university of groningen

University Medical Center Groningen

CRE-free Europe: Prevention of antimicrobial resistance across all borders

Prof. Dr. Alex W. Friedrich
Medical Microbiology and Infection Prevention
University Medical Center Groningen
Netherlands

CEE Conference 2019, Vienna

Disclosure of speaker's interests

(Potential) conflict of interest	None
Potentially relevant company relationships in connection with event	None
Sponsorship or research funding	Several National and European Grants The European Union's Horizon 2020 COFUND programme University Medical Center Groningen (UMCG) umcg INTERREG Deutschland Nederland Europäische Union Europese Unie Ministerie van Volksgezondheid, Welzijn en Sport

Groningen, the very North of the NL

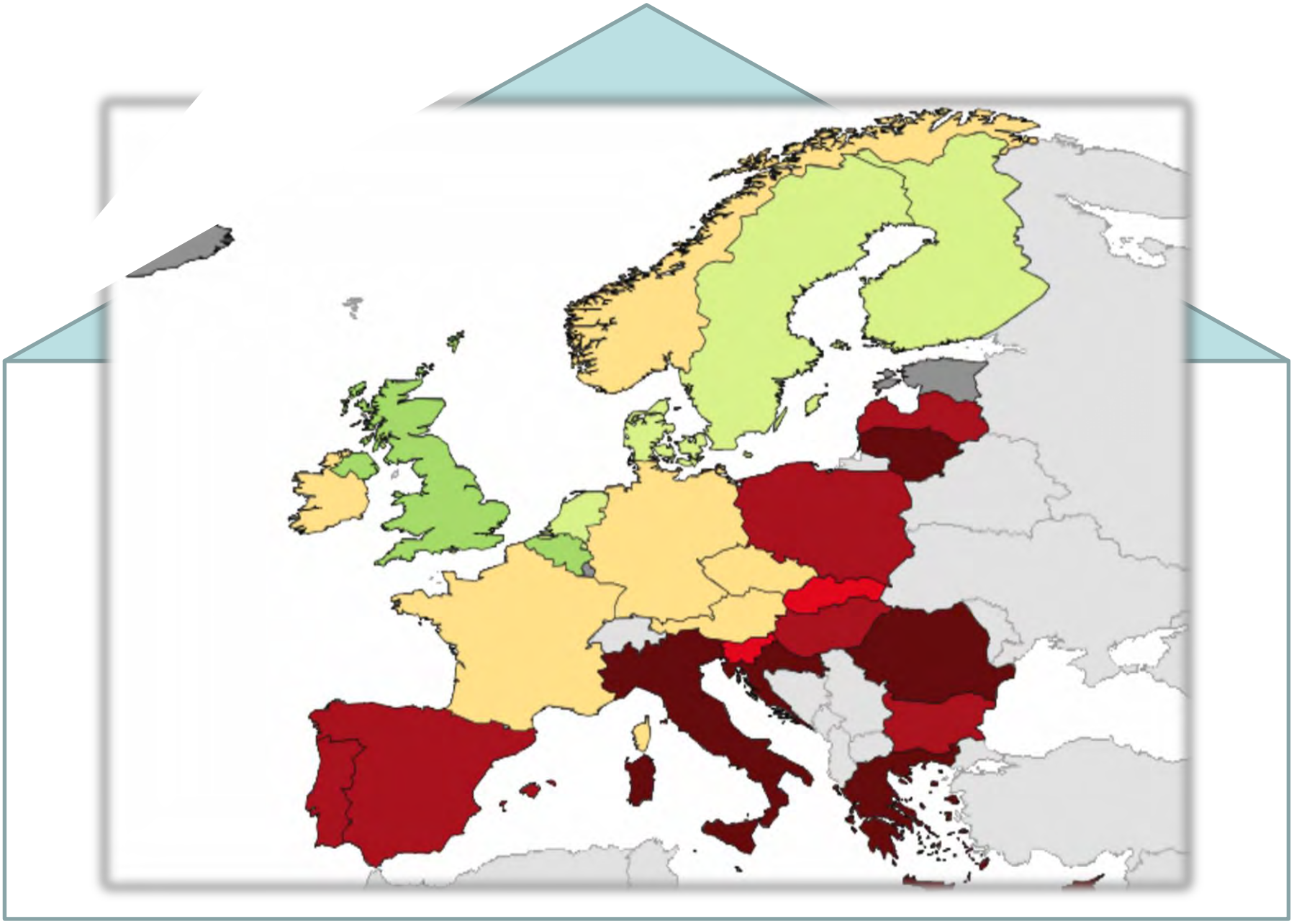
Academy Square in Groningen

The following 40 minutes…

- The challenge
- The reasons behind
- Across borders
- Network-prevention

Imaging you are living in the first-floor appartment of a house and it erupts a fire on the roof. What will you do?

A. Close the door of your appartment
B. Close watersupply for the appartments at the roof
C. Protect your appartment and help the others



CR-*A. baumanii*, EARS-Net, 2017

Cost-analysis of nosocomial outbreaks

7 outbreaks over 2 years at UMCG

Costs 10.778-356.756 Euro

Per pos. patient/outbreak-day:
546 Euro

(e,g. 46 pat./12 weeks: 311.000 Euro)

PLOS ONE

RESEARCH ARTICLE

Cost-Analysis of Seven Nosocomial Outbreaks in an Academic Hospital

Jan-Willem H. Dik[1], Ariane G. Dinkelacker[1,2], Pepijn Vemer[3,4,5], Jerome R. Lo-Ten-Foe[1], Mariëtte Lokate[1], Bhanu Sinha[1], Alex W. Friedrich[1]*, Maarten J. Postma[3,4,5]

1 Department of Medical Microbiology, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands, **2** Department of Medical Microbiology, University Hospital Tübingen, Tübingen, Germany, **3** Department of Pharmacy, Unit of PharmacoEpidemiology & PharmacoEconomics, University of Groningen, Groningen, the Netherlands, **4** Institute of Science in Healthy Aging & healthcaRE (SHARE), University Medical Center Groningen, Groningen, the Netherlands, **5** Department of Epidemiology, University Medical Center Groningen, Groningen, the Netherlands

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Abstract

Citation: Dik J-WH, Dinkelacker AG, Vemer P, Lo-Ten-Foe JR, Lokate M, Sinha B, et al. (2016) Cost-Analysis of Seven Nosocomial Outbreaks in an Academic Hospital. PLoS ONE 11(2): e0149226. doi:10.1371/journal.pone.0149226

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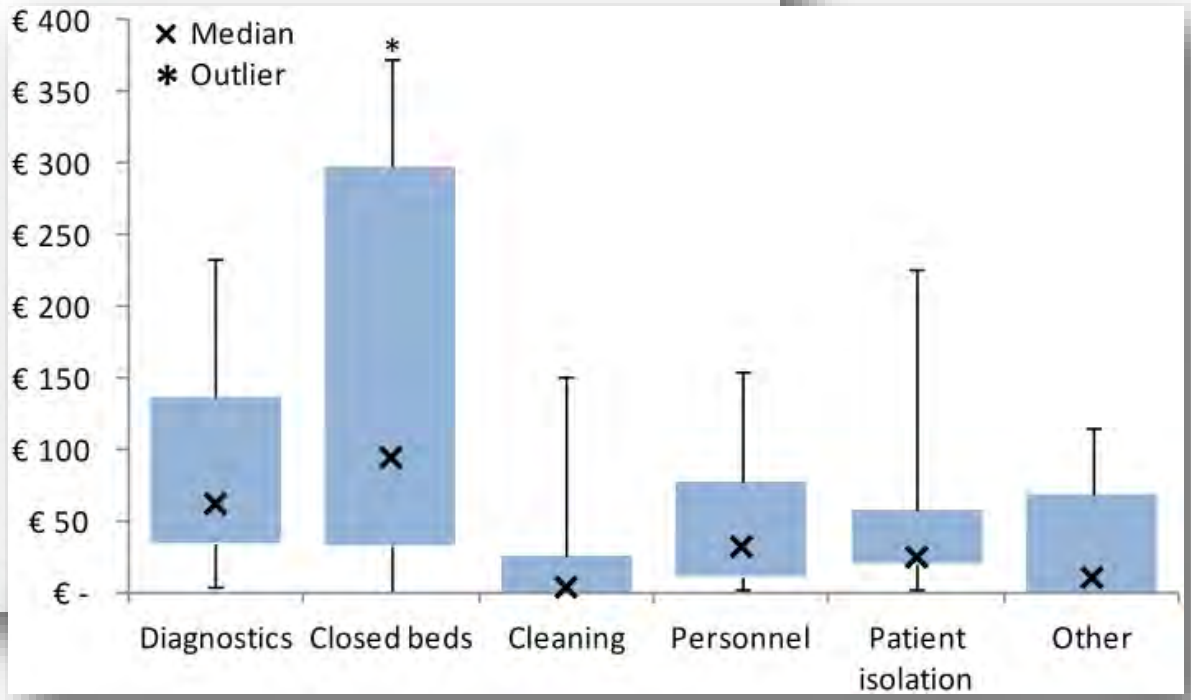
Data Availability Statement: All relevant data are within the paper.

Funding: This work was partly supported by the European Union, the German states of North Rhine-Westphalia and Lower Saxony and the Dutch provinces Overijssel, Gelderland and Limburg via the



Important changes for modern microbiological diagnostics

- Value-based Medicine

  Porter M. NEJM 2010

- Prevention-economic models: pay for safety instead of -performance

- Disruptive innovations (metagenomics)

- personalised /interventional microbiology

- “Zero-cost”-diagnostic-movement

Paper-based microfluidics, George Whitesides, TED


5
EURO
5
EURO

Prevention-economic model

- Integrated cost models for diagnostics within the price of the antibiotics
- Regional prevention budgets (system allowance)
- A financial incentive for rapid diagnostic in acute- care hospitals (Euro-hour-model)
- Prevention-fostering reimbursement following an insurance model,
  whereby risk behaviour (e.g. high SSI, low hand hygiene) gets risk premium

frontiers in Microbiology

ORIGINAL RESEARCH
published: 05 October 2017
doi: 10.3389/fmicb.2017.01914

Epidemiology of Extended-Spectrum β-Lactamase-Producing *E. coli* and Vancomycin-Resistant Enterococci in the Northern Dutch–German Cross-Border Region

OPEN ACCESS

Edited by:
John R. Battista, Louisiana State University, United States

Reviewed by:
Zhuofei Xu,

Xuewei Zhou[1†], Silvia Garcia-Cobos[1*†], Gijs J. H. M. Ruijs[2], Greetje A. Kampinga[1], Jan P. Arends[1], Dirk M. Borst[1], Lieke V. Möller[3], Nicole D. Holman[4], Theo A. Schuurs[5], Lesla E. Bruijnesteijn van Coppenraet[2], Jan F. Weel[5], Jan H. van Zeijl[5], Robin Köck[6,7], John W. A. Rossen[1†] and Alexander W. Friedrich[1†]*

Parameter	EUREGIO-NL	EUREGIO-DE	Ratio
MRSA/100 admissions*	0,11	1,1	1:10
VRE/ 100 admissions	1,3	3,9	1:3
ESBL/100 admissions	6,1	7,7	1:1
CR-MO/100 admissions**	0	0,03	1:1

** prelim. results, Corinna Glasner, Laufende Screening-Studie, EurHealth-1Health

Do we compare the right data?

