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HOTEL NHOW MILAN

One Health priority research agenda for antimicrobial resistance

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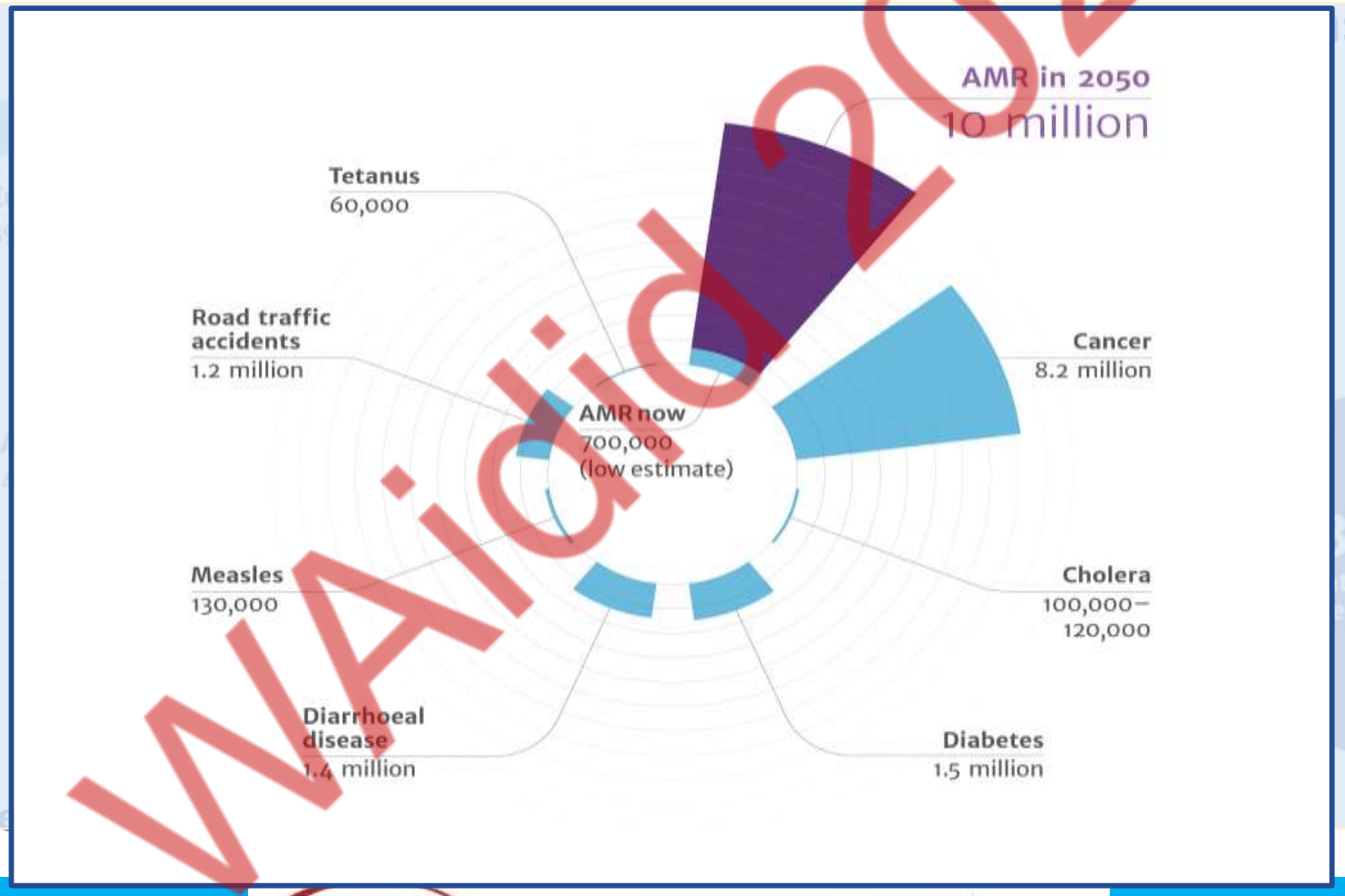
Outline

- Overview & AMR burden
- Drivers of AMR
- Milestone/Progress in AMR containment
- One Health Research Agenda
- Conclusion

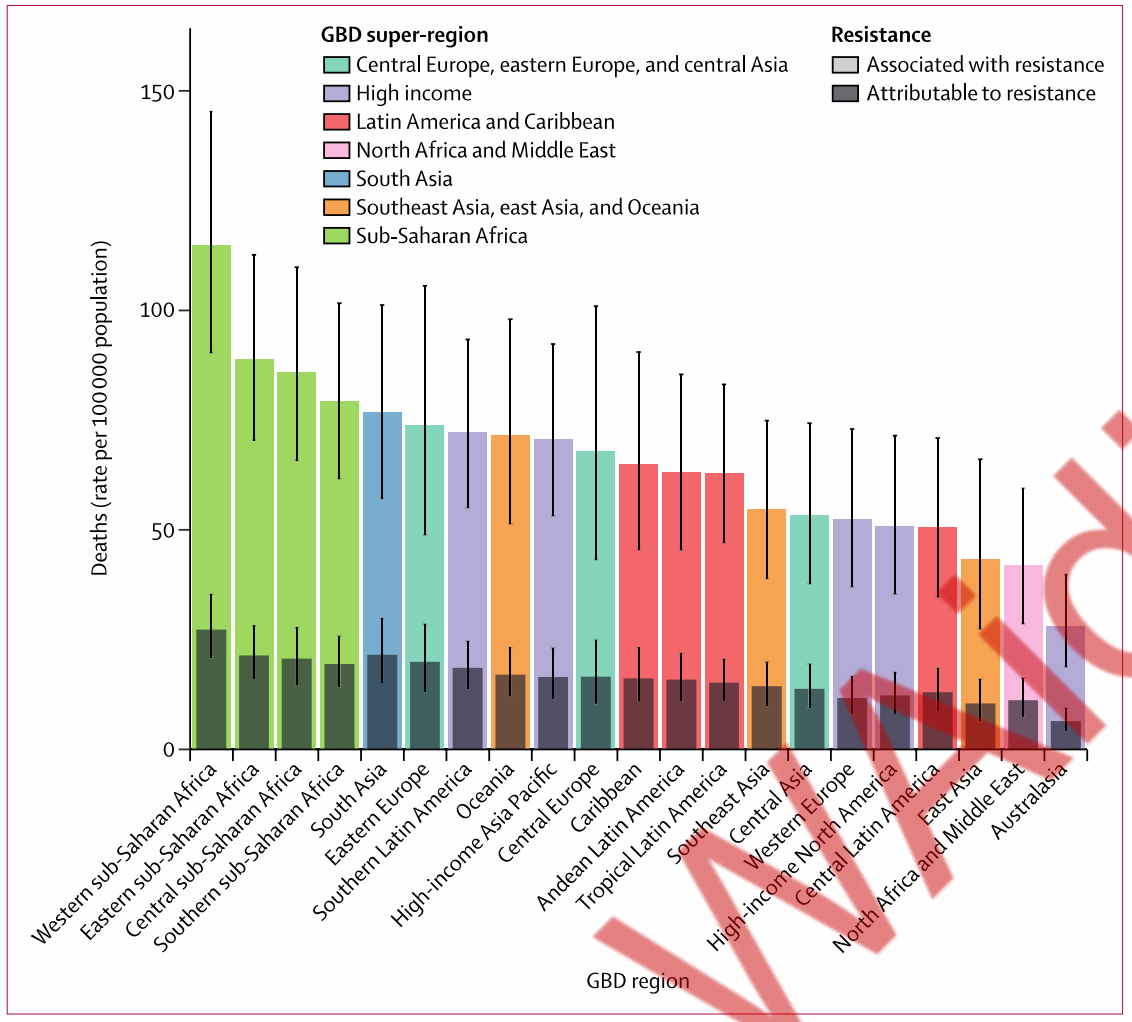
Antimicrobial resistance (AMR) is one of the top 10 global public health threats facing humanity



https://amr-review.org

AMR - Not a future problem..

