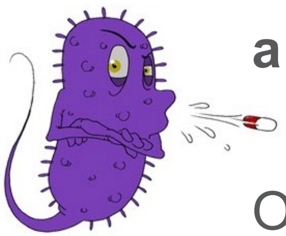
healthy all life long

THE EVOLUTION OF ACQUIRED ANTIMICROBIAL RESISTANCE IN EUROPE AND IN THE HEALTHCARE SECTOR IN BELGIUM

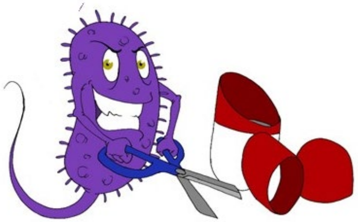
Lucy Catteau

Introduction

- **Antimicrobial resistance (AMR)**

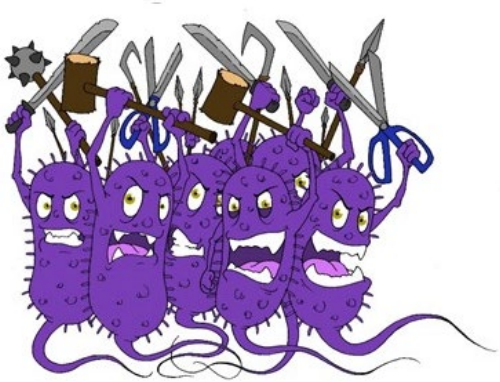


Ability of a microorganism to **resist the action** of one or more **antimicrobial agents**



Occurs naturally → ***intrinsic resistance***

Acquired via genetic mutation or acquisition of exogenous resistance genes → ***acquired resistance***



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Introduction

- **Main causes** of the occurrence and spread of AMR :

- **Use of antimicrobial agents**

→ Pressure, emergence and selection of resistant-bacteria

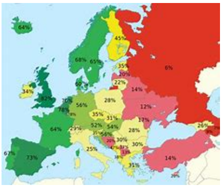
- **Transmission of resistant bacteria between humans, animals and the environment**

→ Poor infection prevention and control practices favour further spread of these bacteria

Introduction

- **Consequences** of AMR can be severe :
    - **A matter of life !**

About **700 000** people die each year **worldwide** from drug-resistant infections. If no action is taken, it is estimated that 10 million people will die each year by 2050 because of AMR (more than from cancer!) (O' Neill, 2014)



In **Europe**, **33 000** people die each year as a direct consequence of an infection due to bacteria resistant to antibiotics.
The burden of these infections is comparable to that of influenza, tuberculosis and HIV/AIDS combined. (ECDC, 2018)

In **Belgium**, it is estimated that **530** deaths are attributable to AMR each year (mortality rate close to the average for EU countries)
(Report of the AMR Policy Policy Dialogue in BE, 2019)

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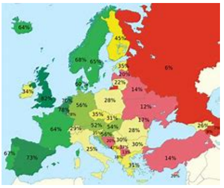
Introduction

- **Consequences** of AMR can be severe :
  - **A matter of money !**



Every year, AMR costs the healthcare systems of **EU/EEA** countries around **€1.1 billion**.

The annual cost of the AMR in **Belgium** is about **24 million €**.

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Introduction

- Infection control
  - Prompt treatment with **effective antimicrobials** is the most important intervention to **reduce the risk of poor outcome** of **serious infections.**
  - Development of **antimicrobial resistance (AMR)** and combined AMR may severely **limit the available treatment alternatives** for the infection.

↓

Importance of epidemiological surveillance of the AMR

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Epidemiological surveillance of AMR in Belgium

- It is one of the mission of *Sciensano* which builds on the more than 100 years of scientific expertise of

  - the former Veterinary and Agrochemical Research Centre (CODA-CERVA)

  - the ex-Scientific Institute of Public Health (WIV-ISP).

Introduction

- Two AMR surveillance programs conducted by *Sciensano* :

  - **AMR**

  Antimicrobial resistance surveillance in Belgian Hospitals

  - **EARS-BE**

  European antimicrobial resistance surveillance for Belgium

EARS-Net

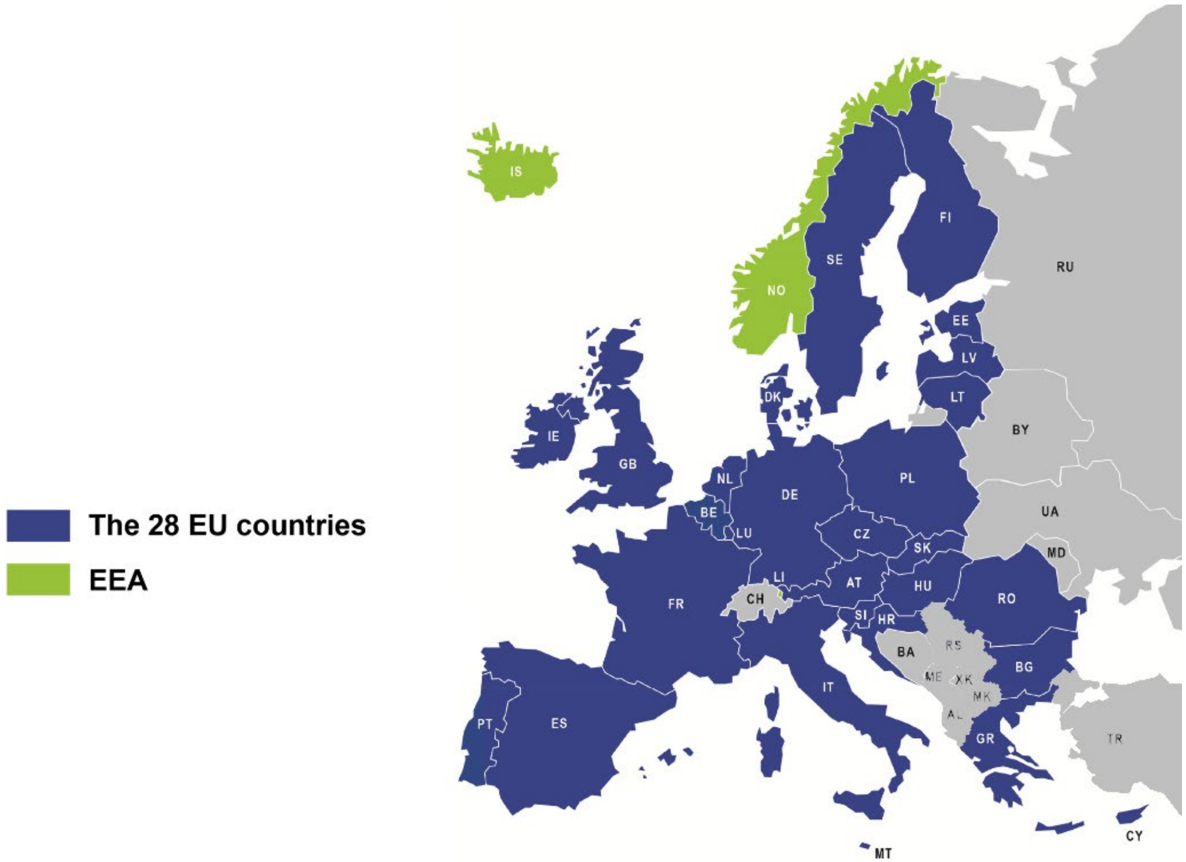
Coordinated by the European Center for Disease prevention and Control (ECDC)

