World Organisation for Animal Health

Regional Workshop on Advancing WOAH AMR Standards in Veterinary Practice

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REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT

The Fleming Fund

Adopting a One Health approach for AMR – why is it important?

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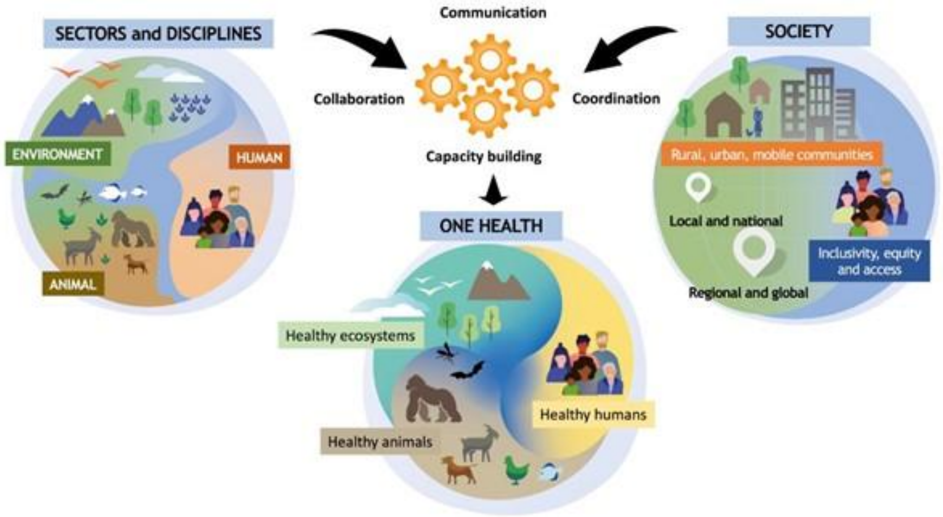
ILRI

- International Livestock Research Institute
- CGIAR AMR Hub
- Several bilateral AMR research projects
- Fleming Fund Country Grant and Regional One Health grant

- ILRI: Deeply committed to supporting NAPs through
  - Engagements with national authorities
  - Evidence generation in collaboration with academic partners
  - Capacity building
  - Implementation of surveillance
  - Support of strategic infrastructure (eg biobanking)

What is One Health?

- Often, a lot of talk, but also a serious issue
- Human, animal and plant health are interdependent and bound to the health of the ecosystems in which they exist.
- Implementing a **whole systems approach** as a collaborative between society, government and individuals, to understand, anticipate and address risks to global health



Joined up evidence, policy, action

WOAH designated ILRI as its first Collaborating Centre for One Health. ILRI is focussing on animal health management by advancing research, capacity building and policy engagement across several key areas.

WOAH Collaborating Centre for One Health

Reference Centre World Organisation for Animal Health Founded as OIE

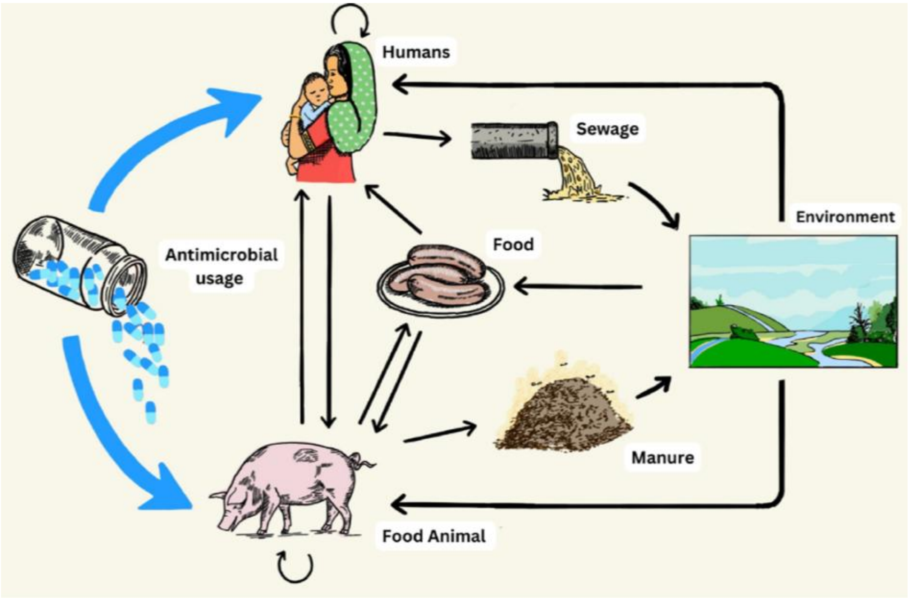
Key Areas of Activities include:

