



BCoDE – Burden of Communicable Diseases in Europe

# Burden of healthcare-associated infections in Europe

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# What is burden of disease?

A common definition:

**Disease burden** is the **impact** of a health problem

...as measured by financial cost, mortality, morbidity, or other indicators...

Choice of a **common currency** in order to compare impact of diseases and its sequelae



SMPH: summary measure of population health  
CHM: composite health measure

# Disability-adjusted life years (DALYs)

$$\text{DALY} = \text{YLL} + \text{YLD}$$



Years of life lost due to premature mortality

Years of healthy life lost due to disability

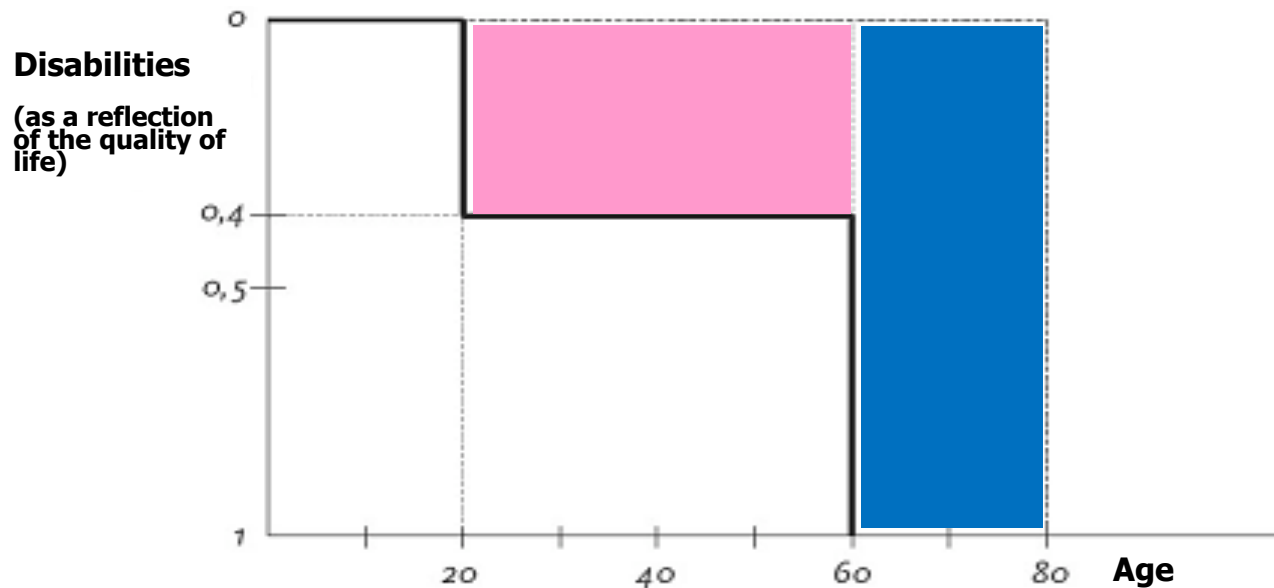
$$= \sum (\mathbf{d} \times \mathbf{e})$$

