Institute and Faculty of Actuaries

NHS Lothian

The University of Edinburgh

Clinical implications of AMR

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Clinical implications

- Increased treatment failure
- Increased morbidity & mortality
- Decreased efficacy of antibiotic prophylaxis

- Need for improved clinical surveillance and data sharing

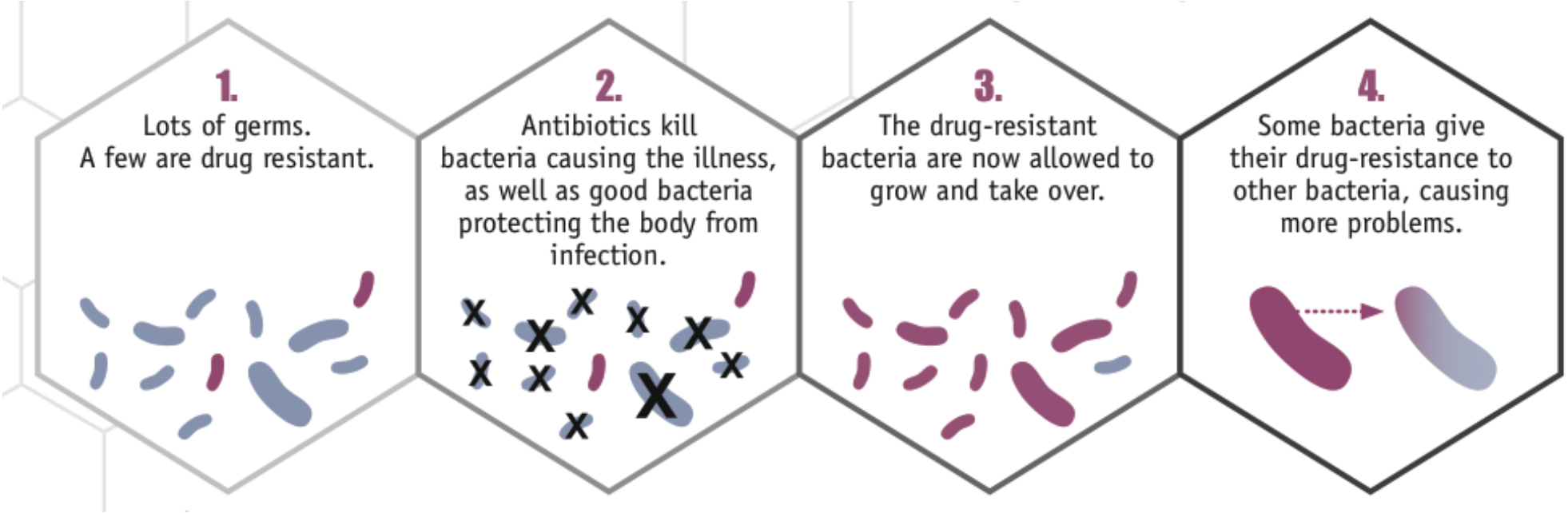
- Requirement for behavioural change

Areas of clinical concern

- Communicable diseases due to bacteria
  - Tuberculosis
  - Sexually transmitted diseases
  - Respiratory tract infections
  - Diarrhoea caused by bacteria
  - Health care-associated infections
- Endogenous bacterial infections
  - Urinary tract infections
  - Skin and soft tissue infections
  - Infective endocarditis
  - Sepsis
- Prophylaxis
  - Burns, wounds
  - Caesarean sections
  - Joint replacements
  - Cancer therapy
  - Organ transplants

