




Reimagining antimicrobial resistance research

How next-generation sequencing (NGS) enables superior detection and monitoring

Going beyond bacteria

Antimicrobial resistance (AMR) fast facts

-  AMR includes resistances acquired by **bacteria, viruses, fungi, and parasites**—not just bacteria alone¹
-  One of the top **global public health** and development threats²
-  Directly responsible for an estimated **1.27 million deaths** and contributed to **4.95 million deaths** globally in 2019²

In assessing potential scenarios, the World Bank estimates that AMR could result in

\$1.2 trillion
additional annual health care costs globally by 2050³



\$3.4 trillion
gross domestic product (GDP) losses per year by 2030³

A rapidly growing problem

Resistance of *Escherichia coli* to fluoroquinolones

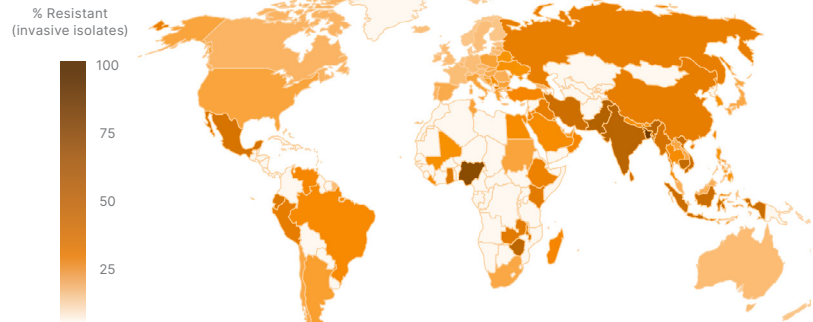


Figure 1. OneHealthTrust, ResistanceMap: Antibiotic resistance.

AMR affects countries in **all regions** and at **all income levels**. Its drivers and consequences are exacerbated by poverty and inequality, in low- and middle-income countries.

The rapidly growing problem associated with ***E. coli* infections in animals and humans** is better documented for isolates from human infections, where resistance is extensive.⁴

Scarcity of new antimicrobials and access crisis for antibiotics

The World Health Organization (WHO) identified:

27 antibiotics in clinical development that address WHO bacterial priority pathogens⁵

6 classified as **innovative**⁵

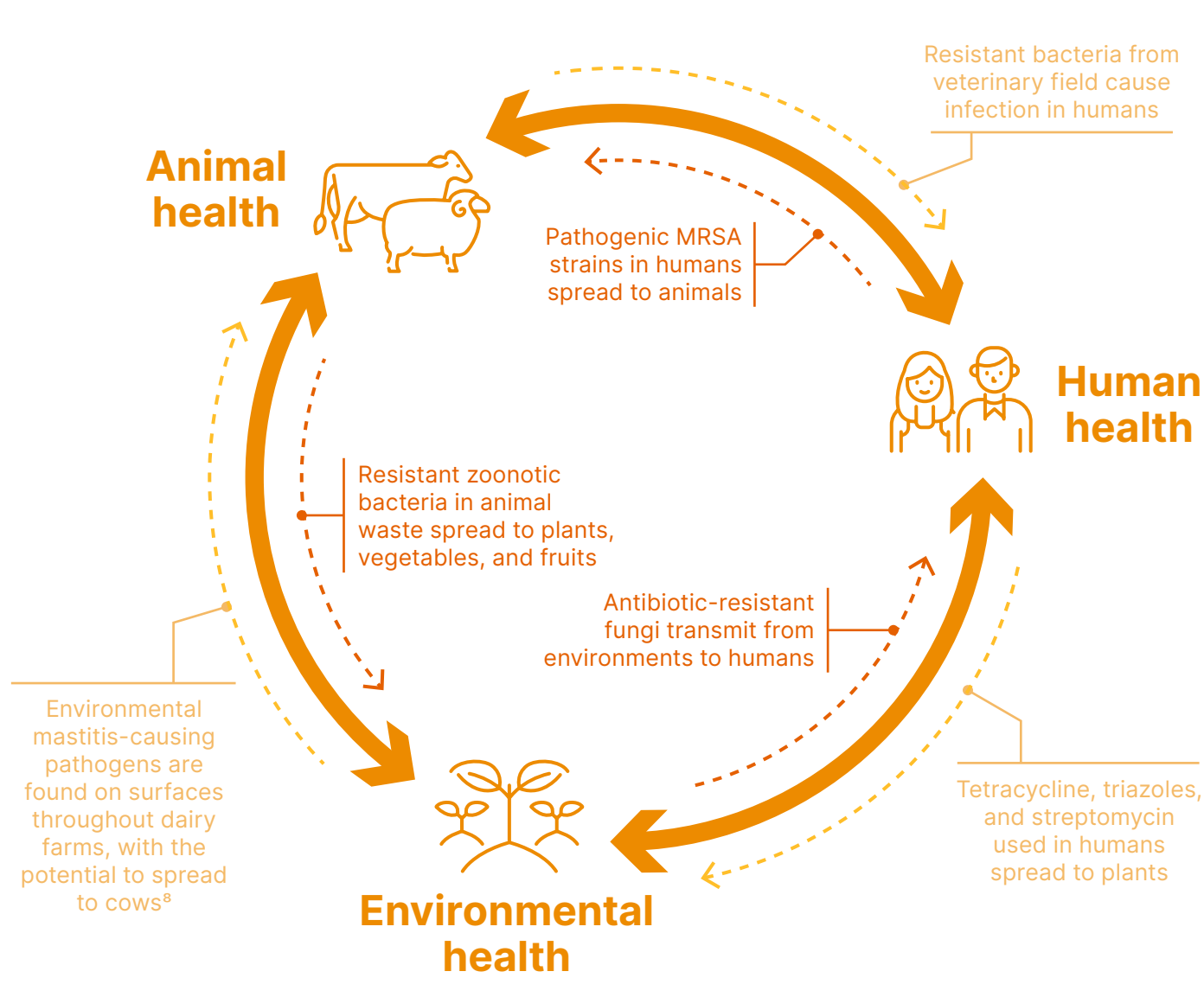


Halting the gains of modern medicine

Infections are harder to treat, and other medical procedures and treatments such as surgery, caesarean sections, and cancer chemotherapy are much riskier.⁶

