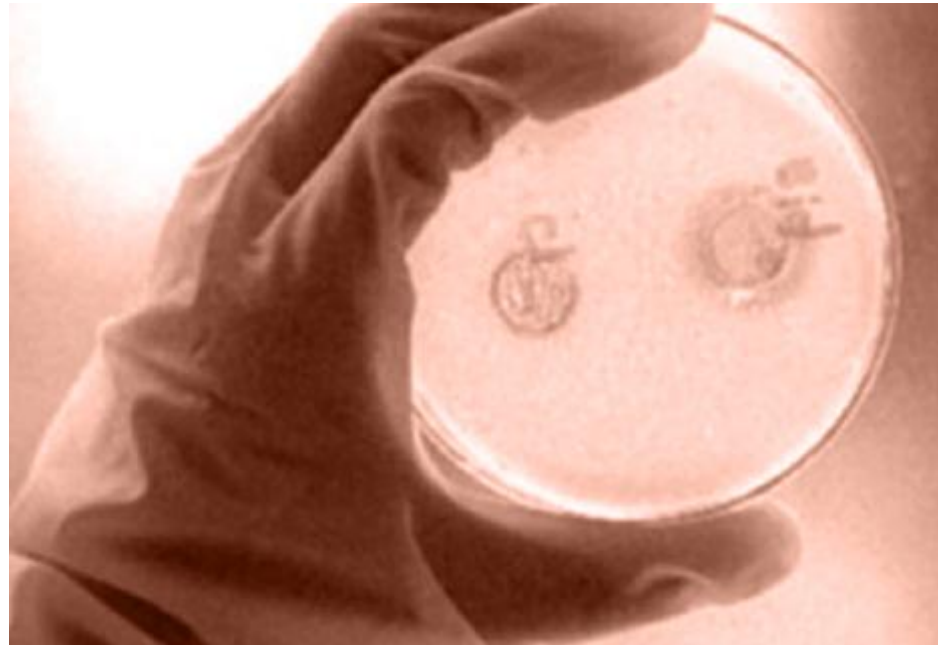
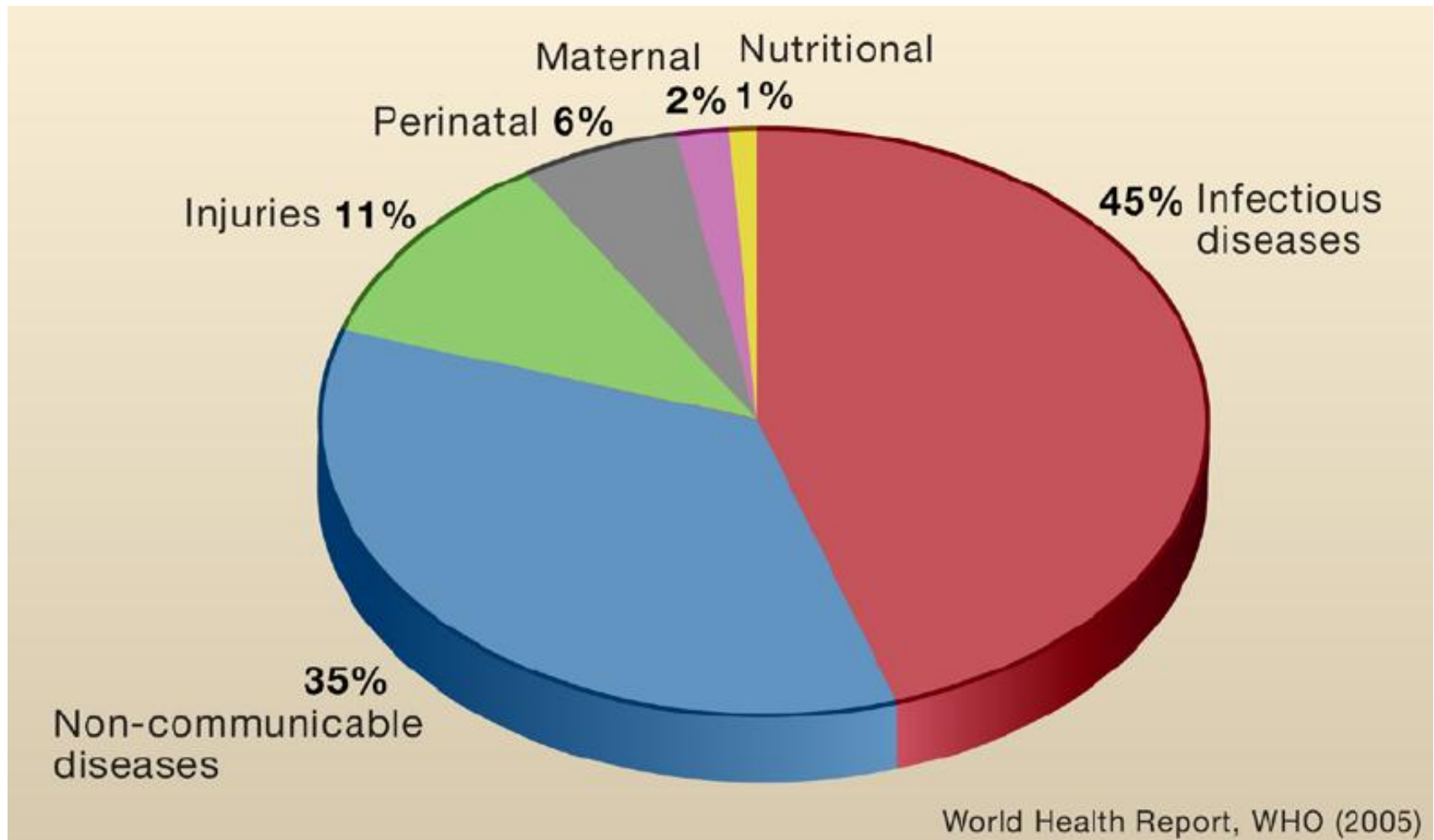


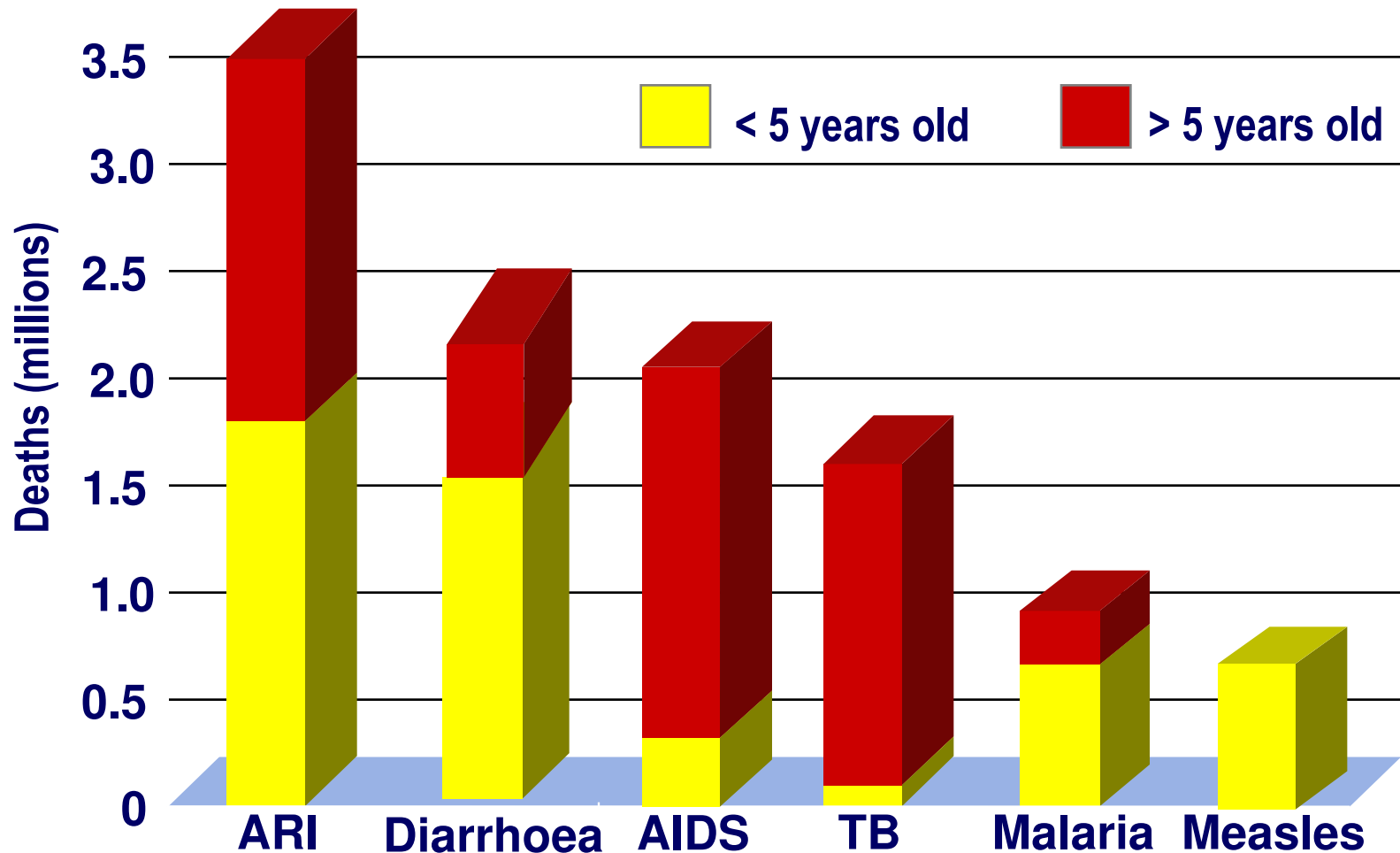
# **Ensuring Effective Antibiotics in the 21<sup>st</sup> Century**



