ASLM
AFRICAN SOCIETY FOR LABORATORY MEDICINE

ADVANCING THE LABORATORY PROFESSION AND NETWORKS IN AFRICA

ANTIMICROBIAL RESISTANCE (AMR) COMMUNITY OF PRACTICE (CoP)

Integrating One Health in EQA PT Programs: Key Considerations

Vashnee Govender

UKaid from the British people

The Fleming Fund

21 June 2024

EQuAFRICA
External Quality Assessment for AMR Testing

Outline

- One Health links in AMR
- Food safety and security concerns
- Antibiotic use in sectors
- Integrated AMR surveillance
- EQu AFRICA role in One Health Approach

What is “One Health”?

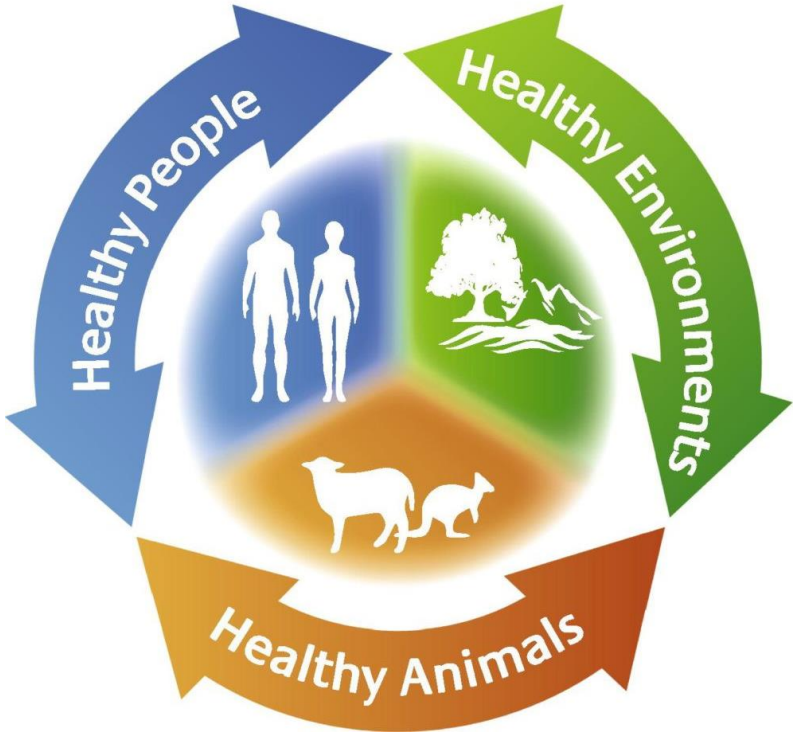
One Health High-Level Expert Panel (OHHLEP

- Scientific and strategic advisory group to the Quadripartite organisations
- Provide the Quadripartite with guidance on implementation of the One Health Joint Plan of Action

World Health Organization
World Organisation for Animal Health
Founded as OIE
UN environment programme
Food and Agriculture Organization of the United Nations

OHHLEP Definition of One Health

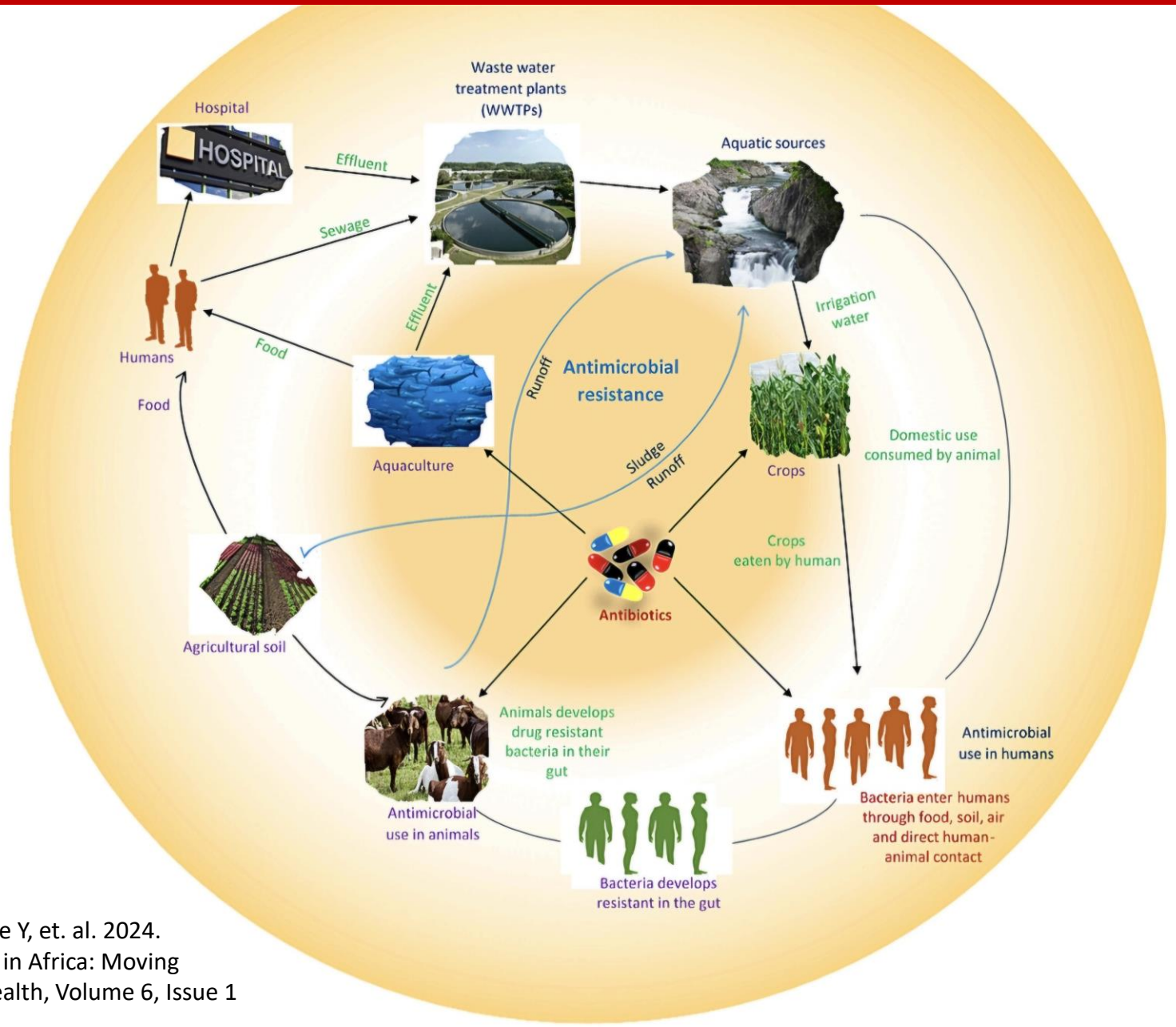
One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems.