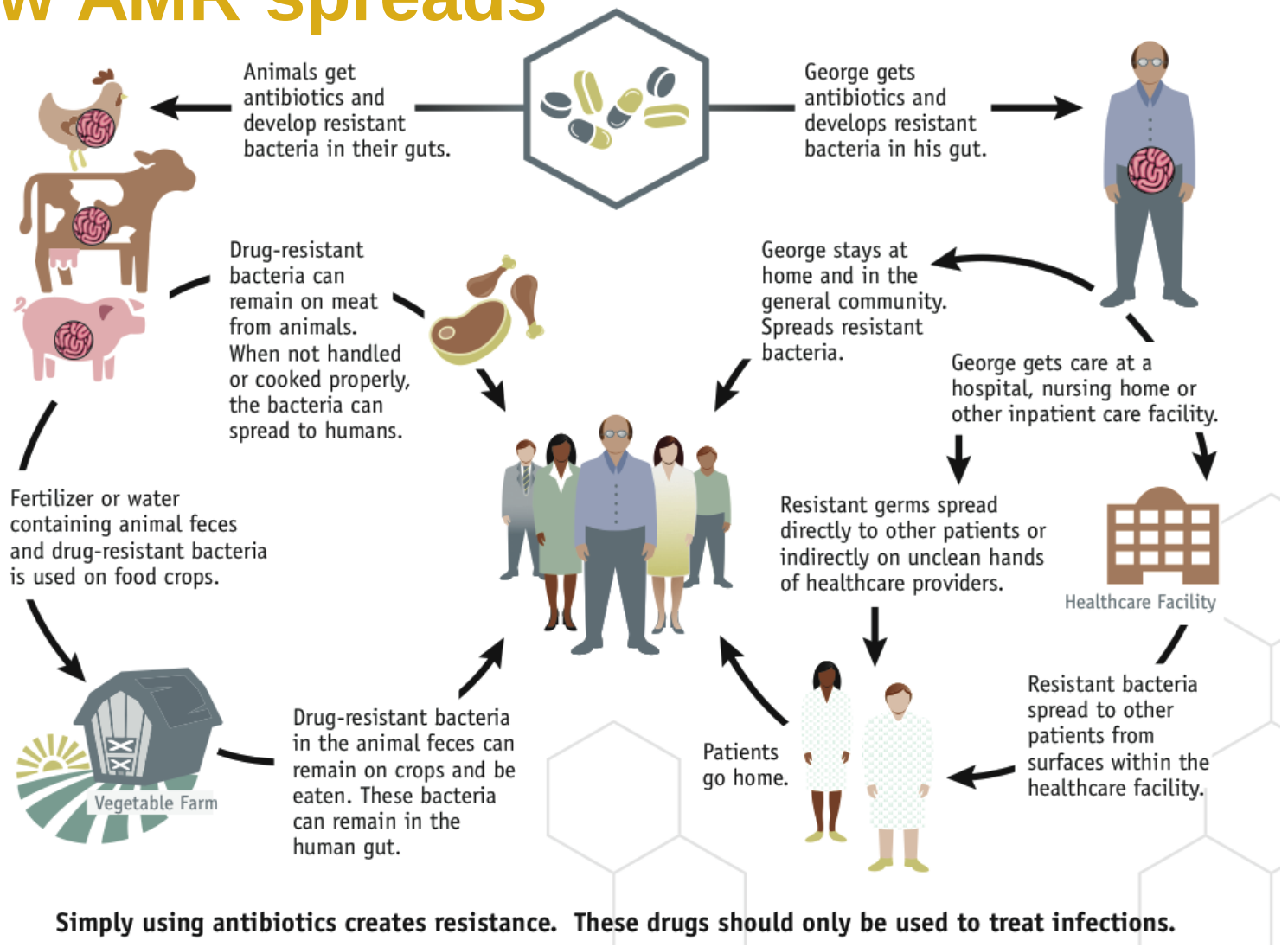
IHME
Institute for Health Metrics and Evaluation

How AMR occurs



Source: Antibiotic Resistance Threats, CDC, 2013

How AMR spreads



Simply using antibiotics creates resistance. These drugs should only be used to treat infections.

