for partial temporal coverage or missing data sources), the quantities shown in **Table 3** were obtained. These coverage-adjusted figures should be interpreted with caution, as data coverage estimations are made subjectively by each participant. By definition, this question aims to identify quantitative data that are inaccessible, and therefore the responses can vary in accuracy. However, these coverage-adjusted quantities can be considered an upper-level estimate of antimicrobial use in animals.

**In order to properly interpret the tonnage of antimicrobials reported, the size and composition of each participant's animal populations must be considered.** For this reason, we refer the reader to Section 3.3 'Antimicrobial quantities adjusted for animal biomass', to interpret differences in the regional use of quantities of antimicrobial agents intended for use in animals.

These regional totals should not be considered representative of the total amounts of antimicrobials consumed in any WOAH region, or in any particular country.

**Table 3**. Reported quantity of antimicrobial agents intended for use in animals by WOAH region, 2021

| WOAH region | Number of participants included in analysis of 2021 quantitative data | Quantities reported (in tonnes) | Quantities reported adjusted by estimated coverage* (in tonnes) |
|---|---|---|---|
| Africa | 25 | 4,228 | 4,888 |
| Americas | 10 | 20,332 | 25,590 |
| Asia and the Pacific | 17 | 51,145 | 52,884 |
| Europe | 39 | 5,322 | 5,480 |
| **Total**** | **94** | **81,084** | **88,927** |

* Estimated coverage: this refers to the subjective estimates participants made with respect to the extent to which their data represented overall sales of antimicrobial agents intended for use in animals. In this column, the figures were adjusted to represent 100% of the total estimated amount (as further explained in the section 'Data Coverage').

** The total includes the data from three Middle East Members.

Among the 94 participants who provided quantitative data on antimicrobial agents intended for use in animals, tetracyclines were the most commonly reported antimicrobial class (**Figure 11**).

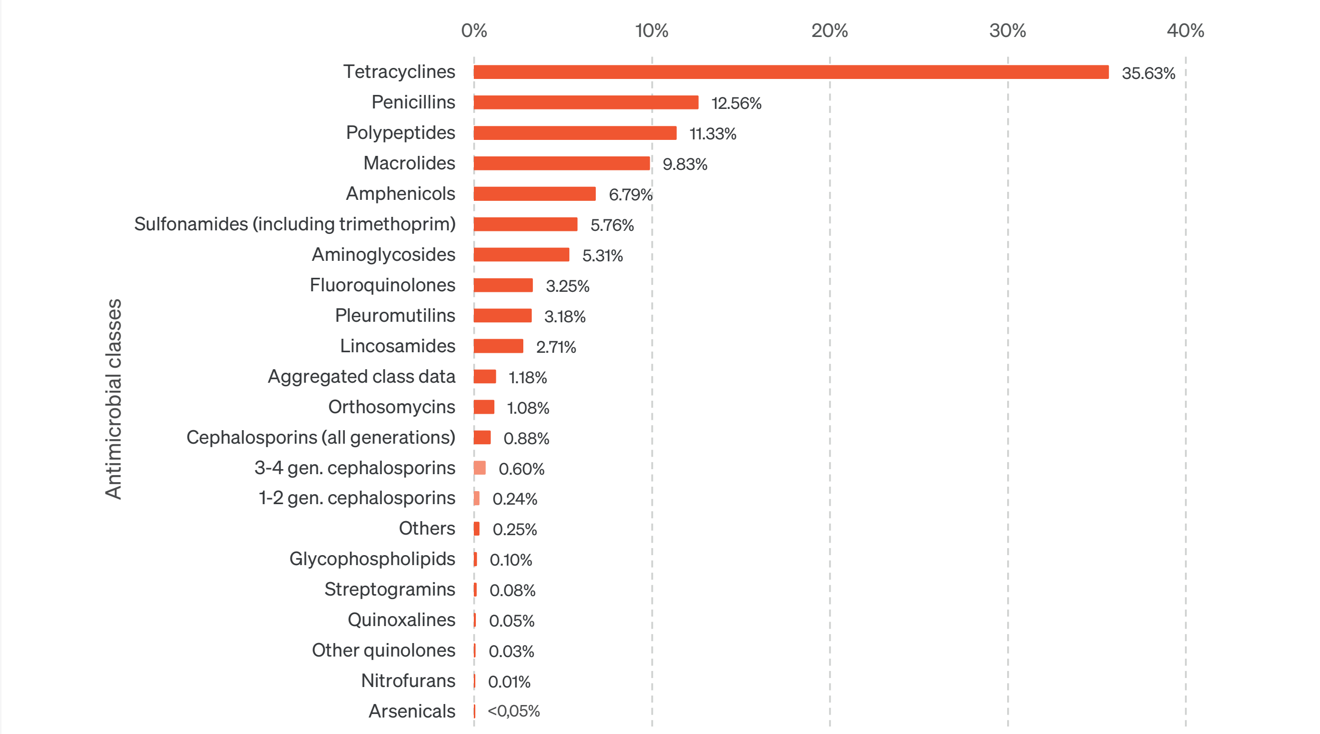



**Figure 11.** Proportion of antimicrobial classes reported for use in animals by 94 Members in 2021[10]

Of the 94 Members, 35 used the ANIMUSE Calculation Module, which provides information by veterinary product. For these 35 Members, the most reported molecules, arranged in descending order, were: oxytetracycline (58%), doxycycline (27%), and chlortetracycline (15%) for the tetracyclines class; amoxicillin (79%), penicillin G procaine (14%), and penicillin G (3%) for the penicillins class; and bacitracin (64%), colistin (32%) and enramycin (4%) for the polypeptides class.

## High levels of use of specific antimicrobial classes

In the 2021 data, it was noted that ten participants (*n* = 94; 11%) allocated more than 70% of their total amount of antimicrobials intended for use in animals to one antimicrobial class (**Table 4**). Globally, it was observed that those participants with high use of one antimicrobial class usually shared the same economic status. Additionally, the high usage rates for the class were principally linked to economic factors.

Five of these participants (*n* = 10; 50%) were from Africa and four of these were classified as low-income countries, according to World Bank figures for income groups effective for 2021[11]. Participants reporting more than 70% of their amounts for one antimicrobial class were further asked to explain any known reason for the high levels of use of a single antimicrobial class. Only three participants provided explanations, mentioning that tetracyclines were favoured because of low financial cost, to control certain diseases or because they were preferred in certain animal species.

**Table 4**. Antimicrobial classes with more than 70% of the total amount of antimicrobials intended for use in animals, by ten participants in 2021

| Antimicrobial class | Number of Members with high levels of use in a specific antimicrobial class | Antimicrobial quantities allocated in the antimicrobial class (tonnes) | Use of the antimicrobial class compared to the total amount reported (% – mean) |
|---|---|---|---|
| Tetracyclines | 9 | 6,517 | 80.8% |
| Polypeptides | 1 | 6,826 | 78% |

[10] Clarifications on the classes:
- **Cephalosporins (all generations)** are not the sum total of all the sub-categories of cephalosporins as some Members did not provide their data by sub-category.
- **Aggregated class data** are used for confidential purposes.
- **Others** includes all antibiotics not otherwise covered.

[11] Please refer to the explanation of this figure to understand the different combinations of animal groups and sums.

## Quantitative data differentiation by animal group

For the purposes of the WOAH survey, animal groups are separated into: 'Terrestrial food-producing animals', 'Aquatic food-producing animals' and 'Non-food-producing animals'. Multiple options were available when responding to this question.

For 2021, 68 participants (*n* = 94; 72%) provided data differentiated by animal group (**Figure 12**).

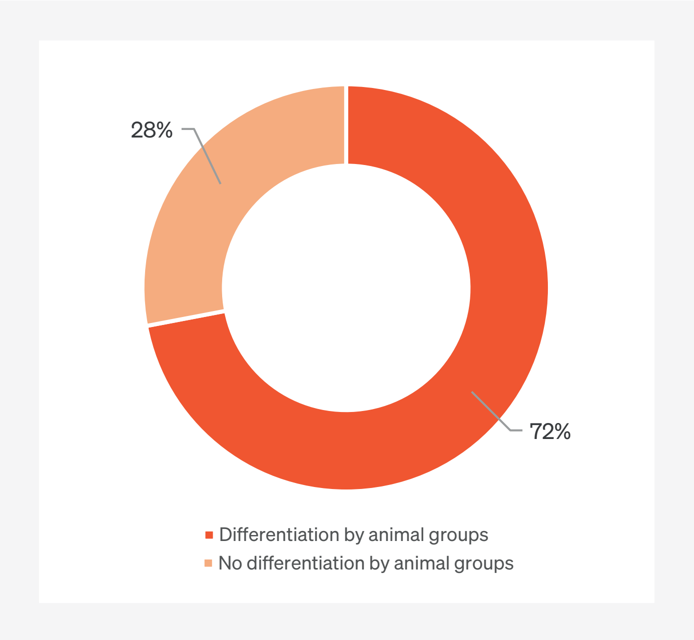



**Figure 12.** Differentiation by animal group among 94 participants reporting quantitative data in 2021

This corresponded to the number of participants reporting their antimicrobial quantities through Reporting Options 2 and 3, which enabled differentiation by animal group.

**Figure 13** provides an overview of countries' preferences for providing data by animal group. The various combinations are explained in the following paragraphs.

*Terrestrial food-producing animals (49 Members)*

- Nine Members provided data only for terrestrial food-producing animals without any data for any other animal groups.
- Forty Members provided data for terrestrial food-producing animals, in addition to data for other animal groups.

*Aquatic food-producing animals (17 Members)*

- Seventeen Members provided data for aquatic food-producing animals in addition to data for other animal groups.

*Non-food-producing animals (56 Members)*

- One participant provided data only for non-food-producing animals without any data for other animal groups.
- Fifty-five Members provided data for non-food-producing animals in addition to data for other animal groups.