One Health Initiative. 2018. https://onehealthinitiative.com/the-one-health-triad/

- *It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent.*
- *The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development.*

One Health AMR Links



Anyaegbunam ZAK, Mba IE, Doowuese Y, et. al. 2024. Antimicrobial resistance containment in Africa: Moving beyond surveillance, Biosafety and Health, Volume 6, Issue 1

One Health AMR Link

Antimicrobials are not only used to treat infections in humans

but also animals and plant crops

- Antibiotics improve food production efficiency by disease control resulting in increased animal growth rates and crop yields
- The use of antibiotics creates a selective pressure for antibiotic resistant microorganisms
- People can be exposed to these resistant microorganisms through
  - shared environments *(e.g. contaminated water sources)*
  - zoonotic transmission from contact with animals *(e.g. pets or farmed livestock)*
  - consumption of contaminated food products *(e.g. fruit, vegetables, meat, dairy, eggs, etc.)*

The extent of AMR as a One Health issue is demonstrated by the following examples:

Detection of zoonotic AMR pathogens in animals/animal products

- ESBL-producing *E. coli* in food producing animals
- MRSA in meat products

AMR in animals

J Antimicrob Chemother
doi:10.1093/jac/dkx397

Journal of Antimicrobial Chemotherapy

Molecular relatedness of ESBL/AmpC-producing *Escherichia coli* from humans, animals, food and the environment: a pooled analysis

Alejandro Dorado-García[1,2]*†, Joost H. Smid[1]†, Wilfrid van Pelt[3], Marc J. M. Bonten[3,4], Ad C. Fluit[4], Gerrita van den Bunt[3,5], Jaap A. Wagenaar[2], Joost Hordijk[2], Cindy M. Dierikx[3], Kees T. Veldman[6], Aline de Koeijer[3,6], Wietske Dohmen[1], Heike Schmitt[1], Apostolos Liakopoulos[6], Ewa Pacholewicz[1], Theo J. G. M. Lam[7], Annet G. Velthuis[6], Annet Heuvelink[7], Maaike A. Gonggrijp[7], Engeline van Duijkeren[3], Angela H. A. M. van Hoek[3], Ana Maria de Roda Husman[1,3], Hetty Blaak[3], Arie H. Havelaar[1,8], Dik J. Mevius[2,6] and Dick J. J. Heederik[1]

[1]Institute for Risk Assessment Sciences (IRAS), Utrecht University, PO Box 80175, 3508 TD Utrecht, The Netherlands; [2]Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, PO Box 80165, 3508 TD Utrecht, The Netherlands; [3]Centre for Infectious Disease Control, National Institute for Public Health and the Environment, PO Box 1, 3720 BA Bilthoven, The Netherlands; [4]Department of Medical Microbiology, University Medical Centre Utrecht, PO Box 85500, 3508 GA Utrecht, The Netherlands; [5]Julius Centre for Health Sciences and Primary Care, University Medical Centre Utrecht, PO Box 85500, 3508 GA Utrecht, The Netherlands; [6]Wageningen Bioveterinary Research, PO Box 65, 8200 AB Lelystad, The Netherlands; [7]GD Animal Health, PO Box 9, 7400 AA Deventer, The Netherlands; [8]Institute for Sustainable Food Systems, Emerging Pathogens Institute and Animal Sciences Department, University of Florida, PO Box 100009, Gainesville, FL 32610, USA

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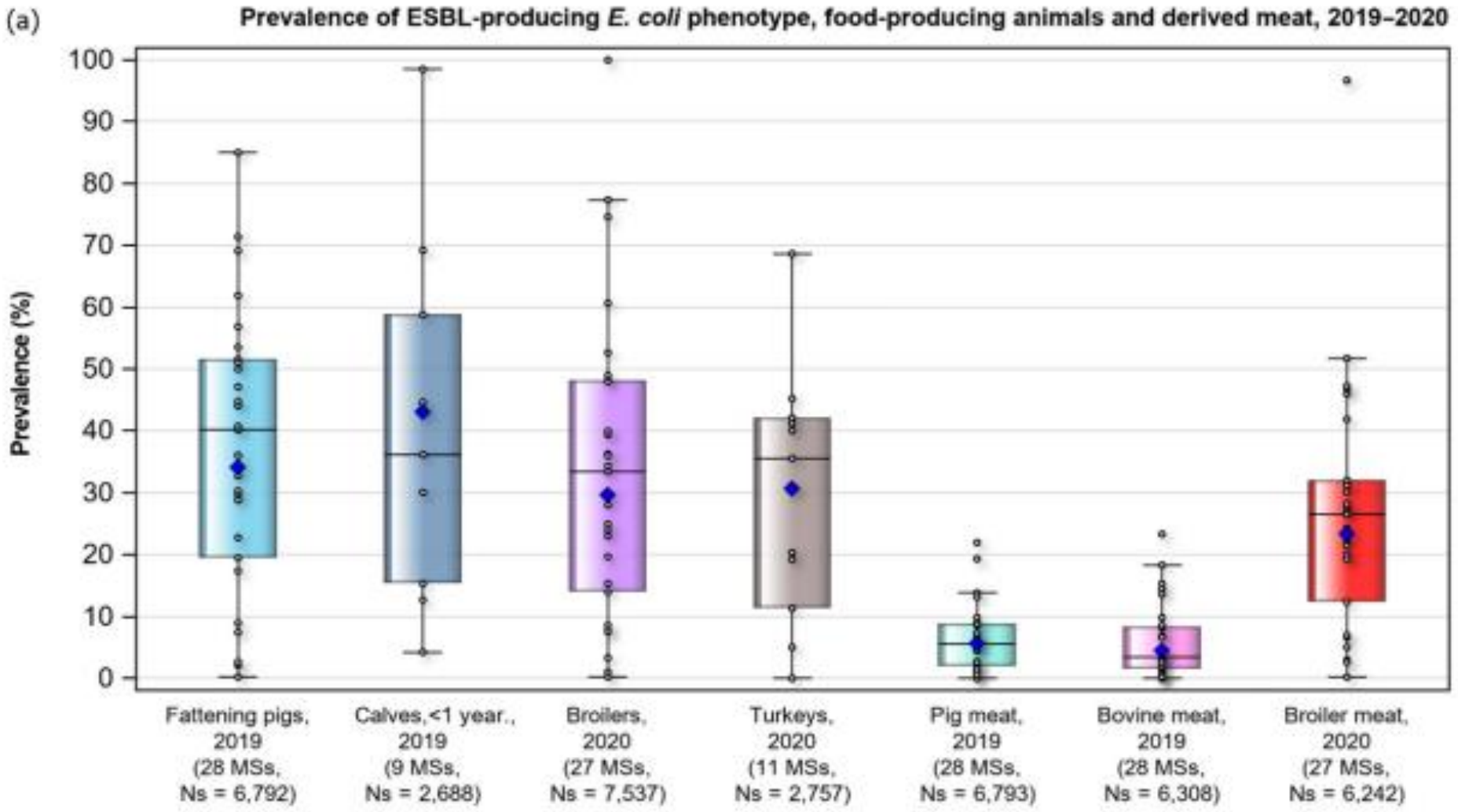
†Both authors have contributed equally to this work.

Received 27 July 2017; returned 29 August 2017; revised 25 September 2017; accepted 27 September 2017

Background: In recent years, ESBL/AmpC-producing *Escherichia coli* (ESBL/AmpC-EC) have been isolated with increasing frequency from animals, food, environmental sources and humans. With incomplete and scattered evidence, the contribution to the human carriage burden from these reservoirs remains unclear.