- Disease prevention, **including zoonotic and emerging pathogens**, through surveillance and early warning systems.
- **Biosecurity** and value chain interventions to reduce disease risks.
- **Epidemiological modelling**, socio-economic impact assessments, and policy engagement.
- Climate-smart strategies to address animal health vulnerabilities linked to **environmental change**

AMR moves between humans, animals, the environment

- Antibiotics are widely used in **human medicine**, **livestock production**, and sometimes crop systems

- Resistant bacteria or *resistance elements* (specific pieces of DNA) can spread:
  - From farm animals to humans (direct contact, food chain) or *vis-versa*
  - Between compartments through waste
  - Through soil and water contaminated with antibiotic residues, eg via manure
  - Wildlife can act as carriers, moving resistant organisms across regions



The antimicrobial resistance ecosystem
https://doi.org/10.1016/j.soh.2024.100082

The global community focuses on human risk

- In 2021, 4·71 million (*4·23–5·19*) human deaths were **associated** with bacterial AMR, including 1·14 million (*1·00–1·28*) deaths **attributable** to bacterial AMR

- By 2050, estimated 1·91 million (*1·56–2·26*) human deaths **attributable** to AMR and 8·22 million (*6·85–9·65*) deaths **associated** with AMR globally

Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050

*GBD 2021 Antimicrobial Resistance Collaborators**

Summary

Background Antimicrobial resistance (AMR) poses an important global health challenge in the 21st century. A previous study has quantified the global and regional burden of AMR for 2019, followed with additional publications that provided more detailed estimates for several WHO regions by country. To date, there have been no studies that produce comprehensive estimates of AMR burden across locations that encompass historical trends and future forecasts.

Methods We estimated all-age and age-specific deaths and disability-adjusted life-years (DALYs) attributable to and associated with bacterial AMR for 22 pathogens, 84 pathogen–drug combinations, and 11 infectious syndromes in 204 countries and territories from 1990 to 2021. We collected and used multiple cause of death data, hospital discharge data, microbiology data, literature studies, single drug resistance profiles, pharmaceutical sales, antibiotic use surveys, mortality surveillance, linkage data, outpatient and inpatient insurance claims data, and previously published data, covering 520 million individual records or isolates and 19 513 study-location-years. We used statistical modelling to produce estimates of AMR burden for all locations, including those with no data. Our approach leverages the estimation of five broad component quantities: the number of deaths involving sepsis; the proportion of infectious deaths attributable to a given infectious syndrome; the proportion of infectious syndrome deaths attributable to a given pathogen; the percentage of a given pathogen resistant to an antibiotic of interest; and the excess risk of death or duration of an infection associated with this resistance. Using these components, we estimated disease burden attributable to and associated with AMR, which we define based on two counterfactuals; respectively, an alternative scenario in which all drug-resistant infections are replaced by drug-susceptible infections, and an alternative scenario in which all drug-resistant infections were replaced by no infection. Additionally, we produced global and regional forecasts of AMR burden until 2050 for three scenarios: a reference scenario that is a probabilistic forecast of the most likely future; a Gram-negative drug scenario that assumes future drug development that targets Gram-negative pathogens; and a better care scenario that assumes future improvements in health-care quality and access to appropriate antimicrobials. We present final estimates aggregated to the global, super-regional, and regional level.

