

# **Public Health Consequences of Use of Antibiotics in Agriculture**

*How is WHO addressing the issue Globally*

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**World Health  
Organization**

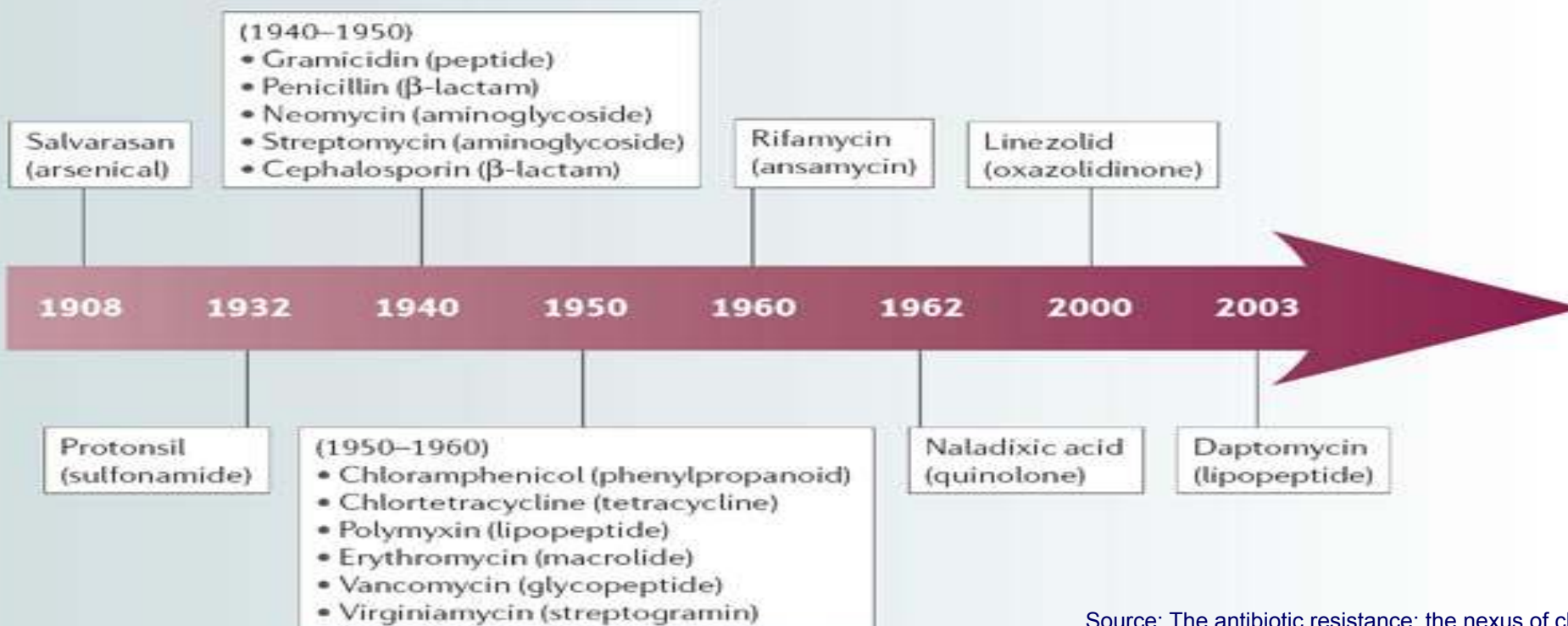
# Foodborne Antimicrobial resistance: a public Health concern

- Antimicrobials are essential drugs for treatment of infectious diseases in Human and Animals
- Discovery of antibiotics has been one of the most important achievements of the 20<sup>th</sup> century
- Resistance has developed soon after and new drugs has been developed to replace older ones as resistance emerged...
- BUT today, Resistance is emerging and spreading faster than new drugs are being developed;



# Discovery of antibiotics: a faltering pipeline

## Timeline | Antibiotic drug discovery



The class of the antibiotic is shown in brackets.

Source: The antibiotic resistance: the nexus of chemical and genetic diversity. Gerard D. Wright. *Nature Reviews Microbiology* 5, 175-186 (March 2007)

# How does antibiotic resistance develop?

- Some bacteria are naturally resistant; new resistances also arise spontaneously by chance mutations and these resistant strains then multiply.
- Some resistances can be passed from one bacterium to another, spreading resistance between species. Loops of DNA (called plasmids) carry the resistance genes from one bacterium to another.
- When an antibiotic is given, it kills the sensitive bacteria, but any resistant ones can survive and multiply.
- The more antibiotics are used (in animals and agriculture as well as in man) the greater will be the "selective pressure", favoring resistant strains. This is an example of Darwin's Theory of evolution, operating the "survival of the fittest".
- Antibiotics don't 'cause' resistance; rather, they create an environment which favors the growth of resistant variants which already exist in nature or arise by chance.