AMR in animals



The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2018/2019

AMR in animals

www.nature.com/scientificreports

scientific reports

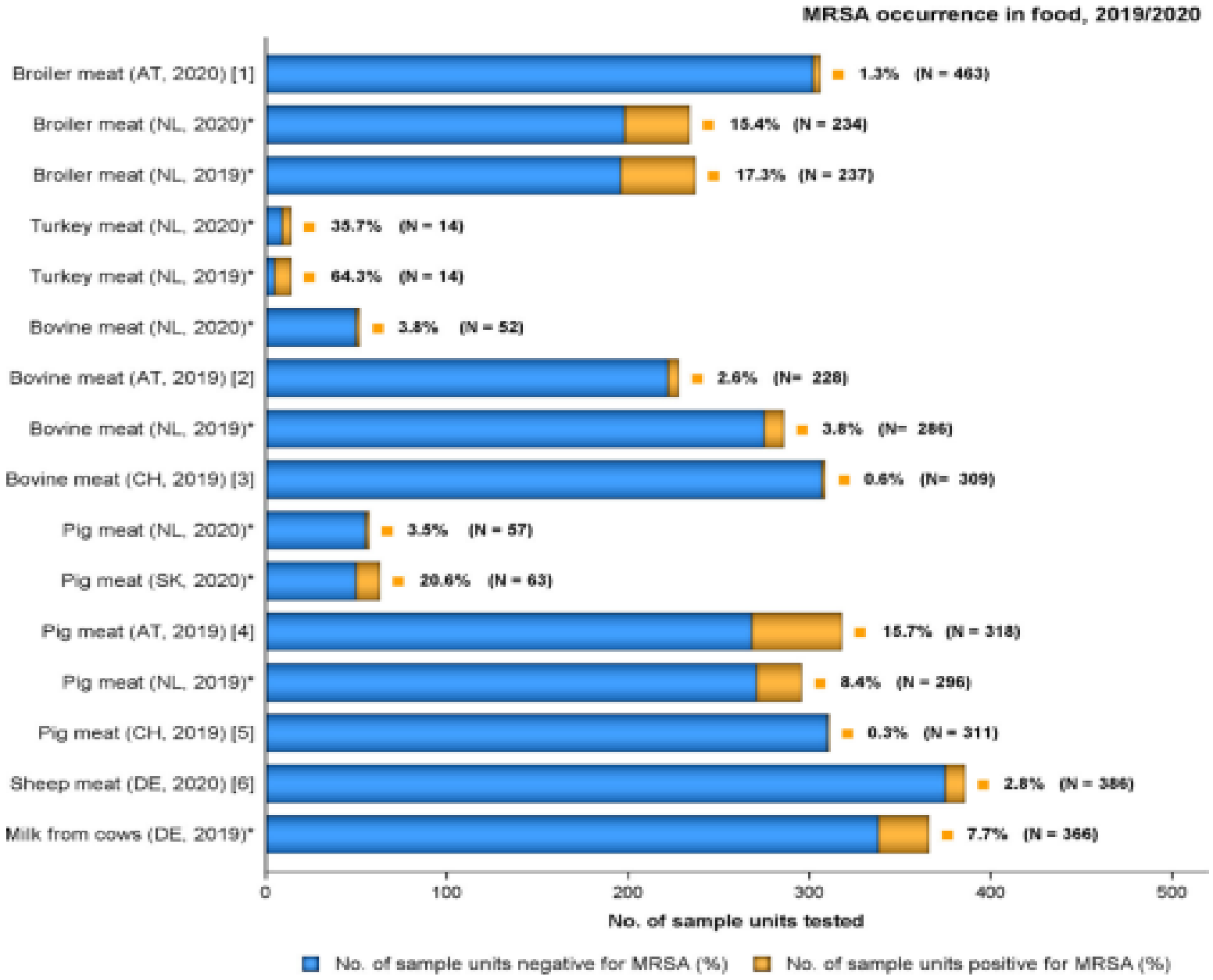
Check for updates

OPEN

Shared antibiotic resistance and virulence genes in *Staphylococcus aureus* from diverse animal hosts

Spencer A. Bruce[1✉], Joshua T. Smith[2,3], Jennifer L. Mydosh[2], John Ball[2], David B. Needle[2,4], Robert Gibson[4] & Cheryl P. Andam[1✉]

AMR in animals



The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2021–2022

AMR in plant products

- MDR *E. coli* in spinach
- Gram negative bacteria resistant to 3rd generation cephalosporins in fruit and vegetables
- Effects of herbicide use in crops on antibiotic susceptibility

AMR in plant crops

Microbiological safety of spinach throughout commercial supply chains in Gauteng Province, South Africa and characterization of isolated multidrug-resistant Escherichia coli

Get access >

Loandi Richter, Erika M. du Plessis, Stacey Duvenage, Lise Korsten

Journal of Applied Microbiology, Volume 132, Issue 3, 1 March 2022, Pages 2389–2409,
https://doi.org/10.1111/jam.15357

Published: 01 March 2022 **Article history** ▾

Cite Permissions Share ▾

Abstract

Aim

To investigate the microbiological quality, potential foodborne pathogen presence, and to phenotypically (antimicrobial resistance [AMR] profiles) and genotypically (DNA fingerprints and diarrhoeagenic genes) characterize *Escherichia coli* isolated throughout spinach production systems from farm-to-sale.

AMR in plant crops

frontiers in Microbiology

ORIGINAL RESEARCH
published: 24 August 2017
doi: 10.3389/fmicb.2017.01569

From Farms to Markets: Gram-Negative Bacteria Resistant to Third-Generation Cephalosporins in Fruits and Vegetables in a Region of North Africa

*Ferielle Mesbah Zekar [1,2], Sophie A. Granier [2], Muriel Marault [2], Lydia Yaici [1], Benoit Gassilloud [3], Charles Manceau [4], Abdelaziz Touati [1] and Yves Millemann [2,5]**

AMR in plant crops

AMERICAN SOCIETY FOR MICROBIOLOGY | mBio®

RESEARCH ARTICLE
March/April 2015 Volume 6 Issue 2 10.1128/mbio.00009-15
https://doi.org/10.1128/mbio.00009-15

Sublethal Exposure to Commercial Formulations of the Herbicides Dicamba, 2,4-Dichlorophenoxyacetic Acid, and Glyphosate Cause Changes in Antibiotic Susceptibility in *Escherichia coli* and *Salmonella enterica* serovar Typhimurium

Brigitta Kurenbach[a], Delphine Marjoshi[a], Carlos F. Amábile-Cuevas[b], Gayle C. Ferguson[c], William Godsoe[d], Paddy Gibson[a], Jack A. Heinemann[a]

[a]School of Biological Sciences, University of Canterbury, Christchurch, New Zealand
[b]Fundación Lusara, Mexico City, Mexico
[c]Institute of Natural and Mathematical Sciences, Massey University, Palmerston North, New Zealand
[d]Bio-Protection Centre, Lincoln University, Lincoln, New Zealand

Detection of AMR genes in environments

- Detection of antibiotic resistomes and residues in water
- Soil as a reservoir of AMR genes and conduit in AMR transmission

AMR in the environment

ELSEVIER

Environmental Pollution

Volume 312, 1 November 2022, 119783

Review

Antibiotic resistomes and their chemical residues in aquatic environments in Africa ☆

Aemere Ogunlaja [a b], Olumuyiwa O. Ogunlaja [a d], Olumide D. Olukanni [a e], Gloria O. Taylor [a b], Chidinma G. Olorunnisola [a c], Victorien T. Dougnon [f], Wassiyath Mousse [f], Despo Fatta-Kassinos [g], Titus A.M. Msagati [h], Emmanuel I. Unuabonah [a c]