Objectives of EARS-Net

- **Collect** comparable, representative and accurate **AMR data**
- Analyse temporal and spatial **trends of AMR in Europe**
- Provide timely AMR for **policy decisions**
- Encourage the implementation, maintenance and improvement of **national AMR surveillance programmes**
- Support national systems in their efforts to improve diagnostic accuracy by offering an **annual external quality assessment**

Participants to EARS-Net

- All 28 EU Member States and two EEA countries (Iceland and Norway)



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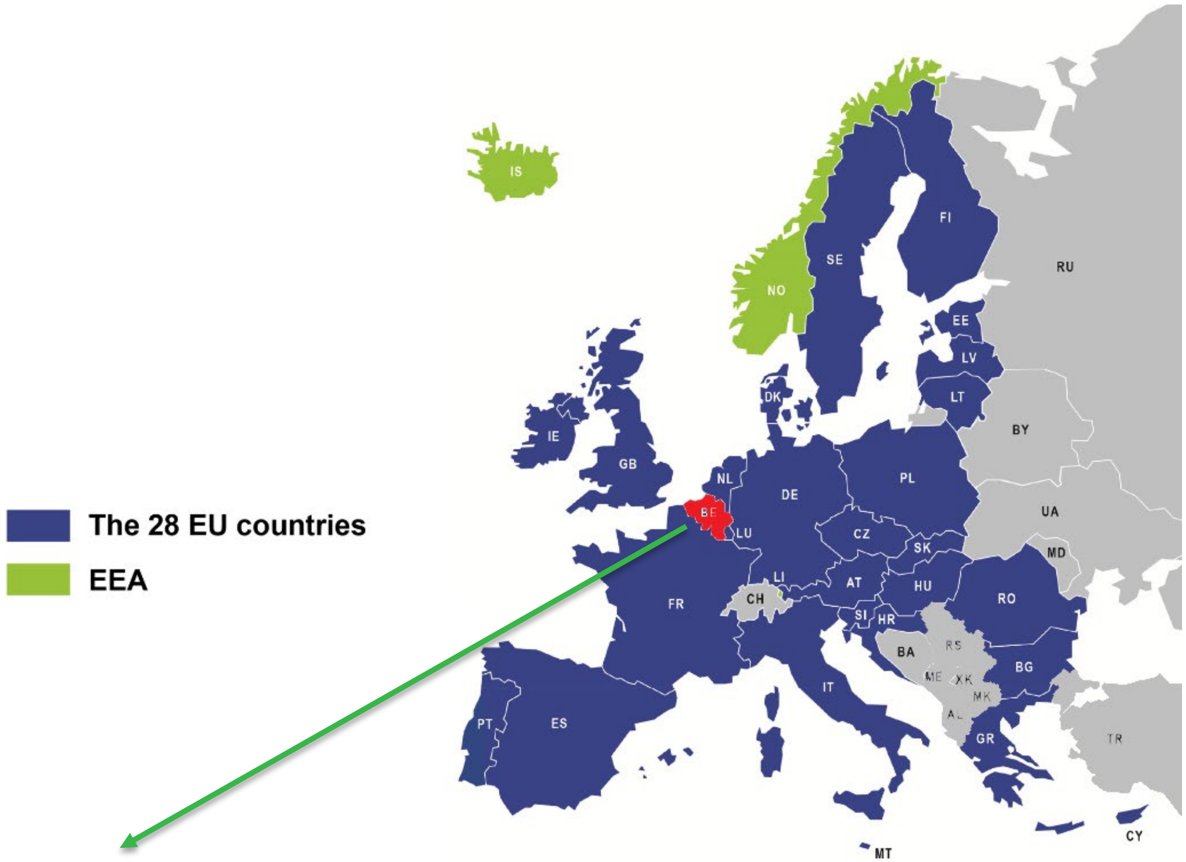
How does that work in Belgium? EARS-BE

- All 28 EU Member States and two EEA countries (Iceland and Norway)



How does that work in Belgium? EARS-BE

Patients with suspicion of bloodstream infection, bacterial meningitis (or urinary tract infection*)

Blood/Cerebrospinal fluid (CSF) or urine samples*

POSITIVE antimicrobial susceptibility test in laboratory

Extraction of an electronic data file from the lab database (1x/year)

Sending of this electronic data file via e-mail to our unit

Data cleaning, standardisation, de-duplication, report & validation

Merge in a national data set

Report to Europe (ECDC) & Annual report for Belgium

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* Only for Belgium since 2017

Data collection

- **Laboratories send their data on a voluntary base**

- **EARS-NET encourages** the use of The European Committee on Antimicrobial Susceptibility Testing (**EUCAST**) guidelines and breakpoints to determine clinical antimicrobial susceptibility but countries and laboratories using **other guidelines are still welcome** to report data if the use of clinical guidelines is specified

- Inclusion of all isolates from **blood** (B), **cerebrospinal fluid** (CSF), and **urine** (U, *BE only*) samples taken in the study year on an identified patient and for which an antimicrobial susceptibility test (**AST**, full list in protocol) has been performed

- **Bacterial species under surveillance**: *Streptococcus pneumoniae* (B,CSF), *Staphylococcus aureus* (B,U), *Enterococcus faecalis* (B,U), *Enterococcus faecium* (B,U), *Escherichia coli* (B,CSF,U), *Klebsiella pneumoniae* (B,CSF,U), *Pseudomonas aeruginosa* (B,CSF,U), *Acinetobacter spp.* (B,CSF,U)