MRSA Blood culture rates in the Euregio per patients vs. per inhabitants

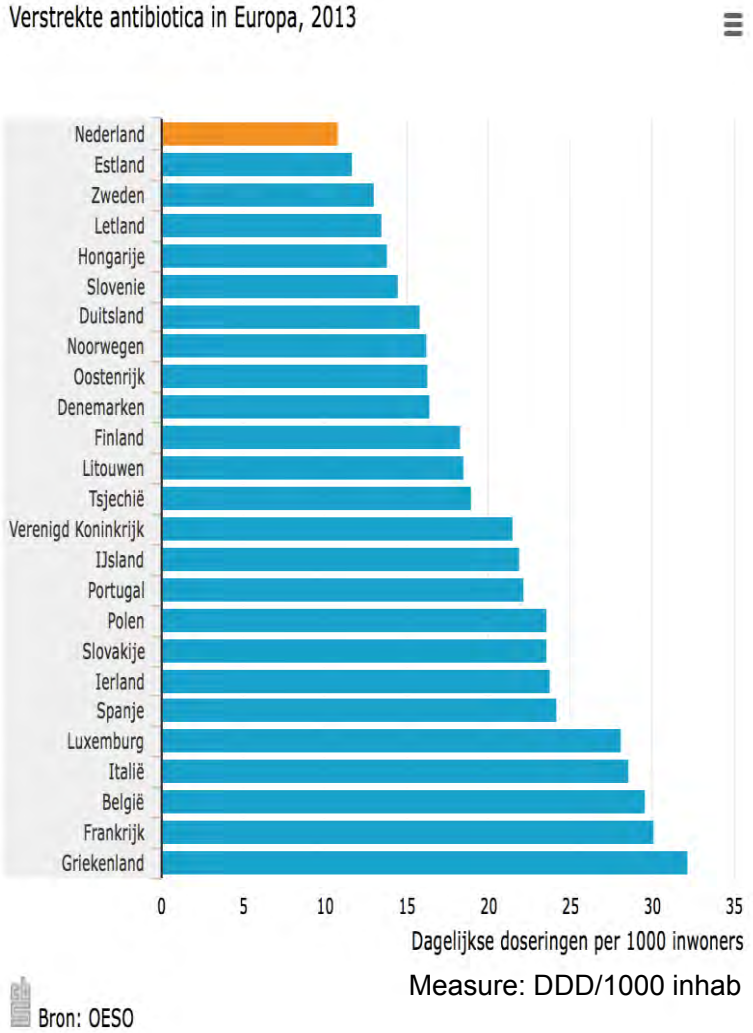
2012-2015	Patients	Pat-days (Pd)	Inhabitants	Patients /100 Inh	Pd/ 100 inh	MRSA-BC	MRSA-BC /10000 pat	MRSA-BC /10000 inh
DE	1.655.580	11.496.572	7.012.932	24	164	274	1,7	0,4
NL	443.863	2.505.630	8.343.128	5,3	30	29	0,6	0,04
Ratio	4:1	5:1	1:1	5:1	5:1	9:1	3:1	10:1

Jurke et al. (submitted)

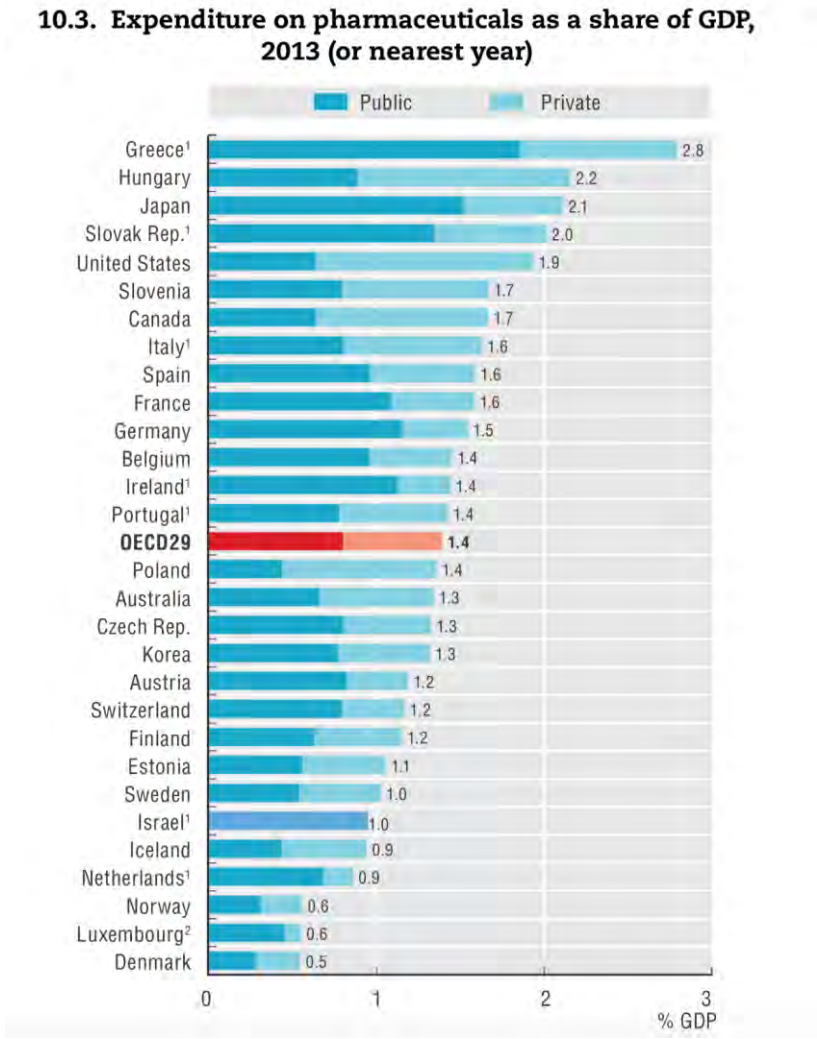
still 30 minutes to go…

- The challenge
- The reasons behind
- Across borders
- Network-prevention

Comparison of rates of antibiotic prescription



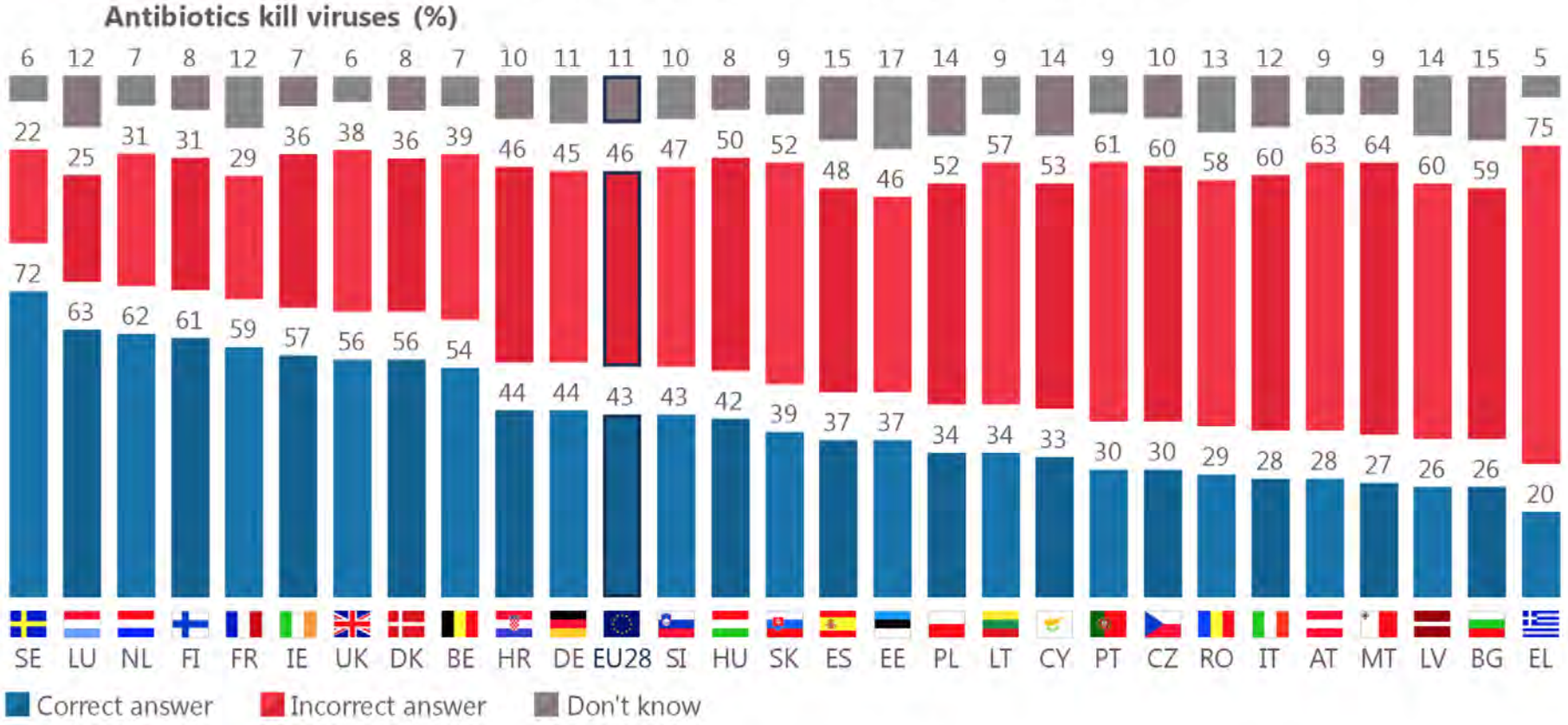
Measure: DDD/1000 inhab



Eurobarometer 2015

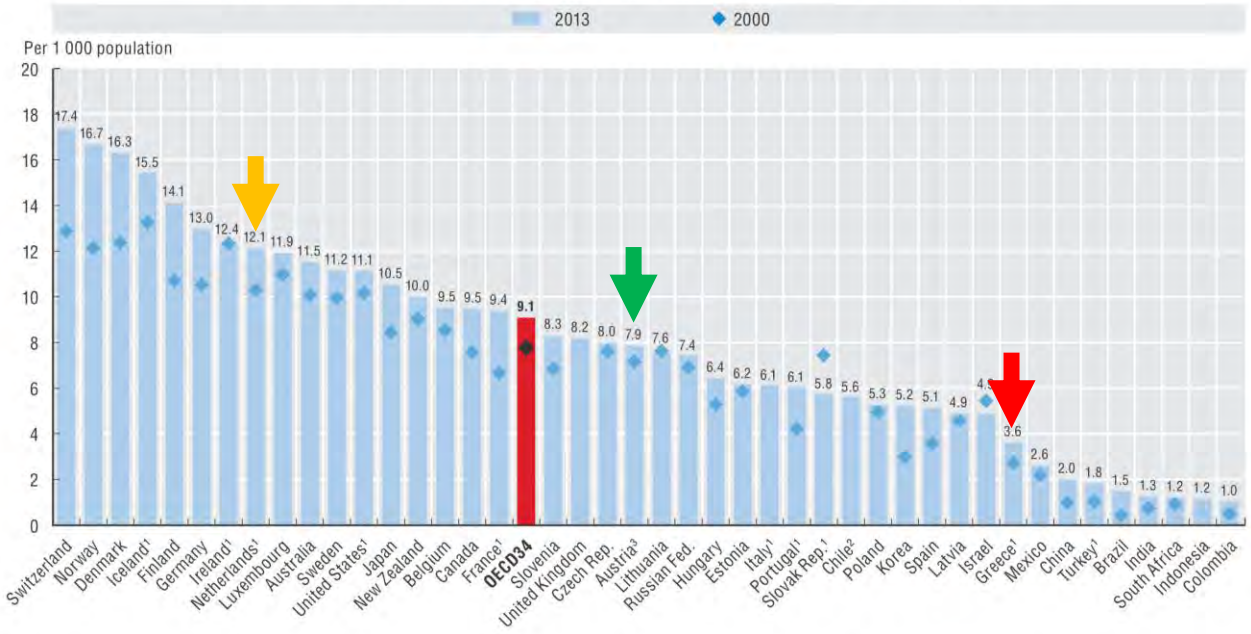
On national level

QB4.1 For each of the following statements, please tell me whether you think it is true or false.

