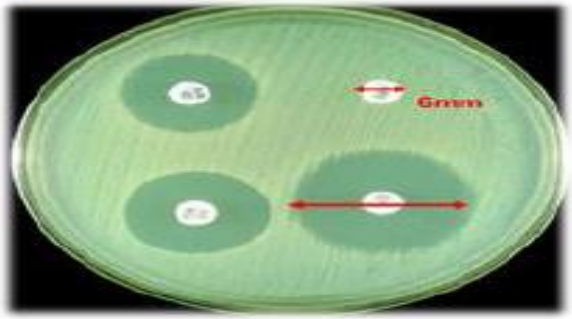
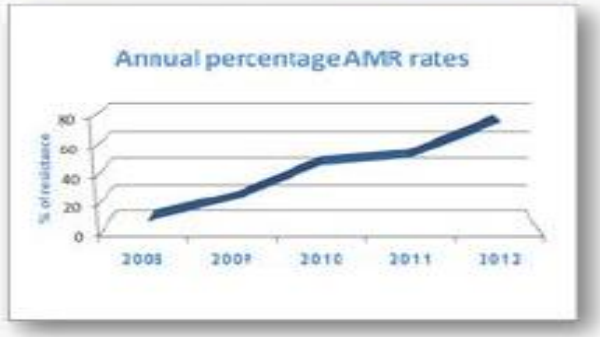




Role of the laboratory in AMR control.

Pr Abdoul-Salam OUEDRAOGO

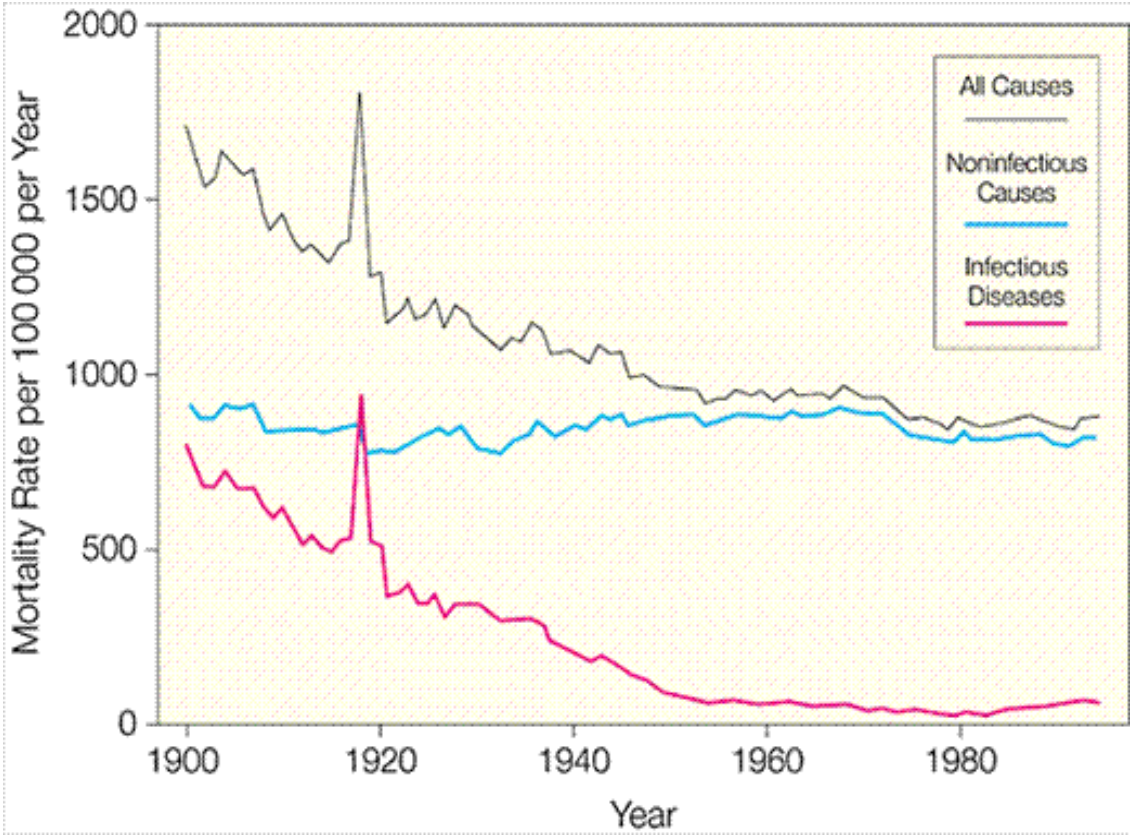
PharmD, Msc, PhD.

Full Time Lecturer

Head of Bacteriology-Virology Department

AMR National Reference Lab

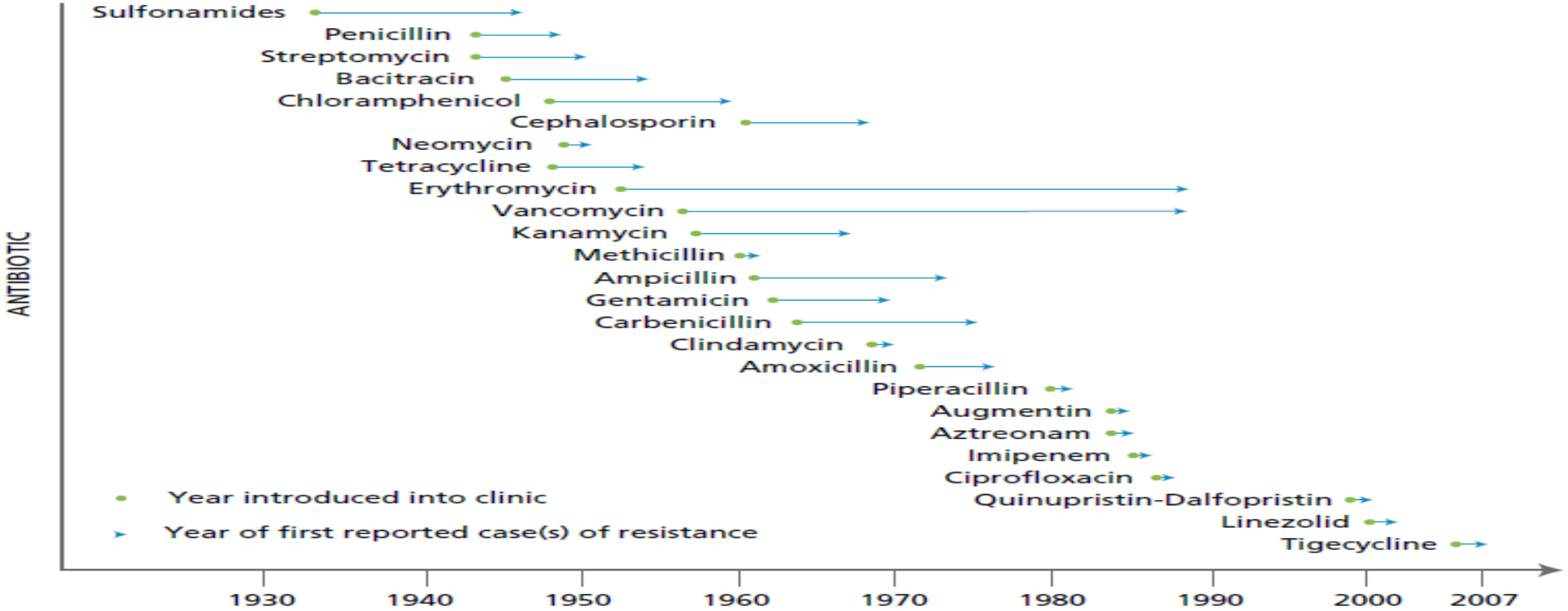
Antibiotics: The ‘miracle’ of XXth century



- Discovery of penicillin revolutionised treatment of infectious disease
- Increased life expectancy due to ability to prevent and treat infection

Crude mortality rates for all causes, non infectious causes and infectious diseases over the period 1900-1996.