# Leading causes of mortality in low-income countries, 2004

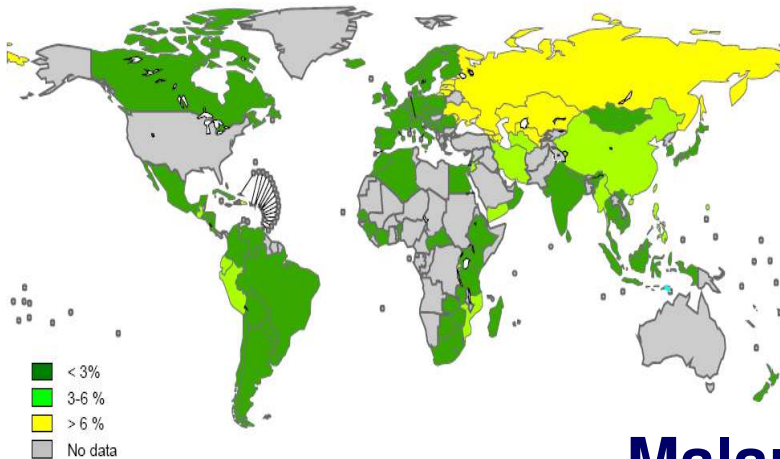


# Leading infectious causes of death in low-income countries 2005 (estimates)

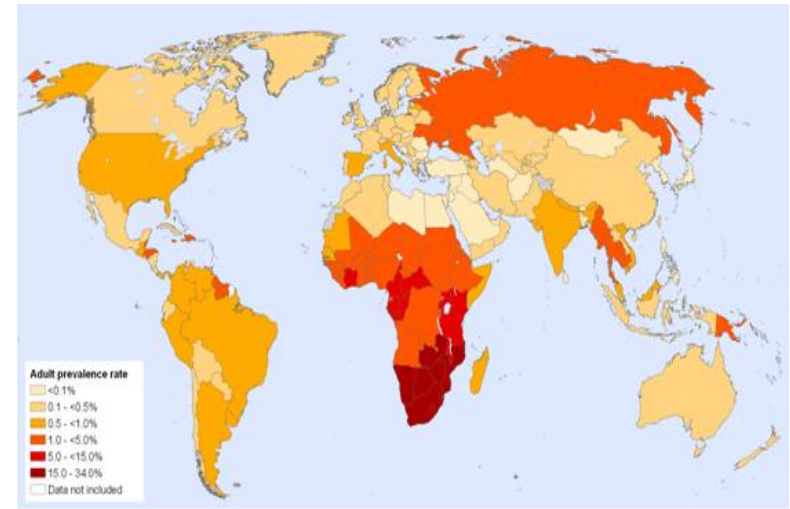


# Antimicrobial resistance: bacterial, viral, and parasitic infections, 2009

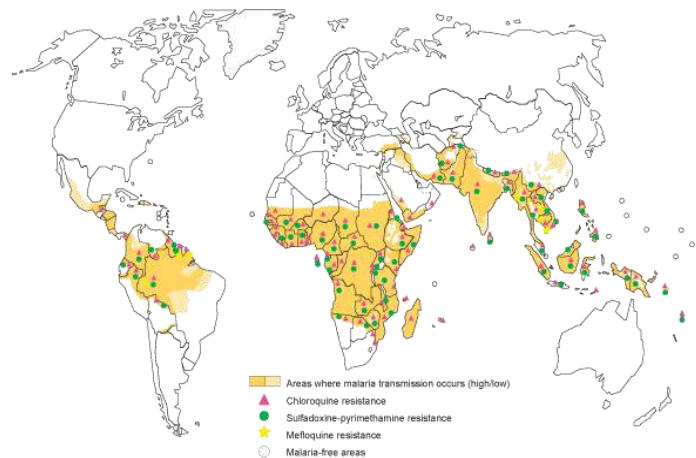
## Tuberculosis



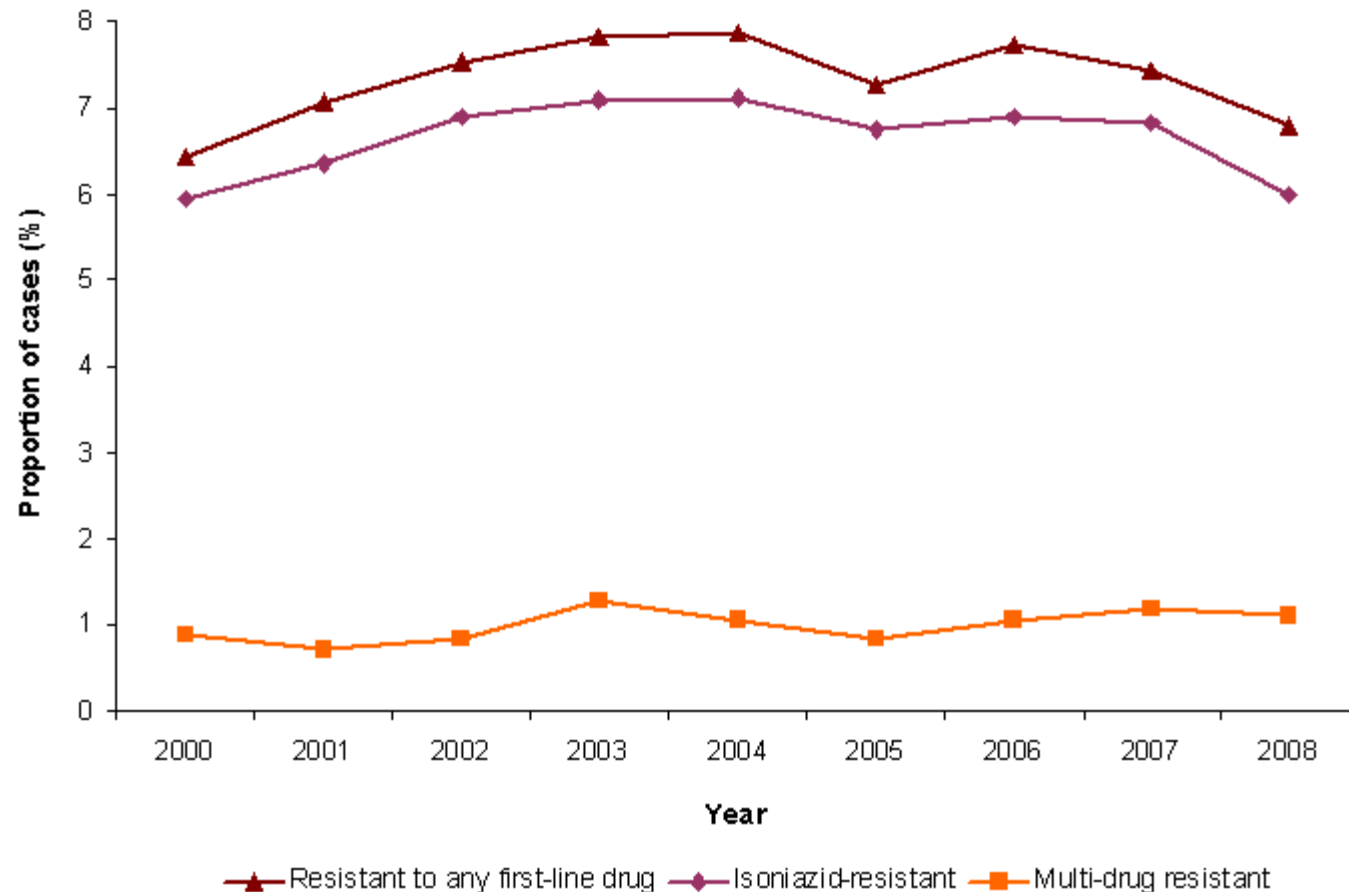
## HIV/AIDS



## Malaria



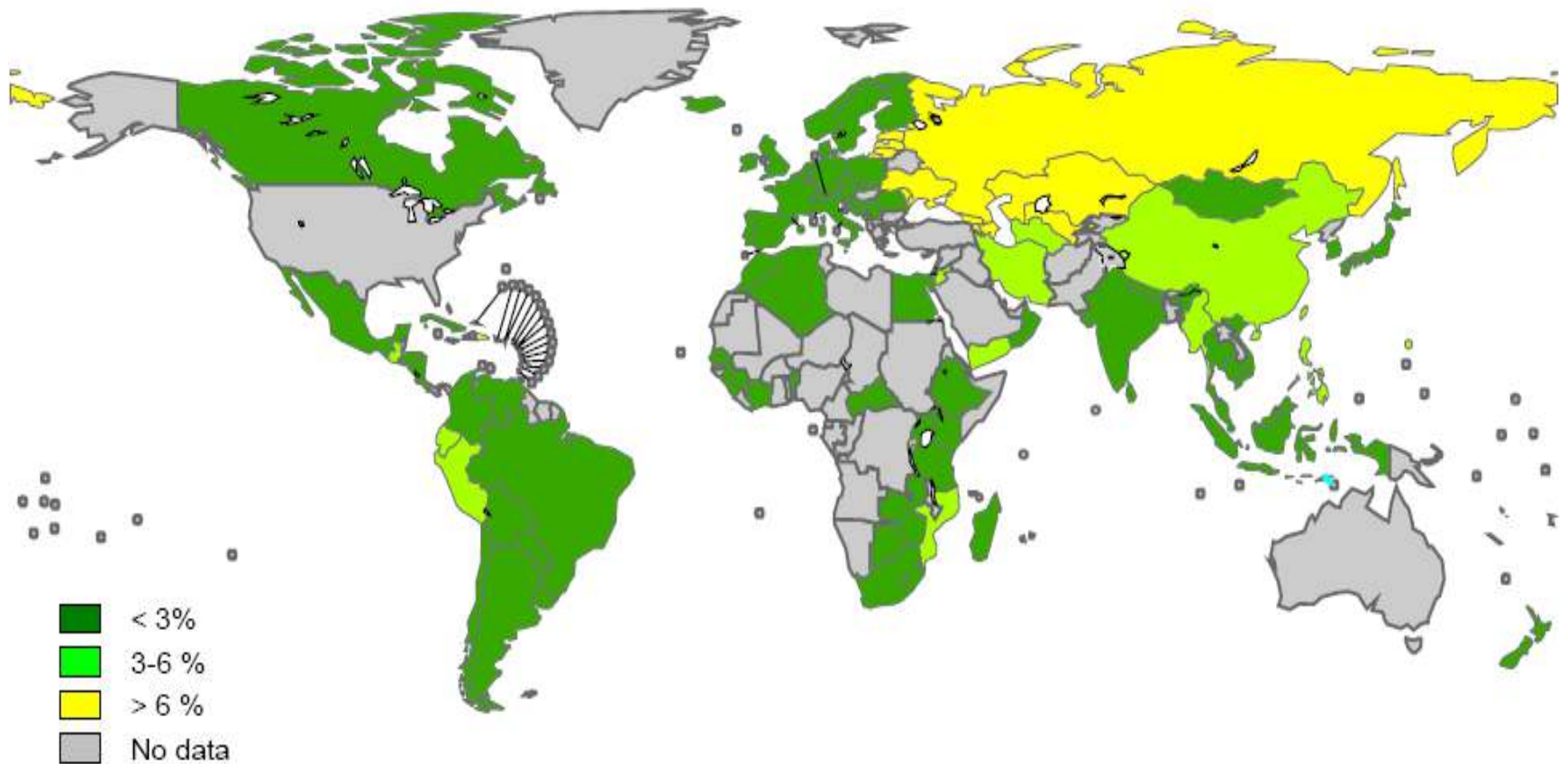
# Proportion of tuberculosis cases with first-line drug resistance, UK, 2000-2008



Source: HPA, UK

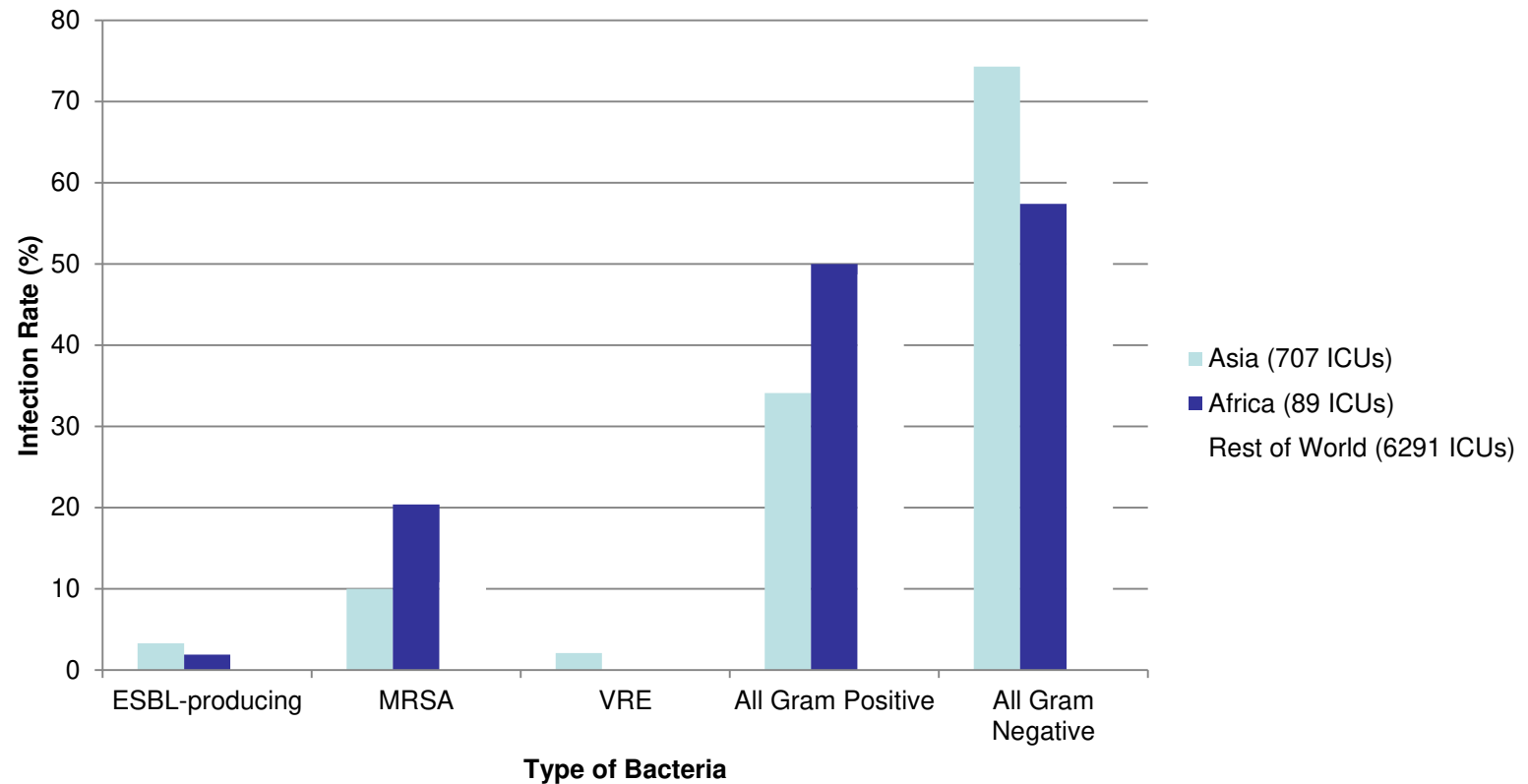
# Percent MDR TB among new cases 1994-2007

\* Sub-national coverage in India, China, Russia, Indonesia.



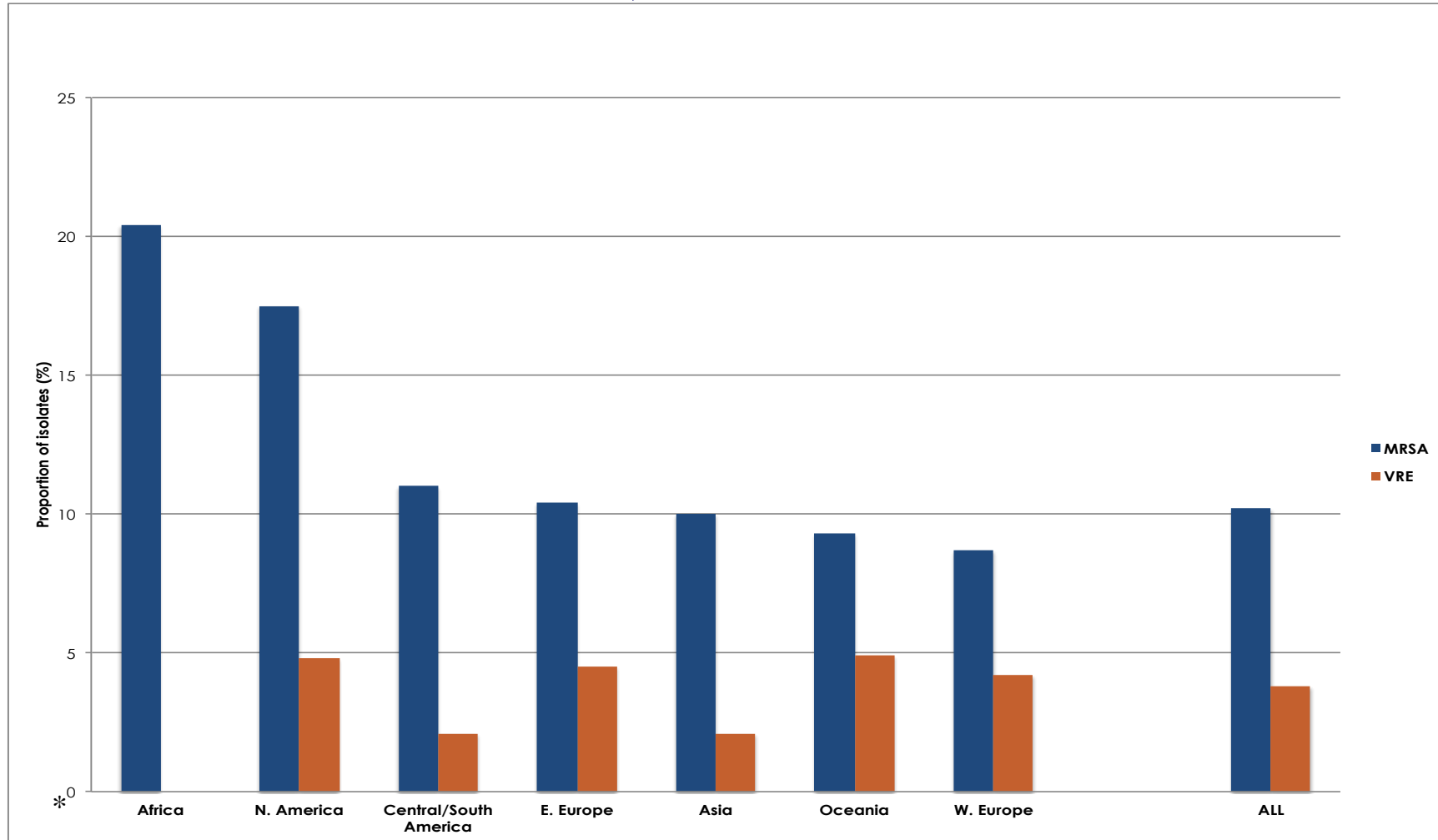
Source: WHO, 4th global TB report

# Rates of resistance in hospital intensive care units worldwide



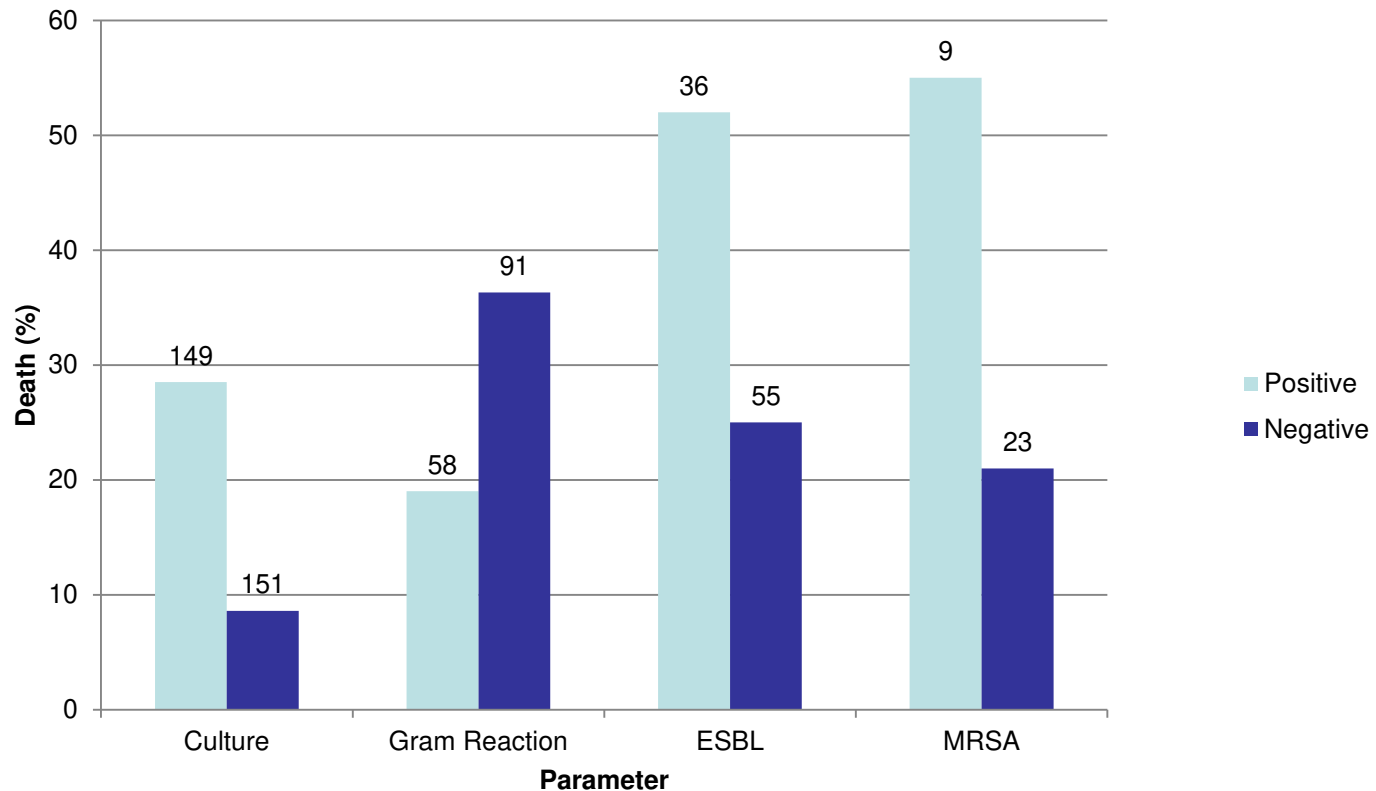
Source: Vincent JL et al *JAMA*302(21):2323-2329.

