Antimicrobial Resistance:
policy recommendations

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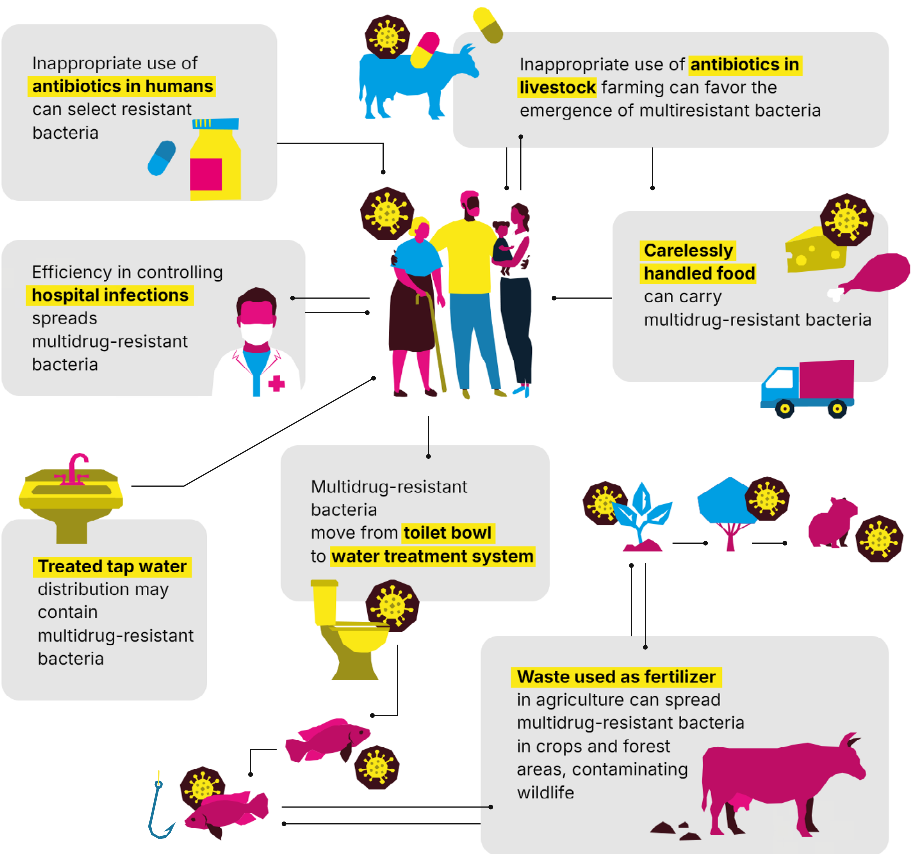
Problem contextualization: What do we need to know about **antimicrobial resistance?**

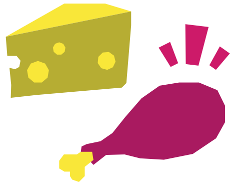
The development of antimicrobials has brought several advances to human, animal and plant health. These have been used in the treatment and prevention of various diseases. However, the effectiveness of these drugs is threatened due to resistance acquired by bacteria.[1]

Antimicrobial resistance (AMR) is one of the biggest global health problems, it is estimated that, in 2019, approximately **4.95 million deaths were associated with resistant bacterial infections.** AMR was the third most common cause of death in 2020, behind only cancer and heart disease.[2] If nothing is done, **it is predicted that by 2050, AMR will be responsible for the deaths of 10 million people annually worldwide.**[3]

AMR is the ability of all microorganisms (bacteria, viruses, fungi and parasites) to adapt and become resistant to antimicrobials to which they were previously susceptible. This is a natural and evolutionary phenomenon of microorganisms, but it has been accelerated by the excessive use of antimicrobials in human health, animal production and agriculture.[1,4] The increased use of these compounds creates a favorable environment for microorganisms to develop resistance.[5,6]

Connections between species in a shared environment facilitate the spread of AMR, which can occur through contact between humans and animals, through the consumption of foods of animal origin (meat, milk, eggs), through the dumping of waste from human activities into soil and water sources, and through air pollution.[7-9]