A short time success story….

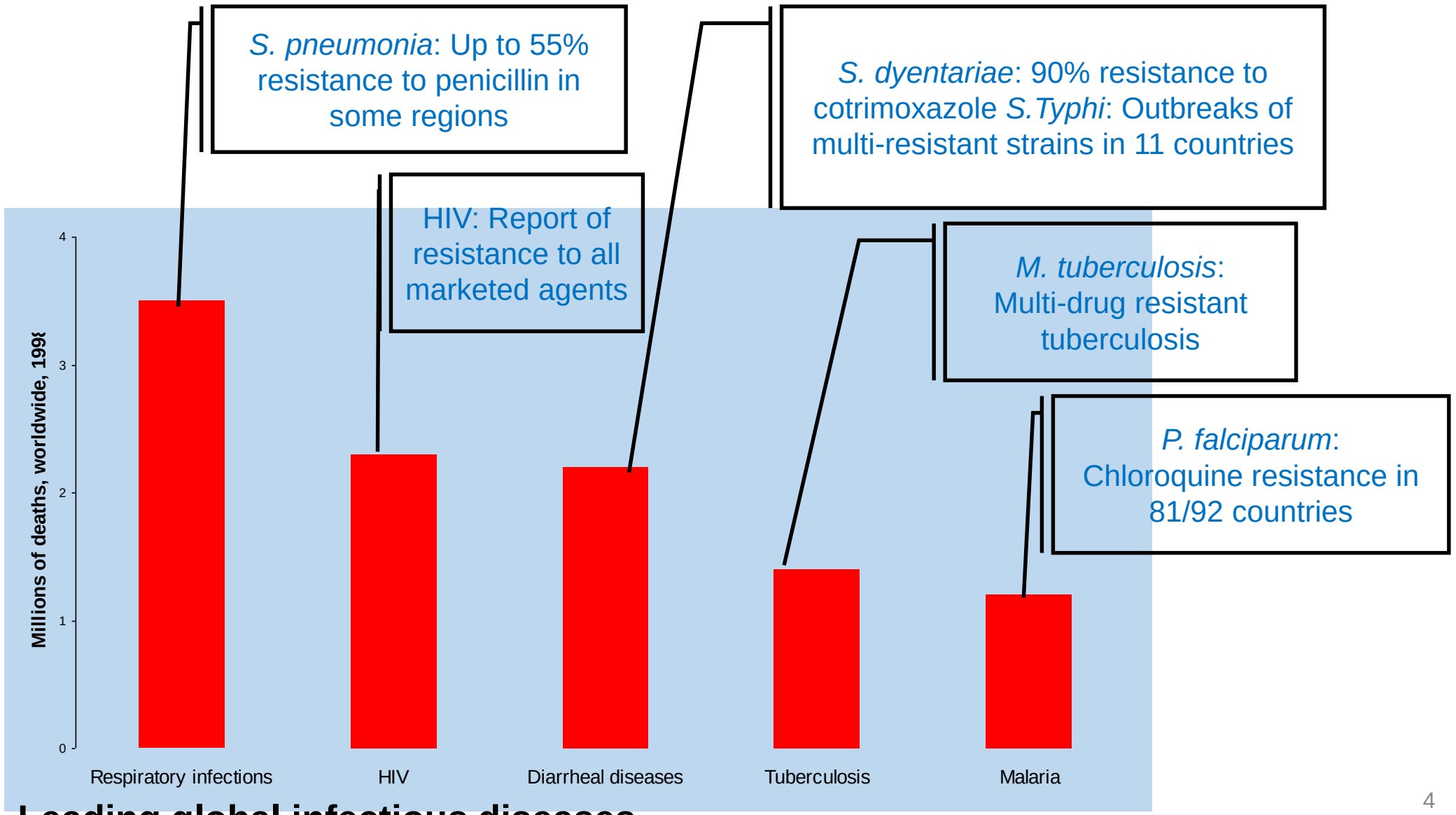


Note: Some of the dates are estimates only.

"It is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them, and the same thing has occasionally happened in the body."

