Antimicrobial resistance: a health technology side-effect

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The burden of AMR

In the European Union, infections caused by antimicrobial resistant organisms, every year, result in:

- 25,000 deaths
- 2,500,000 additional hospital bed days
- €1,500,000,000 overall societal costs

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RESEARCH ARTICLE

Mortality and Hospital Stay Associated with Resistant *Staphylococcus aureus* and *Escherichia coli* Bacteremia: Estimating the Burden of Antibiotic Resistance in Europe

Marlieke E. A. de Kraker, Peter G. Davey, Hajo Grundmann, on behalf of the BURDEN study group

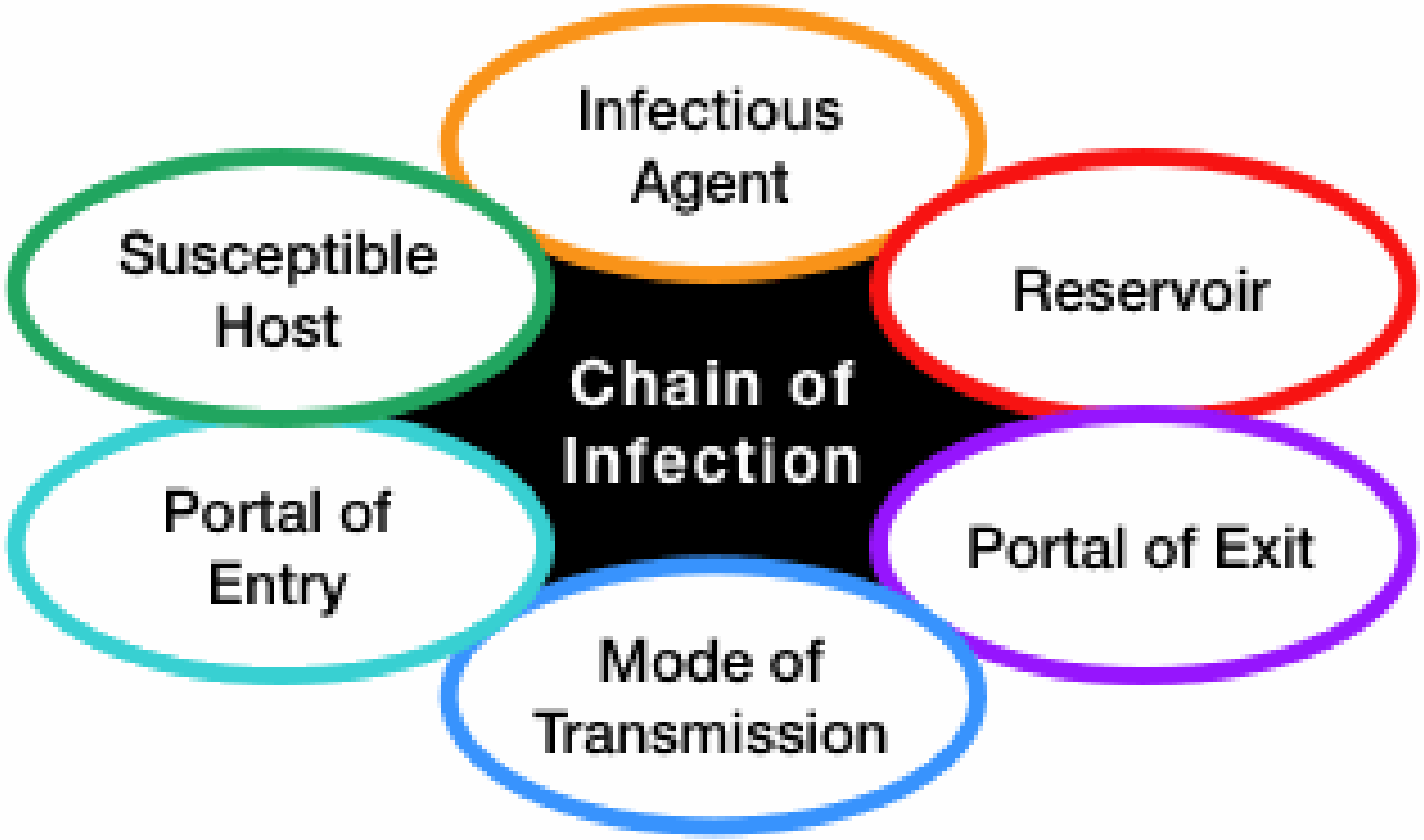
- EU 2007:
  - 27,711 episodes of MRSA BSIs were associated with 5,503 excess deaths and 255,683 excess hospital days
  - The total costs attributable to excess hospital stays for MRSA BSIs were 44.0 million Euros.