AMR in environment

SCIENCE ADVANCES | RESEARCH ARTICLE

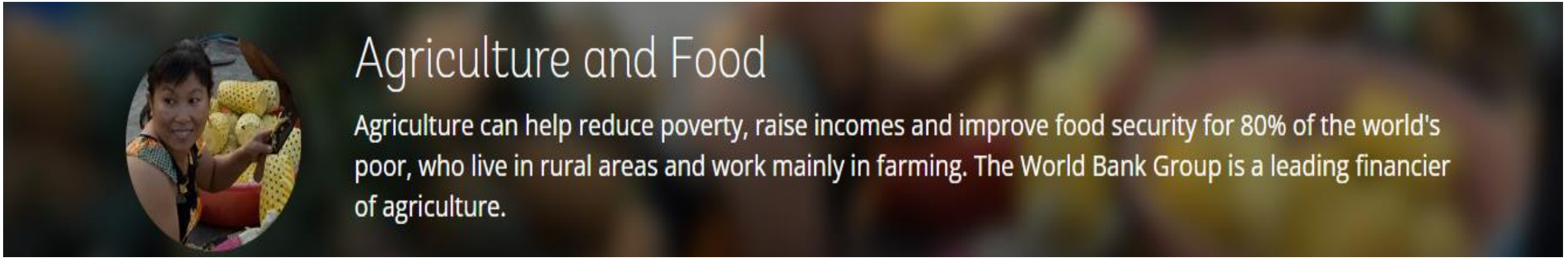
MICROBIOLOGY

Global biogeography and projection of soil antibiotic resistance genes

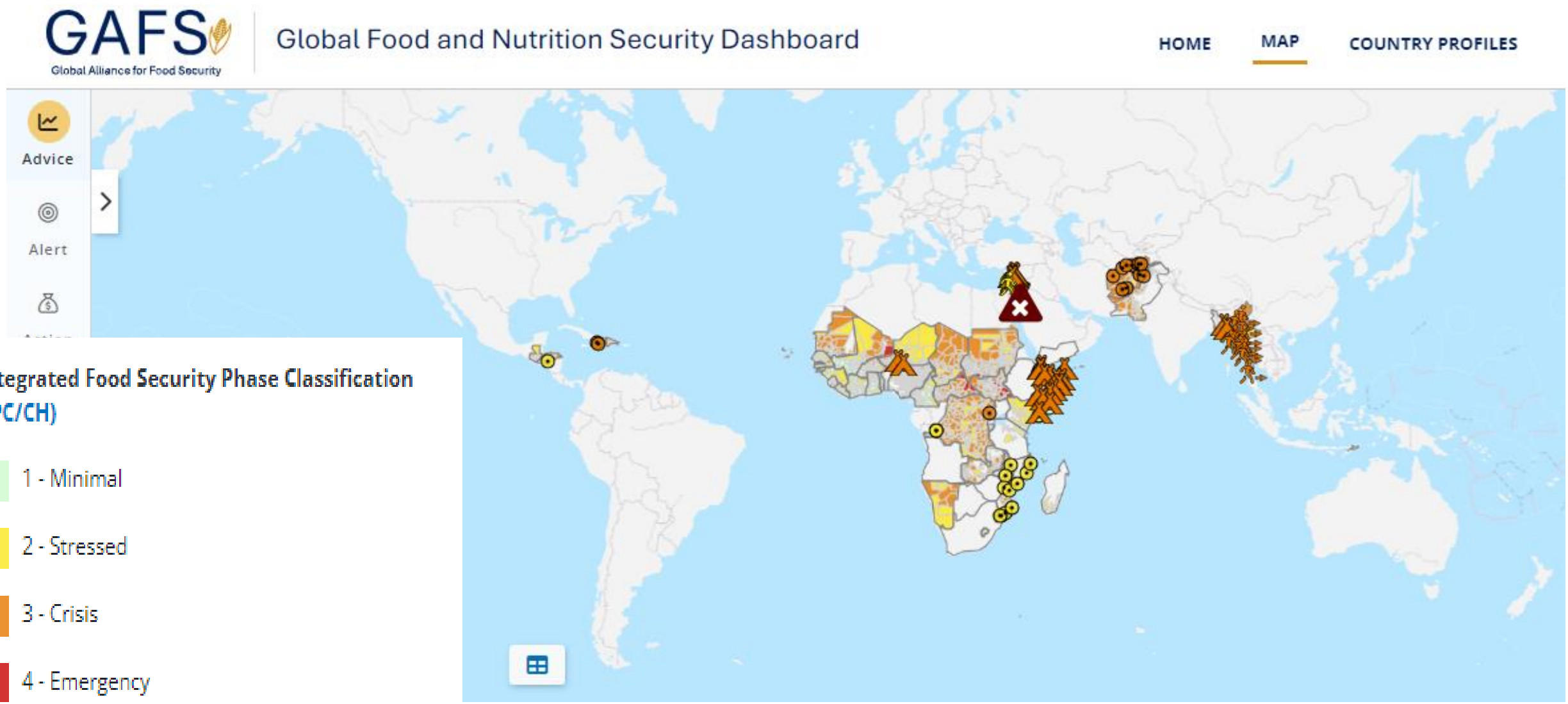
Dongsheng Zheng[1,2,3†], Guoyu Yin[1,2†*], Min Liu[1,2*], Lijun Hou[4*], Yi Yang[1,2], Thomas P. Van Boeckel[5,6], Yanling Zheng[1,2], Ye Li[1,2]

Food safety and security in LMIC

WORLD BANK GROUP



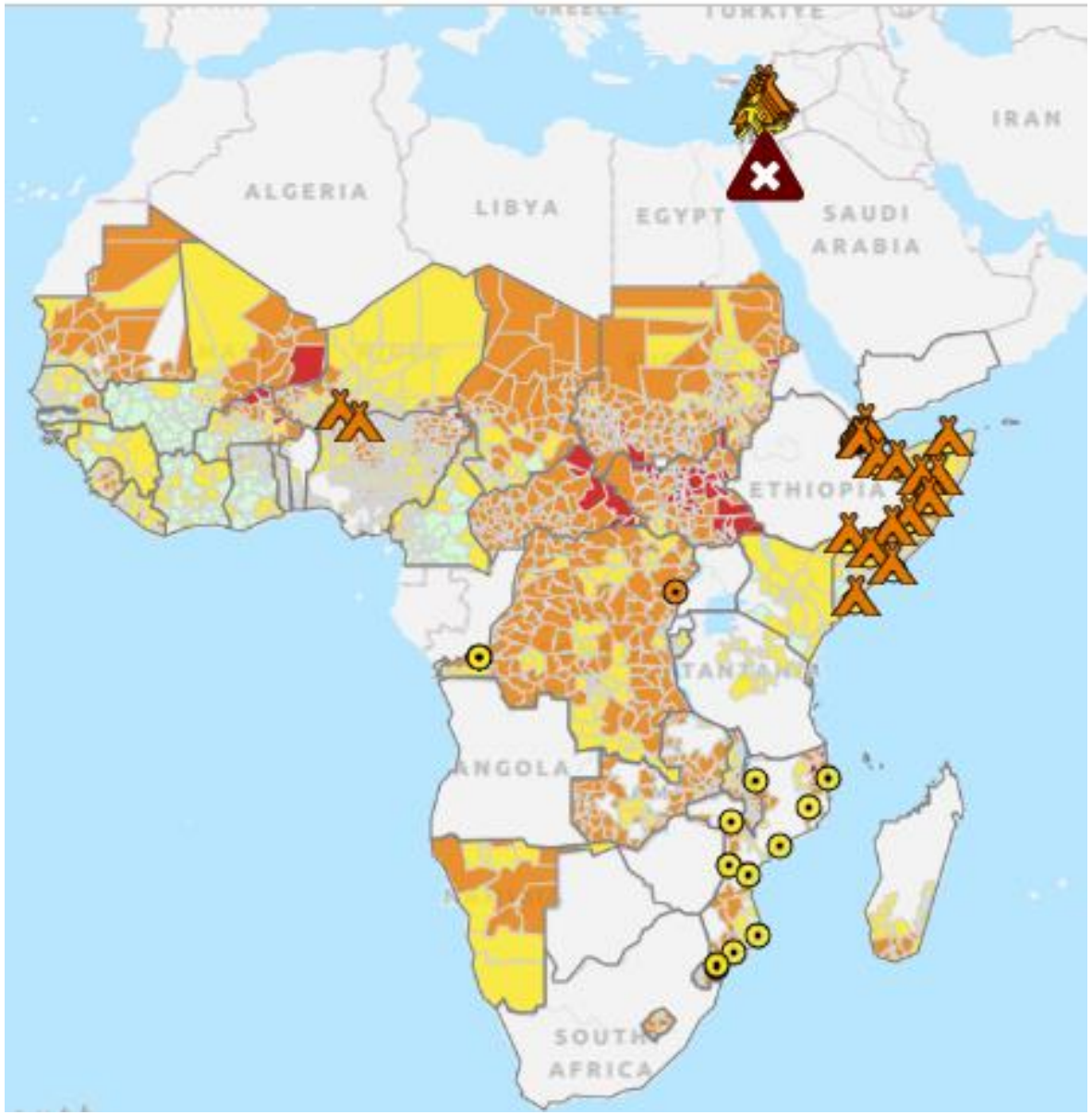
Food safety and security in LMIC



Food safety and security in LMIC

Integrated Food Security Phase Classification (IPC/CH)

- 1 - Minimal
- 2 - Stressed
- 3 - Crisis
- 4 - Emergency



Food safety and security in LMIC

- Food insecurity remains a public health problem
- In LMIC, food safety standards with resources for implementation and enforcement are less rigorous
- Many households in lower-income countries buy their food from informal markets and sellers, who may lack training and infrastructure to keep food safe
- In homes, a lack of access to potable water can compromise hygiene practices during food preparation
- In Africa, the per-capita burden of foodborne disease is about 27 times that of Europe or North America

➢ **Trade off between food safety and food security?**

(Global Alliance for Improved Nutrition. 2020.)