# AMR and Animal Husbandry

- Widespread use of antimicrobials in livestock production ....not only from therapeutic purposes
- Same classes of antimicrobials are used both in humans and food-producing animals...
- Food is generally considered to be the most important vector for spread of resistance between humans and animals
- Globalization of food trade, need for international action



# More than 50% of all antimicrobials are used non-therapeutically in animal husbandry

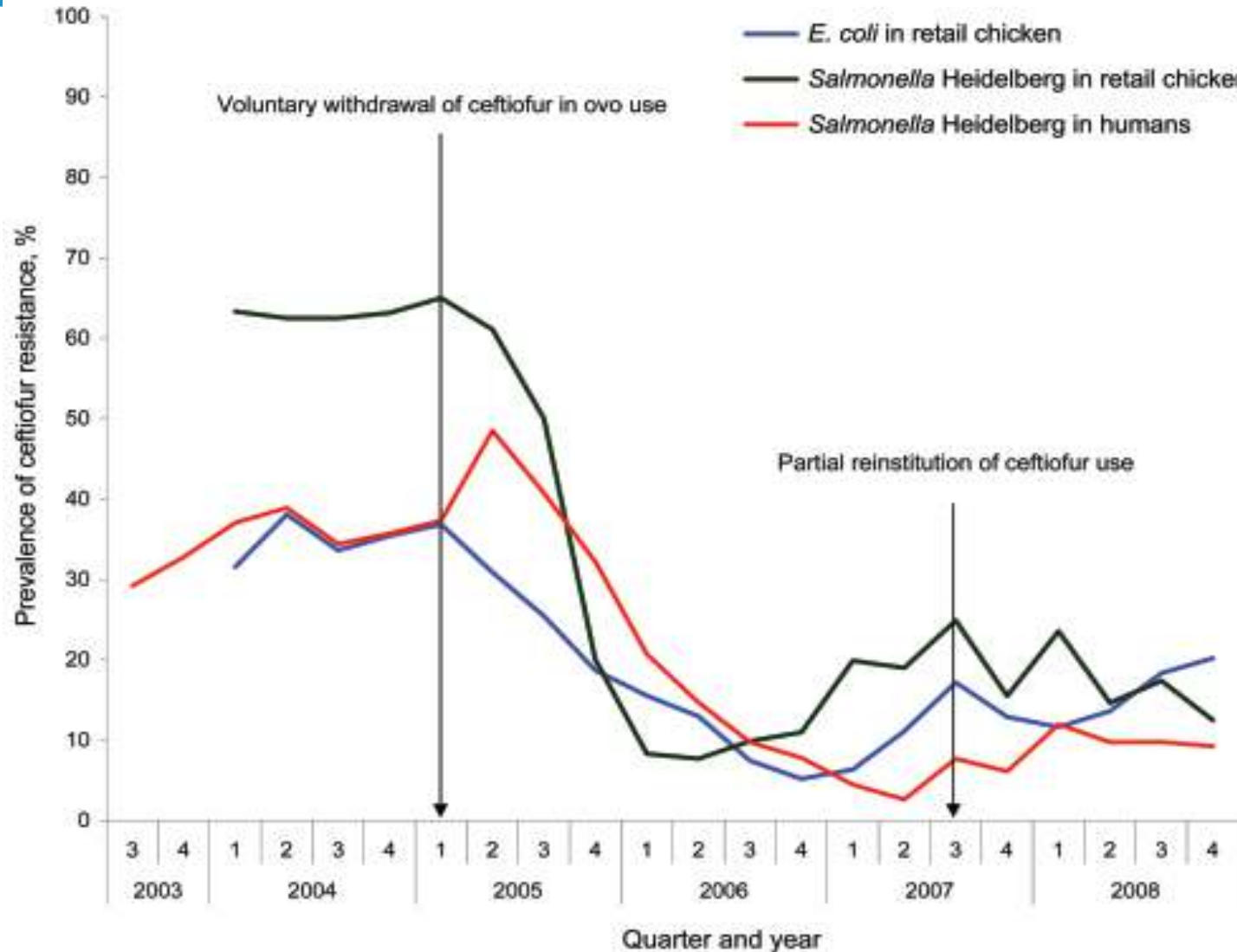
Use of antimicrobials in food animals can lead to **Antimicrobial Resistance (AMR)** in human pathogen.