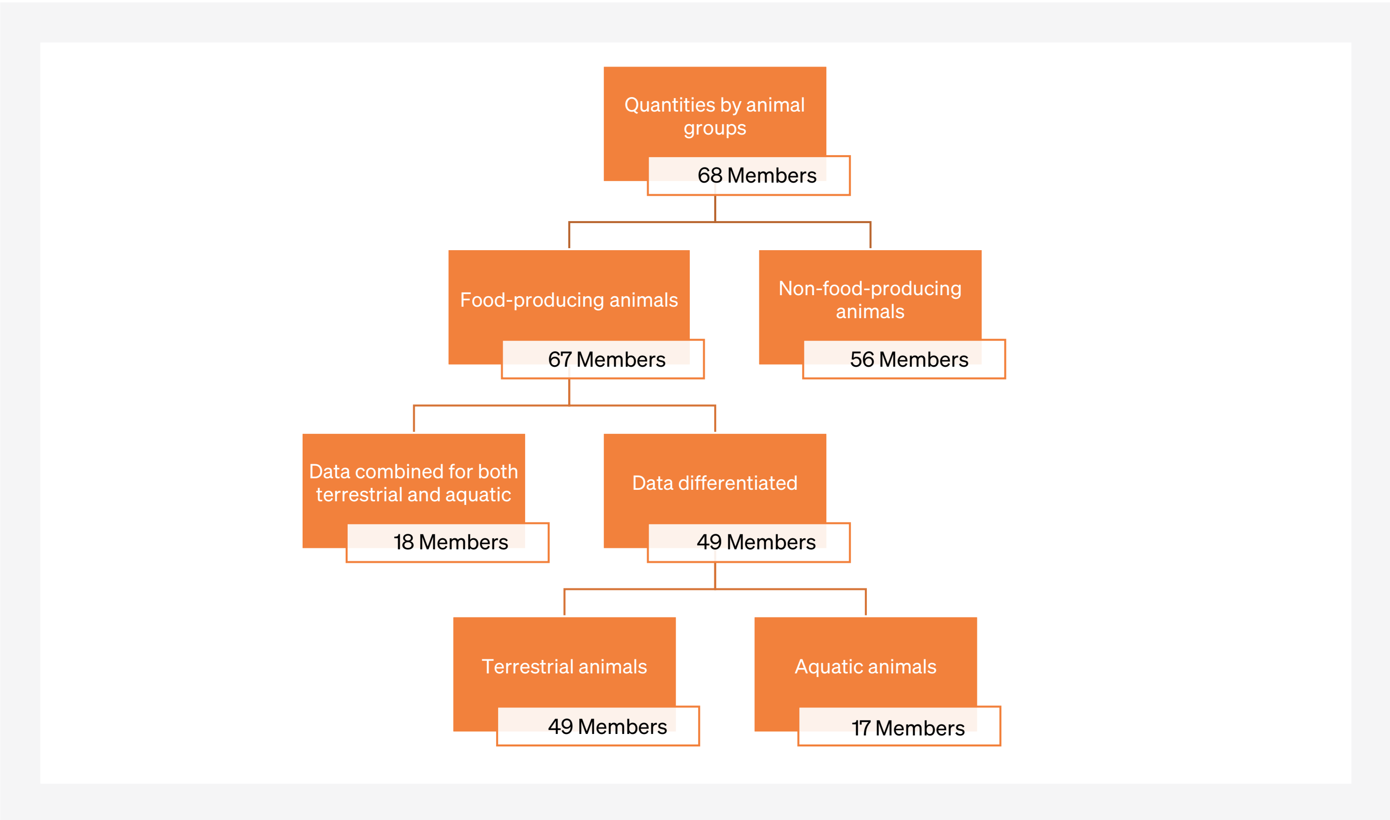



**Figure 13.** Animal groups provided among 68 Members reporting quantitative data in 2021[13]

## Terrestrial food-producing animals

Of the 68 Members able to provide antimicrobial quantities by animal groups, 49 ($n$ = 68; 72%) provided specific quantities for terrestrial food-producing animals. All 49 Members were asked to provide a list of animals covered by those quantities, based on the veterinary product labels. Most participants mentioned cattle, poultry (mainly broilers) and small ruminants. **Figure 14** is not indicative of the species that consume the most antimicrobials, but rather of the species covered according to the veterinary product labels, which – in several cases – could cover more than one species at a time.

The 49 Members who provided quantities specific to terrestrial food-producing animals tended to consumemore tetracyclines, followed by penicillins and macrolides (**Figure 15**).

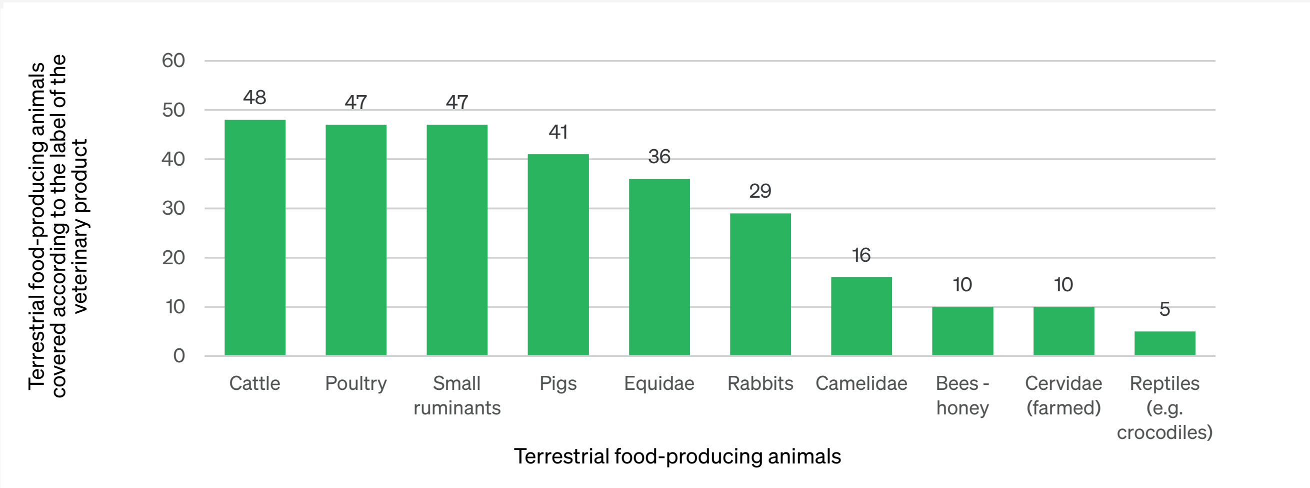



**Figure 14.** Terrestrial food-producing animal species included in quantitative data reported by 49 Members in 2021

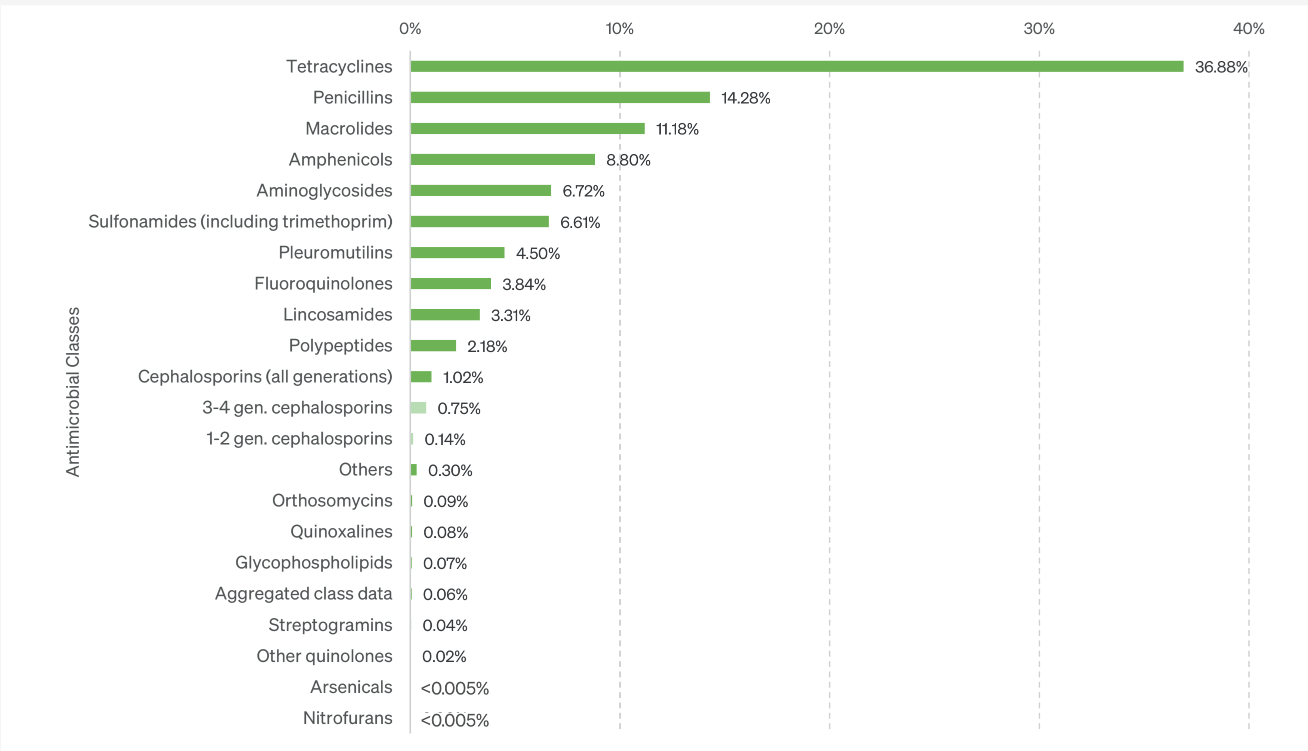



**Figure 15.** Proportion of antimicrobial classes by terrestrial food-producing animals as reported by 49 Members in 2021[12]

Of the 49 Members, 31 used the ANIMUSE Calculation Module, which provides information by veterinary product. Among these 31 Members, the five most reported molecules arranged in descending order were: oxytetracycline (18%), enrofloxacin (12%), tilmicosin (10%), tylosin (10%) and sulfadimidine (9%).

[12] Please see notes from Figure 11.

### Aquatic food-producing animals

Of the 68 participants who provided quantitative data by animal groups in 2021, 17 provided specific quantities for aquatic food-producing animals. These Members provided a list of animals covered by the antimicrobial quantities based on the veterinary product labels. Most of the Members mentioned fish, followed by crustaceans.

**Figure 16** is not indicative of the species that consumed the most antimicrobials, but rather of the species most frequently covered, according to the veterinary product labels, which – in several cases – could cover more than one species at a time. In the case of aquatic animals, the sub-categories of fish corresponded mainly to undefined fish, followed by Salmonids and Cichlids.