Antibiotic use in agriculture

Antibiotic use in plants

Hand-pulled units for herbicide application. Sims, Brian, and Josef Kienzle. 2015. "Mechanization of Conservation Agriculture for Smallholders: Issues and Options for Sustainable Intensification" *Environments* 2, no. 2: 139-166. https://doi.org/10.3390/environments2020139

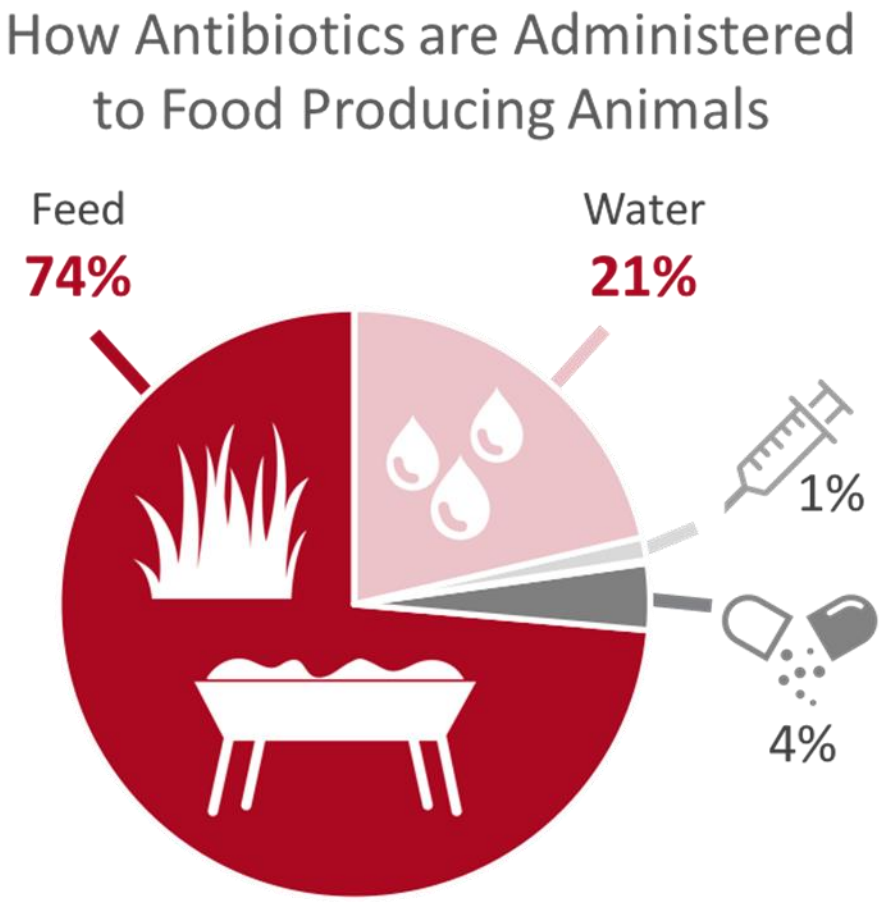
Streptomycin sprayed on citrus crops, USA.2023. https://beyondpesticides.org/dailynewsblog/2023/12/court-finds-epa-allowance-of-antibiotic-streptomycin-use-on-citrus-illegal/

How To Use Chicken Manure as Garden Fertilizer (2021). Backyard Chickens Project Manager. https://www.backyardchickens.com/articles/how-to-use-chicken-manure-as-garden-fertilizer.76952/

Antibiotic use in animals

Prophylaxis	Risk of acquiring a specific infection or in a specific situation where infectious disease is likely to occur if the drug is not administered
Therapy	Showing clinical signs of an infectious disease
Metaphylaxis	Administration of an antimicrobial agent to a group of animals containing sick animals and healthy animals (presumed to be infected), to minimise or resolve clinical signs and to prevent further spread of the disease
Growth Promotion	Administration of antimicrobial agents to animals only to increase the rate of weight gain or the efficiency of feed utilisation

Antibiotic use in animals



Breakdown of how antibiotics are administered to livestock in the United States. Data from 2015 and found in the FDA's report on antibiotics sold for use in food producing animals. https://feedthemwisely.com/antibiotics-in-livestock

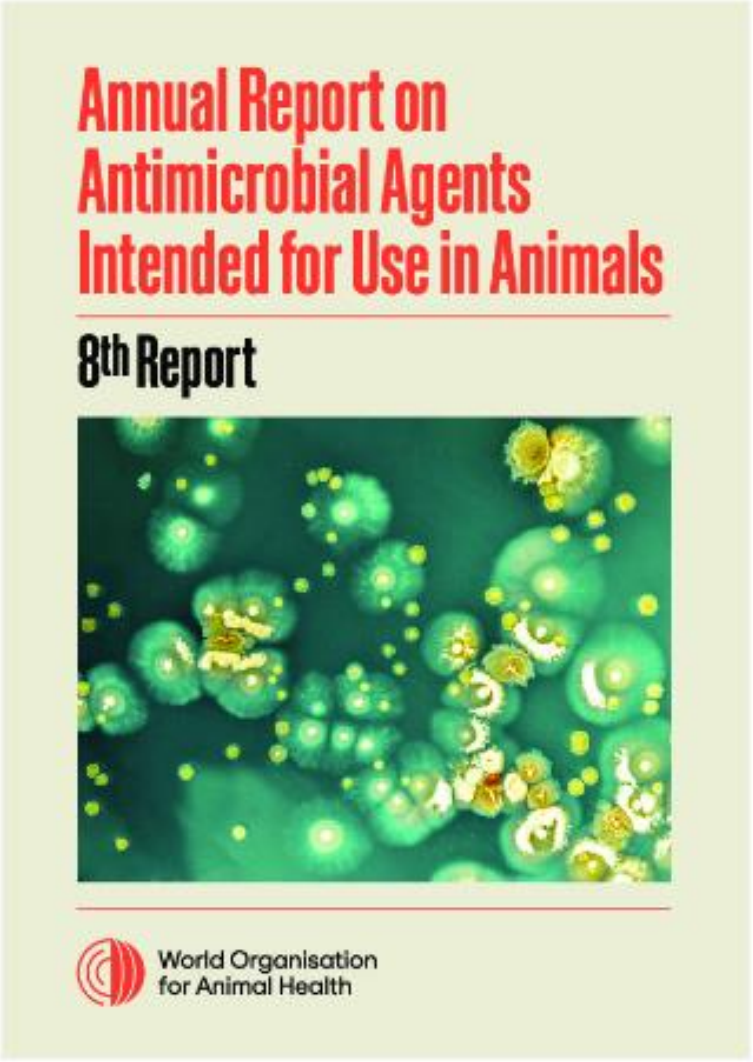
Emerging broiler farm in Gauteng, South Africa. 2021. V Govender.

Antibiotic use in animals

Less than 20% of antimicrobials used in animals in 2019 were of highest priority and critical importance for human health[2] .Collective efforts towards responsible use across all sectors are of utmost importance considering that these medicines are the sole therapy or one of few alternatives to treat life-threatening human diseases. It is important to highlight that, in the same year, an estimated 4 million human deaths were linked to antimicrobial resistance[3].

Dr Javier Yugueros-Marcos, Head of the Antimicrobial Resistance and Veterinary Products Department, WOAH.

Antibiotic use in animals



WOAH region	Number of countries that submitted reports	Number of WOAH Members*	Proportion of response
Africa	44	54	81%
Americas	23	31	74%
Asia and the Pacific	28	32	88%
Europe	46	53	87%
Middle East	11	12	92%
Total	**152**	**182**	**84%**

Countries able to provide antimicrobial quantities

- By antimicrobial class only
- By antimicrobial class and animal groups
- By antimicrobial class, animal groups and route of administration

WOAH. May 2024. OIE Annual Report on the Use of Antimicrobial Agents in Animals (Eighth Report).