- In industrial production, antibiotics are added to drinking water to decrease diseases of crowding and as growth promoters
  - When microbes are exposed to antibiotics, the bacteria resistant to these drugs survive and multiply which results in **Antimicrobial Resistance**



*Antibiotics... "the more you use them, the faster you lose them"*

# Ceftiofur in ovo use and prevalence of ceftiofur resistance among retail chicken *Escherichia coli*, and retail chicken and human clinical *Salmonella enterica* serovar Heidelberg isolates during 2003–2008 in Québec, Canada



# Summary on the importance of the animal reservoir

- Larger selective pressure
- Most important reservoir for antimicrobial resistant *Salmonella* and *Campylobacter*.
- An increasingly important reservoir for MRSA
- Important, but not quantified reservoir for *E. coli*
- Transferable genes





# AMR and the Food Chain = AMU in the Food Chain

- In Terrestrial animals
- In Aquaculture
- In Horticulture
  - Plant production

*Others : Environment, Waste management....One Health!*



# Resistance is consequence of selective pressure created by use

- Any kind of antimicrobial use, can select for emergence of resistance and further promote the dissemination of resistant bacteria and resistance genes
- AMR does not respect phylogenetical, geographical or ecological borders
  - Antimicrobial use in one ecological compartment can have consequences for the resistance situation in another ecological compartment, need for an integrated inter-sectoral approach

# One Health

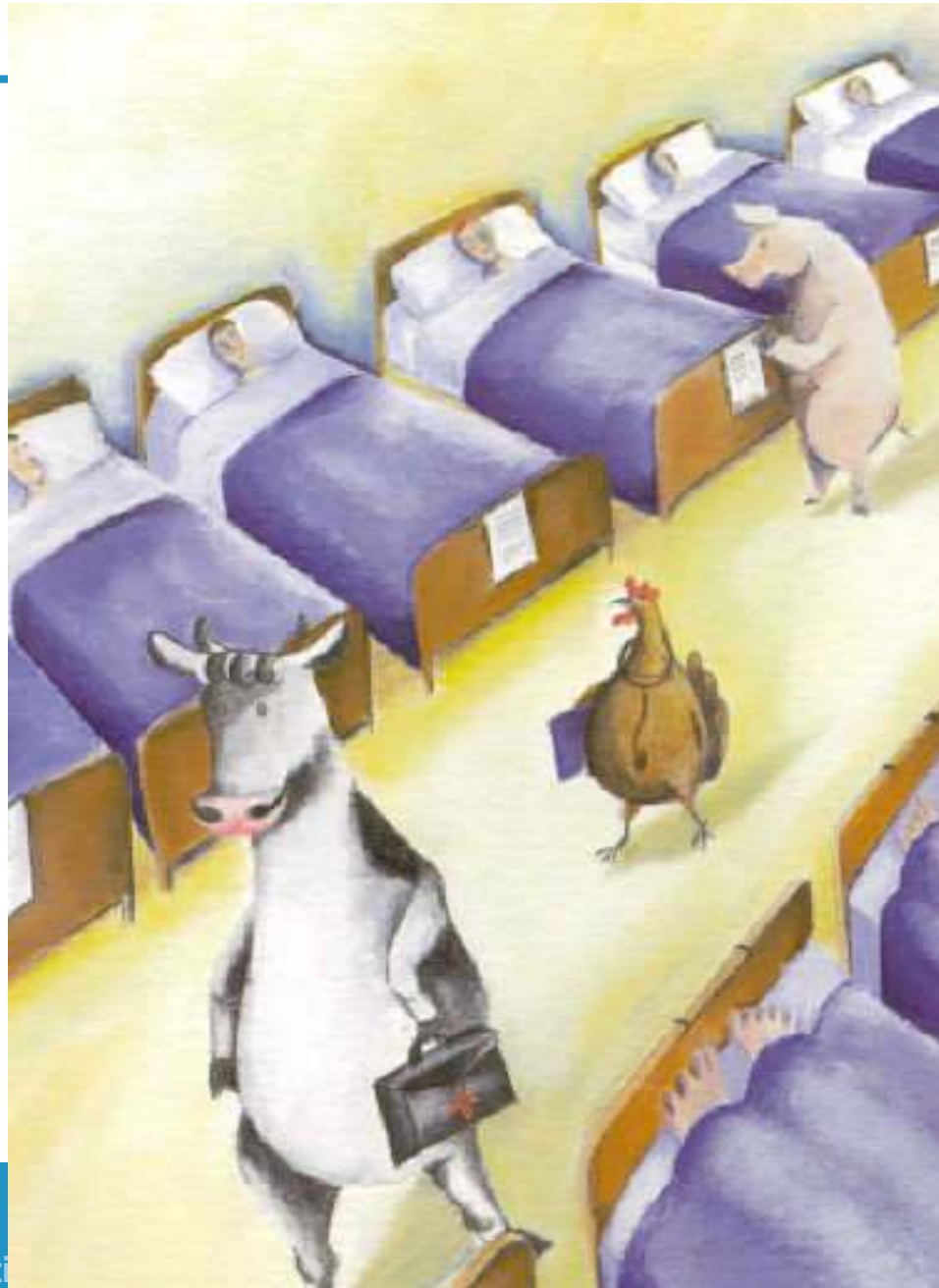
it all goes around, and around, and around



