



Antimicrobial Resistance: An overview

Dr Nyda Fourie:



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Introduction



First antibiotics

- Egyptians mouldy bread to infected wounds
- Malaria: Bark cinchona tree (precursor to quinine)
- Penicillin
 - 1928: Alexander Fleming, London
 - 1940: WWII soldiers
 - 1945: Nobel prize in Medicine
- Sulphonamides 1935



Global Situation



Global Situation



WHO: Are we regressing to a so-called pre-antimicrobial era?

WHO Director general Dr Margaret Chan 2016:

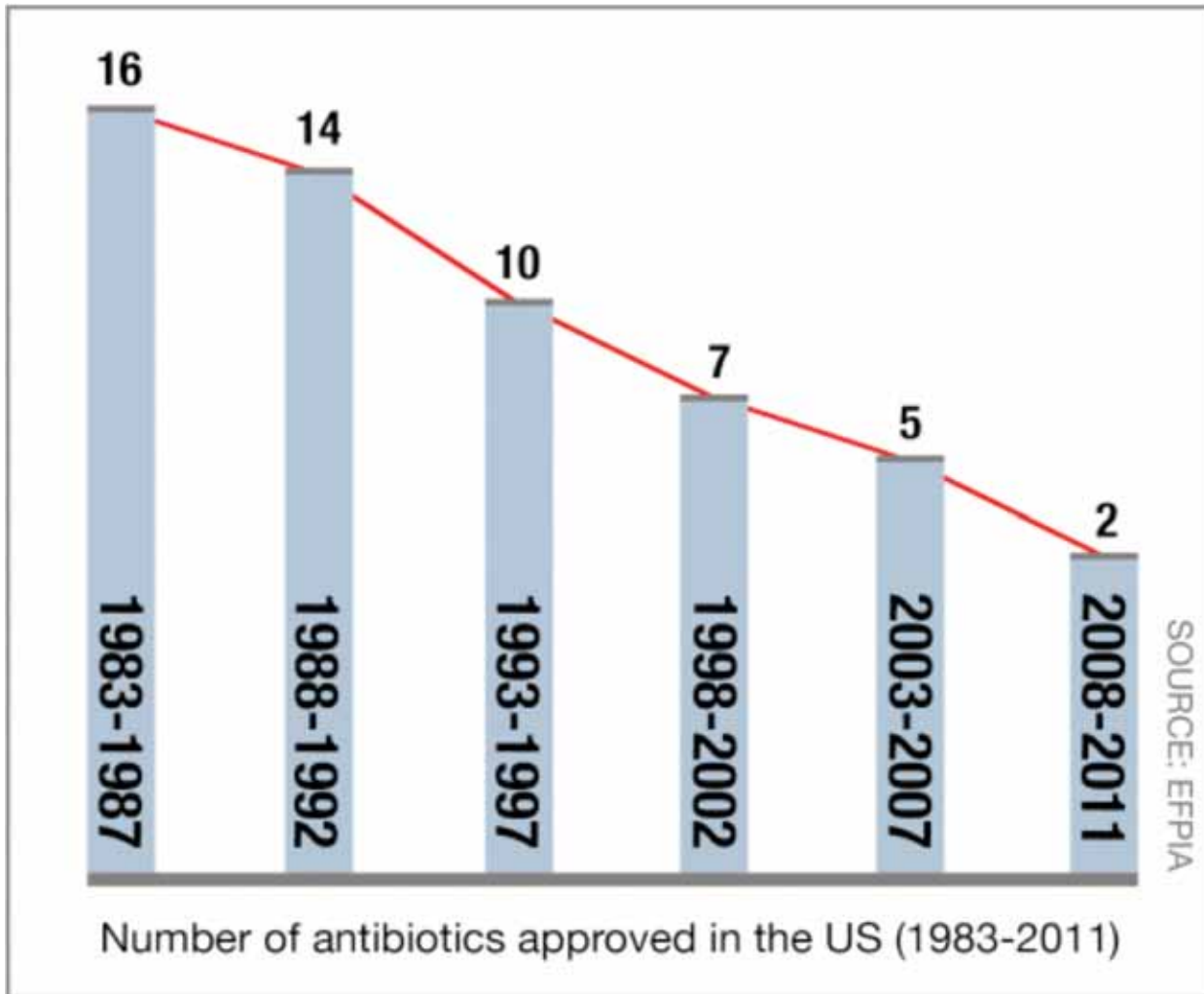
- One of the greatest threats to human health today
- May bring the end of modern medicine as we know it
- “Slow-moving tsunami”