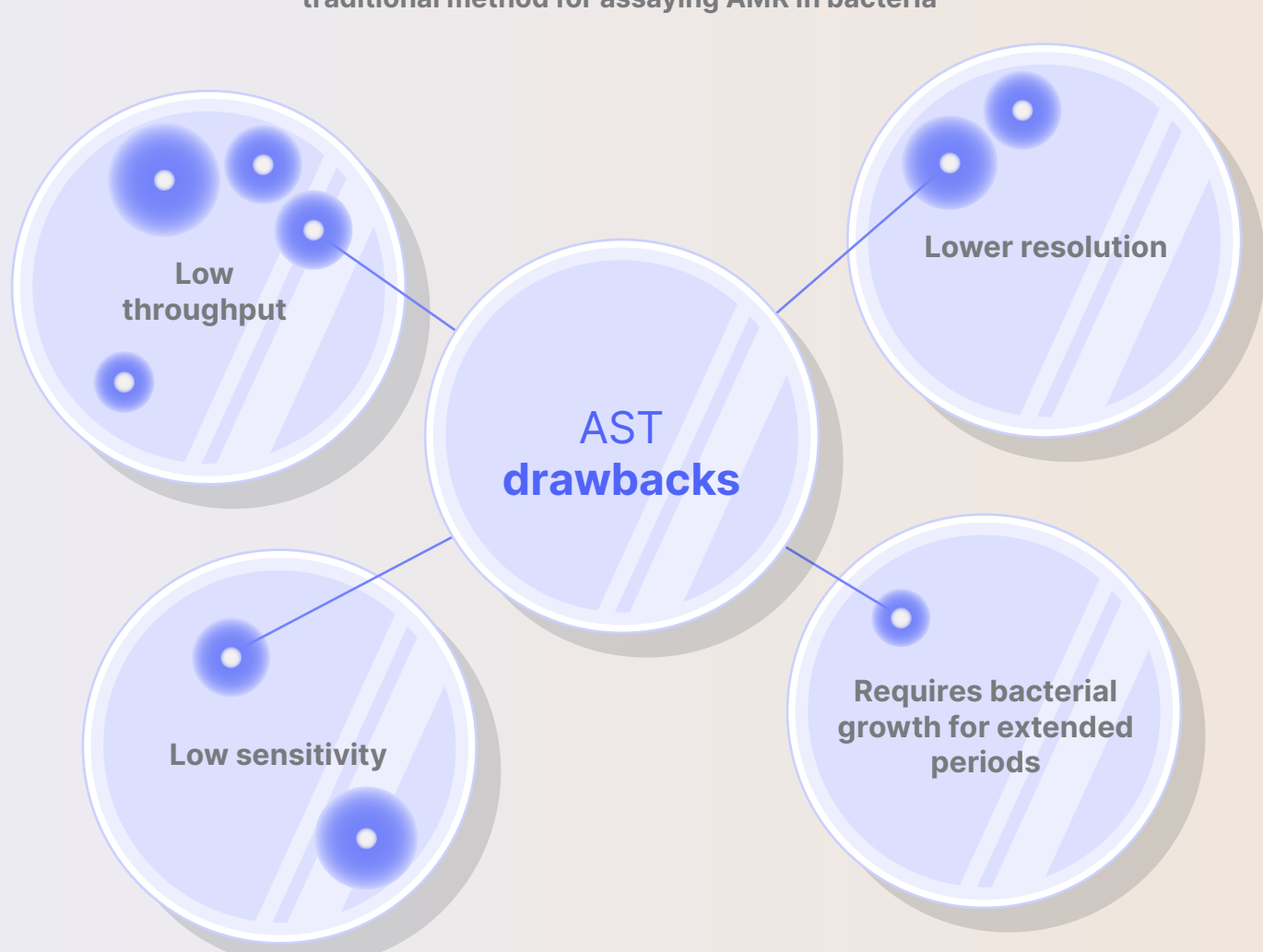
Connecting people, animals, and the environment

Misuse and overuse of antimicrobials impact the spread of resistant microbes and resistance genes⁷



Taking a closer look at the shortcomings of traditional detection methods

Antimicrobial susceptibility testing (AST) is a culture-based, traditional method for assaying AMR in bacteria⁹



Seeing more with sequencing-based approaches

Five ways NGS completes the picture for AMR detection and monitoring¹⁰

- Facilitates **outbreak investigations** and supports **infection prevention** and control in health care settings
- Provides **mechanistic information** about resistance profiles
- Reveals genetic determinants of resistance that can potentially **predict susceptibility** to antimicrobials
- Creates a link between human, animal, and environmental surveillance supporting the **One Health*** approach
- Ensures completeness of sequence data that allows for **retroactive analysis** as new AMR information becomes available

*One Health: [gdc.gov/onehealth](https://www.gdc.gov/onehealth)

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Figures

Figure 1. OneHealthTrust, ResistanceMap: Antibiotic resistance. 2024. <https://resistancemap.onehealthtrust.org/AntibioticResistance.php>. Accessed May 22, 2024.

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