Source: Antibiotic Resistance Threats, CDC, 2013

Increasing antibiotic consumption

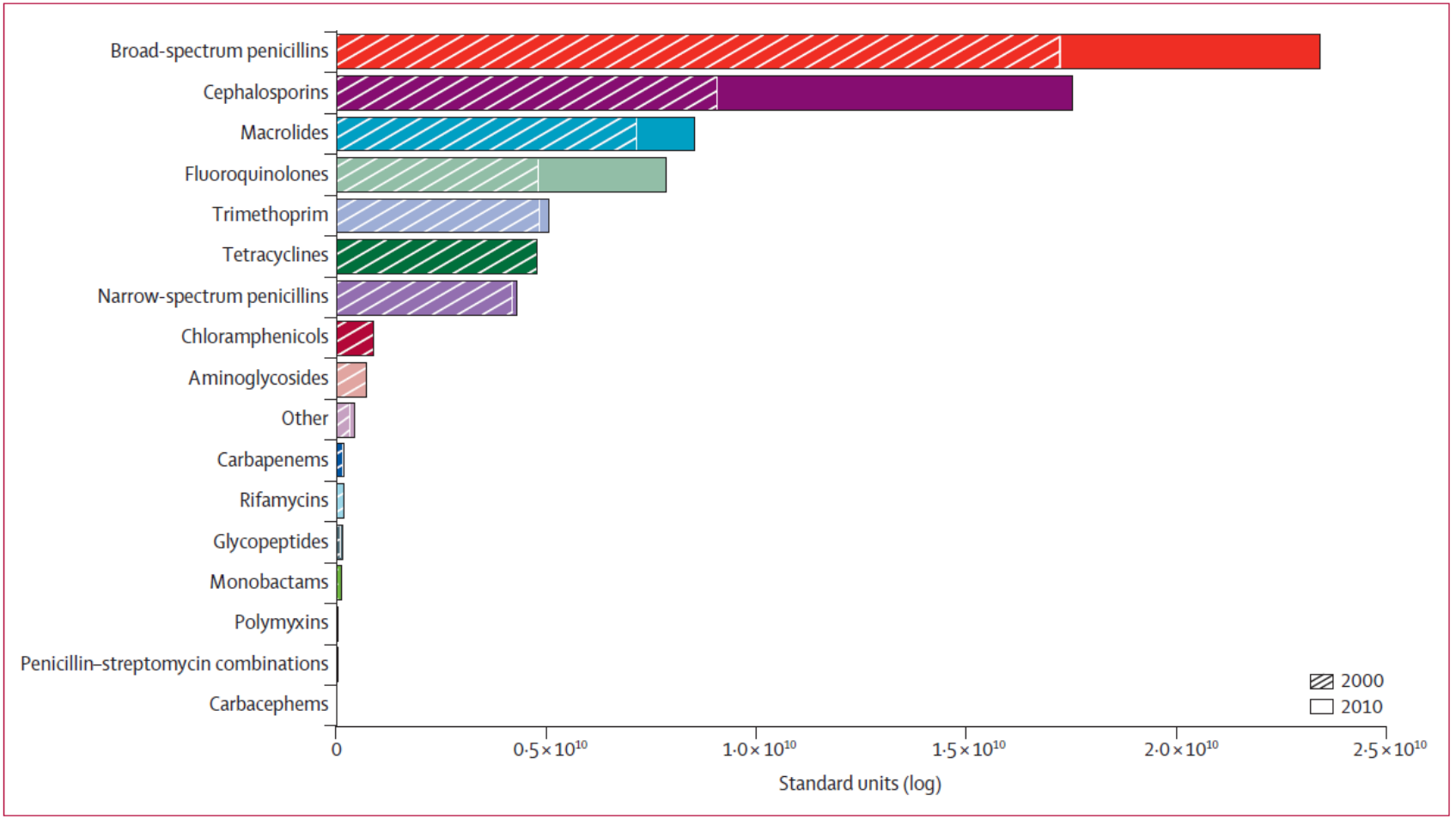
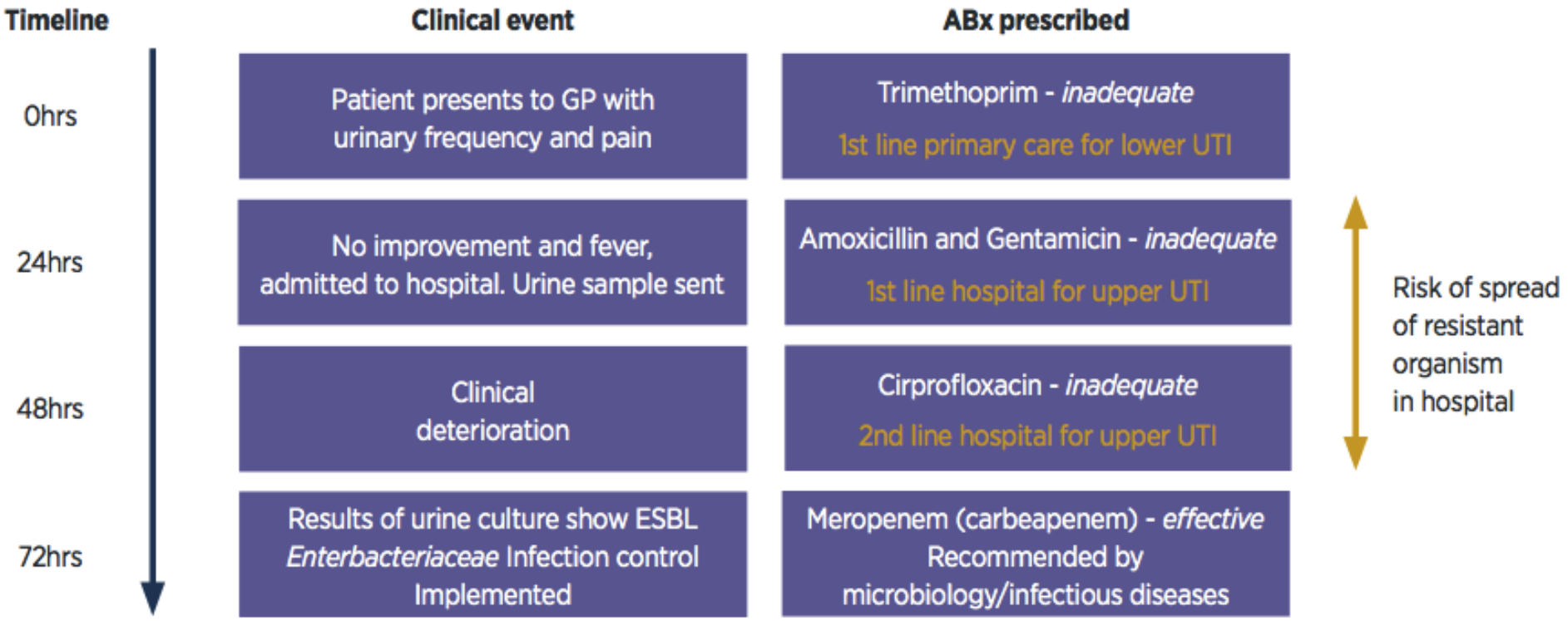