# Antibiotic Resistance in people



# Are Food-Producing Animals involved?



# Addressing the public health impact of use of antimicrobials in food-producing animals- WHO Achievements 1990-2011

- International collaboration established
  - Codex, FAO, OIE, WHO
- 18+ expert meetings and consultations
- Codex Ad Hoc Intergovernmental task Force on Antimicrobial resistance (2007-2010)
- WHO list of Critically Important Antimicrobials for Human Health developed
- Establishment of an Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR)
- WHD 2011 : Joint WHO and OIE Call for reduction of use of AMU in Animal Husbandry

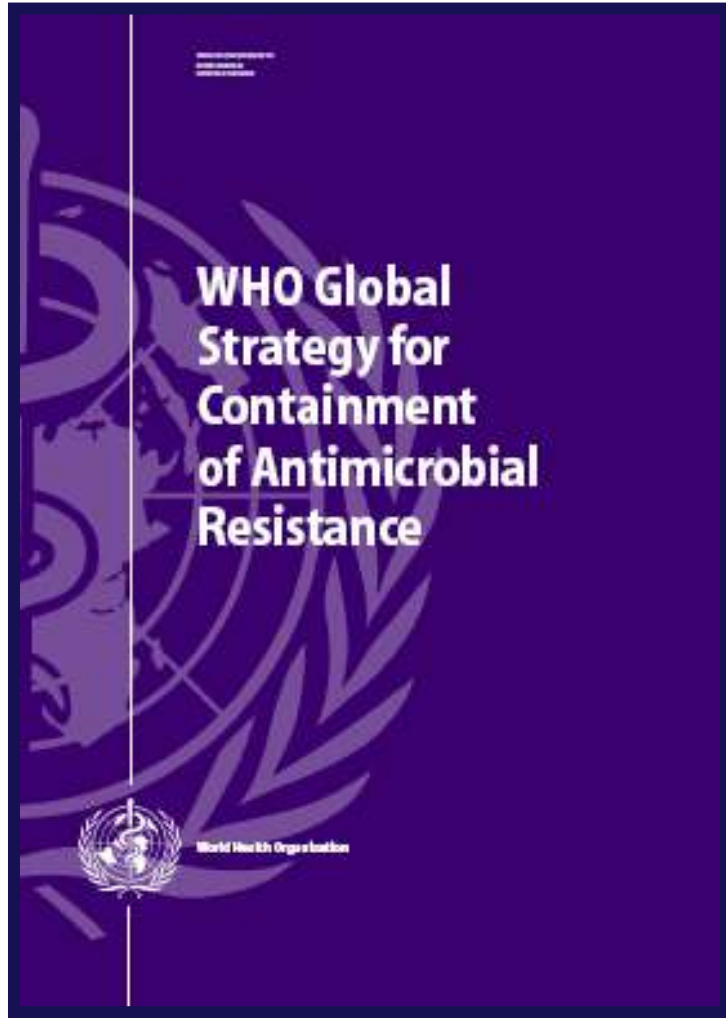


# Berlin 1997. Assessing the Medical Impact

- In 1997 WHO convened an expert meeting on “The Medical Impact of the Use of Antimicrobials in Food Animals”
- The experts acknowledged that antimicrobial use can select resistant forms of bacteria in the ecosystem and resistant bacteria and resistance genes can be exchanged between human, animal and other ecosystems. The following adverse consequences of selecting resistant bacteria in animals were identified:
  - 1. Transfer of resistant pathogens to humans via direct contact with animals or through the consumption of contaminated food or water.
  - 2. Transfer of resistance genes to human bacteria.
  - 3. Increased incidence of human infections caused by resistant pathogens.
  - 4. Potential therapeutic failures.