d – sum of all fatal cases  
e – remaining life expectancy  
at age of death

$$= \sum (\mathbf{n} \times \mathbf{t} \times \mathbf{w})$$

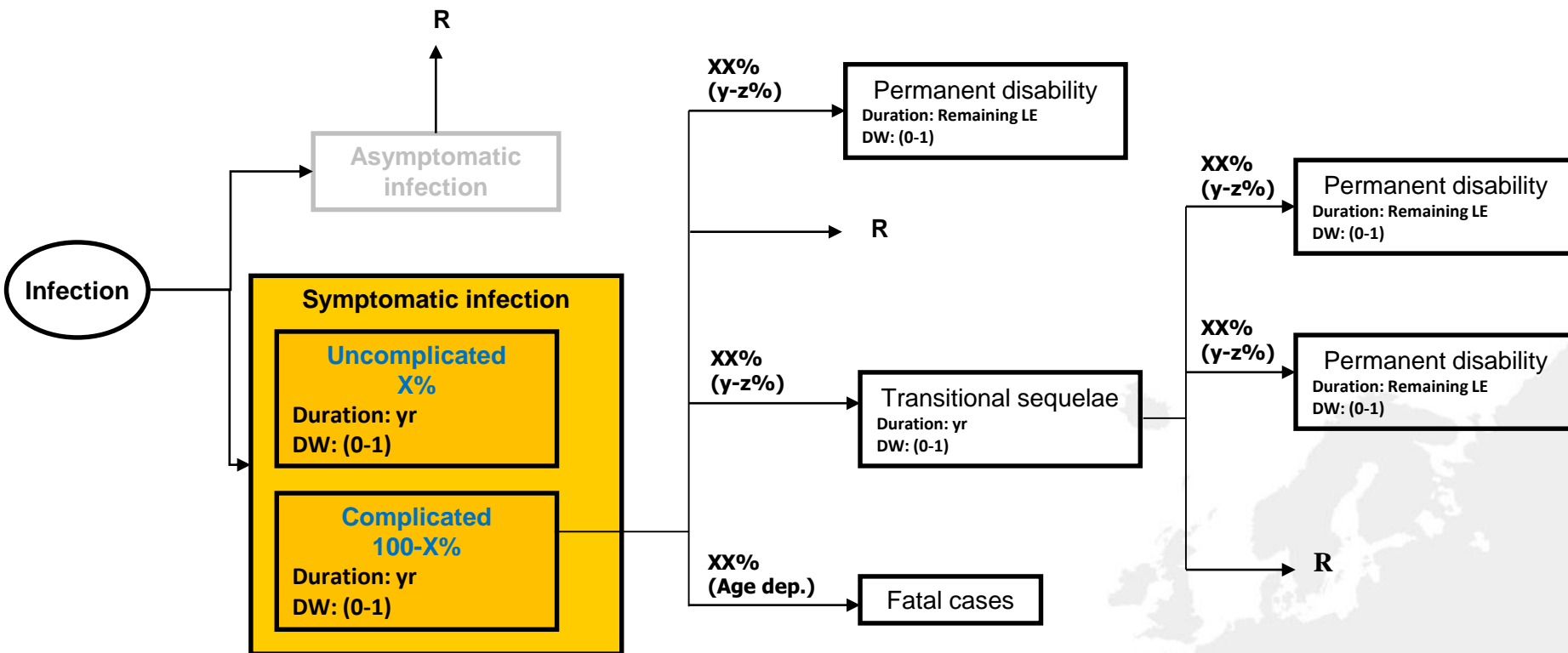
n – number of cases  
t – duration of illness  
w – disability weight

# Disability-adjusted life years (DALYs)



$$\begin{aligned} \text{DALY} &= \text{years of life lost (YLL)} + \text{years lived with disability (YLD)} \\ &= 20 \text{ years} + 16 \text{ years} = 36 \text{ years} \end{aligned}$$