Regarding the consumption of animal products, studies have shown the presence of similar resistance genes between chickens and humans, demonstrating the transmission of AMR between different species through the animal production chain.[10] Although the use of techniques such as cooking, cooling and freezing food reduces the risk of spreading AMR,[11,12] bacterial DNA is resistant to high temperatures and possibly to human digestion, maintaining the possibility of resistance genes being transferred to the human bacterial flora.[13]

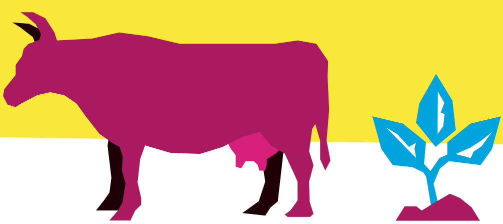
Despite the determination of safety measures such as Maximum Residue Limits (MRLs) by governments and international institutions,[14] long-term exposure to antimicrobial residues generates resistance.[16] Studies have shown that the MRL doses established in the Codex Alimentarius for some antimicrobials are 1000 times higher than the minimum dose required to promote resistance in a microorganism,[17] which is why there has been discussion about the need to review these limits.[1]

The dumping of antibiotic residues by activities such as the pharmaceutical industry, animal production, human sewage and inadequate landfill treatment contaminate the soil, air and water sources.[16] Although the useful life of these compounds in the environment is short (a few hours or days),[18] residues are considered permanent contaminants due to continuous dumping.[19] The selective pressure exerted by residues affects the bacteria in the microbiome, which contributes to the development of an environmental reserve of resistant bacteria and resistance genes.[17]

There are still gaps in knowledge about the transmission chains of AMR, for example, the risk that the use of antibiotics in animal production poses to human health.[7] The different transmission routes do not spread resistance at the same rate. Although knowledge about the human-animal-environment relationship and antimicrobial resistance is still under construction, we already have sufficient evidence to guide public policies aimed at mitigating the problem.[7]

The problem complexity requires that actions have a transdisciplinary and ecosystemic approach, with the aim of achieving control of its threats[1].

The **One Health** approach recognizes that the health of people, animals, plants and the environment are interconnected and interdependent. Based on this idea, it mobilizes different sectors to work together for the collective well-being and to face threats to health and the ecosystem.[10]



This is the approach that underpins the **Global Action Plan to Combat Antimicrobial Resistance**, published by the United Nations Environment Programme (UNEP), the World Health Organization (WHO), the World Organization for Animal Health (WOAH) and the Food and Agriculture Organization of the United Nations (FAO).[20] The plan aims to encourage other countries to develop and implement national plans to combat AMR.

Brazil, due to its size and economic and territorial characteristics, is an important player in discussions on global health. Since 2018, the Government has been implementing national plans, which are now in the second stage of implementation. In 2024, through decree 12,007,[21] the Interinstitutional Technical Committee for One Health was established, which aims to prepare and support the implementation of the National Action Plan for One Health. The committee is made up of official bodies from the human, animal and environmental health sectors and one of the topics addressed is the implementation of intersectoral strategies to combat AMR.

Overview and recommendations for preventing antimicrobial resistance in Brazil

HUMAN HEALTH

In Brazil, **400,000 cases of sepsis** are recorded annually in patients, **60% of which result in death** (240,000 people). In children, the number of cases is 42,000 per year and the mortality rate is 19%, representing **8,000 deaths per year**. Mortality rates from sepsis in Brazil are higher than in other developing countries, which reinforces the need for attention to the problem of AMR.[22]

Brazil is part of the Latin American and Caribbean Antimicrobial Resistance Surveillance Network (ReLAVRA), coordinated by the Pan American Health Organization (PAHO), and the Global Antimicrobial Resistance Laboratories Network , coordinated by the Centers for Disease Control and Prevention. More recently, Brazil joined the WHO Global Antimicrobial Resistance Surveillance System (GLASS) and, at the same time, launched the BR-Glass pilot project, whose main objective is to standardize and systematize the collection and analysis of data on AMRs in hospital settings.[23]

BR-Glass is currently being tested in the state of Paraná and will be expanded to the entire country in the future.[23] The first report demonstrated a high level of resistance in bacterial species that affect human health, well above the global average.[24]