Findings In 2021, we estimated 4·71 million (95% UI 4·23–5·19) deaths were associated with bacterial AMR, including 1·14 million (1·00–1·28) deaths attributable to bacterial AMR. Trends in AMR mortality over the past 31 years varied substantially by age and location. From 1990 to 2021, deaths from AMR decreased by more than 50% among children younger than 5 years yet increased by over 80% for adults 70 years and older. AMR mortality decreased for children younger than 5 years in all super-regions, whereas AMR mortality in people 5 years and older increased in all super-regions. For both deaths associated with and deaths attributable to AMR, meticillin-resistant *Staphylococcus aureus* increased the most globally (from 261 000 associated deaths [95% UI 150 000–372 000] and 57 200 attributable deaths [34 100–80 300] in 1990, to 550 000 associated deaths [500 000–600 000] and 130 000 attributable deaths [113 000–146 000] in 2021). Among Gram-negative bacteria, resistance to carbapenems increased more than any other antibiotic class, rising from 619 000 associated deaths (405 000–834 000) in 1990, to 1·03 million associated deaths (909 000–1·16 million) in 2021, and from 127 000 attributable deaths (82 100–171 000) in 1990, to 216 000 (168 000–264 000) attributable deaths in 2021. There was a notable decrease in non-COVID-related infectious disease in 2020 and 2021. Our forecasts show that an estimated 1·91 million (1·56–2·26) deaths attributable to AMR and 8·22 million (6·85–9·65) deaths associated with AMR could occur globally in 2050. Super-regions with the highest all-age AMR mortality rate in 2050 are forecasted to be south Asia and Latin America and the Caribbean. Increases in deaths attributable to AMR will be largest among those 70 years and older (65·9% [61·2–69·8] of all-age deaths attributable to AMR in 2050). In stark contrast to the strong increase in number of deaths due to AMR of 69·6% (51·5–89·2) from 2022 to 2050, the number of DALYs showed a much smaller increase of 9·4% (–6·9 to 29·0) to 46·5 million (37·7 to 57·3) in 2050. Under the better care scenario, across all age groups, 92·0 million deaths (82·8–102·0) could be cumulatively averted between 2025 and 2050, through better care of severe infections and improved access to antibiotics, and under the Gram-negative drug scenario, 11·1 million AMR deaths (9·08–13·2) could be averted through the development of a Gram-negative drug pipeline to prevent AMR deaths.

Interpretation This study presents the first comprehensive assessment of the global burden of AMR from 1990 to 2021, with results forecasted until 2050. Evaluating changing trends in AMR mortality across time and location is necessary

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*Collaborators listed at the end of the Article

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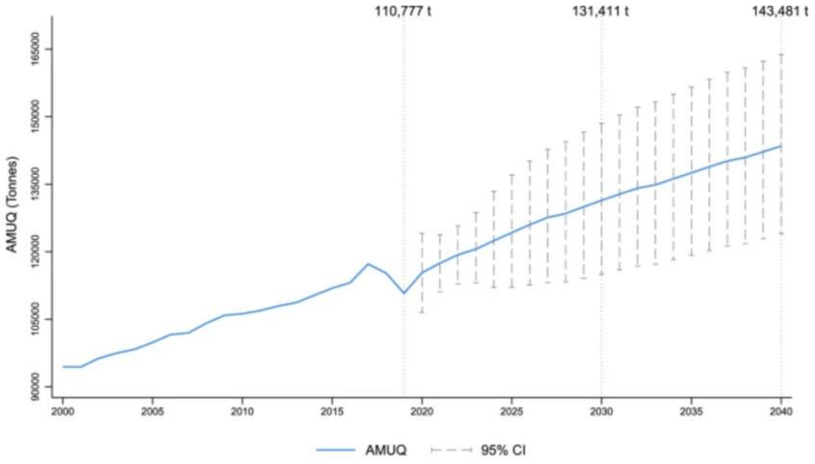
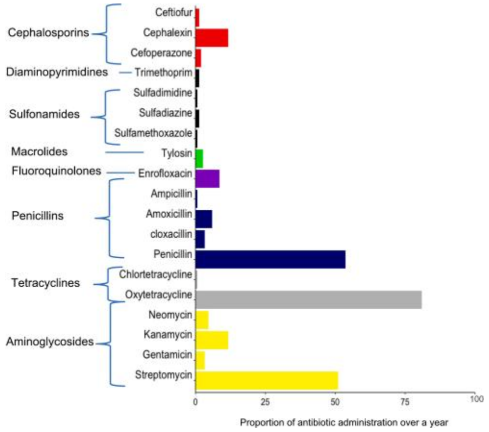
Livestock use is substantial

