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Challenges and Obstacles for Veterinary Antimicrobial Agents' Data Collection for an "One Health" European Goal to Address Antimicrobial Resistances †

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Abstract: According to the 2021 European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) report on sales of veterinary antimicrobial agents, the data collected for the 2010–2021 period points to a significative sales reduction in over 2/3 of the countries included. Until now, a reduction in consumption to an average value of 96.6 mg/PCU was achieved in a premise that the average value of 59.2 mg/PCU can be reached by 2030, urging new political strategies for the next years. However, when exploring data from countries individually for the same decade, several shortcomings in data collection are noticed. In fact, mandatory data reporting was not on equal ground between countries, with different data aggregation strategies used and several countries in multiple years recognizing underreporting values. Access to similar tools and methodologies for data collection is crucial for all European members, especially to collect and report consistent, correct, and uniform data. Simultaneously, some gaps are observed in the PCU unit system, excluding some animals such as livestock goats and pets, and being unclear in others like in aquaculture, requiring revision to help it implement the "One Health" approach. Preventive or mitigation actions require a standardized data system allowing trustworthy conclusions and projections. Platforms like the ESVAC database are interesting tools which can be improved and replicated, allowing for the analysis of the different elements of the "One Health" approach such as human and environmental data, as well as data about resistance to antimicrobial agents.

Keywords: antimicrobial agents; antimicrobial resistance; data collection; one health

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1. Introduction

Antimicrobial agents' discovery, one hundred years ago, brought great hope by extending life expectancy and allowing the improvement of other medical practices. However, the development of resistance in multiple pathogens led to the ineffectiveness of those agents, resulting in the current emergency to overcome antimicrobial resistance (AMR) [1]. Annually, antimicrobial resistance (AMR) is responsible for more than 35,000 deaths in Europe, numbers that can rise to 10 million global annual human deaths. With productivity losses estimated between 2 and 3.5%, representing costs that can surpass 92 trillion euros until 2050 [2], AMR's impact on public health can be compared to "influenza, tuberculosis and HIV/AIDS combined" [3].

The European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project, launched by the European Medicines Agency (EMA) in 2009, presents annual reports of the use of veterinary antibiotics from 31 countries in an attempt at a coordinated approach to data collection and analysis [4].

2. Methods

In this communication, we analysed the last decade of data extracted from the ESVAC database [5] (accessed in October 2023), mainly concerning animal production by species and consumption in each country. Results from the last ESVAC report [4] were explored, and the national reports of specific countries, present on the ESVAC website [6], were analysed when needed, to add context to the reported information and to highlight the particularities.

The profile of animal production for each country was determined by dividing the values reported for production in each species in the Population Correction Unit (PCU) in 2021 by the total animal production (in the PCU) of each country in the same year as reported in the ESVAC interactive database [5] (variables described as "cattle", "pigs", "sheep and goats", "horses", "rabbits", "fish"). This results in a description of each country as a series of species described by a fraction of the overall production of the country and, thus, comparable between countries, irrespective of the total production size.

Data analysis over the retrieved information from the mentioned databases and profiles for the countries was conducted using the Python 3.11 programming language. Data curation was carried out using the Pandas library version 2.0.3 [7], and graphical representations of results were created using Matplotlib version 3.7.1 [8].

3. Results and Discussion

According to the 2021 ESVAC report, the data collected for the 2010–2021 period points to a significative antibiotic sales reduction in over 2/3 of the countries included. Until now, a reduction in consumption to an average of 96.6 mg/PCU was achieved, targeting an average value of 59.2 mg/PCU by 2030 [6].

The evolution of veterinary antibiotic consumption for all countries included in the report is shown in Figure 1. For a clearer reading, the countries were separated into three panels according to the value reported in 2021 (over 120 mg/PC, 120–60 mg/PCU and under 60 mg/PCU). The general tendency is, indeed, that sales have been consistently decreasing in this period, with 19 of the 31 countries having already reported achieving the target value proposed for 2030. However, some countries are showing some difficulty in reducing consumption. Oppositely to what is observed for countries such as Spain, Italy, or Germany, which have reported very large sales values in the past but have substantially reduced the reported values, countries like Cyprus and Greece do not present the same behaviour, with the latter having increased sales in all reported years.

Besides the implementation of new policies and practices throughout Europe explaining the general trends in reported values, other aspects related to the reporting process itself may affect our perception of the current status of antibiotic use. Not all countries are at the same level of accuracy and preparation in terms of data collection, since no uniform collecting procedures are available.

First, reporting is secured by several professional profiles which differ between countries (e.g., Marketing Authorization Holders (MAH), veterinarians, retailers, wholesalers, farmers, or pharmacies). Then, concerning the authorities and centralized agencies, some countries were successful in implementing them earlier, while others achieved it recently, and another group is only working on it for the future.

Under-reporting was officially recognized in different countries in several years, although it remained without analysis in the respective national reports. Accepting values lower than the real rates, without exploring the causes, creates distrust in the data. Moreover, it simultaneously hinders learning lessons from these situations and the deployment of solutions in eventual similar challenges. In general, countries update their data later, but some are still referred to as underreported (e.g., Bulgaria in 2011, 2012, 2014, and 2015, Portugal in 2010–2014, 2017, and 2019, and Spain in 2010, 2012, and 2013) [4]. Cyprus, for example, updated their past data regarding fish production, resulting in corrections in terms of antibiotic sales ranging from −12% to −24% [9].