Aug. 1998



US Discover mag. 2013





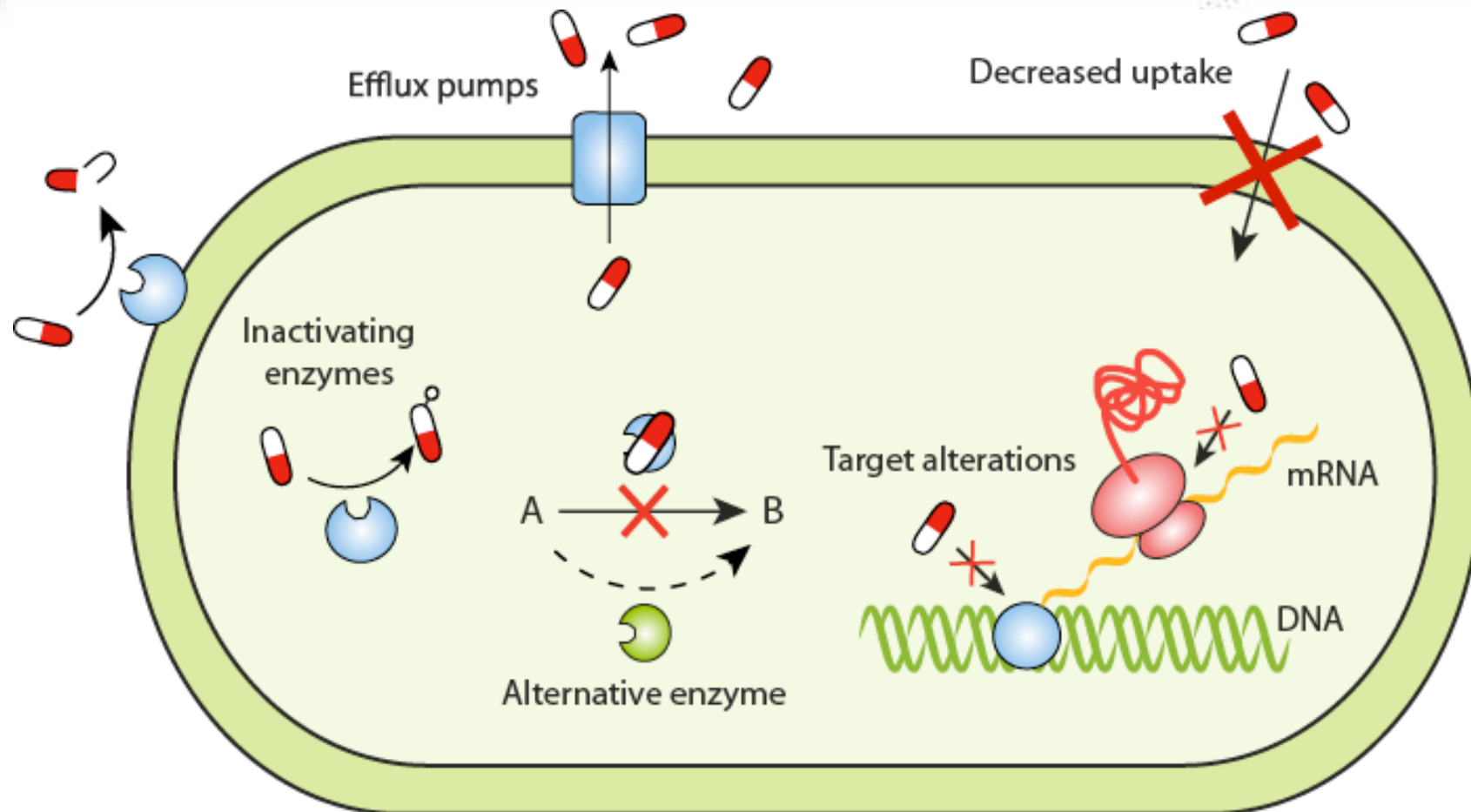
Global Situation: SA



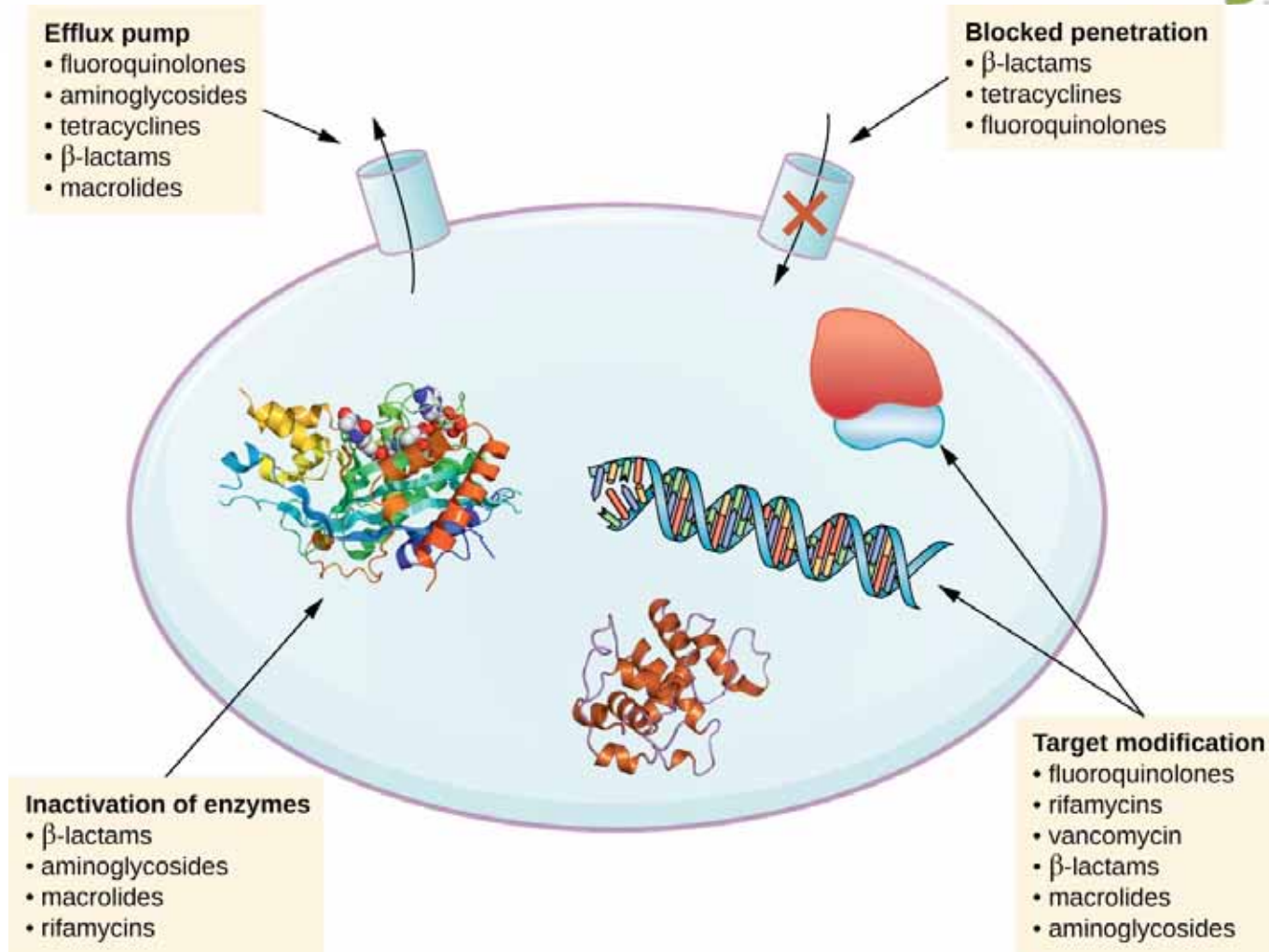
- Director general DOH: Ms Precious Matsoso
 - AMR National strategy framework 2014 – 2024: Introduction
 - Fleming 1928: Driving selection of resistance (inappropriate use)
 - No new class of ABs since 1987



Mechanisms: Resistance



Mechanisms: Resistance



Transfer of resistance



- Vertical: To subsequent microbial generations of *same* microbe
- Horizontal: Transfer between *different* microbes
- Global!