Health technology

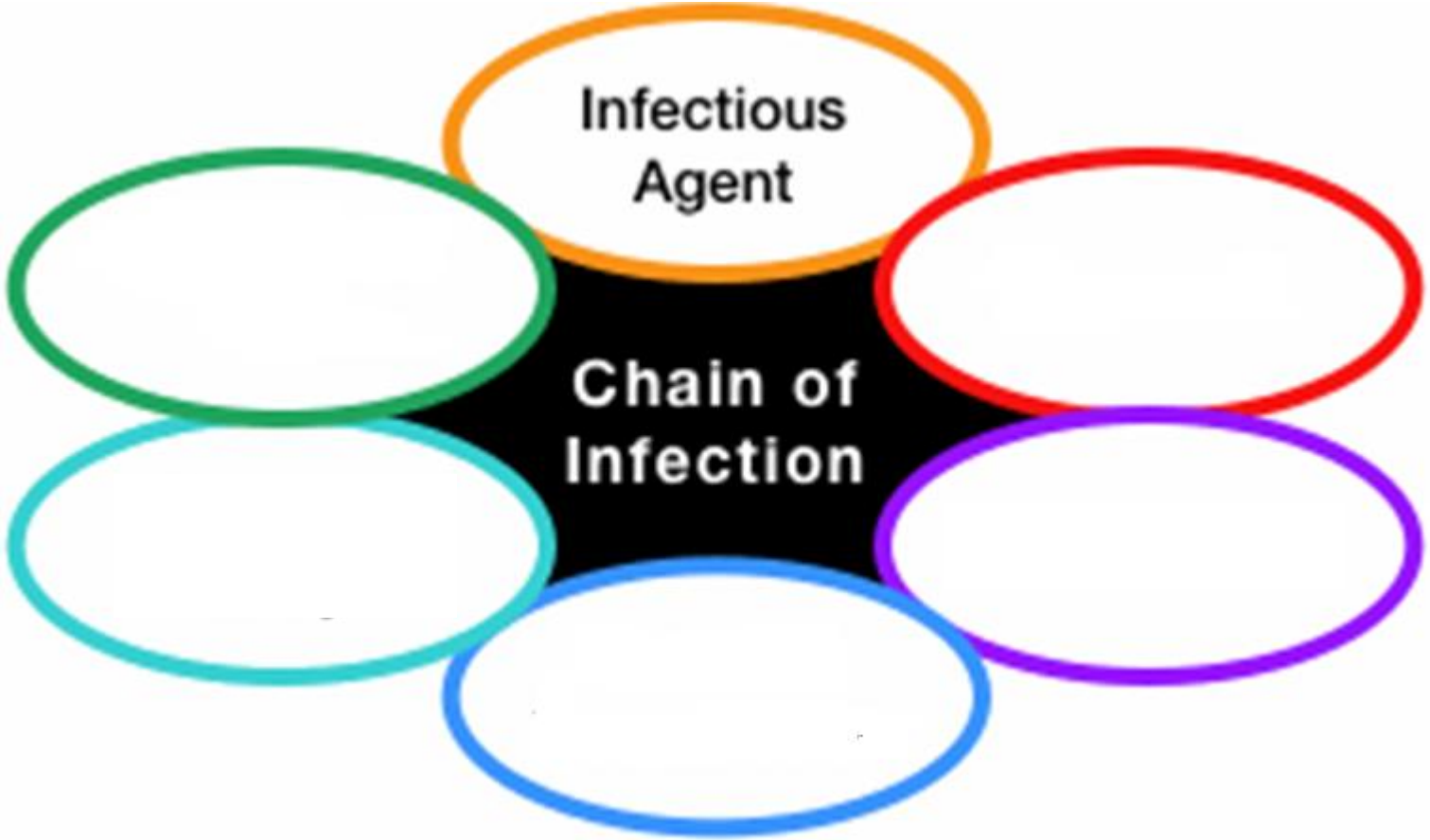
- **Health technology** refers to the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a **health** problem and improve quality of lives.