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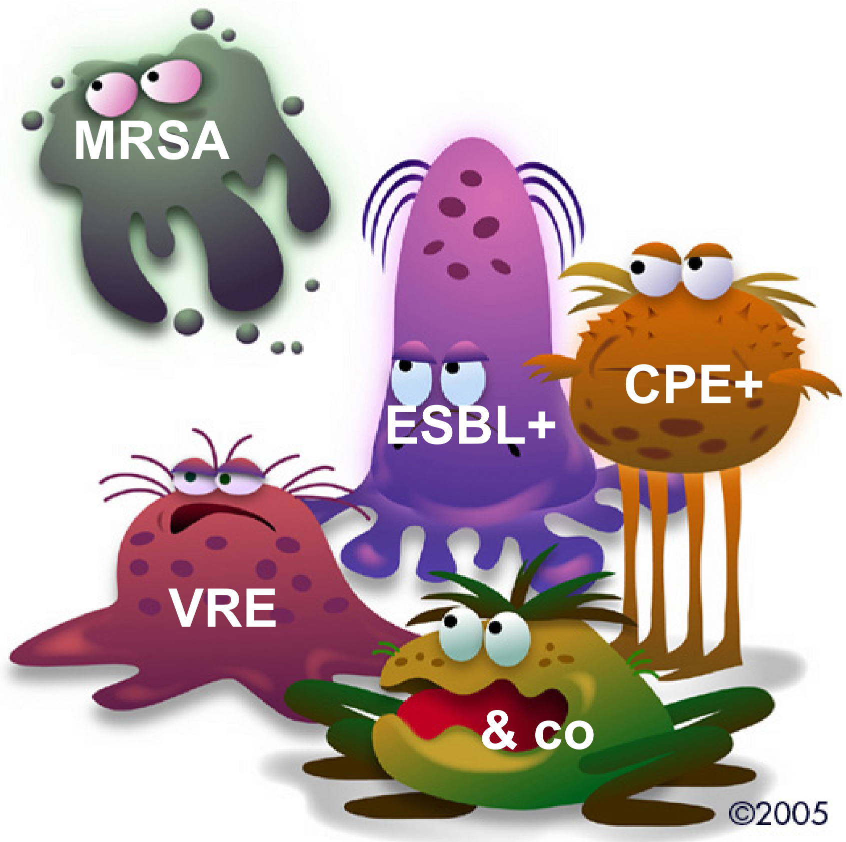
Multidrug resistant microorganisms (MDRO)



Most common MDRO = the ESKAPE(E) bacteria

Enterococcus faecium

Staphylococcus aureus

Klebsiella pneumoniae

Acinetobacter baumannii

Pseudomonas aeruginosa

Enterobacter species

+ *Escherichia coli*

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Main results : participation rate

Number of hospital laboratories reporting at least one BLOOD/CSF isolate for the European Antimicrobial Resistance Surveillance for Belgium (EARS-BE), 2007-2018 (%participation)

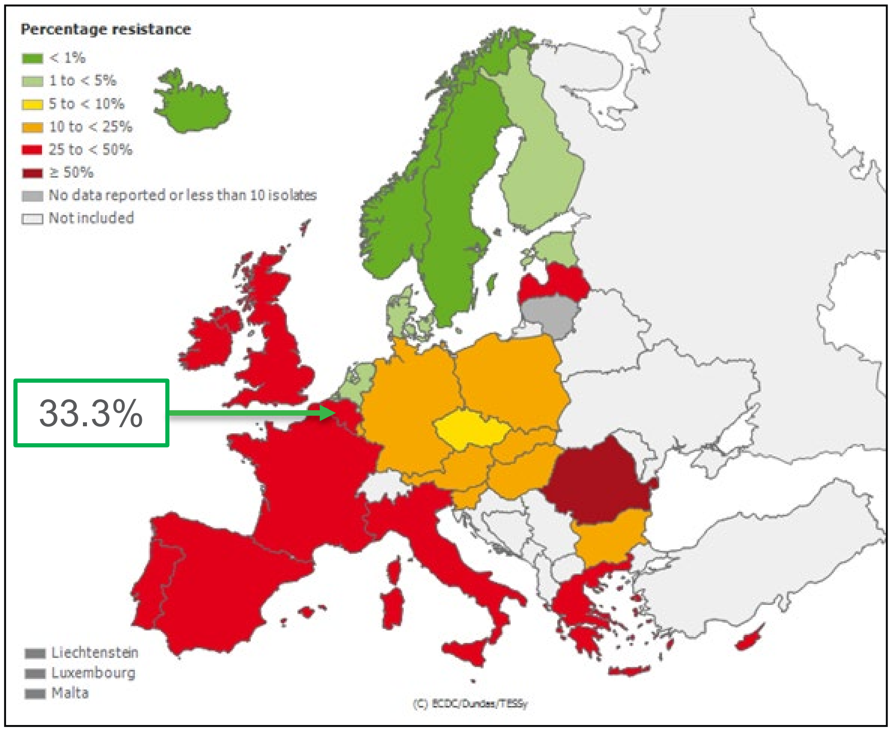
Year	S. pneumoniae	S. aureus	E. coli	Enterococci	K. pneumoniae	P. aeruginosa	Acinetobacter spp.
2007	34/149 (23%)	34/108 (31%)	17/108 (16%)	20/108 (19%)	-	-	-
2008	97/149 (65%)	38/107 (36%)	16/107 (15%)	19/107 (18%)	-	-	-
2009	98/149 (66%)	34/108 (31%)	18/108 (17%)	14/108 (13%)	8/108 (7%)	8/108 (7%)	-
2010	94/149 (63%)	40/108 (37%)	23/108 (21%)	22/108 (20%)	14/108 (13%)	15/108 (14%)	-
2011	89/148 (60%)	50/107 (47%)	43/107 (40%)	46/107 (43%)	44/107 (41%)	43/107 (40%)	-
2012	93/147 (63%)	44/107 (41%)	41/107 (38%)	41/107 (38%)	41/107 (38%)	40/107 (37%)	
2013	92/14 (62%)	41/106 (39%)	41/106 (39%)	39/106 (37%)	41/106 (37%)	40/106 (37%)	2/106 (2%)
2014	96/146 (66%)	27/105 (26%)	27/105 (26%)	25/105 (24%)	26/105 (25%)	27/105 (26%)	3/105 (3%)
2015	89/142 (63%)	25/102 (24%)	25/102 (24%)	25/102 (24%)	24/102 (23%)	25/102 (24%)	8/102 (8%)
2016	97/139 (70%)	31/102 (30%)	31/102 (30%)	30/102 (29%)	28/102 (27%)	31/102 (30%)	18/102 (18%)
2017	92/139 (66%)	30/102 (29%)	31/102 (30%)	31/102 (30%)	31/102 (30%)	30/102 (29%)	21/102 (20%)
2018	88/138 (64%)	31/102 (30%)	31/102 (30%)	31/102 (30%)	31/102 (30%)	30/102 (29%)	26/102 (25%)