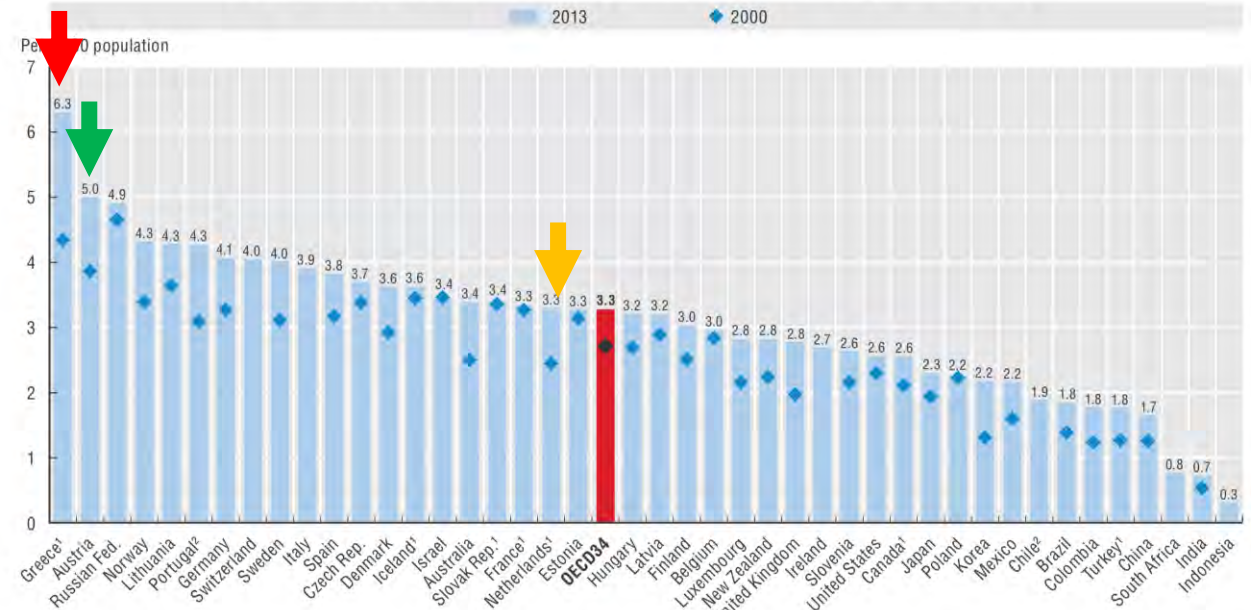


Correct Answer=False

5.13. Practising nurses per 1 000 population, 2000 and 2013 (or nearest year)

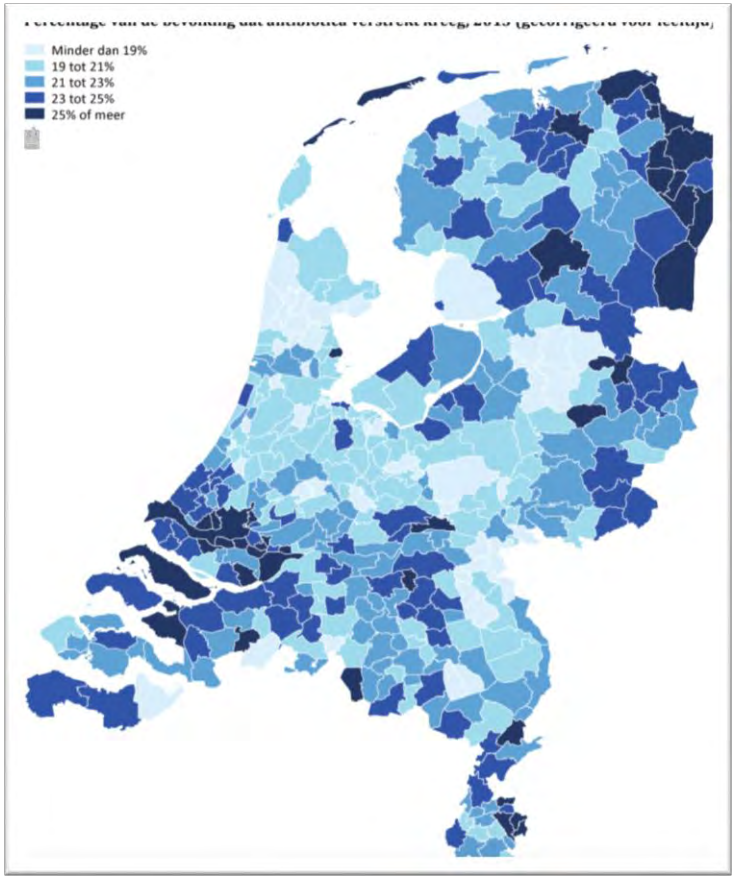


5.1. Practising doctors per 1 000 population, 2000 and 2013 (or nearest year)



Comparison of rates of antibiotic prescription

Netherlands



Niedersachsen

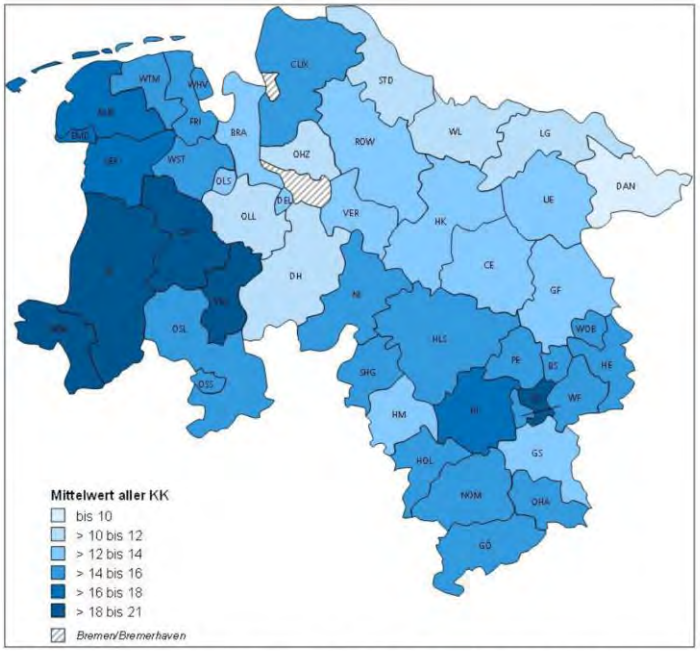
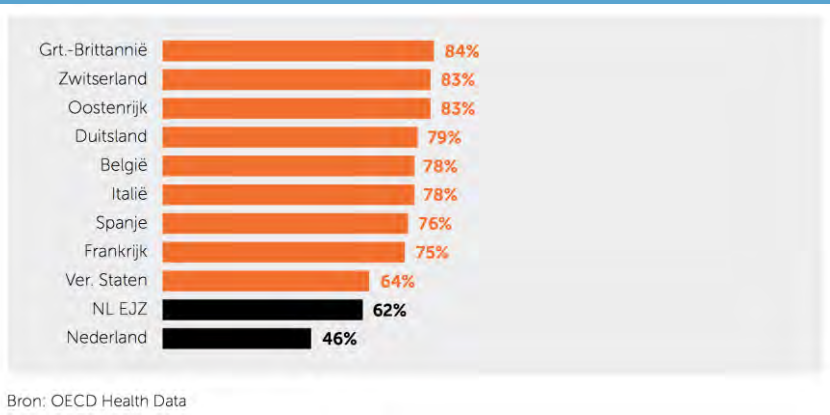


Abbildung 12: Verordnungsdichte(DDD/1000 Versichertentage) in den Landkreisen und kreisfreien Städten Niedersachsens 2015 über alle Altersklassen und alle ATC-Codes.

On regional level

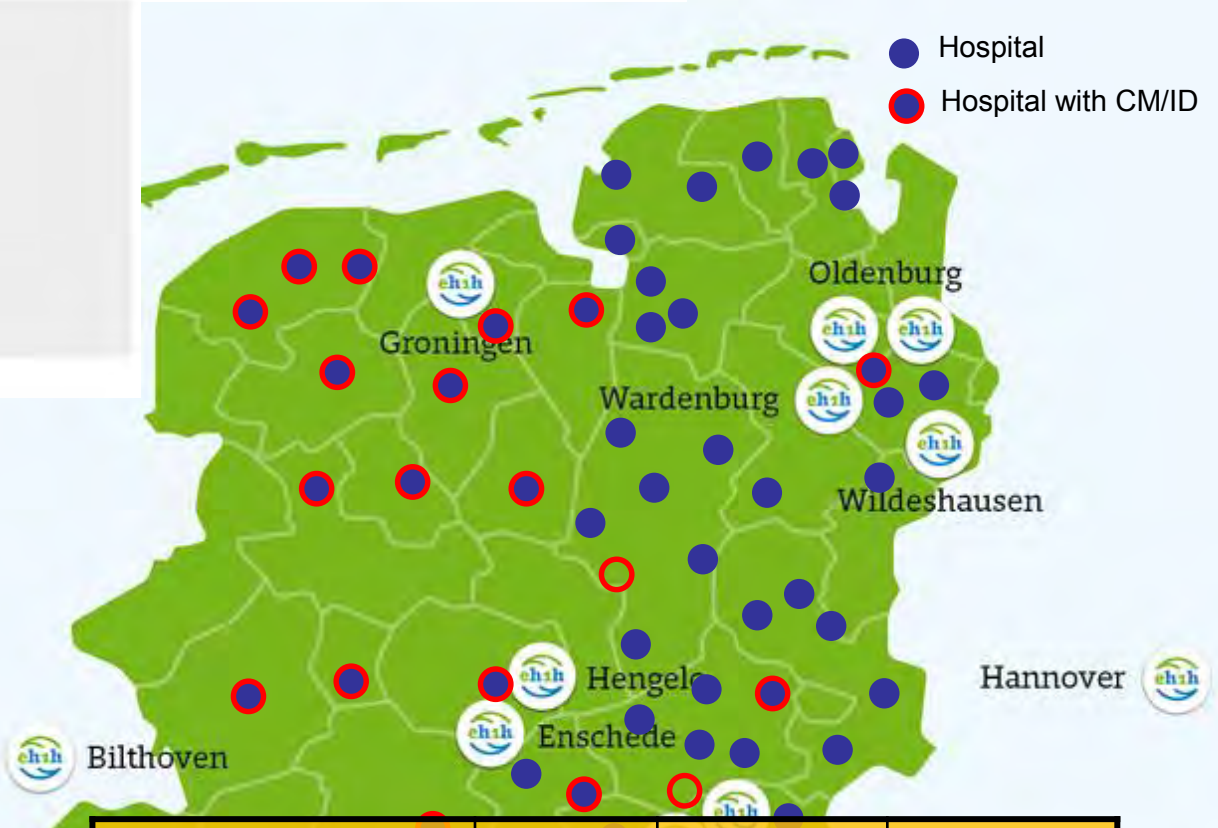
Measure: DDD/1000 inhab

System differences



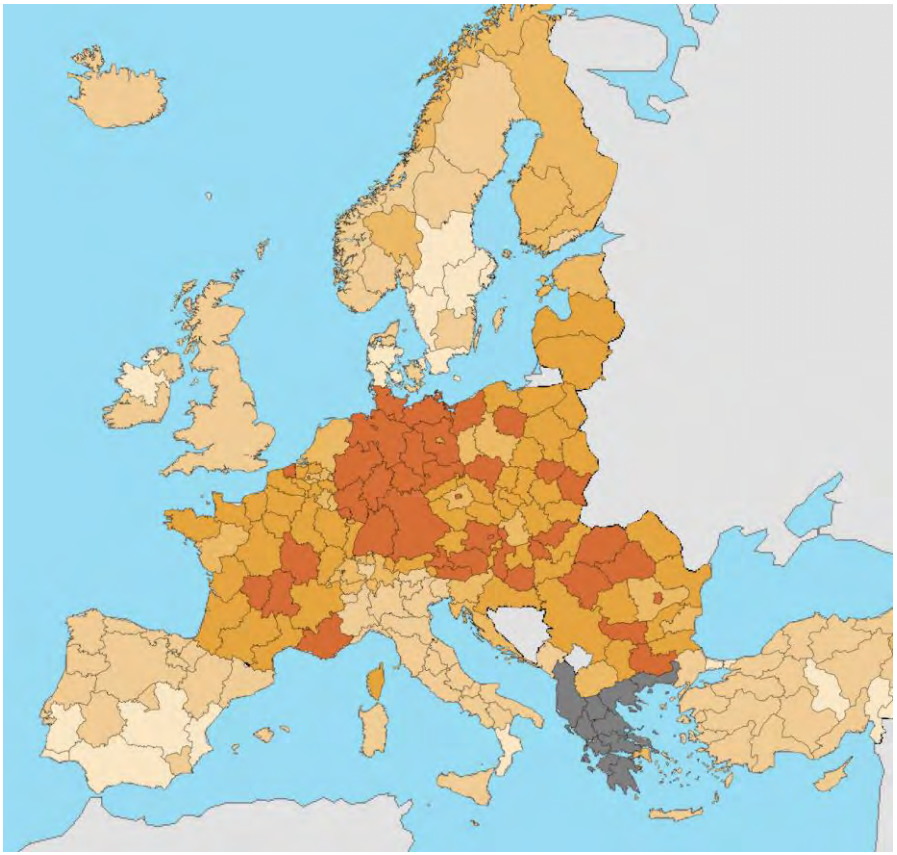
Bron: OECD Health Data

Euregional Antibiotic Resistance and Infection Prevention



Parameter	Euregio-NL	Euregio-DE	Ratio
Inhabitants	8,3 Mio	7 Mio	1:1
Acute care hospital	35	147	1:5
Beds per 1000 inh.	1,5	6	1:4
Stat. patients /100 inh.	6,6	23,8	1:4
HCW: patients ICU (ward)	1,2 (7)	3,4 (14)	3:1
Doctors in own practice/ 1000 inh.	0,4	1,5	1:4
CM/ID per 1000 beds	4,3	1	4:1

Data: EurHealth-1-health, 2018



3.3 Number of hospital beds

Number of hospital beds relative to population size, by NUTS 2 regions, 2015 (number per 100 000 inhabitants, EU-28 = 515)