World Health Organization

Chain of infection



Medicines



- Selection of resistance
  - Antibiotic use

RESEARCH

The Relationship between Antimicrobial Use and Antimicrobial Resistance in Europe

Stef L.A.M. Bronzwaer,* Otto Cars,† Udo Buchholz,* Sigvard Mölstad,‡ Wim Goettsch,* Irene K. Veldhuijzen,* Jacob L. Kool,* Marc J.W. Sprenger,* John E. Degener,§ and participants in the European Antimicrobial Surveillance System

Emerging Infectious Diseases • Vol. 8, No. 3, March 2002

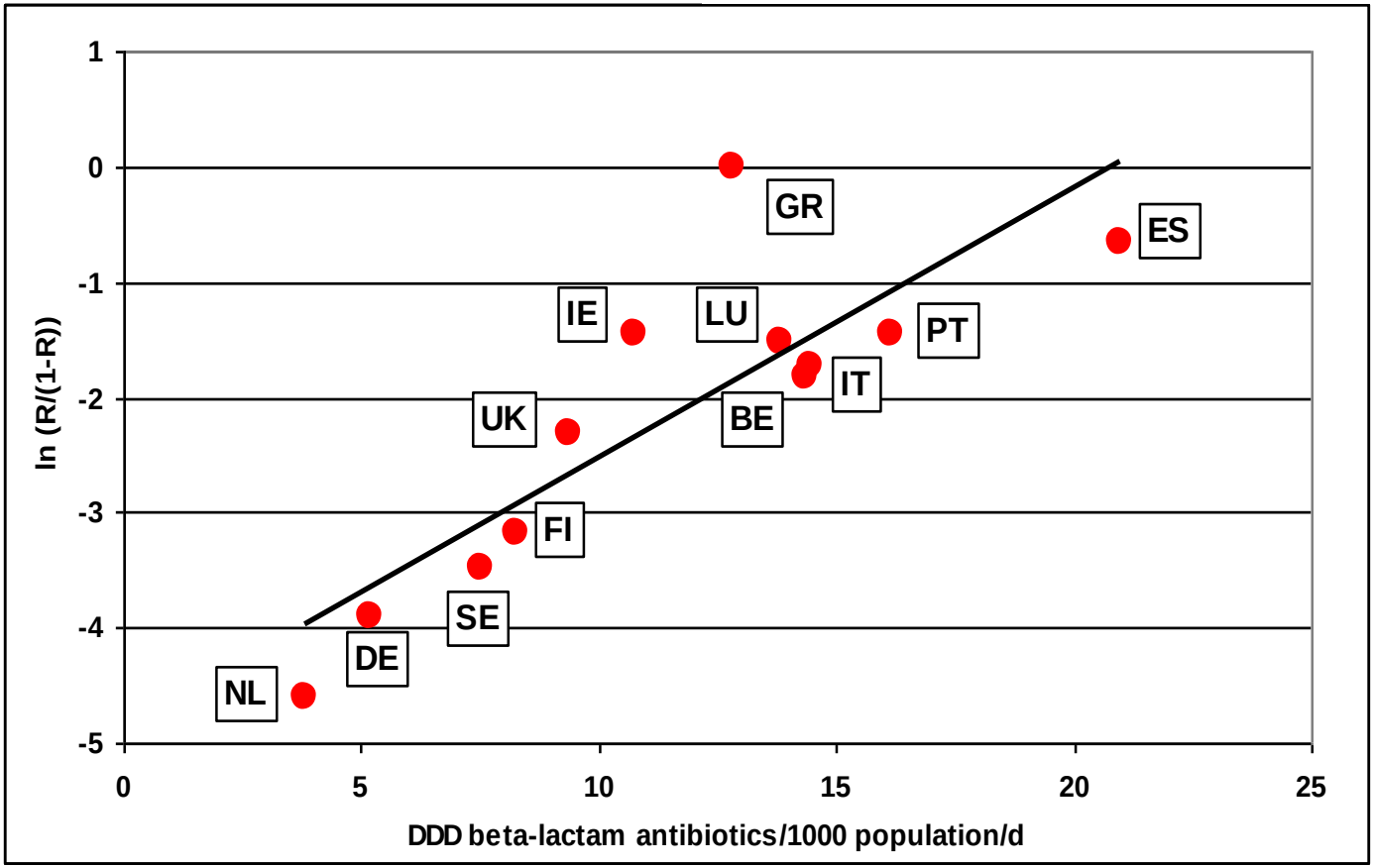