***Figure* 1: Global antibiotic consumption by class in 2000 and 2010**
Standard units are defined as a single dose unit (ie, pill, capsule, or ampoule).

How are antibiotics chosen?

- Clinical diagnosis
- Local guidelines
- (Economic considerations)
- Antimicrobial susceptibility testing
  - Culture
  - Molecular

Hypothetical clinical pathway



Inadequate initial antimicrobial therapy (IIAT)

- Increased morbidity
  - Suppurative complications
  - Sepsis
- 3-fold increased mortality
- Prolonged hospitalisation
- Higher hospital costs
- Increased risk of transmission

Raman *et al*, BMC Infectious Diseases, 2015

Carbapenem-resistant *Enterobacteriaceae*

- Carbapenems ‘last-line’ antibiotics
- 45% increase in global consumption between 2000 and 2010
- CRE often requires treatment with older toxic antibiotics
- Mortality rates 29 to 52 %

Public Health England

Acute trust toolkit for the early detection, management and control of carbapenemase-producing Enterobacteriaceae

Efficacy of antibiotic prophylaxis

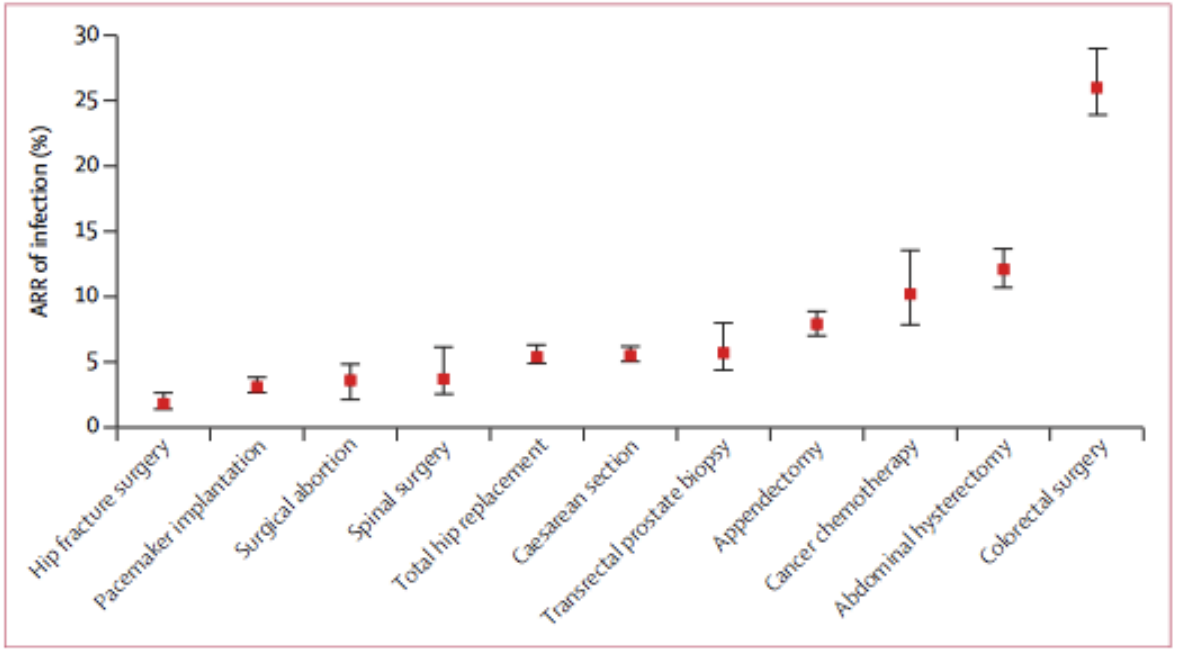


Figure 1: **Absolute risk reduction (ARR) of infection with antibiotic prophylaxis in common surgical procedures and blood cancer chemotherapy in the USA**

- Estimated US levels of resistance to routine prophylaxis:
  - 39-51% of surgical infections
  - 27% post chemotherapy infections