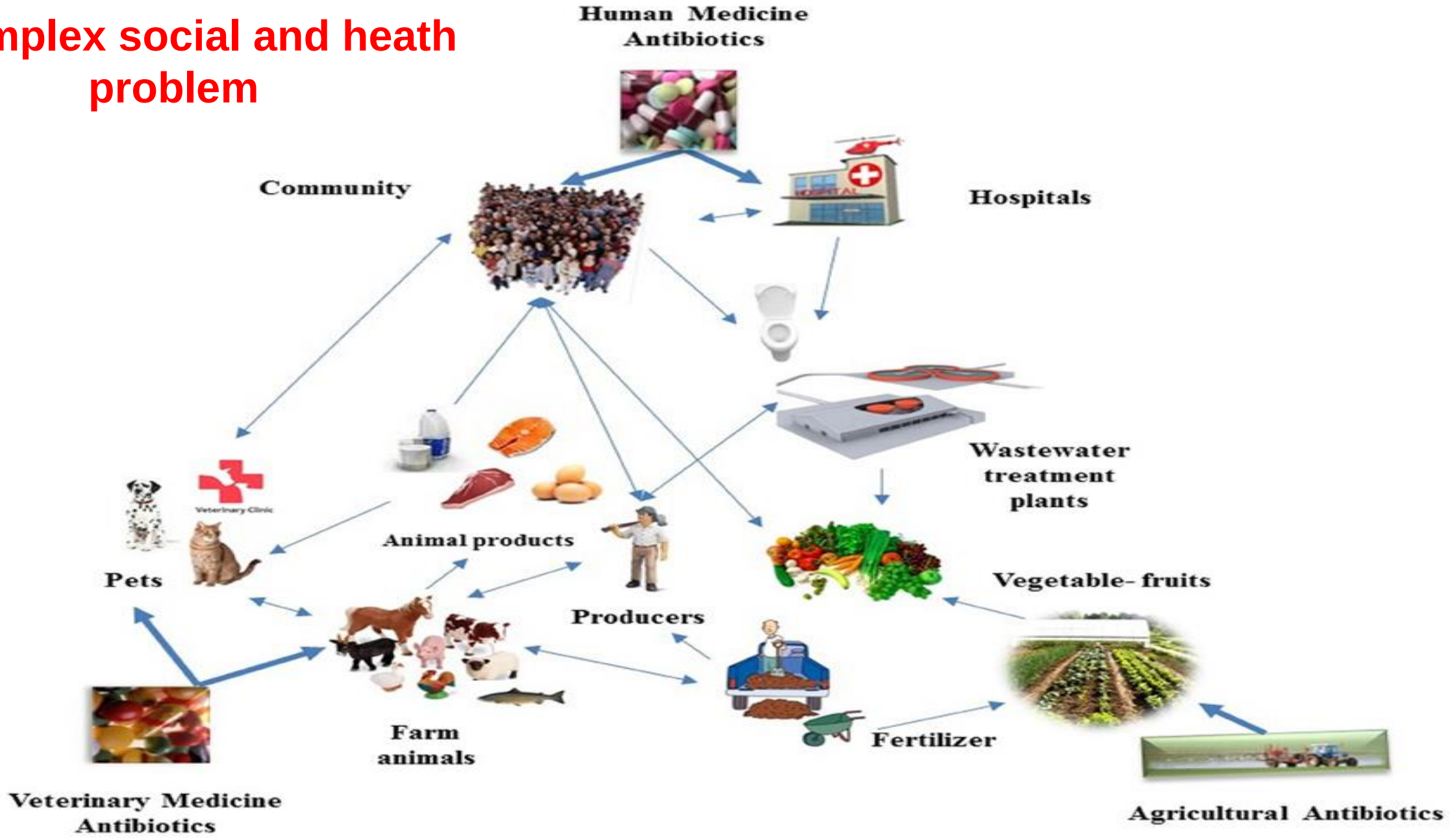
Sir Alexander Fleming, 1945

Resistances on all fronts ... .parasites, viruses, bacteria in various pathologies