Figure 2: The log odds of resistance of invasive isolates of *S. pneumoniae* to penicillin (PNSP; ln(R/(1-R))) is regressed against out-patient sales of beta-lactam antibiotics in 12 European countries;

Forecasting carbapenem resistance from antimicrobial consumption surveillance: Lessons learnt from an OXA-48-producing *Klebsiella pneumoniae* outbreak in a West London renal unit

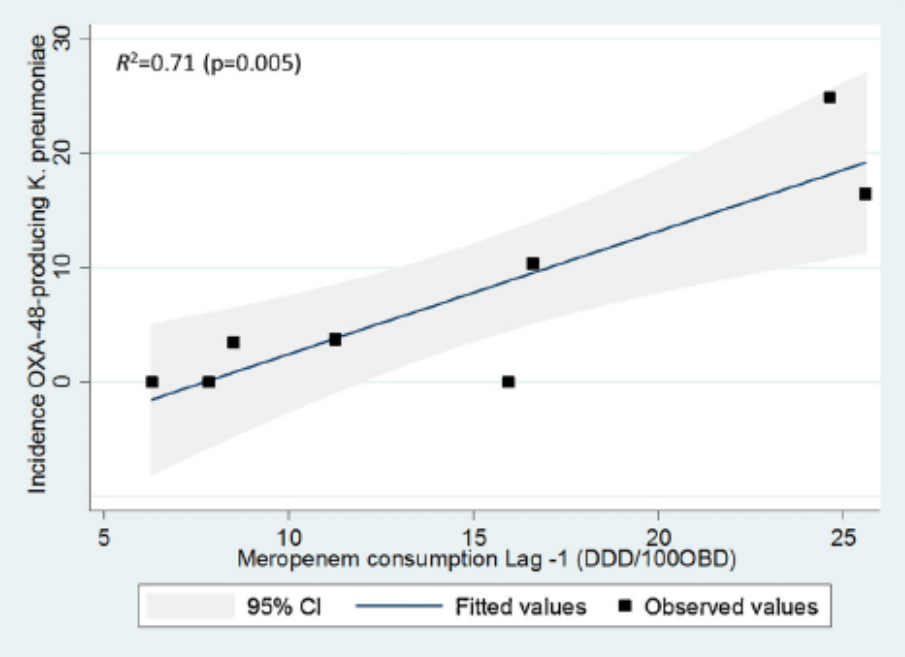


Fig. 1. Cross-correlation between meropenem consumption lag −1 (the preceding year) and the incidence rate of OXA-48-producing *Klebsiella pneumoniae* in a West London renal unit from 2008–2009 to 2013–2014.