Global death attributable to and associated with AMR, 2019



- 4.95 million deaths **associated** with bacterial AMR
- 1.27 million deaths **attributable** to bacterial AMR

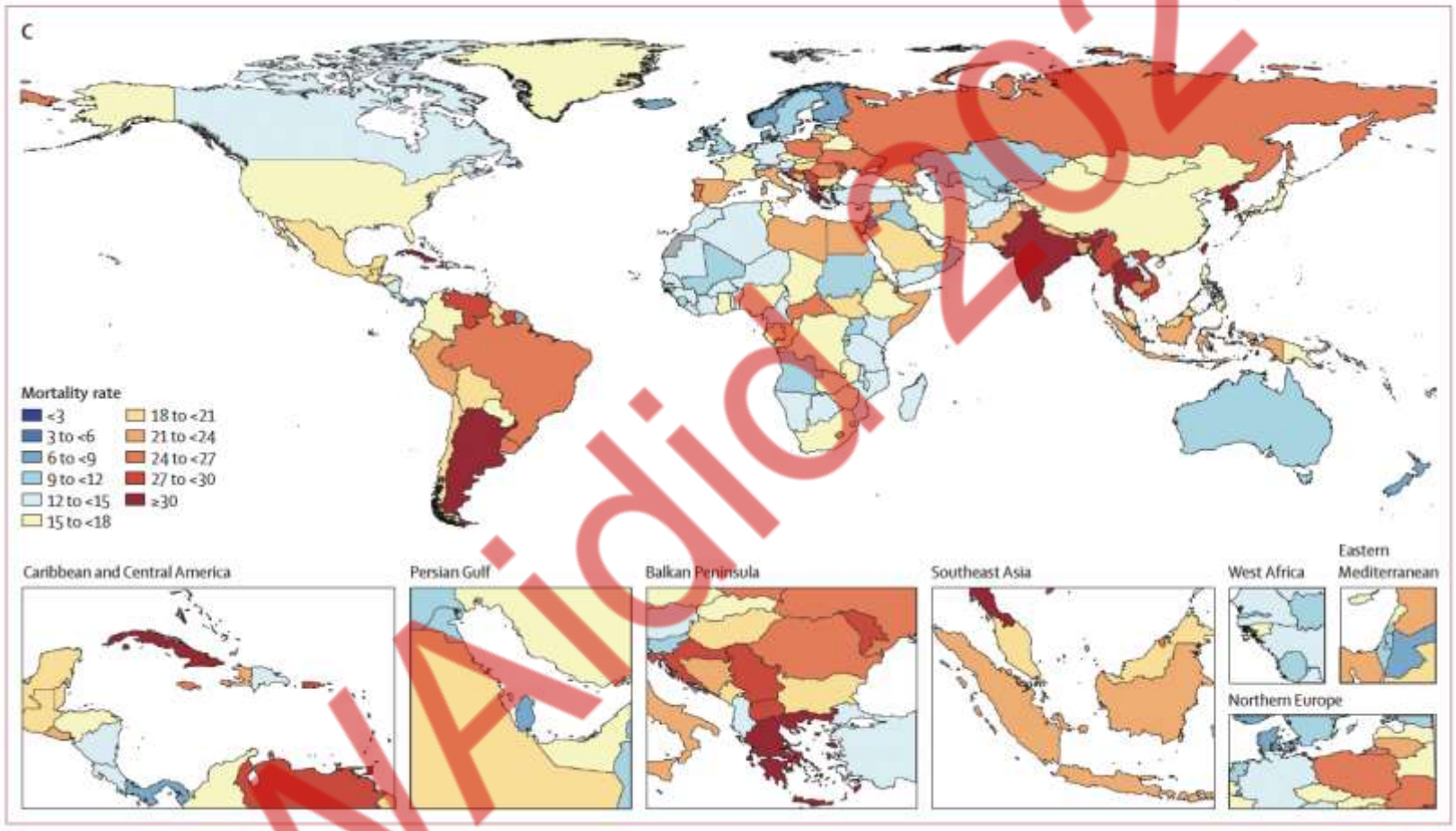
All-age death rate attributable to resistance:

- **highest in western sub- Saharan Africa** (27.3 deaths per 100 000)
- lowest in Australasia (6.5 deaths per 100 000).

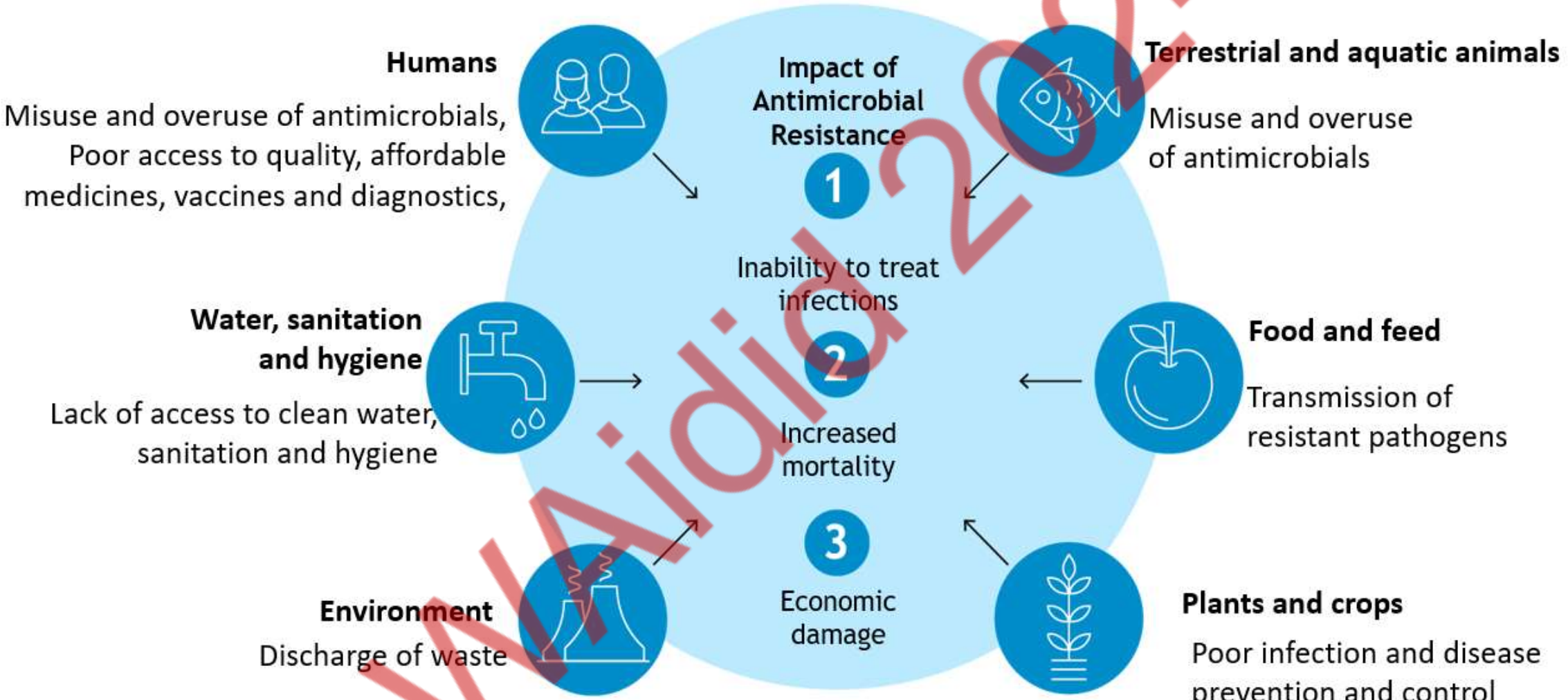
Lower respiratory
Bloodstream infections
intra-abdominal infections