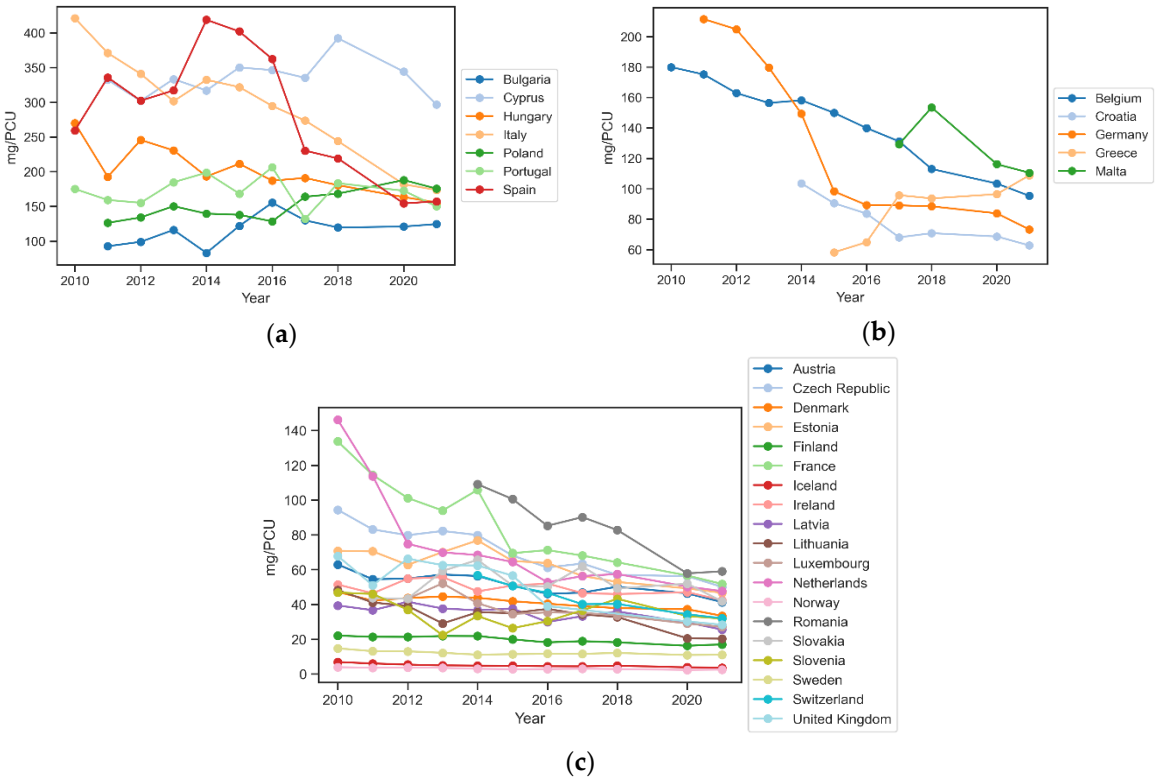

Figure 1. Overall sales of veterinary antibiotics for each country reported in mg/PCU in the 2010–2021 period: (**a**) countries that in 2021 still reported sales over 120 mg/PCU; (**b**) countries that in 2021 reported sales between 60 mg/PCU and 120 mg/PCU; (**c**) countries that in 2021 reported sales below 60 mg/PCU.

A possible type of under-reporting that has been identified but is not considered as such in the reports originates in the legislation of some countries themselves. The acquisition of antibiotics without prescription, for instance, is a critical issue, even for countries that achieved their objective, have strong collecting systems, and have never officially underreported, like Sweden [10].

Some countries already included data for consumption based on different food-producing species in their national reports. However, it was only in June 2023 that the guidelines of data collection were updated to include this information along with the production figures. Furthermore, since the animal production profile of each country is related to overall consumption, this change would significantly improve the accuracy of future consumption reports and the comprehensive analysis of collected data.

For example, Greece, Cyprus, and Bulgaria have high figures in antibiotic sales and a higher component of sheep and goat production (60%, 35%, and 26% of total PCU in "sheep and goats", respectively); they are simultaneously the three countries that report the flaw of the PCU as a metric, since it does not include living goats, creating an error in reporting. This is highlighted by the fact that small ruminants are often treated "off-label" because the existence of antimicrobial agents specific to these species is not common [11]. For example, Cyprus reports that if living goats had been included in the PCU, total annual sales in mg/PCU would have been approximately 7% lower in 2021 [9]. Studies report the necessity of updating the PCU metric even in species already included fully [11,12], and others suggest the adoption of other metrics [13].

The objective of a "One Health" approach, from the European Union point of view, is to address AMR in a holistic way, understanding the interaction and the impact of the different sectors (generally indicated as animal, human, and environmental health) [14]. However, for the goal to be achieved, good data analysis, and therefore reliable data collection, is critical. This information is fundamental to create awareness campaigns

and AMR education, which can have a huge impact on the population perception of the problem [15]. For this reason, the European Union and even each country individually could benefit, e.g., from spatial modelling [16] with all the data collected over the years, to pinpoint regions with higher consumption tendencies in order to focus their campaigns.

4. Conclusions

Although most countries are on trajectory to reach their goal of antimicrobial agent consumption reduction, new strategies are still being included because of the alarming figures in AMR.

In a closer analysis, the European countries that report to ESVAC do not do it in a uniformised way and had different periods where specific changes were implemented, showing discrepancies between them. At the same time, underreporting seems to happen occasionally, but it is not treated as a mistake to avoid but more as a random nonconformity.

The PCU metric is flawed and influences data, especially in countries with higher fish, sheep, and goat productions, since small ruminants are often treated "off label". A change or adaptation in this metric seems necessary.

Preventive or mitigation actions require a standardized data system allowing trustworthy conclusions and projections. Standardizing methods is essential for a "One Health" approach, so that analysing data from different areas of public health becomes possible and/or easier.

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