# MRSA and VSRE as percentage of all bacteria isolated from intensive care units, 2007

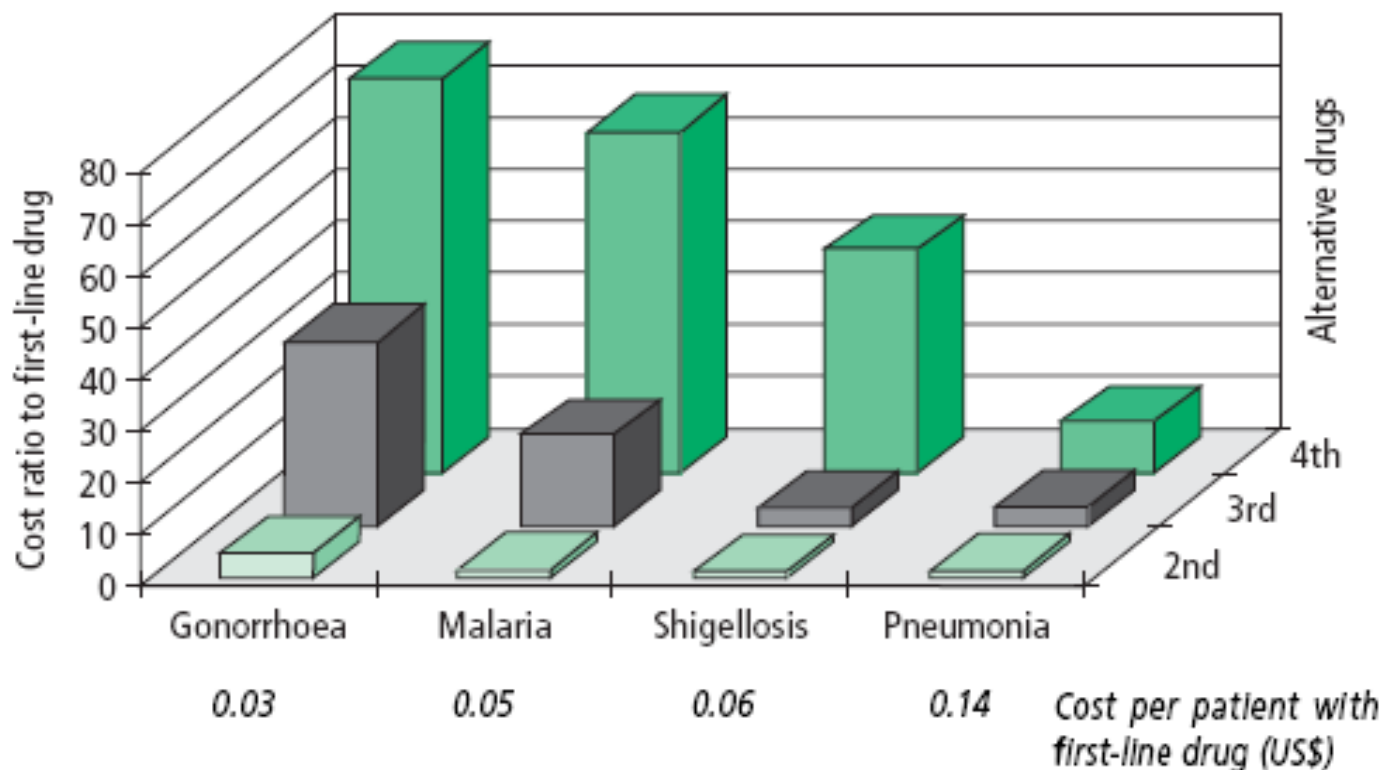




# Positive blood culture and deaths, neonates with suspected sepsis, Mwanza- Tanzania

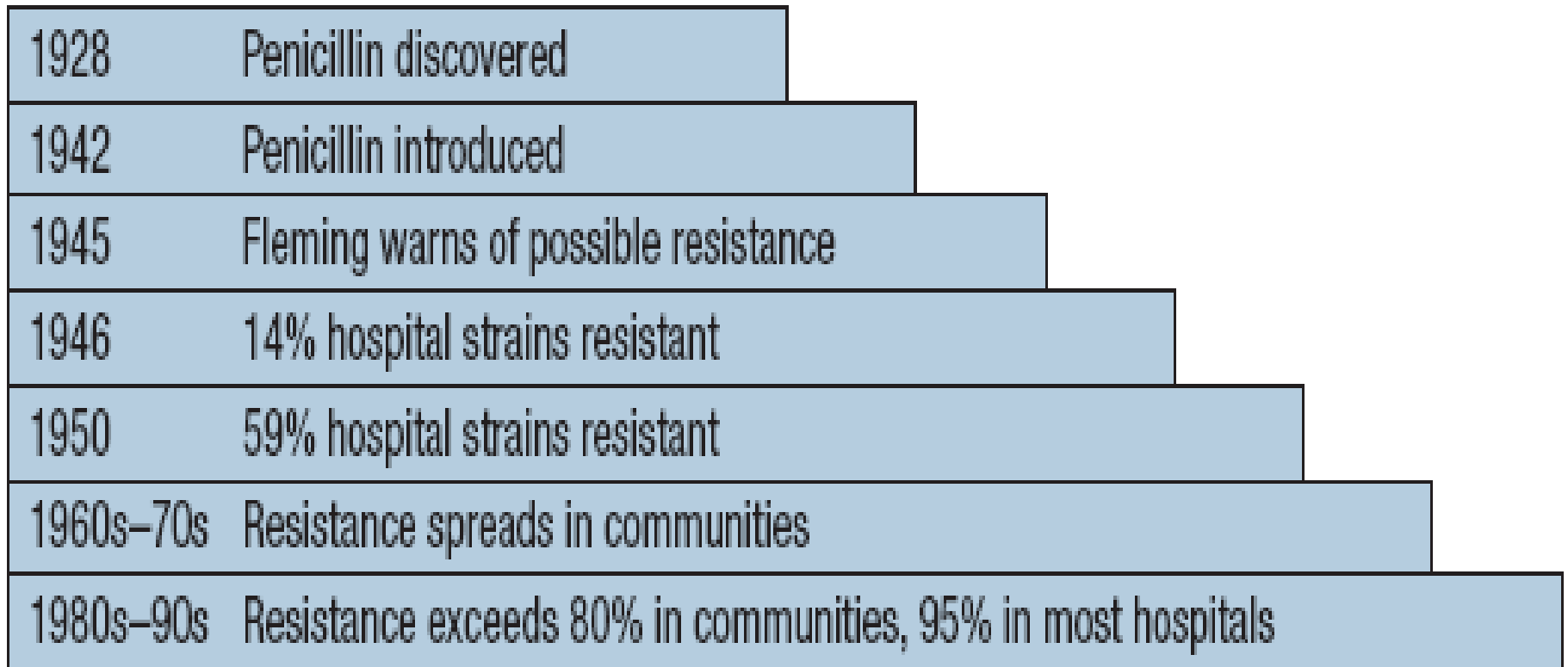


# Use of second and third generation antimicrobials and cost, 2004 estimates

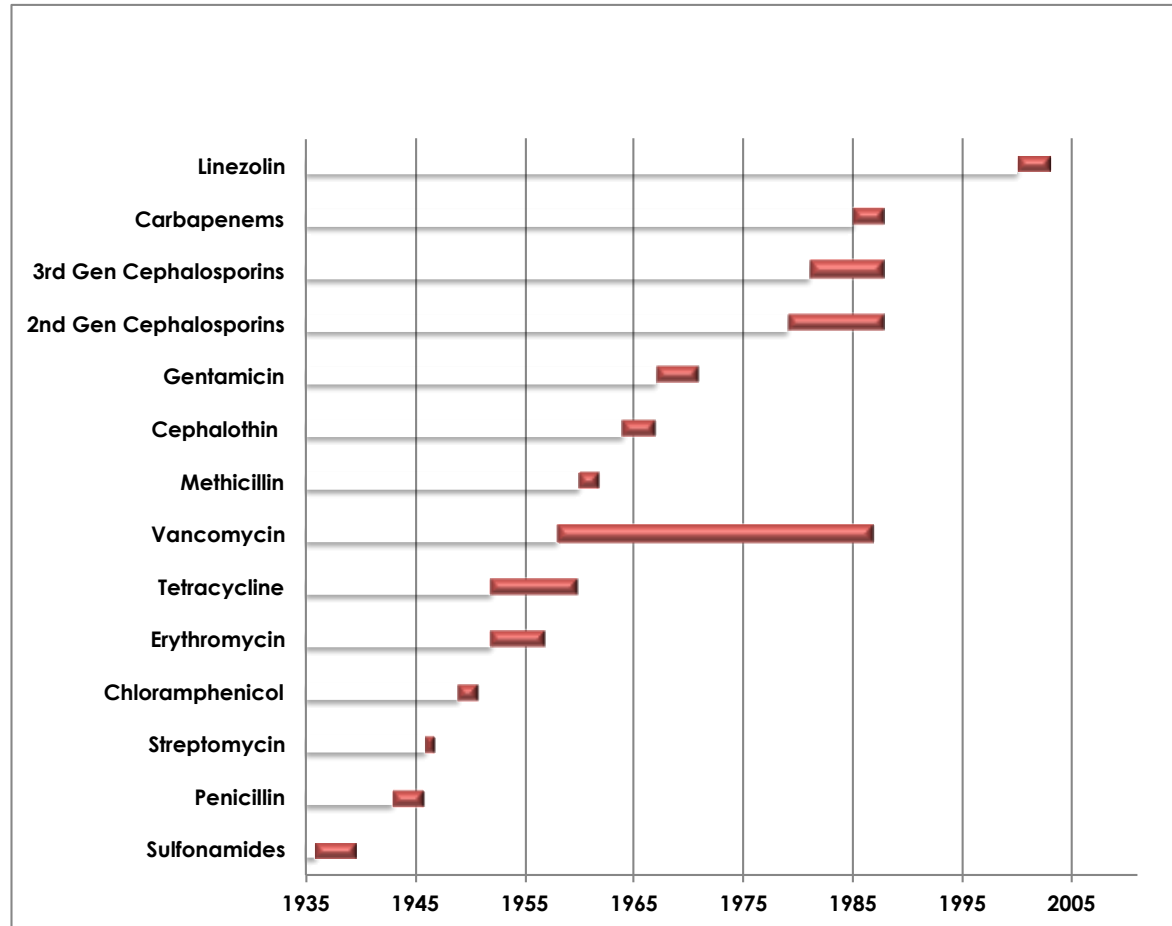


# **"Misuse of drugs could result in selection of resistance"**

**Alexander Fleming, 1945**

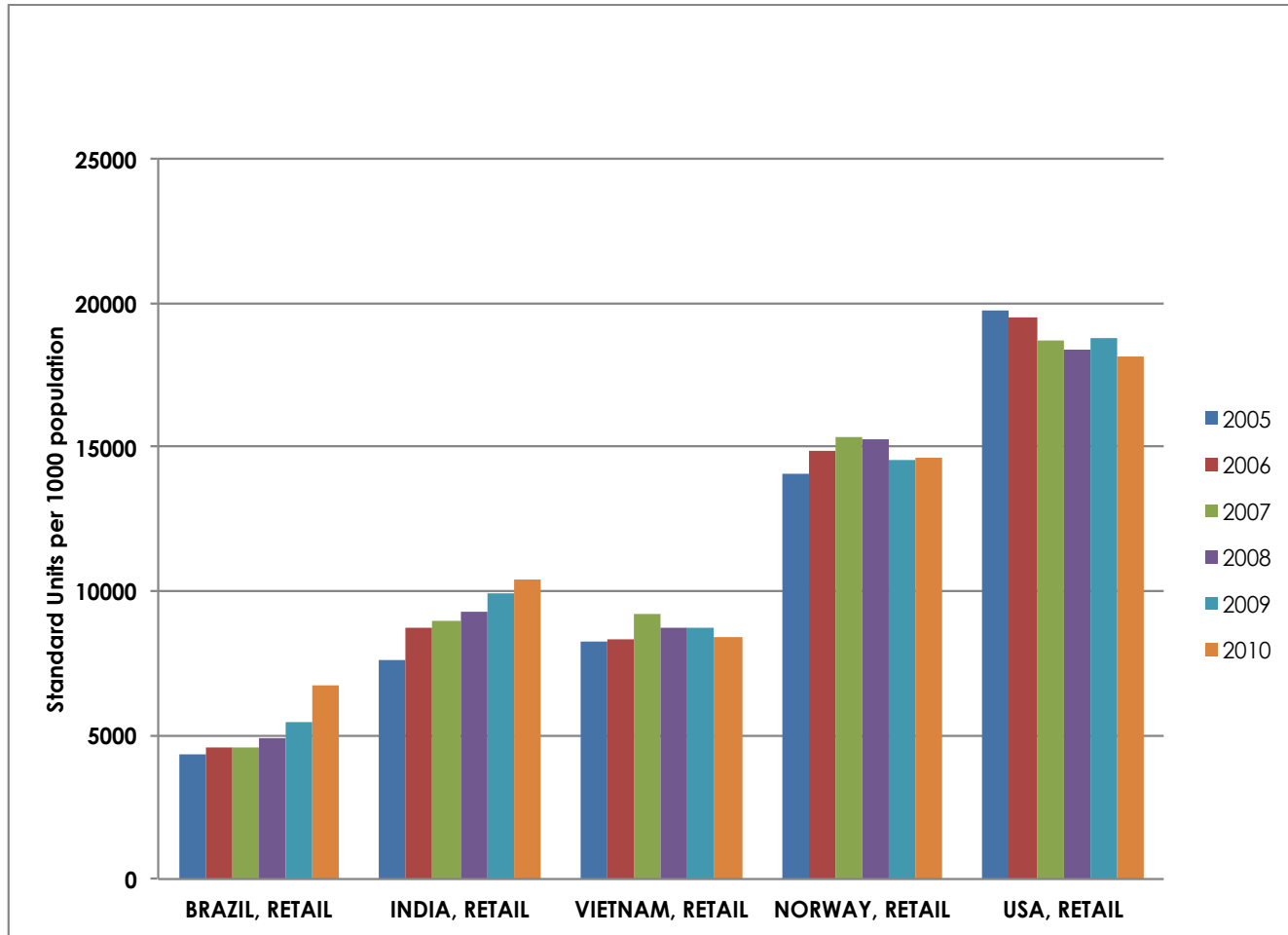


# Interval between start of antibiotic use and first report of resistance



Source: Jacoby, G. A. (2009). History of Drug-Resistant Microbe. Antimicrobial Drug Resistance. D. L. Mayers, Humana Press: 3-7. Bergstrom CT, Feldgarden M (2008). The ecology and evolution of antibiotic-resistant bacteria. In Evolution in Health and Disease. 2nd edition. Oxford University Press; 2008.