- A significant share of antibiotics are used in livestock — often for:
  - Growth promotion
  - Disease prevention to make up for husbandry deficiencies
  - Treatment of infections

- Agri-sector selection for resistance is unchecked
- In many low- and middle-income countries — including much of Africa — human and animal antibiotic access systems overlap (informal drug markets, shared antimicrobials), accelerating resistance spread.
- The vet sector thinks in terms of kgs of use, vs mg in humans



https://doi.org/10.1038/s41467-025-56825-7

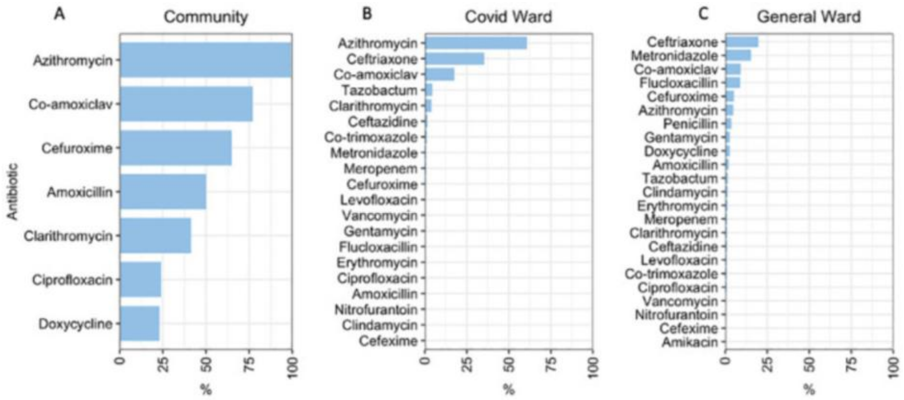


https://doi.org/10.1016/j.onehlt.2023.100646

Human use is often irrational

- Irrational: ‘wrong or unnecessary drug use’
- This is a big part of AMR story

- Eg COVID overprescription in community pharmacies in Kenya
- High levels of injectable antibiotic use in hospitals



Antibiotics prescribed for A) customers in the community pharmacies, B) patients admitted in COVID-19 wards, and C) patients admitted in general wards

https://doi.org/10.1371/journal.pgph.0003046

The environment is a reservoir of resistance genes

- The mediating role of the environment often fails to be considered
- Often due to lack of solid data

- UNEP: *"While the relationship between environmental pollution and AMR and the reservoir of resistance genes in the environment has been established, the significance and its contribution to AMR globally is still unclear"*

Animal waste and the environment

Image generated with ChatGPT

- Farm and animal waste may be heavily contaminated with drug residues and resistance elements
- Leaching into water sources
- Uptake by wildlife (eg birds) and wide dissemination