Since 2011, the National Health Surveillance Agency (Anvisa) has made it mandatory for doctors to prescribe antibiotics.[25] To date, there has been no official systematic monitoring of antibiotic consumption at the national level, as observed in developed countries.[26] Furthermore, there are few studies evaluating antibiotic consumption in the country. Cruz Lopes et al.[27] evaluated the consumption of antibiotics in private pharmacies between 2014 and 2019 based on medical prescription data. The authors identified a 30% increase in antibiotic consumption during this period. Furthermore, research has shown that Brazilians consume large quantities of antibiotics that should only be used in more serious cases, which tends to aggravate the problem of antimicrobial resistance.[24]

Classification and recommended use of antibiotics

Antibiotics are classified according to their potential to promote resistance. This classification is called AWaRe and divides antibiotics into three categories from least to most potential:

(a) ***Access*** - has less potential to promote resistance and can be used without restrictions. E.g.: 1st generation cephalosporins, some penicillins and beta-lactams.

(b) ***Watch*** - has intermediate potential and should be used with caution. E.g.: 2nd, 3rd and 4th generation cephalosporins, aminoglycosides, fluoroquinolones.

(c) *Reserve* - has a high potential to promote resistance and should only be used as a last resort, when there are no other alternatives. They are intended for the treatment of cases of infection by multi-resistant bacteria.

Brazil goes against the recommendation

The WHO recommends that at least 60% of antibiotics consumed should be from the *access* group. However, in Brazil, almost half of the antibiotics used (45%) were from the *watch* group. Another alarming fact is that antibiotics in the *reserve* group already represent 9.4% of total consumption.

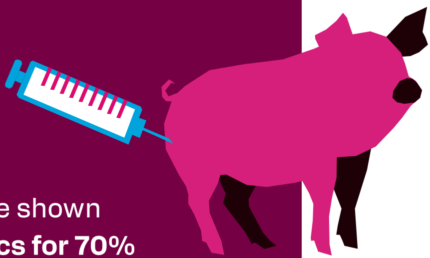
Another study evaluated the outpatient use of antibiotics (in public and private networks) between 2019-2021 and identified that consumption in Brazil was lower than in some developed countries. However, there was an increase in the use of azithromycin and other drug classes critically important to human health during the Covid-19 pandemic.[26]

ANIMAL HEALTH

In animal health, consumption is concentrated in the production of pigs and chickens, since these are the two sectors of animal production that most frequently use antibiotics.[28] The technical, economic and political characteristics of the formation and expansion of these economic activities favored the dissemination of verticalized systems integrated with agribusiness to produce on a large scale and at lower costs. This model is generally characterized by a high concentration of genetically homogeneous animals, with inhibited natural behavior and subjected to situations of stress and pain, making these animals more vulnerable to infection by viruses and bacteria. These choices are accompanied by the large-scale use of antibiotics, leading to the intense acceleration of antimicrobial resistance.[29] In these systems, antimicrobials are used not only for therapeutic purposes, but increasingly for prophylactic, metaphylactic purposes and as animal growth promoters.

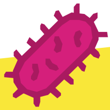
Despite the implementation of the Veterinary Antimicrobial Sales Data System (AgroMonitora),[32] official data on the use of antimicrobials in animals are not available to the public. These data could contribute to the development of research to understand the Brazilian reality and to guide public policies to combat AMR in Brazil.

Excessive use of antibiotics in pigs



Studies carried out on pig farms have shown that these animals **receive antibiotics for 70% of their lives.** Evidence shows that the amount used in Brazil (358.4 mg/kg) in pigs was higher than in most European countries.33 In 2024, antibiotic consumption on farms in the state of Minas Gerais reached 434.17 mg/kg.[34]

Given this scenario, would it be possible to reduce the use of antimicrobials and continue with high-scale productivity? Answering this question, Iannetti and collaborators[36] demonstrated in their study the possibility of producing broiler chickens without antibiotics and, at the same time, guaranteeing animal health and welfare results equal to or superior to conventional systems. In pigs, studies carried out in Brazil demonstrated the possibility of a 30% reduction in the antimicrobials used[33]. Furthermore, it was found that the amount of antimicrobials used is not related to productivity, with biosecurity measures being one of the factors most closely related to herd productivity.[34]




Based on this evidence; and on the premises that animal health goes beyond the administration of antimicrobials and other medications and also includes their balance with the environment, public health and economic issues[37]; the **gradual implementation of biosecurity strategies and the promotion of animal welfare** is essential as ways to reduce the use of antibiotics in this production system, without significant losses in the production scale.