Leading global infectious diseases

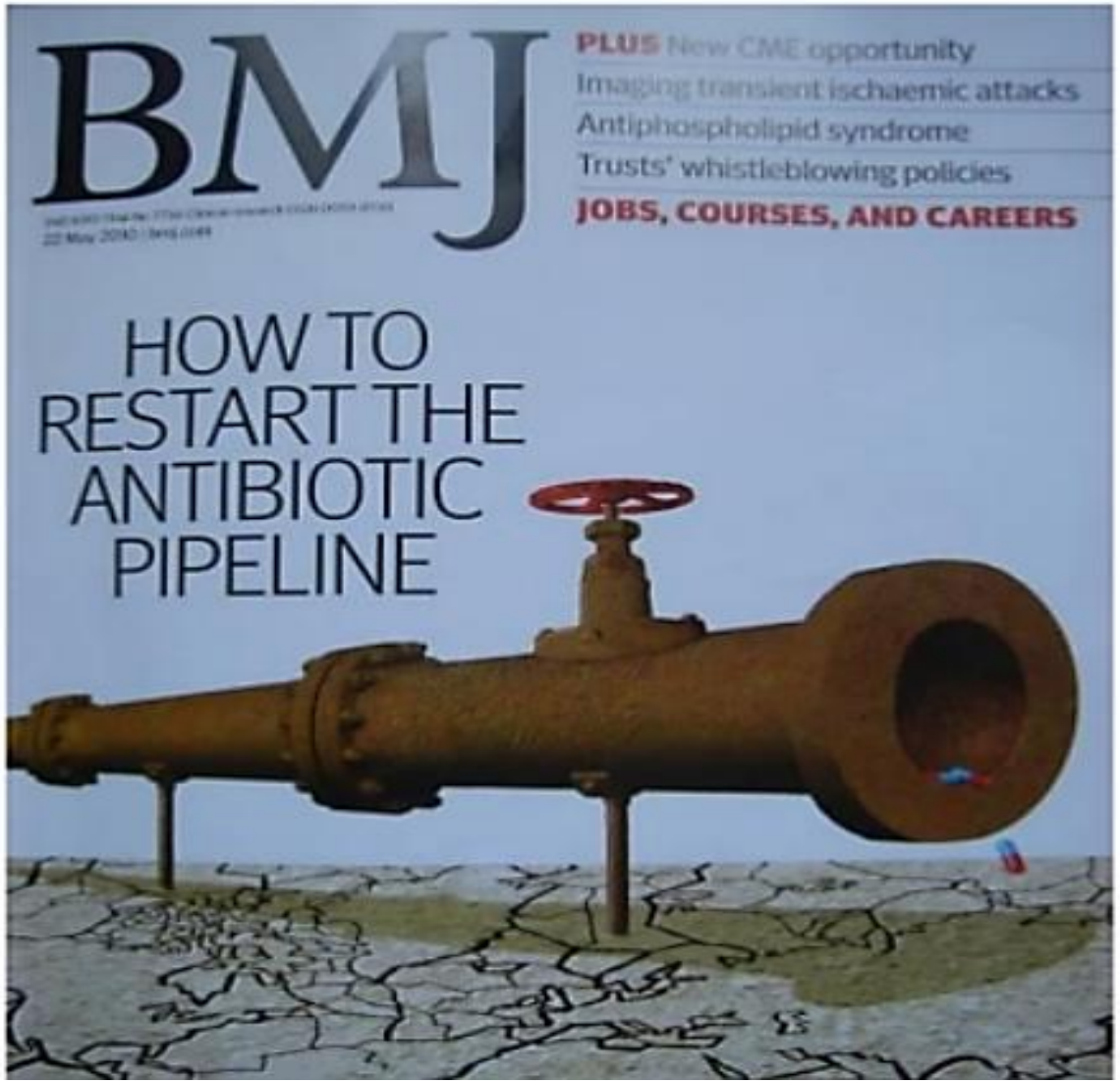
A complex social and heath problem

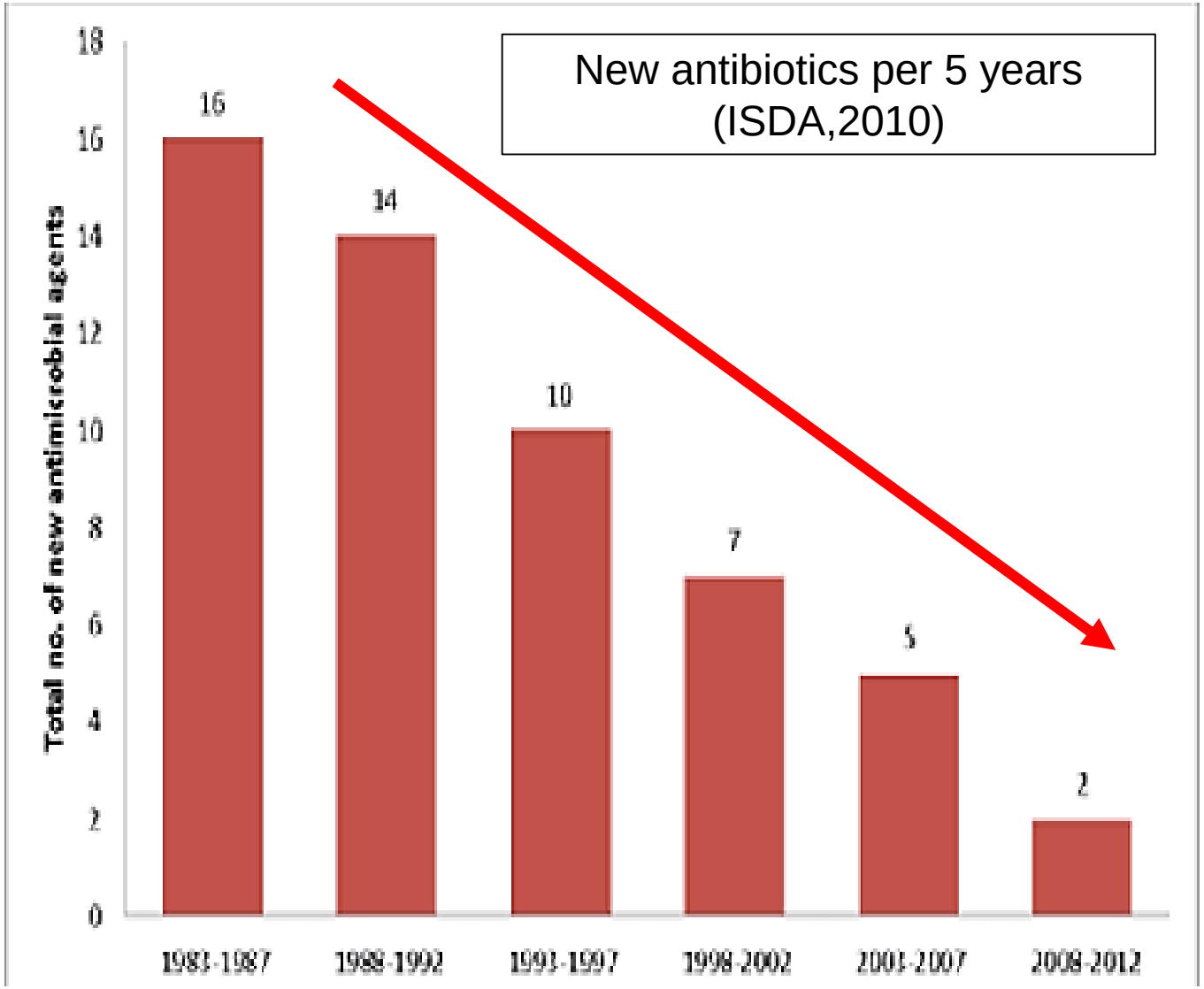


Dissemination of antibiotics and antibiotic resistance within agriculture, community, hospital, wastewater treatment, and associated environments.

Contas L.,2013

Dry up of pipelines

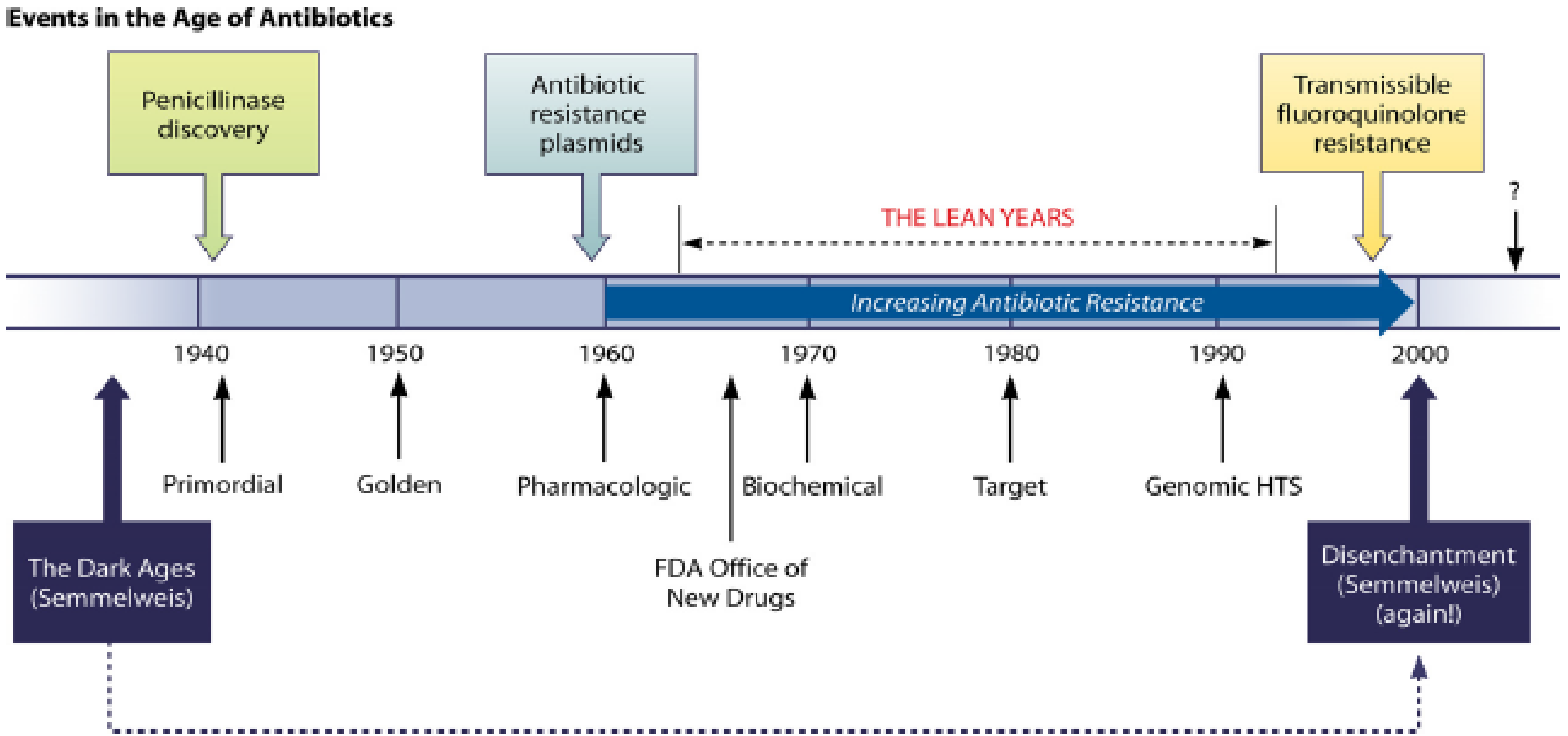




↑Increasing antibiotic resistance, Increased use of antibiotics and Decreasing pipeline of new antibiotics