Teillant *et al*, Lancet Infectious Diseases, 2015

Predicted effect of AMR on prophylaxis

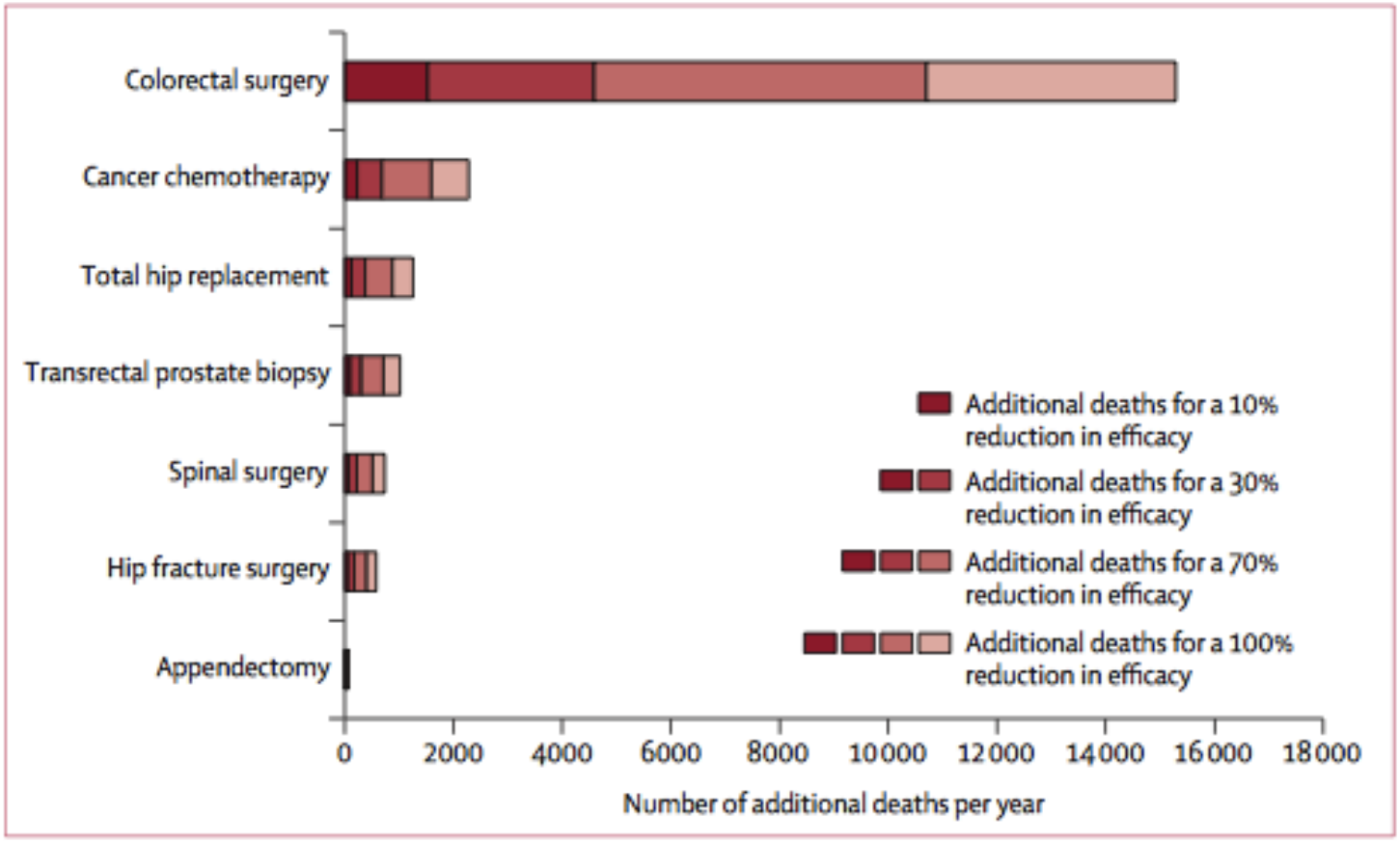
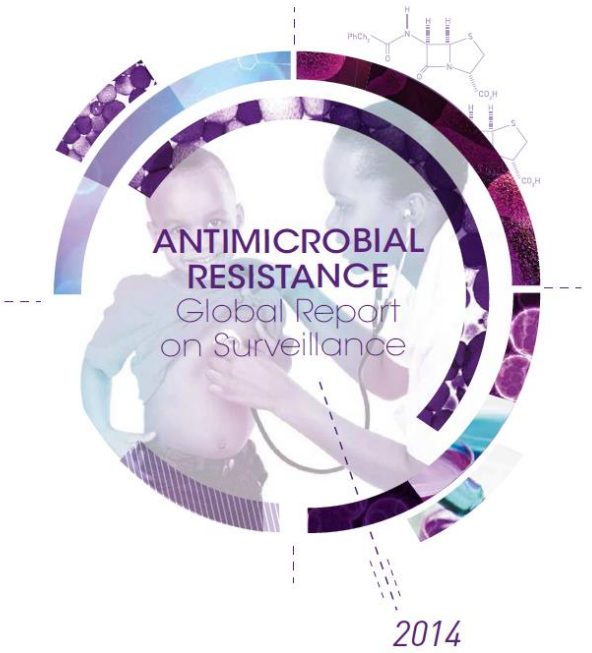


***Figure 3*: Number of additional deaths per year in the USA under four scenarios of decreased efficacy of antibiotic prophylaxis**

Teillant *et al*, Lancet Infectious Diseases, 2015

AMR surveillance - WHO

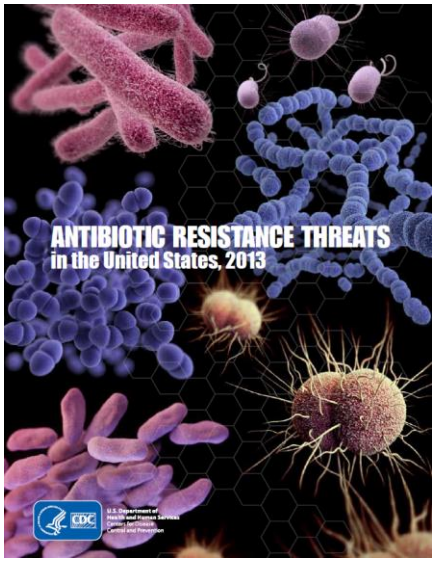
- Global survey of national resistance data
  - Estimates of resistance rates in common bacteria in all WHO regions
  - Significant gaps in resistance surveillance
  - Lack of standard methodology
  - Lack of data sharing