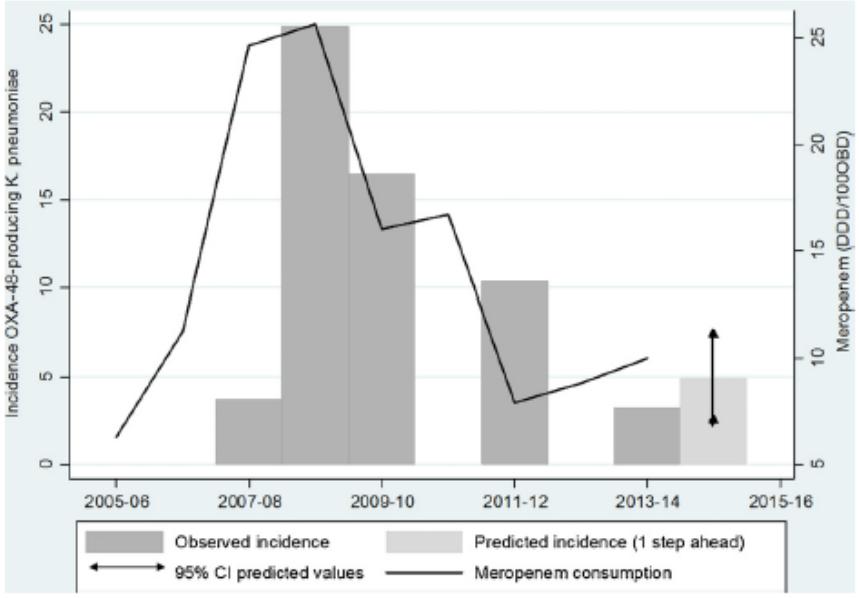
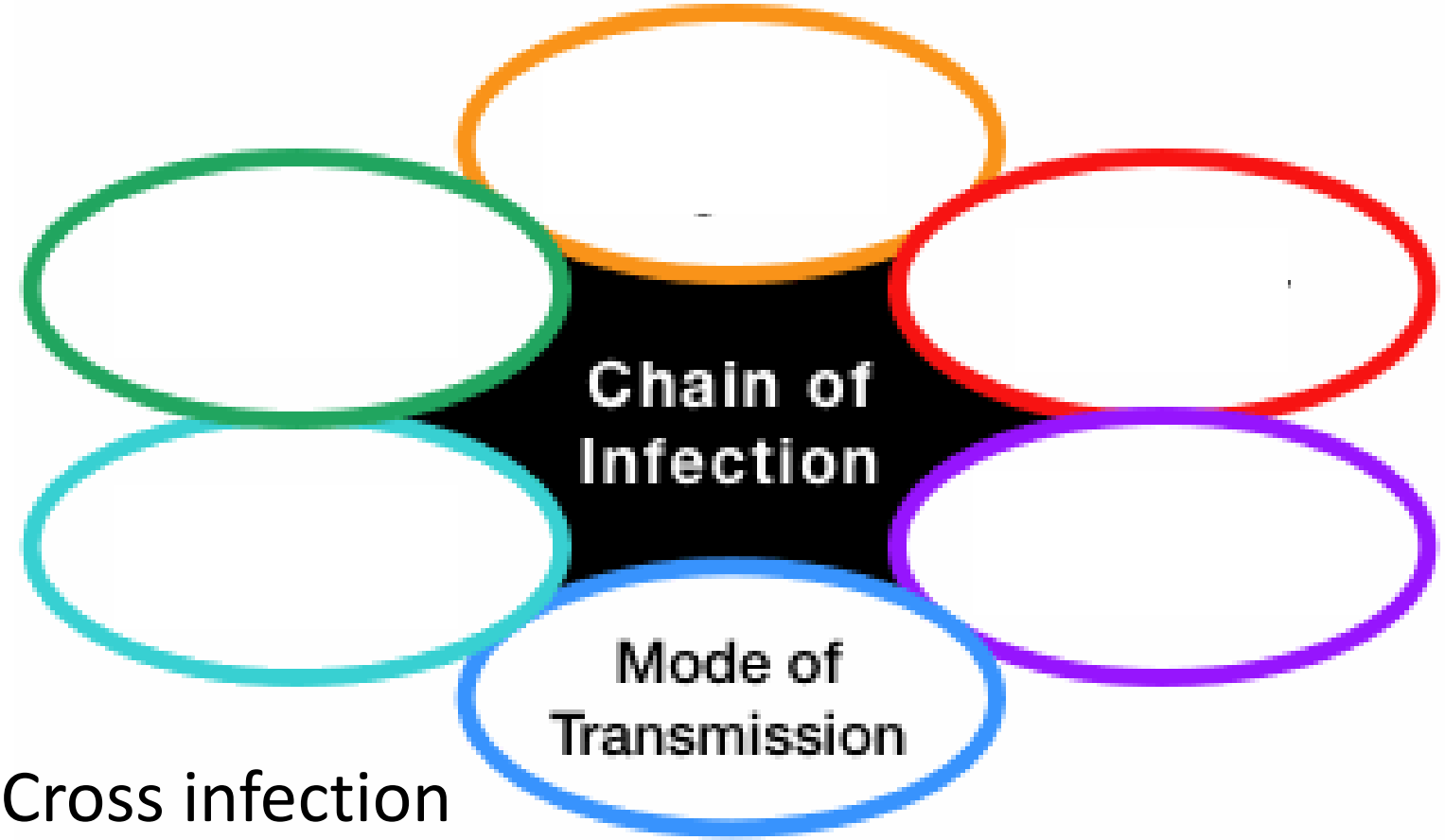