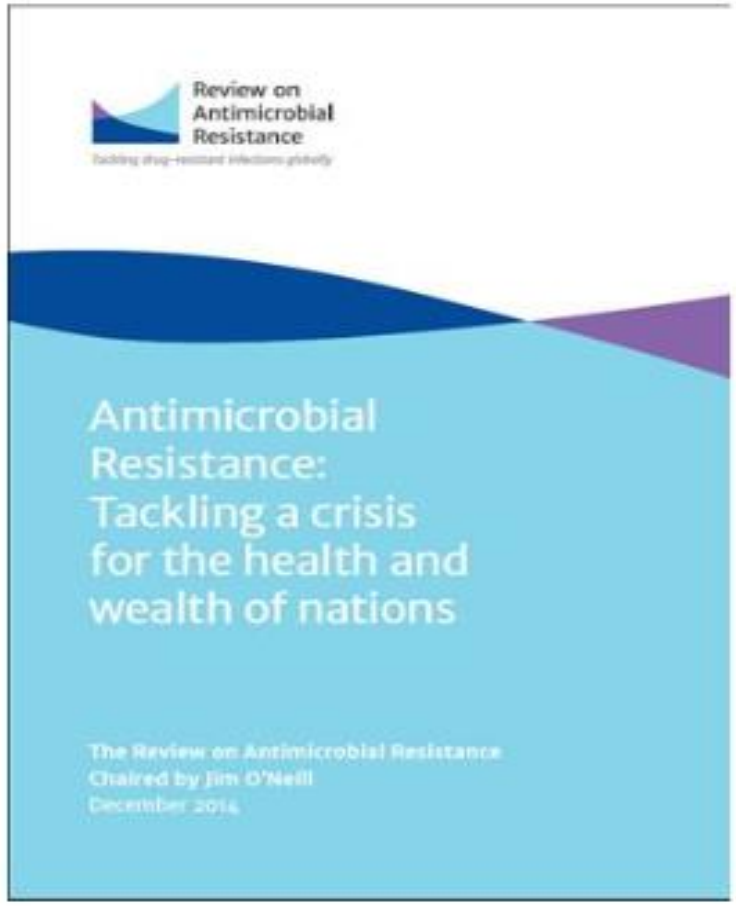
On Going to post-antibiotic era….?

- **As advocated by *Semmelweis* in pre-antibiotic era, hand washing become again today the best way of avoiding infection**