# Considering all sequelae: building outcome trees from systematic reviews of the literature

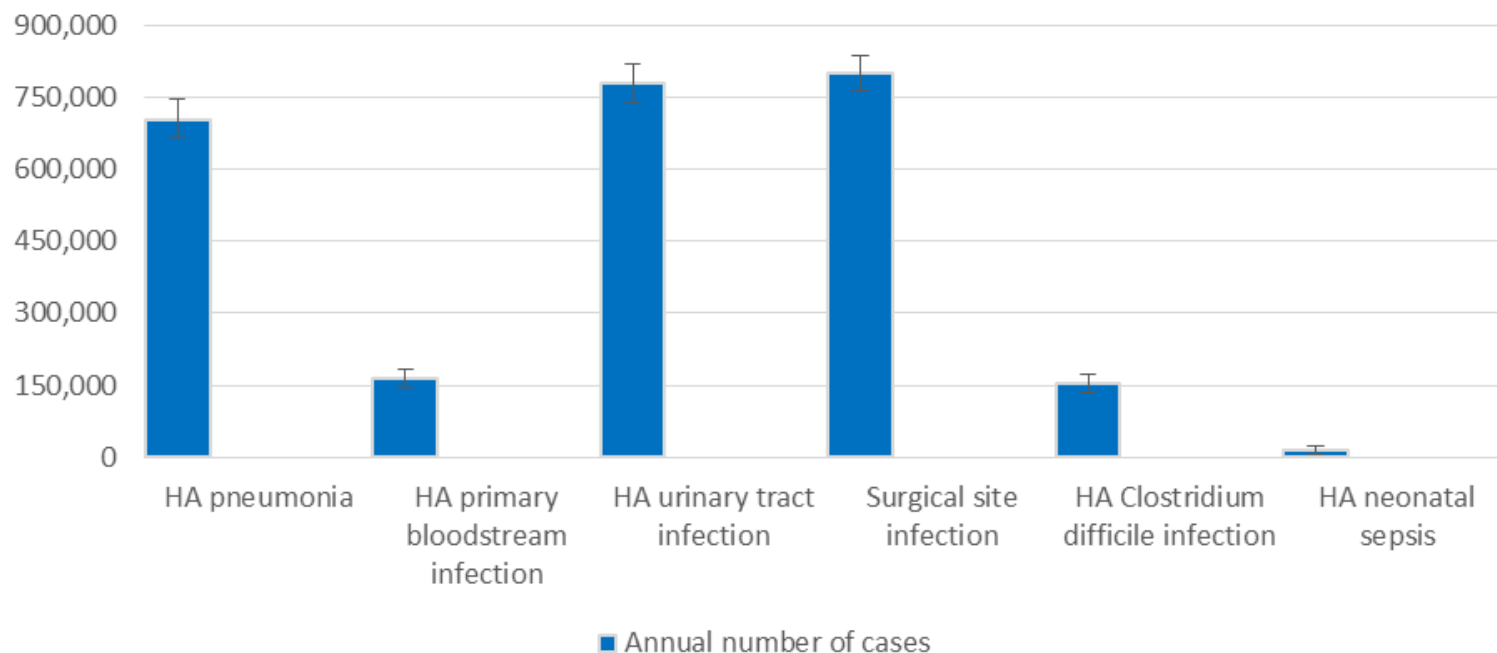


**Outcomes, transition probabilities and durations:** Robert Koch Institute. Burden of healthcare associated infection (BHAi) - evidence-based and comorbidity-adjusted outcome trees for estimation of burden of disease. Berlin: RKI; 2016. Available from: [http://www.rki.de/DE/Content/Institut/OrgEinheiten/Abt3/FG37/Research\\_Report\\_BHAi.pdf?\\_\\_blob=publicationFile](http://www.rki.de/DE/Content/Institut/OrgEinheiten/Abt3/FG37/Research_Report_BHAi.pdf?__blob=publicationFile)

**Disability weights:** Haagsma JA et al. Assessing disability weights based on the responses of 30,660 people from four European countries. Popul Health Metr. 2015; 13: 1-15.