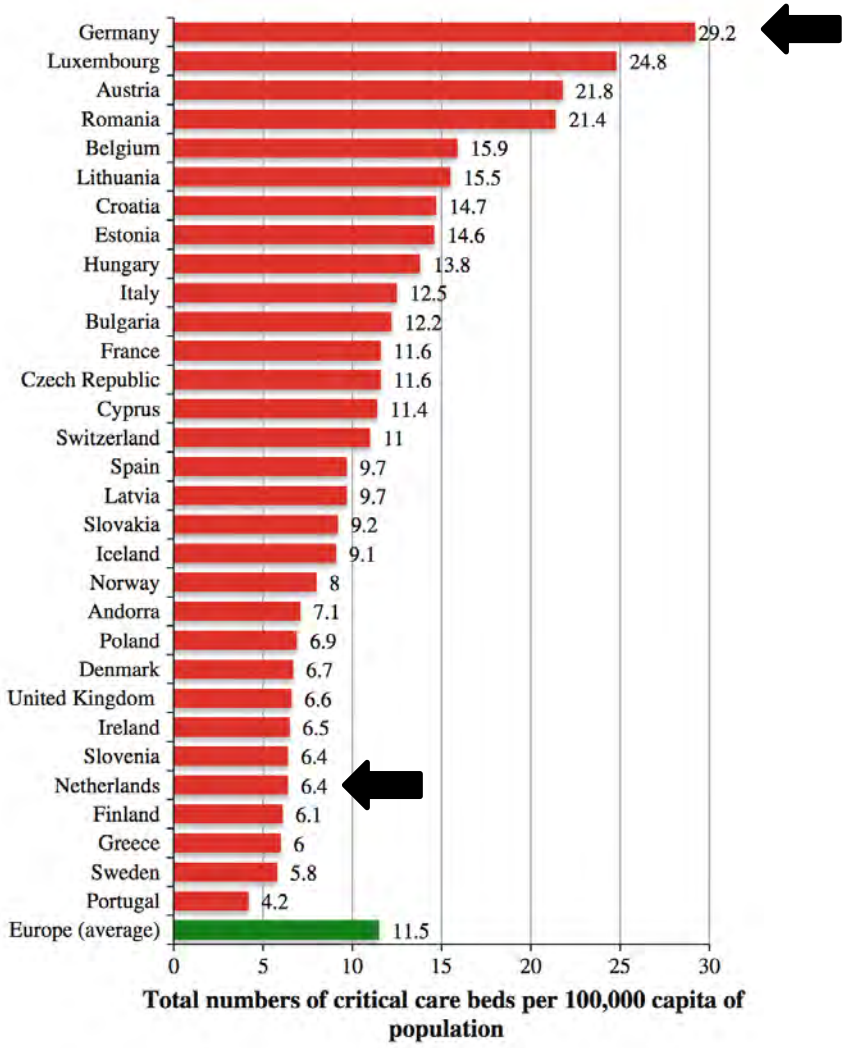
- < 250
- 250 - < 400
- 400 - < 550
- 550 - < 700
- ≥ 700
- Data not available

Intensive Care Med (2012) 38:1647–1653
DOI 10.1007/s00134-012-2627-8

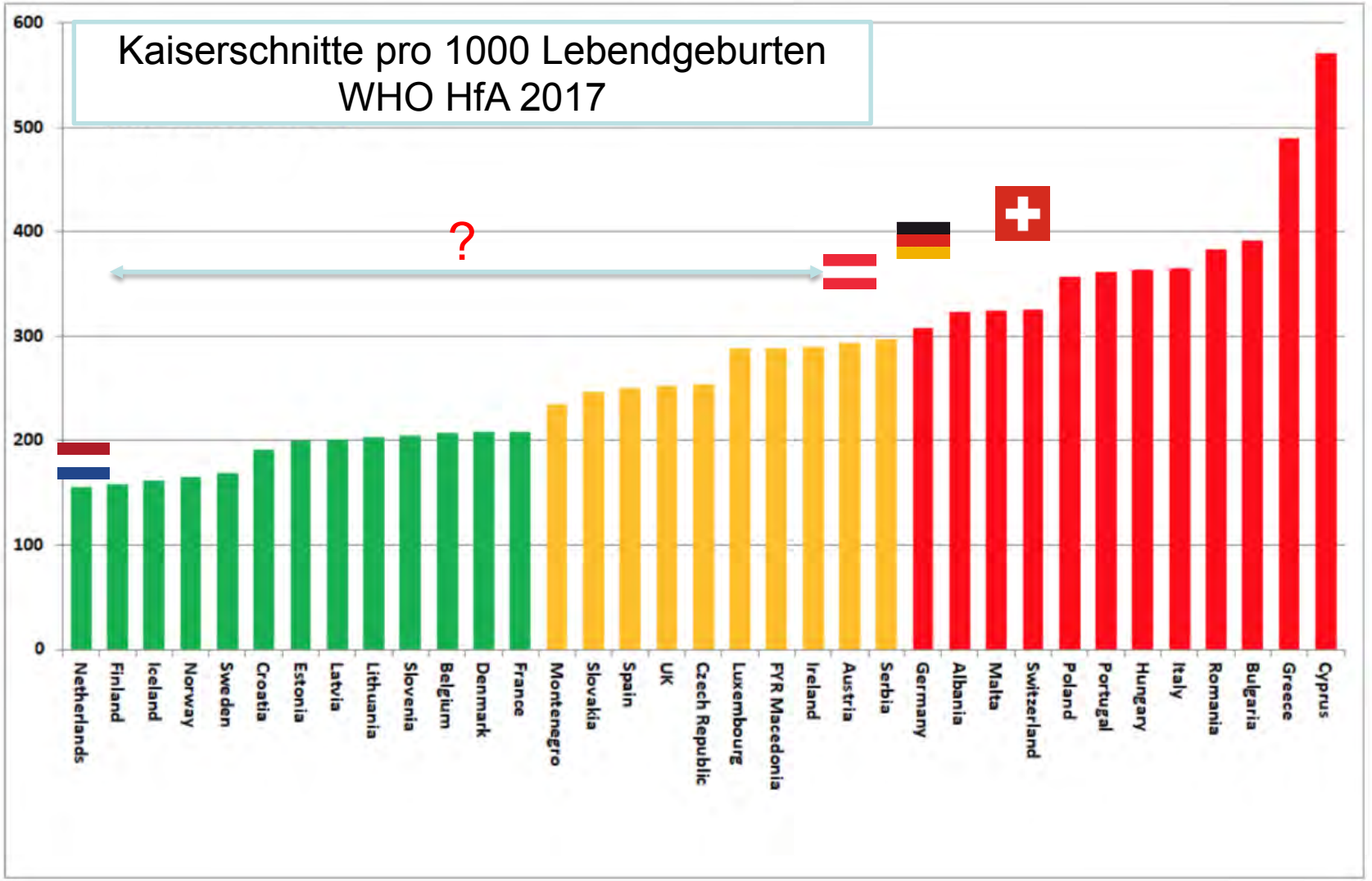
ORIGINAL

A. Rhodes
P. Ferdinande
H. Flaatten
B. Guidet
P. G. Metnitz
R. P. Moreno

The variability of critical care bed numbers in Europe



Differences raise questions

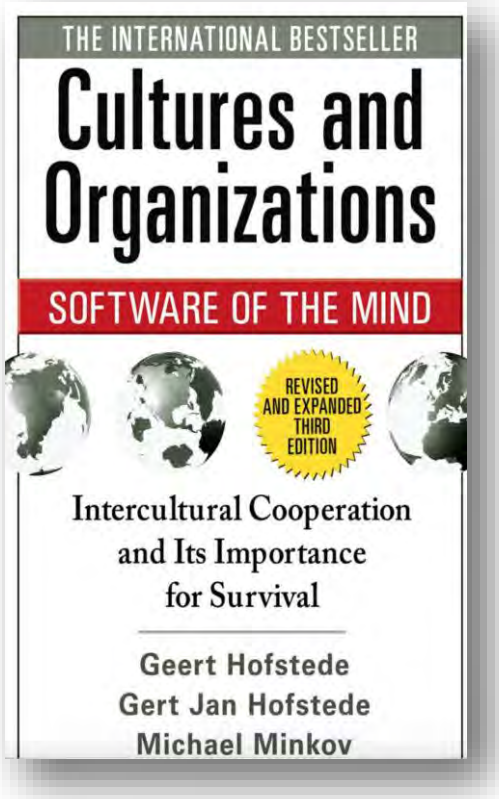


This takes 10 minutes…

- The challenge
- The reasons behind
- Across borders
- Network-prevention

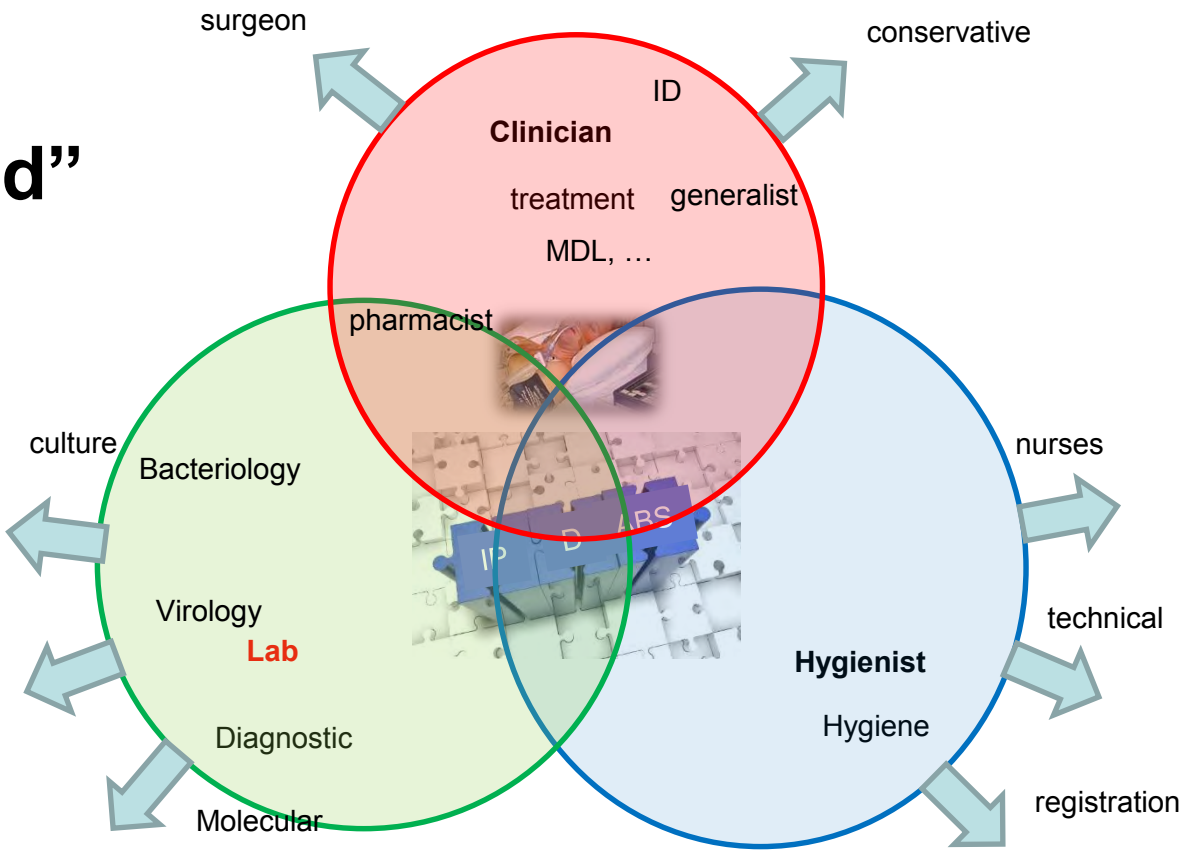
Borders are the lived space between cultures

- …of countries/regions
- …of professionals
- …of departments
- …of…



From competence...