Effluents from animal production also contribute to the increase in the problem. In Rio Grande do Sul, in agricultural production areas bathed by the Guaporé River, the study by Bastos *et al*[38] identified the presence of antibiotic residues and resistance genes present in soil fertilized by animal production waste. A greater variety of antibiotic classes were found in places fertilized with manure from pig production. Antibiotic residues were also detected in forest areas that did not receive fertilizer, indicating the possibility of these residues spreading to nearby production areas through particles in the air, heavy rains and soil erosion.[38]

Another study evaluated water samples from several regions of the Pinhal River, near the city of Concórdia in Santa Catarina, and found a greater number of resistant bacteria.[39] Also in Santa Catarina, high concentrations of antimicrobial residues were identified[40] in a water sample from the Coruja River near pig farms in the city of Braço do Norte.

Another important source is the dumping of untreated hospital waste. A study carried out in two hospitals in the city of Vitória in Espírito Santo detected the presence of resistant bacteria and resistance genes present in the effluents of these hospitals.[41] In Brazil, the treatment of hospital sewage is not mandatory and the dissemination of resistant microorganisms from hospital effluents to the environment is not evaluated.[42]

Policy recommendations:

Considering the evidence presented and with the aim of qualifying policies to combat Antimicrobial Resistance, the Institute for Consumers Defense in partnership with ReAct Latinoamérica, through this policy brief, proposes a set of strategies to combat AMR to be implemented in the Brazilian context.

1. Develop a One Health education and communication plan on AMR to promote the rational use of antibiotics in human and animal health and the prevention and control of AMR.
2. Promote professional training programs for human and veterinary health and other healthcare professionals on the rational use of antimicrobials.
3. Identify, develop and implement best practices for the control and prevention of AMR in human and animal health, considering territorial specificities.
4. Establish a public policy for surveillance and monitoring of the use of antimicrobials in human health, with the publication of annual reports available to civil society, using the database of the National System for the Management of Controlled Products (SNGPC).
5. Advance the implementation of BR-Glass and the publication of national reports on the incidence of AMR in humans.
6. Improve Agromonitora to use direct sources from distributors such as animal feed factories by retaining second copies of prescriptions and/or health programs and mandatory forwarding to the official veterinary system.
7. Publish data on AMR and antimicrobial use collected by Agromonitora and the Surveillance and Monitoring System for Antimicrobial Resistance in Agriculture for all civil society, and disseminate national reports on the incidence of AMR and antimicrobial use.
8. Establish a public policy for monitoring AMR in wastewater from human sewage, animal production establishments and hospital units (human and animal) to guide public health decision-making

9. Integrate data on the incidence of AMR and the use of antimicrobials in human, animal and environmental health to compose an integrated surveillance system. The information collected should be used to identify risk regions and direct technical and financial support to these areas.
10. Invest in research to identify new sustainable means of treating hospital and animal production effluents.
11. Establish hospitals and other health units, companies and model rural properties and develop a quality certification project for the Rational Use of Antimicrobials, as a way of encouraging actors who meet the established criteria
12. Establish basic biosecurity and animal welfare standards for different production animal species. Biosecurity and animal welfare policies must be fully integrated with agricultural policies. This requires the establishment of clear regulations to ensure the protection of animals at all stages of production.
13. Ban bacitracin and virginiamycin for use as performance-enhancing additives, and gradually and responsibly withdraw the use of other classes of antimicrobials for preventive use, starting with the classes of greatest importance for human health until restricting the use of antibiotics only for therapeutic purposes.
14. Improve access to veterinary services, increase vaccination coverage, implement necessary preventive measures and educate all stakeholders on the responsible use of antimicrobials and antimicrobial resistance.

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