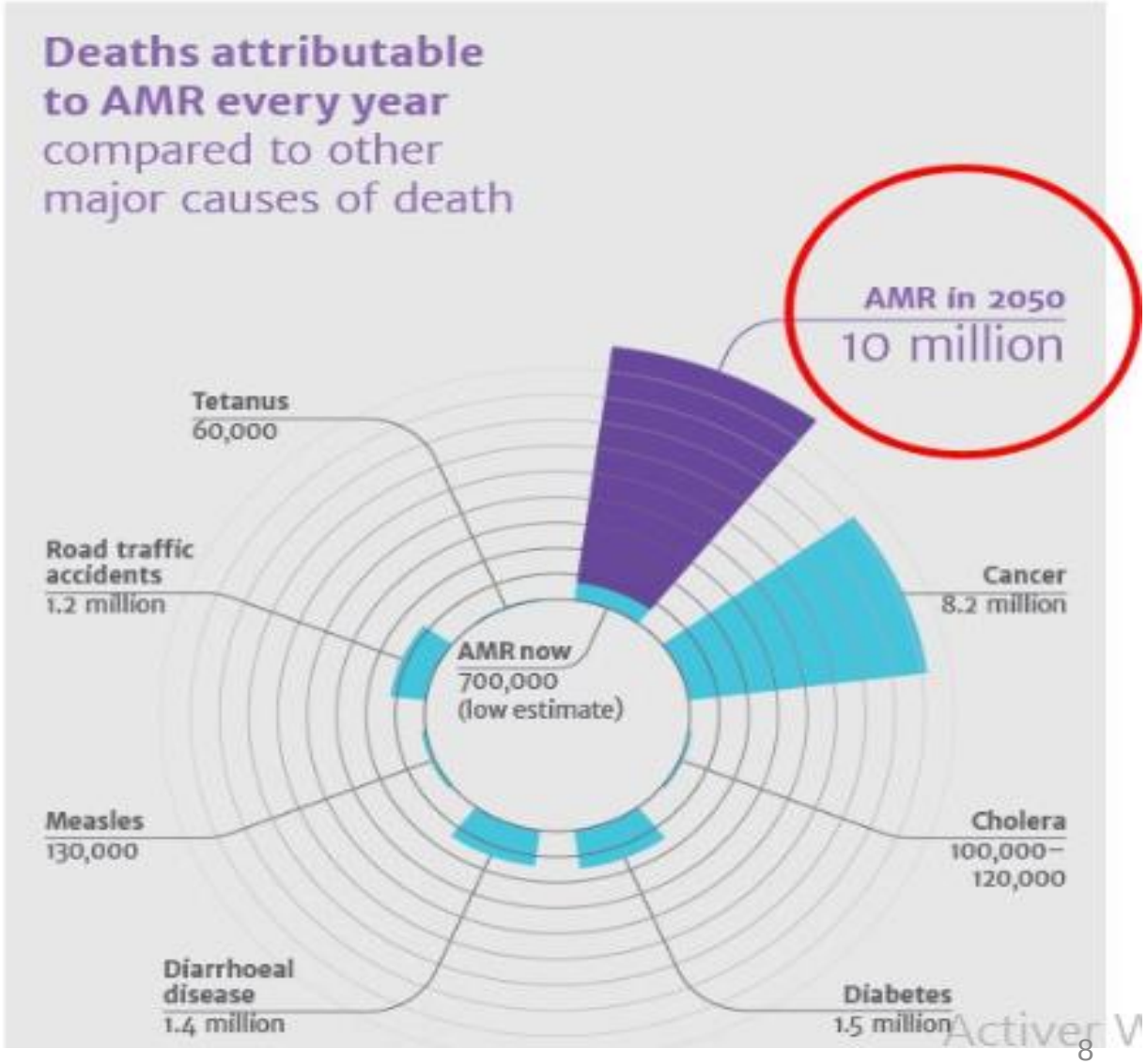


Julian D. 2010

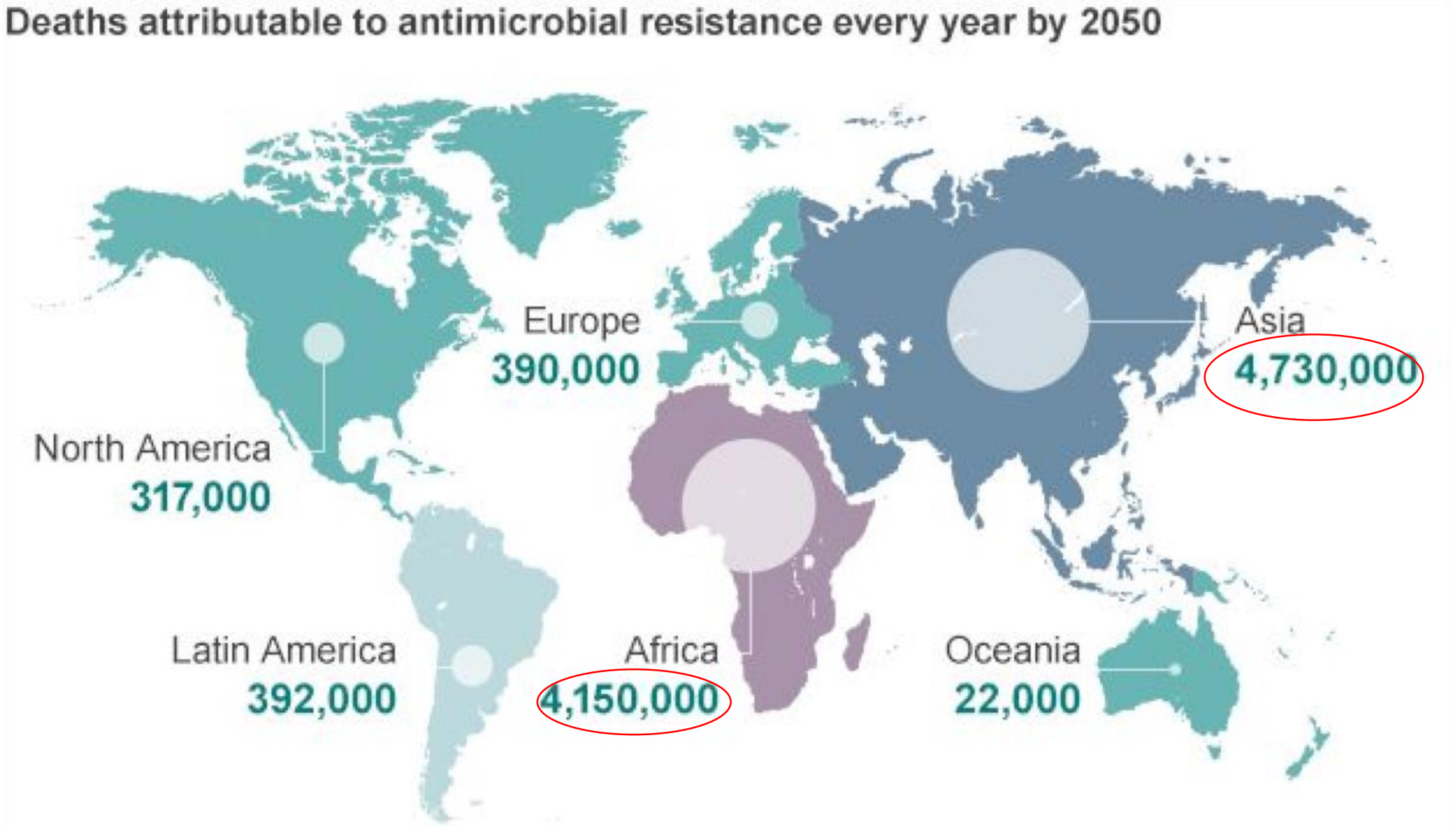
Bleak skyline….if effortless



JUM O.,2014



Asia and Africa will (again) pay the heavy burden ....



What strategies use ?……

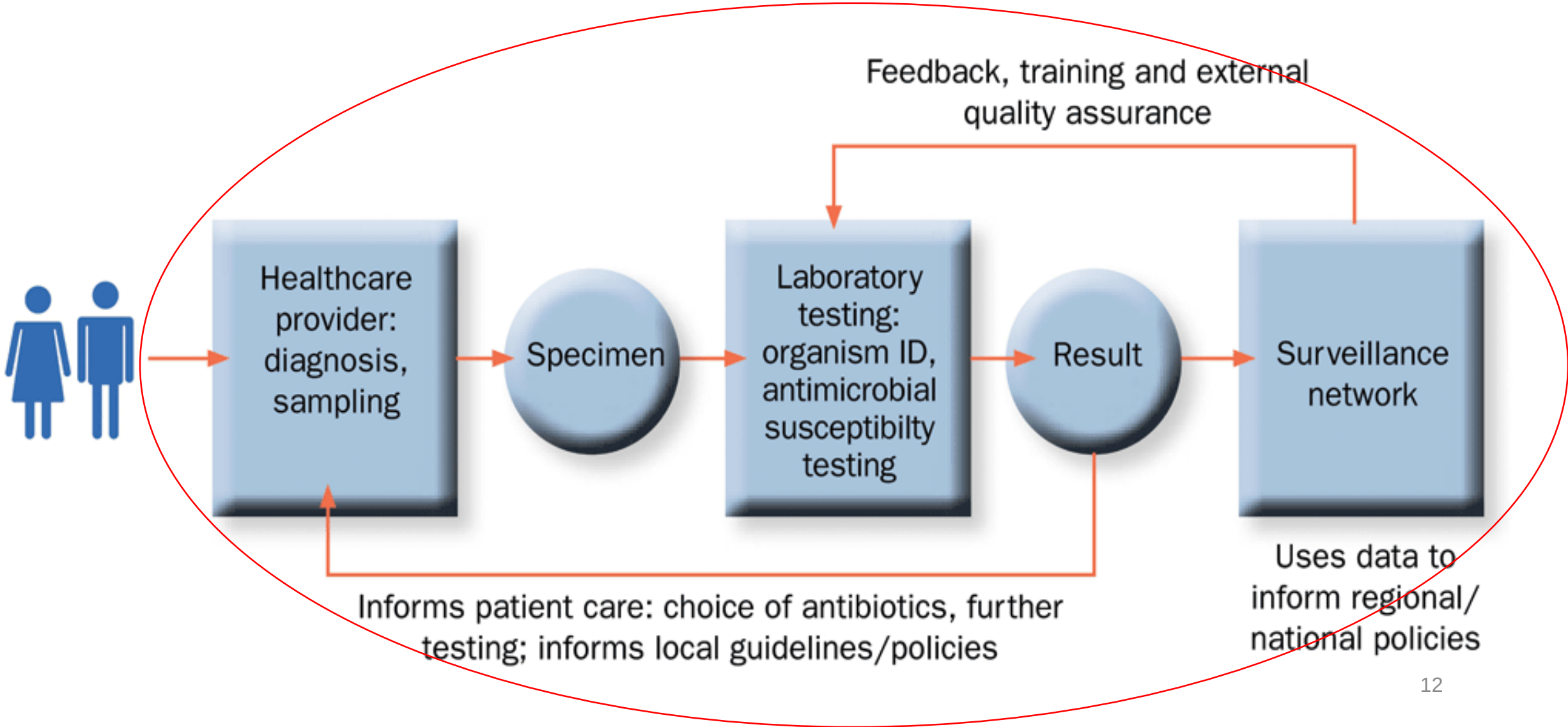
Global solutions for a worldwide problem…

5 Strategic objectives

1. Improve awareness and understanding
2. Strengthen the knowledge and evidence base through surveillance and research
3. Reduce the incidence of infection
4. Optimize the use of antimicrobial medicines
5. Develop the economic case for sustainable investment

What about Lab contributions to achieve these objectives??

AMR control steps : Lab place



1.Improve awareness and understanding

Communications from lab: a evidence-based…

❑**Clinical functions**:

- Adequate training on AMR to prescribers and other health professionals
- Patient education to reduce unnecessary antimicrobials use

❑**Public heath functions**:

- Updated reports to policy makers.
- Inform media and all stakeholders on AMR issues.
- Communicate on AMR causes.