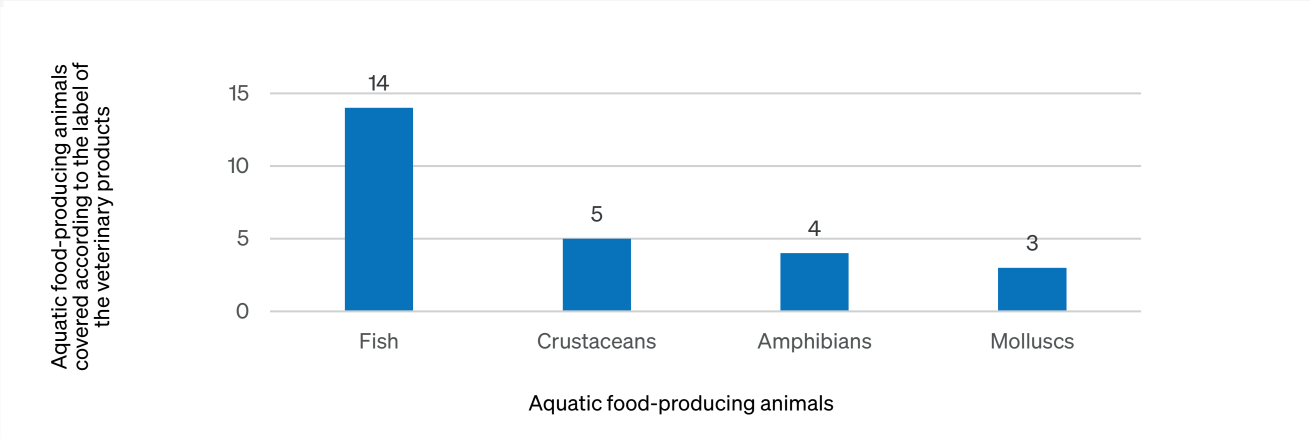



**Figure 16.** Aquatic food-producing animals covered in quantitative data reported by 17 participants in 2021

Among the 17 participants who reported quantitative data for aquatic food-producing animals, amphenicols were the most commonly reported antimicrobial class, followed by fluoroquinolones and tetracyclines (**Figure 17**).

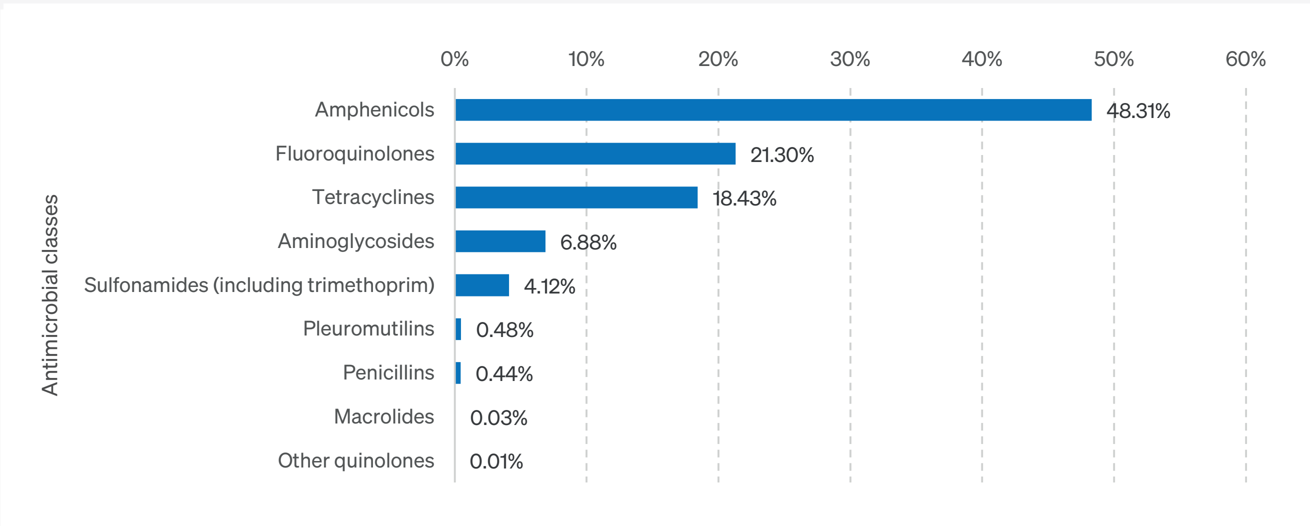



**Figure 17.** Proportion of antimicrobial classes by aquatic food-producing animals as reported by 17 participants in 2021

Of the 17 Members, seven used the ANIMUSE Calculation Module, which provides information by veterinary product. For these seven Members, the most reported molecules in descending order were: amoxicillin (50%), oxytetracycline (41%), enrofloxacin (6%), florfenicol (2%) and chlortetracycline (<1%).

### Non-food-producing animals

Of the 68 Members able to provide antimicrobial quantities by animal group, 56 (*n* = 68; 82%) provided specific quantities for non-food-producing animals. All 56 Members were asked to provide a list of animals covered by those quantities, based on the veterinary product labels. Most Members mentioned canines and felines.

**Figure 18** is not indicative of the species that consumed the most antimicrobials, but rather of the species covered according to the veterinary product labels, which – in several cases – covered more than one species at a time.

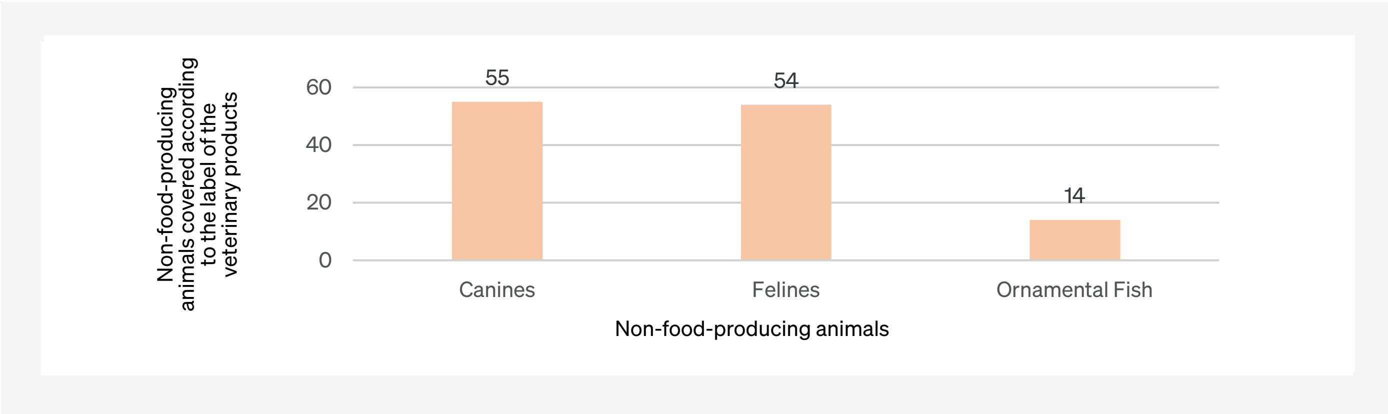



**Figure 18.** Non-food-producing animals covered in the quantitative data reported by 56 participants in 2021

Among the 56 Members reporting quantitative data for non-food-producing animals, penicillins were the most commonly reported class, followed by fluoroquinolones and tetracyclines (**Figure 19**).

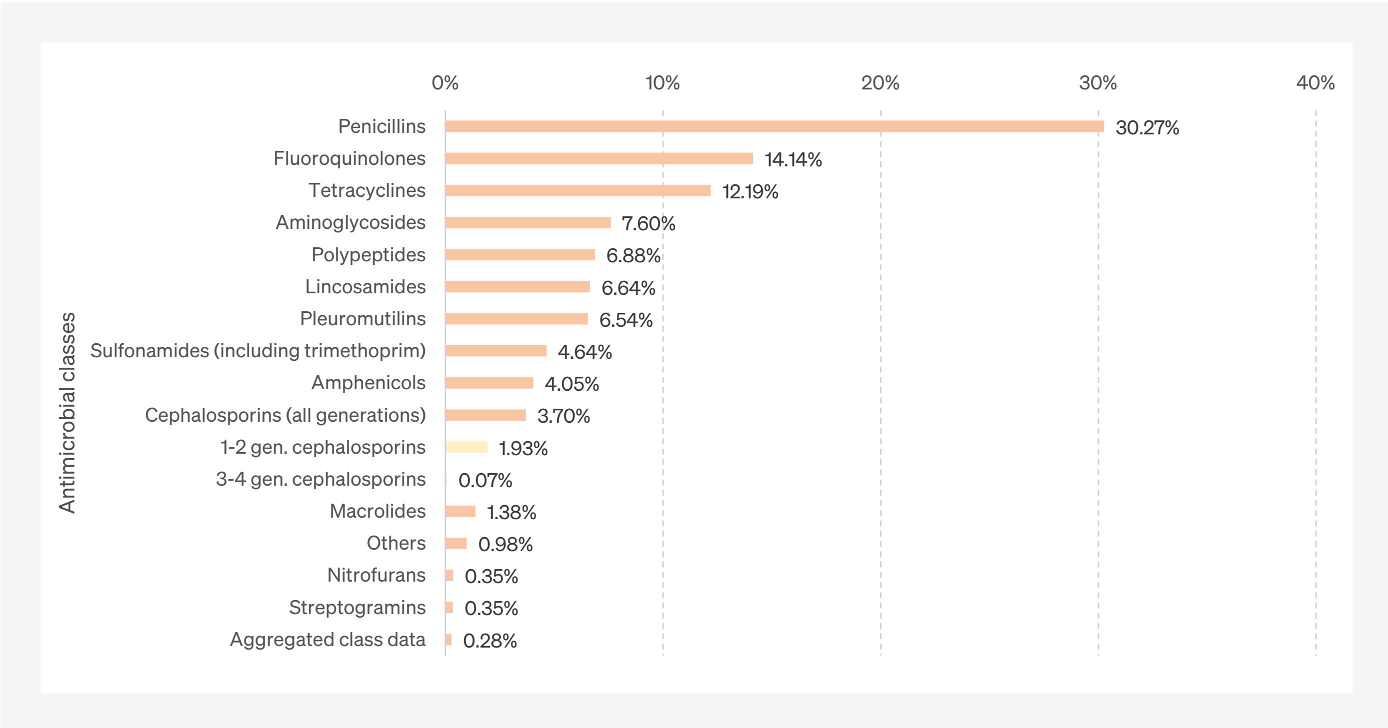



**Figure 19.** Proportion of antimicrobial classes in companion animals as reported by 56 Members in 2021[13]

Of the 56 Members, 44 used the ANIMUSE Calculation Module, which provides information by veterinary product. Among these 44 Members, the five most reported molecules in descending order were: lincomycin (28%), amoxicillin (25%), doxycycline (23%), cefalexin (7%) and streptomycin (6%).