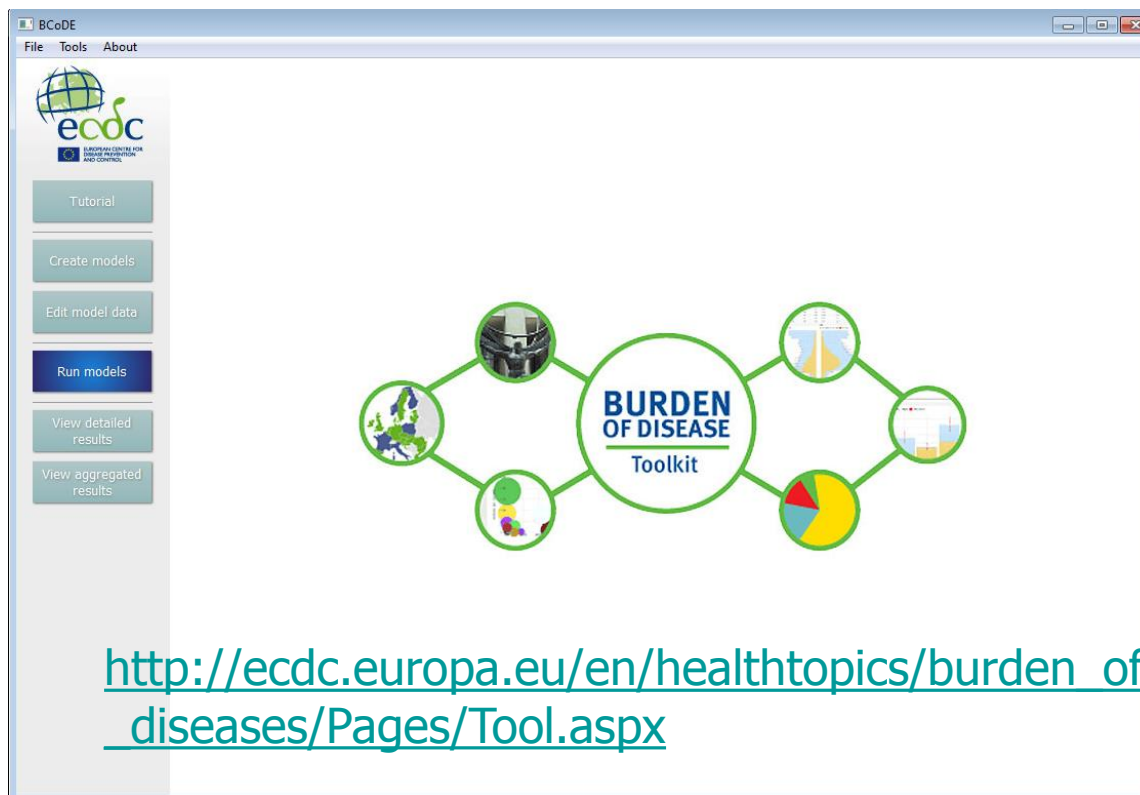
# Estimating incidence of HAIs from the ECDC Point Prevalence Survey 2011-2012

- Age-group and sex prevalent number of HAIs from the PPS was converted into annual incidence rates applying the Rhome and Sudderth formula
- 2.6 million annual number of cases of HAIs estimated in the EU/EEA (95% UI: 1,624,140 - 4,084,550)