Burden of AMR – published estimates

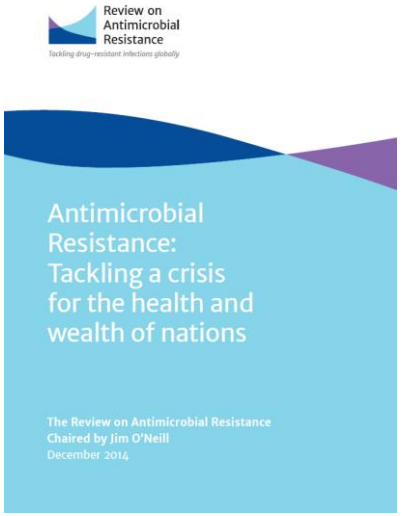
ECDC
- EU in 2009
- 5 bacterial infections

→ 25K deaths per yr
→ 400K illnesses



CDC
- US in 2013
- 16 bacterial infections

→ 23K deaths per yr
→ 2M illnesses

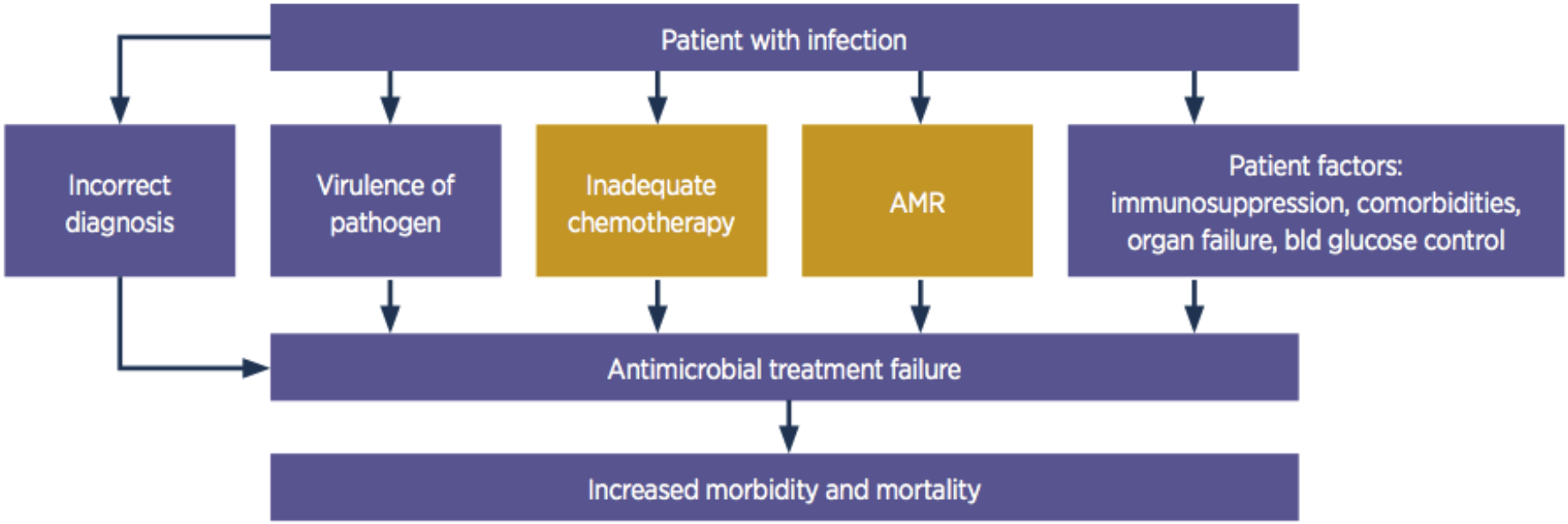


O'Neill Review
- Global in 2013
- Extrapolated from US + WHO estimates for TB

→ 700K deaths per yr

AMR burden

‘number of deaths attributable to the failure of antibiotic therapy due to antibiotic resistance’



Measuring global clinical implications

- AMR is a global, not a local concern
  - New Delhi metallo-β-lactamase (NDM-1)
- Lack of access to antimicrobials still a significant issue

- Global standardized antimicrobial surveillance network – WHO
- Data collection and sharing
  - measurement of rates of IAT
  - ? use of ICD-10 codes
  - ‘attributable burden’

