Food and Agriculture Organization of the United Nations

FOOD SAFETY

FAO DIVISION OF FOOD SYSTEMS AND FOOD SAFETY (ESF)

September 2023

© FAO/IFAD/WFP/Michael Tewelde

Foodborne antimicrobial resistance (AMR): an economic concern

Antimicrobial resistance (AMR) is the inherited or acquired characteristic of microorganisms to survive or proliferate in concentrations of an antimicrobial that would otherwise kill or inhibit them. People, plants, or animals infected with resistant pathogens cannot be easily treated: the microorganisms thrive, disease continues to spread, individuals get sicker and may die. Antimicrobial resistance increases costs of both health care and food production. Paradoxically, although the use of antimicrobials is a common treatment of infections, it also drives the emergence of resistant organisms.

The worldwide loss of the effectiveness of antimicrobials can be understood as a "tragedy of the commons". Individuals who pursue their own interests by using antimicrobials in a manner that is not prudent, squander antimicrobial efficiency for the rest of society. The "tragedy of the commons" has been used to describe other situations in agrifood systems, such as the case of grazing livestock on communal pastures, overfishing and environmental pollution. It would be in the best long-term interest of all individuals to steward antimicrobial use to safeguard antimicrobial effectiveness for future generations.

There are two negative unintended consequences (externalities) associated with antimicrobial use in food production: the development of resistance and the possible presence of antimicrobial residues in food. These externalities are amplified when antimicrobials are not used appropriately. An awareness that antimicrobial use in agriculture has societal impacts is not well known.

There is no one solution to reduce the use of antimicrobials in agriculture while keeping plants and animals healthy and productive. Employing alternative methods to promote health and prevent disease in plants and animals – one aspect of antimicrobial stewardship – can reduce the need for antimicrobials, but, it may come at an added costs to producers.

A current challenge is developing policies that consider the trade-offs between producers' financial investments in antimicrobial stewardship and the societal benefits of reduced antimicrobial resistance achieved by decreased antimicrobial usage.

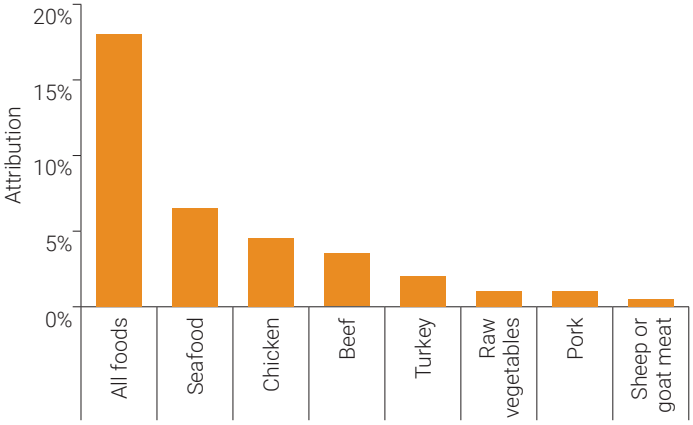
Key Messages

- The global loss of antimicrobial efficacy as a consequence of antimicrobial use represents a "tragedy of the commons".
- The use of antimicrobials creates multiple externalities. These include higher public and private health costs associated with antimicrobial resistance (AMR) and the potentially harmful levels of antimicrobial residues in food.
- The social costs associated with AMR are not reflected in the price of antimicrobials or food. Public policy should consider the social costs of AMR and the individual benefits of antimicrobial use in agrifood sectors.
- Policies that promote antimicrobial stewardship, surveillance and data collection are fundamental steps in addressing AMR.

The economic costs of AMR

Bacteria are becoming more frequently resistant to antimicrobials. Treatment failures are increasing. Although person-to-person transmission contributes greatly to antimicrobial resistant infections in the community, in one study, almost one in every five infections of a particular kind of resistant *Escherichia coli* in people came from eating contaminated food (Figure 1). *Escherichia coli* and other foodborne pathogens are widespread in the food production environment. Contamination in animals and on plants occurs along the supply chain – from production to consumption as well as in the waste stream, sometimes used as an agricultural input. The frequency and duration of illness caused by foodborne AMR increases the economic burden on public health through productivity losses and premature deaths.

Figure 1. Source attribution of ESBL *E. coli* in humans



Source: Lancet Planet Health. 2019. Attributable sources of community-acquired carriage of *Escherichia coli* containing β-lactam antibiotic resistance genes: a population-based modelling study. 3(8):e357-e369. DOI: 10.1016/S2542-5196(19)30130-5.

Using the value of a statistical life, the estimated economic value of a premature death due to non-Typhoidal *Salmonella* (NTS) is USD 10 million.[1] Each year, over 5 000 people lose their lives due to resistant NTS infections worldwide.[2] Thus, the worldwide economic burden of premature deaths due to resistant NTS was equivalent to USD 50 billion in 2019. This is only the premature death burden of a single foodborne pathogen. There are over 30 different pathogens that commonly cause foodborne illness.

The World Bank has projected the losses from AMR on the global economy until 2050. Their simulations show low- and high-impact scenarios. The estimated drop in real-world GDP is between 1.1 percent to 3.8 percent. Furthermore, countries with low per capita incomes, higher infectious disease prevalence and greater dependence on labour incomes will suffer more. Globally, trade will decrease, and inequality will rise. These models included foodborne AMR as a source of resistance that will increase health care expenditures and decrease food productivity and international trade. AMR impacts were modelled as shocks to labour supply and livestock productivity – an approach that underestimates AMR's full economic effects.

The World Bank estimates that economic losses to agriculture and trade could result in a 7.5 percent decrease in the value of global livestock production and a decrease of 3.8 percent in global exports by 2050, compared to current levels.

Antimicrobial residues that exceed acceptable limits in food can cause serious allergic reactions and anaphylaxis. Imported foods containing violative antimicrobial residue levels may be rejected resulting in negative economic impacts for international trade.

Policy considerations

AMR is a genuine cost to society. Rising cases of antimicrobial-resistant infections result in increasing mortality and morbidity across the world in humans, animals, and plants. The impact of AMR will not be distributed equally across populations. Low-income countries may suffer the largest losses of life and lower economic growth. Future policy decisions in agrifood systems need to consider the worldwide consequences to society for antimicrobial use.

Countries should develop and promote policies that:

- Minimize and control AMR in agrifood systems (e.g. by implementing Codex and other relevant international standards and stewardship).
- Strengthen food control systems to prevent transmission of foodborne pathogens, including those that are antimicrobial resistant.
- Ensure food producers who adopt antimicrobial use stewardship practices are championed and not economically disadvantaged.
- Collect, analyse and share data on AMR in food products as part of an integrated (food, environment, animal, human) surveillance system.

Antimicrobial resistance is a threat to healthy and sustainable food systems, future economic growth and the future of our planet. Bold action today can safeguard the health and prosperity of those who will come after us.

For inquiries, please contact food-quality@fao.org

Authored by Topazio, D., Moledina, A. and LeJeune. J. 2023. Foodborne antimicrobial resistance (AMR): an economic concern. Rome, FAO. https://doi.org/10.4060/cc6014en. NOTES: [1] U.S. Department of Agriculture (USDA), Economic research service (ERS). Cost estimates of foodborne illnesses. (2020): https://www.ers.usda.gov/webdocs/DataFiles/48464/Salmonella_2018.xlsx?v=9285.5, [2] Murray, C, et al. "Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis." The Lancet 399.10325 (2022): 629-655.