# Calculating DALYs: the BCoDE toolkit

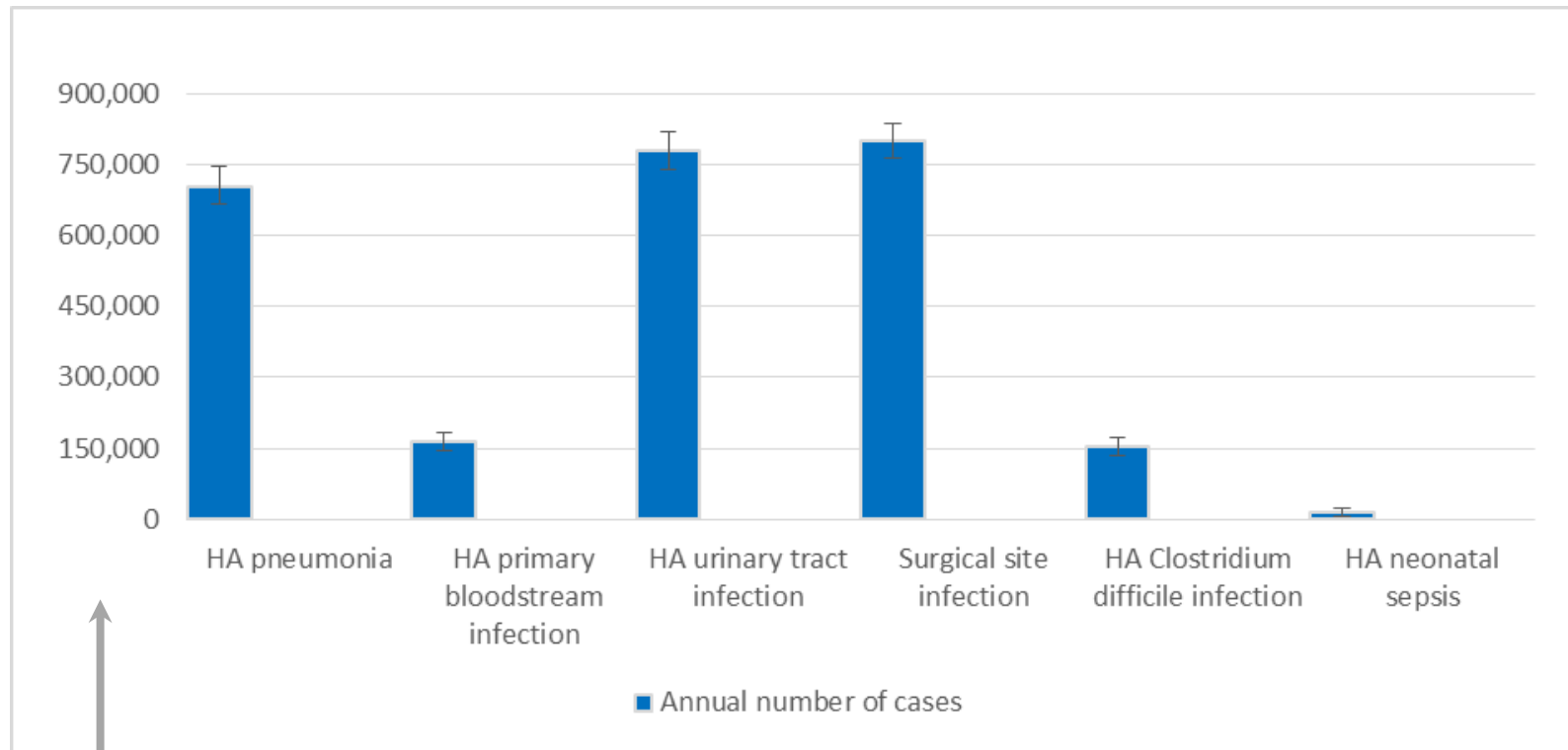
- Cases were further split according to McCabe score and adjusted for life expectancy
- Age-group and sex number of cases were inserted in the software