## Routes of administration

For 2021, 70 participants chose to report their quantitative data through Reporting Option 3, the only choice which enables disaggregation of data by route of administration. Among these 70 participants, 78% of antimicrobial quantities were administered orally, 14% by injection and 8% by other routes of

[13] Please see notes from Figure 11.

administration (**Figure 20**). The antimicrobial class most frequently administered orally was tetracyclines (42%); those most often given by injection were penicillins (24%); and the class most often administered by other routes was again tetracyclines (96%).

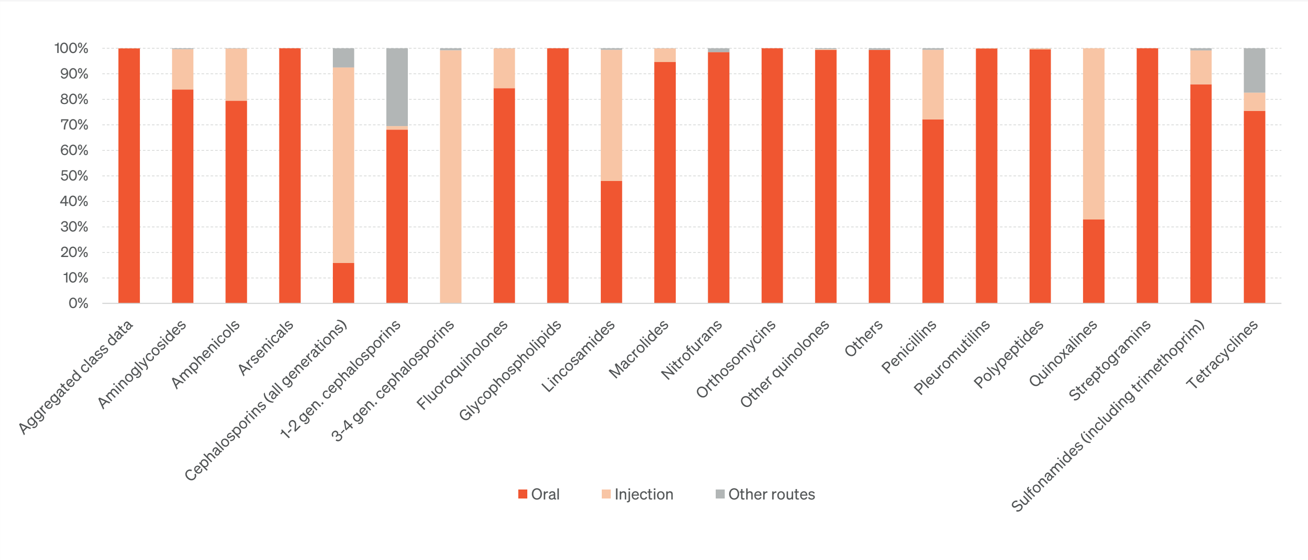



**Figure 20.** Proportion of antimicrobial quantities (by antimicrobial class) reported for use in animals by routes of administration, aggregated by 70 participants in 2021

Of the 70 Members, 35 used the ANIMUSE Calculation Module, which provides information by veterinary product. Of these 35, the principal molecule administered orally was bacitracin (39%); for injections it was tetracycline (57%); and for other routes of administration it was cefacetrile (27%).

## 3.2. Animal biomass

Animal biomass was calculated for 94 Members who provided quantitative data for 2021 during different rounds of data collection, based on animal population figures for 2018. Populations represented in the animal biomass analysis reflect the number, size and dynamics of the animal populations of the participants who reported data to WOAH for the given year of analysis.

The analysis of animal biomass for the years 2020 and 2021 is currently calculated from animal population figures for the year 2018, due to temporary constraints on the availability of data for animal populations. As we work towards resolving these issues, the interim solution involves using the animal population figures of 2018 (the year for which the most reliable and up-to-date data are available) to bridge the information gap for 2020 and 2021. However, given the general global increase observed in food-producing animal populations, it is likely that using animal population data from 2018 results in an underestimation of animal biomass for 2020 and 2021. Despite this limitation, the animal biomass denominator is maintained to provide a continuous mg/kg analysis of antimicrobial quantities.

**The following figures represent only those 94 countries who took part in reporting quantitative data on antimicrobial agents intended for use in animals and may not be representative of global animal populations or biomass, or of any particular WOAH region.**

### Estimated coverage of animal biomass for Members providing 2021 data

For the 94 Members providing AMU data for 2021, it was estimated that their animal biomass represents 65% of the total global animal biomass. Worldwide, the estimated biomass coverage of the responding participants increased from 29% in 2014, the year covered by the first AMU Annual Report, to 65% in 2021, the year covered by the current report.

These estimates were made by calculating the ratio of animal biomass for the reporting Members in relation to the total estimated biomass for all countries across the globe, whether or not they participated in the data collection. The Americas and Europe have particularly high animal population coverage for 2021, with responding participants representing 77% (Americas) and 70% (Europe) of their region's total animal biomass (**Figure 21**). The animal biomass coverage estimates were calculated using live animal population data from 2018 and following the animal biomass methodology described at the ANIMUSE public portal.

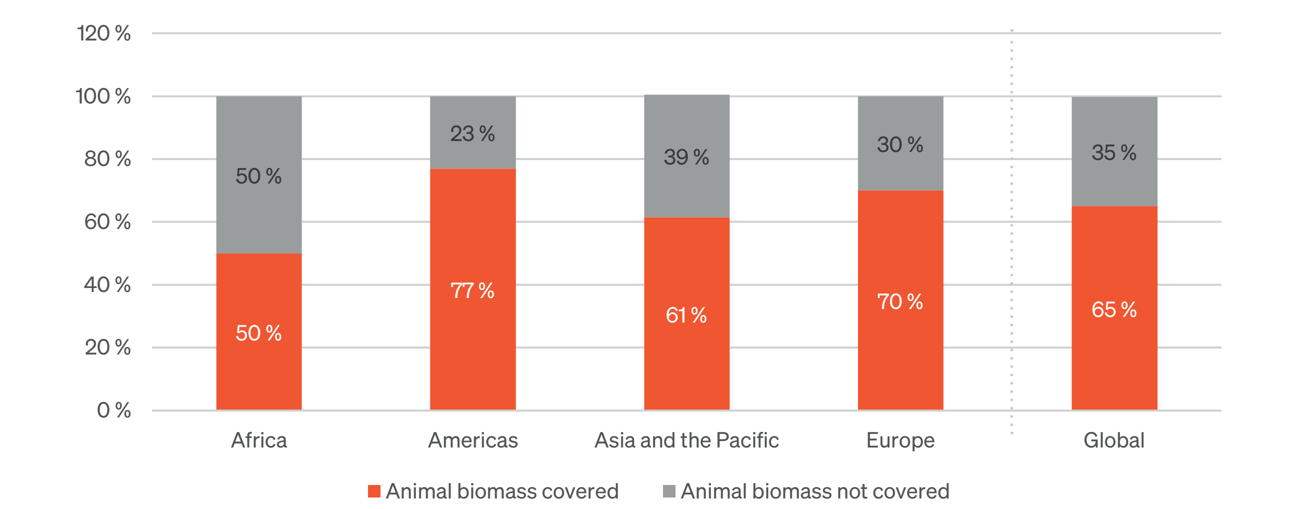



**Figure 21.** Regional percentages of estimated biomass covered by participants who reported quantitative data for 2021*

* The Middle East was not included in the visual representation, but the region's coverage was included at the global level.

**Figure 22** shows the regional distribution of the estimated percentages of biomass covered by the 94 Members in comparison to the global biomass estimate. When analysed at a global level, the animal biomass contribution from the Americas and Asia and the Pacific represents a particularly high proportion of the global biomass estimate.

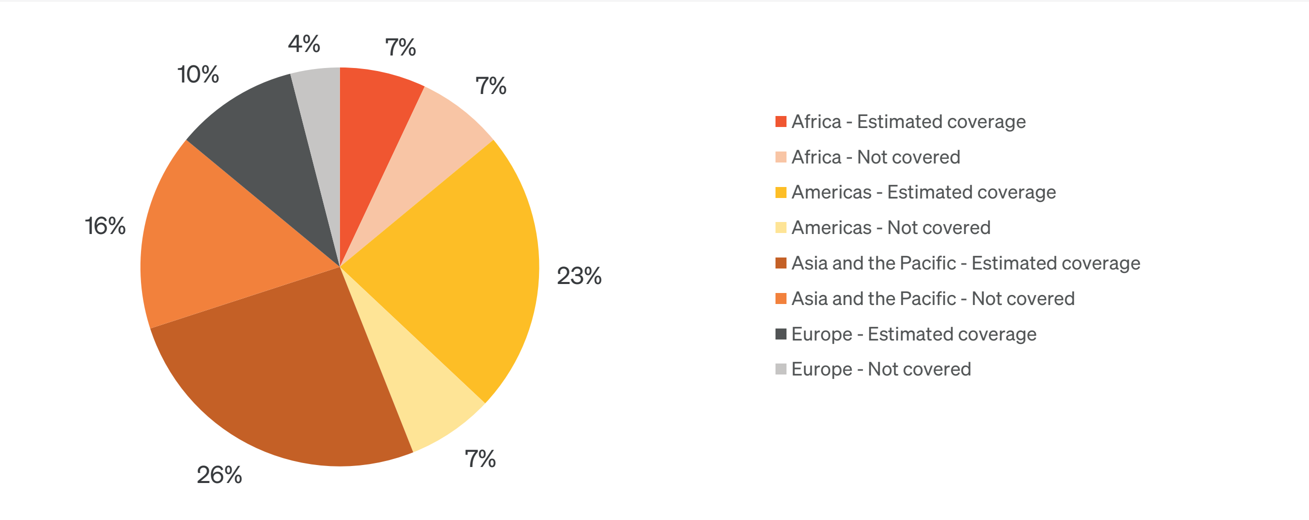



**Figure 22.** Regional percentages of estimated biomass covered by Members reporting quantitative data for 2021

## Animal biomass composition for Members providing 2021 AMU data

**Figure 23** shows the global composition of animal species potentially exposed to antimicrobial quantities by the 94 countries who reported to WOAH for 2021. These percentages depend on the animal population figures reported by the participants, as well as their average weight based on data for the year 2018.

In the four WOAH regions covered by the analysis, bovines (41%) make up the largest contribution to animal biomass, according to the reported quantitative data. Swine (21%) and poultry (18%) also play a significant role, with sheep (6%), fish (5%), equines (2%), molluscs (2%) and goats (2%) playing relatively minor roles in this analysis. The contributions of crustaceans (1%), camelids (0.6%), rabbits (>0.2%) and cervidae (>0.05%) are globally negligible for the participants covered.