Requirement for behavioural change

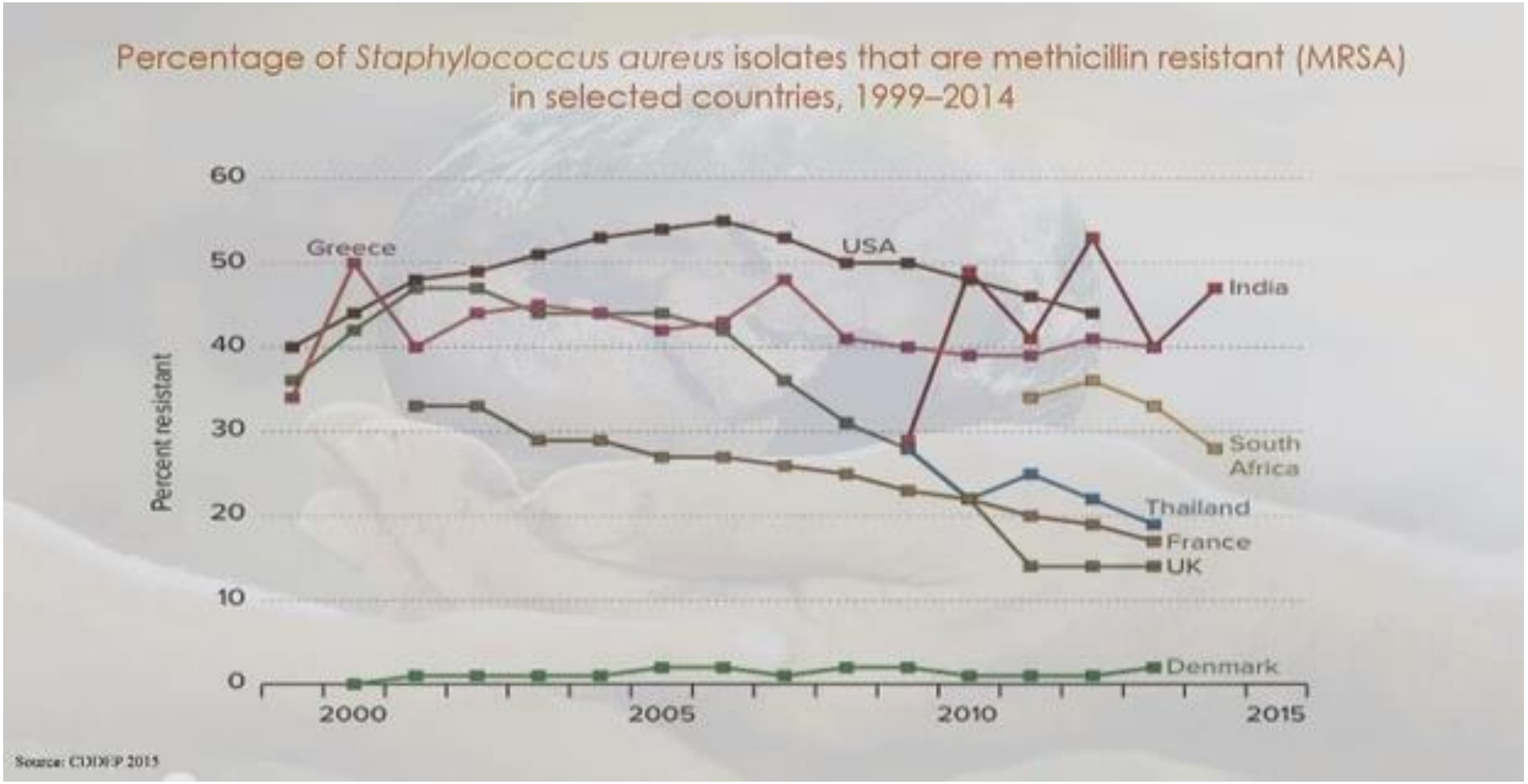
- Education
- Infection control
- Avoidance of inappropriate treatment
- Targeted antibiotic therapy
- Improved stewardship

NHS England launches national programme to combat antibiotic overusage

10 March 2016 - 19:46

NHS England has today launched the world's largest healthcare incentive scheme for hospitals, family doctors and other health service providers to prevent the growing problem of antibiotic resistance.

There is hope…



Acknowledgements

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Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.


Crude infectious disease mortality rate in the United States, 1900–1996
Mortality rate per 100,000 per year
1,000
900
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Influenza pandemic
40 states have health departments
Last human-to-human transmission of the plague
First use of penicillin
Salk vaccine introduced
Passage of Vaccination Assistance Act
First continuous municipal use of chlorine in water in United States

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