# Comparing number of cases and burden of disease

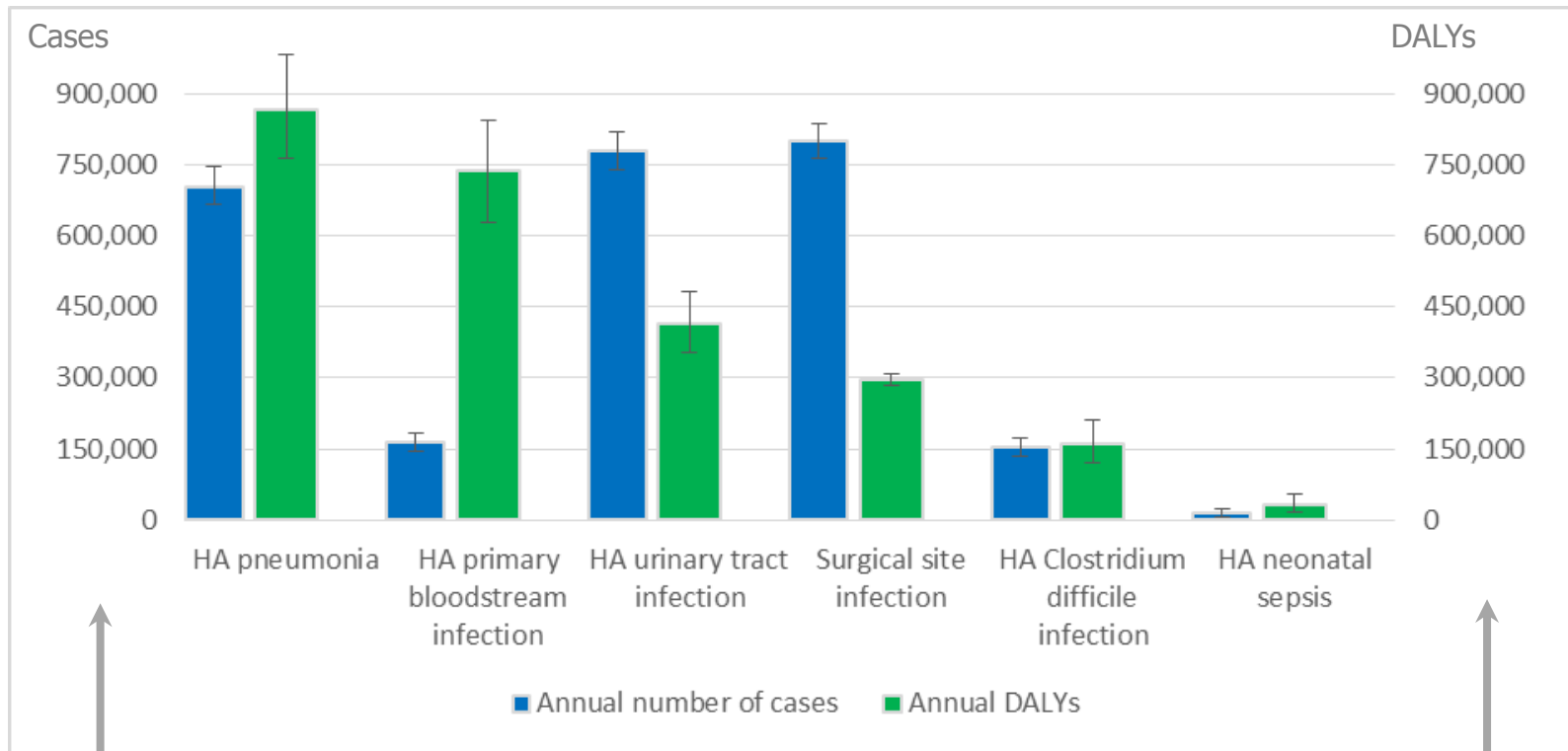
**Annual burden of HAIs in EU/EEA Member States – 2011-2012 compared to estimated annual number of cases.  
(estimated more than 2.5 million cases and 85,000 deaths)**



(estimated from ECDC point prevalence survey 2011-2012)