Main results : resistance rate

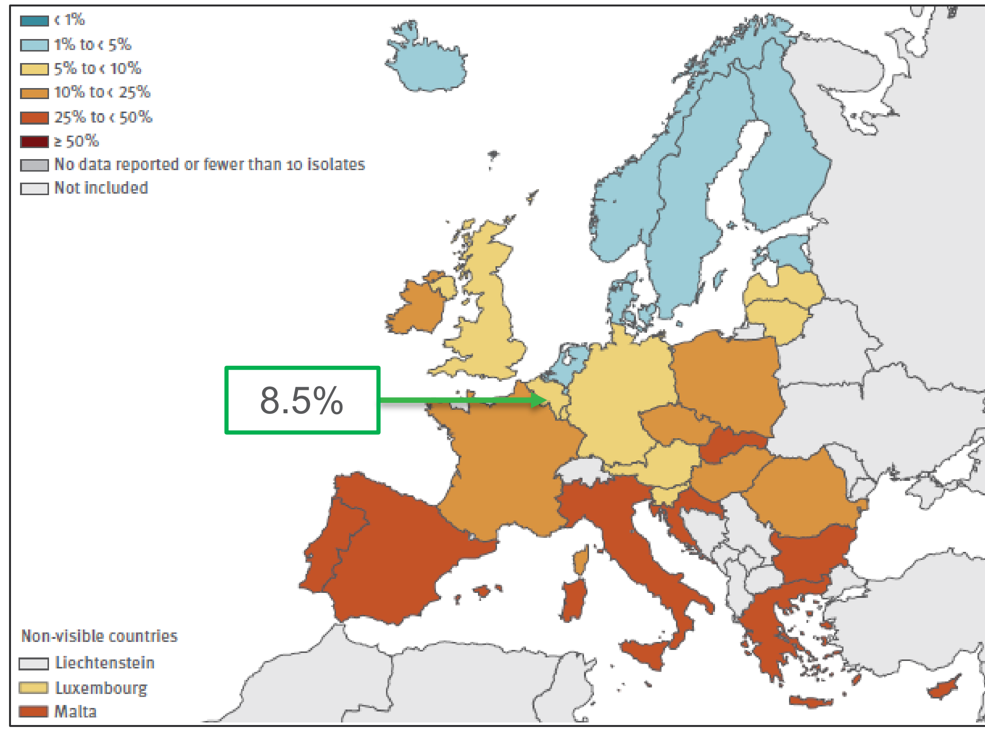
- Gram positive bacteria :
  - *Staphylococcus aureus*
    - MRSA
    - Fluoroquinolones
    - Rifampicine
  - *Enterococci : Enterococcus faecalis & Enterococcus faecium*
    - Aminopenicillins
    - Gentamicin high level
    - Vancomycin
    - Teicoplanin
    - Linezolid

Methicillin-resistant *Staphylococcus aureus*

2004



2017



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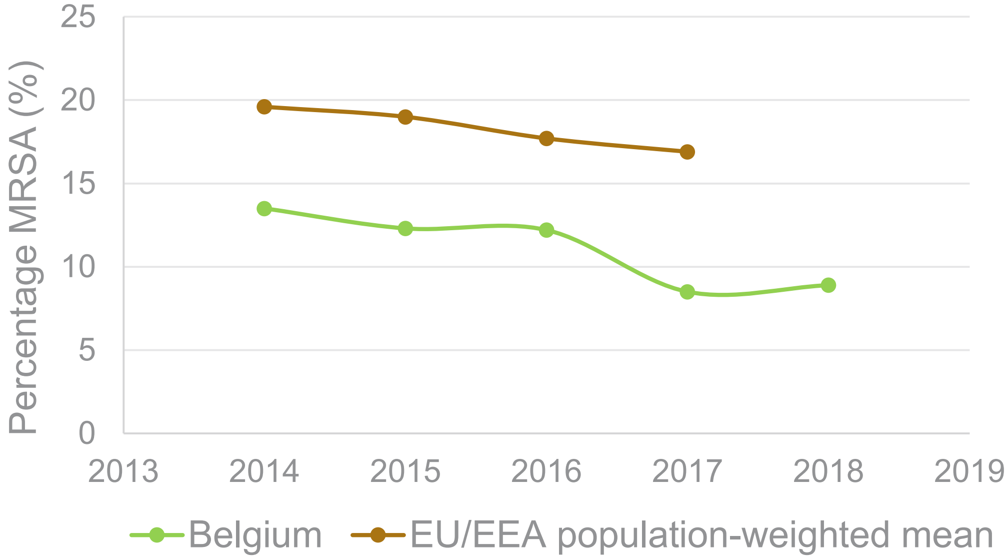
Methicillin-resistant *Staphylococcus aureus*

Staphylococcus aureus. Percentage (%) of invasive isolates with resistance to methicillin, Belgium and EU/EEA population



- Significantly decreasing trend between 2014 and 2017 in Belgium and in Europe in general
- The percentage of MRSA in Belgium seems to stabilize in 2018

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Methicillin-resistant *Staphylococcus aureus*

- This decreasing trend can be attributed to the development and implementation of national recommendations on the prevention of spread of MRSA focusing on
  - improved infection prevention and control
  - prudent antimicrobial use

- However, *S. aureus* remains one of the most common causes of serious bacterial infections with high rates of mortality and morbidity.