Fig. 2. Multiple time series analysis for forecasting one-step (year)-ahead incidence rate of OXA-48-producing *Klebsiella pneumoniae* (cases/100,000 OBD) using meropenem consumption (in DDD/100 OBD) lag −1 as an external predictor in a West London renal unit from 2008–2009 to 2013–2014. DDD, defined daily doses; OBD, occupied bed-days.

Int J Antimicrob Agents. 2015 Aug;46(2):150-6.

Procedures



- Cross infection
  - Inappropriate practices, mainly healthcare workers
    - Hand hygiene
    - Cleaning & disinfection
    - Isolation

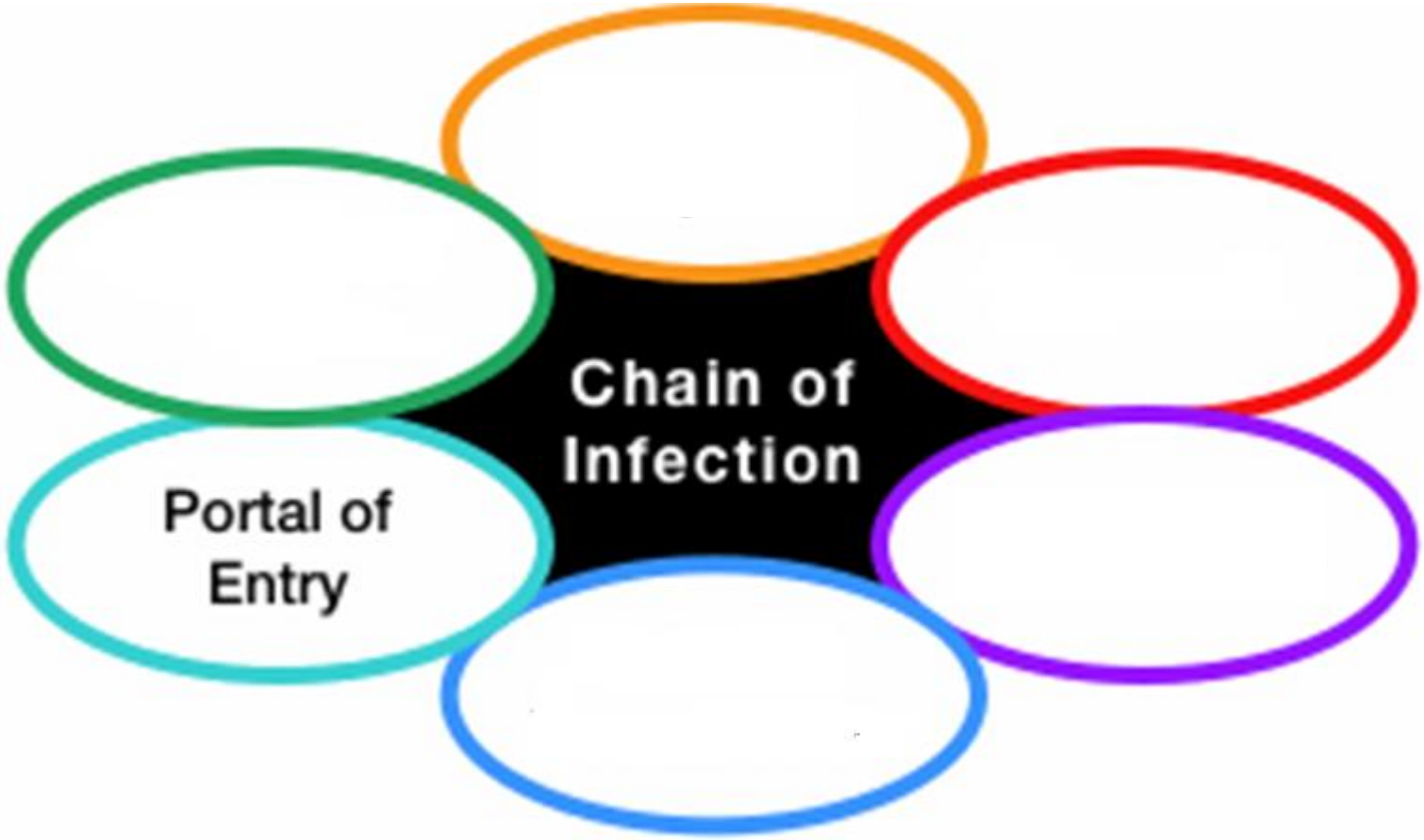
SPTAR MATER DEI

World Health Organization

Evidence of hand hygiene to reduce transmission and infections by multi-drug resistant organisms in health-care settings

Year Country	Setting	Effect on hand hygiene compliance and/or consumption of alcohol-based handrubs (ABHR)	Impact on MDROs'	Reference
2011 Australia	Nationwide (521 hospitals)	In sites not previously exposed to the campaign, increase of HH compliance went from 43.6% to 67.8%	Significant reduction of overall MRSA BSI (from 0,49 to 0,3497 per 10,000 patients-days) but not of hospital-onset MRSA BSI	Grayson ML et al (10)