78.8%
of deaths

Death rates per 100 000 attributable to AMR
1990 -> 2021 -> 2050



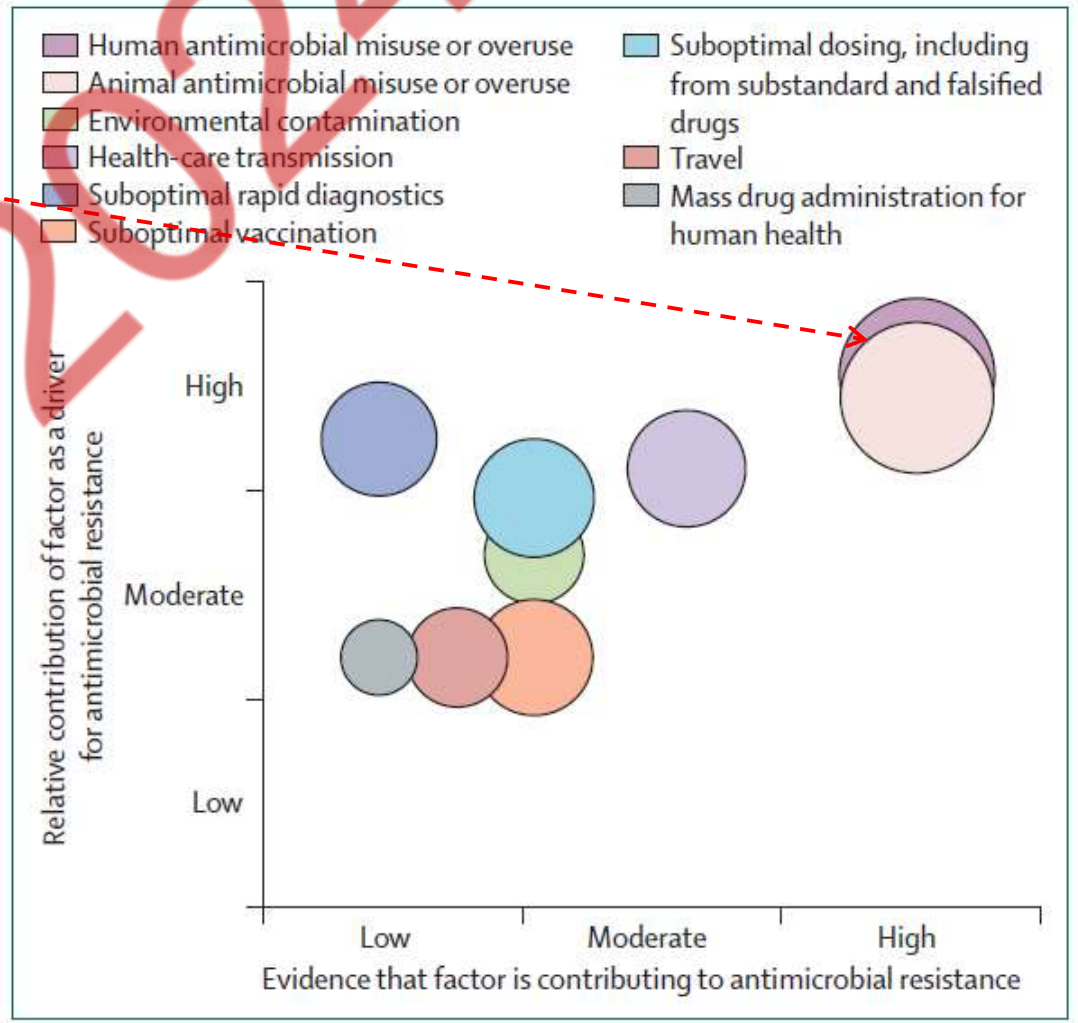
Complex and interlinking drivers are increasing the prevalence of AMR



Drivers of AMR: antimicrobials exacerbates the selection of resistant organisms

AMR drivers[2] can either impact directly or indirectly

- **Overuse and misuse of antimicrobials**
- Poor Infection Prevention and control (IPC)
- Agricultural practices
- Globalization and trade
- Lack of new antibiotics
- Lack of clean water, sanitation and hygiene
- Poor public awareness
- Poor access to quality medicines, vaccines and diagnostics



2. Holmes, A. H., Moore, L. S., Sundsfjord, A., Steinbakk, M., Regmi, S., Karkey, A., Guerin, P. J., & Piddock, L. J. (2016). Understanding the mechanisms and drivers of antimicrobial resistance. *Lancet (London, England)*, *387*(10014), 176–187. https://doi.org/10.1016/S0140-6736(15)00473-0

Drivers of AMR: Lack of diagnostic tools contributes to antibiotic misuse.

Humans
Misuse and overuse of antimicrobials, Poor access to quality, affordable medicines, vaccines and diagnostics,

- **Blood cultures** remain the gold standard for diagnosing infections -> still **not widely used** as a standard of care in many **countries**, particularly in LMICs.
- **Diagnostic Gap**: Expanding access to rapid point-of-care tests is critical for better antimicrobial stewardship and combating AMR.