- Increased spread of healthcare associated MRSA (HA-MRSA) into the communities

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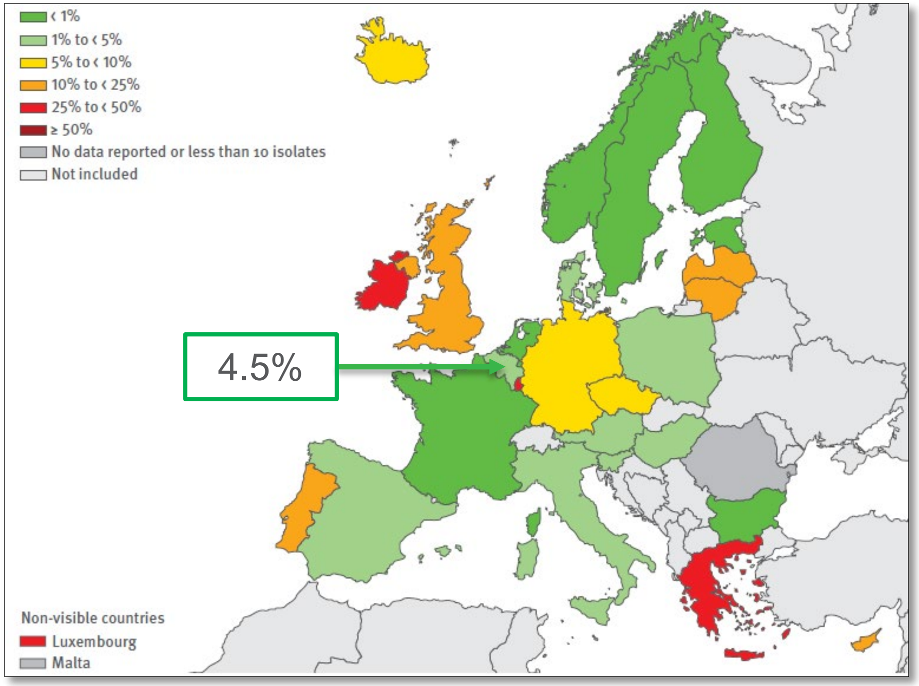
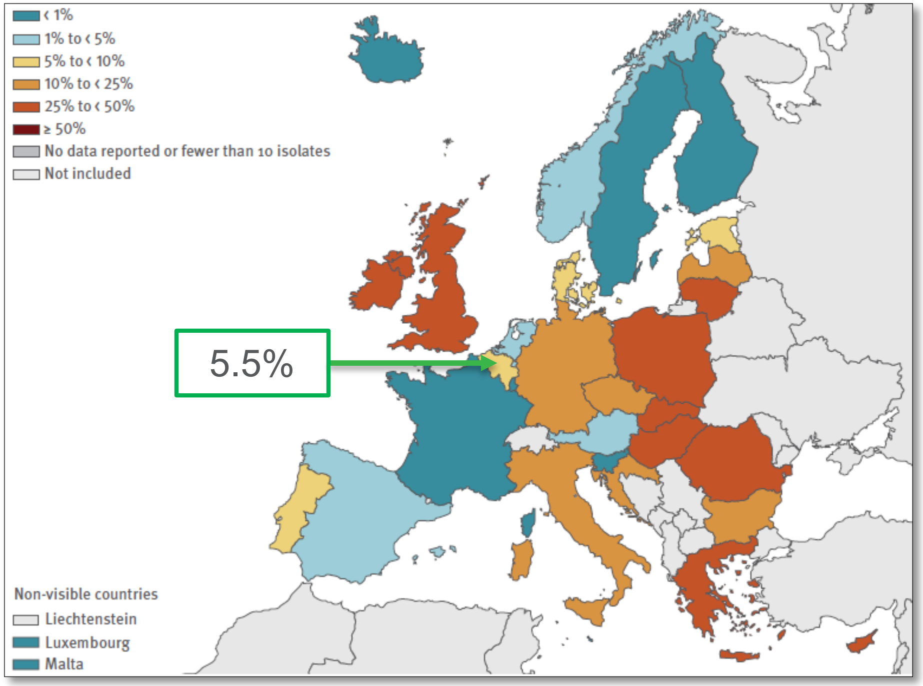
Vancomycin-resistant *Enterococcus faecium*

2009



2017



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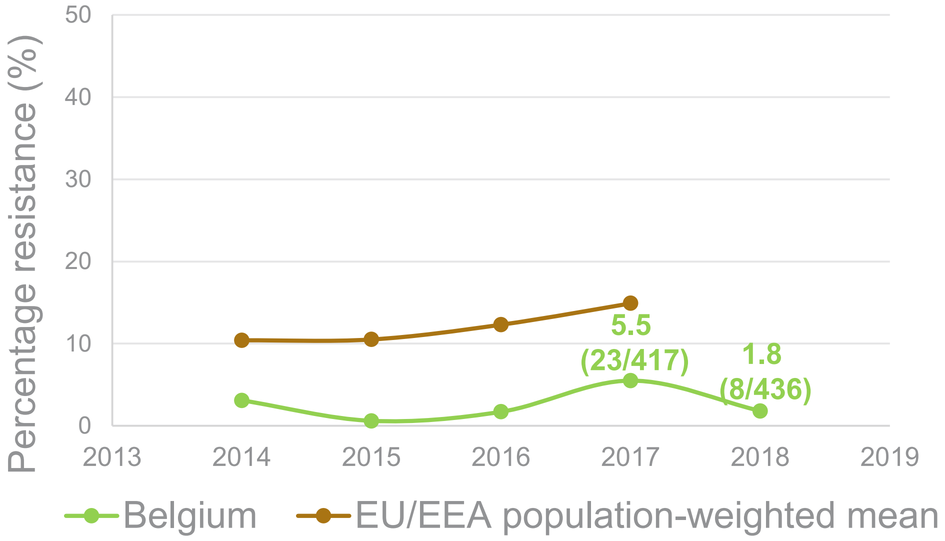
Vancomycin-resistant *Enterococcus faecium*

Enterococcus faecium. Percentage (%) of invasive isolates with resistance to vancomycin, Belgium and EU/EEA



- Significantly increasing trend between 2014 and 2017 in Belgium and in Europe in general
- Drop from 5.5% in 2017 to 1.8% in 2018 for Belgium (due to multiple hospital outbreaks in 2017?)

Vancomycin-resistant *Enterococcus faecium*

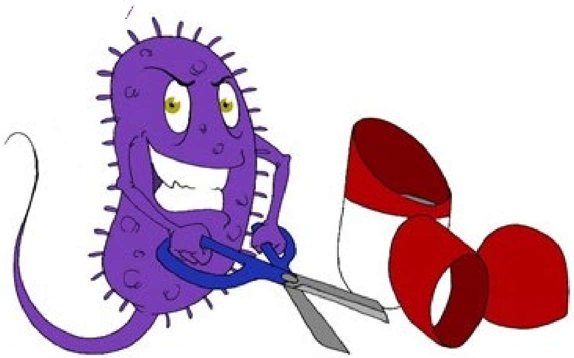
- Enterococci are intrinsically resistant to a broad range of antimicrobial agents :
    - Cephalosporins, sulphonamides, low concentrations of aminoglycosides, beta-lactams

- Additional acquired resistance severely limits the number of treatments options

- Pathogen with high priority in the challenge of infection control

Main results

- Gram negative bacteria :
  - *Esherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Acinetobacter baumanii*