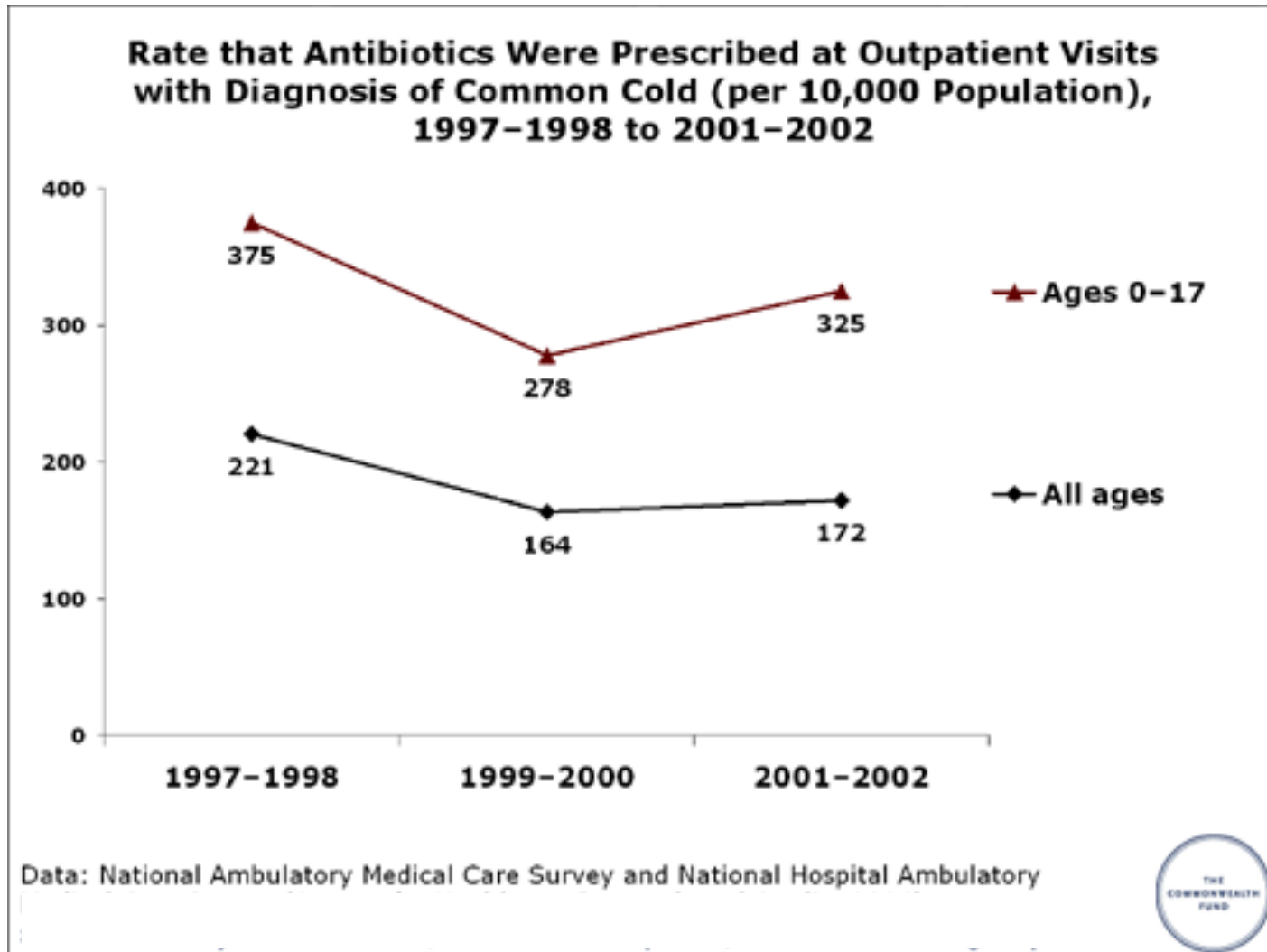
# Per capita total antibiotic sales, 2005-2010



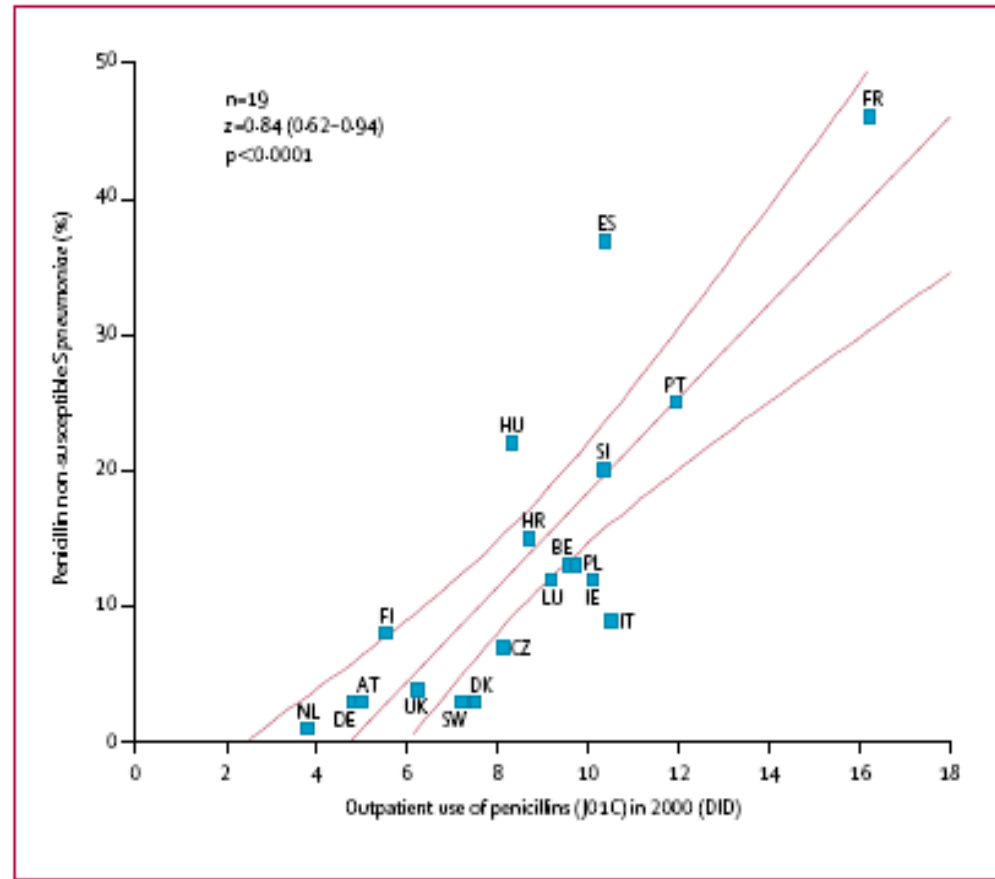
Source: IMS Health Incorporated.: marketing research