These percentages may change slightly over time if the number or composition of Members who provide quantitative data from the WOAH regions also changes. This is expected to occur as Members improve their capacity to report data.

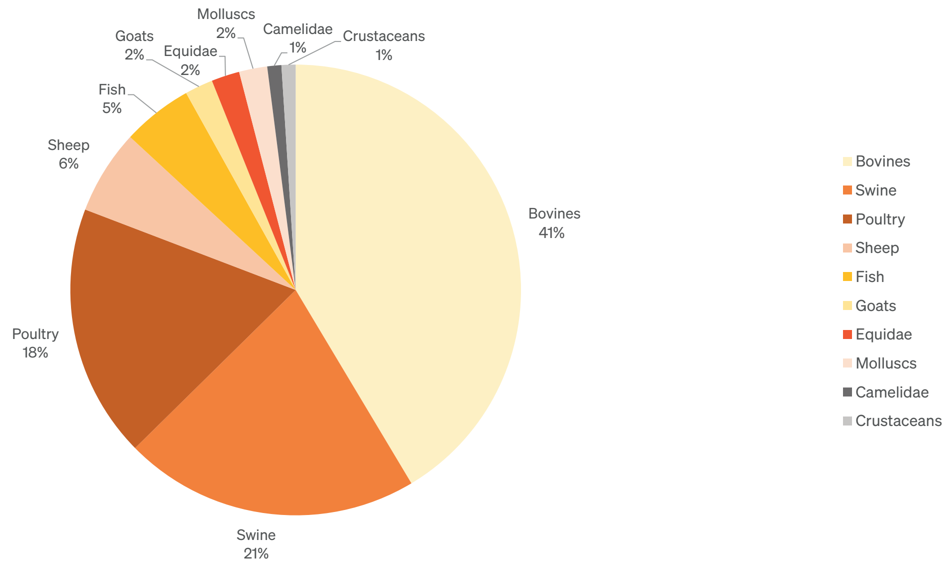



**Figure 23.** Species composition of animal biomass for the 94 participants included in the 2021 quantitative data analysis

These results should be interpreted with caution for all species for which slaughter data were the predominant contribution to the biomass calculation (swine, poultry, sheep and goats). These percentages may underestimate the significance of species that are often slaughtered for personal consumption at places other than slaughterhouses. The amount of slaughter undertaken elsewhere and the extent to which this population is captured in the slaughter data are expected to vary significantly between countries and regions.

## 3.3. Antimicrobial quantities adjusted by animal biomass

### 2021 antimicrobial quantities adjusted by animal biomass at the global and regional level

**Figure 24** provides an overview of antimicrobial agents intended for use in animals adjusted by animal biomass. The estimates compile the data of the 94 participants from all WOAH regions who supplied data for food-producing animals in different rounds of data collection for 2021.

Using this rate (antimicrobial agents reported [mg]/ animal biomass [kg]) provides an indicator that remains relevant for comparison purposes (e.g. over time and between regions). The first global estimate of 112 mg/kg represents a global estimate of antimicrobial agents used in animals adjusted by animal biomass, as represented by the quantitative data reported to WOAH from 94 participants during different rounds of data collection.

The second estimate of 116 mg/kg represents the same quantitative data, adjusted by participant estimates of how much data on antimicrobial agents intended for use in animals they were able to cover in 2021. These coverage estimates are subjective for each participant, but can provide an upper-level estimate of global antimicrobial use in animals, including from unregulated sources. Estimates of data coverage were lowest in the Americas, leading to the widest variation between reported antimicrobial quantities and those quantities adjusted by Members' estimates of data coverage. Participants in Europe and Africa were the most confident of their data coverage. For more detail of coverage estimates, see 'Data coverage' under Section 3.1.

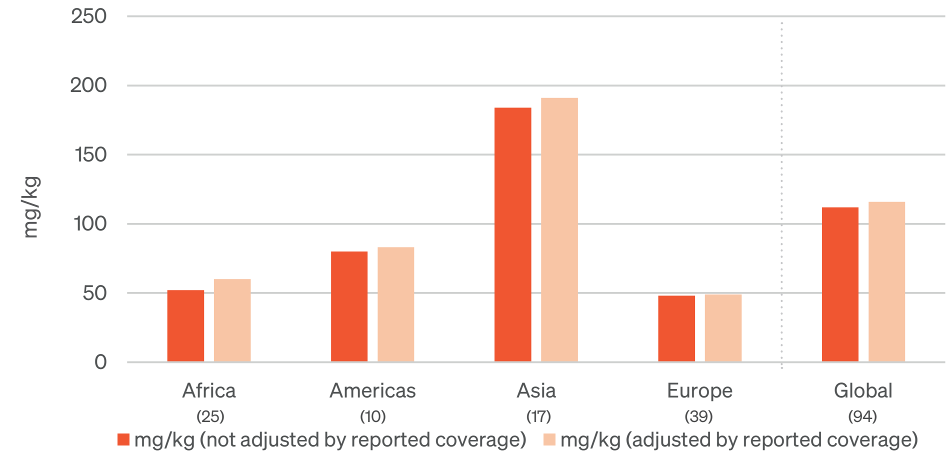



**Figure 24.** Global and regional quantities of antimicrobial agents intended for use in animals based on data reported by 94 participants for 2021, adjusted by animal biomass (mg/kg)

It is important to interpret the estimates of antimicrobial quantities adjusted by animal biomass (mg/kg) in the context of animal biomass coverage for the region (see **Figure 21**). Assessments of the total estimated regional animal biomass covered by the quantitative data reported for 2021 were calculated and explained in Section 3.2. Changes in those participants who report data, as well as in regional animal biomass coverage across years of analysis, may significantly change the results. WOAH is working with participants to continue to improve and maintain data coverage to enable an evaluation of trends over time.

Furthermore, since antimicrobial usage differs for different species (as a result of disease burden and husbandry practices), the species composition of regional animal biomass is an additional factor to be taken into account when considering the differences between regions. For more information on the regional animal biomass composition or on data from previous years, please refer to the ANIMUSE public portal.

## Antimicrobial quantities adjusted by animal biomass in 2021: distinctions between terrestrial and aquatic animals

Of the 94 participants who provided quantitative data for food-producing animals in 2021, 17 were able to report quantitative data for aquatic food-producing animals separately from their data for terrestrial animal groups.

This enabled WOAH to perform a separate analysis of mg/kg by animal group. It was observed that, in nine Members, the mg/kg ratios were higher for aquatic animals than for terrestrial animals. **Table 5** presents some characteristics of the data distribution by animal group, including the median, standard deviation and range (with the upper-level estimates adjusted by participant estimates of data coverage in parentheses). **It is expected that these initial figures will be refined over time and should therefore be interpreted with caution and not be considered representative of global aquaculture production.**

**Table 5**. Antimicrobial quantities, adjusted by animal biomass, for terrestrial animals and aquatic animals, from 17 Members, 2021.

| Animal group | Number of participants | Mean (mg/kg)* | Median (mg/kg)* | Standard deviation (mg/kg)* | Minimum (mg/kg)* | Maximum (mg/kg)* |
|---|---|---|---|---|---|---|
| Terrestrial food-producing animals | 17 | 169.86 (203.05) | 29.44 (34.39) | 320.84 (422.40) | 0.92 (1.26) | 1,140.45 (1,733.06) |
| Aquatic food-producing animals | 17 | 104.64 (112.88) | 23.66 (23.70) | 264.19 (293.25) | 0.73 (0.73) | 1,265.67 (1,267.17) |

*Adjusted estimated data coverage in brackets.

# 4. Trends from 2019 to 2021

This section presents the changes in mg/kg, antimicrobial classes and animal biomass from the 81 participants who reported data to WOAH each year from 2019 to 2021. **Table 6** presents the number of participants by each WOAH region considered for this analysis. Previous years were not included in this section. For readers interested in previous years, the trends from those periods can be accessed through the ANIMUSE public interface[14]. The period of 2019 to 2021 should not be compared to the trends provided in the previous WOAH annual reports, because different countries were included in the analysis and new Members may have been added.

**Table 6**. Number of Members who reported data to WOAH for each year from 2019 to 2021

| WOAH region | Number of participants who submitted quantities from 2019 to 2021 | Number of WOAH Members | Members covered (%) |
|---|---|---|---|
| **Africa** | 21 | 54 | 39% |
| **Americas** | 9 | 31 | 29% |
| **Asia and the Pacific** | 14 | 32 | 44% |
| **Europe** | 36 | 53 | 68% |
| **Middle East** | 1 | 12 | 8% |

The analysis of animal biomass for the years 2020 and 2021 is currently calculated from animal population figures for the year 2018, due to temporary constraints on the availability of data on animal populations. As we work towards resolving these issues, the interim solution involves using the available animal population figures for 2018, to bridge the information gap for the relevant years. 2018 is the year for which the most reliable and up-to-date data are available: however, given the generally increasing global trends for animal biomass observed in the past, the authors estimate that using animal population data from 2018 may result in a possible underestimation of animal biomass for 2020 and 2021, and therefore probably leads to an overestimation of the mg/kg indicator.

For the 81 participants who reported data to WOAH each year from 2019 to 2021, an overall increase of 2% in mg/kg was observed. From these 81 participants, the following situations were observed.

- A decrease in mg/kg in 51 participants: 29 reported a decline greater than 10% and 22 ranged between 1% and 10%.
- An increase in mg/kg in 30 participants: 26 reported an increase greater than 10% and 4 four ranged between 1% and 10%.

WOAH regions that showed a decrease were: 9% in the Americas; 6% in Europe and 0.7% in Asia and the Pacific. The region that presented an increase was Africa, with 179%.