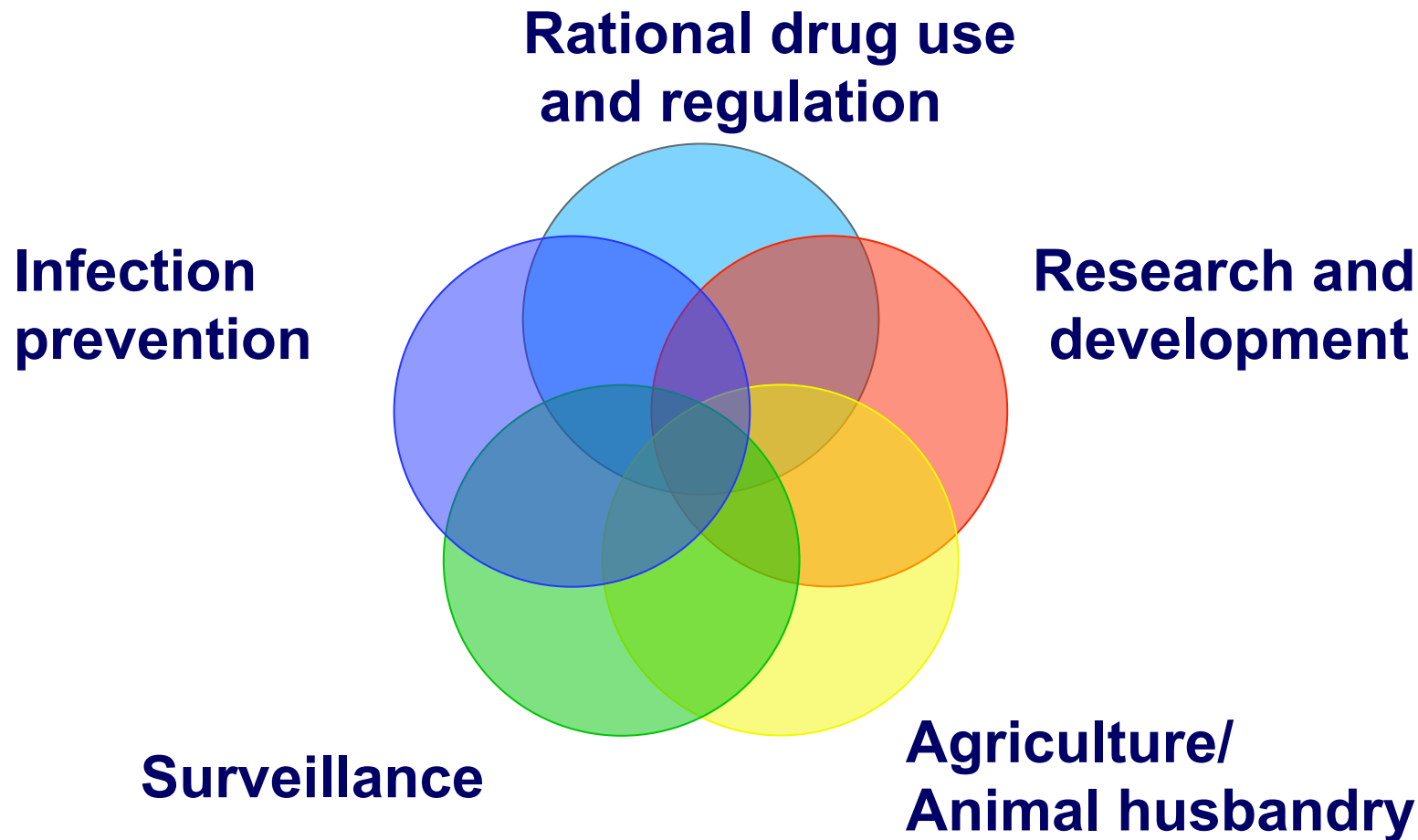
# Preserving effectiveness of anti-microbial therapy: globally