# Antimicrobial over-use: medical workers

Antibiotic use for common cold, United States, 1997-2002

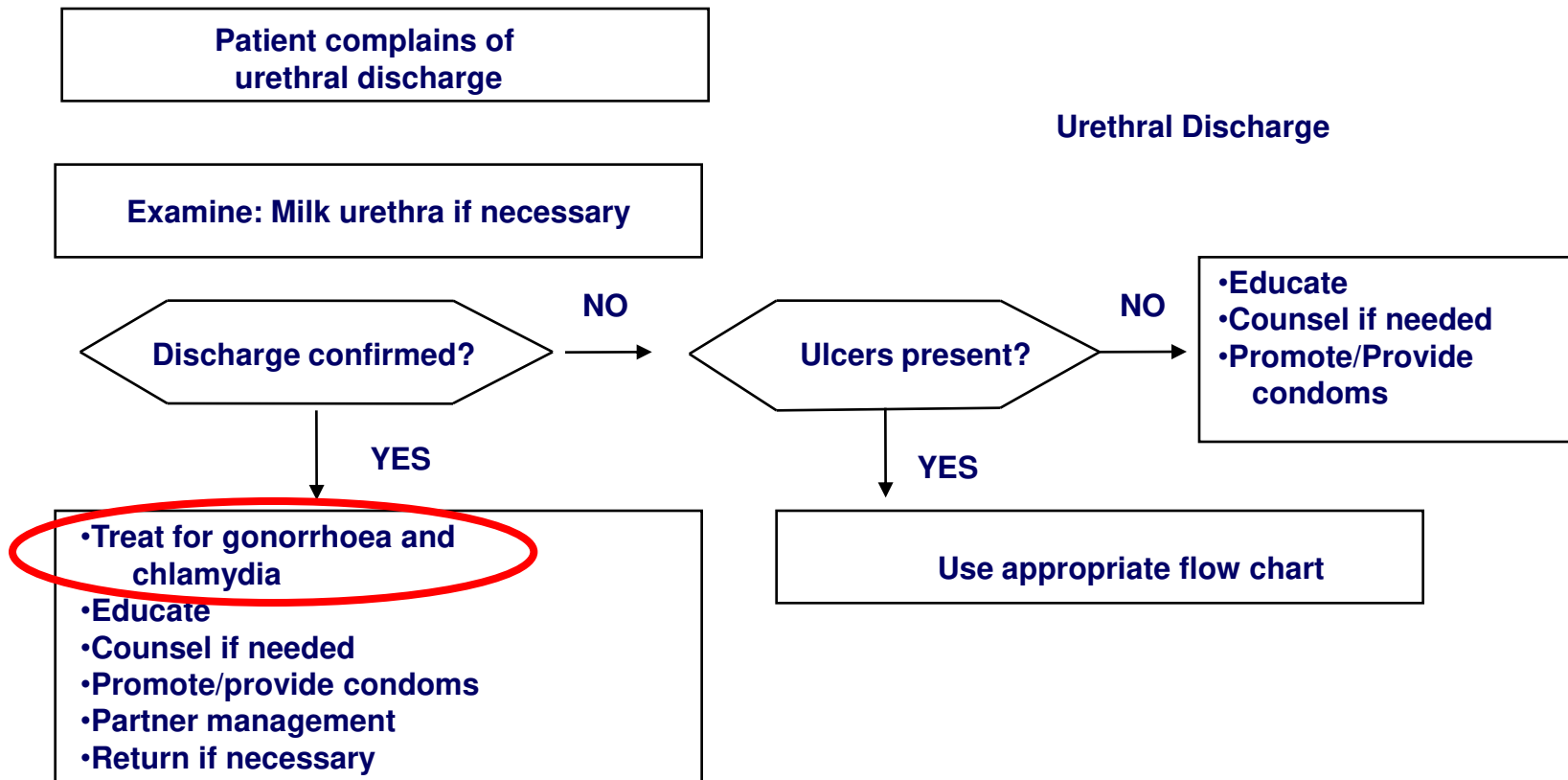


# Antibiotic use: outpatient penicillin usage correlated with penicillin resistance, Europe, 2005



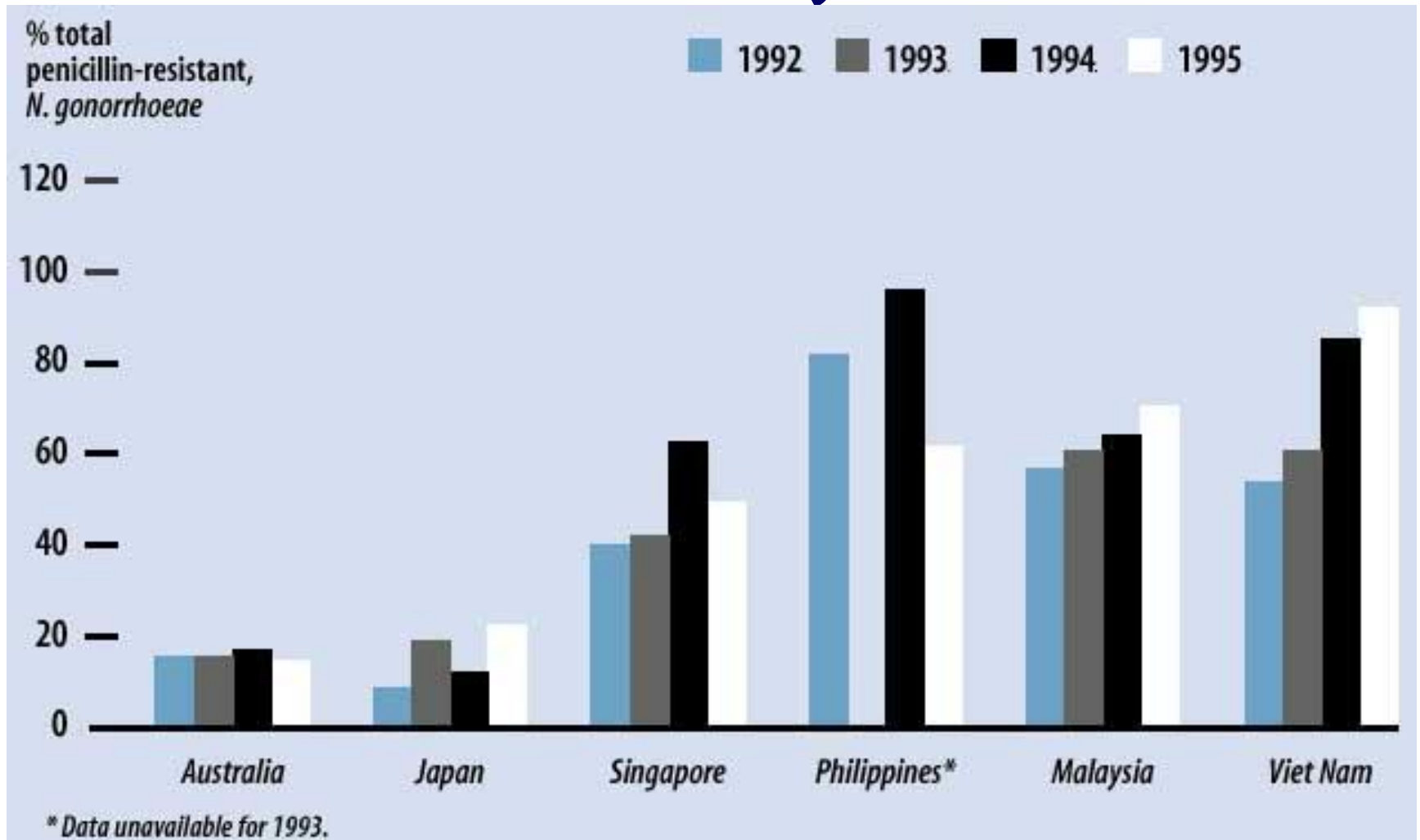
Source: Goossens, 2005

# Antibiotic over-use: lack of simple diagnostics for human infections



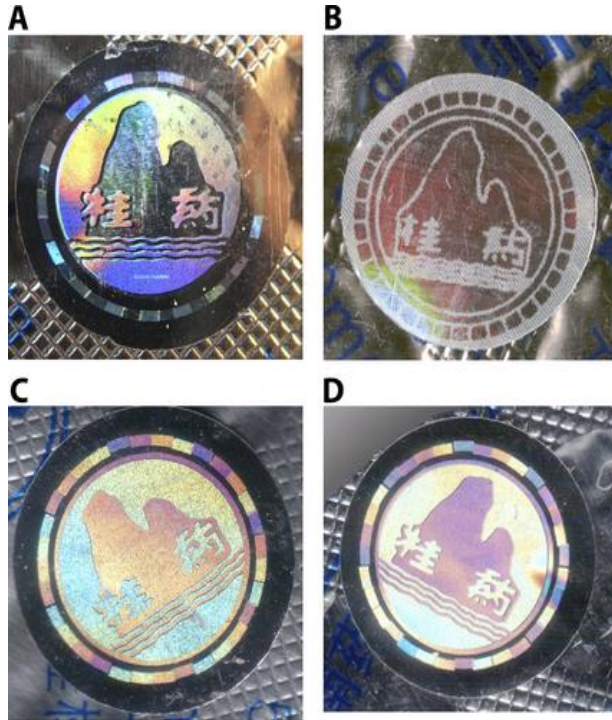


# Penicillin resistant Gonorrhoea, 1990s



Source: WHO from published reports

# Counterfeit Artesunate (53% of all sampled), Southeast Asia, 2006-2007

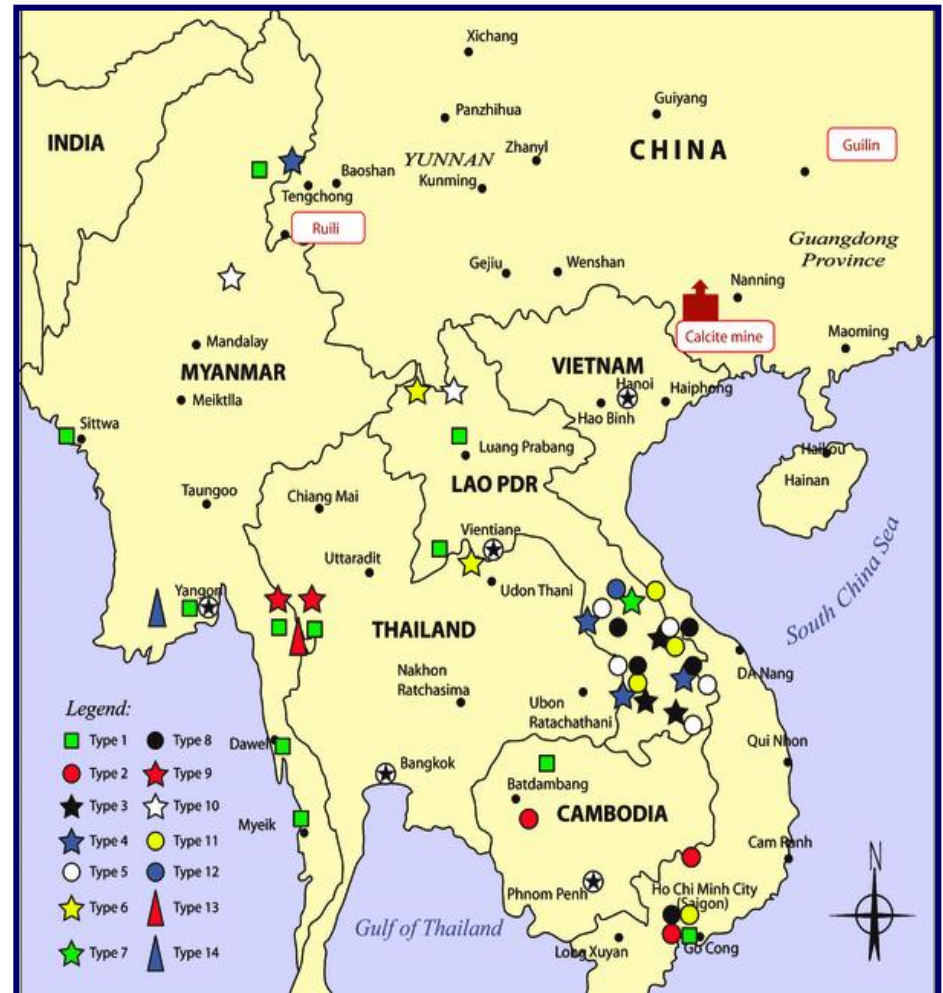


(A) Genuine

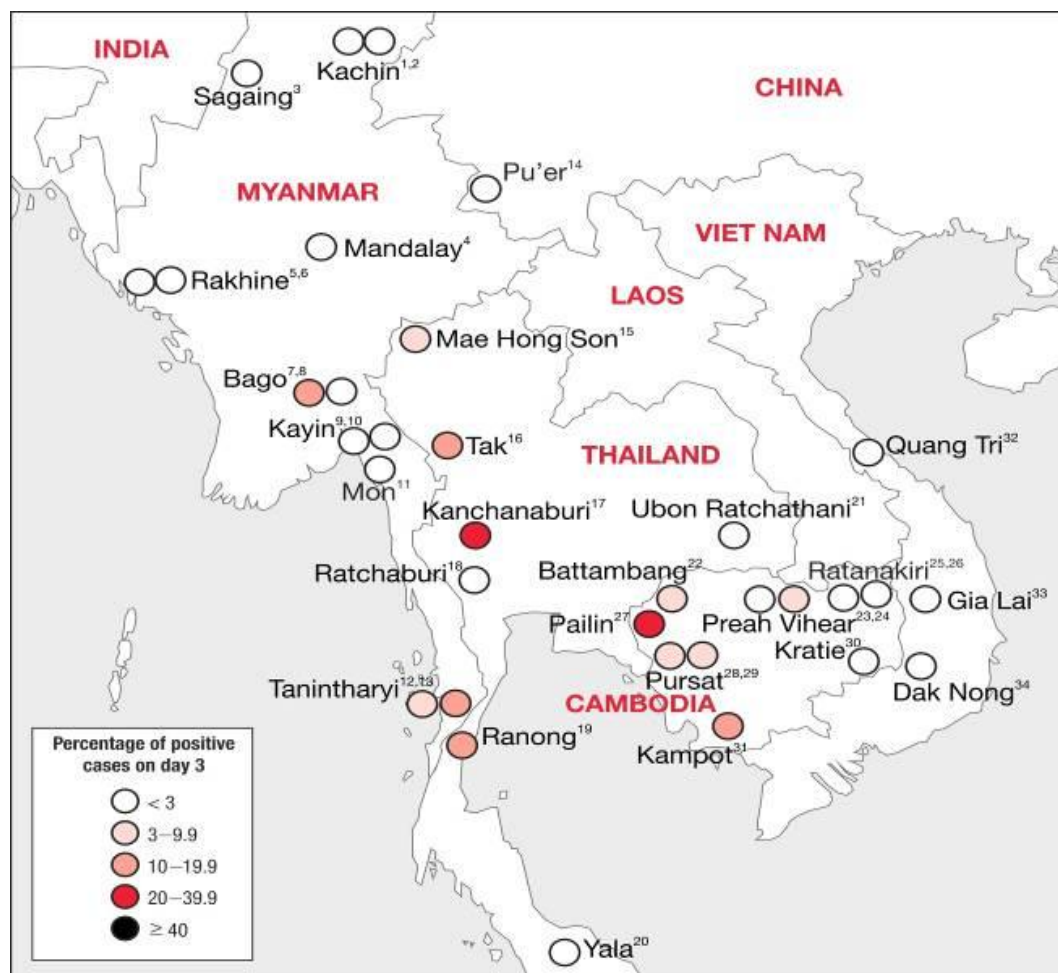
(B) Sticker copy

(C) Fake stamp (only visible under UV light)

(D) Hologram copy



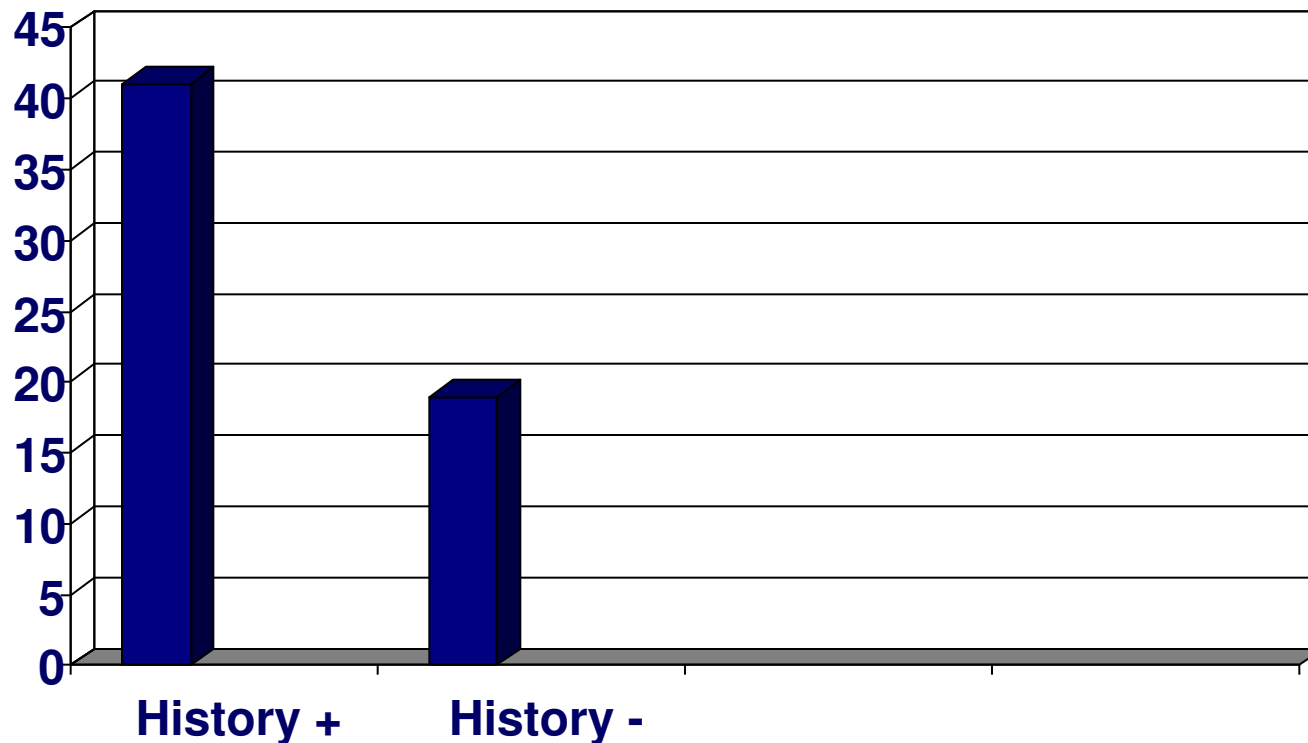
# ***P. falciparum* parasitaemia 3 day post treatment, artemisinin-based combination therapies (2006-2010)**



# Antimicrobial use: mis-understanding by patients

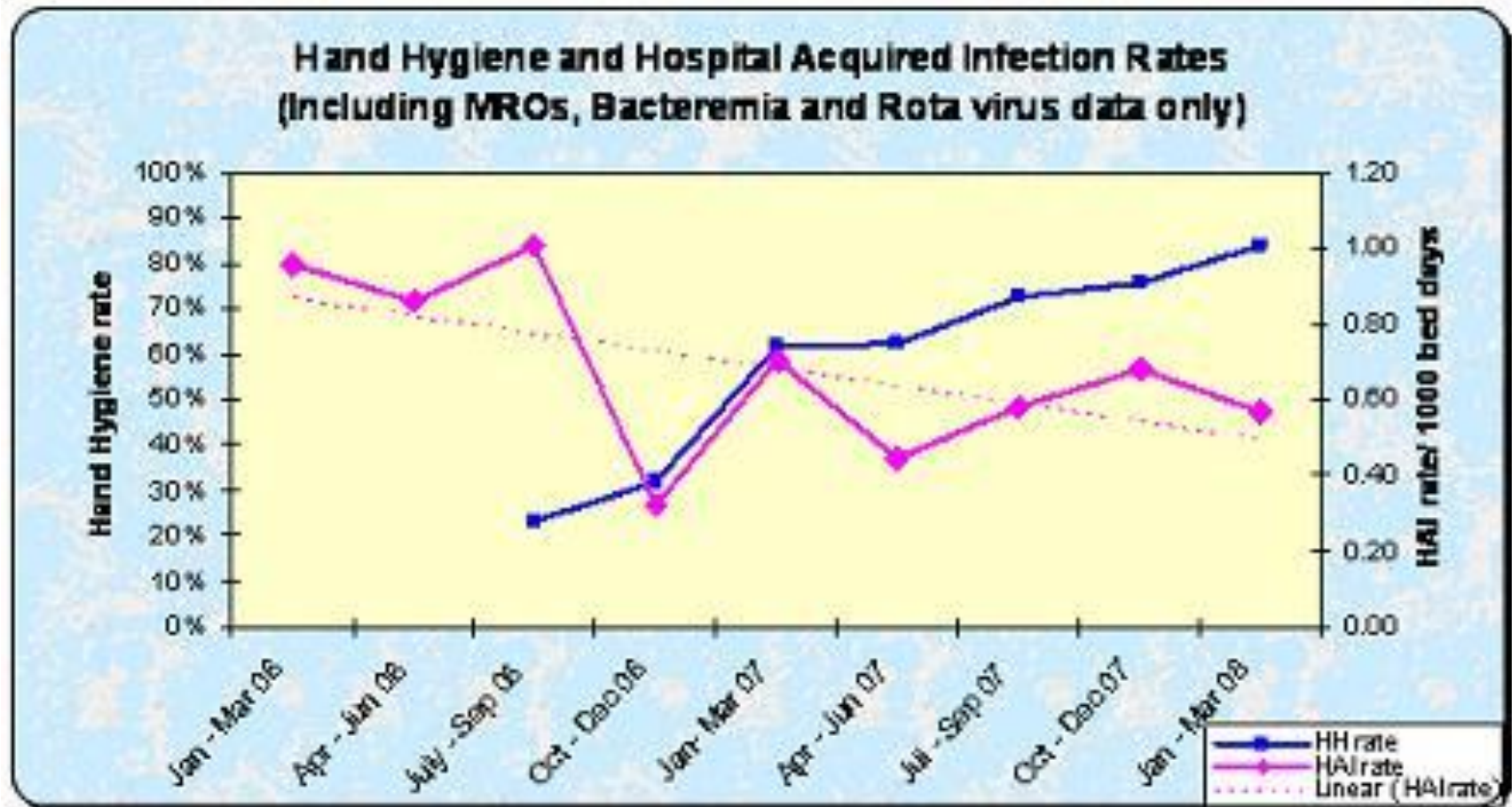
**Malaira, chemoprophylaxis, 635 pregnant women, Malawi**