[14] https://amu.woah.org/amu-system-portal/home

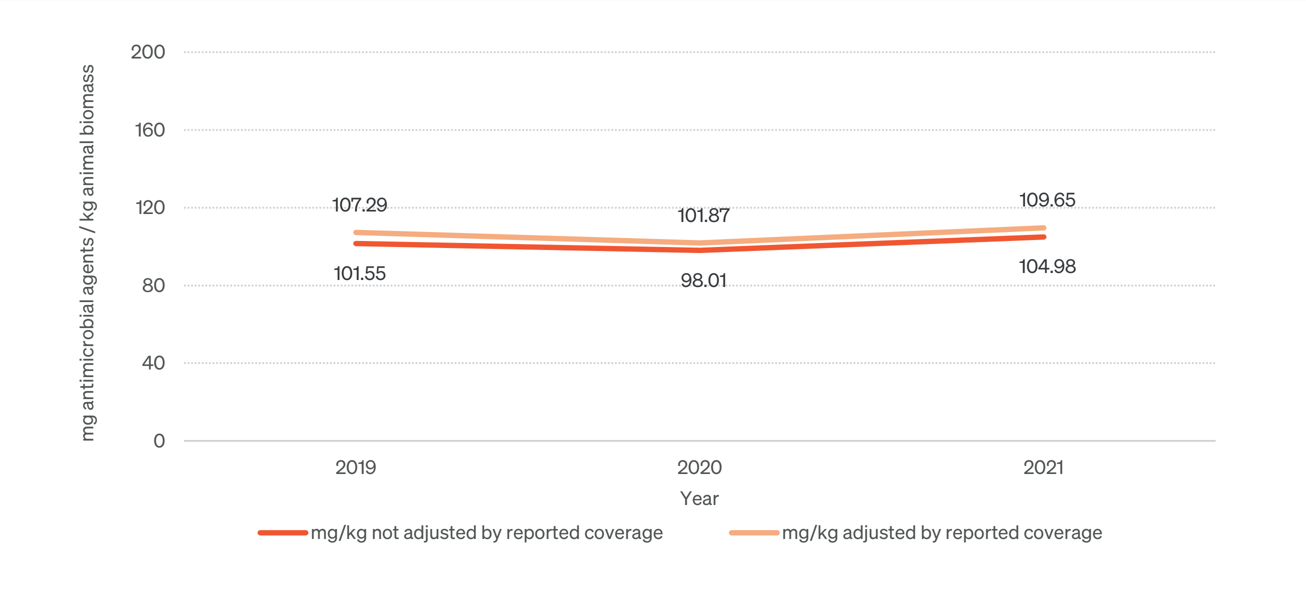



**Figure 25.** Trends over time for the global quantities of antimicrobial agents intended for use in animals, based on data reported by 81 participants from 2019 to 2021, adjusted by animal biomass (mg/kg)

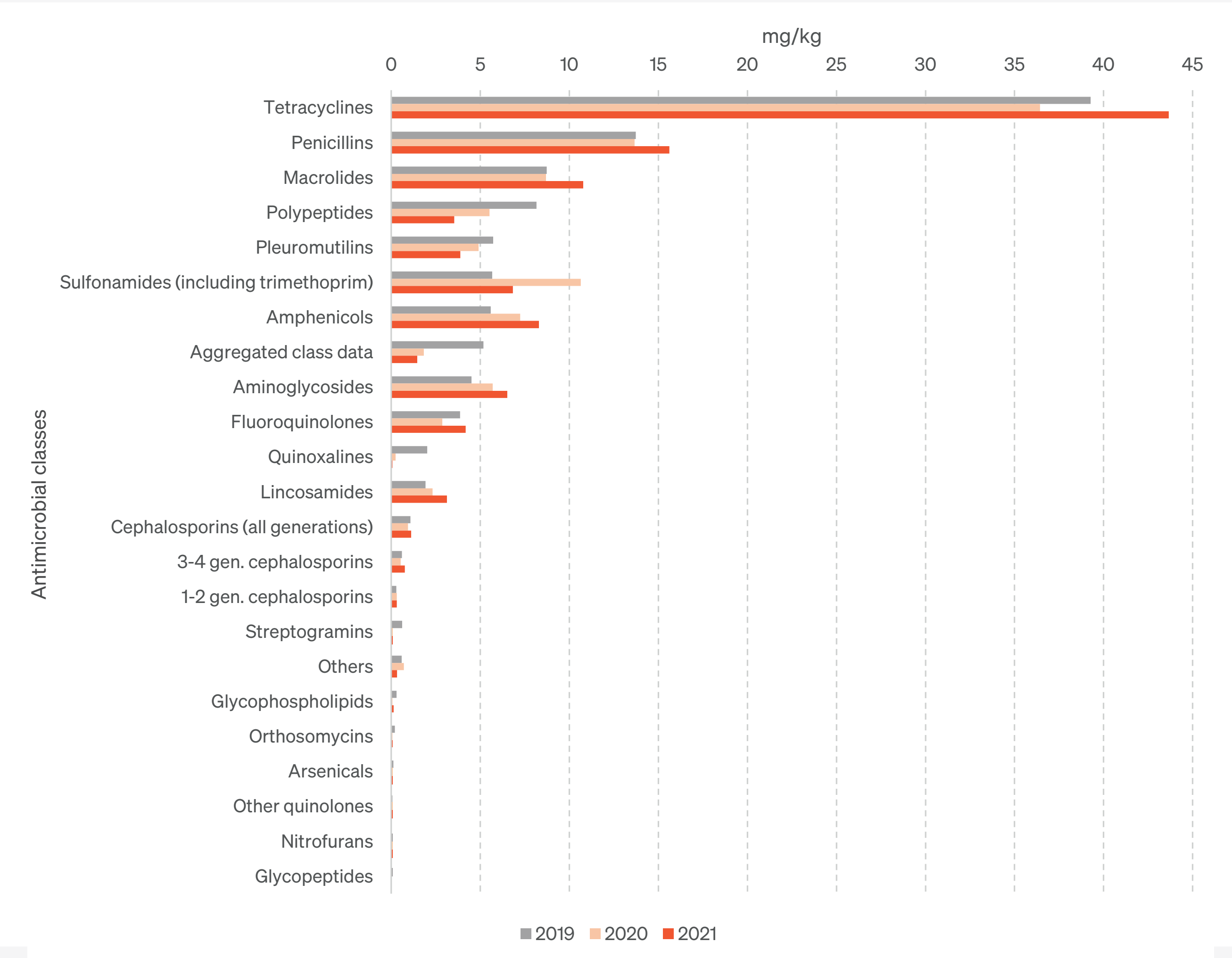



**Figure 26.** Trends over time for the antimicrobial classes reported by 81 Members from 2019 to 2021, adjusted by animal biomass (mg/kg)*[15]

* For each antimicrobial class, the summed antimicrobial quantities reported (in mg) in all WOAH regions are divided by the total animal biomass (in kg)

[15] Please see notes from Figure 11.

# 5. Discussion

## 5.1. Progress made by Members

A large number of Members remained engaged in data reporting during the eighth round of data collection, demonstrating the willingness of Members to take part in the Global Action Plan on AMR.

Of the 152 Members who submitted reports in the eighth round, 138 also participated during the seventh data collection round. Among these 138 Members, the following progress was noted:

- Eleven Members graduated from reporting baseline information in the seventh round to reporting quantitative data on antimicrobial agents used in animals for the first time (*n* = 26; 42%). Four Members used Reporting Option 1, which allows data to be reported by antimicrobial class and type of use (veterinary medical use or growth promotion). One Member used Reporting Option 2, which allows categorisation by antimicrobial class, by type of use and by animal group. Six Members used Reporting Option 3, which allows for categorisation of quantitative data by type of use, animal group and route of administration; and four of these Members used the Calculation Tool.
- Fifteen Members who had previously reported quantitative data through Reporting Option 1 (*n* = 31; 48%) progressed to more detailed reporting in this round. One Member switched to Reporting Option 2, and 14 switched to Reporting Option 3 (12 of them using the Calculation Tool).
- Two Members who used Reporting Option 2 in the seventh round provided data through Option 3 (*n* = 9; 22%).

It is important to note that, for this eighth round, most regions showed continued progress in the Reporting Options, with Africa (29 out of 34) and Europe (34 out of 45) providing the highest number of Members progressing to more detailed reporting levels of their quantitative data.

During the eighth round, 40% of the 129 Members who provided quantitative data used the Calculation Tool (Excel format) or the Calculation Module (the online version in ANIMUSE); there was an increase of 15 Members using this support for the calculations. The Calculation Module assisted Members in collecting product information, calculating amounts of active ingredients and providing different visuals for national analysis. Much of the progress demonstrated by Members can be attributed to the use of these supports.

## 5.2. Limitations in the analysis of antimicrobial quantities

All the Members who reported quantities of antimicrobial agents intended for use in animals did so using the template that WOAH created. This document collects essential information to analyse the amounts of antimicrobials ('Baseline Information', part C, as described in the *Guide for completing the AMU questionnaire*, available at the ANIMUSE public portal. In this document, Members were also given instructions to perform the calculations to report kg per active ingredient.

### Data sources

In some cases, data duplication or overestimation is considered a risk when the following situations are reported in a participant's data sources:

- Import data of active ingredients or manufacturing data reported without taking into account the potential for re-exports;
- Import data of veterinary products reported by a participant who is also providing data on sales of veterinary products (domestic and imported);
- Import, sales or purchase data of veterinary products reported in addition to usage data at the farm level;
- Data from wholesalers or marketing authorisation holders in addition to data from retailers, prescriptions, pharmacies and/or farm records.

Where these risks exist, WOAH engages with participants to highlight and clarify possible areas of data duplication or overestimation. As most of these participants are in the process of refining their data collection systems, it is expected that it will take several more years to achieve systems that provide more accurate data. WOAH continues to work closely with these participants to understand their systems and approach and support them to address limitations in their data.

### Calculation of quantitative data

Wherever possible, the data reported by participants were checked by WOAH against existing reference sources, either using the previous year's reported data or national reports available online. The indicator for this comparison was a calculated 'percentage of change'.

During the eighth round, for 12 participants ($n$ = 94; 13%) the data varied by more than 25% from one year to another. In some participants this reached a 100–200% variation. These changes were considered unlikely to reflect the true situation.

For participants with high percentages of unexplained change (>25%), WOAH enquired how the calculations to obtain kg of antimicrobial agents were carried out. Through this process, errors in the calculations were discovered where participants did not follow or misinterpreted the procedure stated in the in the annex provided to participants for calculating kilograms of active ingredients. Errors in the calculations occurred in all WOAH regions.

In addition to the analysis of the percentages of change, WOAH developed a Calculation Tool to help participants in performing calculations to obtain amounts of active ingredients. The tool takes into account the different rules when reporting to WOAH. 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 the data to the different antimicrobial classes of Reporting Options 1, 2 and 3.

Of the 129 participants reporting antimicrobial quantities in the seventh round, 40% used the tool for calculating amounts of active ingredients. While using the tool, WOAH noted that, in some cases, participants declared the wrong concentration for veterinary products due to errors while entering the information (e.g. enrofloxacin 250 g/g instead of enrofloxacin 250 mg/g). None of the participants noticed these errors, even when visuals were provided. As a consequence, WOAH will look to introduce a component for data visualisation and interpretation in upcoming regional workshops.

