EDITORIAL

Veterinary Antibiotics as an Emerging Class of Environmental Contaminants: Urgent Measures are Needed

Jūratė Žaltauskaitė

Department of Environmental Sciences, Vytautas Magnus University, Lithuania

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The discovery of antibiotics was a key breakthrough of the 20th century in human and veterinary medicine. Antibiotics are essential for maintaining human and animal health, and their health and economic benefits are unquestionable, but their use is also associated with their continuous release into the environment and the resulting risks to the environment and human health. Antimicrobial resistance (AMR), driven by excessive and inappropriate use of antibiotics, has emerged as one of the leading public health threats of the 21st century. The European Commission identifies AMR as one of the top three priority health threats, causing an annual estimate of 1.27 million deaths globally with direct health care costs of US$ 66 billion (McDonnell et al., 2024; Murray et al., 2022).

Veterinary antibiotics widely used for disease prevention, control and treatment in food animal production have helped in meeting the rising needs in meat production in the 20th century. Worldwide use of antimicrobials reached 99 502 tonnes in 2020 with the top 5 consumers being China, Brazil, India, USA, and Australia (Mulchandani et al., 2023). Based on current veterinary antibiotic trends, it is projected that the consumption will increase by 8.0% by 2030. Human population is expected to exceed 9.7 billion by 2050, resulting in a doubled demand for livestock products implying considerable use of antibiotics. Reduction of antibiotic use not only might be challenging due to the increasing need for food, but ongoing climate change may increase disease pressures in food producing animals leading to greater usage of veterinary antibiotics (Hader et al., 2022).

To achieve the goals of human health and environmental protection, the reduction and rational use of antibiotics have become part of global and regional policies. The Global Action Plan on Antimicrobial Resistance (GAP-AMR) (2016, WHO), EU action plans against AMR (2011, 2017) and national plans call for better knowledge, appropriate use and surveillance. These action plans highly underscore the need for an effective holistic "one health" approach involving cross-sectoral coordination, including human and veterinary medicine, agriculture, finance, environment, and well-informed consumers.

Despite the predicted increase in the use of veterinary antibiotics, some positive changes in the use of antibiotics were also observed. According to the World Organisation for Animal Health (WOAH), the use of antimicrobials for veterinary purposes worldwide decreased by 27% between 2016 and 2018. In Europe, sales of veterinary antibiotics have also decreased significantly (53%) over the past decade. EU "Farm to Fork" Strategy (2020) set the target of reducing the sales of antimicrobials for livestock and aquaculture by 50% by 2030. In 2022, the use of antimicrobials in EU Member States was reduced from 118.3 to 84.8 mg/PCU, i.e. more than half of this target was achieved. However, the situation in individual countries is very different and poses health and environmental challenges. Since antibiotics have different physicochemical characteristics, determining their behaviour and fate in the environment, the overall drop in veterinary antibiotics consumption could not be directly linked to reduced environmental risk.

The increasing number of studies showing evidence on the presence of antibiotics in various environmental compartments and their ecotoxicological effects implies that ongoing efforts and measures embracing only prudent antibiotic usage in the veterinary and strengthened monitoring are not sufficient to tackle AMR and other adverse consequences. Although the monitoring of antibiotics is essential to assess environmental risk, only several of them are monitored and only at a limited number of surface water monitoring sites according to Watch Lists under the Water Framework Directive. Furthermore, no routine monitoring is settled for soil. To date, no recent comprehensive evaluation of the antibiotic occurrence in the EU has been done. Therefore, the understanding of ecological and human health implications of these contaminants remains incomplete.

Since the use of antibiotics is inevitable for medical care and the health of animals, it is very important to reduce their release into the environment. Veterinary antibiotics enter the environment via several routes: the improper disposal of used containers and unused antibiotics, wastewater, and waste disposal. As the dominant pathway of veterinary antibiotics entrance to the environment is through manure land application, proper storage and disposal of manure is of high importance. Around 1.4 billion tonnes of manure are produced annually by more than 5.7 million livestock farms counted in the EU, of which only 40% have manure storage facilities (Köninger et al., 2021). Manure storage combined with appropriate manure treatment (such as composting, anaerobic digestion, etc.) could reduce the content of antibiotics and resistant gene abundance.

Lacking efficient technologies to remove antibiotics from wastewater can also be identified as an obstacle to effectively reducing antibiotics discharge into the environment via effluents. Therefore, the development and implementation of new technologies efficient in degrading or removing antibiotics in wastewater are of high concern. However, advanced wastewater treatment technologies for pharmaceutical removal are implemented to a very low extent, and generally, no legal requirements for the application of technologies removing pharmaceuticals are settled.

Summing up, prudent use of antibiotics in line with appropriate management of the agriculture and wastewater treatment sectors are crucial elements in the sustainable management of veterinary antibiotics. Last but not least, a multi-stakeholder dialogue is needed for a holistic understanding of the ecological and human health implications of antibiotics.

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