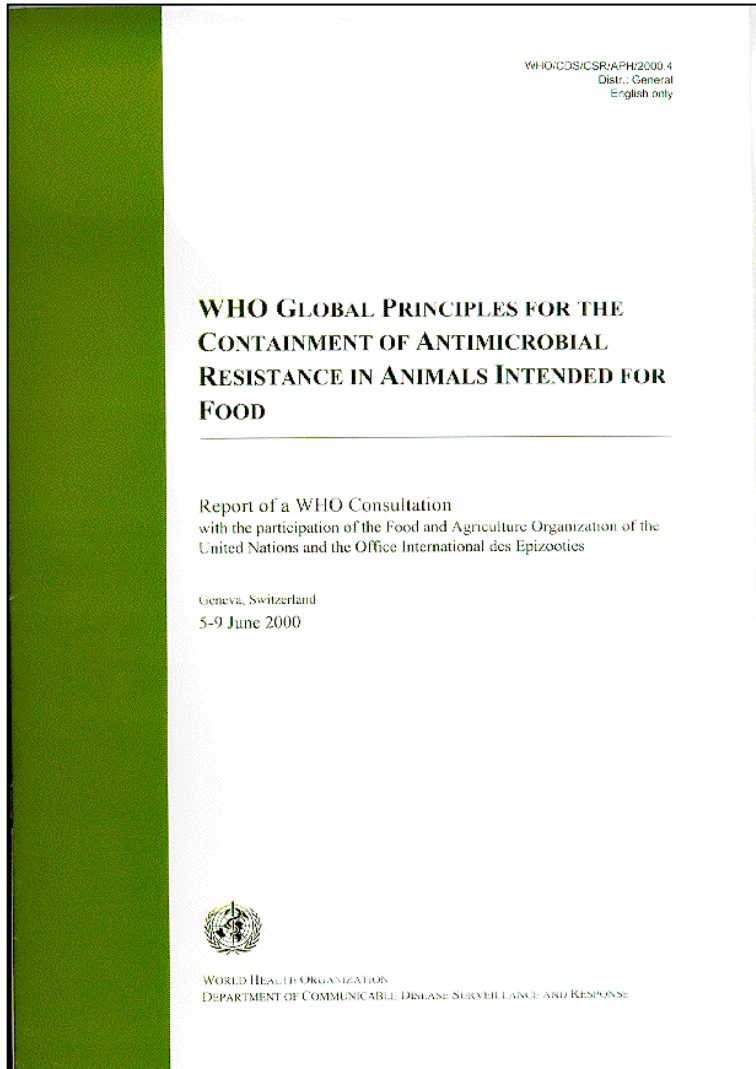
September  
2001



# The five key areas: global strategy for containment of antimicrobial resistance



# WHO Global Principles for the Containment of AMR in food-animals



**To minimise the public health impact of  
the use of antimicrobial agents in food  
animals**

**and provide recommendations for their  
safe and effective use in veterinary  
medicine.**

**Large consultation incl. stakeholders**

**As chapter in the publication on WHO  
Global strategy on Containment of  
Antimicrobial Resistance - 2001**

# WHO Global strategy for Prevention and Control of Foodborne Antimicrobial Resistance

- National and international interdisciplinary cooperation for a fully integrated surveillance system
- Prudent use of antimicrobial agents in all sectors
  - Phasing out use of antimicrobial agents for growth promotion
    - EU banned all growth promoters as of January 1, 2006
  - A good regulatory system for approval and licensing
  - Prescription-only
  - Practitioners not having economic profit from prescription
  - Routine prophylactic use of antimicrobials should never be used as a substitute for health management
  - Accurate diagnosis and antimicrobial susceptibility testing
  - Appropriate antimicrobial product and administration route
- Infection control
  - Successful disease control relies on a holistic approach encompassing hygiene, animal husbandry and management, nutrition, animal welfare, and vaccination



# Integrating Surveillance Systems AGISAR

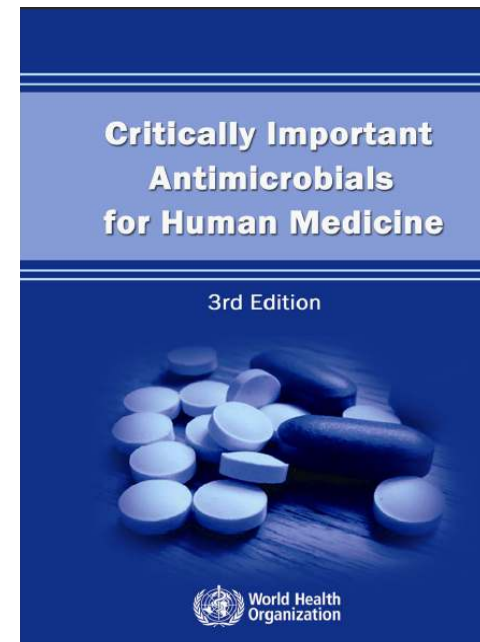
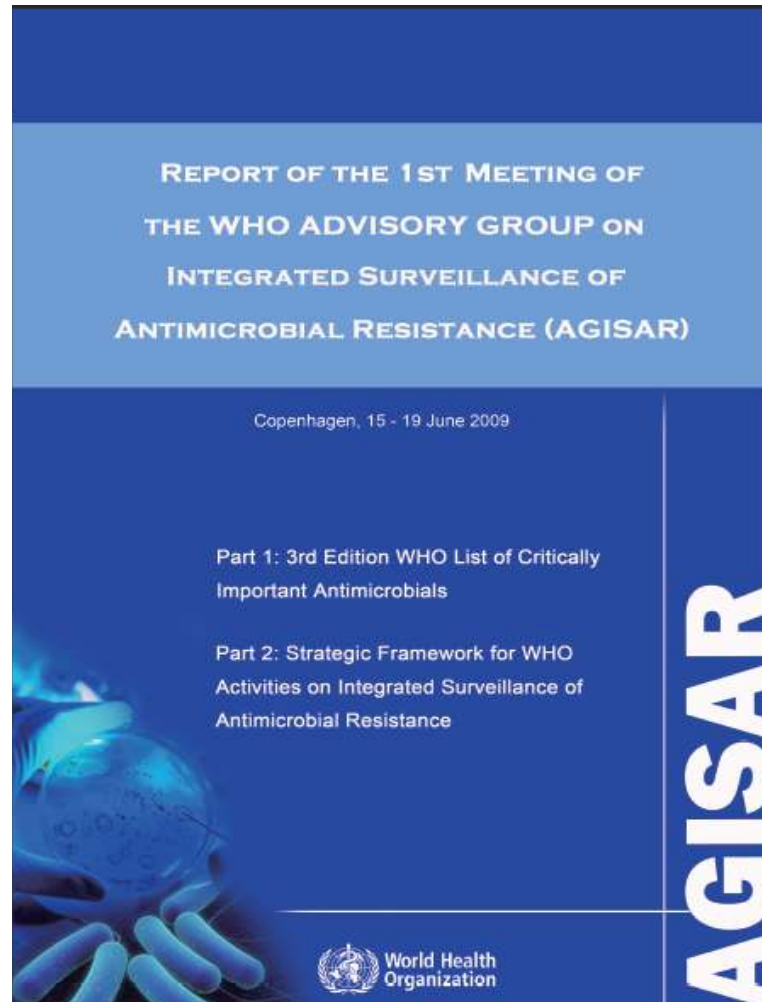
A group of experts working in veterinary, food and public health disciplines advising WHO on ensuring globally containment of foodborne antimicrobial resistance through integrated surveillance of antimicrobial usage and antimicrobial resistance in the animal, food and human sectors