### Development of antimicrobial monitoring systems

Considering that many participants worldwide are still improving their capability to accurately report quantitative data on antimicrobials intended for use in animals, and that errors in data sources have been noted that may result in instances of data duplication, caution is necessary in the interpretation of the results. As stated in the 2021 annual report of the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project: **'It is generally agreed that it usually takes at least three to four years to establish a valid baseline for the data on sales of veterinary antimicrobial agents. Consequently, the data from countries that have collected such data for the first or even second time should be interpreted with due caution'** [17]**.**

## 5.3. Limitations in estimating animal biomass

The animal biomass methodology was developed with the goal of best representing animal biomass in all WOAH regions, with different animal populations and data collection systems. The biomass figures obtained from this methodology reflect a margin of error, which will be reduced over time as data collection is further refined (see Section 6, 'Future developments for the Antimicrobial Use Survey').Further information can be found in the 'OIE Annual Report on Antimicrobial Agents Intended for Use in Animals: methods used' article published in *Frontiers in Veterinary Medicine* in September 2019 [3].

### Data availability

The analysis of animal biomass for the years 2020 and 2021 is currently calculated from animal population figures for the year 2018, due to temporary constraints on the availability of data on animal populations. As we work towards resolving these issues, the interim solution involves using the available animal population figures of 2018 to bridge the information gap for these years, since 2018 is the most recent year for which reliable and up-to-date data are available. However, given the generally increasing global trends in animal biomass observed in the past, it is estimated that using data from 2018 may result in a possible underestimation of animal biomass for 2020 and 2021. Despite this limitation, the animal biomass denominator is maintained to provide a continuous mg/kg analysis of antimicrobial quantities.

## Calculation methodology of average animal weights

Different antimicrobial use surveillance programmes have used various methodologies to determine average animal weights for use when calculating total biomass. In the ESVAC report [17], estimated average weights at time of treatment are used. The Canadian Integrated Surveillance Program for Antimicrobial Resistance (CIPARS) [18] uses the same standard weights at time of treatment, as well as Canadian standard weights. The surveillance programmes of Japan [19] and the United States of America [20] take a different approach, instead using estimates of average animal weights by production category, rather than focusing the estimates on the time of treatment.

For the purposes of this report, it was determined that the latter approach, using estimates of live average weight without focus on time of treatment, would be the most appropriate. The antimicrobial compounds used and their labelling, including target species and production class, varied widely on a global scale, with data on these differences not available. Given these variations, it is not feasible to estimate weights at time of treatment for all participants reporting data to WOAH. Instead, average weights were calculated using globally available slaughter data as reported by FAO Statistical Database (FAOSTAT), for all species and regions where these data were available.

The average weights calculated for this report are therefore larger than the estimated weights at the time of treatment, resulting in a larger denominator and a decreased relative mg/kg estimate of antimicrobial agents intended for use in animals. Therefore, the results reported in WOAH analyses of antimicrobial quantities adjusted by animal biomass are not directly comparable to those of ESVAC or the CIPARS estimates, which are based on treatment weights.

## Specificity of data

As described in the methodology, the globally available data sources on animal population, FAOSTAT and the World Animal Health Information System (WAHIS), were not, were not systematically reported by production class for 2019. However, it is necessary to stratify species population by production class to better assign average weights, for example, to separate veal calves from adult cattle.

The methodology for calculation of biomass therefore uses some necessary standard animal reproduction rates to extract a best estimate of the population breakdown by production class. These rates will vary between species, countries and production systems and so are not fully representative of the animal populations of any one country or region.

## Imported and exported animals

Imported and exported animals are commonly subtracted and added, respectively, from animal populations when calculating animal biomass, as done by ESVAC and CIPARS. This occurs so that only animals raised in the country during the time at which they would have been treated with antibiotics are considered. An effort was made to minimise the effect of imported and exported animals by using the FAOSTAT 'Trade of live animals' data set for bovine species.

## Extrapolations within the methodology

*Carcass conversion factors:* The methodology for calculating average animal weight from slaughter data requires a conversion factor from carcass weight to live weight at time of slaughter (see the methodology available in ANIMUSE). At present these conversion factors are only available for Europe. It is not currently known how well European conversion factors apply to other countries, which may have different breeds, husbandry and slaughter practices, but it is likely that they differ. The significance of this difference and its impact on the accuracy of the biomass calculation for all countries cannot be estimated.

*Reproduction rates and weights:* Data on reproduction rates were not collected at the time of reporting, nor were slaughter data for cervids, camelids or equids in some regions. Therefore, this information was taken from the literature where necessary, or extrapolated from regions where data were available. The extent to which these published and extrapolated weights and reproduction rates represent the true situation in any country is expected to vary.

### Animal species not retained in the denominator

In the development of the current denominator methodology, it was decided not to include companion animals when calculating animal biomass. Data on populations of cats and dogs are available in WAHIS, and not in FAOSTAT. However, many countries do not report these figures, or report them inconsistently. Another consideration is the need to better understand whether reported cat and dog populations represent owned or stray animals, as this would affect the likelihood of their treatment with antimicrobials.

For participants where cat and dog population data were available, it was seen that their contribution to overall biomass was minor (<0.5%).

However, as some participants do include antimicrobials used in companion animals in their reported quantitative data, excluding these species is expected to have a small effect on the results. Since excluding them decreases the denominator, the effect, if any, would be a minor increase in antimicrobial quantities adjusted for animal biomass.

In the future, one goal of the AMU data collection would be to provide separate analysis for antimicrobial agents used in companion animals, as more participants become able to report these population data and distinguish antimicrobial quantities by animal group.

## 5.4. Barriers to collecting antimicrobial quantities

According to those participants unable to report antimicrobial quantities, the main barrier was the lack of coordination and collaboration with the Ministry of Health, which was in charge of authorising veterinary products at the national level. This, despite a One Health approach being needed to tackle AMR and approaches from Veterinary Services to strengthen collaboration with their Health Ministry on AMR.

Some Members continue to report a lack of structure or enforcement of a regulatory framework for veterinary products as an obstacle. To ensure data quality, investment will be required in prioritised activities to support the removal of these barriers.

# 6. Future developments for the Antimicrobial Use Survey

## Institutionalisation of AMU data

In 2022, after seven years of AMU data collection, WOAH launched its interactive online Global Database for **ANI**mal anti**M**icrobial **USE** (**ANIMUSE**) for all its Members. In ANIMUSE, Members have access to their historical data, animal biomass data, the Calculation Module feature and different data visualisation dashboards performed with Power Bi. Despite this significant milestone, and as mentioned in this report, only 30% of WOAH Members have released a public national AMU report, with a notable 85% of these reports originating from Europe.

WOAH is committed to guide and support its Members who have demonstrated high engagement in AMU data collection, especially those who have improved their data collection systems. By 2024, WOAH aims to a comprehensive workshop focused on assisting WOAH Members from different regions in drafting AMU national reports. This initiative will emphasise fostering communication with diverse stakeholders and promoting transparency in data reporting. This action should align closely with Members' National Action Plans on AMR, helping to raise awareness of AMR, while facilitating any initiative for integrated analyses at national levels. By publishing the AMU reports, WOAH Members will be better equipped to take decisions based on science and different sectors will be empowered to collectively address the challenges posed by antimicrobial resistance.

## Reported years

By the time this report was published, in the ongoing ninth round of data collection, WOAH had requested quantitative data for 2022 (the target year for that round), but also accepted 2023 data in certain cases. Nevertheless, all Members intending to submit 2023 data have been encouraged to conduct further analysis on their national data sets and defer submission until the tenth round. This ensures that all WOAH Members will be providing data from the same target year during the tenth round, streamlining the reporting process. By synchronising data collection efforts, WOAH aims to enhance the consistency and reliability of global monitoring of antimicrobial agents intended for use in animals. This strategic approach reflects the evolving standards of data collection systems among Members, facilitating more routine and systematic reporting.

## Animal biomass

WOAH will continue to work closely with Members to support them in calculating the amounts of active ingredients of antimicrobials. WOAH will continue to support improvements to AMU and the quality of animal population data and refine its methodology for calculating animal biomass based on globally available data, in cooperation with Members through the regional offices.

An important step in this process will be achieved through the interface with WAHIS. In consultation with the previous WOAH *ad hoc* Group on Antimicrobial Resistance, new species and animal sub-categories have been added to the WAHIS data collection guidelines. These new population sub-categories are now being implemented in WAHIS and will allow data on animal biomass to be refined over time.

The next generation of the WAHIS data collection interface was launched in March 2021 and will incorporate further updates to the collection of global animal population data. In addition to providing more sub-categories representing detailed production data (where Members can supply such data), it will also support the reporting of data on average live weights and the number of animals slaughtered.

Aside from the collection of more detailed global animal population data, additional work is needed to validate some of the conversion factors used in the methodology, which have frequently been extrapolated from European data. In particular, a better understanding of potential regional variation in carcass conversion factors (for estimating live weights) and annual multiplication rates of species living less than one year (i.e. 'cycle factor') are needed to refine the current methodology.

# 7. Conclusions

Our Members' commitment to providing information on the use of antimicrobials represents a remarkable achievement since 2015. The overall participation rate in the current eighth data collection round has changed very little over time, despite all the competing priorities and resilience challenges that WOAH Members have had to face. Four out of five submitted reports contained quantitative data, representing a stunning result for the constant efforts WOAH Members make to improve their valuable AMU surveillance systems. This represents a three-fold increase in capacity from the baseline established in 2012, when scarcely 40 Members had systems in place to collect and analyse quantitative sets of data. With the consistent engagement of its Members, and the full deployment of the ANIMUSE system across the globe, WOAH is providing an invaluable set of validated and analysed data to all Members, including trends over time, for their own use in AMR monitoring and surveillance programmes. ANIMUSE provides the most comprehensive and reliable representation of the global situation of antimicrobial agents intended for use in animals, representing almost 80% of global geography and 65% of the total animal biomass on earth.