- Aminopenicillins
- 3rd generation cephalosporins

} Resistance development by the production of ESBL

- Carbapenems

} Resistance development by the production of carbapenemases

- Fluoroquinolones
- Aminoglycosides

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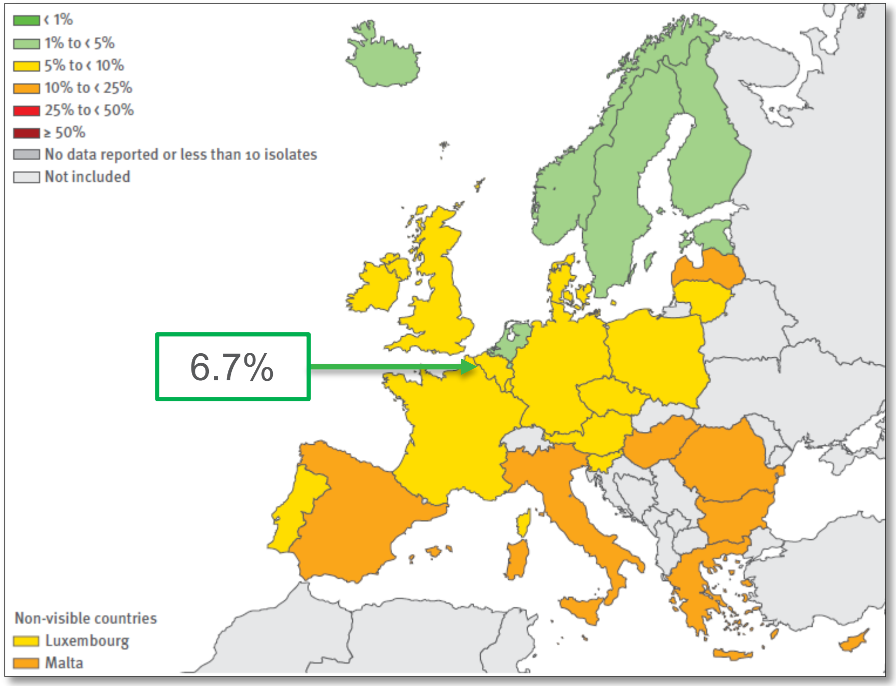
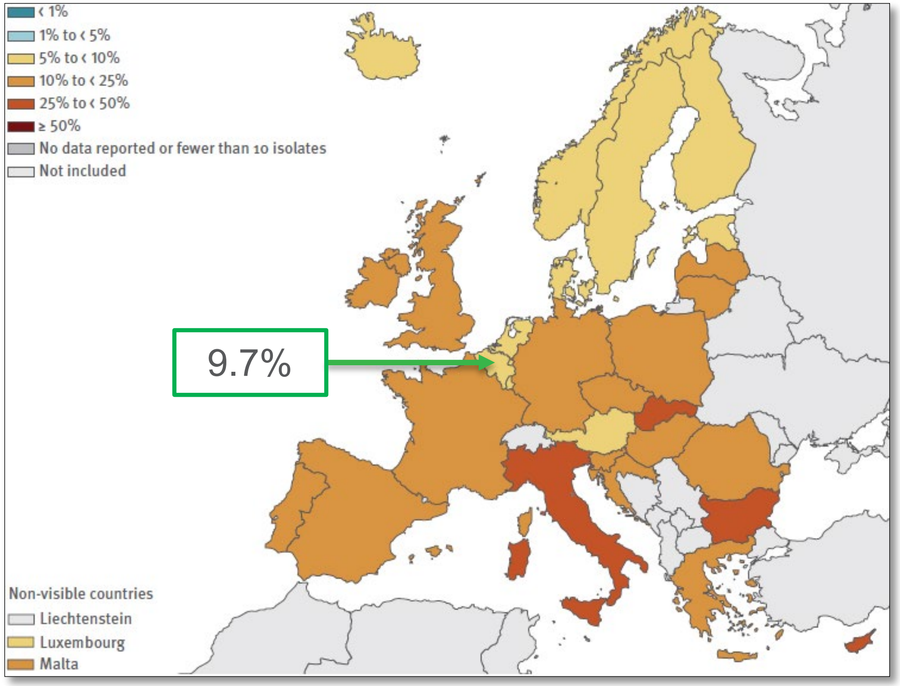
3rd generation cephalosporins-resistant *Escherichia coli*

2009



2017



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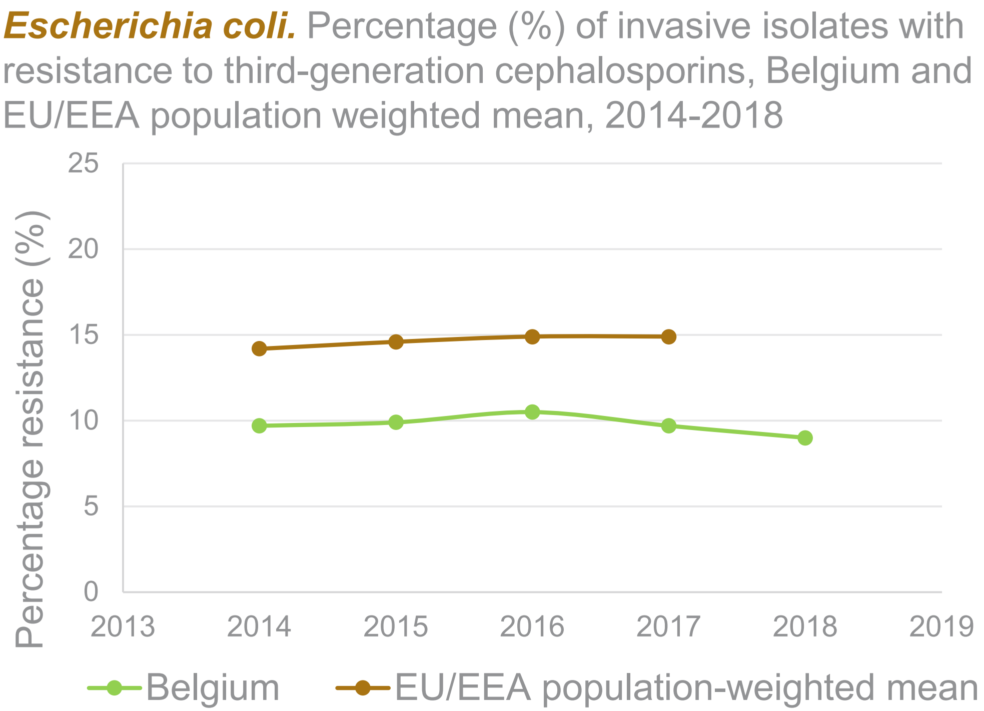
3rd generation cephalosporins-resistant *Escherichia coli*



- Small but significant increasing trend in the EU/EEA population weighted means percentages of 3rd generation cephalosporin resistance between 2014-2017
- No significant trend detected for Belgium
- A majority of 3rd generation cephalosporin-resistant isolates are ESBL positive

