Measuring medicine use in livestock supports the fight against antimicrobial resistance

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Measuring how much antimicrobial medication is given to food animals is key to understanding how to slow antimicrobial resistance, when dangerous microbes get so used to antimicrobials that they evolve

stronger defenses against them. However, measuring the actual antimicrobial use in animals on a large scale is still a logistical challenge. Because data on antimicrobial sales for use in food animals are easier to obtain, they are frequently used at the national levels as proxies for antimicrobial use. In a first-of-its-kind study published recently in the *Journal of Antimicrobial Chemotherapy*, scientists at the Cornell University College of Veterinary Medicine analyzed four different measurement methods used across the globe in the hopes of steering governing groups toward a more unified system. The study was supported by The Pew Charitable Trusts.

Each governing group used similar equations to calculate how many veterinary antimicrobials were sold for use in food animals each year—but with a few key differences, and no one method was a silver bullet, said Renata Ivanek, associate professor of population medicine and diagnostic sciences. "Our study will aid the global action against antimicrobial resistance," Ivanek said.

Ivanek and Dr. Ece Bulut, post-doctoral fellow in Ivanek's lab, looked at methods used by the FDA, the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), the Public Health Agency of Canada (PHAC) and the World Organization for Animal Health (OIE); using each one with U.S.-specific antimicrobial sales and livestock data. "We are grateful to the experts at the FDA, ESVAC, PHAC and OIE for help with details about their methods," Ivanek said.

Overall, the scientists found that the FDA's method had a higher level of detail when estimating the total animal weight in a country, while the OIE's method was easier to use and apply to many countries around the world, with the two other methods falling roughly in between the FDA's high level of resolution and the OIE's ease of comparability.

Each method employs a similar formula: The total kilograms of

antimicrobial sales in a year for a food-producing animal species in a country is divided by total weight of all animals of that species (i.e., biomass) present in a year. The resulting number is the total amount of antimicrobial sales per kilogram of animal weight in a year.

All four methods use national antimicrobial sales, animal population data and average weight of animals in a country for their calculations for estimating weight-adjusted antimicrobial sales per animal category.

"For example, matching their agriculture's characteristics, the European Union does not include beef cattle that have calved in the estimation of weight-adjusted antimicrobial sales, but that is an important cattle production category in the U.S.," said Bulut. "Therefore, the cattle weight in the U.S. would be underestimated if the European Union's methodology is used."

"It was surprising to find that the four methodologies resulted in substantially different estimates," said Bulut, noting that the FDA and OIE rendered higher biomass estimates than the others. The reason for this, Bulut says, is because the FDA and OIE use the weight of animals at the time of their slaughter, while the Canadian and European methods use the animals' weight at their time of treatment.

Each method presents flaws. Using an animal's slaughter weight typically overestimates the true biomass number, as most animals are typically heavier at slaughter than they are when they receive antimicrobial treatment. On the other hand, getting accurate, annual data on animals' weight at treatment is difficult to do, thus the Canadian and European methods use the same standardized weight values for several years at a time, which ignores the potential weight changes for an animal category in a country, such as because animals are raised differently or for a different length of time.

"Understanding the nuances about the weight parameters used in the four methods and their influence on the weight-adjusted antimicrobial sales not only help interpret estimates, but can also guide future research efforts in monitoring antimicrobial sales," Ivanek said.

The study also exposes the fact that none of these tools are perfect for monitoring veterinary antimicrobial sales. "All the methodologies are limited by the quality of the databases of actual animal population and weight of animals," said Bulut. "In addition, the weight parameters used by all methodologies are flawed."

By exposing these issues, the scientists hope it will inspire more rigor in the systems used to monitor antimicrobial use. "We hope that our findings will lead the way to a better and hopefully more uniform methodology to track antimicrobial use globally by efforts toward resolving the identified limitations," said Ivanek. "Even more importantly, once we have a good understanding of when, why and how antimicrobials are actually used in food animals, we will be able to assess whether regulations are successful, and aid future policies and studies on the association between antimicrobial use in animals and the One Health burden of antimicrobial resistance."

More information: Ece Bulut et al, Comparison of different biomass methodologies to adjust sales data on veterinary antimicrobials in the USA, *Journal of Antimicrobial Chemotherapy* (2021). DOI: 10.1093/jac/dkab441

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