Adequate training on AMR to prescribers and other health professionals

- **Participation of Lab Team to (Daily) multidisciplinary work**

- Microbiologists are in an excellent position to disseminate information on antimicrobial resistance to health Professionals
- Opportunity to discuss specifics cases or issues
- Elaborate antimicrobial using guidelines

2.Strengthen the knowledge and evidence base through surveillance and research

The lab for better identify the enemy and choose the most suitable weapon….

❑Lab’s clinical functions

- Identify aetiology of human and animal infections.
- Monitor efficacy of antibacterial treatment.
- Communicate susceptibility testing results to clinicians.
- Pilot and then implement new technologies that could increase the access and speed of testing or reduce its cost.

Identify aetiology of human and animal infections

- Once a laboratory is capable of isolating and identifying pathogens from clinical specimens.
- Disc tests are the most commonly-used methods of bacterial susceptibility testing worldwide(manual or automatic methods)

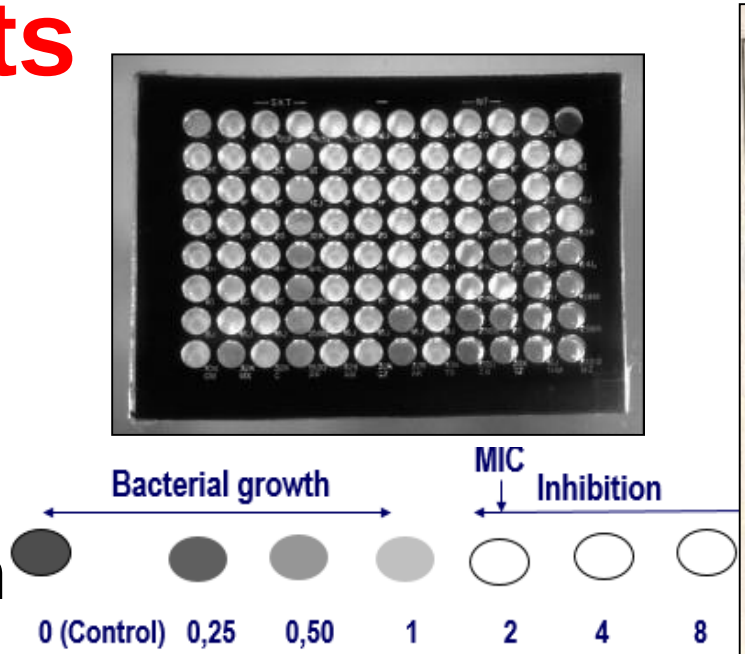
- Diagnostic testing is a powerful tool management of infectious diseases in individual patients as well as for public health purposes

Antimicrobial susceptibility tests

Minimum inhibitory concentration [MIC]

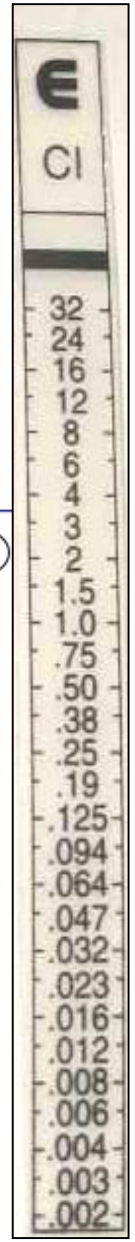
- The smallest concentration of antibiotic that inhibits the growth of organism

Liquid media (dilution) allows MIC estimation



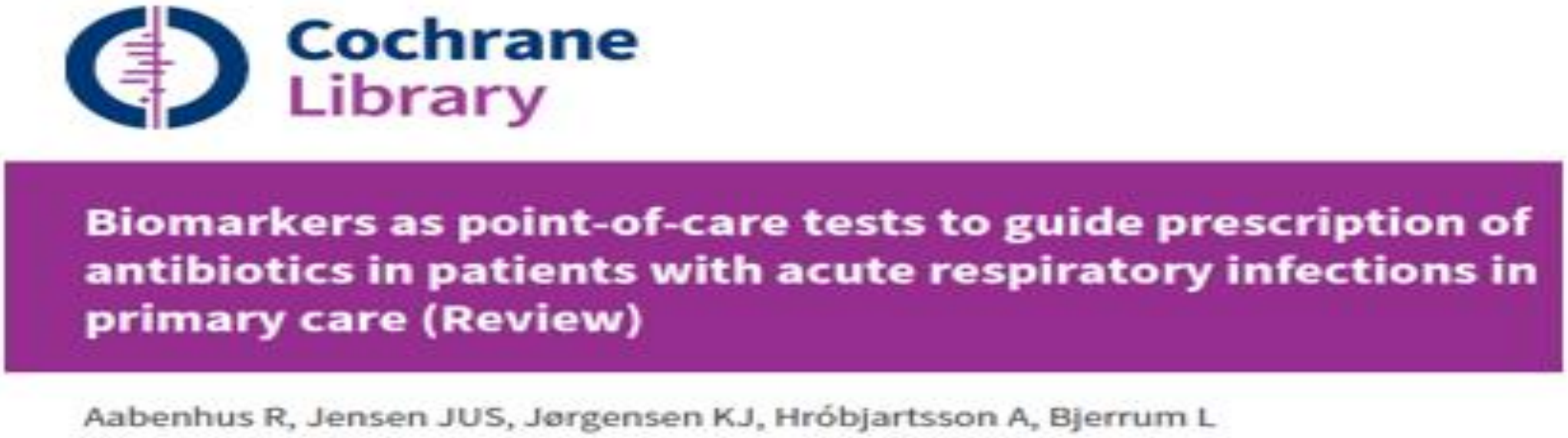
Solid media (diffusion)

- Disk diffusion (Kirby-Bauer)
- E-tests
- Allows MIC estimation



Identify aetiology of human and animal infections

Biomarker tests can rapidly narrow differential diagnoses



- Biomarker tests that provide rapid results and can reliably identify a bacterial infection,
- C-reactive protein and procalcitonin are among useful markers of systemic bacterial infection

Communicate susceptibility testing results to clinicians (Lab antimicrobial stewardship)

Choose what to show to protect the best……

"Nudging" in Microbiological Reports: A Strategy to Improve Prescribing

"Nudge" strategy	Possible use in microbiological reporting
Putting choices at "eye level"	Emphasizing certain antimicrobials by using bold or larger font and/or placing them at the top of the list ("at eye level")
Default choice	Restricting reports to selected antimicrobials and providing further data on request only
Framing	Changing the context of data presentation, e.g. by providing interpretation (colonization versus infection) or information on substances (broad or narrow spectrum, pharmacokinetics, adverse events, costs, etc.)