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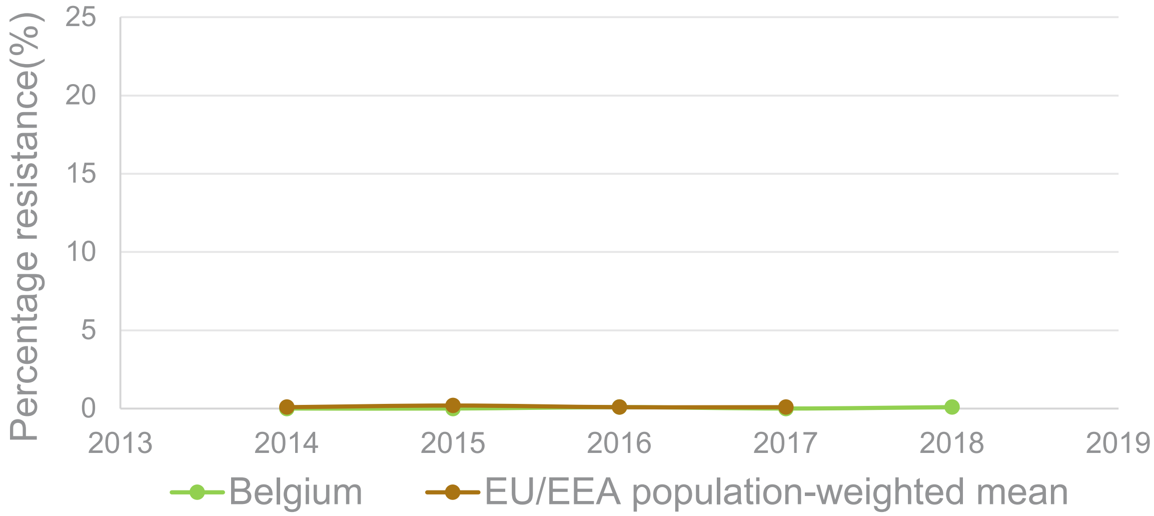
Carbapenem-resistant *Escherichia coli*

Escherichia coli. Percentage (%) of invasive isolates with resistance to carbapenems, Belgium and EU/EEA population weighted mean, 2014-2018



- Carbapenem resistance for *E. coli* stay really low in Belgium (0.1% in 2018) as well as in Europe in general (0.1% in 2017).

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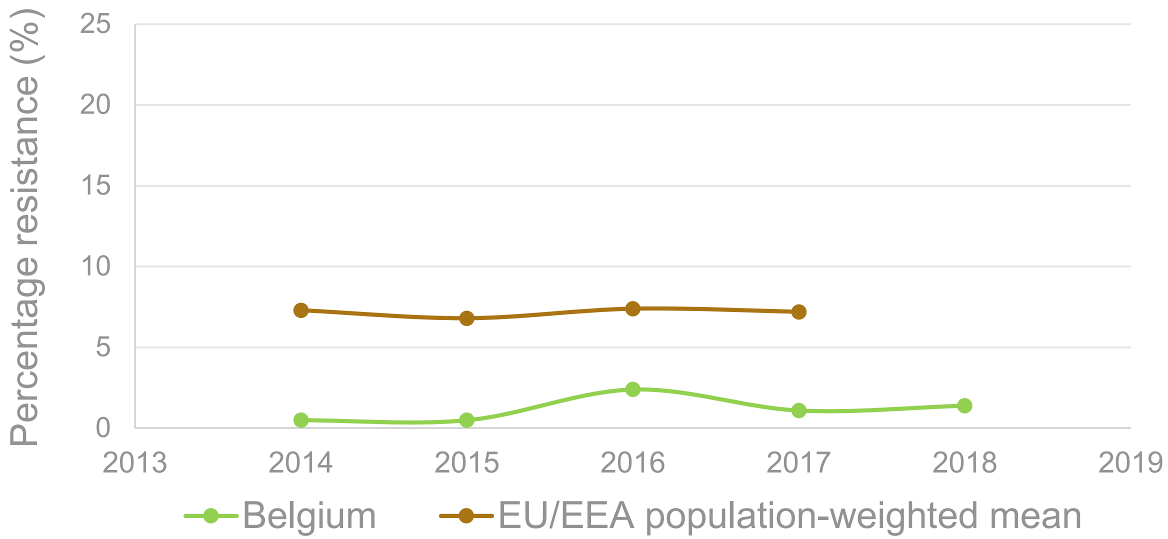
Carbapenem-resistant *Klebsiella pneumoniae*

Klebsiella pneumoniae. Percentage (%) of invasive isolates with resistance to carbapenems, Belgium and EU/EEA population weighted mean, 2014-2018



- Higher carbapenems resistance in *K. pneumoniae* than in *E. coli*.
- Several European countries reported carbapenem resistance percentages above 10% in 2017

Conclusion

- Antimicrobial resistance remains a serious threat in Europe
- Strategies to reduce the occurrence and spread of AMR :