% with urine CQ metabolites compatible  
with intake preceding 7 days



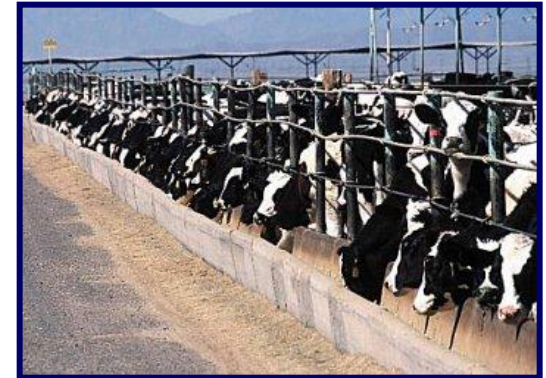
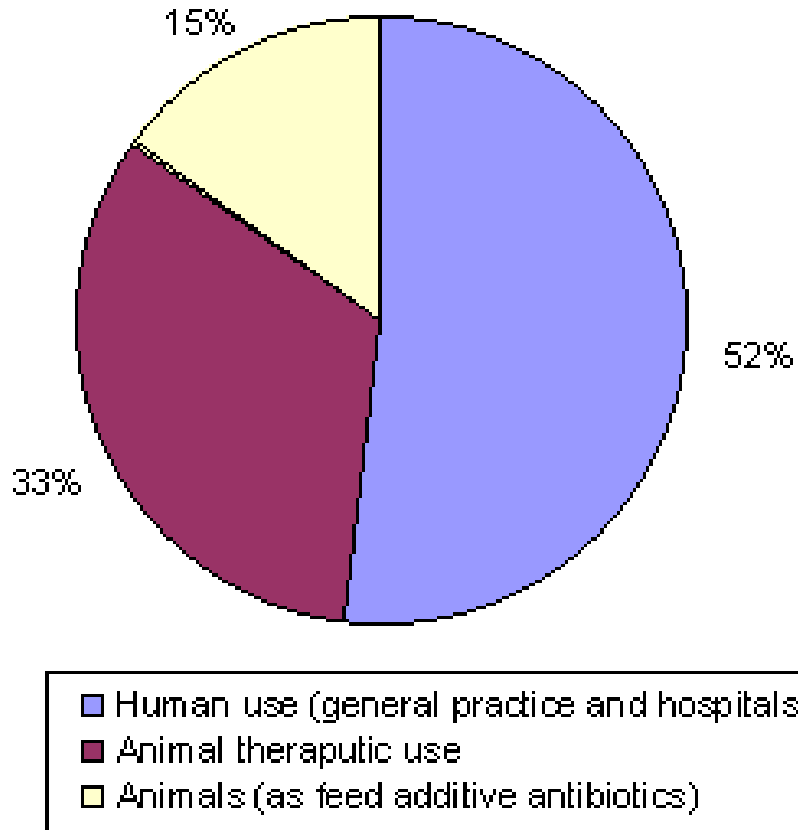


# Hand hygiene and hospital acquired infections, Australia, 2007



Source: Australia Clinical Excellence Commission, 2007

# Antibiotic consumption in animals, 2005



Source: Agbioforum

# Antibiotic use: use in plants, fish and animals

US: OVER-USE OF ANTIBIOTICS THREATENS HUMANS  
by Danielle Knight

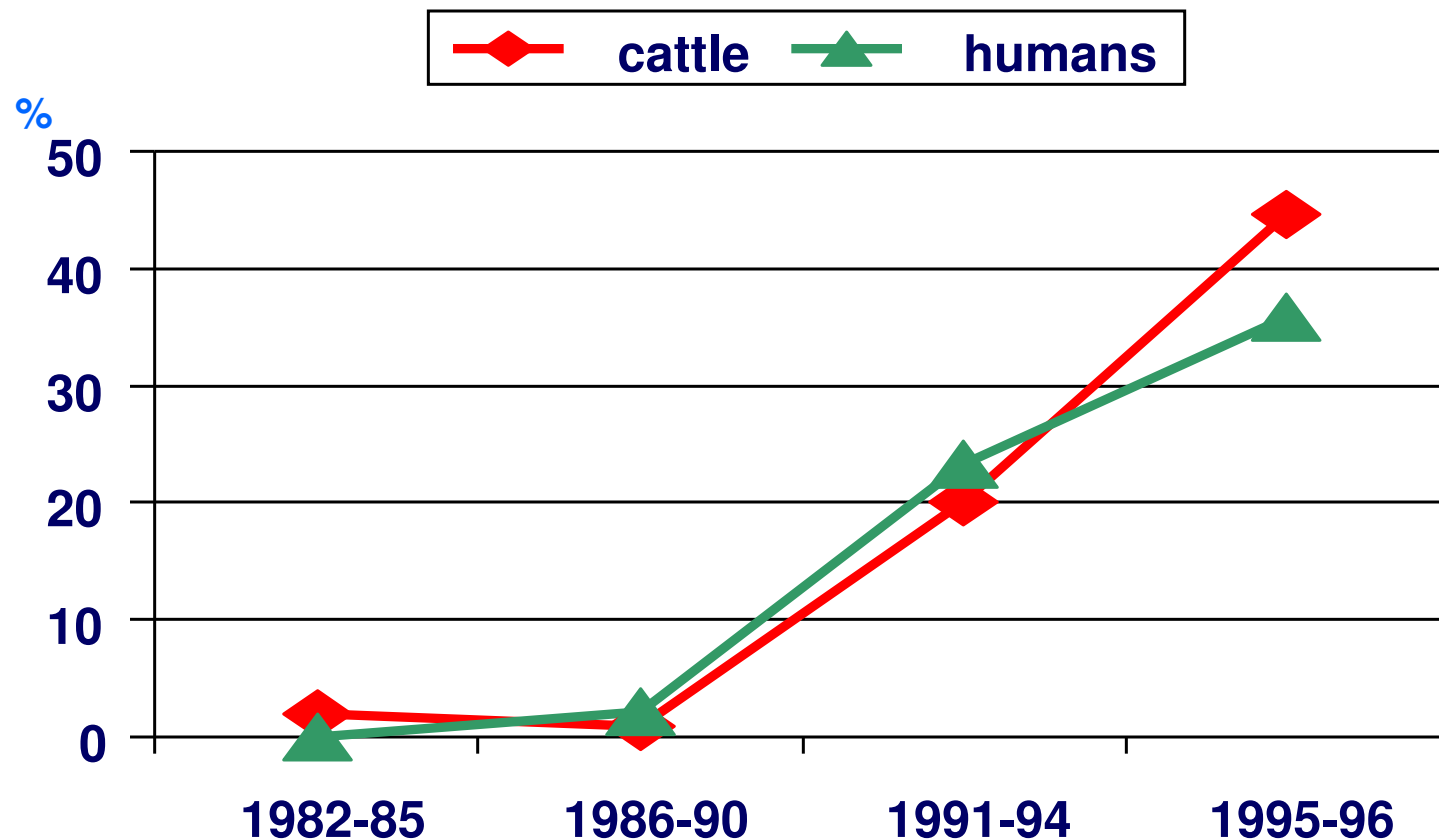
Washington, 11 Oct. (IPS) –

More than half of the antibiotics used in the United States are estimated to be used in **animal feed** for poultry, hogs, and cattle. In 80 percent of cases, the drugs are used to **fatten the animals faster**.

Between **40,000 and 50,000 pounds of tetracycline and streptomycin** - both used to treat infections in humans - are sprayed to control bacterial disease among **fruit trees**.

In the United States nearly **150 pounds** of antibiotic are applied **per acre of salmon**

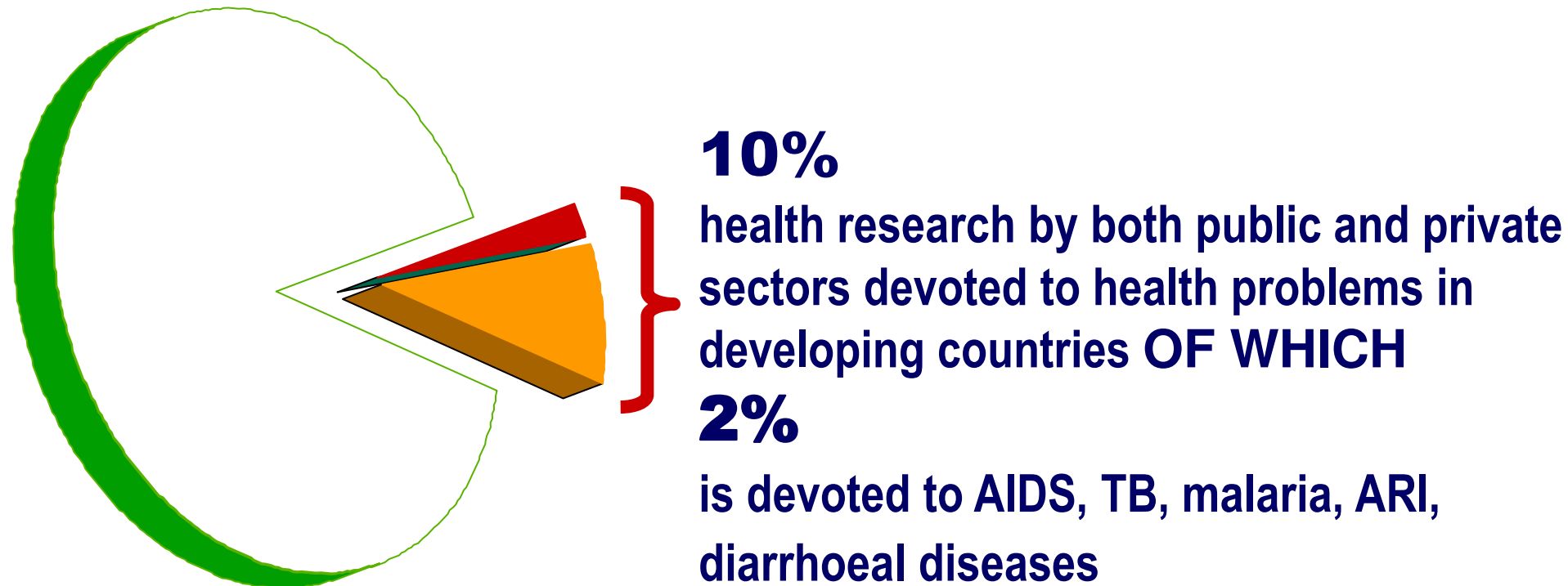
# Multidrug-resistant Definitive Type (DT) 104 Salmonella Typhimurium, Europe, 1982-1996



Source: WHO from published data



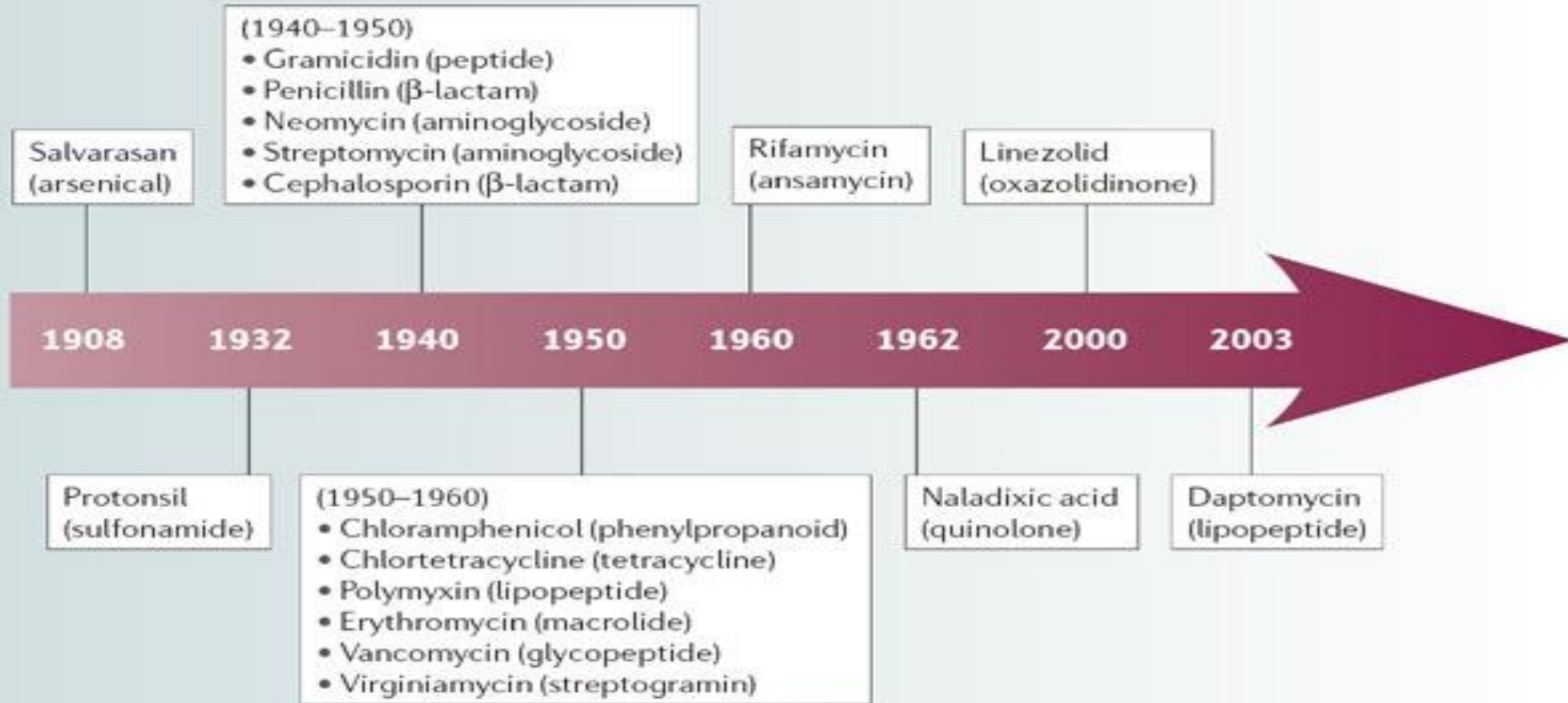
# Failing research and development: 90/10 gap