Antibiotic use in animals

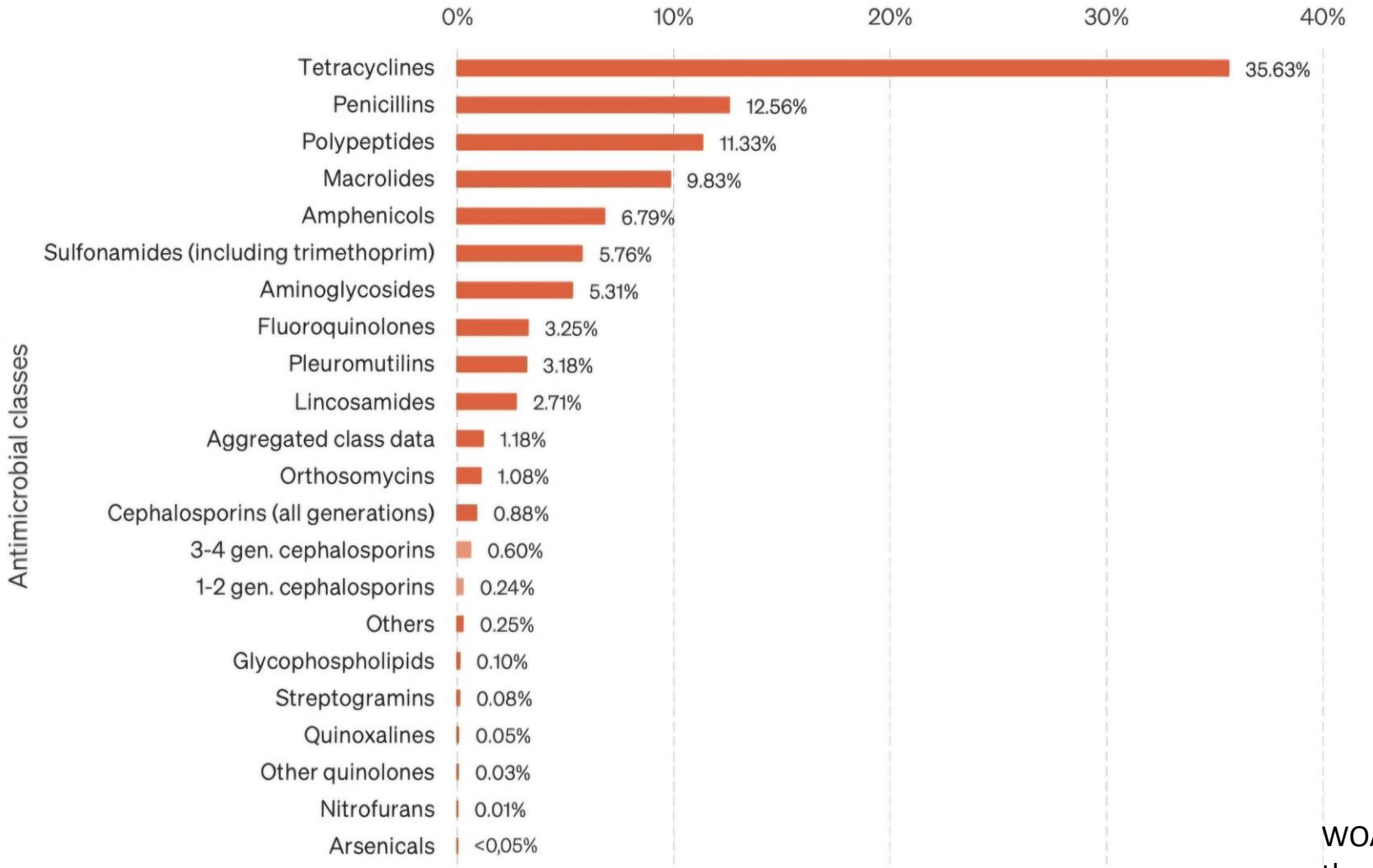
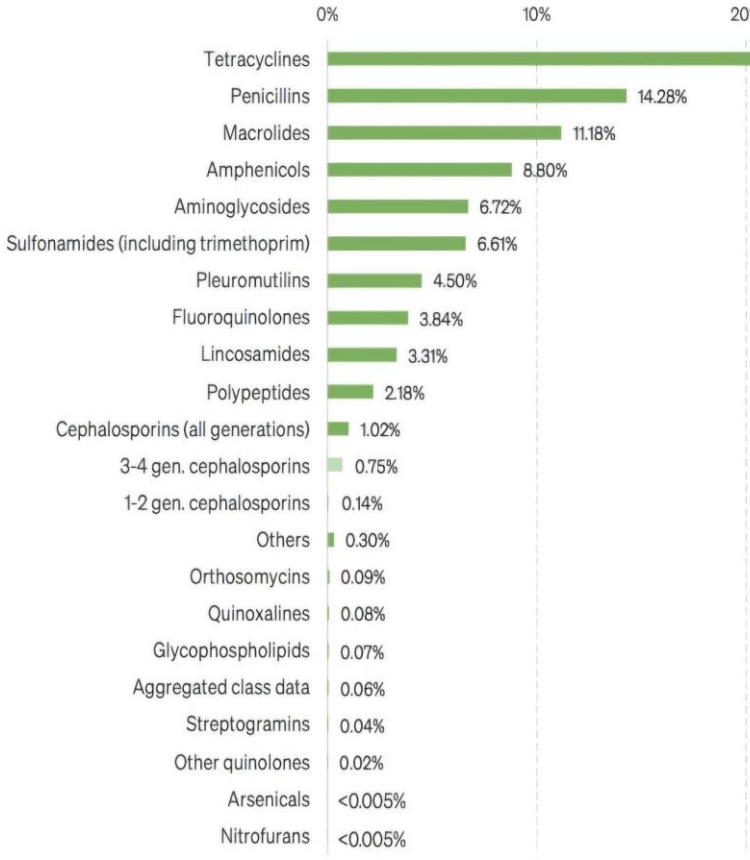


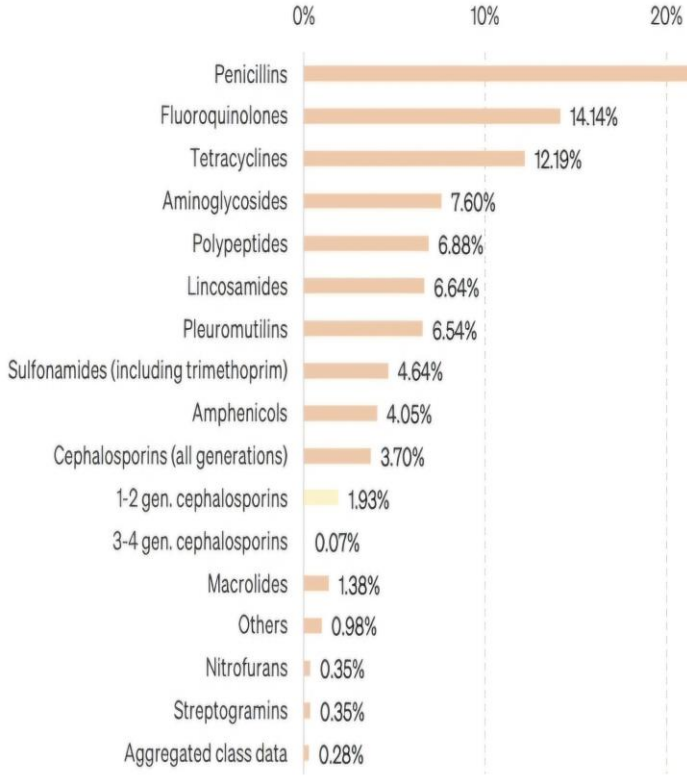
Figure 11. Proportion of antimicrobial classes reported for use in animals by 94 Members in 2021[10]

WOAH. 2024. WOAH Annual Report on the Use of Antimicrobial Agents in Animals (Eighth Report).