- **Antimicrobial stewardship**

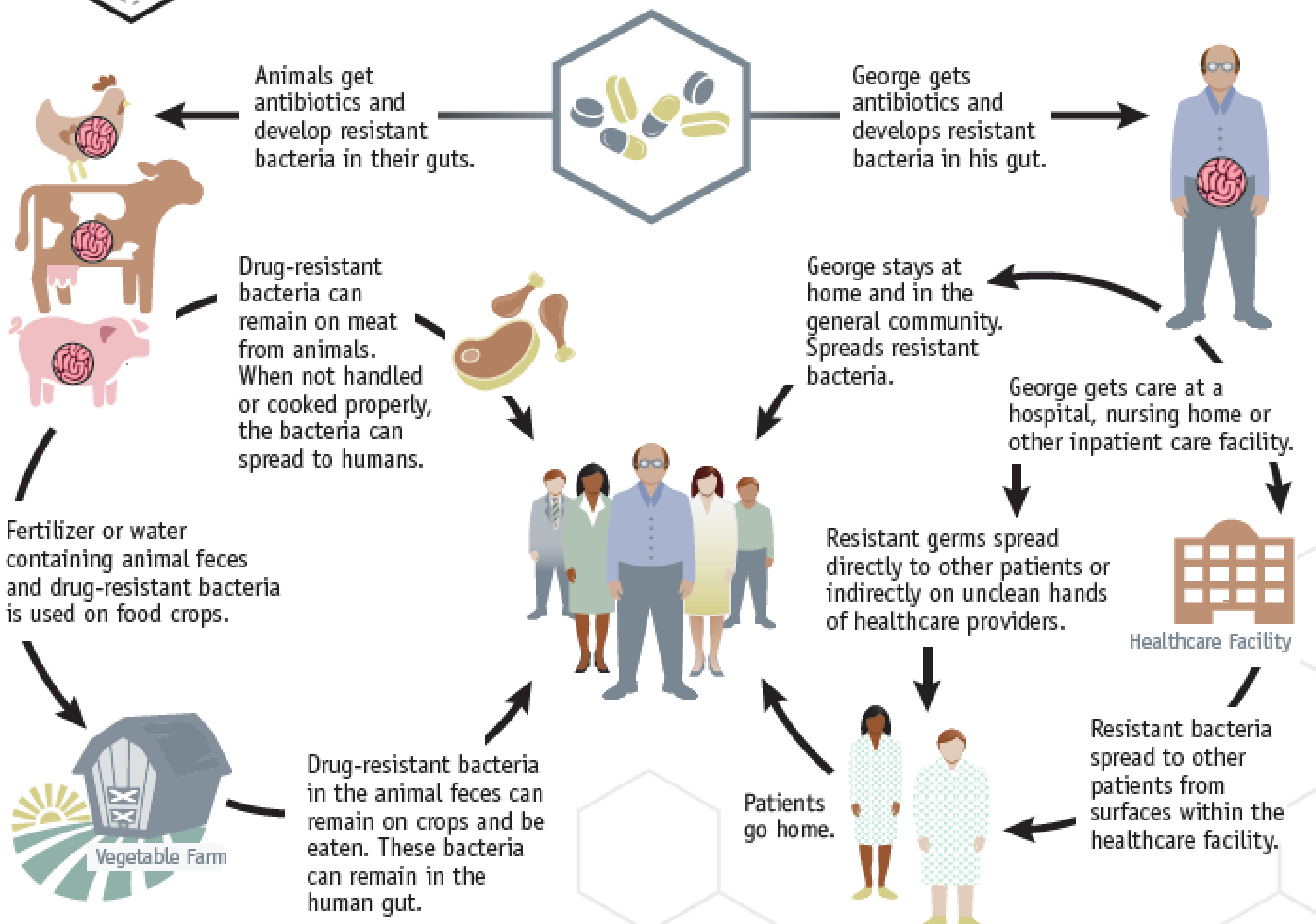
→ Prudent use of antibiotics

- **Improve infection prevention and control practices**

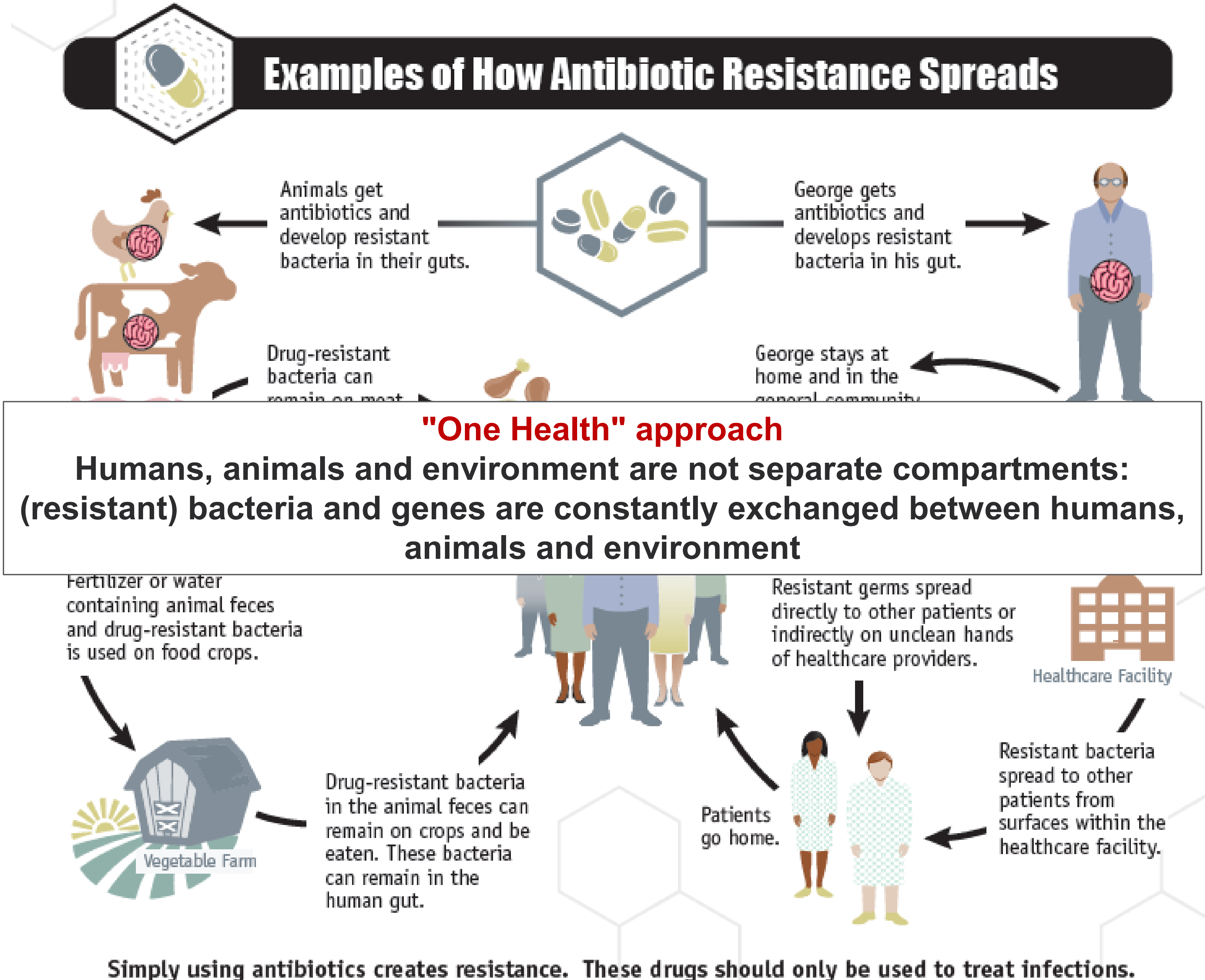
→ Effective hygiene practices, including hand hygiene

→ Use a clean, well-functioning environment and equipment

Examples of How Antibiotic Resistance Spreads



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

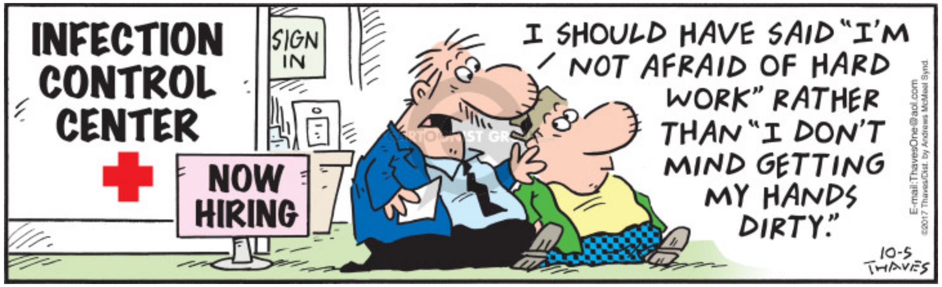


"One Health" approach

Humans, animals and environment are not separate compartments: (resistant) bacteria and genes are constantly exchanged between humans, animals and environment

Conclusion

Every infection prevented is an antibiotic treatment avoided!



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Aknowledgements

- All participating labs and hospitals
- NSIH team

THANKS FOR YOUR ATTENTION

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