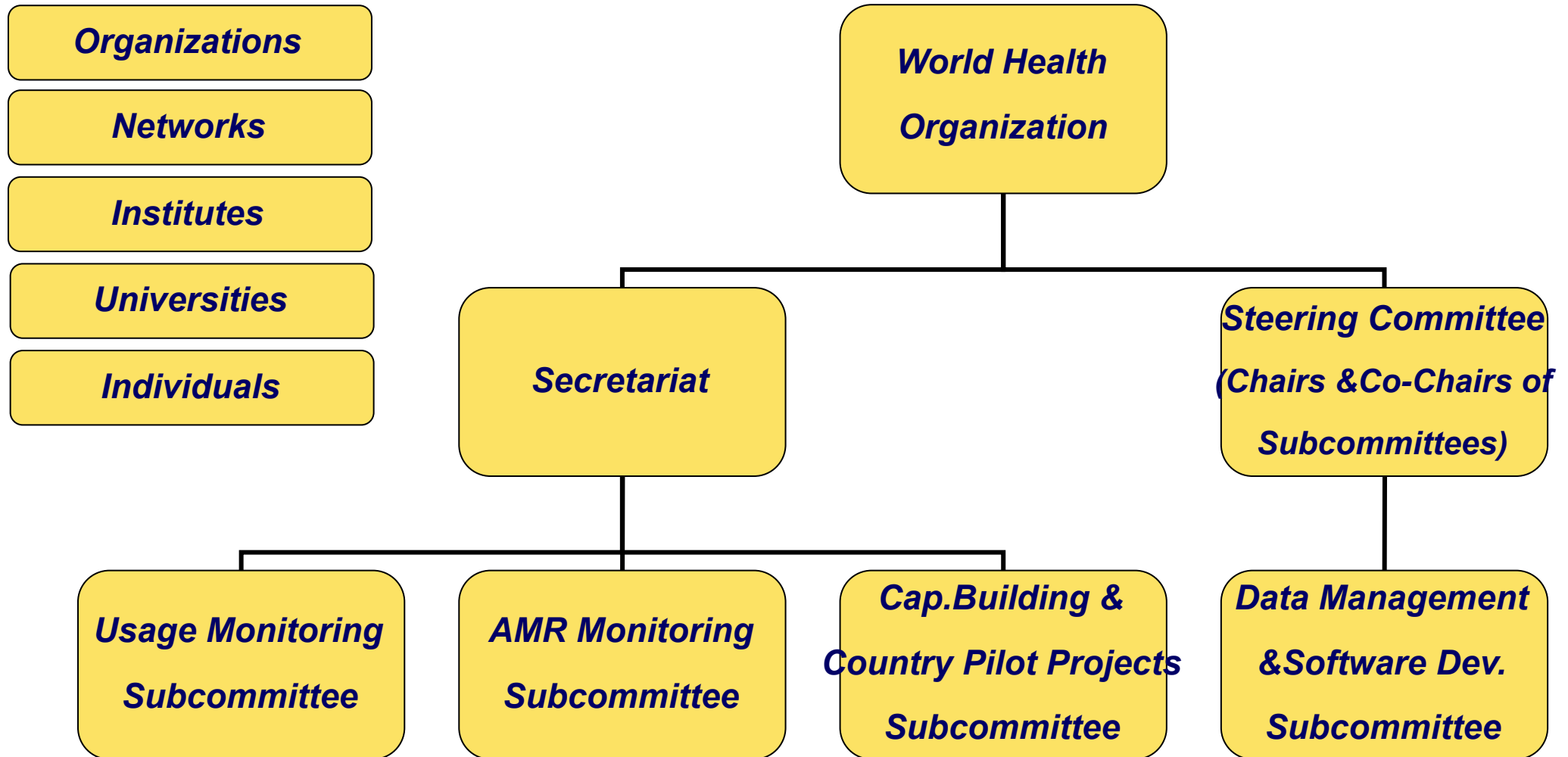
# Outputs of AGISAR Meetings

- Annual Meeting Report

- WHO List of Critically Important Antimicrobials for Human Medicine (revised version every 2 years)