2012 Hong Kong (China)	18 LTCFs (4 months)	Significant increase of HH compliance in intervention arms (27% to 61% and 22% to 49%) The proportions of ABHR usage among compliant actions increased from 33.9% - 53.2% to 90.3% - 94.6%	Significant decrease of respiratory outbreaks (IRR, 0.12; 95% CI, 0.01–0.93) and MRSA infections requiring hospital admission (IRR, 0.61; 95% CI, 0.38–0.97)	Ho M et al (12)
2013 Saudi Arabia	Hospital-wide	Significant increase of HH compliance from 38% in 2006 to 83% in 2011 Significant increase in ABHR consumption over time from 10.3 to 57.3 L/1,000 patient-days.	Significant reduction of MRSA infections (from 0.42 to 0.08), VAP (from 6.1 to 0.8), CLA-BSI (from 8.2 to 4.8), catheter-associated UTI (from 7.1 to 3.5)	Al-Tawfiq AA et al (24)
2013 Spain	Hospital-wide	Significant HH compliance increase from 57% to 85%	Significant reduction of MRSA infections/colonization/10 000 pt-days*	Mestre G et al (25)
2013 Serbia, France, Spain, Italy, Greece, Scotland, Israel, Germany & Switzerland	Multicenter (33 surgical wards of 10 hospitals)	HH compliance improved in all centres with overall compliance increase from 49.3% to 63.8%	Immediate non-significant increase in nosocomial MRSA isolation rate (aIRR 1.44, 95% CI 0.96 to 2.15) with no change in the trend in rates over time in the HH arm of the study. Enhanced HH promotion alone was not associated with changes in MRSA infection rates.	Lee AS et al (26)