The “old world” approach



...to Metacompetence

Journal of Clinical Microbiology®

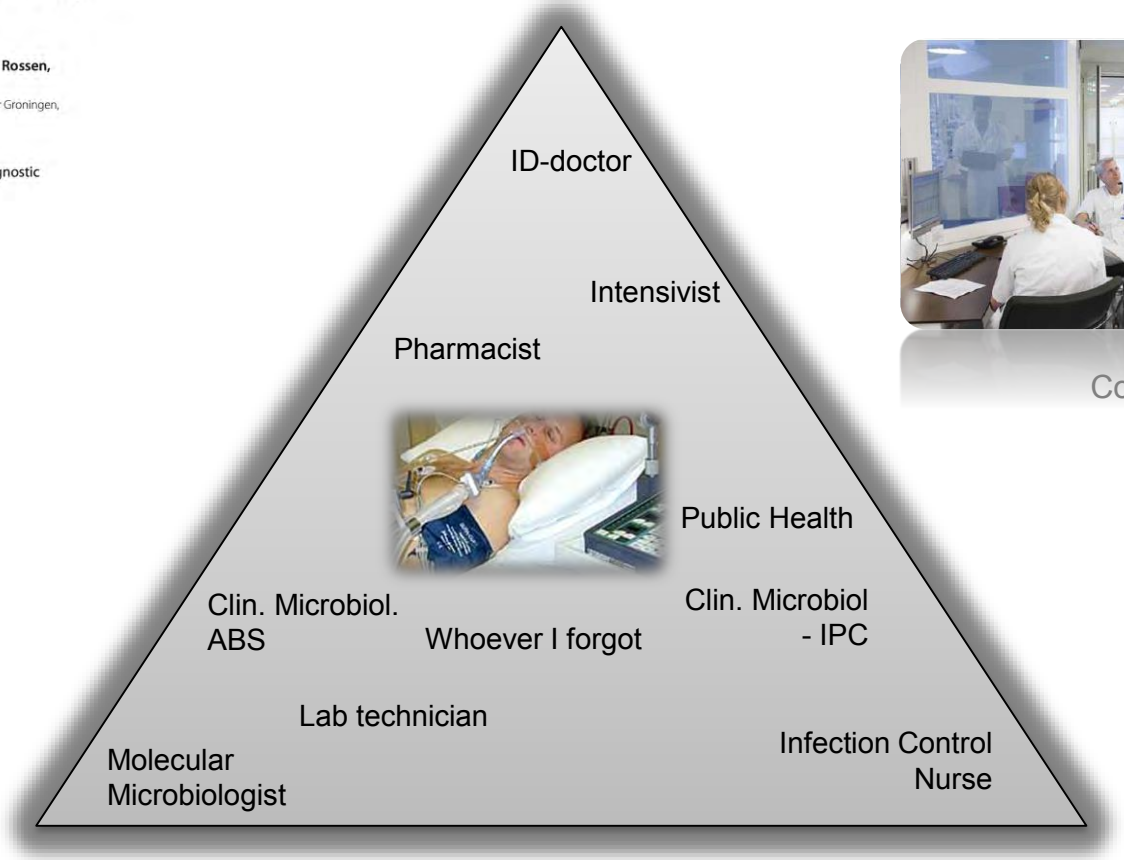
Integrated Stewardship Model Comprising Antimicrobial, Infection Prevention, and Diagnostic Stewardship (AID Stewardship)

J. H. Dik, R. Poelman, A. W. Friedrich, H. G. M. Niesters, J. W. A. Rossen, B. Sinha
Department of Medical Microbiology, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands

KEYWORDS antimicrobial stewardship, antimicrobial resistance, diagnostic stewardship, integrated stewardship

Antimicrobial Stewardship

Courtesy: NVMM.nl

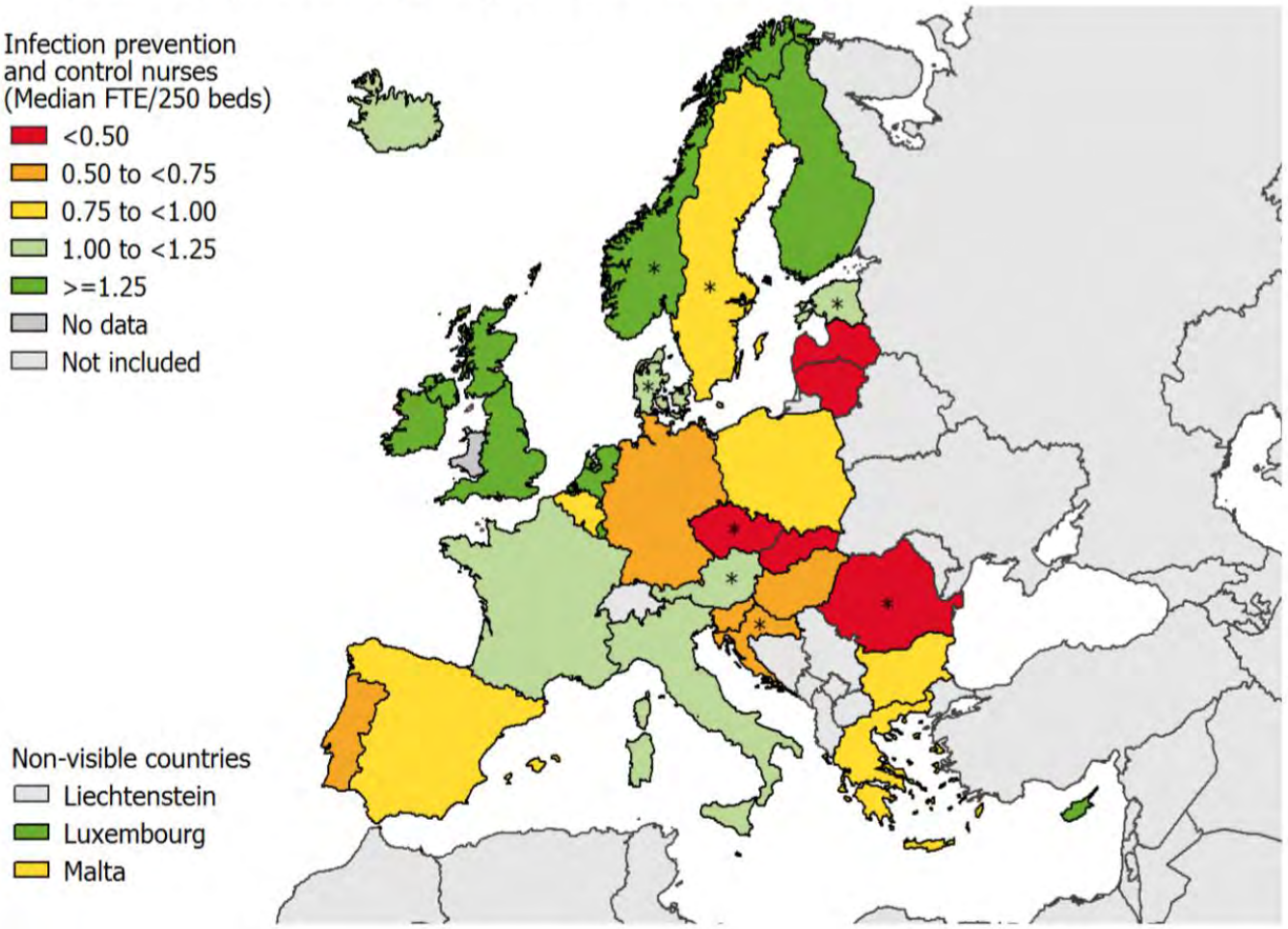


Diagnostic Stewardship

Infection Prevention Stewardship

Dik et al. 2015 Future Microbiology
Zingg et al. 2015 CMI

Figure 19. Median number of infection prevention and control nurse full-time equivalents (FTE) per 250 hospital beds (n=866 hospitals), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden.*

ECDC report, 2013

THE LANCET
Volume 383, Issue 9931, 24–30 May 2014, Pages 1824-1830

Articles

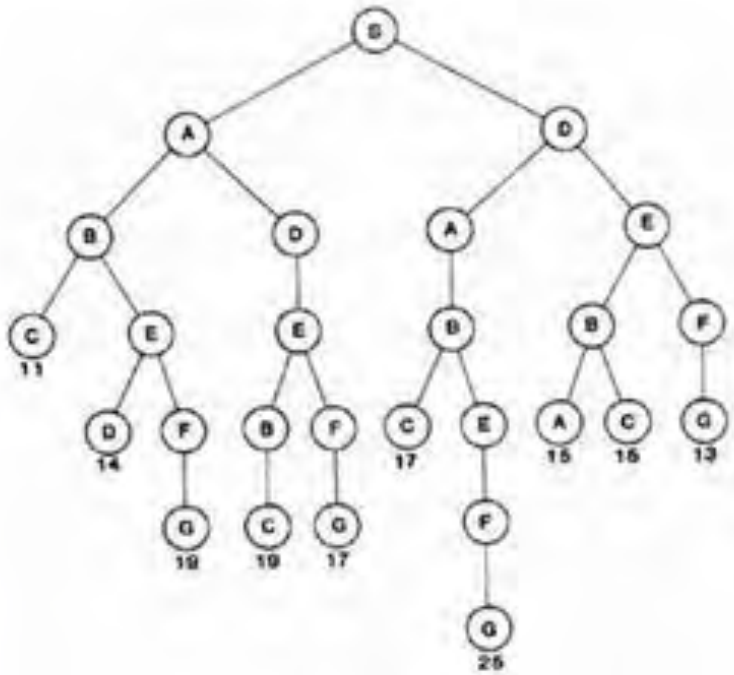
Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study

Prof Linda H Aiken PhD [a] ✉, Douglas M Sloane PhD [a], Luk Bruyneel MS [b], Koen Van den Heede PhD [b], Prof Peter Griffiths PhD [c], Prof Reinhard Busse MD [d], Marianna Diomidous PhD [e], Prof Juha Kinnunen PhD [f], Prof Maria Kózka PhD [g], Prof Emmanuel Lesaffre PhD [h], Matthew D McHugh PhD [a], M T Moreno-Casbas PhD [i], Prof Anne Marie Rafferty PhD [j], Rene Schwendimann PhD [k], Prof P Anne Scott PhD [l], Prof Carol Tishelman PhD [m], Theo van Achterberg PhD [n], Prof Walter Sermeus PhD [b], for the RN4CAST consortium †

⊞ Show more

- An increase in a nurses' workload by one patient increased the likelihood of an inpatient dying within 30 days of admission by 7% (odds ratio 1·068, 95% CI 1·031–1·106),
- Every 10% increase in bachelor's degree nurses was associated with a decrease in this likelihood by 7% (0·929, 0·886–0·973).

Change needs networks, networks need trust



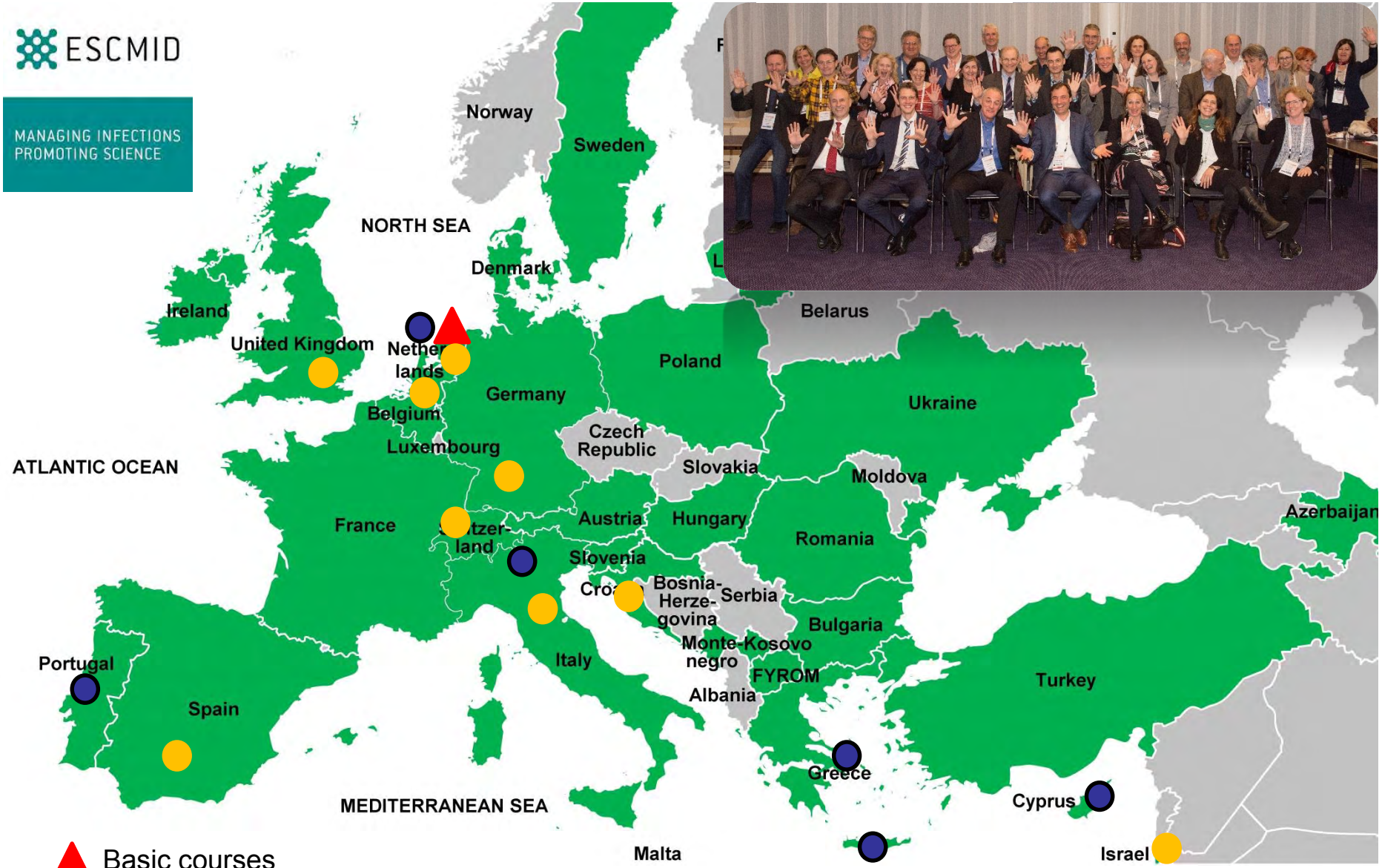
Bottom up
Decentralized
Redundant
Long-term goal
Highly adaptive