# Governance of AGISAR



# Global Foodborne Infections Network (GFN)

A network of professionals working in veterinary, food and public health disciplines committed to enhancing capacity of countries to conduct integrated surveillance of foodborne and other enteric infections, incl. antimicrobial resistance

## GFN Steering Committee



Public Health  
Agency of Canada

Agence de la santé  
publique du Canada



University of Utrecht



# (Inter)national Training Courses

## Microbiology training

- Global/Region-specific pathogens  
(e.g. *Salmonella*, *Campylobacter*, *E. coli*, *V. cholerae*,  
*S. Typhi*, *Brucella*, *Shigella*, *Listeria*, *C. botulinum*)
- Quality assurance
- Biosafety
- Antimicrobial Susceptibility Testing

## Epidemiology training

- Outbreak detection and response
- Evaluation of surveillance systems
- Study design
- Source attribution
- Burden of disease

## Joint Epidemiology and Laboratory

- Joint case studies
- Integrated surveillance
- Risk assessment
- Country Plans of Action
- Advocacy and communication
- Information sharing networks





# GFN training activities



❖ 20 Active Sites

❖ > 1 300 Trained

❖ > 130 MS

# GFN Training activities

## 2000 - 2011

70. Argentina-Adv Wksp III-May 2010
71. Thailand GFN/ASIA Foodnet Wksp-July 2010
72. China-Adv Wksp V-Sept 2010
73. Tunisia-Level I-Nov 2010
74. Kenya-Level III-Nov 2010
75. Cameroon-Adv Wksp II-January 2011
76. United Arab Emirates – Nat. course-March 2011
77. India – Level I Nat. course I – March 2011
78. India – Level I Nat. course II – March 2011
79. South Africa – Level I – May 2011
80. Costa Rica – Level II – May 2011



# More information at :

[http://www.who.int/foodborne\\_disease/resistance](http://www.who.int/foodborne_disease/resistance)

**World Health Organization**

Home | Foodborne Disease Surveillance | HIGHLIGHTS

WHO > Programmes and projects > Foodborne Disease Surveillance > Antimicrobial Resistance

printable version

General information

WHO has played a major role in addressing antimicrobial resistance in food. The three organizations (WHO, FAO and OIE) have established the Codex ad hoc Intergovernmental Task Force of Antimicrobial Resistance.

WHO strategy to ensure the proper use of antimicrobials in food includes:

- Develop and promote good antimicrobial practices in food production
- Develop a list of Critically Important Antimicrobials (CIA)

**Meetings**

- 2nd meeting (WHO-AGISAR) - 16 October 2010
- The 3rd Session (AGISAR) - 16 October 2010
- First Meeting (AGISAR) - 15-19 June 2009
- The 2nd session (AGISAR) - 24 October 2010
- Joint FAO/OIE Meeting - November 2010
- Joint FAO/OIE Meeting - November 2010

**Publications**

- 2nd edition WHO list of CIA [pdf 450kb]
- The list may be found in the report of the 2nd WHO Expert Meeting on Critically Important Antimicrobials for Human Health
- 1st edition WHO list of CIA [pdf 214kb]
- The list may be found in the report of the 1st WHO Expert Meeting on Critically Important Antimicrobials for Human Health

**WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR)**

The WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (WHO-AGISAR) was established in December 2008 to support WHO's effort to minimize the public health impact of antimicrobial resistance associated with the use of antimicrobials in food animals. In particular, the Advisory Group will assist WHO on matters related to the integrated surveillance of antimicrobial resistance and the containment of food-related antimicrobial resistance. The terms of reference of WHO-AGISAR are as follows:

- Develop harmonized schemes for monitoring antimicrobial resistance in zoonotic and enteric bacteria. This should include appropriate sampling.
- Support WHO capacity-building activities in Member countries for antimicrobial resistance monitoring (AMP) training modules for Global Foodborne Infections Network (GFIN) training.

AGISAR members

- AGISAR subcommittees
- First Meeting of the WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR), 15-19 June 2009
- List of Critically Important Antimicrobials
- Global Foodborne Infections Network (GFIN) training courses

## General information

## Codex ad hoc Intergovernmental Task Force of Antimicrobial Resistance

## List of Critically Important Antimicrobials

## WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR)

## Publications on Bacterial Infections, New Delhi, 3-5 October 2011

## Meetings