Source: Global Forum for Health Research

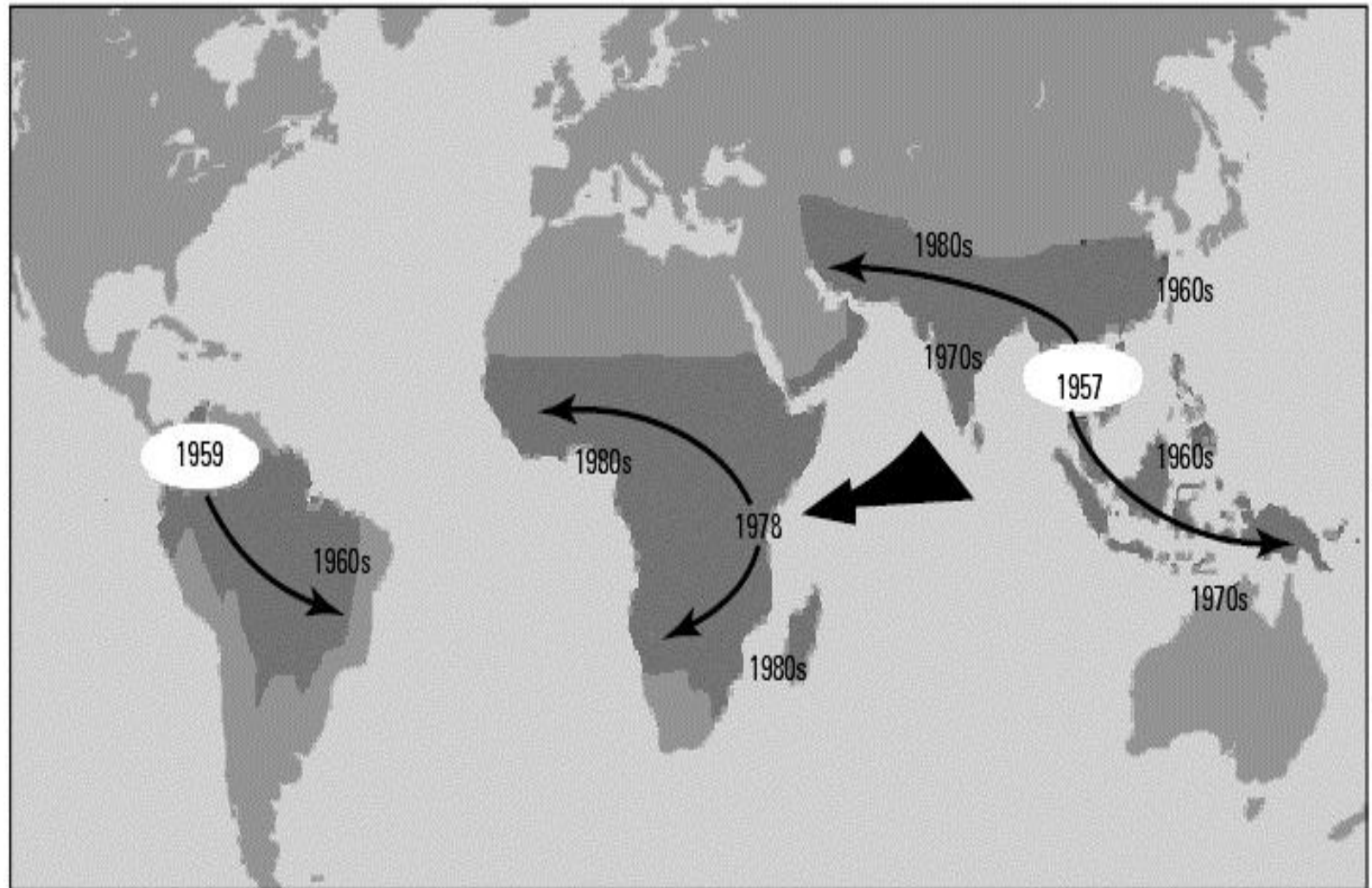
# Discovery of antibiotics: a faltering pipeline

## Timeline | Antibiotic drug discovery



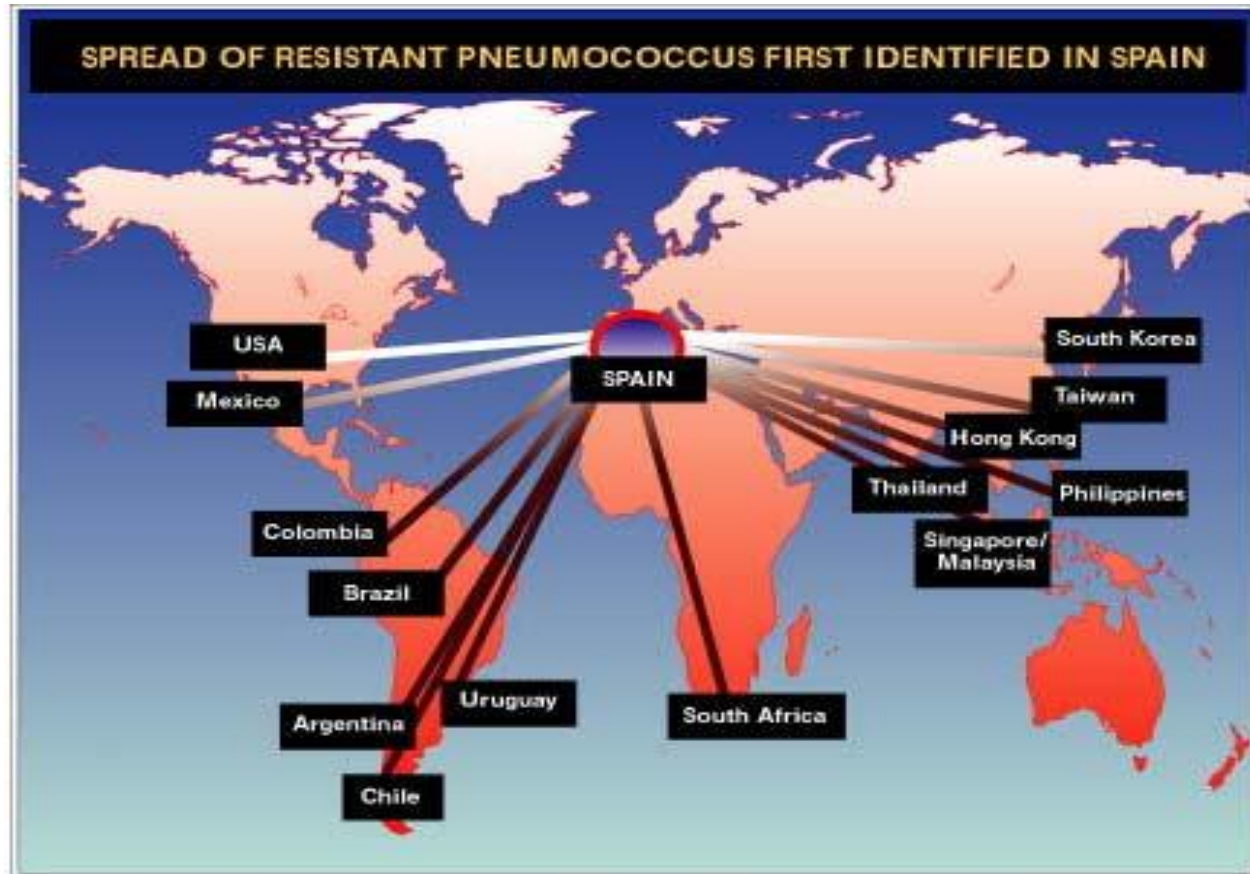
The class of the antibiotic is shown in brackets.

# Global Spread of Chloroquine-Resistant Strains of *P. falciparum*, 1950-1980



Source: Cell. 1997. Global spread of chloroquine-resistant strains of *P. falciparum*.

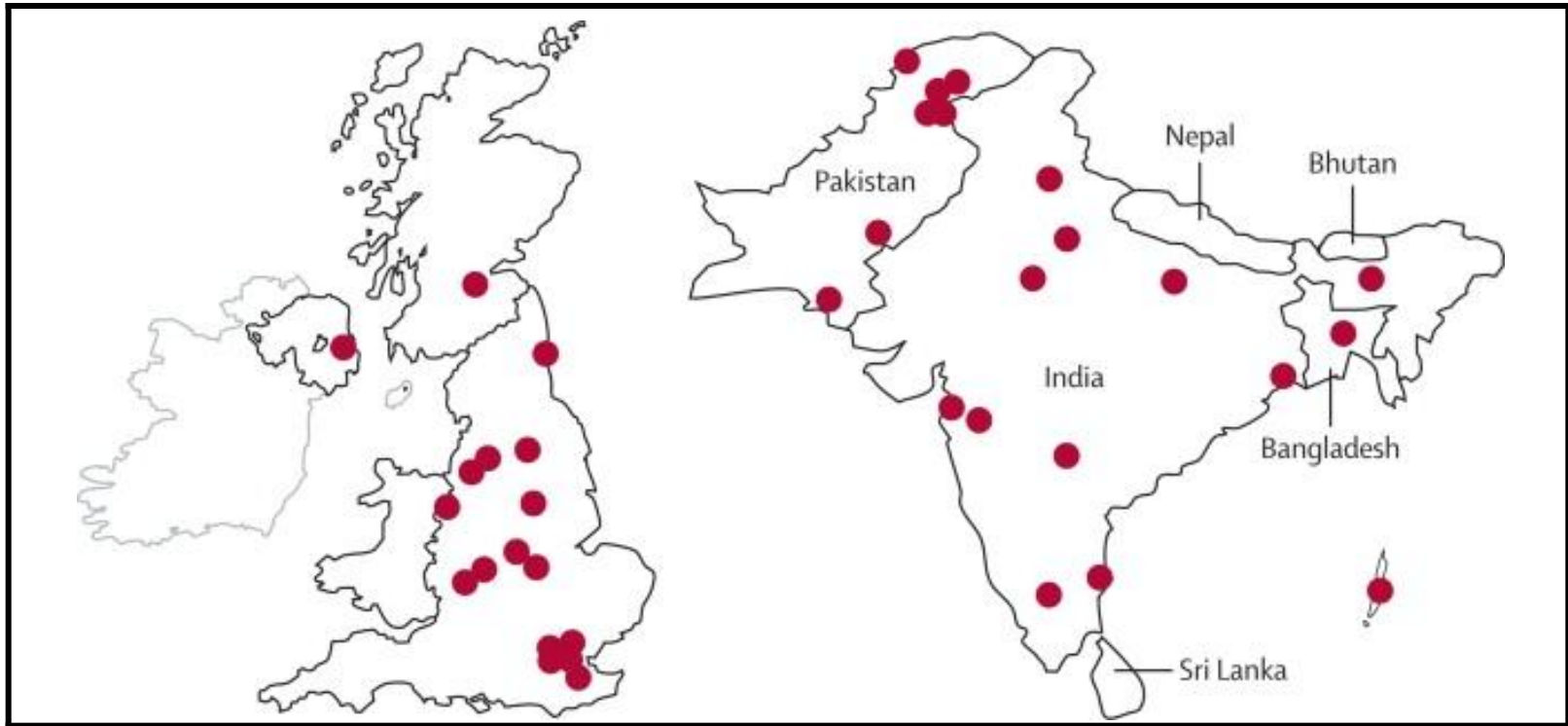
# **Spread of multi-resistant pneumococcus first identified in Spain, 1990s**



*Source: Klugmann, South African Institute of Medical Research*

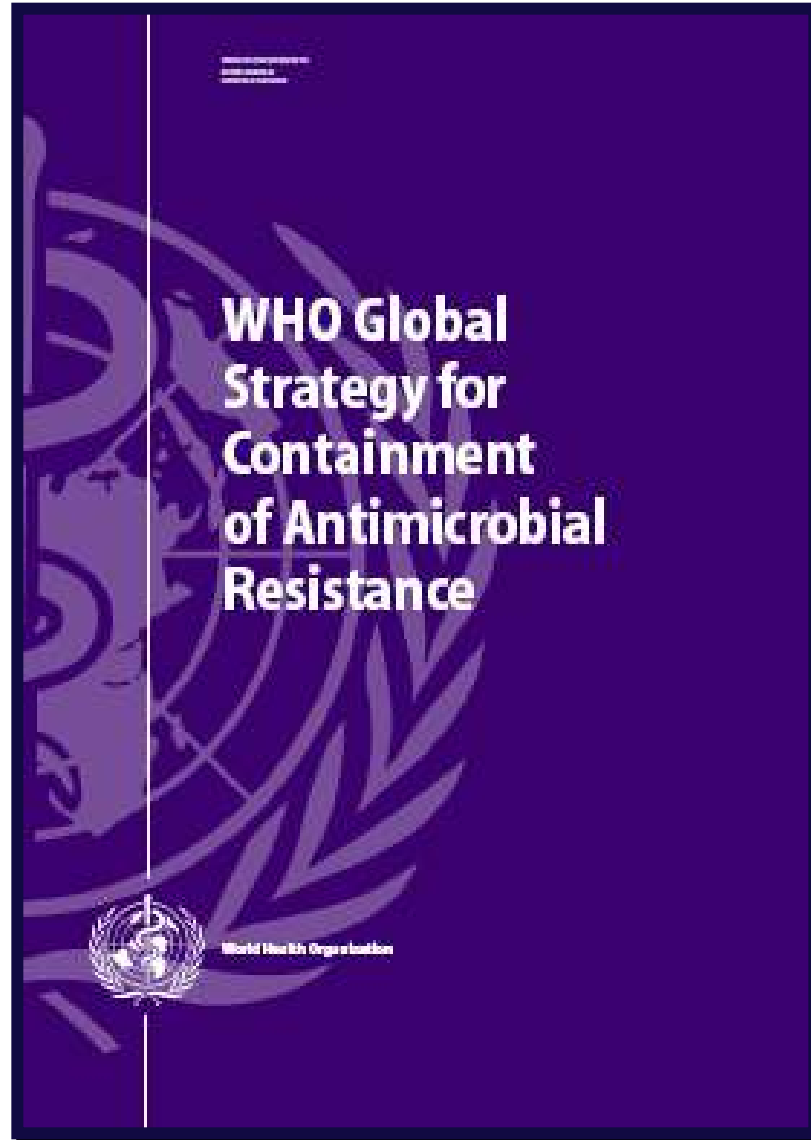
# **Carbapenamase-producing *Enterobacteriaceae* strains.**