Top down
Centralized
Easy to control
Short-term goal
Stable, inflexible

EUCIC participating countries
Courses (2016-2019)

EUCIC
EUROPEAN COMMITTEE ON INFECTION CONTROL

ESCMID
MANAGING INFECTIONS
PROMOTING SCIENCE



Basic courses
Advanced courses
Local courses

Metacompetence

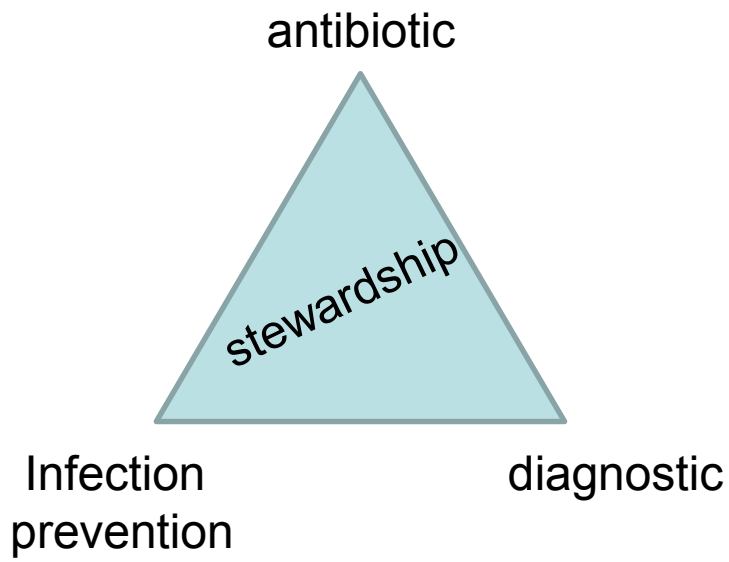
“Socratic dialogue” learning:

In my country we do…
What a nice particularity to see…

Meta-competence

humility

To know, how it should be from one specialty/profession pointview, is not enough



"Every professional can offer an answer to others"

European competence

curiosity

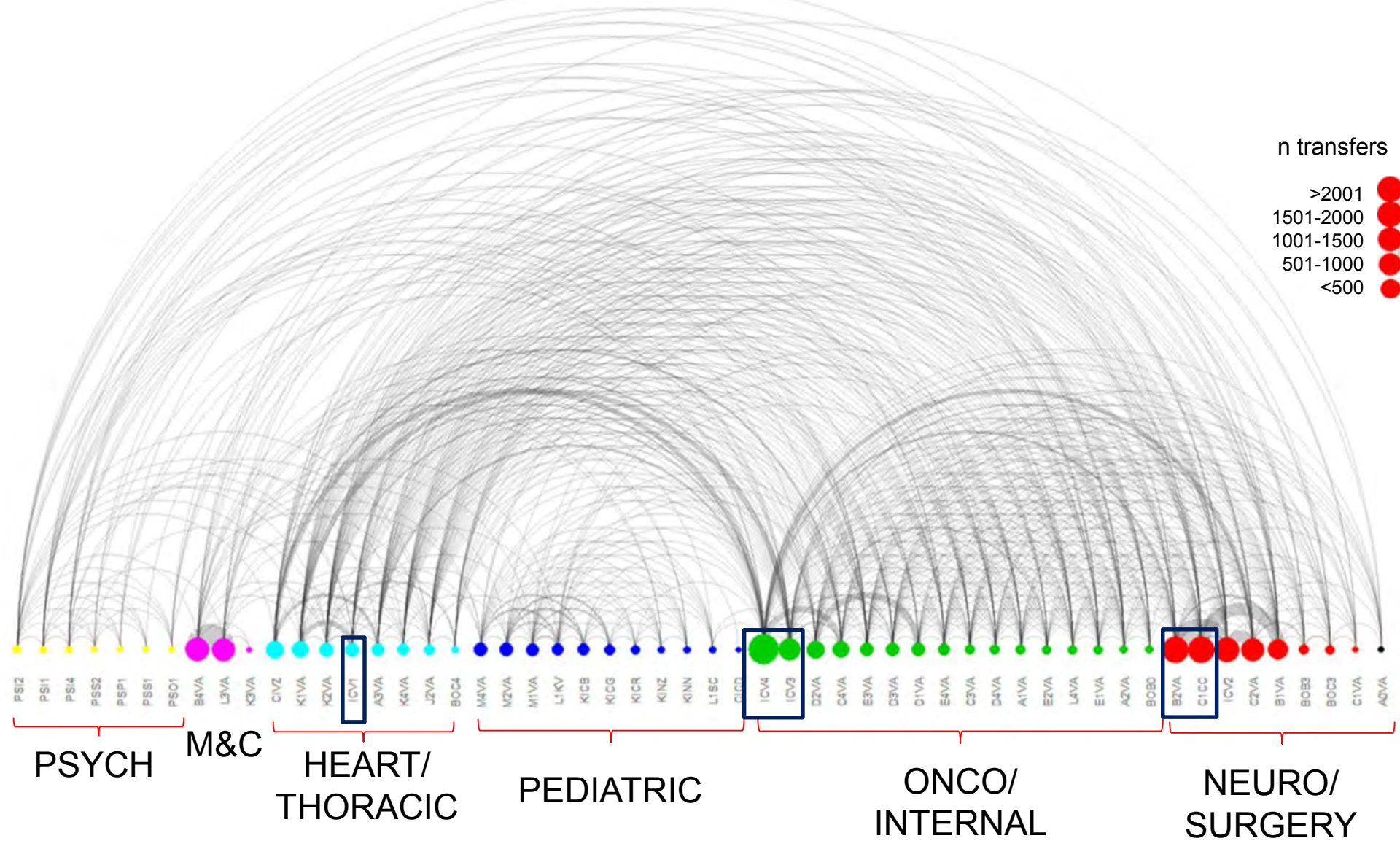
To know, how it works in one country, is not enough

"Every country can offer an answer to others"

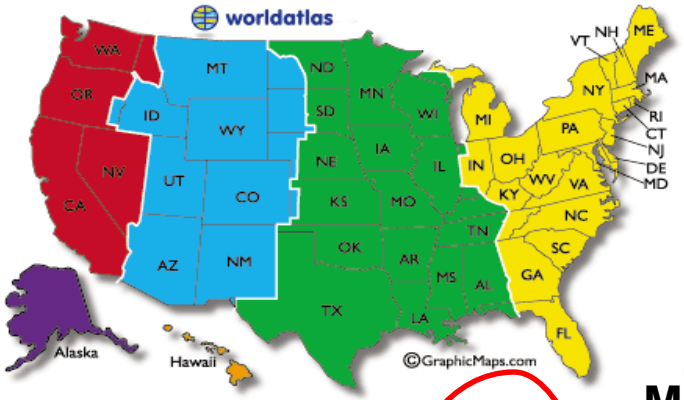
The last 10 minutes…

- The challenge
- The reasons behind
- Across borders
- Network-prevention

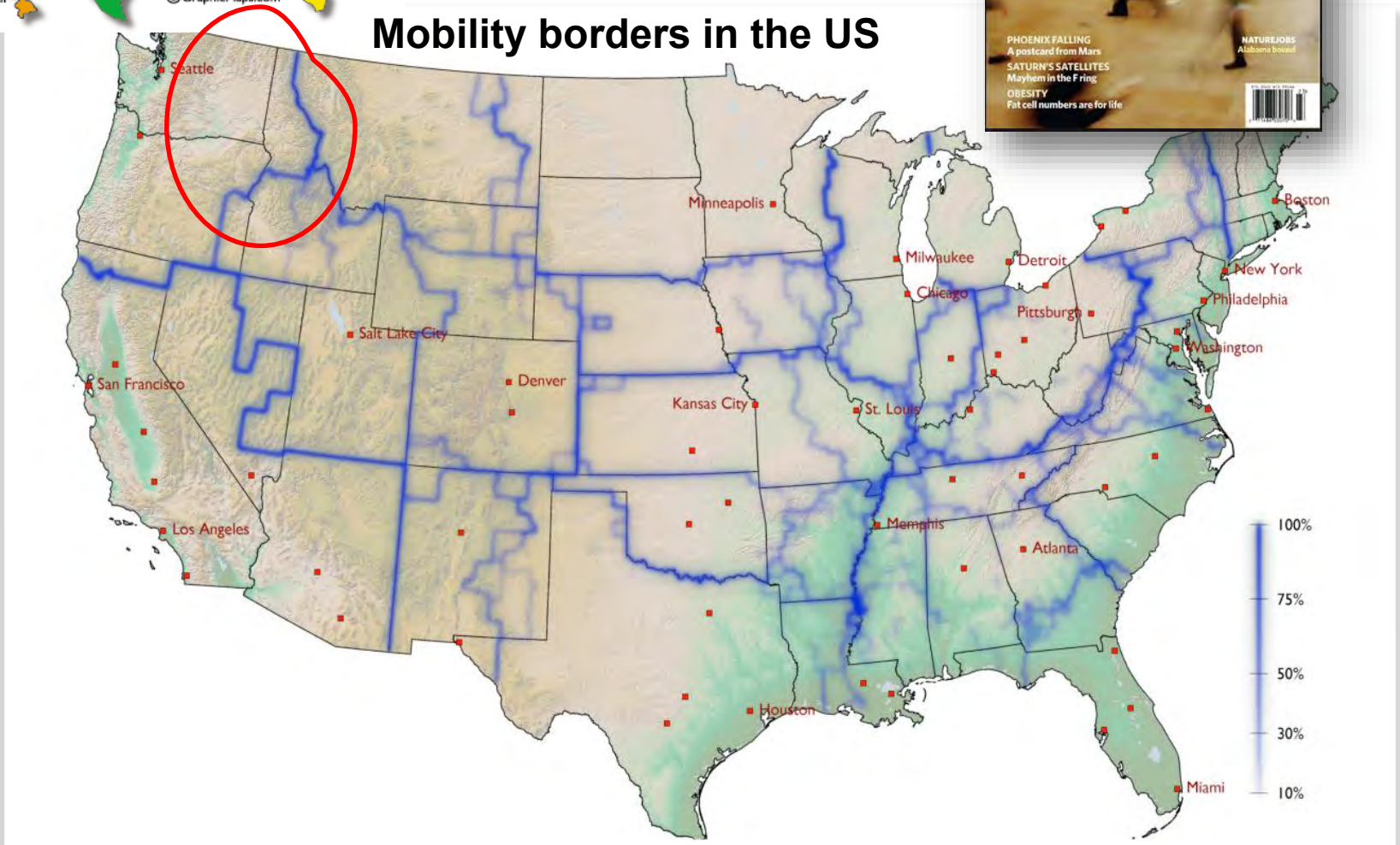
Patient transfer within hospitals show cluster forming



Data analysis: Frieso Coerts, UMCG



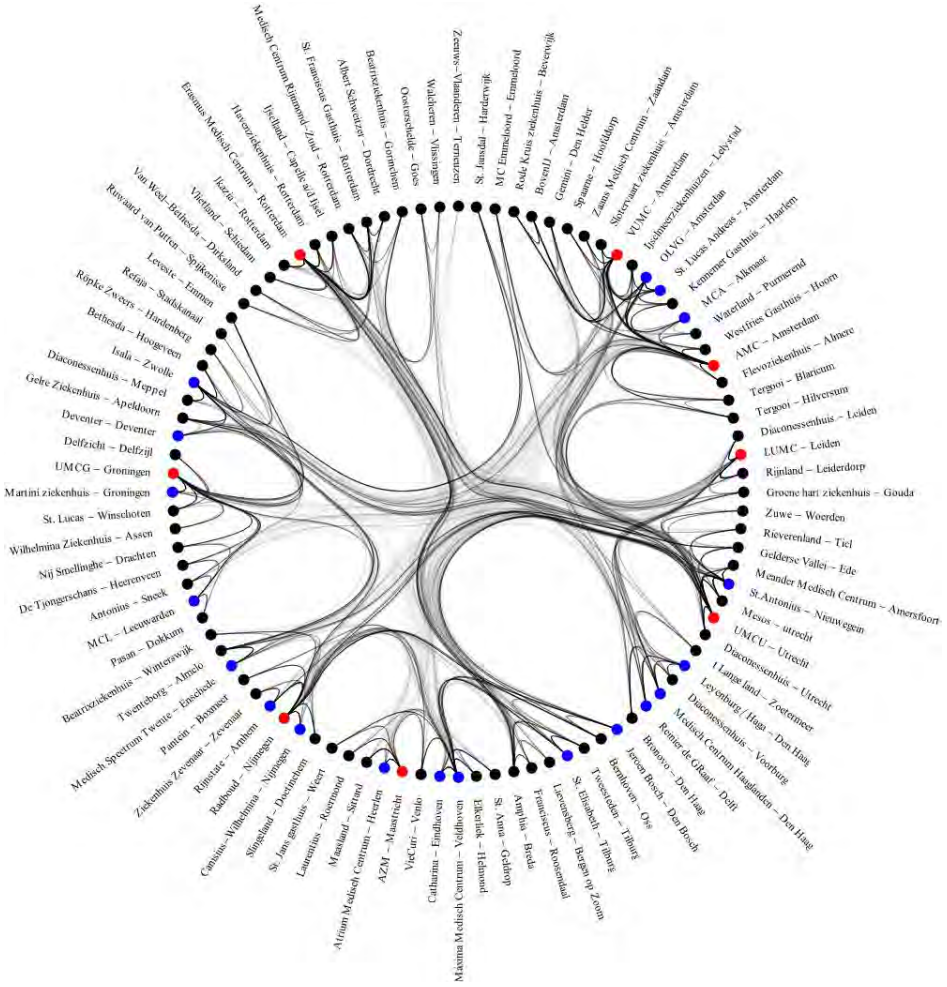
Mobility borders in the US



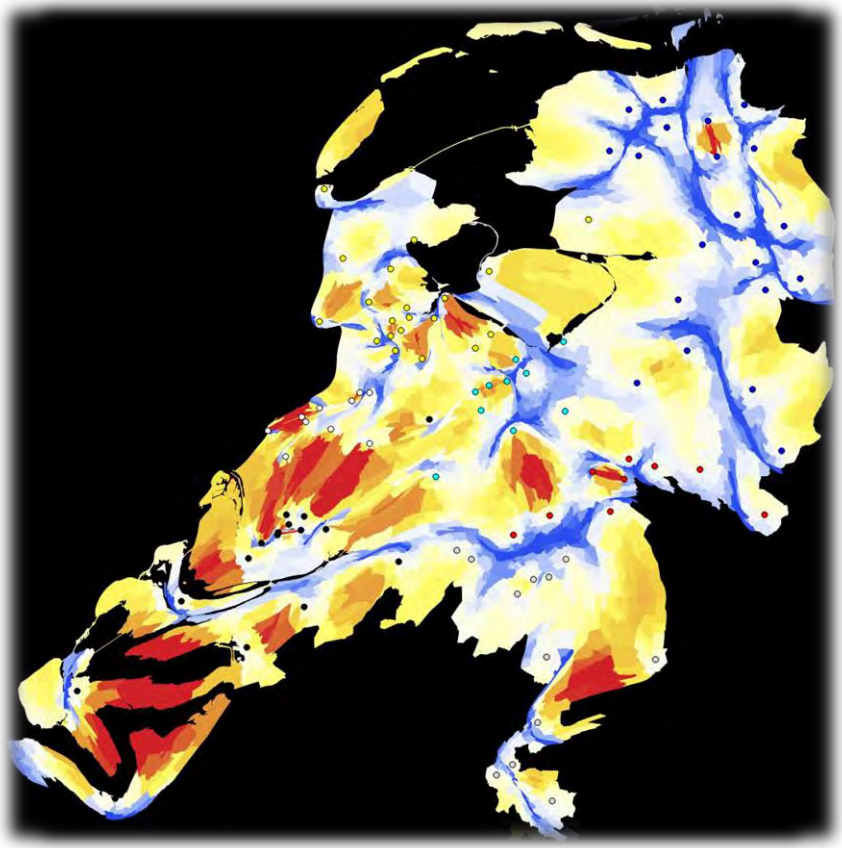
Courtesy: Dirk Brockmann, RKI

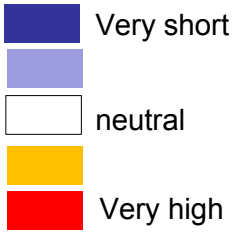
Successful prevention needs a look at the real world

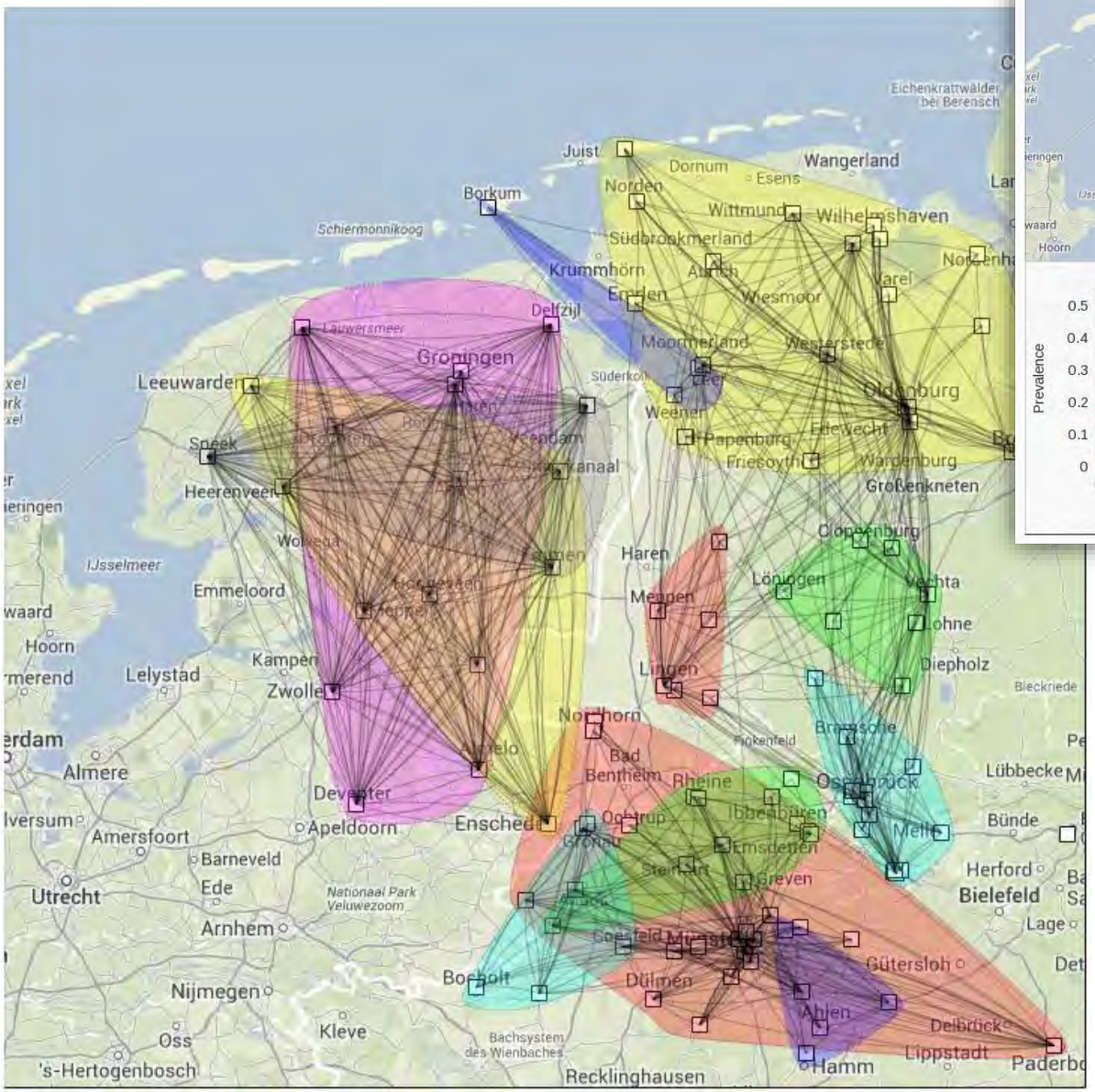
Healthcare network map

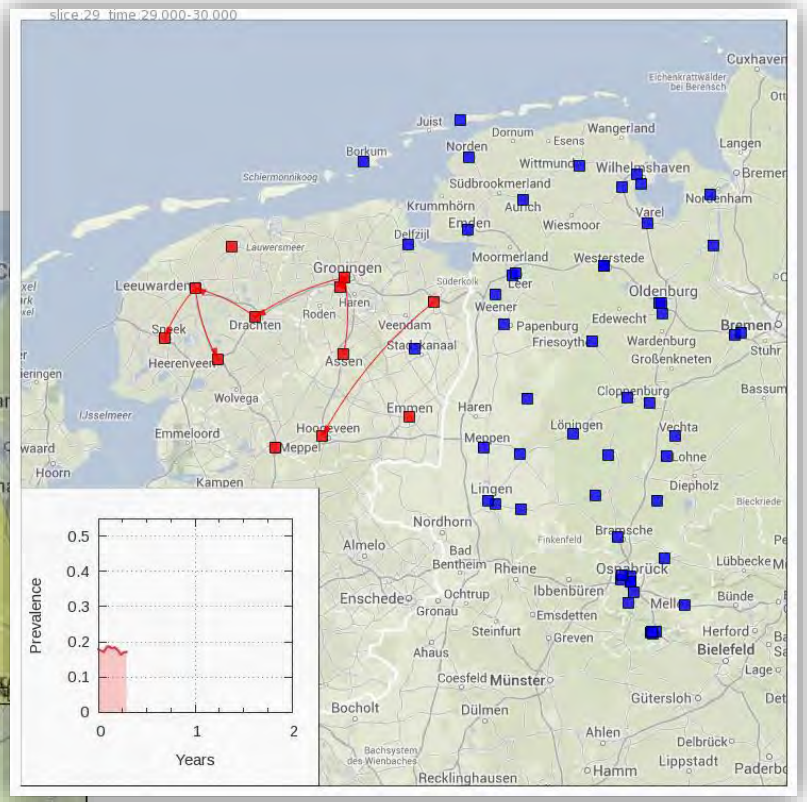


Heat map of epi-distance by geo-distance





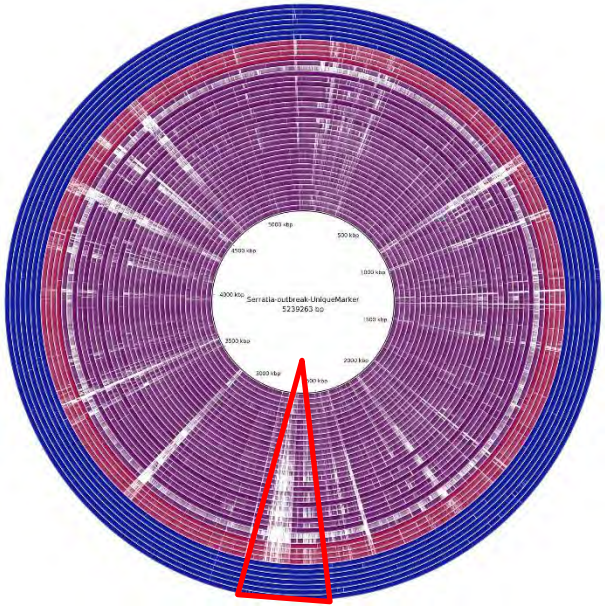




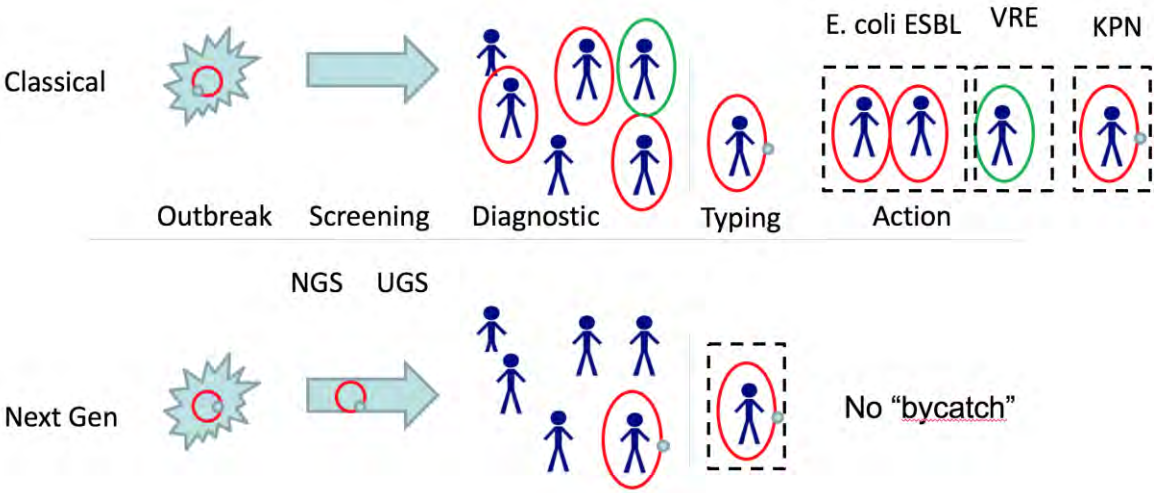
Data: Tjibbe Donker (UMCG- RIVM)
Matthias Pulz (NLGA)
Network analysis: Mariano Ciccolini

Using NGS for outbreak-specific screening test

- Next Gen sequencing
- Identifying **Unique Marker Signatures**
- **Ad hoc design** of Primers for outbreak isolate
- Appropriate infection control measures

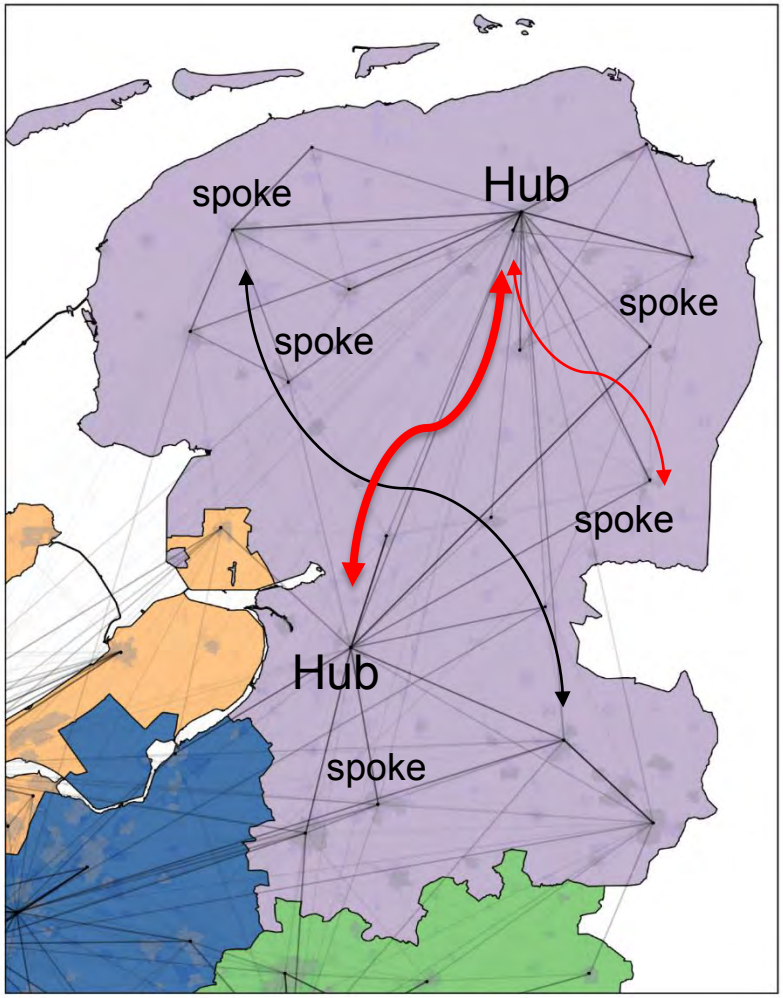


Comparative Genome analysis during a *K. pneumoniae-outbreak*



Zhou et al. Nat Scient Rep 2015

Hub&Spoke Microbiology



Spokes
- Screening and send outbreak-strains to hub
- swarm-screening with adapted primers

Hubs
- Molecular Surveillance and *ad hoc* Development of outbreak-specific diagnostic
- Regional sharing of primer with spokes

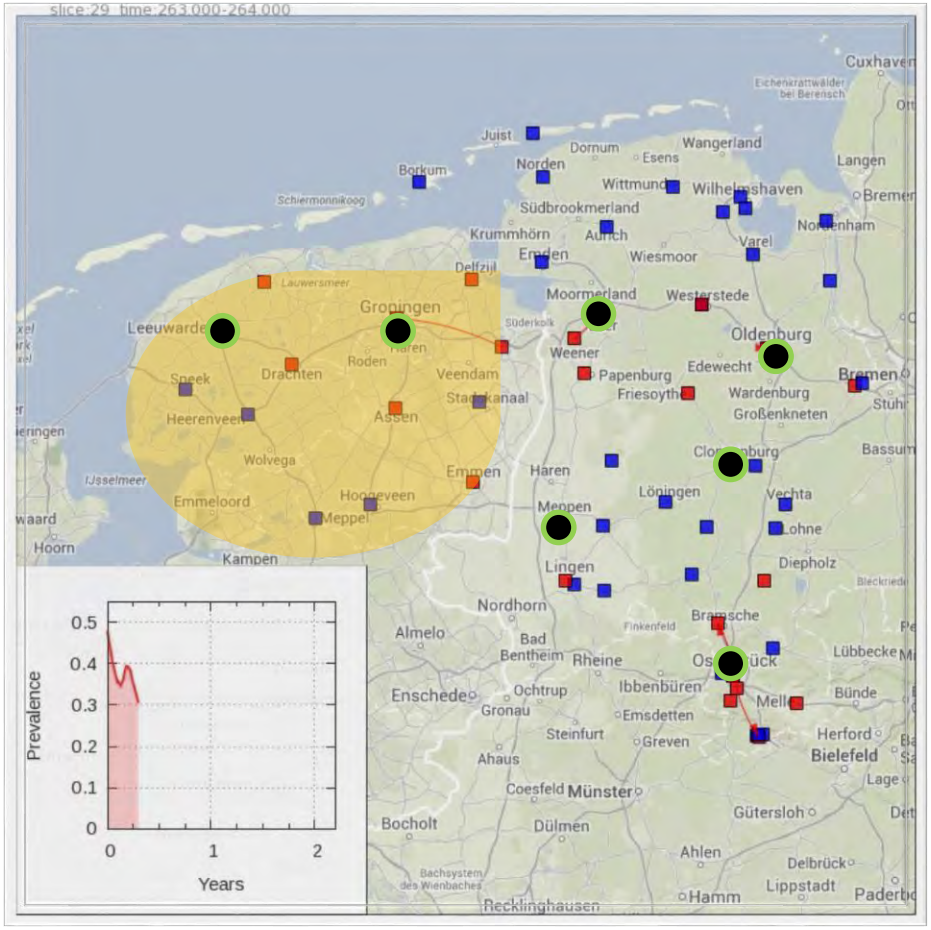
Rapid, Responsive and Relevant

www.remis-plus.net

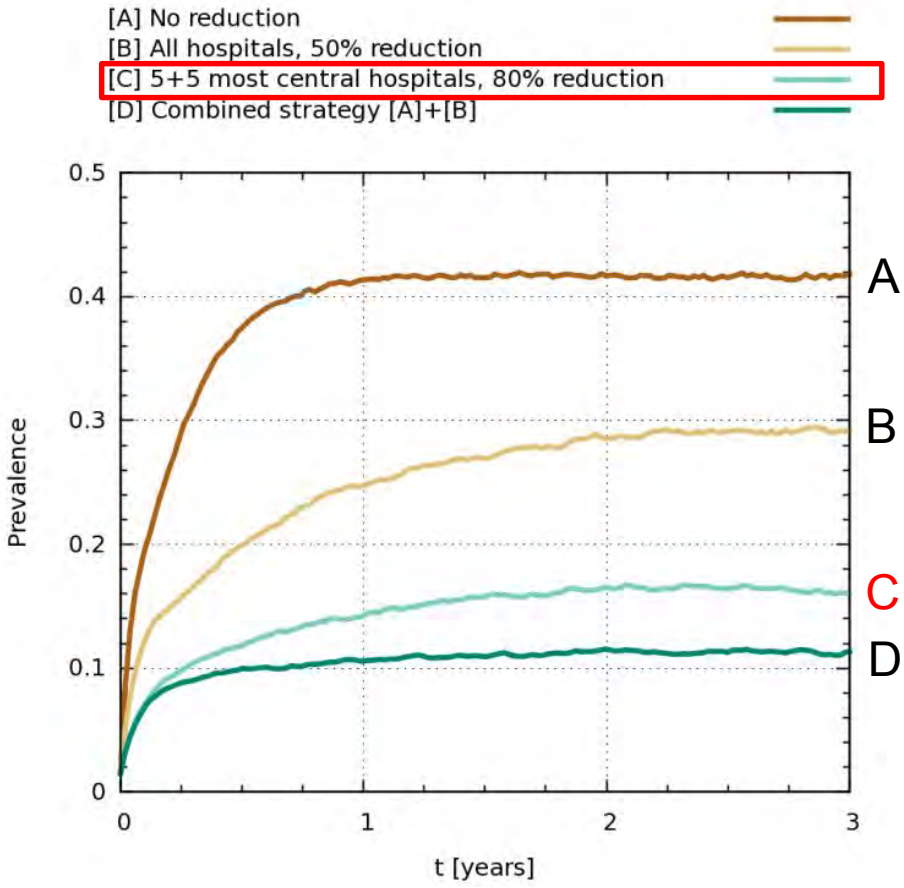
Hub&Spoke-intervention in the Dutch-German Euregio

hub-hospital

spoke-hospital



Effect on outbreak dynamic

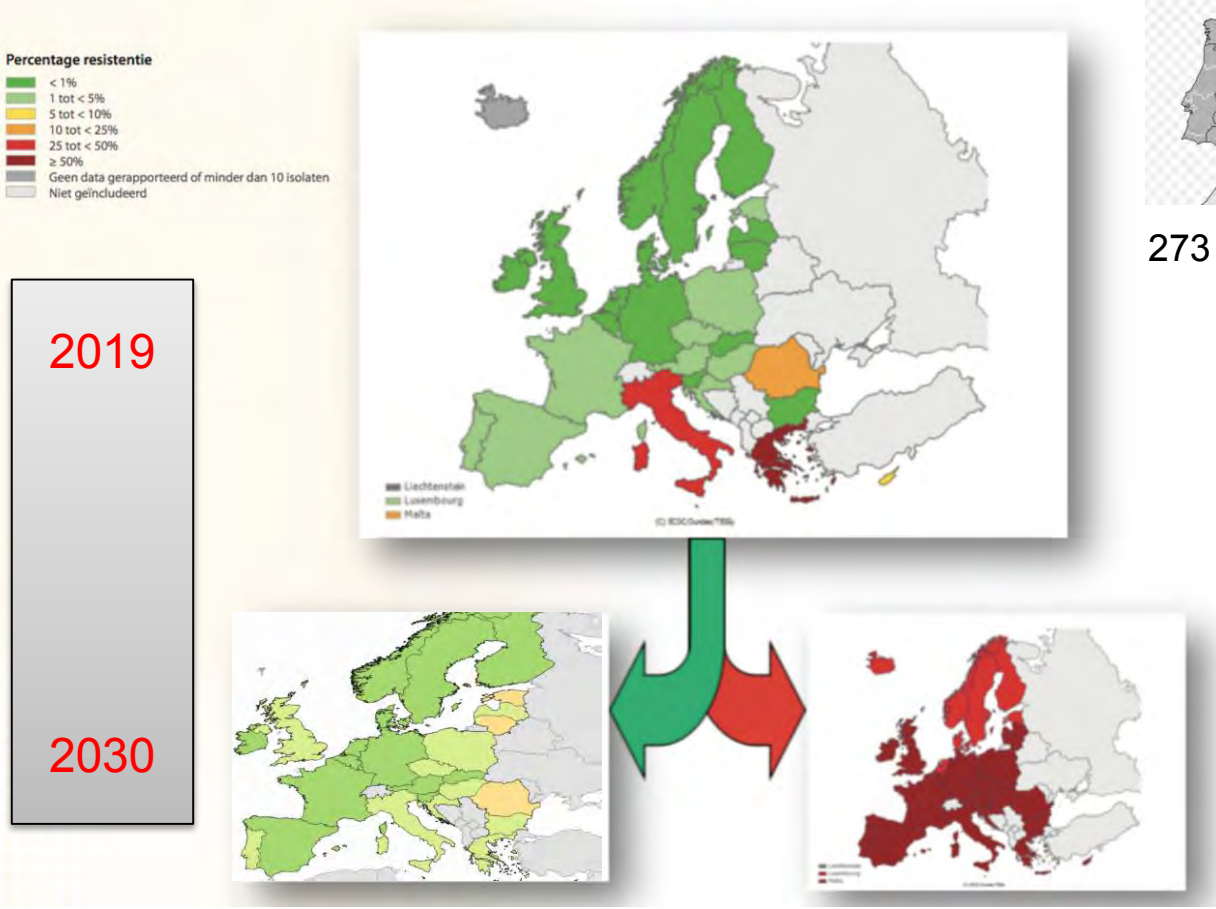


Get back to Epidemiological Reality

CRE-free in 2030

- 250 AMR Prevention Regions
- Inter-mural Network-forming
- Regional System-budget
- 1 Euro/citizen/year

273 European Prevention Regions (NUTS2)



Map of scientific collaboration, O.H. Beauchesne; http://collabo.olihb.com/collabolinks.jpg

“Roll back CRE”

- ❑ Regional data, more than national
- ❑ Look at system-related factors
- ❑ Network awareness
- ❑ Be rapid, responsive and relevant
- ❑ European meta-competence

Thank you!