“Superbugs”



- > 1 Mechanism of resistance
 - 2 million infections in US annually
 - 23 000 Fatalities
- ESKAPE / ESCAPE pathogens
 - *Enterococcus faecium*
 - *Staph. aureus*
 - *Klebs. pneumoniae*
 - *Acin. baumannii*
 - *Pseud. aeruginosa*
 - *Enterobacter spp.*
- (2016: 490 000 cases of MDR TB – 50% cured)



**NEISSERIA
GONORRHOEAE**



**ACINETOBACTER
BAUMANNII**



**STAPHYLOCOCCUS
AUREUS (MRSA)**



**BURKHOLDERIA
CEPACIA**



**PSEUDOMONAS
AERUGINOSA**



**CLOSTRIDIUM
DIFFICILE**



**ESCHERICHIA
COLI (E.COLI)**



**MYCOBACTERIUM
TUBERCULOSIS**



**KLEBSIELLA
PNEUMONIAE**



**STREPTOCOCCUS
PYOGENES**

Causes: Agricultural



Concentrated animal feeding operations

Prevention of infections

Growth promotion

Pollution of water and soil

WHO: Some countries: Use more

ABs in food production than in
medical care (up to 80%)



Causes: Human



- Natural selection: “Survival of the fittest”
- Overuse and misuse: Driven by total volume of AB used
- Inappropriate use
 - US study: 30% of 47 million prescriptions unnecessary
- Subtherapeutic dosing
- Pt non-compliance
- AB factory waste



Implications: Health Sector



Infectious diseases:

- Prolonged illness
- Disability
- Death

Compromise:

- Cancer chemotherapy
- DM management
- Organ transplantation
- Major surgery



Implications: Financial



Prolonged stay:

- Hospital
- ICU

Costly:

- Antibiotics
- Research



Implications: Research



Few AB in Development: Why?



Society:

- New AB
- Cheaper AB

Policy makers:

- “Do not use; sit on shelf until really needed”

Pharmaceutical companies:

- Challenging studies
- Difficulties in demonstrating efficacy
- Short-term use
- Lack of return on investment

Research units:

- Challenging studies e.g. ICD in ICU



Possible Solutions / Efforts to address



Joint recognition of the crisis

Action:

- Regulatory sectors
- Health profession
- Society
- AB factory waste
- Agricultural Industry
- Research / Pharmaceutical Industry



Possible Solutions / Efforts to address



Regulatory sectors: WHO initiatives

- World Antibiotic Awareness week (Annual Nov. since 2015)
- The Global Antimicrobial Resistance Surveillance system (GLASS)
 - Collection, analysis and sharing of resistance data
- Global Antibiotic Research and Development Partnership (GARDP)
 - Public private partnerships: Improvement existing ABs / Dev. new ABs
- Interagency Coordination Group on Antimicrobial Resistance (IACG)
 - Improve coordination between international organisations to ensure effective global action against AB resistance

Possible Solutions / Efforts to address



Health care professionals: Judicious use

- Infection control
- Training / Education
- “Delayed prescriptions”
- Antimicrobial stewardship programmes



Possible Solutions / Efforts to address

Society

Healthy lifestyle

Infection control

Agricultural Industry

Controlled use

AB factory waste:

Destruction vs dumping



Possible Solutions / Efforts to address



Possible Solutions / Efforts to address



Research / Pharmaceutical Industry

Marketing: Decouple AB sale volumes from sales agents' bonuses

Incentives to encourage research

- Smaller clinical trials?
- EU and Eur. Federation of Pharm Indust. and Associations:
Innovative Medicines Initiative: 2012
 - Public/private project funding research
- Research and Development Tax Credit for Companies

Alternatives: Immunization / ?Probiotics / ?Immune modulation



AM Resistance

Thank you!