Behaviour of farmers is a key consideration in drug use

- **Easy Access**: A significant proportion of farmers administer antibiotics themselves rather than relying on veterinary professionals/paraprofessionals. Mostly, they are bought directly from agrovet stores without a prescription
- **Prophylactic Behaviour**: Over 70% of farmers surveyed reported that if one bird in a chicken flock is sick, they administer antibiotics to the whole flock to prevent the disease from spreading.
- **Misleading Awareness**: While 76% of farmers are aware of AMR, many still engage in risky practices. Knowledge is not the only driver of behavior, as economic pressure and lack of alternatives (such as effective vaccines) encourage continued antibiotic reliance.
- **Misuse of Human Medicine**: 10.7% of surveyed farmers reported using human antibiotics on their poultry.
- **Improper Withdrawal Periods**: Farmers often report shorter withdrawal periods than those officially recommended, leading to potential residue risks in food products.

https://doi.org/10.1016/j.onehlt.2025.100987

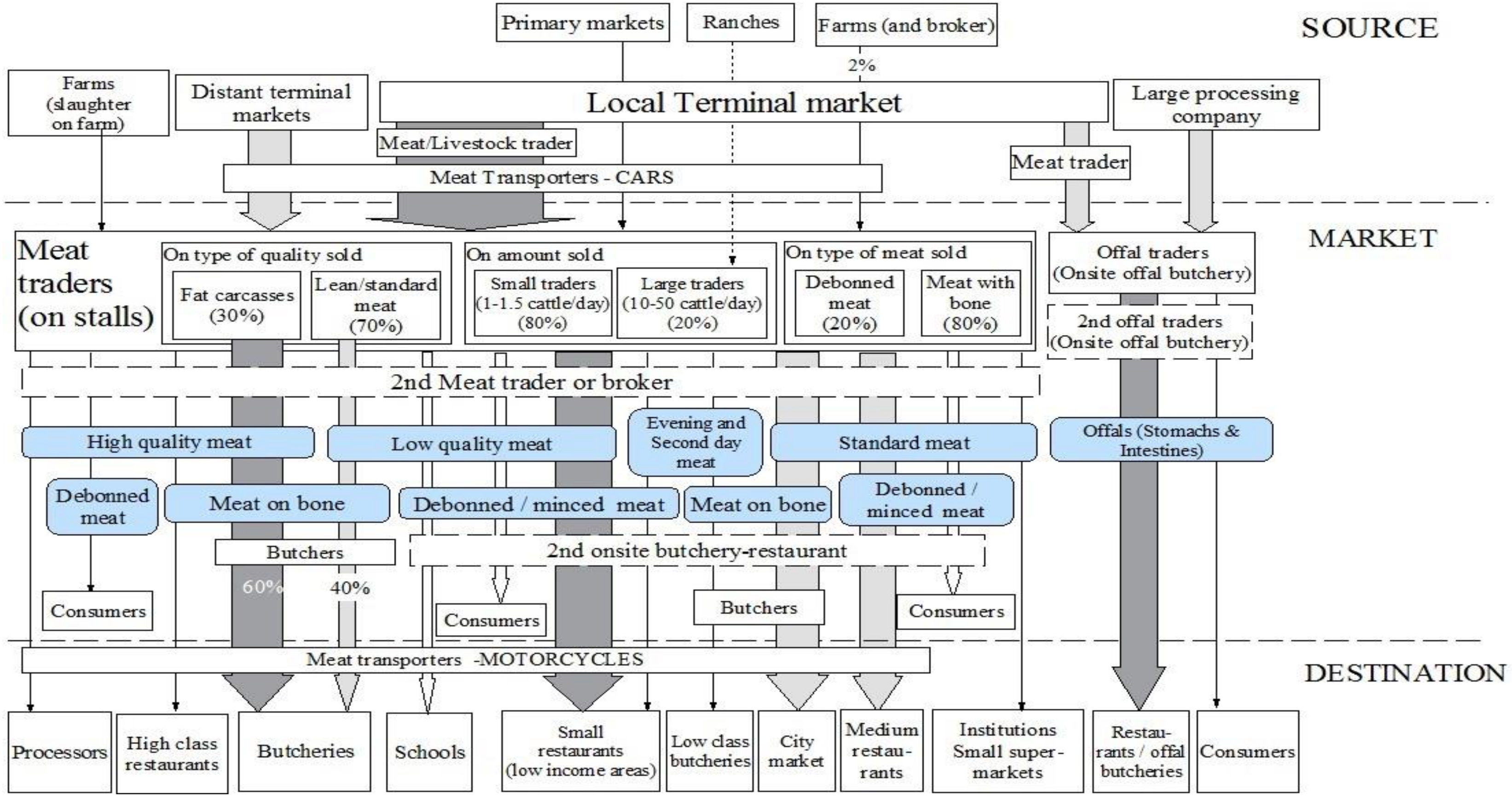
Antibiotics have food security and economic impacts