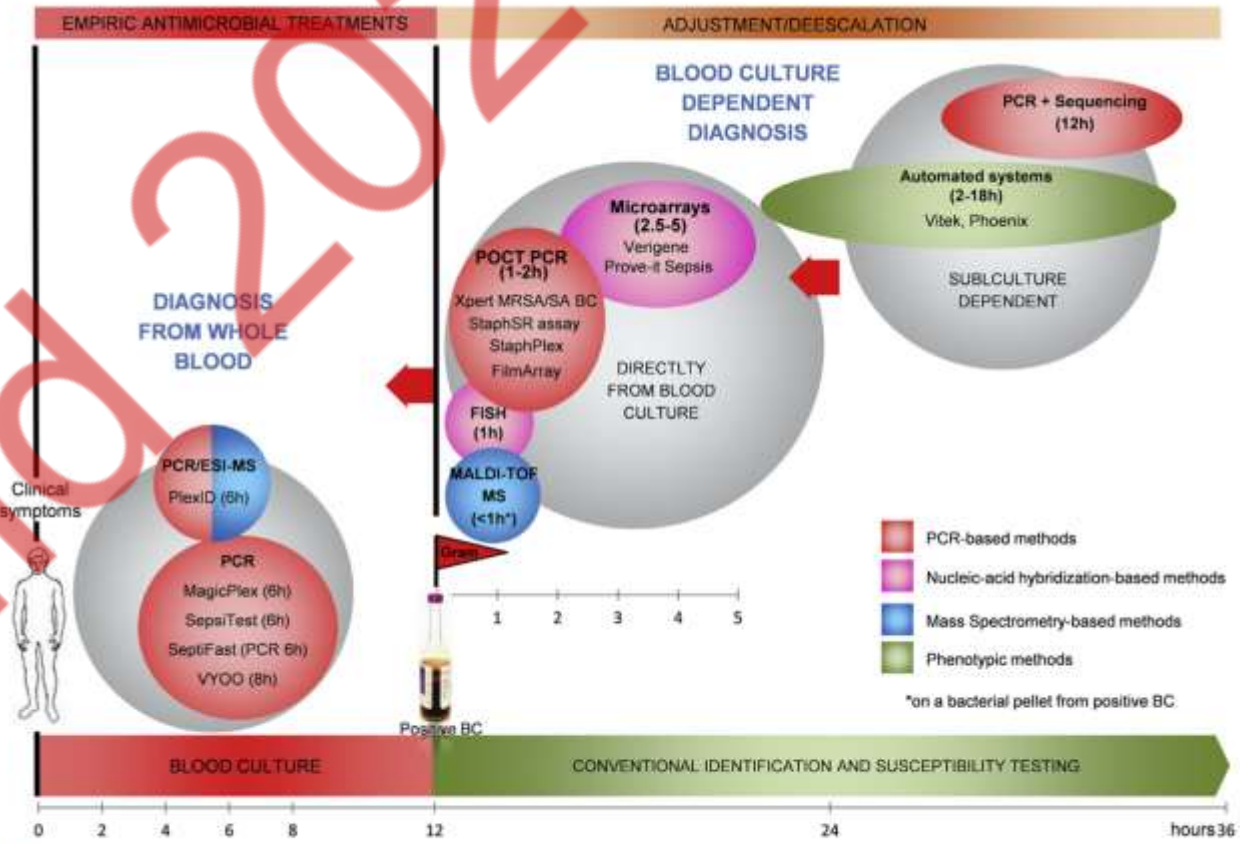


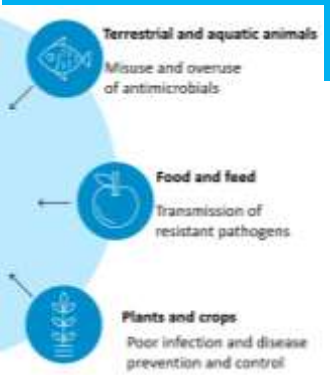
FIG. 2. Nucleic acid methods for the microbial diagnosis of BSI, BC-independent and BC-dependent methods. Nucleic acid–based methods have shortened the time to result BSI diagnosis. In the absence of microbial documentation of the etiologic agent of the BSI, anti-infectious treatments are initiated on the basis of clinical and epidemiologic information. Diagnosis directly from blood samples could shorten the length of empiric treatment.

REVIEW

Microbial diagnosis of bloodstream infection: towards molecular diagnosis directly from blood

O. Opota[1], K. Jaton[1] and G. Greub[1,2]
1) Institute of Microbiology and 2) Infectious Diseases Service, University of Lausanne and University Hospital Center, Lausanne, Switzerland

Drivers of AMR: Overuse of antibiotics in livestock and fishfarming significantly contributes to AMR



- **Therapeutic and Non-Therapeutic Use**:
  - **Prophylaxis**: Administered to entire herds or flocks at risk of disease.
  - **Metaphylaxis**: Given to healthy animals in groups where some show infection signs.
  - **Growth Promotion**: Used in sub-therapeutic doses to enhance productivity (banned in the EU since 2006).

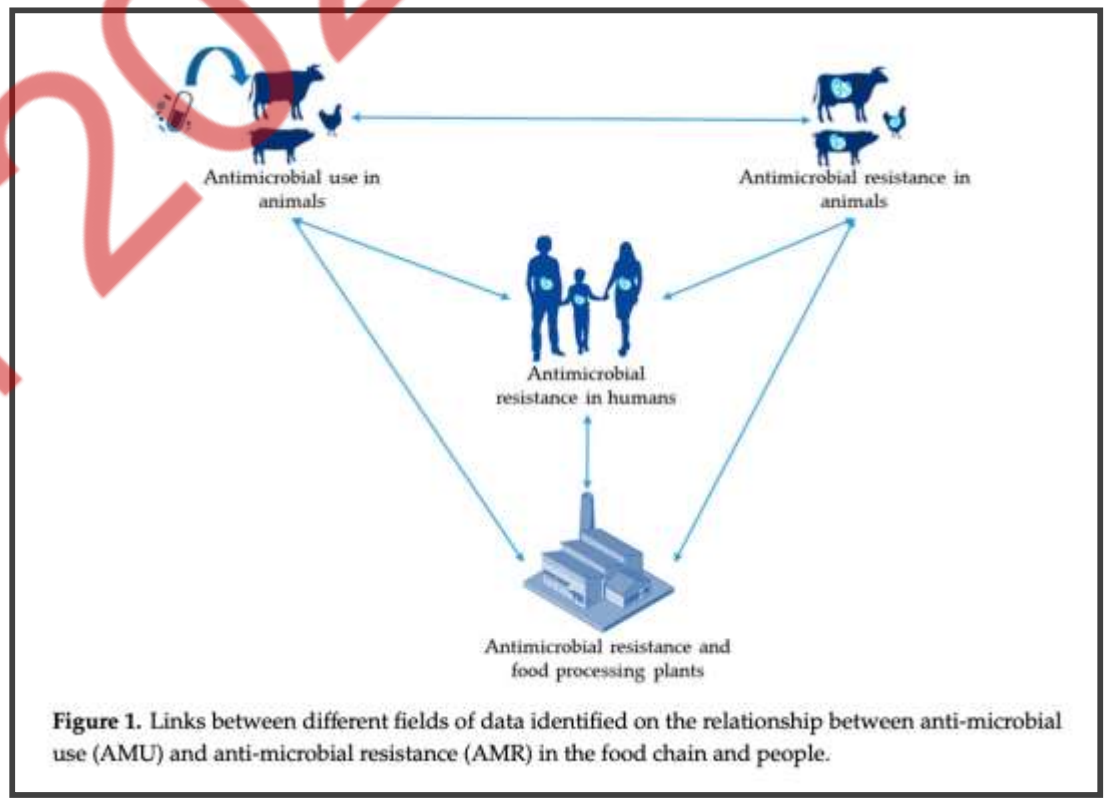
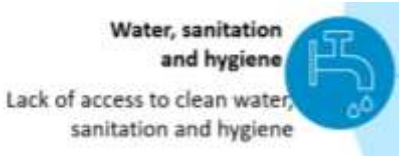


Figure 1. Links between different fields of data identified on the relationship between anti-microbial use (AMU) and anti-microbial resistance (AMR) in the food chain and people.

Adapted from «Overview of Evidence of Antimicrobial Use and Antimicrobial Resistance in the Food Chain», Bennani et al

Inadequate hand hygiene, poor sanitation and hygiene, and lack of infection control measures contribute to the spread of resistant infections.