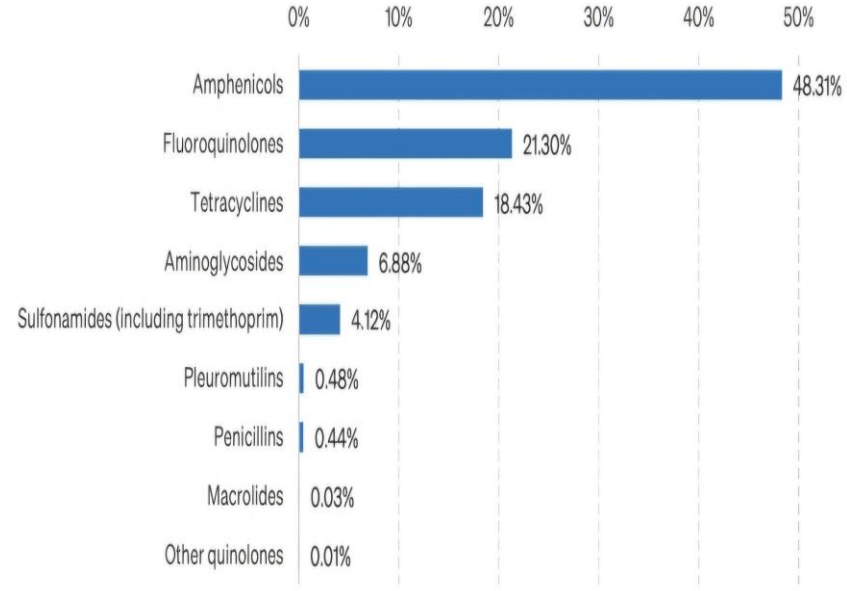
Antibiotic use in animals



Terrestrial food-producing animals



Companion animals (pets)



Aquaculture

Figures 15, 17 & 19. Proportion of antimicrobial classes as reported by 51 members in 2021

Antibiotic use in animals

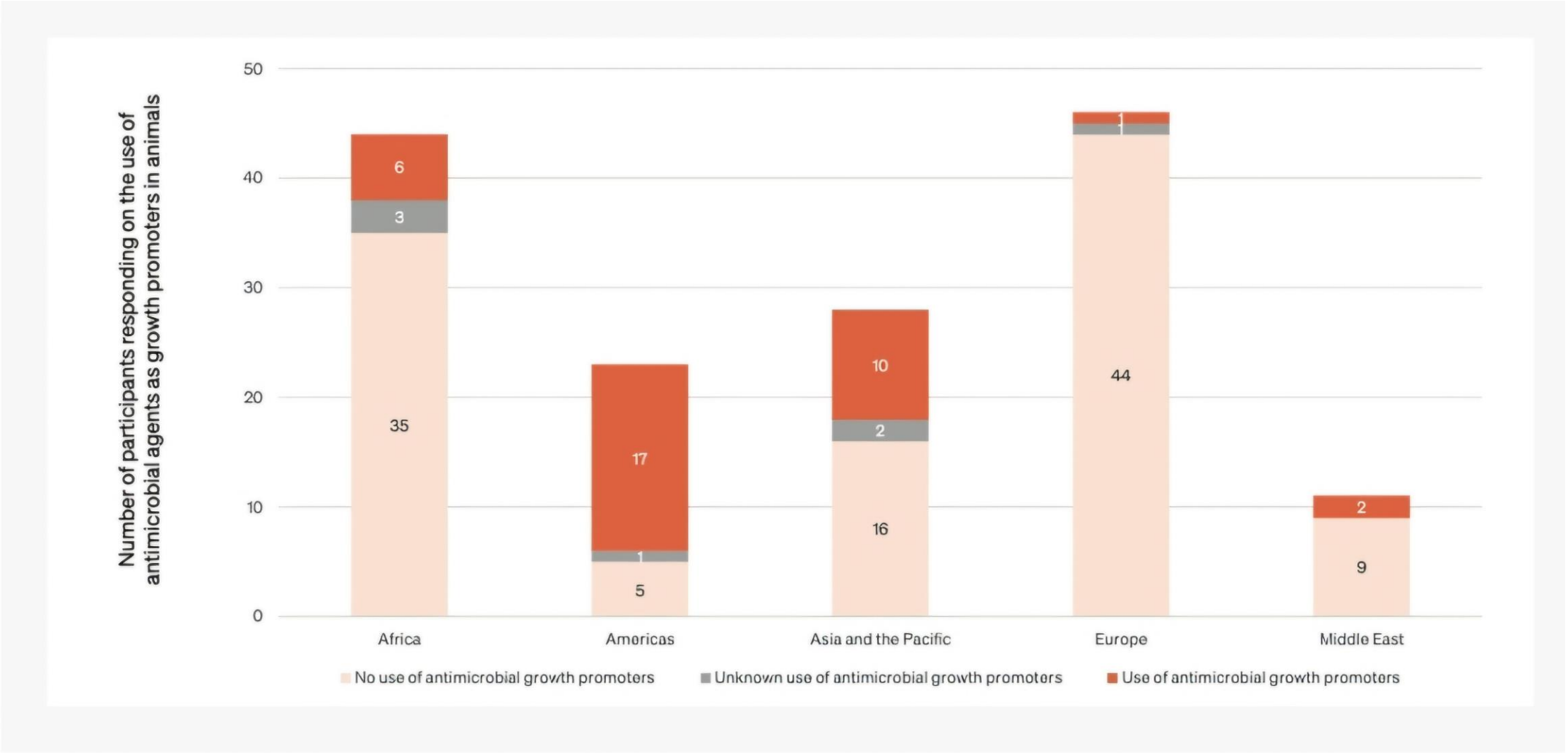


Figure 6. Number of participants using antimicrobial agents for growth promotion in animals in 2022, of 152 responding participants, by WOAH region