- Extreme regulation might be counterproductive

- Antibiotics are essential to
    - Creating enough protein
    - Animal welfare
    - Economically stable food systems

- The right kind of regulation is important, encouraging better husbandry, more rational use and care in waste disposal

Complex food systems: Ruminant meat



Alarcon et al (2017) *Frontiers in Veterinary*
Alarcon et al (2017) *Agricultural Systems*

Policy fragmentation weakens control

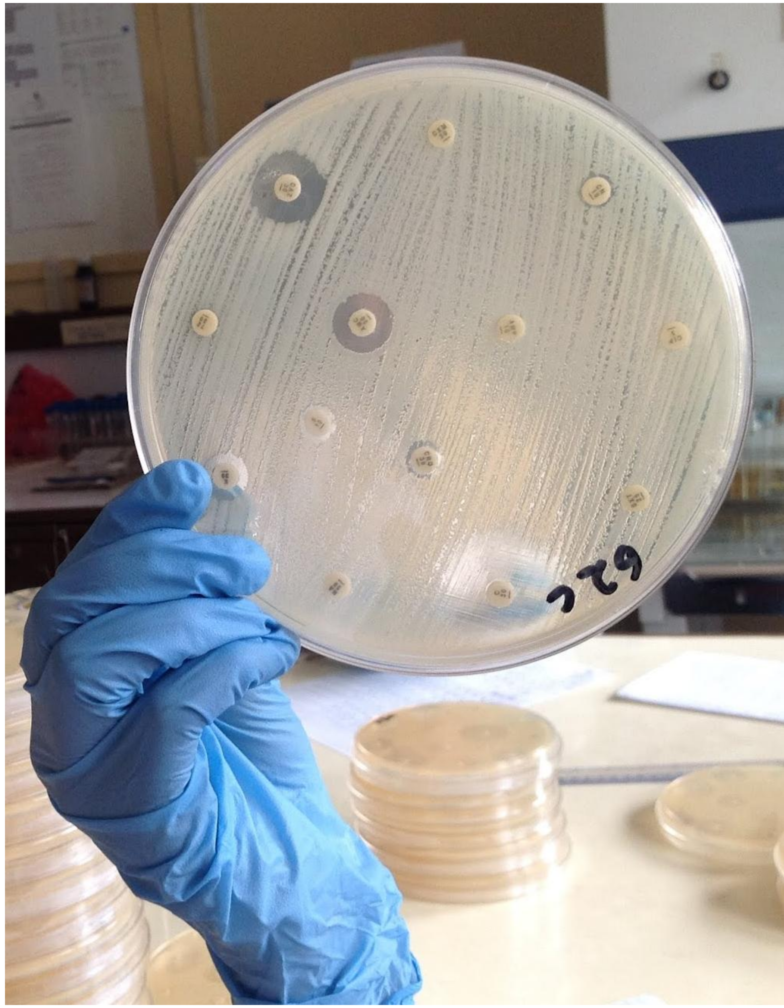
- Policy and structural issues prevent full integration
- Animal disease control policy, human disease control policy, drug management policy, environmental management policy – often (usually) developed in isolation
- Ministerial funding and priorities may not align
- Conceiving of policy from a One Health perspective would have important benefits