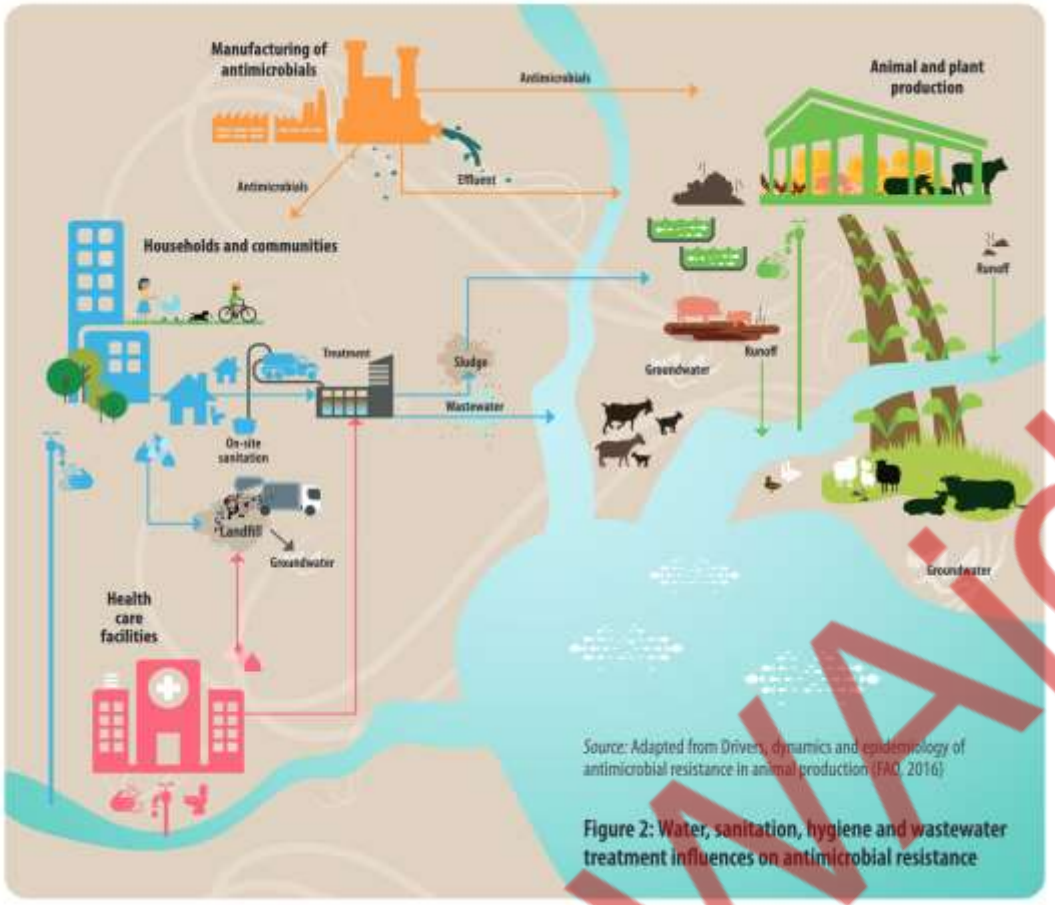
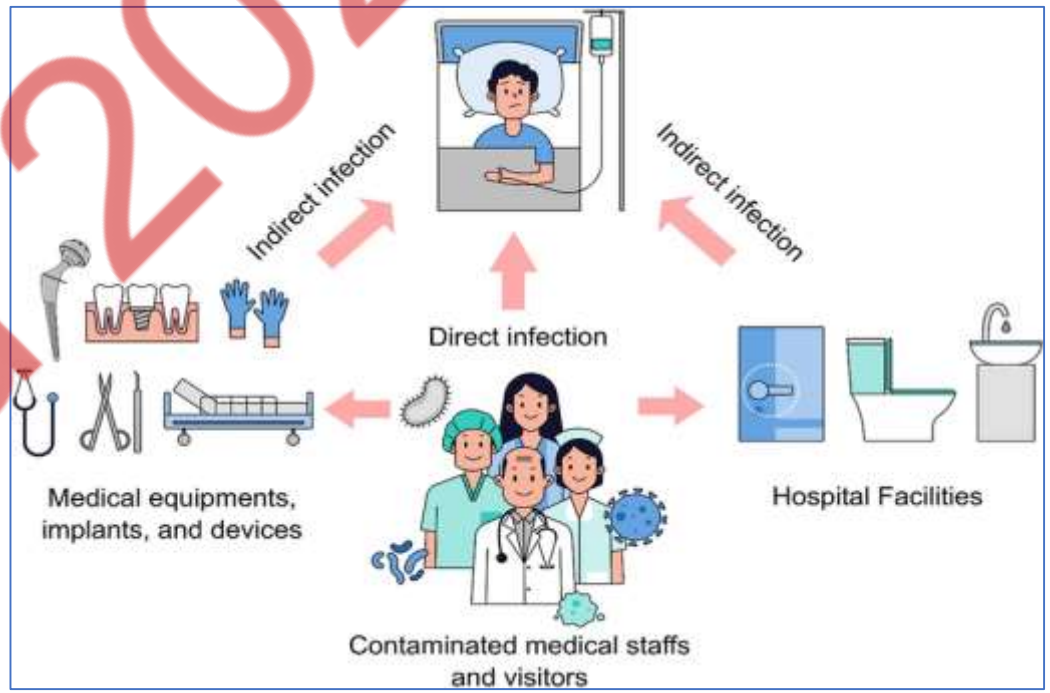
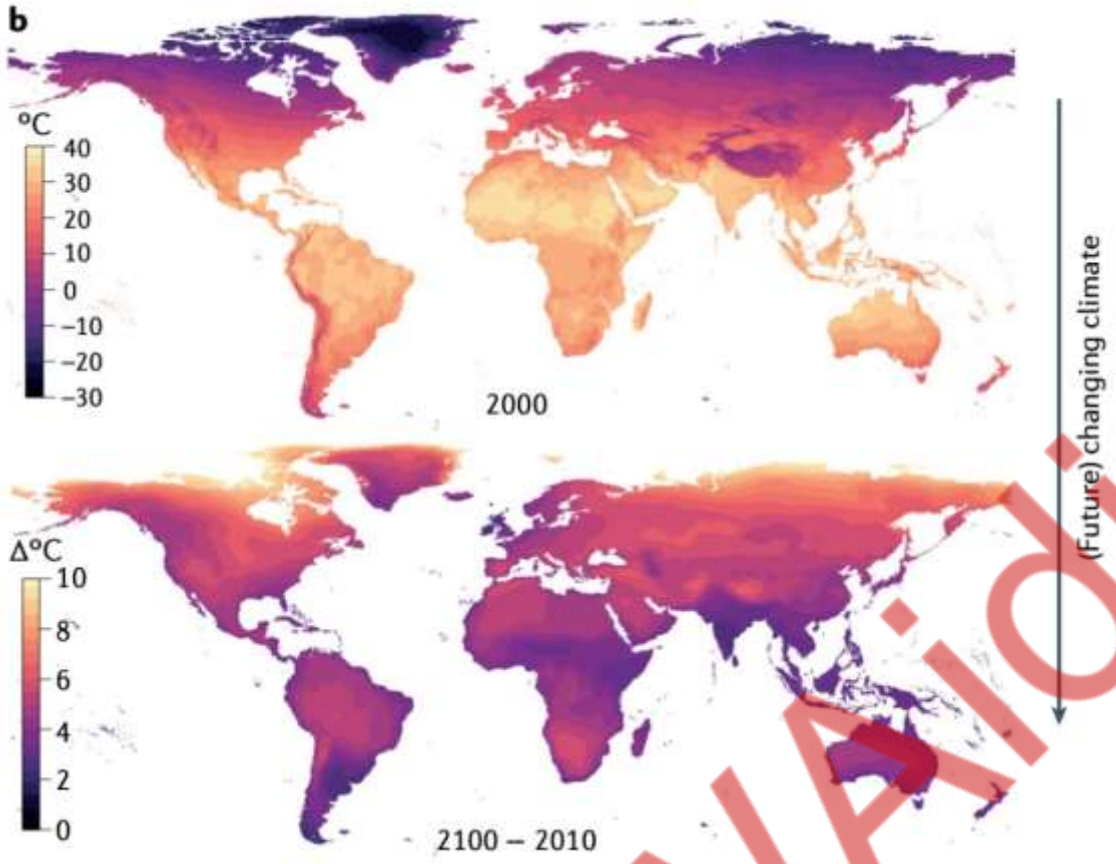


Figure 2: Water, sanitation, hygiene and wastewater treatment influences on antimicrobial resistance



Patients who are hospitalized or receive medical treatment are particularly vulnerable to resistant infections.

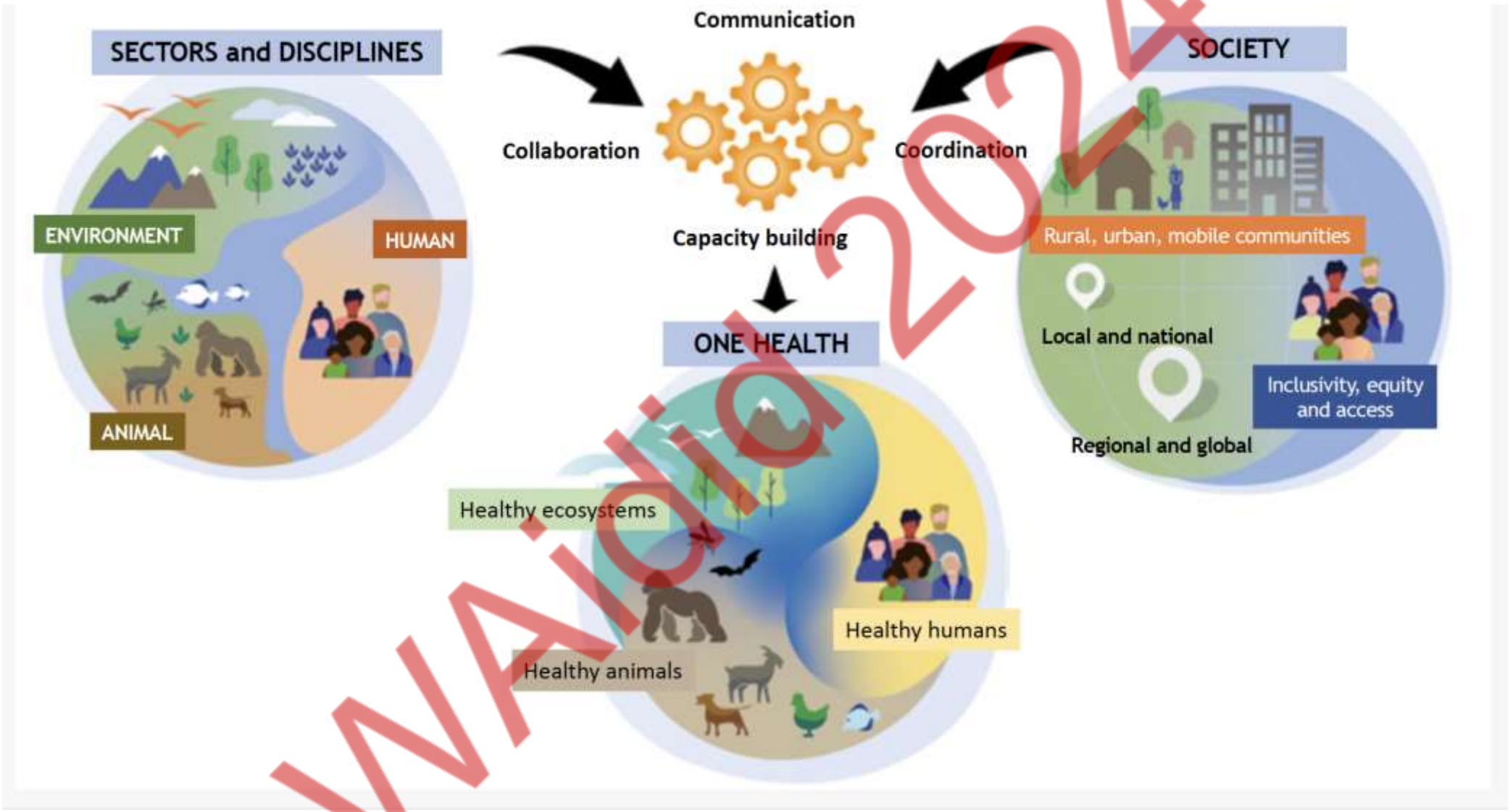
AMR: The Role of Climate Change



Average monthly maximum temperature in 1970–2000 and difference between 2070–2100 and 1970–2000 averages (data from WorldClim, Shared Socioeconomic Pathway 3 (SSP3)

- Accelerate the spread of resistant bacteria and pathogens.
- Extreme weather events compromise sanitation and water systems
- Climate-induced agricultural shifts may increase antibiotic usage in new regions.

….One Health Approach



Milestone/Progress in AMR containment

The Global Action Plan serves as a framework to combat AMR at the global level

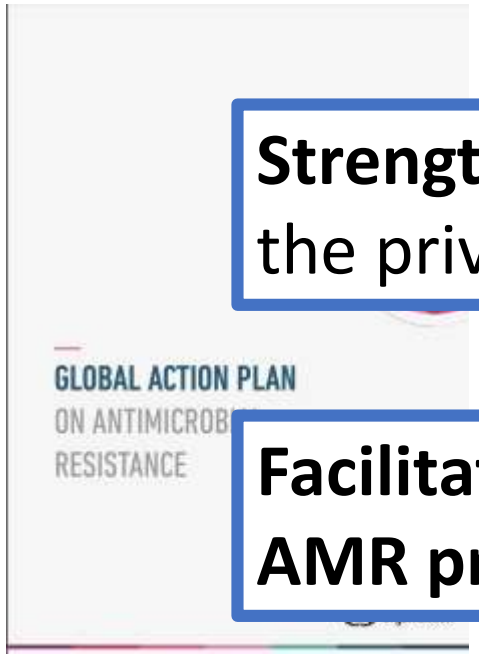
MAIN OBJECTIVES:

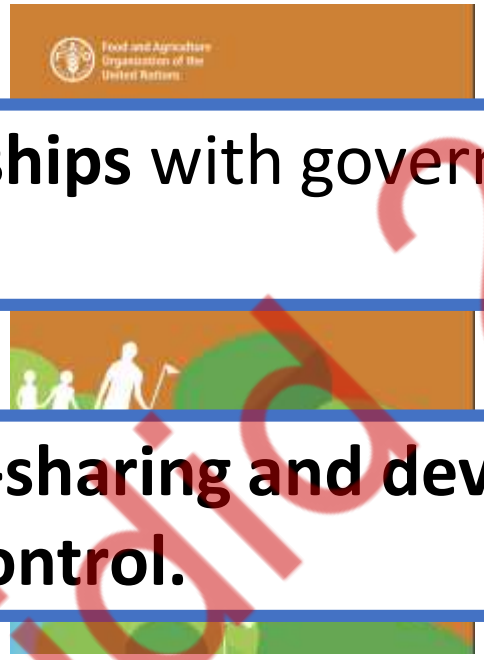
- Improve **AWARENESS** and **UNDERSTANDING** of AMR.
- **STRENGTHEN SURVEILLANCE** and research.
- **OPTIMIZE THE USE OF ANTIMICROBIALS** in human and animal health.
- **SUPPORT INVESTMENTS IN NEW TECHNOLOGIES AND DRUGS**.

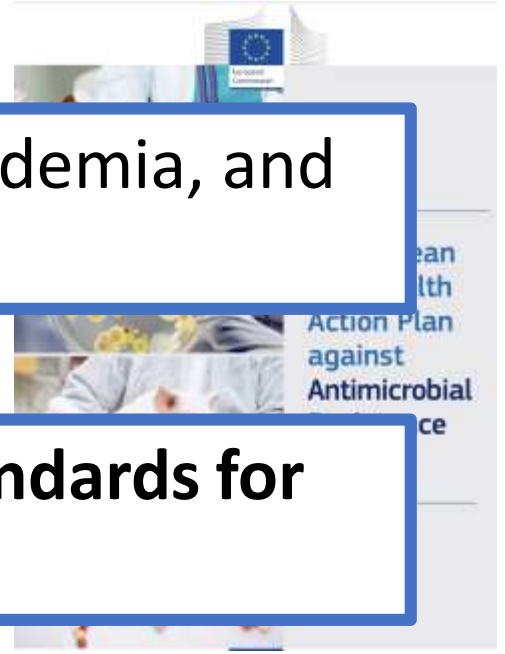
This plan had already recognized the importance of the **One Health** approach, but it primarily focused on human health

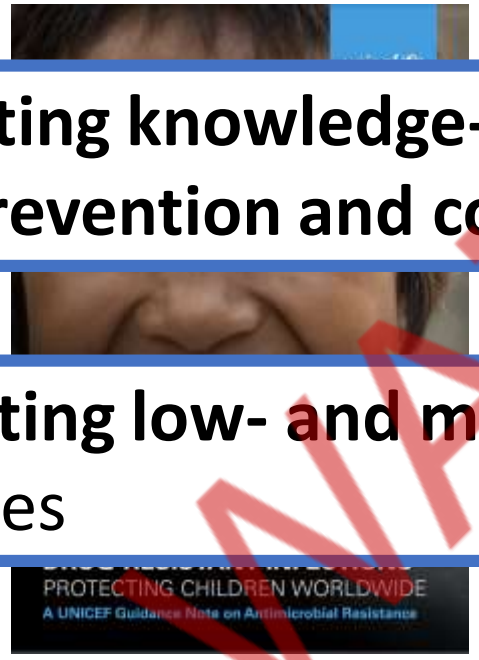
Milestone/Progress in AMR containment

Global Collaboration and Partnerships









Strengthening partnerships with governments, NGOs, academia, and the private sector

Facilitating knowledge-sharing and developing global standards for AMR prevention and control.

Supporting low- and middle-income countries in implementing AMR strategies

Milestone/Progress in AMR containment

National Action Plans

WHO Implementation Handbook for National Action Plans on AMR:

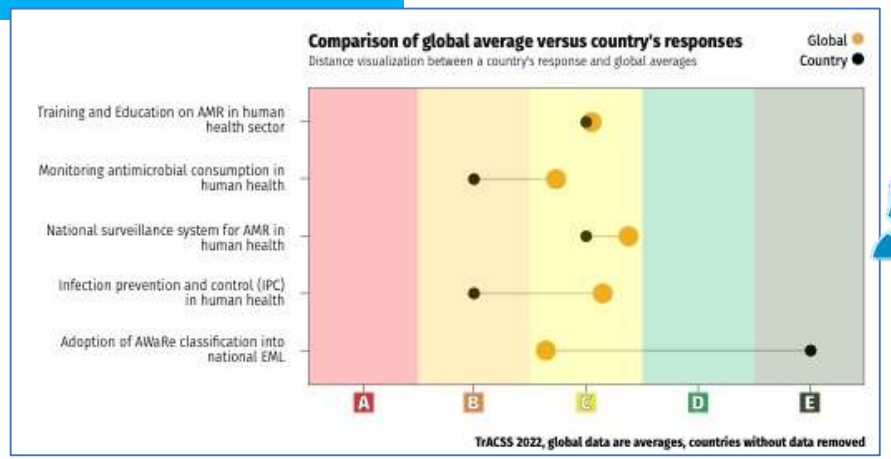
- **step-by-step guidance**
- Focuses on priority setting, monitoring, and evaluation.
- Promotes a **One Health approach with multisectoral collaboration**.
- Includes **best practices, capacity-building tools**,
- Aligns national efforts with global standards and WHO recommendations.

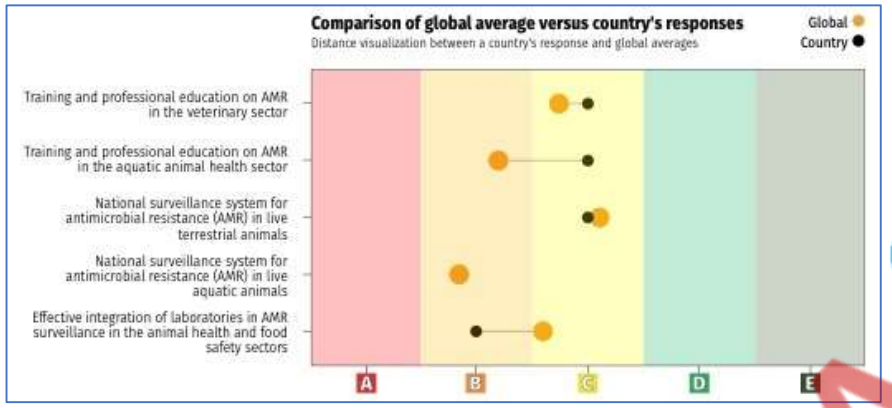
TrACSS (Tracking Antimicrobial Resistance Country Self-Assessment Survey)

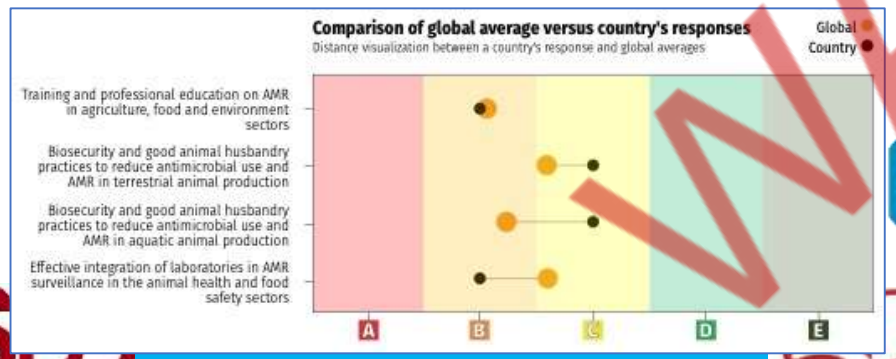
A crucial tool to:

- ❑ **Track progress**
- ❑ **Identify gaps**
- ❑ **Facilitate reporting in a standardized format**
- ❑ **Multi-Agency Collaboration**

Milestone/Progress in AMR containment







capacity

none	A
limited	B
developed	C
demonstrated	D
sustained	E

TrACSS (Tracking Antimicrobial Resistance Country Self-Assessment Survey)

- **Annual Monitoring:** Tracks the implementation of AMR national action plans through yearly surveys.

- **Regional Reporting:** Produces individual country reports for each WHO region based on responses to the 2022 survey.

- **Data Visualization:** Includes tools that compare each country's responses to global averages, highlighting progress, gaps, and areas for improvement.

- *170 countries have NAP; 166 reported their progress on TrACSS 2022; Out of 166, 109 NAPs implementation is underway*

Milestone/Progress in AMR containment

UNIFIED APPROACH FOR COLLECTING, ANALYZING, INTERPRETING, AND SHARING AMR DATA GLOBALLY

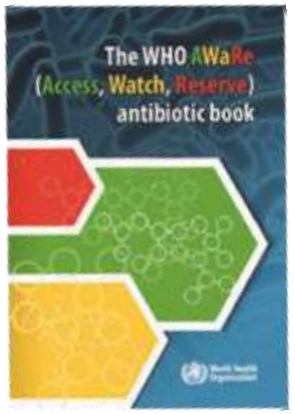
GLASS (Global Antimicrobial Resistance and Use Surveillance System)

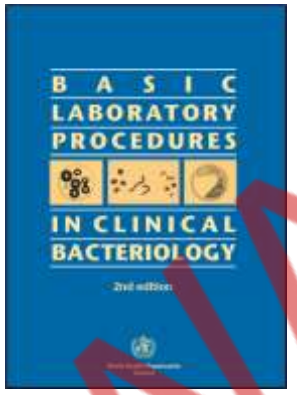
- ❑ **Capacity Building:** collecting data with a unified approach
- ❑ **Expanded Membership-** activation of new sites
- ❑ **Comprehensive Data Inclusion:** development of national surveillance
- ❑ **Data Transparency**
- ❑ **One Health Integration**

- ○ *127 countries **enrolled** in GLASS; 87 countries **provided** data on **AMR** in 2022; 57 countries provided data on **AMC**.*

Milestone/Progress in AMR containment

WHO Initiatives on Antimicrobial Resistance and Stewardship in humans





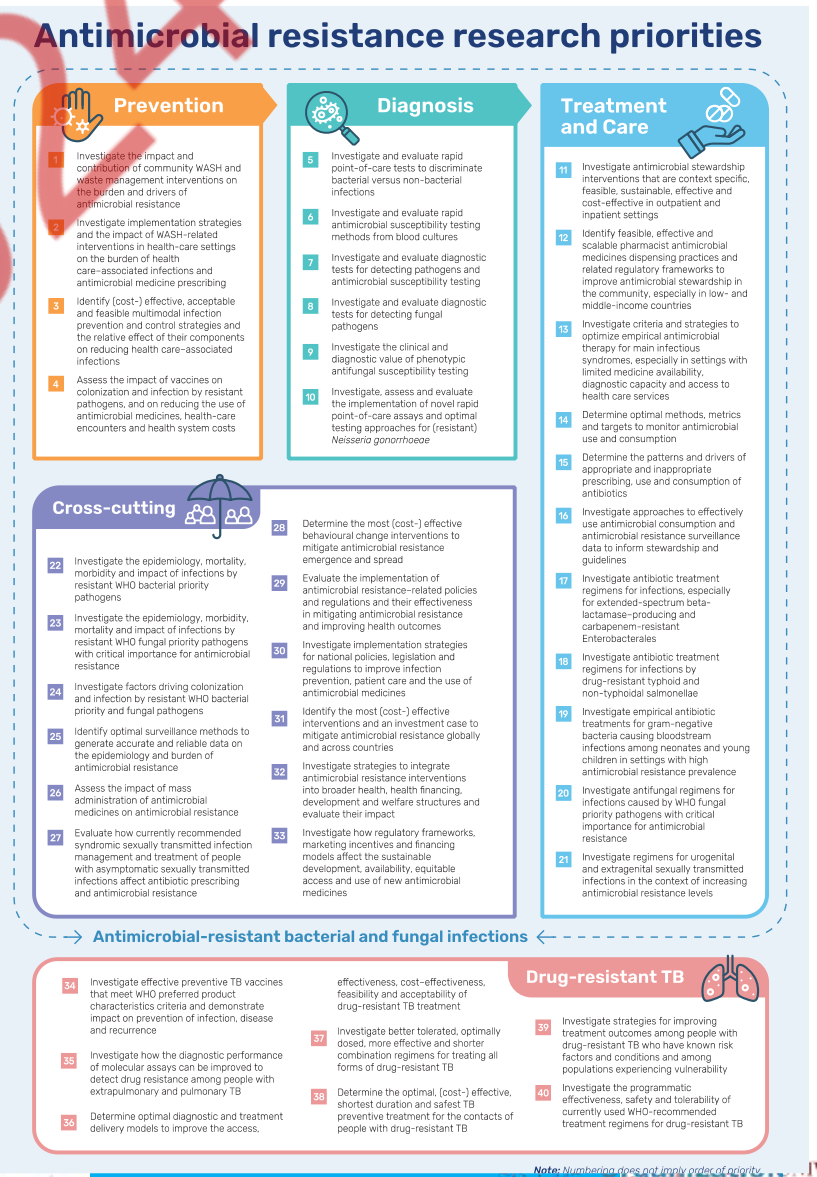
- **Clinical Guidance (AWaRe Antibiotics Handbook):**
  - Provides practical guidelines for the appropriate and safe use of antibiotics, categorized into Access, Watch, and Reserve groups to minimize resistance.
- **Diagnostic Stewardship:**
- **Antimicrobial Stewardship:**
  - Promotes policies and practices to optimize antimicrobial use in healthcare settings, ensuring effective treatment and preserving antibiotic efficacy.
- **Infection Prevention and Control (IPC):**
  - Implements measures to prevent healthcare-associated infections, reducing the need for antibiotics and limiting resistance spread.
- **WHO Bacteria Priority List:**
- **WHO Fungal Priority List:**

THE GLOBAL RESEARCH AGENDA FOR ANTIMICROBIAL RESISTANCE IN HUMAN HEALTH

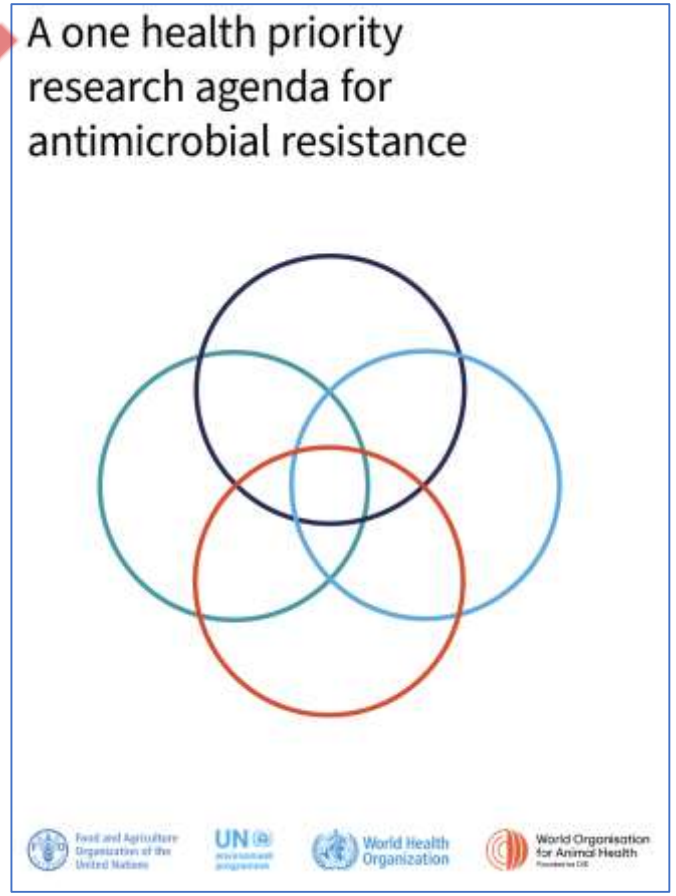
..even more has been done to **identify** and **prioritize** 40 research topics to produce evidence-based policies to combat AMR globally by 2030.

Goals:

- Improve prevention and diagnostics.
- Develop new treatments
- Promote antibiotic stewardship and public health measures.



Following Global Action Plan, the international community increasingly recognized the roles of animals, the environment and agricultural practices in the development and spread of AMR.



The **Global Action Plan** remains the primary framework for combating AMR, while the **One Health** approach is an operational strategy adopted to address the issue in a more integrated and holistic manner.

5 Pillars
Top 10 Research Priorities
One Health Research Agenda

- ✓ **TO STRENGTHEN RESEARCH CAPACITY**
- ✓ **ACTIONABLE AND IMPACTFUL IN 4–8 YEARS** (short to medium term).

Transmission

Transmission

Focus → Generating evidence of **DYNAMICS AND DRIVERS** of AMR in shared environmental settings

- **WHERE** transmission happens
- **WHAT** drives this transmission
- **WHY** transmission happens
- **HOW** human practices affects the interface between humans, plants, animals

Integrated Surveillance

Integrated surveillance

Focus → CROSS-SECTOR SURVEILLANCE to improve common **technical understanding** and **generate and exchange** information about AMR/AMU between One Health sectors

- ❑ questions about **HARMONIZATION and IMPLEMENTATION** of One Health INTEGRATED **SURVEILLANCE** and applicability to **LMICs;**
- ❑ considerations for innovative surveillance approaches to AMR

Interventions

Interventions

Focus → PROGRAMMES, PRACTICES, TOOLS and activities designed to **PREVENT, CONTAIN OR REDUCE** the incidence, prevalence and circulation of AMR

Interventions commonly implemented

- ❑ water, sanitation and hygiene (**WASH**) measures;
- ❑ biosecurity and infection prevention and control **(IPC)** on farms and in health care facilities
- ❑ **significant gaps persist in understanding the availability of potential technical interventions and the reality of implementing these in <u>LMIC contexts</u>**

Behavioural insights and change

Behavioural insights and change

Focus → UNDERSTANDING BEHAVIOUR across **DIVERSE GROUPS** and **ACTORS** that are implicated in the development and circulation of AMR

- ways to change behaviours that increase AMR risk

- ❑ understanding **macrostructural** and policy factors as well as **microcommunity** and individual behaviours
- ❑ understanding **influences on human behaviour in different context**s (social influences and support, livelihoods, financial resources, etc.).
- ❑ It operates at multiple levels of complex systems, including organizational structures that enable or disable AMR mitigation, as well as individual and interpersonal sociocultural practices.

Economics and policy

Economics and policy

Focus → INVESTMENT AND ACTION in AMR prevention and control

- policy, governance, legislative and regulatory instruments, cross-sector processes and strategies affecting AMR (e.g. regulation of antimicrobial manufacturing, use, disposal, monitoring), joint planning and policy goals among ministries
- **cost–effectiveness considerations** to **support development of the AMR investment**
- **financial sustainability** and **long-term financial** impact

Conclusions

- Most AMR drivers stem from a common origin—**inappropriate antimicrobial use across human, animal, and environmental sectors**, emphasizing the interconnectedness of One Health.

- There is **no 'one size fits all' solution**; success requires **synergizing strategies across human, veterinary, and environmental health** to protect antimicrobials effectively.

- Researching the mechanisms of AMR and its long-term persistence across ecosystems is vital for developing **innovative strategies, diagnostic tests and therapeutic agents.**

- Deeper insights into the **bacterial evolution, and AMR mechanisms** in humans, animals, and the environment are critical for sustainable solutions.

Thank YOU!