Data presented in this report estimate that, in 2021, the total amount of antimicrobial agents intended for use in animals oscillated between 81,084 and 88,927 tonnes (there were 94 participants in this eighth annual report). Overall, tetracyclines remained the most used antimicrobial agent in animal health globally (35.6% of the total amount), followed by penicillins and polypeptides (12.6% and 11.3%, respectively). The number of participants providing data by antimicrobial class and animal group has increased over time, with 70 participants providing these data for 2021. When looking at terrestrial food-producing animals, tetracyclines and penicillins remained the most used antimicrobials (36.9% and 14.3% of the total amount, respectively) among the 49 participants who provided data. When focusing on the 17 participants who provided specific data for aquatic animals, tetracyclines came third after amphenicols and fluoroquinoles (18.4%, 21.3% and 48.3% of the total amounts, respectively), also considered as veterinary critically important antimicrobial agents. Fifty-six participants reported the use of antimicrobial agents in companion animals, mainly canines and felines, followed by ornamental birds. Penicillins were the most reported antimicrobial class (30.3% of the total amount), followed by fluoroquinolones and tetracyclines (14.1% and 12.2% of the total amount, respectively) – all of them veterinary critically important antimicrobial agents. The implementation of the Calculation Tool (Calculation Module in ANIMUSE) in previous years has contributed positively to the higher number of detailed returns, and WOAH would like to encourage participants to continue providing such accurate reporting.

These absolute numbers around quantities of antimicrobial agents were also analysed in relation to the animal population, by normalisation with the use of the WOAH animal biomass denominator. This denominator was estimated to be the best indicator for global monitoring of antimicrobial sales in food-producing animals by an independent review[16]. It allows data comparison across sectors and regions and over time. In this eighth report, WOAH covers 65% of the total animal biomass for the year 2021, representing 94 participants around the globe. This figure encompasses terrestrial and aquatic food-producing animals, with companion animals excluded from the analysis. Bovine species accounted for 41% of the total coverage, followed by swine (21%) and poultry (18%). Aquatic animals accounted for 8% of the total coverage, and almost two-thirds of these were fish. Taking all this into consideration, WOAH estimates that, in 2021, a total of 112 to 116 mg of antimicrobial agents were used per kg of animal biomass (mg/kg), depending on how coverage estimations were adjusted among the 94 participants. Analysis of these data over time shows that, among the 81 participants who have consistently provided data from 2019 to 2021, an increase of 2% has been observed in the indicator used to track trends (from 107.3 mg/kg to 109.7 mg/kg, respectively).

Africa presented a staggering 179% rise during the same period, while the Americas, Europe and Asia and the Pacific decreased by 9%, 6%, and 0.7%, respectively. While Africa's increase appears remarkable, deeper analysis of the reported data seems to point towards a significant refinement of antimicrobial usage monitoring systems and thus higher accuracy in the estimations. Updates to historical ANIMUSE data occur with each round due to increased data coverage, enhancements to information capture systems and, in some cases, corrections to previously reported antimicrobial quantities. Therefore, it is essential to continue the enhancement of surveillance systems in African countries, so that estimations keep improving in their precision.

[16] E. Bulut & R. Ivanek, Comparison of different biomass methodologies to adjust sales data on veterinary antimicrobials in the USA, *Journal of Antimicrobial Chemotherapy*, 2021; https://doi.org/10.1093/jac/dkab441

It is also worth going deeper in the analyses to determine whether a particular disease in animal species might have been the cause of the increase in quantities. When analysing trends over time, mg/kg are predominantly influenced by regions with the largest amount of antimicrobial quantities. On a global scale, Africa's increase does not significantly impact mg/kg, as it represents only 10% of biomass and 2% of antimicrobial quantities for the 81 countries analysed. In contrast, the Americas account for around 30% of antimicrobial quantities, and Asia and the Pacific nearly 60%. In terms of animal biomass, these two regions represent 30–40% of the total. In other words, the Americas and Asia and the Pacific hold greater importance for these 81 countries, noting that their respective decreases were 9% and only 0.7%, respectively.

Even though significant progress has been made in reducing the use of antimicrobials for growth promotion, this practice is still reported by almost 20% of our Members. An additional survey carried out by WOAH showed that 76% of users have not performed any preliminary risk analysis, as recommended by the Global Action Plan on AMR and WOAH's List of Antimicrobials of Veterinary Importance. More worryingly, no fewer than 11% of WOAH Members still use at least one of the highest priority Critically Important Antimicrobials for Human Medicine [5], such as colistin, for growth promotion. Given these factors, and the commitments made by WOAH Members in 2016, WOAH reminds its Members of the statement made during the 2023 World AMR Awareness Week, calling on Members to restrict the use of antimicrobials to solely veterinary medical use, and to actively engage in dialogue with concerned parties to achieve a total ban on the use of antimicrobials as growth promoters, starting with those that are critically important for human health.

In September 2023, WOAH launched the public interface of its ANIMUSE system and by November 2023 it had been deployed worldwide across all WOAH regions. ANIMUSE provides easy data entry, calculation of antimicrobial quantities and animal biomass estimations, using secure confidential access to a central database. By December 2023, only 11% of our Members had made their antimicrobial use data publicly available through ANIMUSE. WOAH reminds all Members of the importance of transparency, as noted in Chapter 6.9. of the *Terrestrial Animal Health Code*, to allow all interested parties to assess trends, perform risk assessments and for risk communication purposes.

Each year, WOAH not only highlights the reported quantitative data for participants currently able to provide them, but also examines the current situation of the governance of veterinary antimicrobials worldwide, and identifies barriers to quantitative data collection. WOAH will continue to seek solutions for Members who report a lack of regulatory framework through its Veterinary Legislation Support Programme, part of the Performance of Veterinary Services (PVS) tool. Moreover, WOAH remains strongly committed to supporting its Members to develop robust and transparent measurements and reporting mechanisms for antimicrobial use. As WOAH assists Members to improve the accuracy of their data, it will continue to refine the methodology for calculating animal biomass. As data collection systems develop further, this annual report will continue to provide an essential global and regional analysis of antibiotic use in animals, as well as changes over time.

Finally, and in conjunction with WHO, WOAH aims to strengthen communication with other national agencies, beyond Veterinary Services, who are involved in the collection of antimicrobial use data within the animal health sector. This collaborative effort underscores the importance of interdisciplinary cooperation in addressing antimicrobial resistance and promoting responsible antimicrobial use practices.

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# Annex

## Distribution of Members by WOAH Region

**AFRICA (54)**

1. ALGERIA
2. ANGOLA
3. BENIN
4. BOTSWANA
5. BURKINA FASO
6. BURUNDI
7. CAMEROON
8. CABO VERDE
9. CENTRAL AFRICAN REP.
10. CHAD
11. COMOROS
12. CONGO (REP. OF THE)
13. CONGO (DEM. REP. OF THE)
14. CÔTE D'IVOIRE
15. DJIBOUTI
16. EGYPT
17. EQUATORIAL GUINEA
18. ERITREA
19. ESWATINI
20. ETHIOPIA
21. GABON
22. GAMBIA
23. GHANA
24. GUINEA
25. GUINEA-BISSAU
26. KENYA
27. LESOTHO
28. LIBERIA
29. LIBYA
30. MADAGASCAR
31. MALAWI
32. MALI
33. MAURITANIA
34. MAURITIUS
35. MOROCCO
36. MOZAMBIQUE
37. NAMIBIA
38. NIGER
39. NIGERIA
40. RWANDA
41. SAO TOME AND PRINCIPE
42. SENEGAL
43. SEYCHELLES
44. SIERRA LEONE
45. SOMALIA
46. SOUTH AFRICA
47. SOUTH SUDAN (REP. OF)
48. SUDAN
49. TANZANIA
50. TOGO
51. TUNISIA
52. UGANDA
53. ZAMBIA
54. ZIMBABWE

**AMERICAS (31)**

1. ARGENTINA
2. BAHAMAS
3. BARBADOS
4. BELIZE
5. BOLIVIA
6. BRAZIL
7. CANADA
8. CHILE
9. COLOMBIA
10. COSTA RICA
11. CUBA
12. CURACAO
13. DOMINICAN REP.
14. ECUADOR
15. EL SALVADOR
16. GUATEMALA
17. GUYANA
18. HAITI
19. HONDURAS
20. JAMAICA
21. MEXICO
22. NICARAGUA
23. PANAMA
24. PARAGUAY
25. PERU
26. SAINT LUCIA
27. SURINAME
28. TRINIDAD AND TOBAGO
29. UNITED STATES OF AMERICA
30. URUGUAY
31. VENEZUELA

**MIDDLE EAST (12)**

1. AFGHANISTAN
2. BAHRAIN
3. IRAQ
4. JORDAN
5. KUWAIT
6. LEBANON
7 OMAN
8. QATAR
9. SAUDI ARABIA
10. SYRIA
11. UNITED ARAB EMIRATES
12. YEMEN

**ASIA AND THE PACIFIC (32)**

1. AUSTRALIA
2. BANGLADESH
3. BHUTAN
4. BRUNEI
5. CAMBODIA
6. CHINA (PEOPLE'S REP. OF)
7. FIJI
8. INDIA
9. INDONESIA
10. IRAN
11. JAPAN
12. KOREA (REP. OF)
13. KOREA (DEM. PEOPLE'S REP. OF)
14. LAOS
15. MALAYSIA
16. MALDIVES
17. MICRONESIA (FED. STATES OF)
18. MONGOLIA
19. MYANMAR
20. NEPAL
21. NEW CALEDONIA
22. NEW ZEALAND
23. PAKISTAN
24. PAPUA NEW GUINEA
25. PHILIPPINES
26. SINGAPORE
27. SRI LANKA
28. TAIPEI (CHINESE)
29. THAILAND
30. TIMOR LESTE
31. VANUATU
32. VIETNAM

**EUROPE (53)**

1. ALBANIA
2. ANDORRA
3. ARMENIA
4. AUSTRIA
5. AZERBAIJAN
6. BELARUS
7. BELGIUM
8. BOSNIA AND HERZEGOVINA
9. BULGARIA
10. CROATIA
11. CYPRUS
12. CZECH REP.
13. DENMARK
14. ESTONIA
15. FINLAND
16. FRANCE
17. GEORGIA
18. GERMANY
19. GREECE
20. HUNGARY
21. ICELAND
22. IRELAND
23. ISRAEL
24. ITALY
25. KAZAKHSTAN
26. KYRGYZSTAN
27. LATVIA
28. LIECHTENSTEIN
29. LITHUANIA
30. LUXEMBOURG
31. MALTA
32. MOLDOVA
33. MONTENEGRO
34. NETHERLANDS (THE)
35. NORTH MACEDONIA
36. NORWAY
37. POLAND
38. PORTUGAL
39. ROMANIA
40. RUSSIA
41. SAN MARINO
42. SERBIA
43. SLOVAKIA
44. SLOVENIA
45. SPAIN
46. SWEDEN
47. SWITZERLAND
48. TAJIKISTAN
49. TÜRKIYE (REP. OF)
50. TURKMENISTAN
51. UKRAINE
52. UNITED KINGDOM
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