Antibiotic use in animals

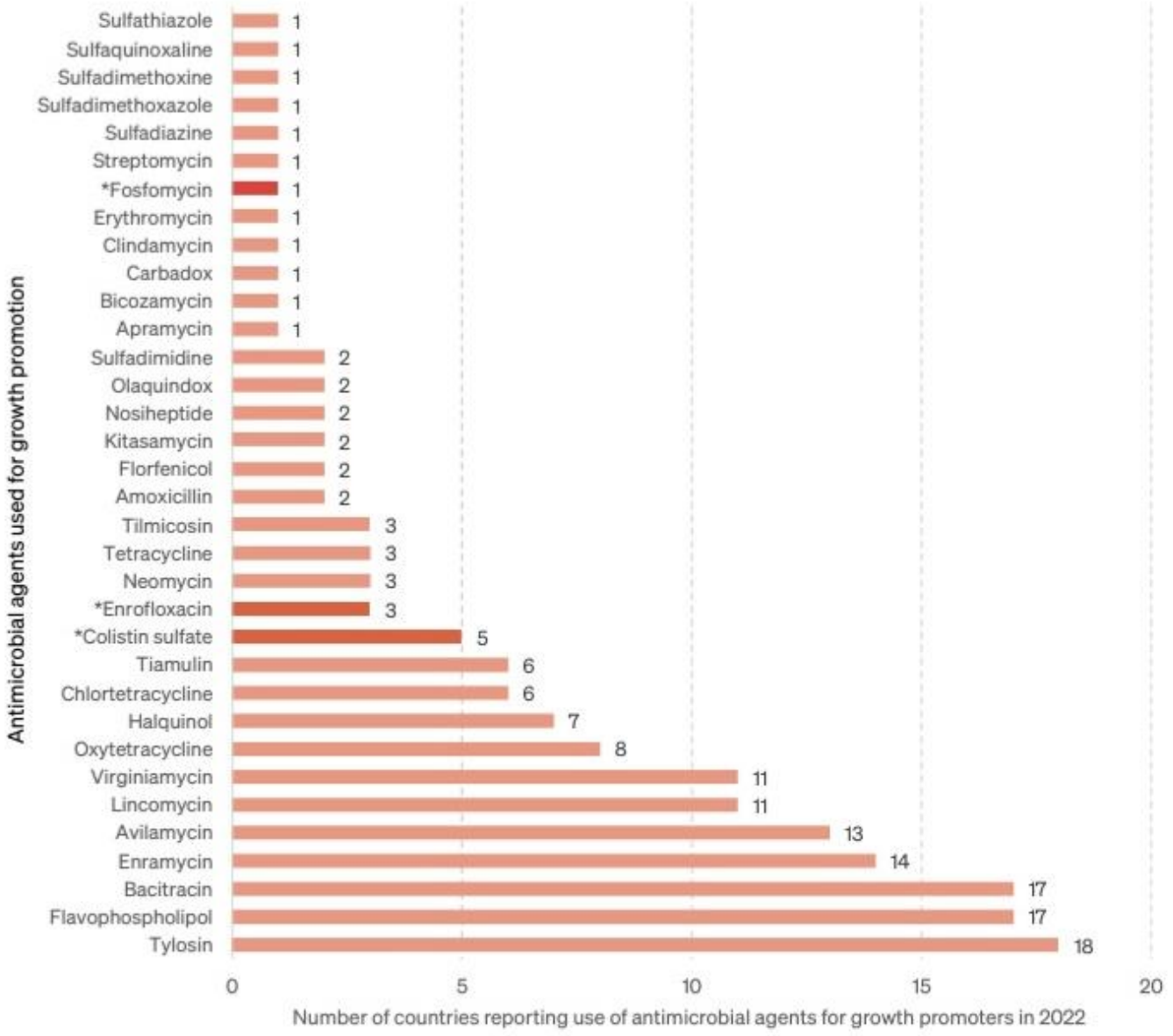


Figure 9. Antimicrobial agents used for growth promotion in animals in 35 Members in 2022

*WHO Medically Important Antimicrobial List

Fosfomycin
Colistin sulfate
Enrofloxacin

8/35 countries (23%) reporting use

Global trends in animal antibiotic use

- 65% of the animal biomass for terrestrial and aquatic food producing animals
- An overall increase of 2% mg/kg from 2019 to 2021
- Decreases in Americas (-9%), Asia and Pacific (-0.7%), Europe (-6%),
- Increase in Africa 179% (10% of animal biomass and 2% of antimicrobial quantities)
- 24% of members reported using antimicrobials as growth promoters
  - Half the members did not have a regulatory framework
  - 76% did not conduct preliminary risk analysis

Received: 29 January 2020 | Revised: 9 March 2020 | Accepted: 9 March 2020

DOI: 10.1002/mbo3.1035

REVIEW

MicrobiologyOpen WILEY

The incidence of antibiotic resistance within and beyond the agricultural ecosystem: A concern for public health

Chidozie D. Iwu[1,2] | Lise Korsten[3] | Anthony I. Okoh[1,2]

World Health Organization | Health Topics | Countries | Newsroom | Emergencies

Quadripartite launches a new platform to tackle antimicrobial resistance threat to human and animal health and ecosystems

18 November 2022 | News release | Rome/Nairobi/Geneva/Paris |Reading time: 3 min (707 words)

The Antimicrobial Resistance Multi-Stakeholder Partnership Platform was launched today to ensure the growing threats and impacts of antimicrobial resistance are addressed globally.

AMR Surveillance

- Generally well-coordinated in human medical sector with participation in well-funded international programmes (WHO-GLASS)
- Globally, lacking in veterinary and environmental sectors with limited coordinated veterinary surveillance programmes in developing countries
- Not always integrated with food safety surveillance systems

AMR Surveillance

Approved: 19 January 2024

DOI: 10.2903/j.efsa.2024.8583

SCIENTIFIC REPORT

efsa JOURNAL

The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2021–2022

European Food Safety Authority (EFSA) | European Centre for Disease Prevention and Control (ECDC)

- Harmonised Antimicrobial Resistance (AMR) monitoring in *Salmonella* spp., *Campylobacter jejuni* and *C. coli* from humans and food-producing animals.
- Broilers, layers, turkeys, pigs and cattle and relevant meat thereof
- The temporal trend analyses in susceptibility and prevalence of ESBL-/AmpC-producers in E. coli) showed an encouraging progress in reducing AMR in food-producing animals in several EUMSs over the last 7 years.

Integrated AMR Surveillance

1. **Antibiotics Consumed**
   - Humans
   - Animal production and aquaculture
   - Plant production

2. **Antibiotic Resistance (AST)**
   - Humans
   - Animals
   - Agricultural food products
   - Environments (soil and water sources)

3. **Antibiotic Residues**
   - Plant and animal food products
   - Environments (soil and water sources)

Emerging threats | Cross-posts | Antimicrobial resistance

What Africa is doing to fight the silent epidemic of antibiotic resistance

Africa bears the heaviest burden of antimicrobial resistance, a phenomenon fuelled largely by poverty, But there are encouraging signs that the continent is taking action to fight it.

22 November 2023 • 5 min read **by** The Conversation

What does the future hold?

The antimicrobial resistance challenges in African countries are huge. But momentum to counter it is building.

Crucial steps include:

- greater investment
- expansion of infection, prevention and control programmes, including good clinical prescription practices
- improving access to essential antibiotics and diagnostic tools
- the development of new antibiotics that can treat infections that are multi-drug resistant.

However, these “crucial steps” will only be effective through the following mechanisms:

- Improving cross-sectoral AMR diagnostic capacity and proficiency in Africa with quality standards (medical, veterinary, food safety and environmental laboratories)
- Capitalise on AMR resources between medical, veterinary and environmental health sectors
- Identification or development of sentinel AMR surveillance sites

Role of EQu AFRICA

Role of EQu AFRICA

- Establishment of regional capacity and coordination to provide bacteriology External Quality Assessment (EQA) Proficiency Testing (PT) panels in 14 Fleming Fund priority countries
- EQA PT Service Providers for East, West and Southern Africa
- Aims to reinforce knowledge, skills, practice and regulation around quality management systems in general and EQA in particular.
- Facilitate the implementation of quality standards for bacteriology testing and achievement of ISO accreditation in reference AMR laboratories under One Health
- Five cycles since 2021 for medical, animal health, and food and environmental laboratories

EQuAFRICA
External Quality Assessment for AMR Testing

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

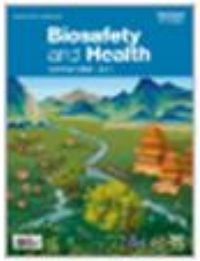
INSTITUT PASTEUR de Dakar

amref health africa

ELSEVIER

Biosafety and Health

Volume 6, Issue 1, February 2024, Pages 50-58



Review Article

Antimicrobial resistance containment in Africa: Moving beyond surveillance

Zikora Kizito Glory Anyaegbunam [a], Ifeanyi Elibe Mba [a b], Yandev Doowuese [c], Ngozi J. Anyaegbunam [d], Toluwalase Mba [e f], Fetuata Aminat Aina [g], Vincent Nnamdigadi Chigor [a], Emeka Innocent Nweze [a], Emmanuel A. Eze [a]

Key considerations

- AMR is the quintessential One Health issue demanding multisectoral collaboration
- Integrated AMR surveillance must involve resistant microorganisms and antimicrobial residues across sectors
- Laboratory capacity and proficiency (phenotypic and molecular) must be developed to support surveillance
- Valid and reliable surveillance data for risk assessments and risk management interventions to combat AMR

Ongoing role of EQA and PT in laboratory evaluation of efficacy of AMR interventions


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

ASLM

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ADVANCING THE LABORATORY PROFESSION AND NETWORKS IN AFRICA

ANTIMICROBIAL RESISTANCE (AMR) COMMUNITY OF PRACTICE (CoP)

AMR CoP

THANK YOU

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

Division of the National Health Laboratory Service

EQuAFRICA

External Quality Assessment for AMR Testing

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA