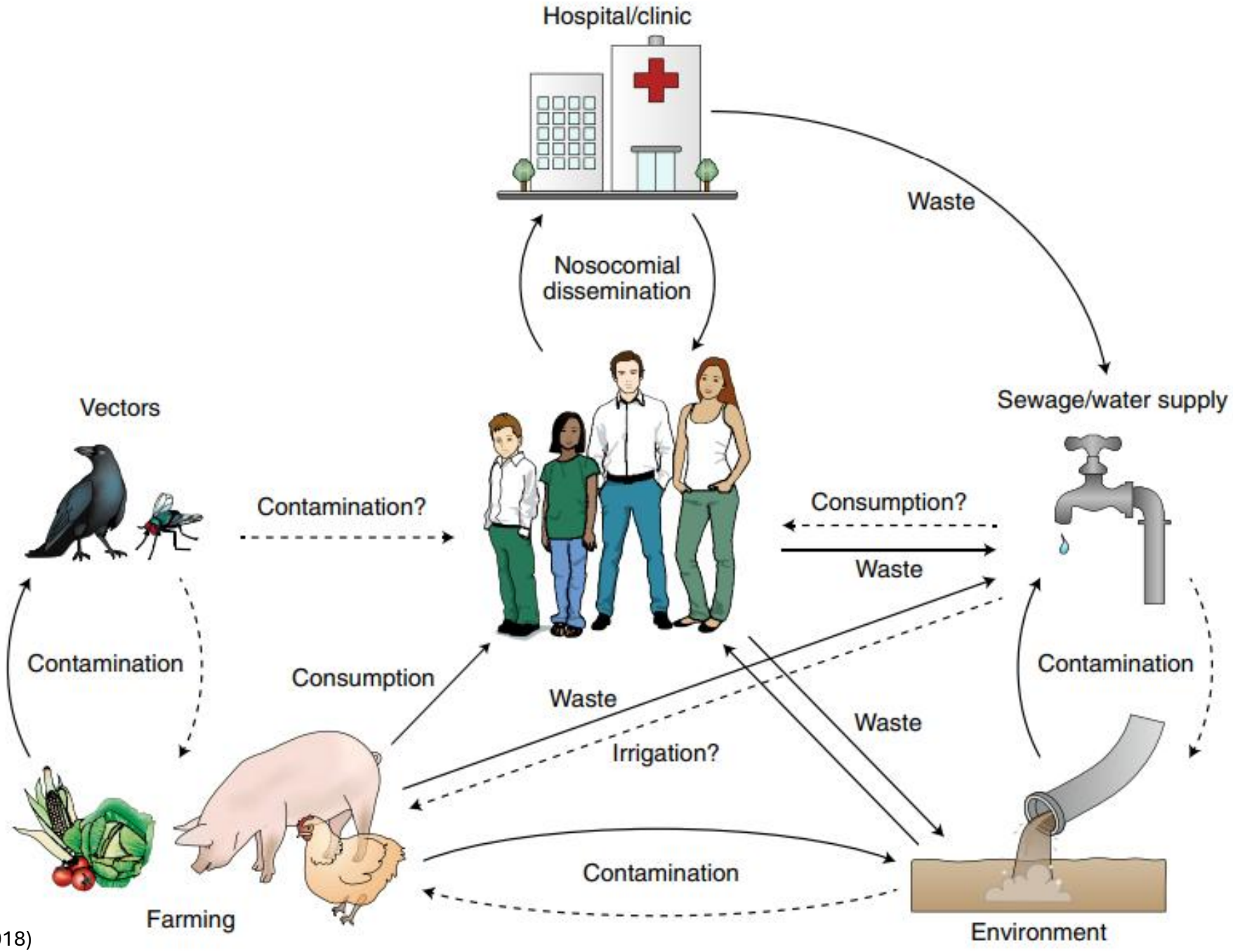
Advancing antimicrobial stewardship together

Alessandro Cassini

Chief medical officer, Republic and canton of Geneva



Nat Microbiol 3, 854–855 (2018)

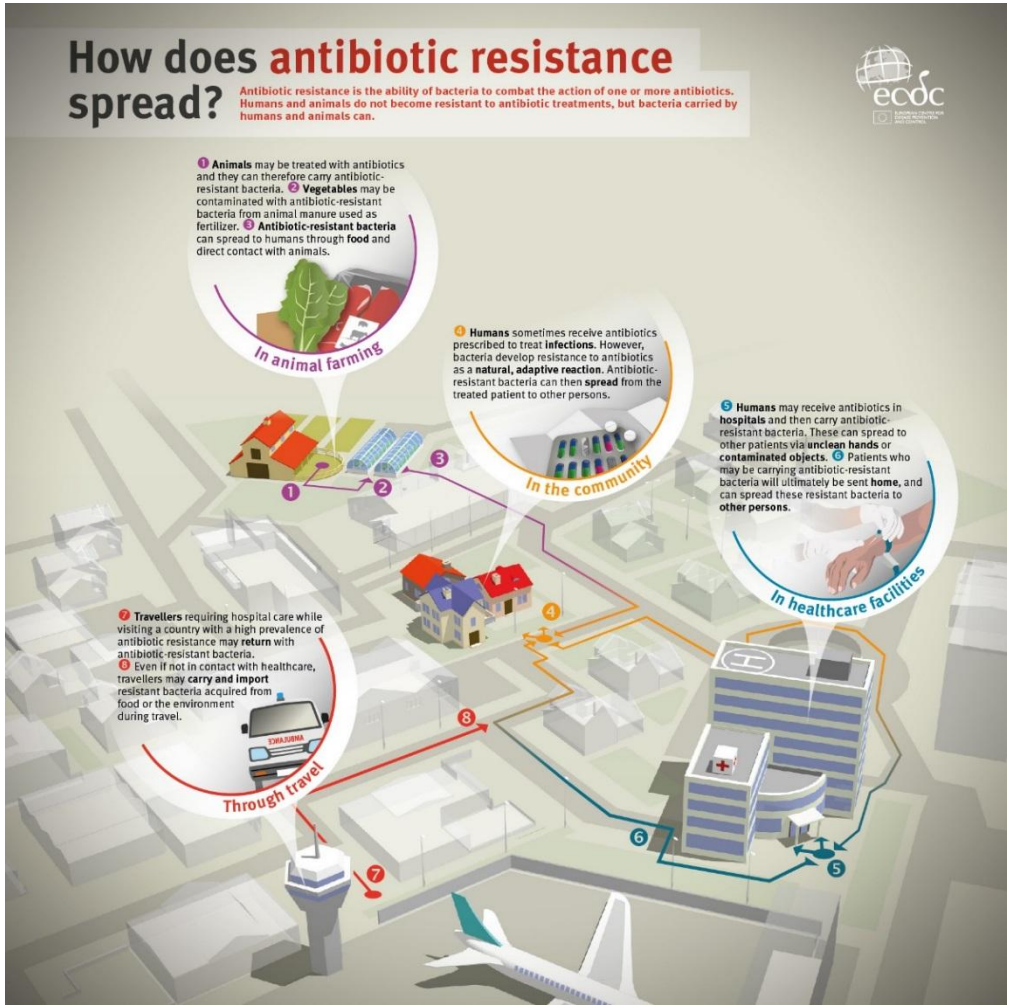
Antimicrobial resistance is a complex and systemic problem

Antimicrobial resistance is:

- Multi-factorial (mutation, acquired genes)
- Multi-sectorial (one health, one world)

Varies according to:

- Host
- Microorganism
- Antimicrobial
- Type of infection

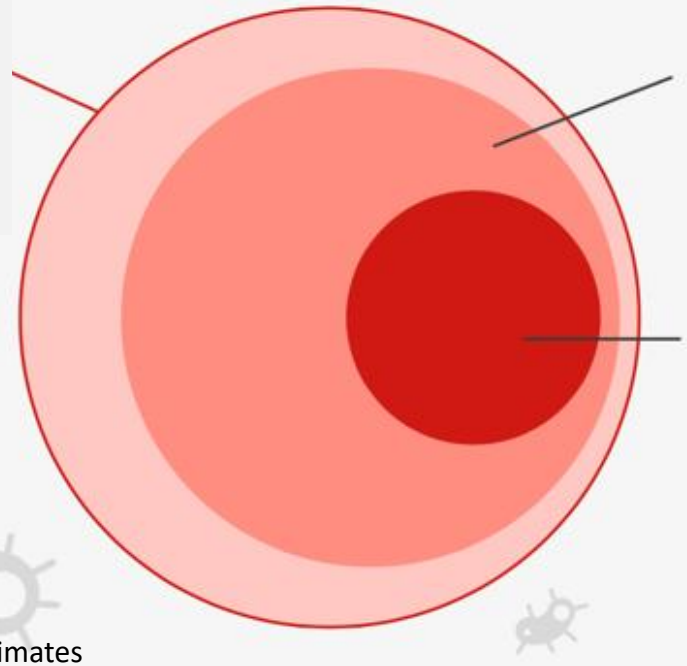


Burden of Antimicrobial Resistance

Increase in deaths from sepsis (>5 years) from
8.81 million (8.30–9.32) in 1990, to **11.0 million (10.2–11.7) in 2019**

- **8.51% (8.00–8.95) sepsis deaths attributable to AMR**

7.7 m
annual deaths due to bacterial infections



4.71 m
annual deaths associated with AMR

1.14 m
annual deaths attributable to AMR

2021 estimates

Counterfactuals:

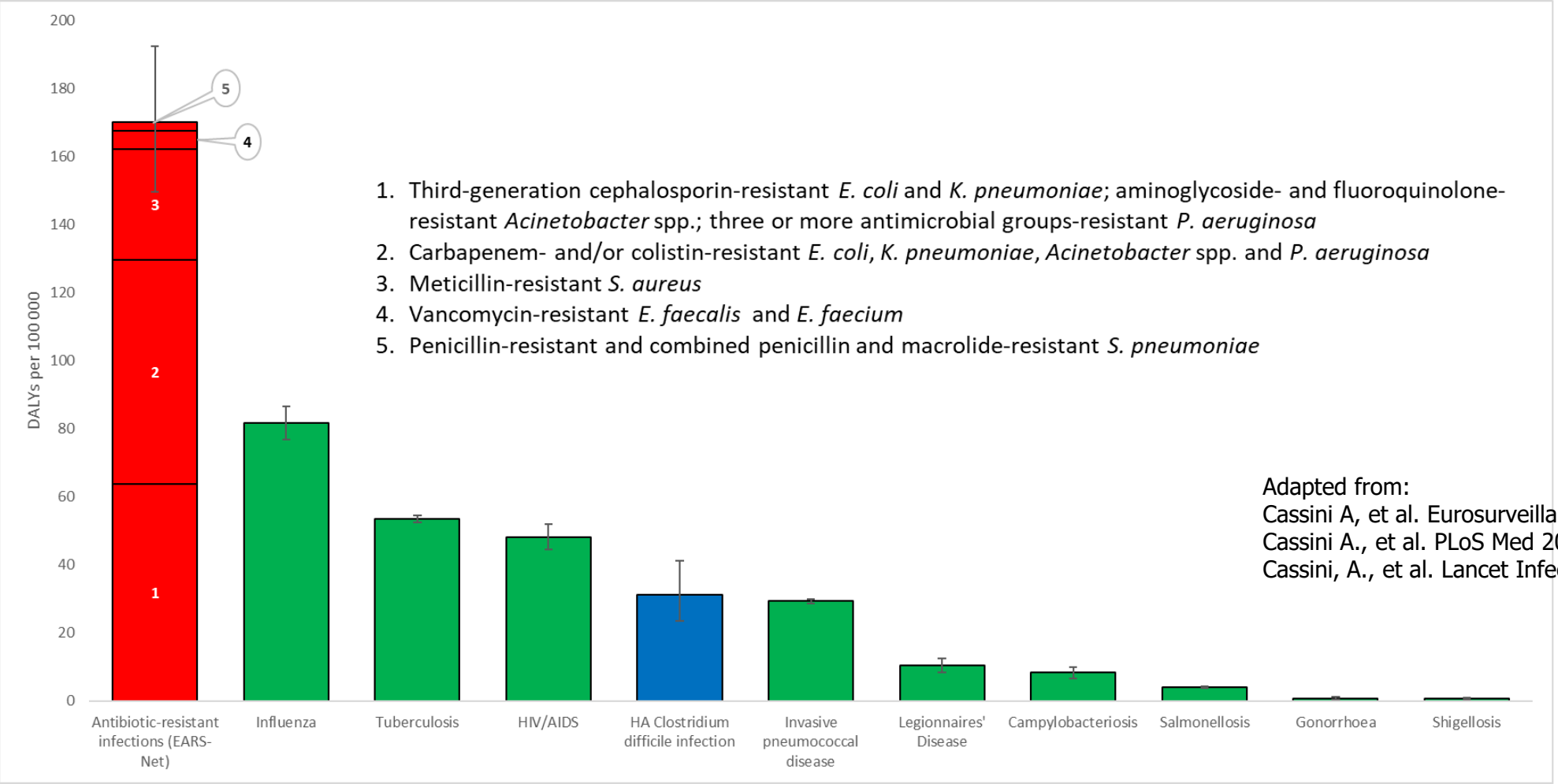
- **associated with AMR: no infection**
- **attributable to AMR: drug-sensitive infection**

US$ 855
billion/year
for treating resistant infections and productivity losses by 2050

Up to
11%
decline in livestock by 2050

GBD, Lancet, 2024; GLG group. 2024; World Bank Group. 2017.

Burden of AMR is comparable to the combined burden of influenza, TB & HIV/AIDS



1. Third-generation cephalosporin-resistant *E. coli* and *K. pneumoniae*; aminoglycoside- and fluoroquinolone-resistant *Acinetobacter* spp.; three or more antimicrobial groups-resistant *P. aeruginosa*
2. Carbapenem- and/or colistin-resistant *E. coli*, *K. pneumoniae*, *Acinetobacter* spp. and *P. aeruginosa*
3. Meticillin-resistant *S. aureus*
4. Vancomycin-resistant *E. faecalis* and *E. faecium*
5. Penicillin-resistant and combined penicillin and macrolide-resistant *S. pneumoniae*

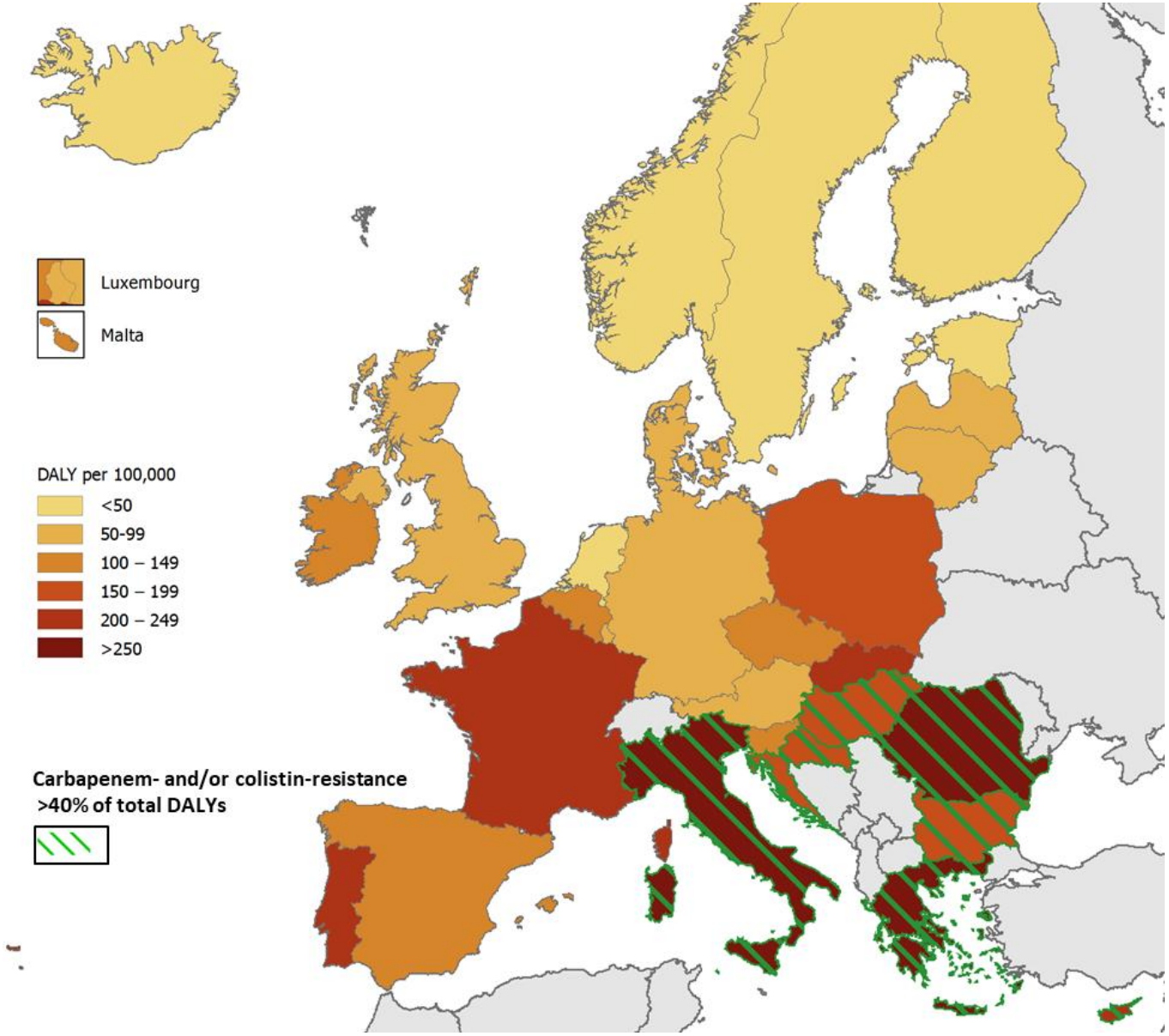
Adapted from:
Cassini A, et al. Eurosurveillance 2018;23(16):pii=17-00454
Cassini A., et al. PLoS Med 2016;13(10): e1002150.
Cassini, A., et al. Lancet Infect Dis. 2019 Feb;19(2):129-130.

Burden of AMR, per country – carbapenem-resistance

63% of cases were HAI representing 75% of total burden (DALYs)

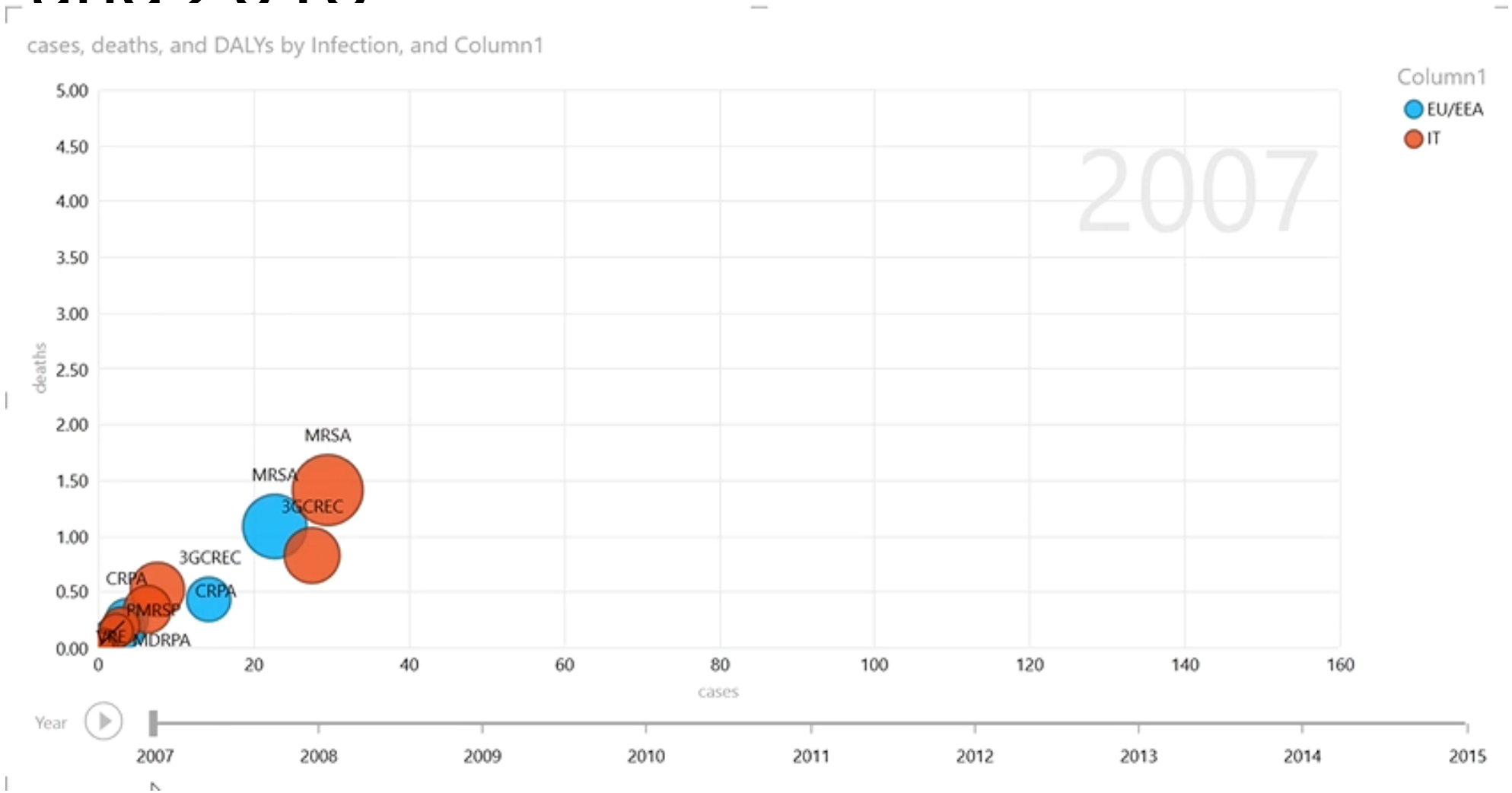
70% due to 4 top-ranking antibiotic-resistant bacteria

39% due to carbapenem- and/or colistin resistance



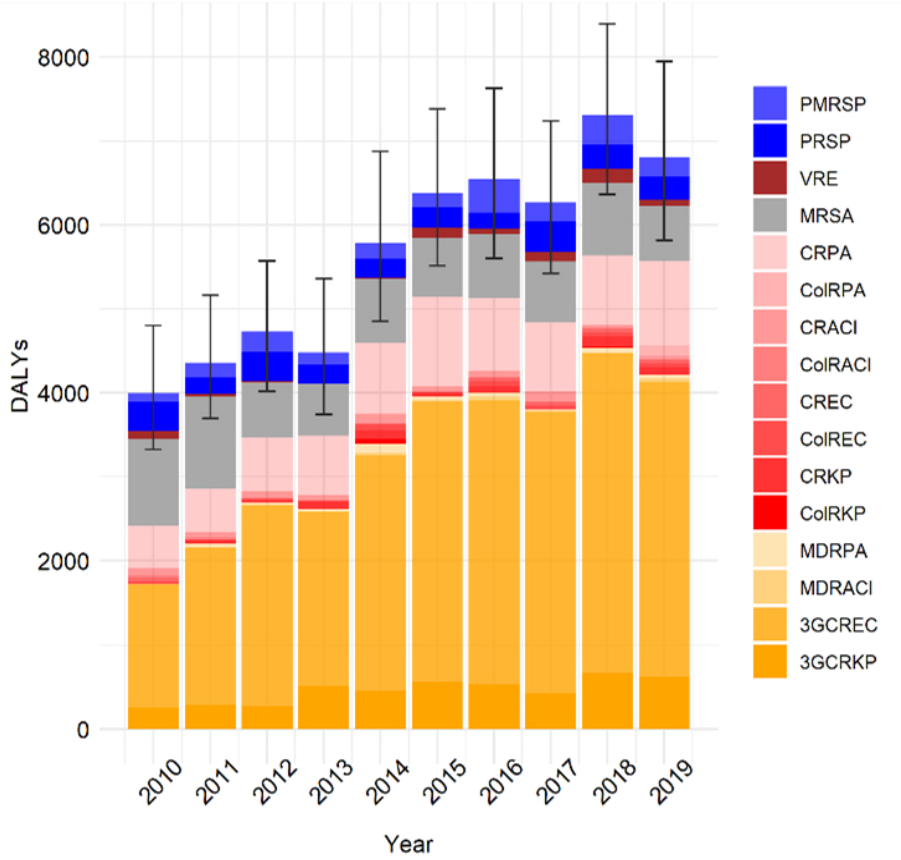
Cassini, A., et al. Lancet Infect Dis. 2019 Feb;19(2):129-130.

CRKP increased 80 times in Italy between 2007 and 2015

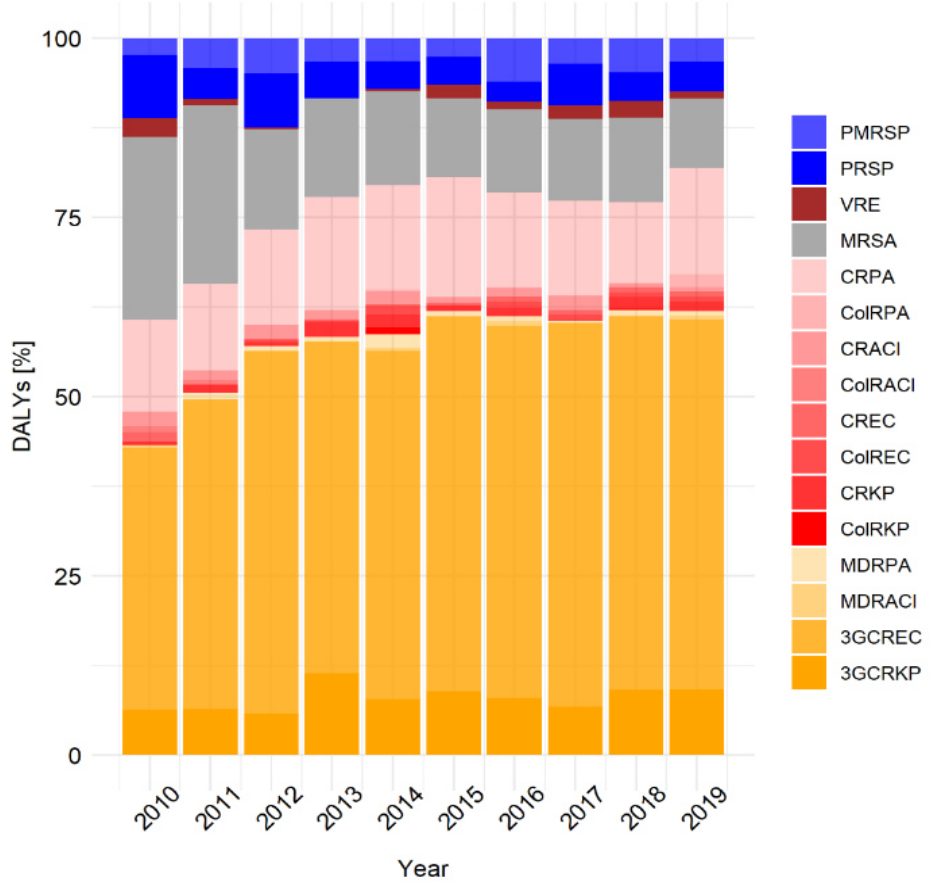


Adapted from Cassini, A., et al. Lancet Infect Dis. 2019 Feb;19(2):129-130.

Burden of AMR in Switzerland



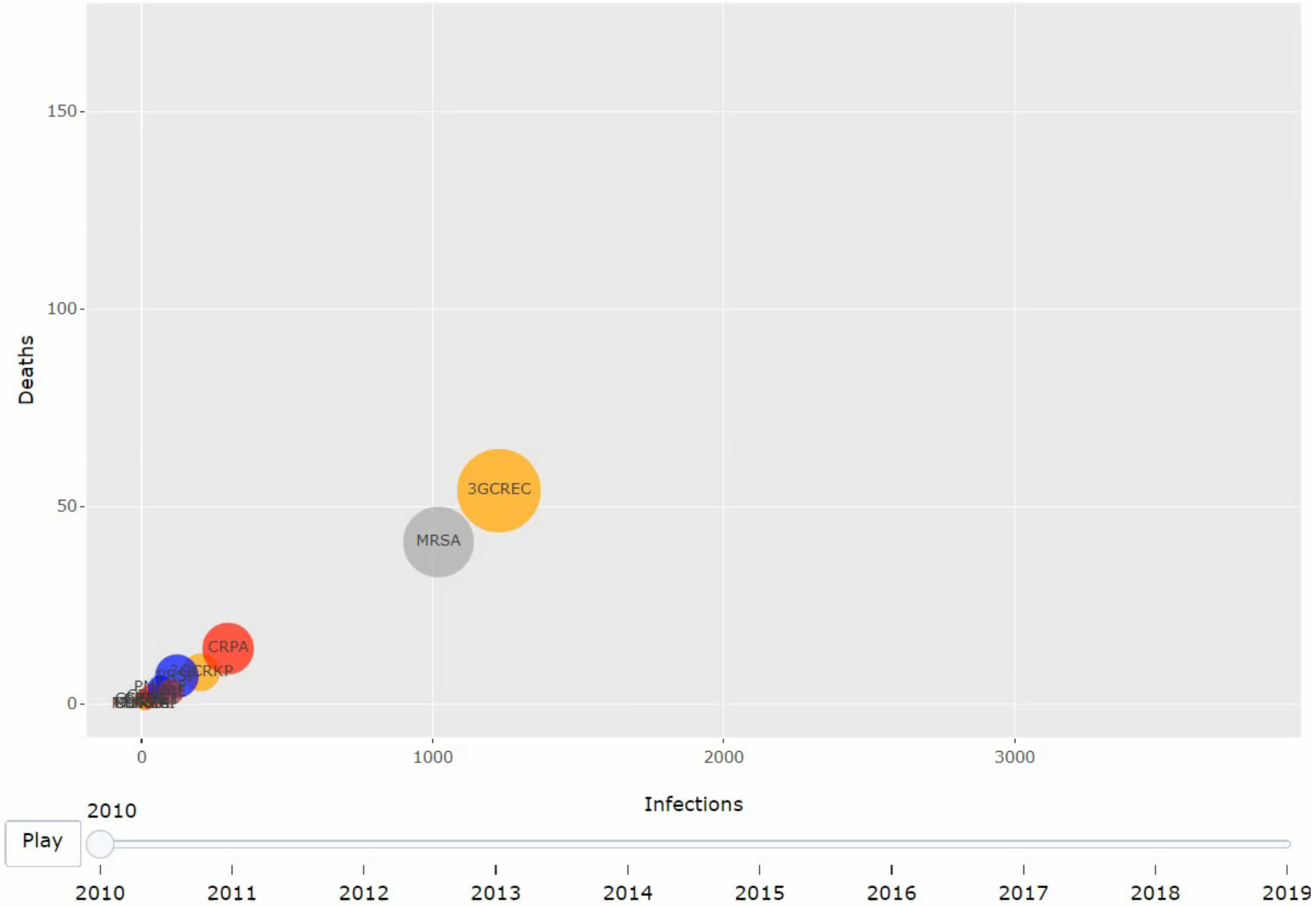
2010-2019: **Significant increase** of **infections** (+104%), **DALYs** (+70%) **and deaths** (+111%).



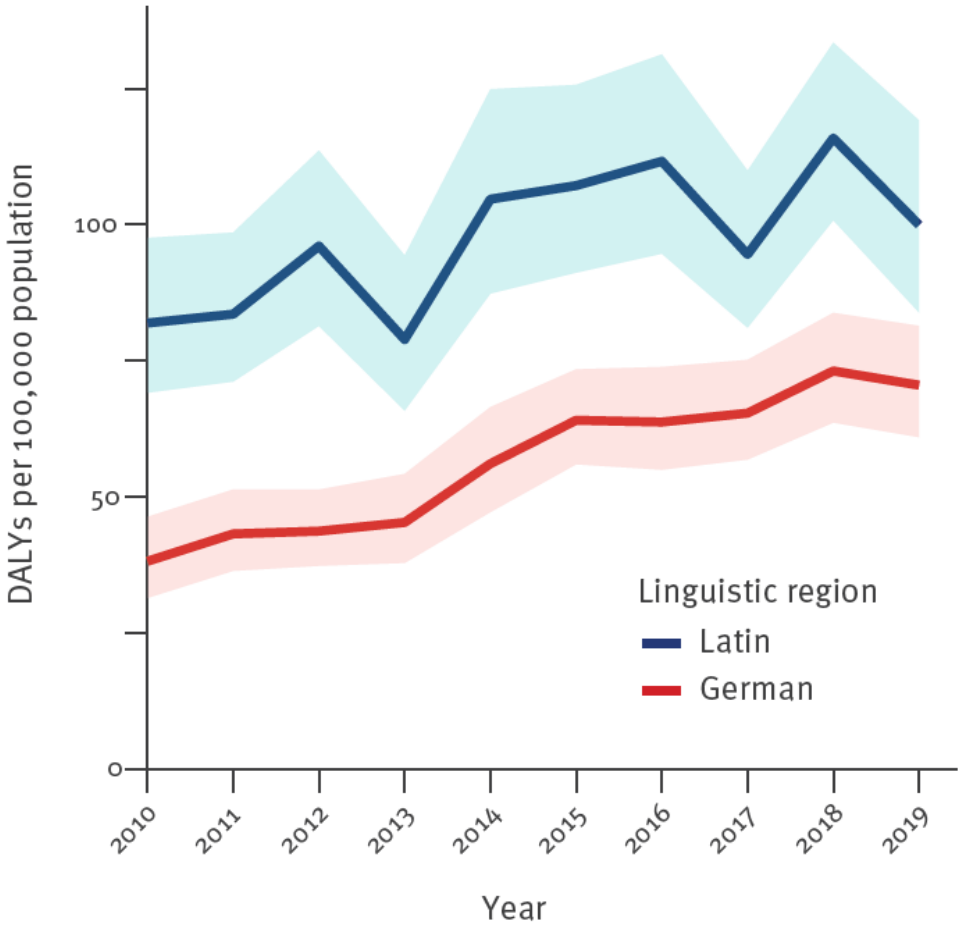
- **Third-generation cephalosporin-resistant** ***Escherichia coli*** as **main contributor.**
- **Decreasing** proportions of **MRSA**
- **Colistin** and **Carbapenem** resistances relatively **rare** and stable

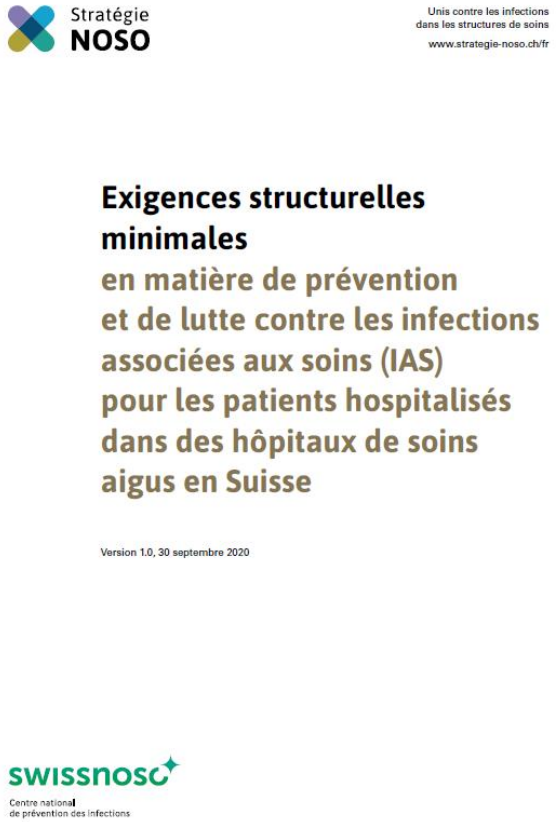
Gasser M, Cassini A, et al.. Associated deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in Switzerland, 2010 to 2019. Euro Surveill. 2023;28(20):pii=2200532.

Courtesy of:
Michael Gasser and Andreas Kronenberg, IFIK University of Bern

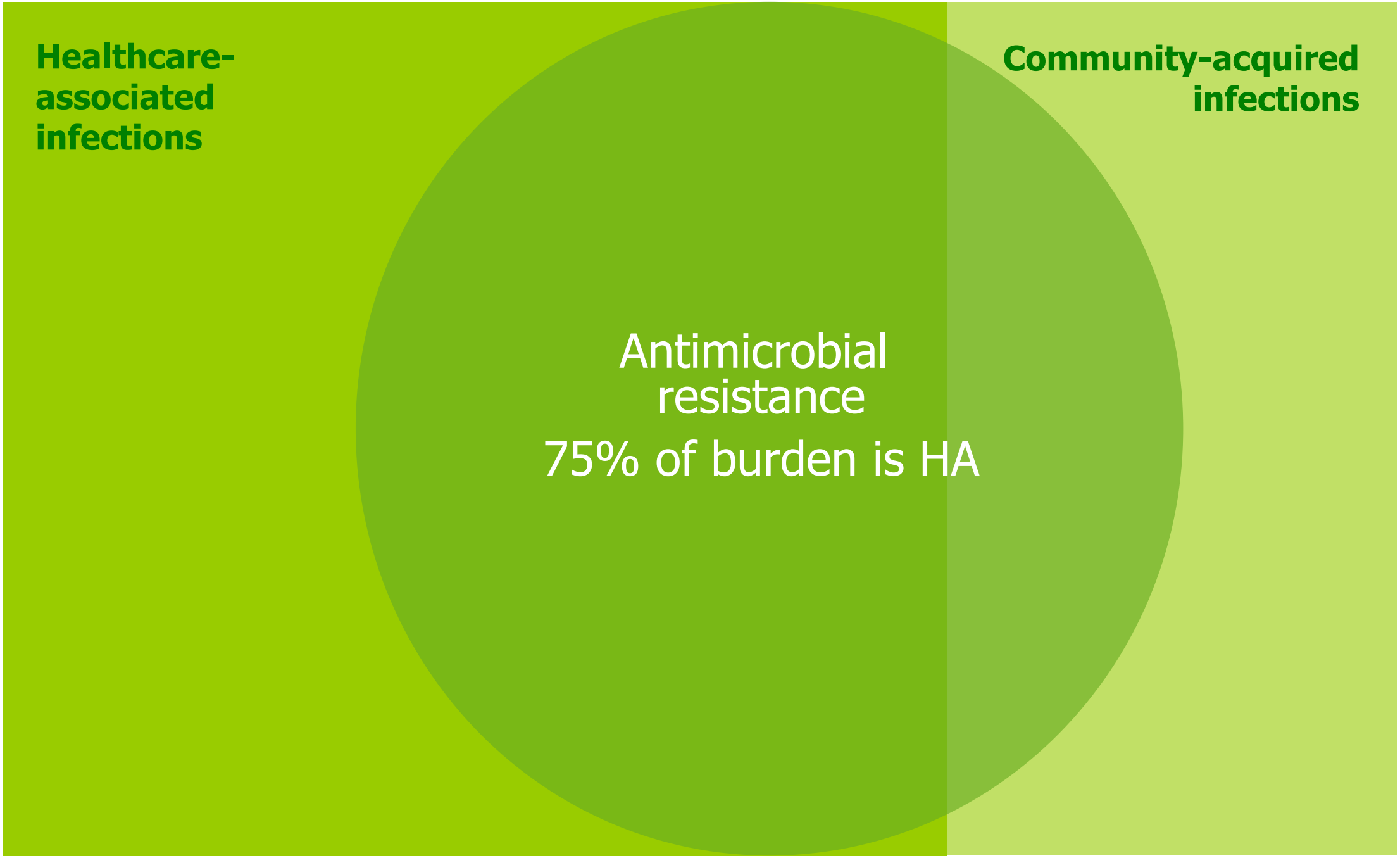


Burden reflects the burden of neighbouring countries



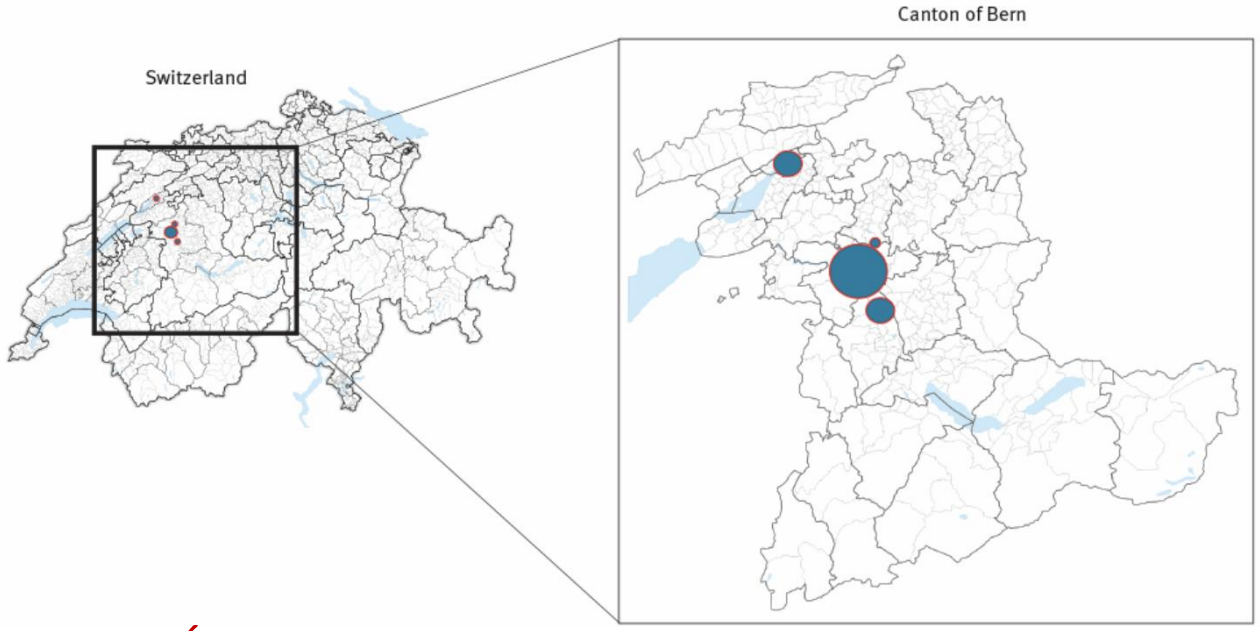


Gasser M, Cassini A, et al.. Associated deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in Switzerland, 2010 to 2019. Euro Surveill. 2023;28(20):pii=2200532.


Healthcare-associated infections
Community-acquired infections
Antimicrobial resistance
75% of burden is HA

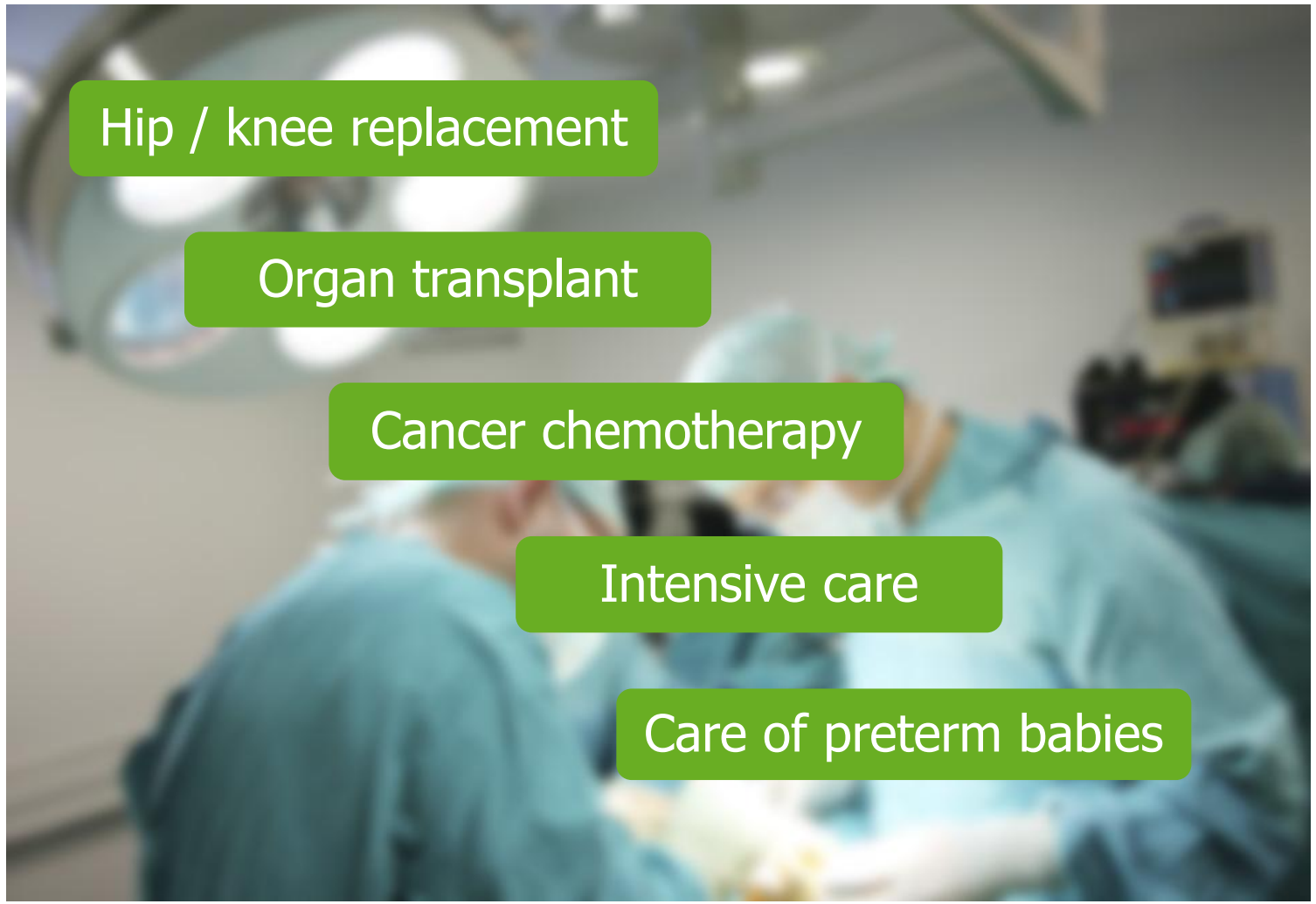
Risques pour l'hôpital

- Séjours hospitaliers prolongés
- Risque d'épidémies nosocomiales
- Augmentation de la charge de travail du personnel
- Augmentation des coûts
- Dégat d’image



Épidémie de bactérie résistante à la vancomycine *Enterococcus faecium* clone ST796:
89 patients atteints dans
quatre hôpitaux suisses 2017-18

Modern medecine will become increasingly difficult without effective antimicrobials



Limited options for treatment

Increased length of hospital stays

Increased patient morbidity and mortality

Courtesy of Dominique L. Monnet, ECDC

Antibiotic stewardship

"A coherent set of actions which promote the responsible use of antimicrobials."

Dyar et al. Clin Microbiol Infect. 2017 Nov;23(11):793-798.

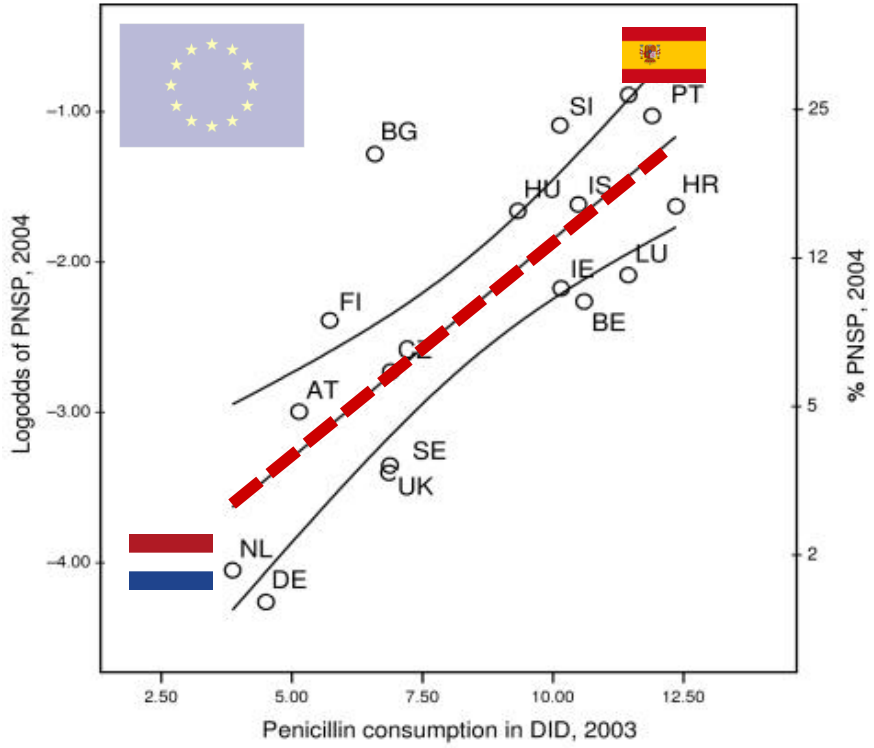
Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries: a WHO practical toolkit. World Health Organization. (2019).

Courtesy of Benedikt Huttner, WHO

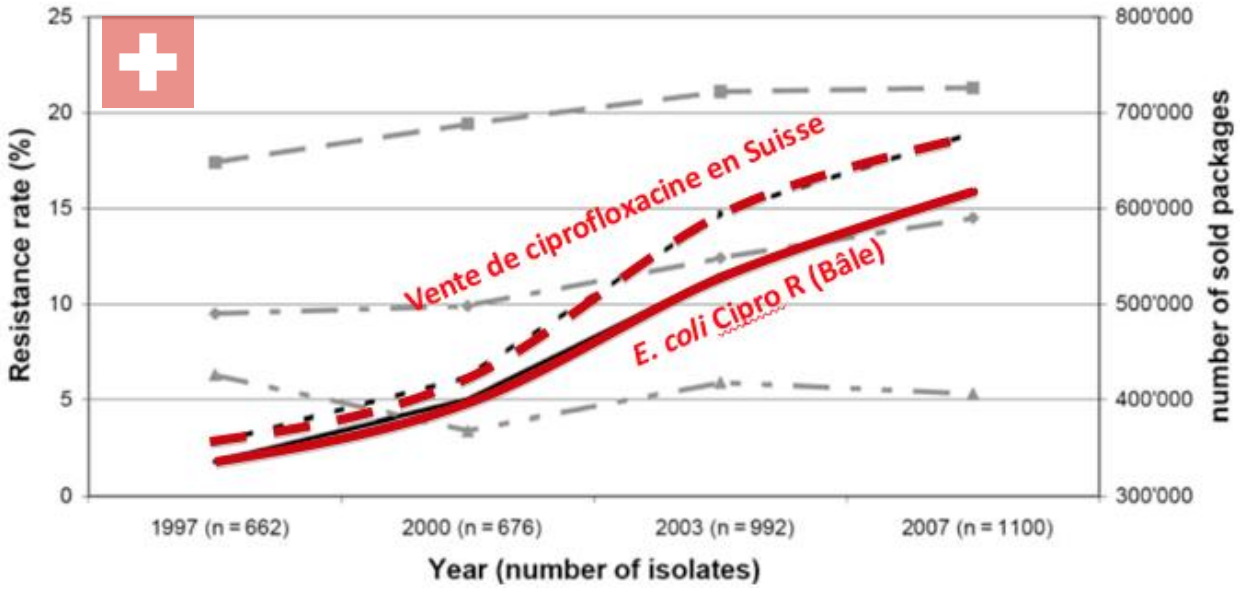
World Health Organization

Association between antibiotic resistance and consumption

Correlation between the prevalence of *Streptococcus pneumoniae* with reduced penicillin susceptibility and national use of penicillin



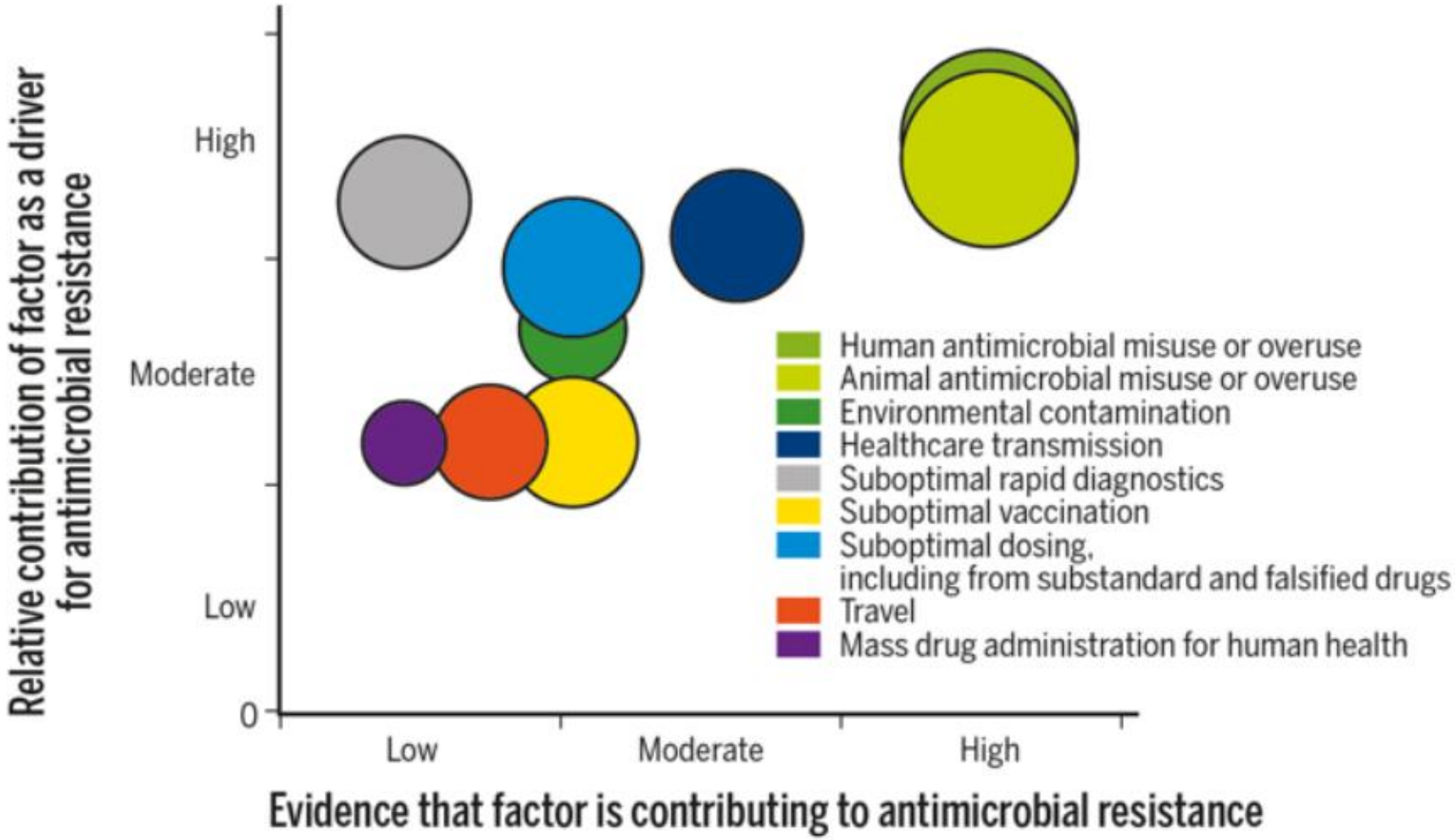
Correlation between the prevalence of ciprofloxacin resistance in *Escherichia coli* and consumption of ciprofloxacin in Switzerland



van de Sande-Bruinsma et al. Emerg Infect Dis. 2008 Nov;14(11):1722-30.
Blaettler et al. Infection. 2009 Dec;37(6):534-9.

Courtesy of Benedikt Huttner, WHO

Adapted from Holmes AH et al. *The Lancet* 2016;387:176-187



5’000’000’000

Estimated annual number of global antibiotic prescriptions

Courtesy of Benedikt Huttner, WHO

Browne et al. Lancet Planet Health . 2021 Dec;5(12):e893-e904.

Antibiotics are among the most used medicines globally

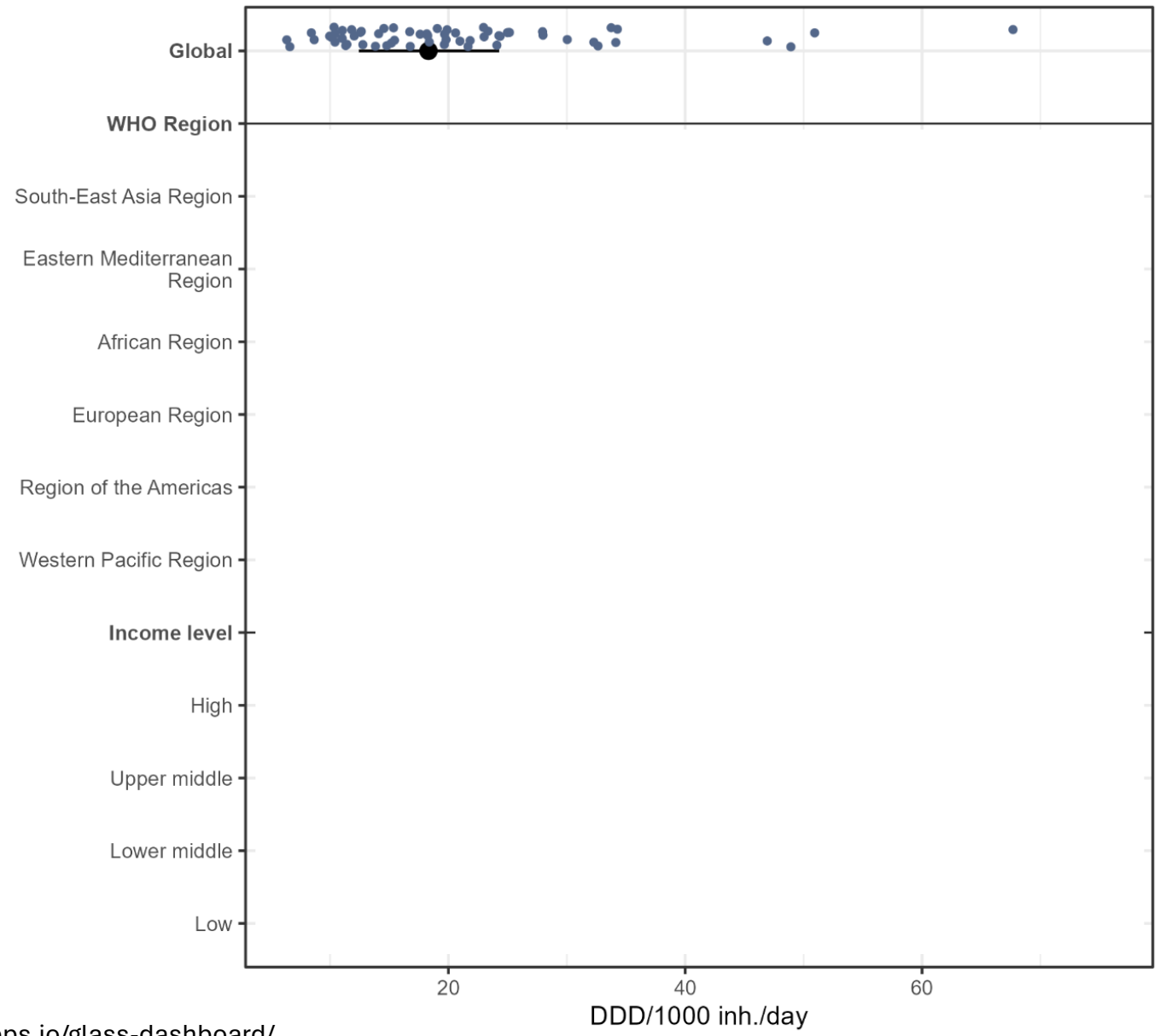
- Globally: estimated 34.3 billion DDD in 2023 for a population of 8.1 billion
  - = about **4.2 DDD for every person in the world per year**

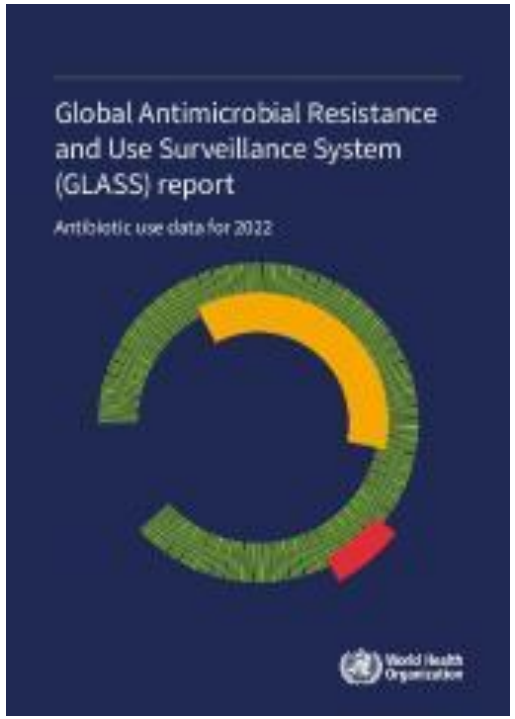
- In some LMICs children **receive up to 25 antibiotic prescriptions** for respiratory tract infection or fever **during their first 5 years of life**
  - Most of them inappropriate

Courtesy of Benedikt Huttner, WHO

Klein et al. Proc Natl Acad Sci U S A. 2024 Dec 3;121(49):e2411919121.
Fink et al. Lancet Infect Dis. 2020 Feb;20(2):179-187.

Total antibiotic use expressed as DDD per 1000 inhabitants per day in 60 CTAs in 2022, globally and by WHO Regions and World Bank income group classification





https://worldhealthorg.shinyapps.io/glass-dashboard/_

Courtesy of Benedikt Huttner, WHO

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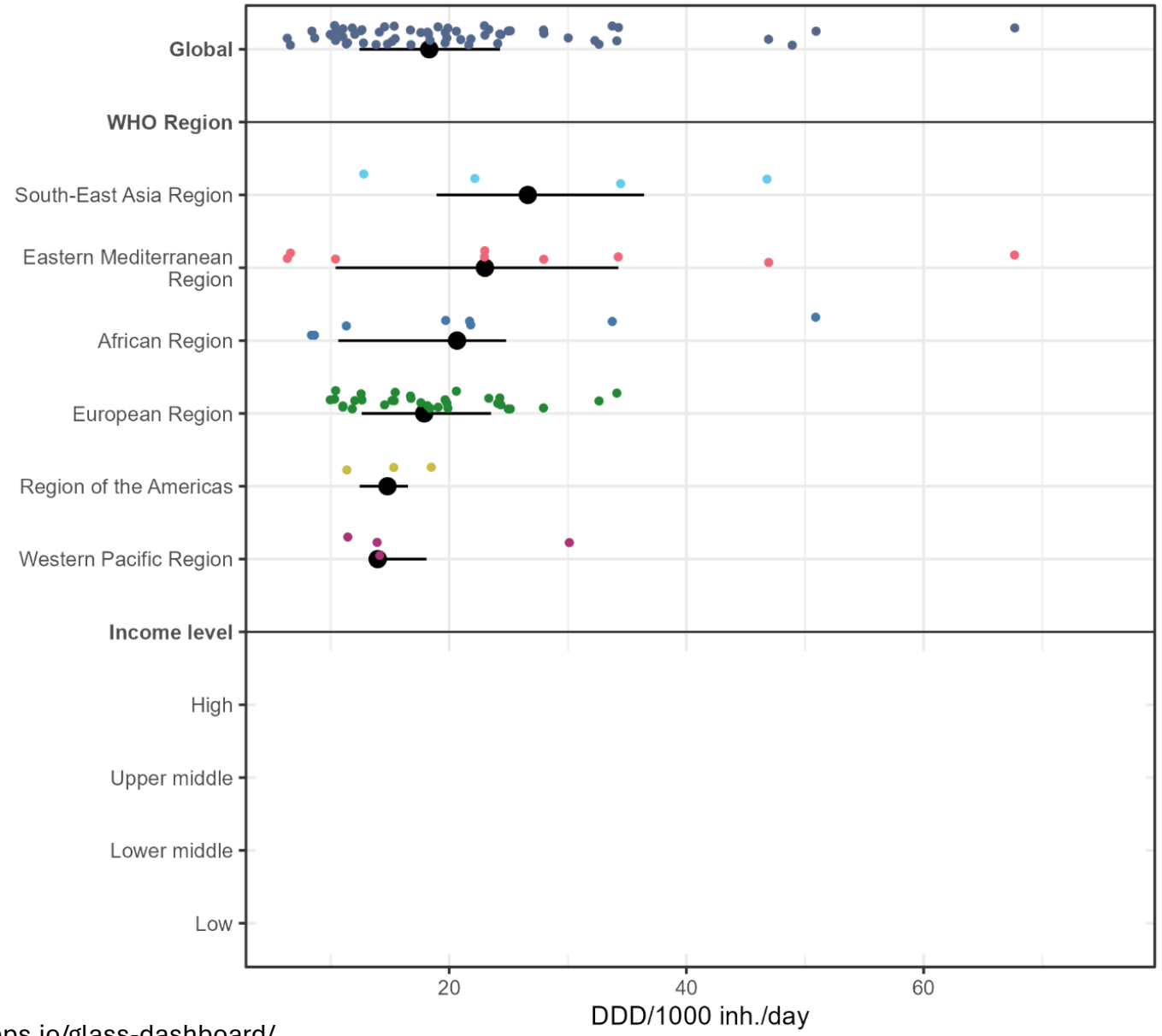

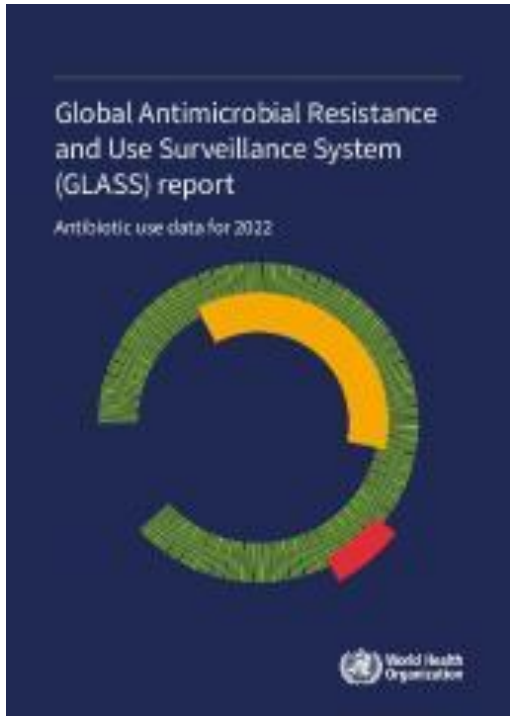

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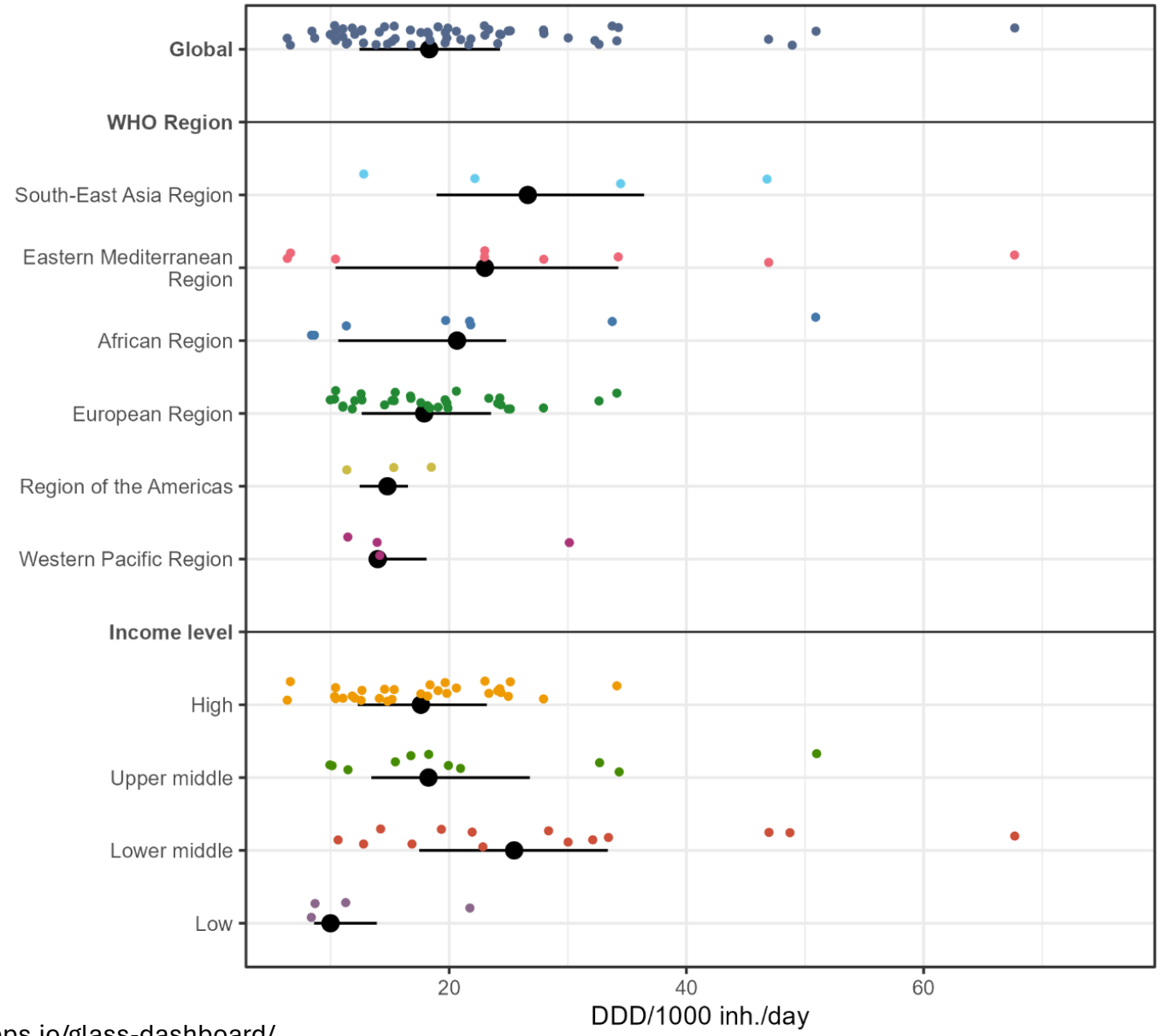

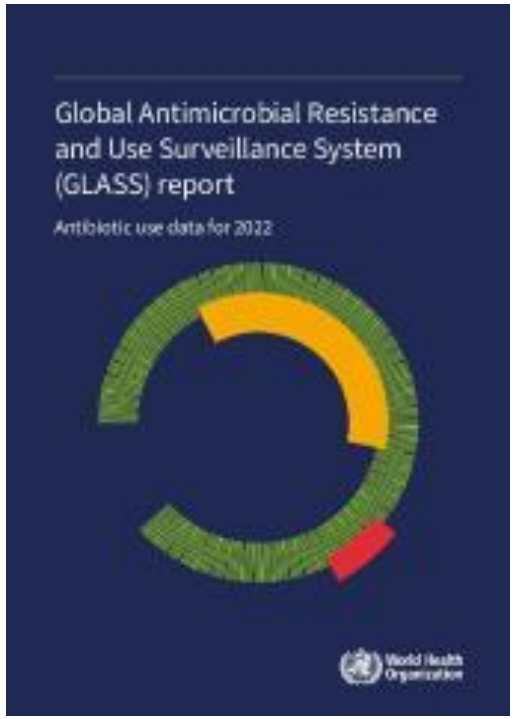

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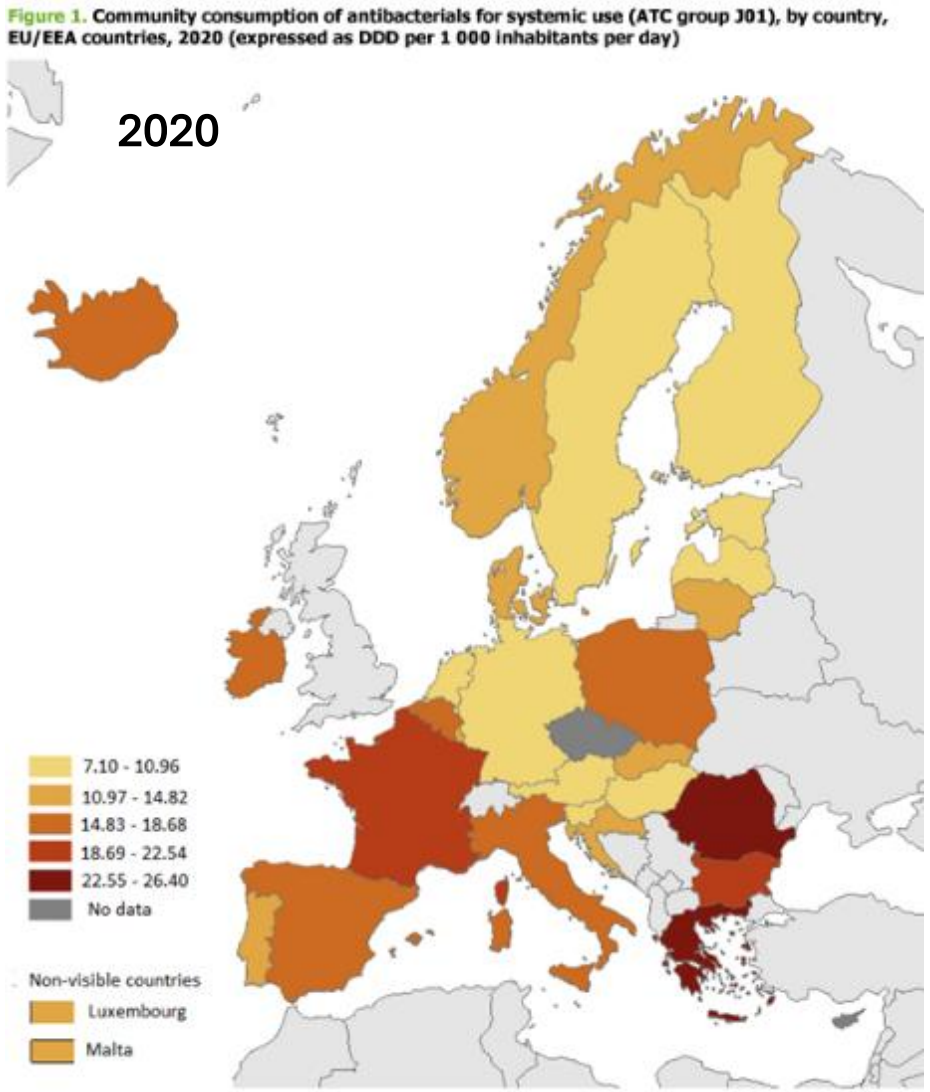
Courtesy of Benedikt Huttner, WHO

Antimicrobial consumption in the EU/EEA (ESAC-Net)



- Mean consumption of antibacterials for systemic use in 2023*: 20.0 DDD per 1000 inhabitants per day

- Country range: 9.6–28.5

Courtesy of Benedikt Huttner, WHO

https://www.ecdc.europa.eu/en/publications-data/surveillance-antimicrobial-consumption-europe-2020
https://www.ecdc.europa.eu/sites/default/files/documents/ESAC-Net_report-2023.pdf

*community and hospital sector combined

OECD Health Policy Studies

Stemming the Superbug Tide

JUST A FEW DOLLARS MORE

OECD

LAUNCH VERSION

SURVEILLANCE AND OUTBREAK REPORT

Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017

Carl Suetens[1], Katrien Latour[2], Tommi Kärki[1], Enrico Ricchizzi[3], Pete Kinross[1], Maria Luisa Moro[3], Béatrice Jans[2], Susan Hopkins[4], Sonja Hansen[5], Outi Lyytikäinen[6], Jacqui Reilly[7,8], Aleksander Deptula[9], Walter Zingg[10], Diamantis Plachouras[1], Dominique L Monnet[1], the Healthcare-Associated Infections Prevalence Study Group[11]

1. European Centre for Disease Prevention and Control, Solna, Sweden
2. Sciensano, Brussels, Belgium

Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis

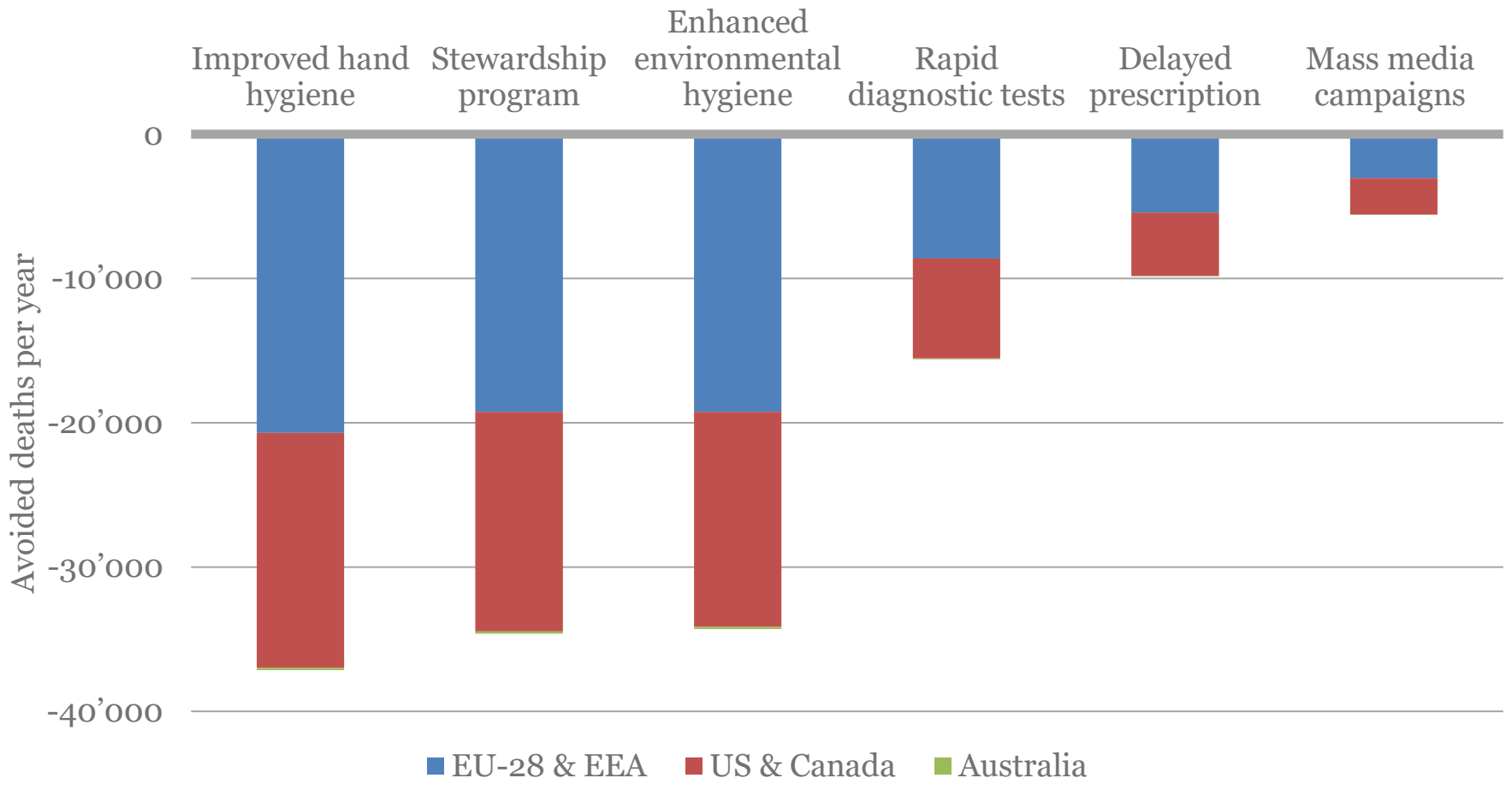
*Alessandro Cassini, Liselotte Diaz Högberg, Diamantis Plachouras, Annalisa Quattrocchi, Ana Hoxha, Gunnar Skov Simonsen, Mélanie Colomb-Cotinat, Mirjam E Kretzschmar, Brecht Devleesschauwer, Michele Cecchini, Driss Ait Ouakrim, Tiago Cravo Oliveira, Marc J Struelens, Carl Suetens, Dominique L Monnet, and the Burden of AMR Collaborative Group**

Lancet Infect Dis 2019; 19: 56-66

Summary

Background Infections due to antibiotic-resistant bacteria are threatening modern health care. However, estimating their incidence, complications, and attributable mortality is challenging. We aimed to estimate the burden of infections

Public Health Policies to Tackle AMR Save Lives…

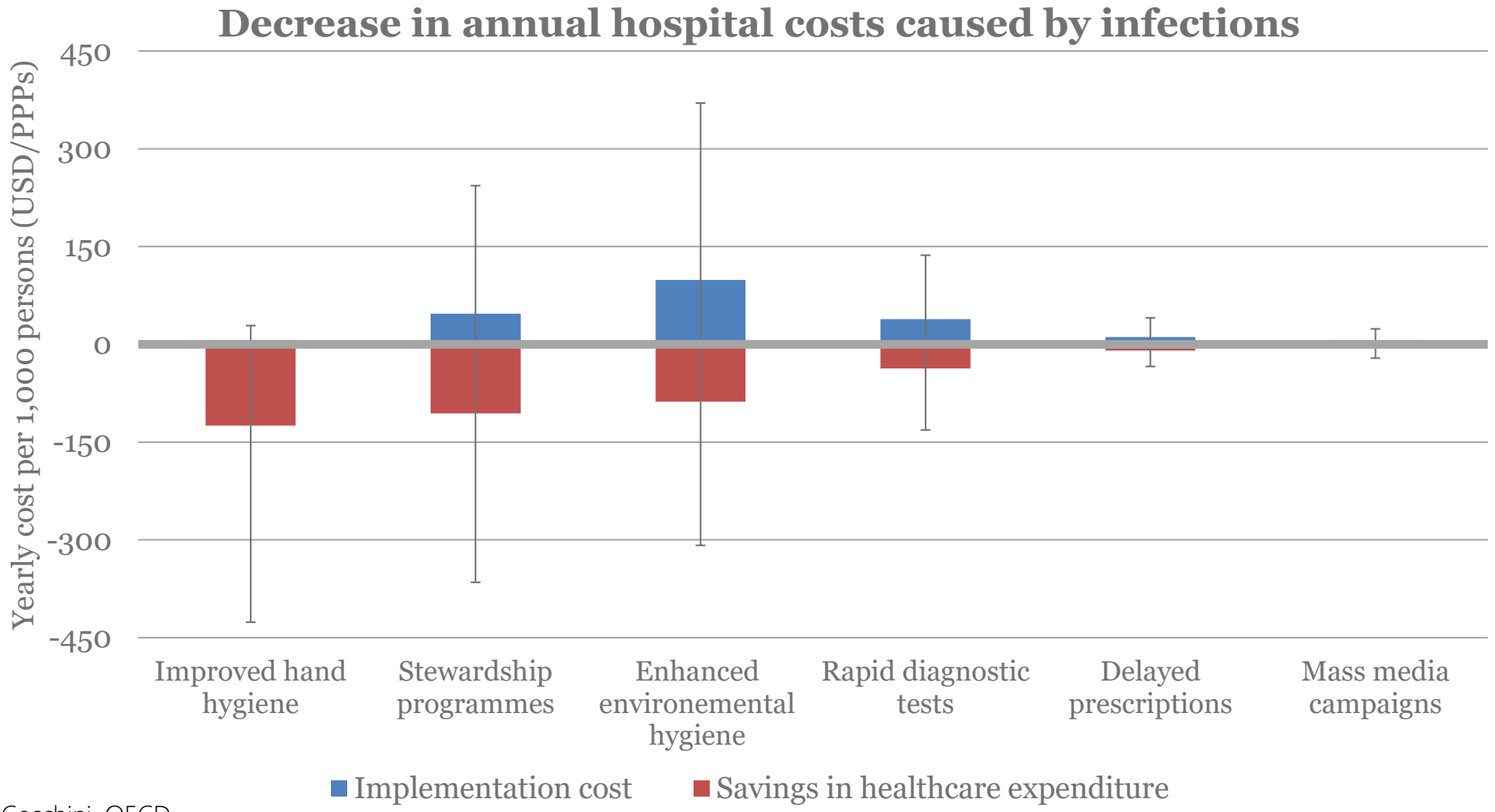


Courtesy of Michele Cecchini, OECD

Source: OECD. Stemming the Superbug Tide: just a few dollars more. 2018. oe.cd/amr-2018

Courtesy of Michele Cecchini, OECD (Michele.CECCHINI@oecd.org)

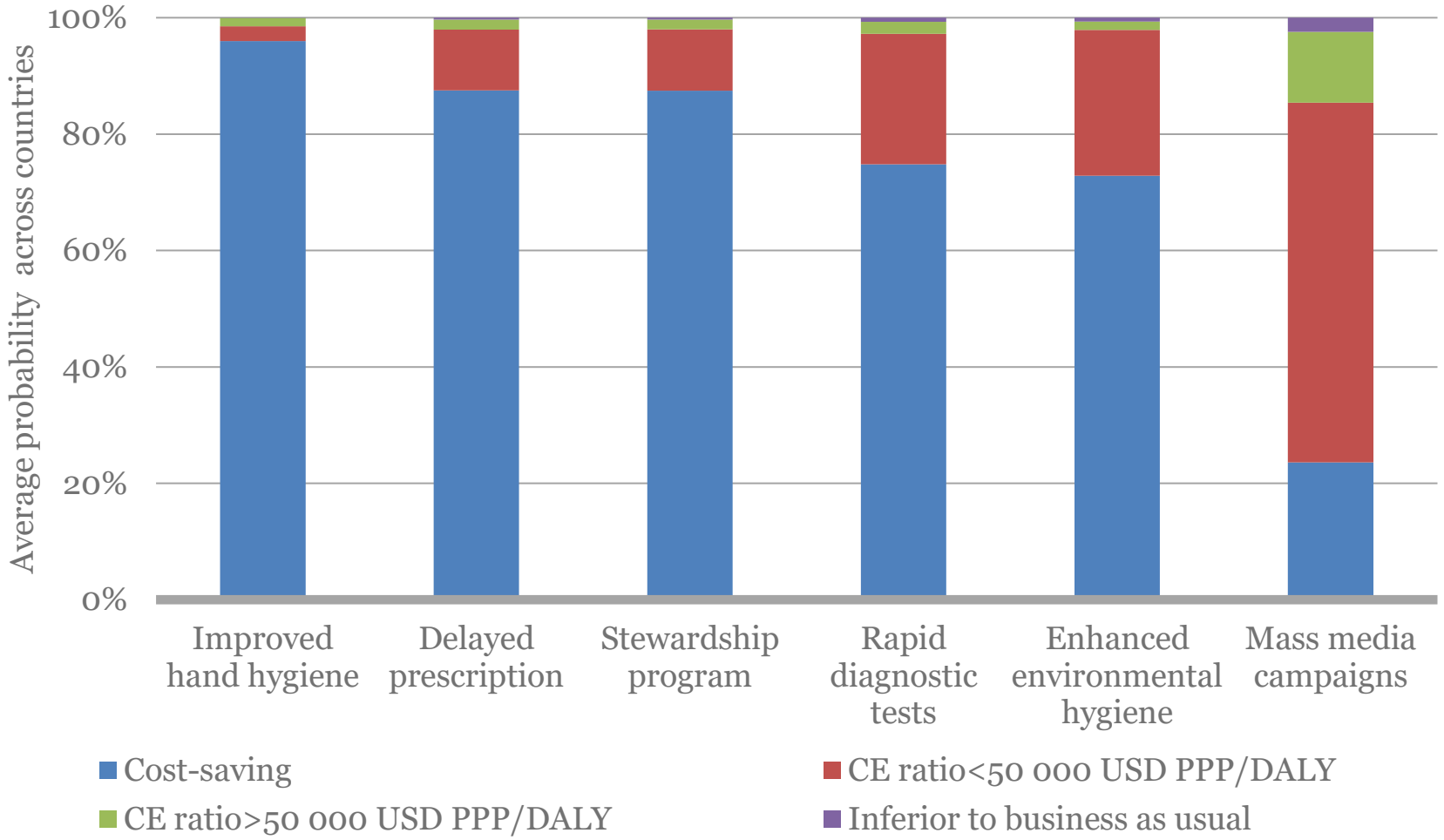
… And Decrease Healthcare Expenditure



Courtesy of Michele Cecchini, OECD

Note: columns show the median value across 33 OECD and EU countries; whiskers show min and max values

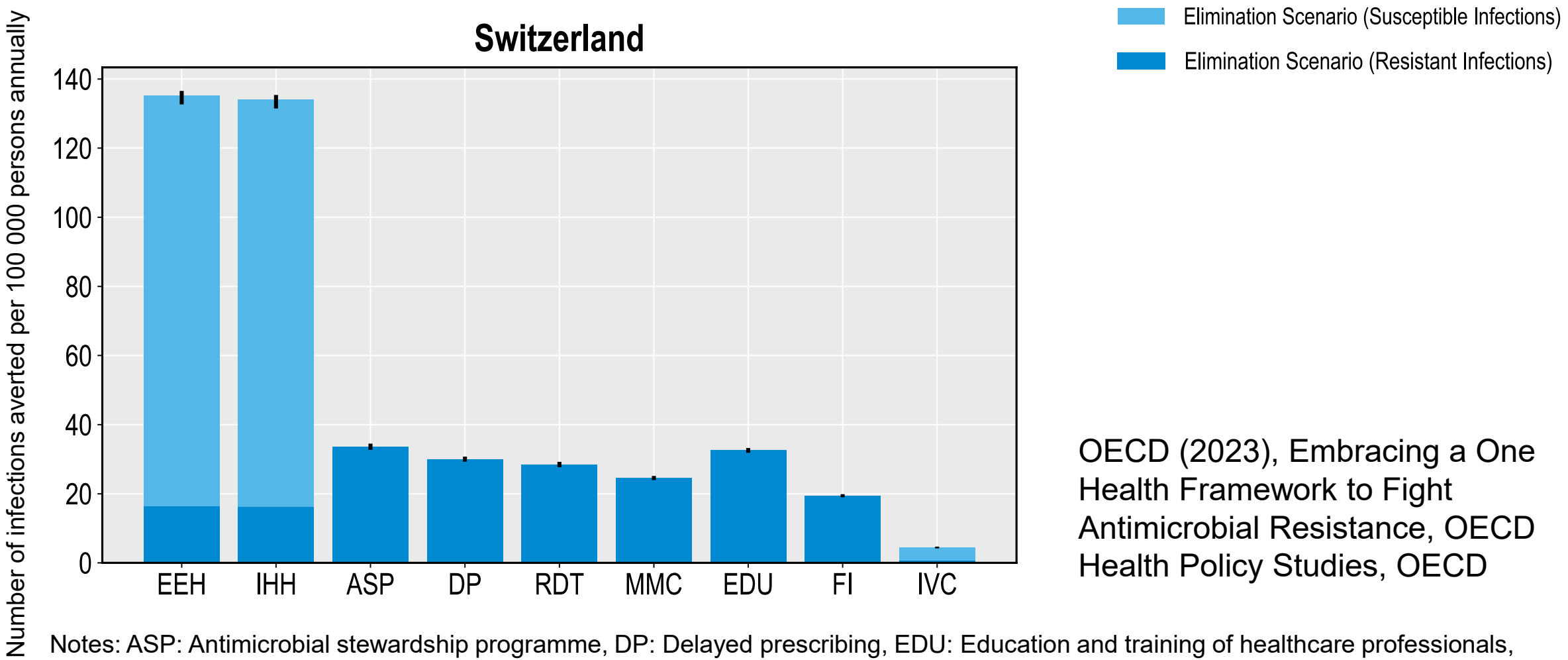
Tackling AMR is a Very Good Investment for OECD and EU Countries



Courtesy of Michele Cecchini, OECD

Source: OECD. Stemming the Superbug Tide: just a few dollars more. 2018. oe.cd/amr-2018

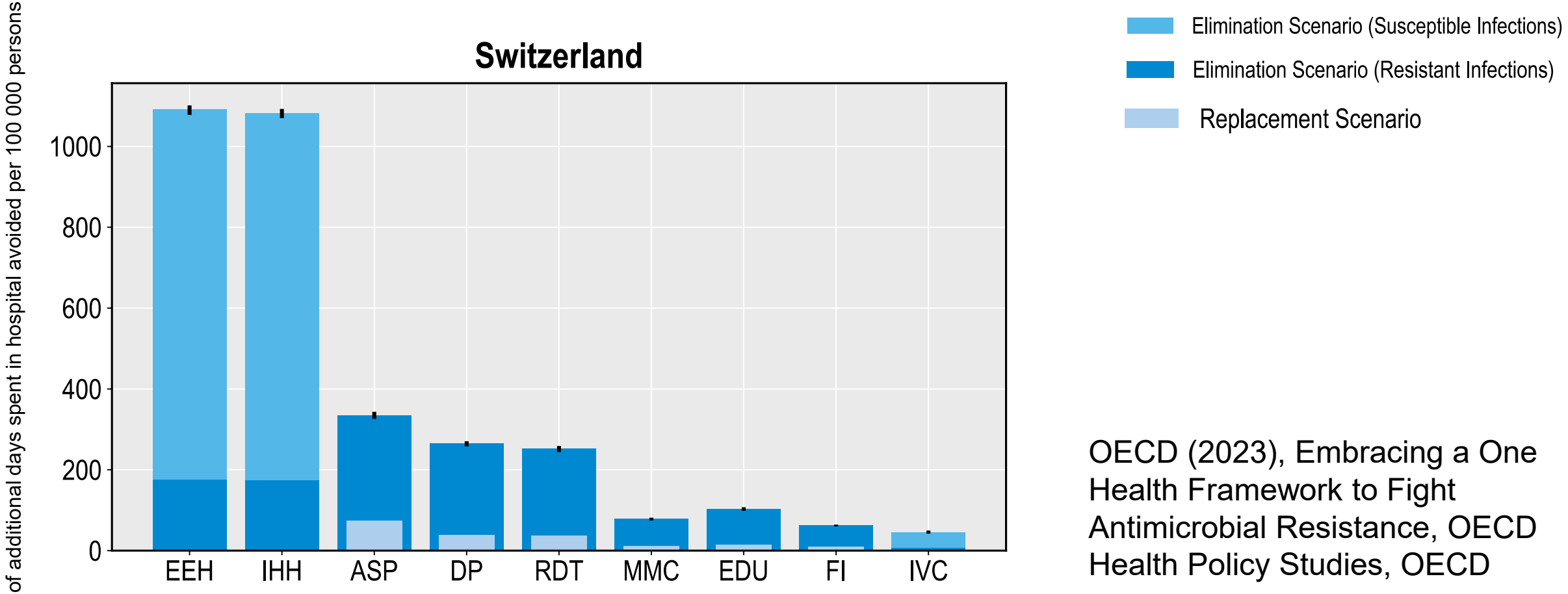
Antimicrobial stewardship programs are the most effective modelled policy intervention to avert resistant infections



OECD (2023), Embracing a One Health Framework to Fight Antimicrobial Resistance, OECD Health Policy Studies, OECD

Notes: ASP: Antimicrobial stewardship programme, DP: Delayed prescribing, EDU: Education and training of healthcare professionals, EEH: Enhancing environmental hygiene, FHP: Food handling practices, FH: Farm hygiene, FMS: Improve farm hygiene practice, FI: Financial incentives, IHH: Improving hand hygiene, IVC: Increase vaccine coverage, MMC: Mass media campaigns, RDT: Rapid diagnostic testing capacity.

Investing in policies to tackle AMR can reduce additional days spent in hospitals due to treating resistant infections



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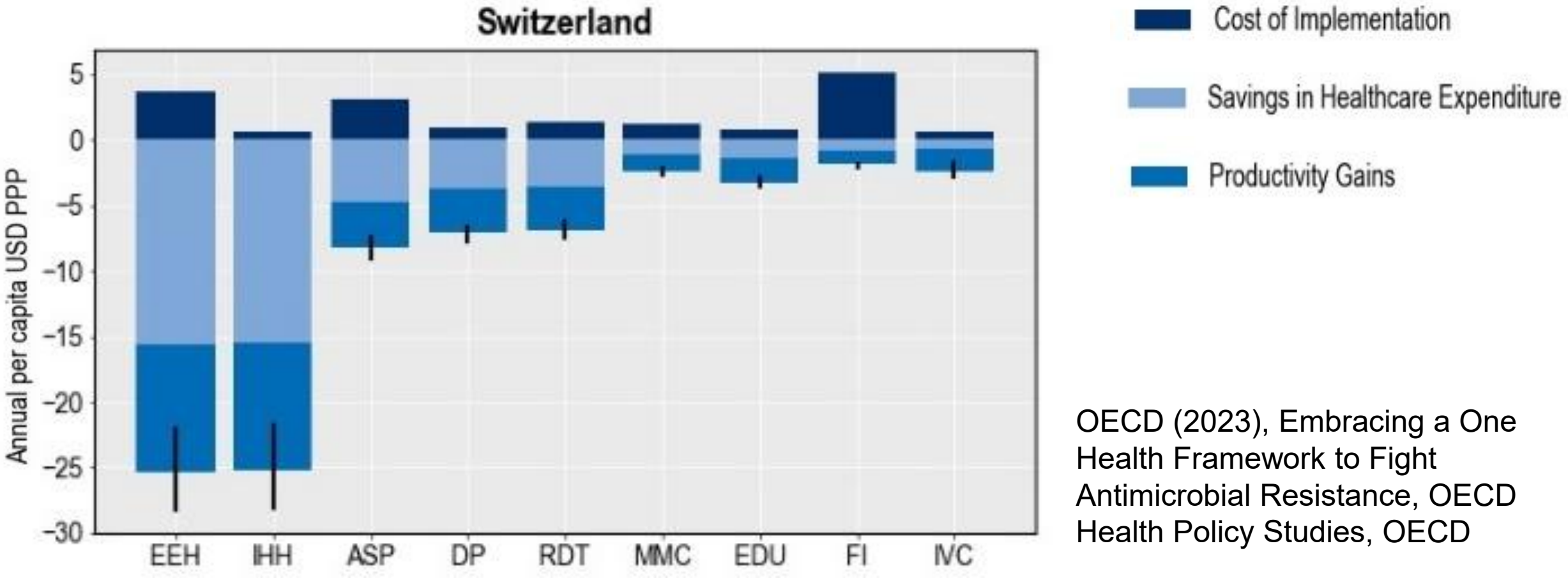
Benefits accrued by scaling up policy interventions to tackle AMR outweigh costs



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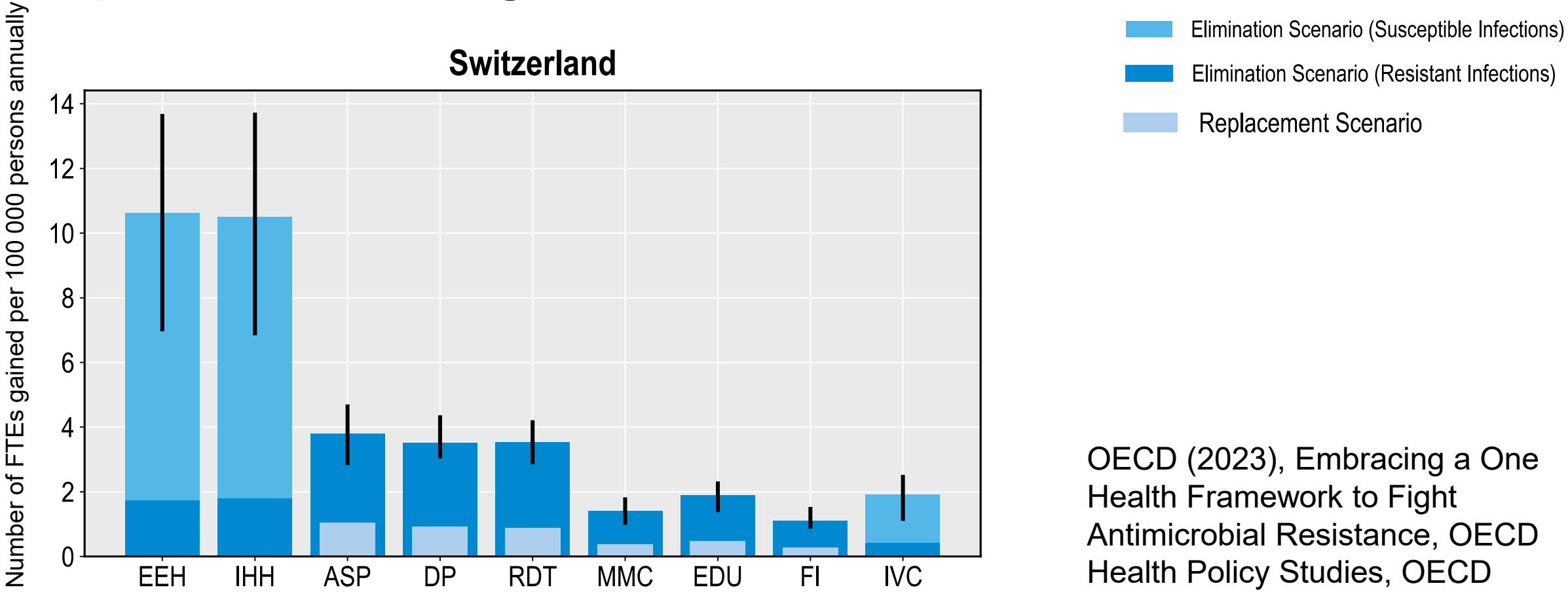
Investing in AMR policies can improve workforce productivity equivalent to adding thousands of full-time workers every year



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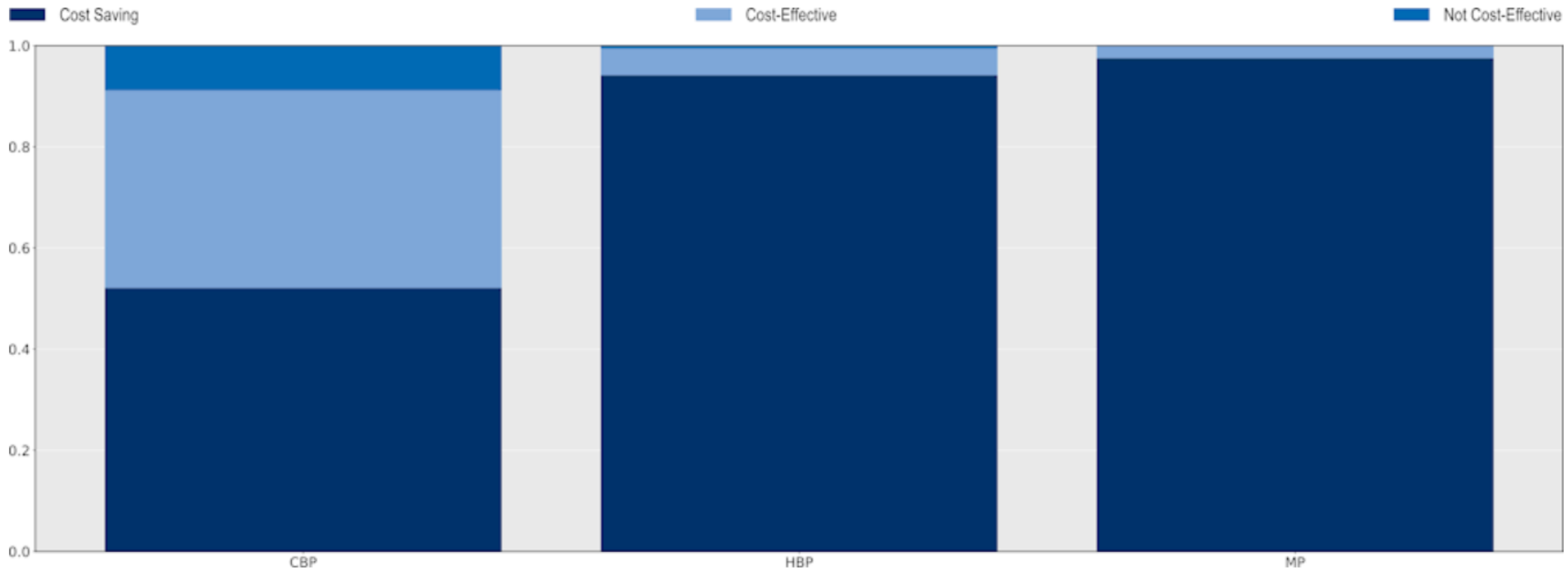
The mixed package yields the largest reductions in the number of resistant infections

Figure 6.13. Probability of cost-effectiveness of the modelled policy packages vs. business-as-usual scenario



Note: CBP: Community-based package; HBP: Hospital-based package; MP: Mixed package.

Source: OECD analysis based on the OECD SPHeP-AMR model.

Conclusions

- AMR is a complex and multi-system issue
- The burden of AMR depends on the context, but is always higher in acute-care settings; the burden is clinical and economic
- AMR represents a threat everywhere and has been increasing in recent decades
- Antimicrobials are among the medicines most consumed, globally
- Antimicrobial consumption is a main driver of AMR; hence, antimicrobial stewardship is a necessary intervention
- AMS programmes are effective in preventing infections and deaths due to AMR
- AMS programmes are cost-saving in most settings, including in Switzerland

A communication campaign that worked – France

https://www.youtube.com/watch?v=6JdRuhZnZpw

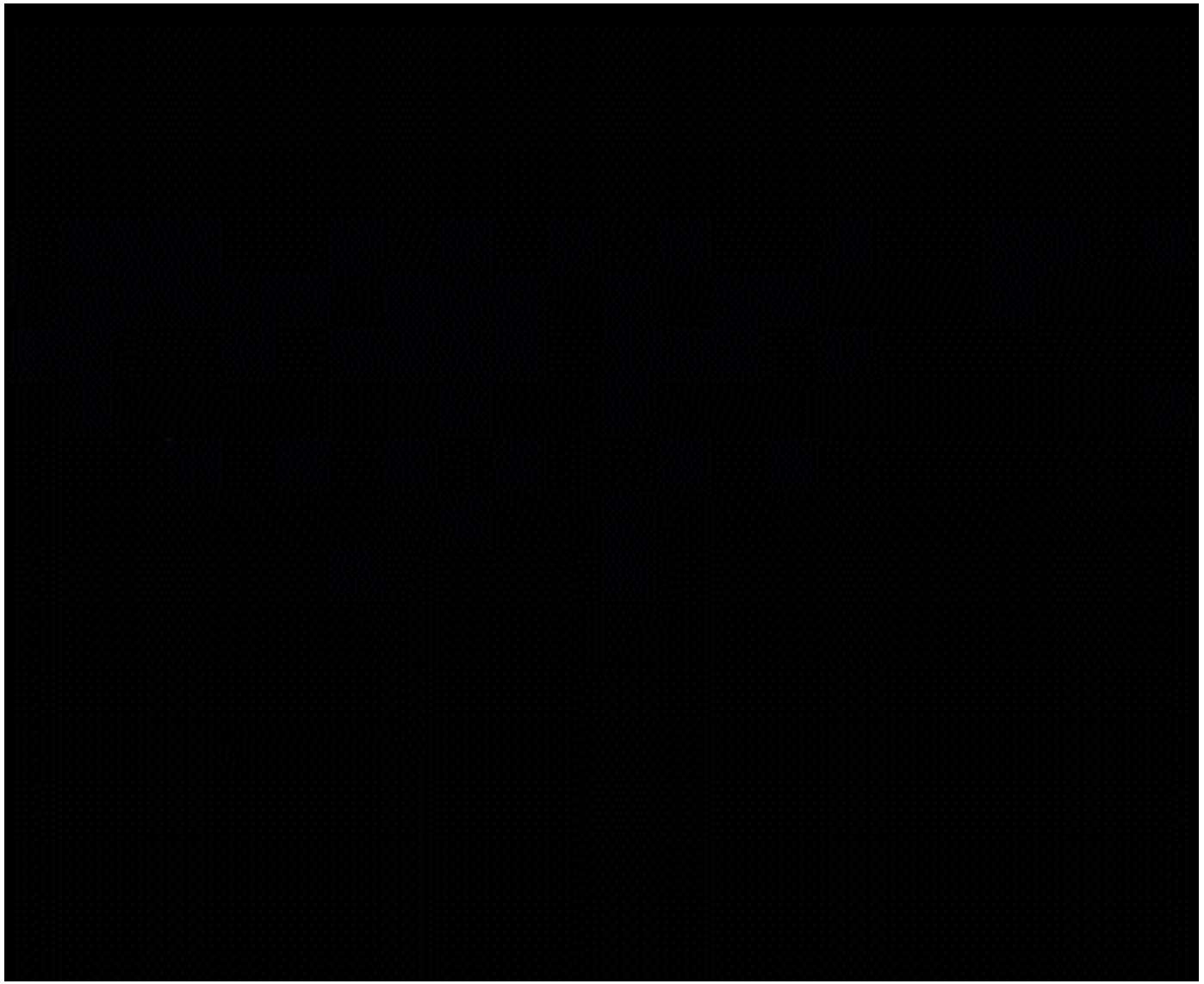
Adapt to sense of humour – Belgium

https://www.youtube.com/watch?v=HPp3MlXInrc

Thank you for your attention

Alessandro.Cassini@etat.ge.ch

One that worked less well – Spain



https://www.msssi.gob.es/campannas/campanas06/Antibioticos.htm

Adapt to history and culture - Poland

https://www.youtube.com/watch?v=9M6oXpaTM7s