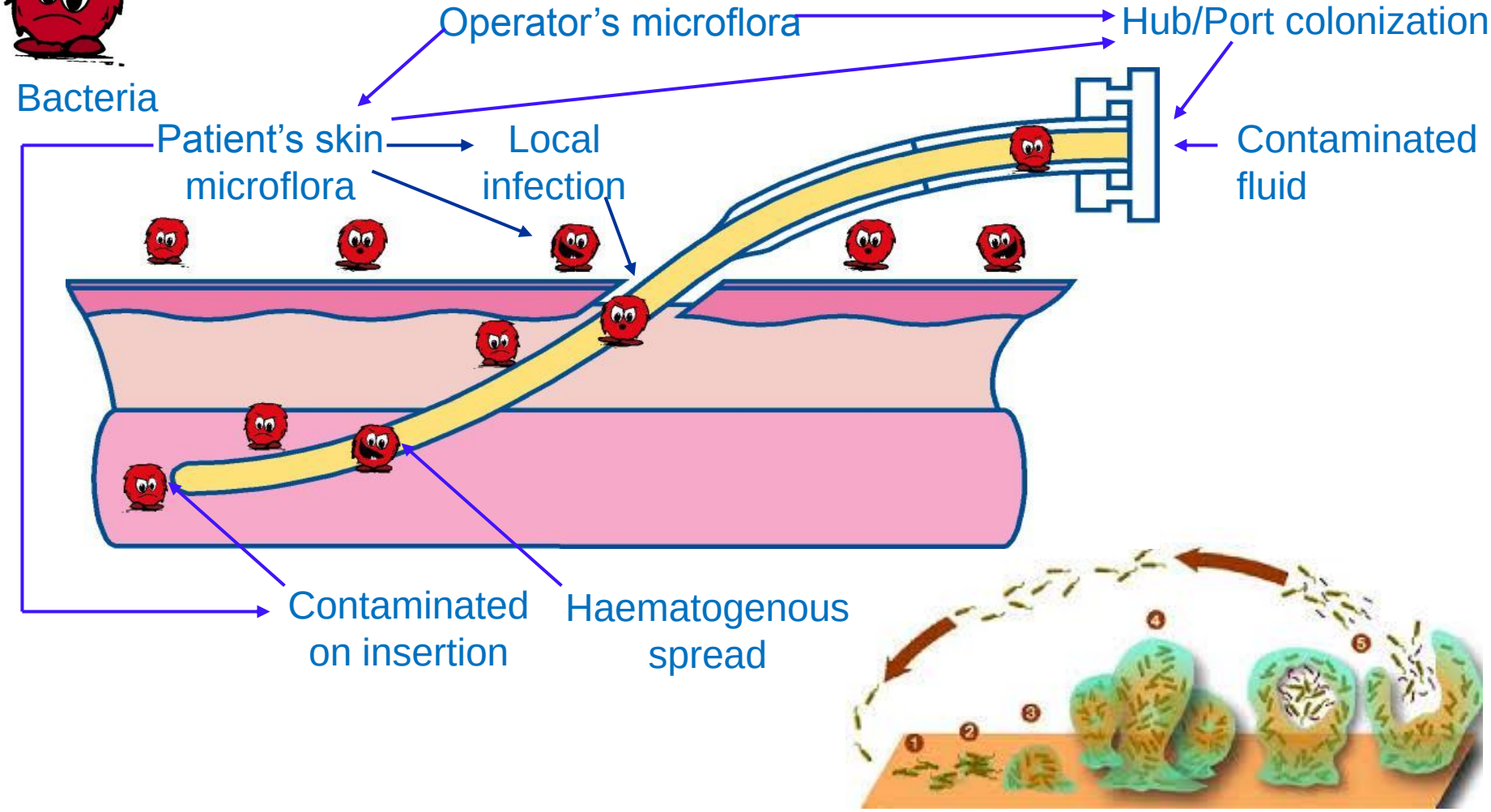
Devices



- Intravenous cannulae
- Urinary catheters

Medical devices

Bacteria



What are the key factors?

- Medicines:
  - Selection of resistance
    - Inappropriate antibiotic use
- Practices
  - Cross infection
    - Hand hygiene
    - Cleaning & disinfection
    - Isolation
- Devices
  - Portals of entry
    - Intravenous cannulae
    - Urinary catheters

What we need to do to reduce AMR?

It's not exactly rocket science