Antimicrobial resistance in livestock: resistance increases in emerging countries

A consortium of researchers – including Marius Gilbert from Université libre de Bruxelles (ULB) – produced the first global map of the hotspots of antimicrobial resistance in livestock production systems in low- and middle-income countries. The study published this week in the journal Science found that between 2000 and 2018, the proportion of antimicrobials showing resistance above 50% increased from 0.15 to 0.41 in chickens, and from 0.13 to 0.34 in pigs.

Low- and middle-income countries (LMICs) are growing hungry for meat, dairy, and antimicrobials. Since 2000, meat production has grown by 68% in Asia, 64% in Africa, and 40% South America. This transition to high-protein diets has been facilitated by the global expansion of intensive farms where antimicrobials are used routinely to maintain health and productivity in animals. However, a growing body of evidence has linked this practice with the development of antimicrobial-resistant infections not only in animals, but also in humans.

In high-income countries, surveillance systems to monitor antimicrobial resistance (AMR) have been set-up over the last 20 years, and helped inform policies aimed at reducing antimicrobial overuse. However, in LMICs, patterns of AMR remain largely unknown.

An international research consortium lead by Thomas Van Boeckel – a ULB bioengineer alumni and now Assistant Professor at ETH Zurich – produced the first global map of the hotspots of antimicrobial resistance in low- and middle-income countries. This consortium includes Marius Gilbert – researcher at ULB’s Spatial epidemiology Lab (SpELL), Interfaculty School of Bioengineering (EIB), Faculty of Sciences – and scientists from Princeton University and Centre for Disease Dynamics, Economics & Policy (CDDEP).

The study, "Global Trends in Antimicrobial Resistance in Animals in Low- and Middle-Income Countries", published today in Science, found that between 2000 and 2018, the proportion of antimicrobials showing resistance above 50% increased from 0.15 to 0.41 in chickens, and from 0.13 to 0.34 in pigs. This alarming trend shows that veterinary drugs are increasingly
losing their efficacy, with potential consequences for long term sustainability of the livestock industry, and the health of consumers.

“It is of particular concern that AMR is rising in low- and middle-income countries because this is where meat consumption is growing the fastest while access to veterinary antimicrobials remain largely unregulated. AMR is a global problem, and there is little point of making considerable efforts to reduce AMR on one side of the world if AMR is increasing dramatically on the other side” said study author Prof. Thomas Van Boeckel.

The researchers screened tens of thousands of publications by veterinarians from across the world to build a database of more than 1,300 point-prevalence surveys reporting drug-resistant bacteria in animals. They used geospatial mapping techniques to predict geographic hotspots of antimicrobial resistance. The main regions affected were Northeastern China and India, Southern Brazil, Iran, and Turkey. Few hotspots were identified in Africa, with the exception of Johannesburg and Nigeria. Antimicrobials with the highest resistance rates were also those most commonly used in animal production: tetracyclines, sulphonamids, penicillins and quinolones.

“Large-scale mapping of emerging infectious disease and disease threats have become an essential tool for targeted decision-making and measurement of trends and progresses. They rely on collaborative efforts to compile, assemble and process large-scale geospatial databases on the distribution of hosts and pathogens, and making them available in the public domain”, commented Dr Marius Gilbert.

An important factor that limits the accuracy of this first assessment was the number of surveys available from certain regions. “We were particularly surprised to find few surveys from South America. In terms of public data available on AMR in animals some South American countries are currently outperformed by African countries despite more limited resources to conduct surveillance”, said author Dr Joao Pires.

To facilitate tracking trends in AMR in the future the authors have developed an open-access platform –resistancebank.org–, where veterinarians can share their reports of AMR in animals. “This will provide a much-needed focal point for the community of scientists working
on AMR in animals, as well as a support tool for international funders to target resources in the areas of the world most affected by the problem. As animal production is gradually increasing, there may be a window of opportunity to help LMICs transitioning to more sustainable farming practices, and high-income countries – where antimicrobials have been used since the 1950s – should support that transition” said author Prof Ramanan Laxminarayan.

The research was conducted by Van Boeckel, Pires, Zhao, Criscuolo and Bonhoeffer from the Department for Earth Systems Science at the ETH Zurich; Gilbert from the “Université Libre de Bruxelles”; Song from the university of Princeton and Silvester and Laxminarayan, from the Center for Disease Dynamics, Economics & Policy, a global health think tank from Washington, D.C.

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