Source: Katchanov J, Kluge S, MacKenzie CR, Kaasch AJ. "Nudging" in microbiological reports: a strategy to improve prescribing. Infection. 2016 Aug 19 [Epub ahead of

Communicate susceptibility testing results to clinicians(Lab antimicrobial stewardship)

Selective Reporting of Ciprofloxacin

Before → After

Culture Urine	Escherichia coli >100 x E6 CFU/L.
Ampicillin:	S
Cefazolin:	S
Ciprofloxacin:	S
Gentamicin:	S
Nitrofurantoin :	S
Tobramycin :	S
Trimethoprim/Sulfa:	S

Culture Urine	Escherichia coli >100 x E6 CFU/L.
Ampicillin:	S
Cefazolin:	S
Gentamicin:	S
Nitrofurantoin :	S
Tobramycin :	S
Trimethoprim/Sulfa:	S

Example: In St. Joseph's Health Centre(Canada) This method provide decrease of Cipro using -39.2%(-59.5 to -18.9)

Langford BJ,2016

Lab research to answer complex questions…

❑**Lab's public heath functions**

- Support research to develop point-of-care assays for the rapid diagnostic of bacterial infections.
- Implement quality assurance for susceptibility testing.
- Develop strategies for AMR surveillance at the human-animal and the human-ecosystem interface.
- Develop and implement national AMR laboratory based-surveillance plans

Surveillance for control of antimicrobial resistance: Stay awake to avoid unpleasant deletions….

- Qualifying and quantifying the problem,
- Informing essential empiric prescribing of medication.
- Somes time the precise magnitude of resistance is not known. Lab testing and surveillance provide scope and volume of the problem

GLASS
Global AMR Surveillance System

Laboratory based surveillance for control of antimicrobial resistance

- Surveillance determines **burden of health-care-associated infections and antimicrobial resistance**
- It provides the necessary information to develop and monitor therapy guidelines, antibiotic formularies, antibiotic stewardship programs, public health interventions, infection control policies, and novel antimicrobials and vaccines.
- Development of both algorithms for empirical antibiotic therapy and stewardship programs.

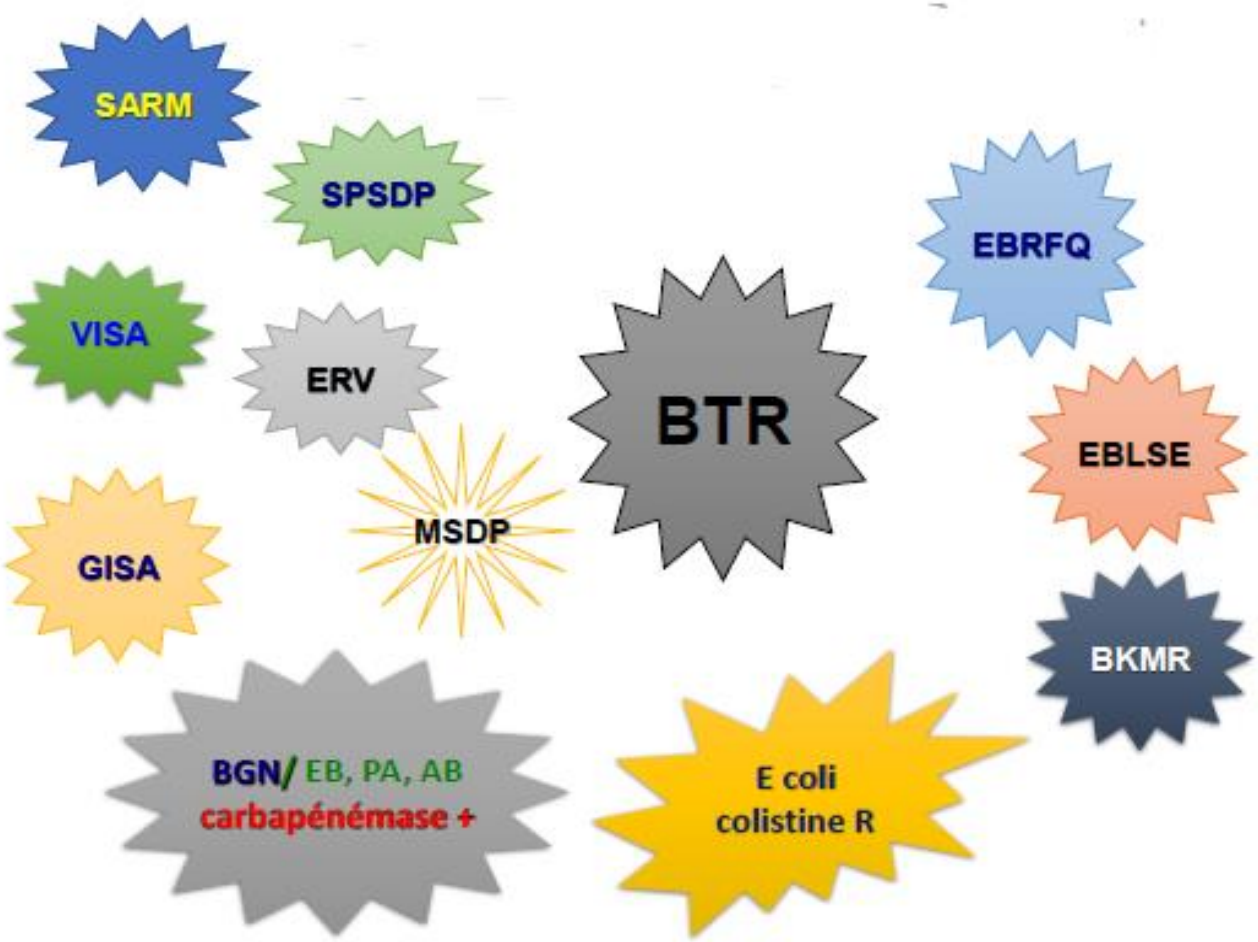
3.Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures

3.Reduce the incidence of infection

❑**Lab's clinical functions:**

- Support infection control by identifying and segregating patients infected by resistant pathogens.
- Permit source-tracking for infections.

Lab in infection control system: outbreaks investigation



- MRB / HRB Screening
- Participation in microbiology network surveys of CLIN-BMR / BHR
- Regular Microbiological Control Medical Devices (Endoscopes)

4.Optimise the use of antimicrobial medicines

4.Optimise the use of antimicrobial medicines

❑**Lab's clinical Functions**

- Allow for broad-spectrum regimen to be replaced with narrow spectrum drugs,
- Thereby reducing the risk of antibiotic-associated infections.

When the prognosis depends on your speed….

- **Informed prescribing for life-threatening invasive disease**
- Recent local susceptibility information guide empiric prescribing.

4.Optimise the use of antimicrobial medicines

❑**Lab’s public heath function**

- Promote the application of surveillance data to national and regional drug policy.

5.Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions

Lab manager provide economic evidence

❑Lab's public heath functions

- Allow the true cost of resistance to be computed and tracked.
- Provide economic evidence to support the replacement of antimicrobial drug use with vaccine and other preventive strategies.

Summary of lab role

Laboratory systems in resistance containment:

- Antimicrobial susceptibility testing and surveillance, central AMR management and control.
- Laboratory tests for pathogens or their associated biomarkers confirm or rule out specific infectious causes.
- Provide critical support to infection control programs.
- Routine laboratory data supports the development of vaccines and other technologies that could ease the pressure placed by antimicrobials

CONCLUSION

- AMR management and control need multidisciplinary collaborations
- Laboratory systems are integral to antimicrobial resistance containment and contributions to addressing resistance exist but need to be enhanced


THANK YOU FOR YOUR ATTENTION