**Bangladesh, India, Pakistan and the UK,  
2009**



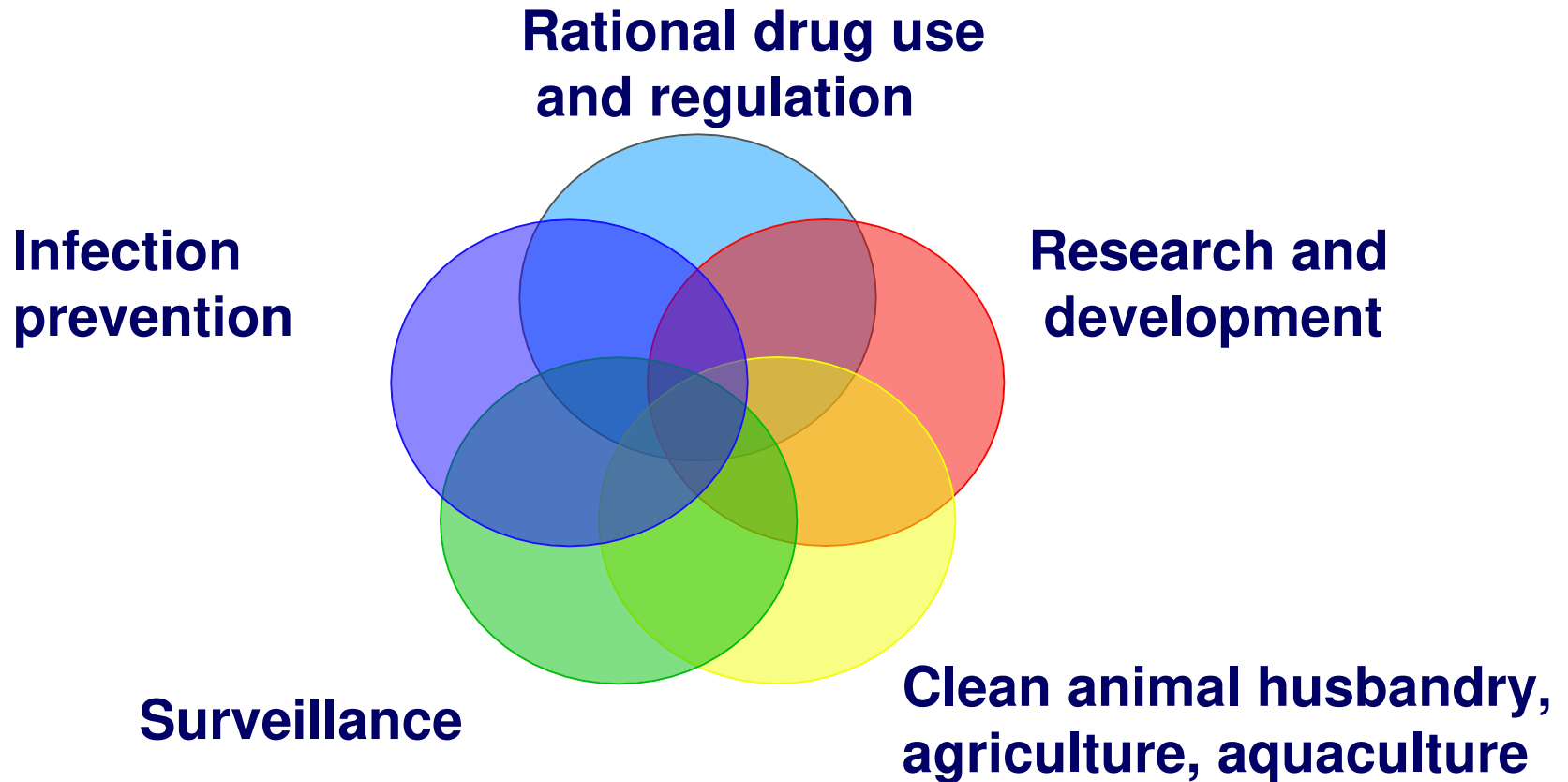
Source: Kumarasamy KK, et al Lancet ID, 2010

# **WHO Global strategy for containment of resistance, 2001**





# **The five key areas for containment of antimicrobial resistance**



# Campaign to decrease antibiotic demand, Europe

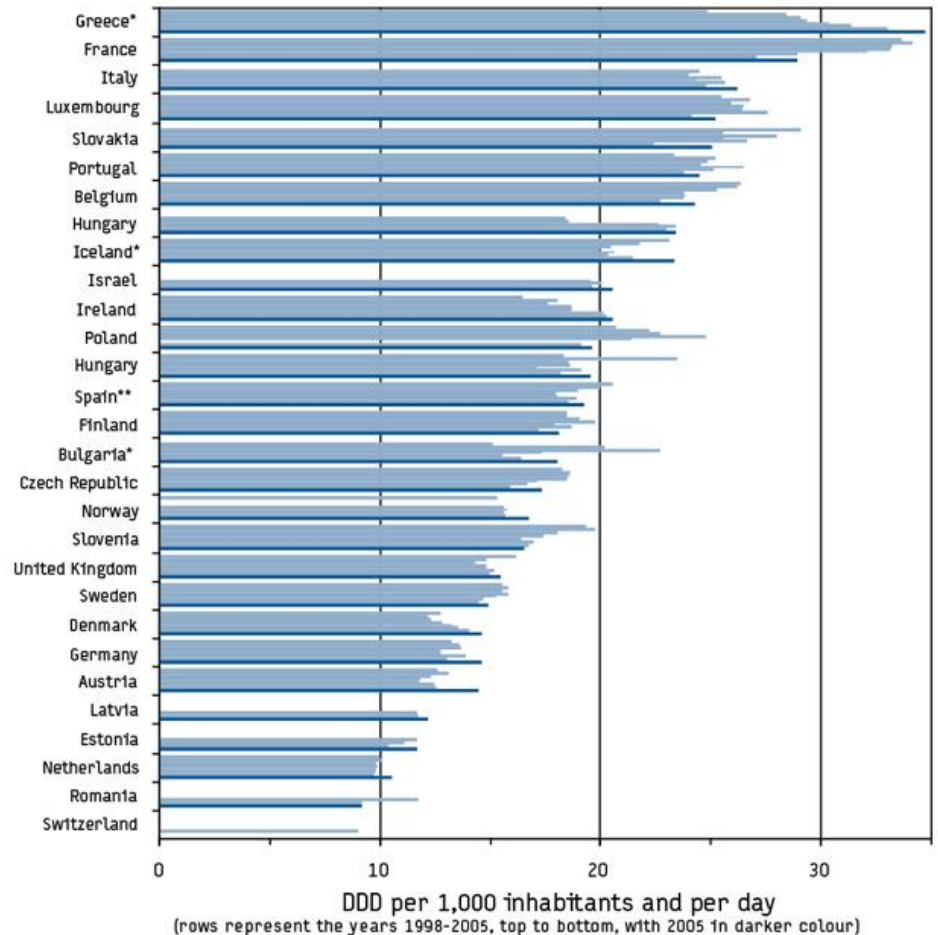


**UNFORTUNATELY,  
NO AMOUNT  
OF ANTIBIOTICS  
WILL GET RID  
OF YOUR COLD.**

The best way to treat most colds, coughs or sore throats is plenty of fluids and rest. For more advice talk to your pharmacist or doctor.

FIGURE 2

Trends of outpatient antibiotic use (ATC group J01) in 29 European countries, 1998-2005



\* BG, EL, IS: Total use, i.e. including the hospital sector (EL, only for 2004 and 2005).

\*\* ES: reimbursement data, which do not include over-the-counter sales without a prescription.



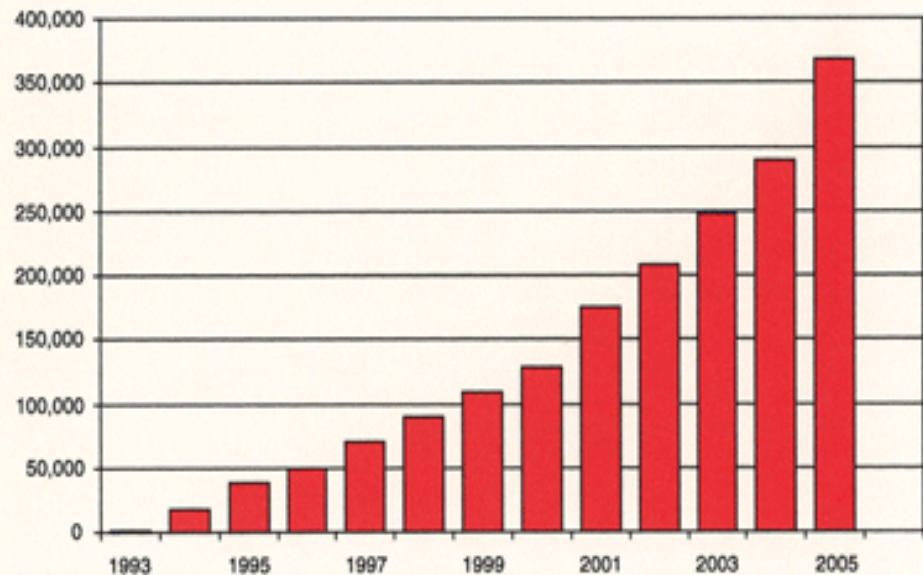
# Hospital Acquired Infections and antimicrobial resistance, 1993 - 2005



DON'T GIVE BACTERIA A FREE RIDE.

WASHING YOUR HANDS  
WITH SOAP AND WATER  
IS ONE OF THE BEST WAYS  
TO PREVENT DISEASES.

Annual Hospital Admissions with MRSA  
USA



- CDC (2007)

# European ban on use of antibiotic for animal growth promotion

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## World: Europe

### EU bans farm antibiotics



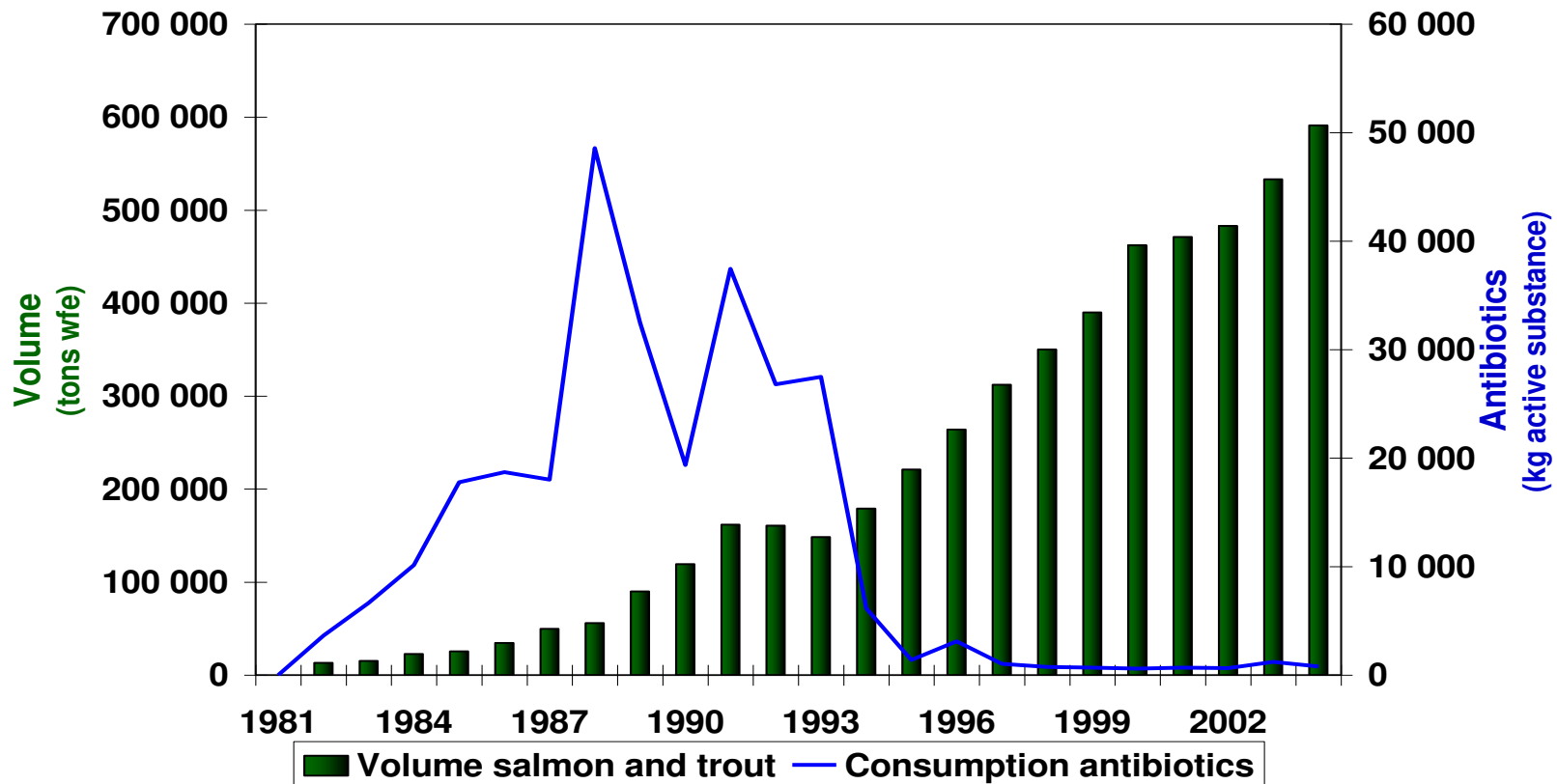
Antibiotics are used in animal feed to stop disease spreading through a herd

The use of four antibiotics in animal feed has been banned throughout Europe because of the possible risks to human health.

Twelve EU agriculture ministers including Britain's Nick Brown, endorsed the Commission proposal, with Belgium, Portugal and Spain abstaining.

The ban will be phased in over six months, with the use of the antibiotics outlawed in Britain from July 1 next

# Antimicrobial use in Salmon and trout production in Norway



Source: FAO/OIE/WHO Expert consultation on antimicrobial use in aquaculture and antimicrobial resistance, 2006

# WHO - Patient Safety Programme

## Report on examples of containment



**Patient Safety**  
A World Alliance for Safer Health Care

To be  
released  
in 2011

### COMBATING ANTIMICROBIAL RESISTANCE: EXPERIENCES FROM THE FIELD

A reference book describing the need for and examples of successful interventions

To help national policy-makers dealing with health, the pharmaceutical industry, animal husbandry and civil society engagement, WHO will release, in 2011, a book entitled 'COMBATING ANTIMICROBIAL RESISTANCE: EXPERIENCES FROM THE FIELD'. The book builds and expands on the six points highlighted in the World Health Day 2011 policy package to tackle the growing global problem of antimicrobial resistance. It provides in-depth analysis of the need for and examples of successful interventions in reducing antimicrobial resistance across WHO Member States. It is the result of wide international expert consultations organized by WHO, supported by literature reviews and experiences of groups involved in addressing AMR at the national and international level.

#### The Causes

##### SIX MAJOR FACTORS TOGETHER DRIVE AMR: INTERVENTIONS NEED TO ADDRESS ALL THESE FACTORS

- Lack of comprehensive national actions with civil society engagement to address AMR
- +
- Lack of laboratory capacity and surveillance lead to inadequate information for choosing treatment for individual patient and for making policy decisions
- +
- Overuse of antibiotics for diseases that do not require them and underuse due to insufficient doses, duration or use of antibiotics of substandard potency
- +
- Unnecessary use of antibiotics in food-producing animals, especially for supposed benefits in disease prevention and growth promotion
- +
- Insufficient measures to prevent the spread of resistant bacteria in hospitals and the community
- +
- Inadequate momentum in research and development in the essential technologies to combat AMR, e.g. drug, diagnostics and vaccine

#### The Problem

BACTERIA DEVELOP RESISTANCE AND RESISTANT BACTERIA THRIVE



SPREAD

PATIENTS AT RISK OF PROLONGED DISEASE, MORE COMPLICATIONS OR NO CURE AT ALL DUE TO DELAY OR ABSENCE OF CORRECT TREATMENT

+  
DIRECT AND INDIRECT COSTS TO PATIENTS AND THEIR FAMILIES

#### Possible Solutions


##### COMBATING ANTIMICROBIAL RESISTANCE: EXPERIENCES FROM THE FIELD

Addressing the six points identified for action in the World Health Day 2011 policy package


- The evidence for action
- Surveillance of antimicrobial resistance and use
- Rational drug use and regulations
- Animal husbandry regulations
- Infection prevention and control in health-care facilities
- Enabling innovations in technology
- Intersectoral and multi-disciplinary nationally coordinated actions involving civil society


# Antimicrobial resistance: the problem is global, the solutions are local






Global  
Antibiotic  
Resistance  
Partnership







**SITUATION ANALYSIS:**  
Antibiotic Use and Resistance in Vietnam

The GARP- Vietnam National Working Group  
Dr. Nguyễn Văn Kinh, Chairman

October 2010

**CDDEP** THE CENTER FOR  
Disease Dynamics,  
Economics & Policy  
WASHINGTON DC • NEW DELHI