Sector integration is cost-efficient

- Infrastructure and supply chains can be shared....
  - Physical separation of laboratories and processes hinders integration
  - Data systems may not be integrated
  - Storage/biobanking need not be separate
  - Supply chain integration provides added value
  - New generation analytical tools (MALFI-TOF, sequencing) can be shared

Integrated surveillance as a key one health output

- Joined up surveillance activities (shared systems, shared motivations)
- Surveillance across sectors that gives unity **AND** sectorial independence
- National budgets that include surveillance activities for AMR
- Data sharing between sectors
- Sectorial contributions of surveillance data to national reporting

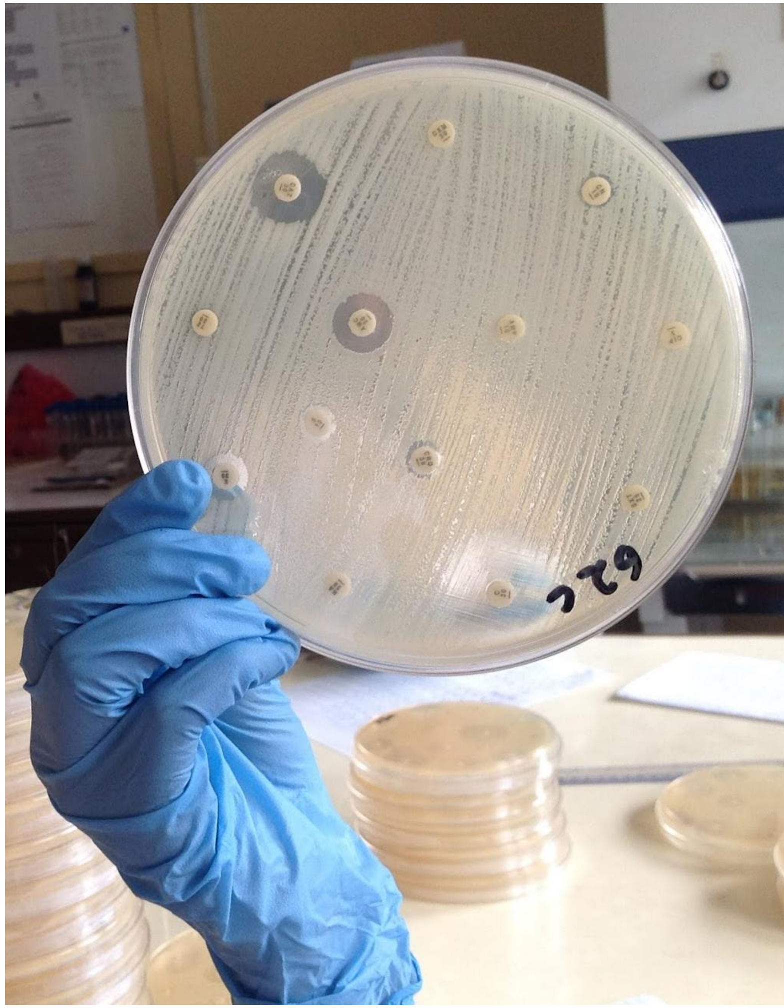


Integrated surveillance as a key one health output

AMR is fundamentally an ecological systems problem

Adopting a One Health approach for AMR is important because:

- Resistance circulates across and between humans, animals, and ecosystems
- Antibiotic use in one sector affects all others
- Environmental reservoirs sustain resistance
- Food systems and economies are affected
- Policy coordination improves efficiency and impact
- Surveillance becomes more accurate and preventive when integrated



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Thanks for your attention!

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