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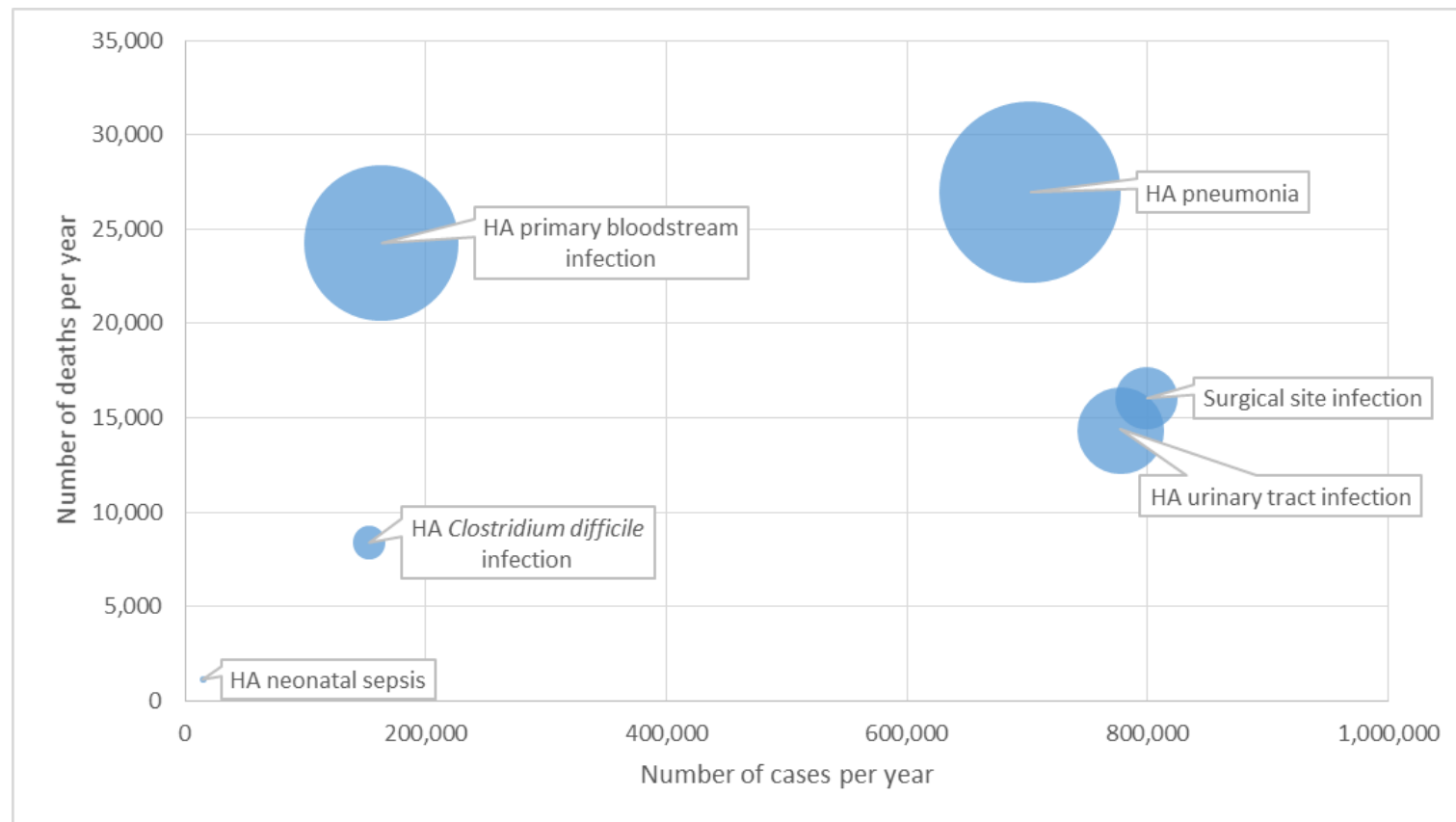
(estimated by inserting number of cases in BCODE toolkit)

# Results of the burden of HAIs study

Healthcare-associated infections	Median (95% uncertainty interval)			% total DALYs
	Cases per year	Deaths per year	DALYs per 100,000 population	
HA pneumonia	702,315 (664,764-744,419)	26,972 (21,859-32,541)	169 (149-192)	33.7
HA primary bloodstream infection	163,216 (145,012-182,059)	24,284 (20,824-27,755)	145 (123-166)	28.9
HA urinary tract infection	777,639 (737,820-820,228)	14,334 (11,768-17,162)	81.2 (69.0-94.2)	16.2
Surgical site infection	799,185 (762,721-835,448)	16,049 (15,249-16,893)	58.2 (55.7-60.6)	11.6
HA <i>Clostridium difficile</i> infection	152,905 (134,053-173,089)	8,382 (6,034-11,152)	31.2 (23.6-41.1)	6.23
HA neonatal sepsis	14,651 (7,466-23,873)	1,109 (383-2,380)	16.8 (8.9-27.6)	3.35
Overall	2,609,911 (2,451,235-2,778,451)	91,130 (76,117-107,883)	501 (429-582)	100

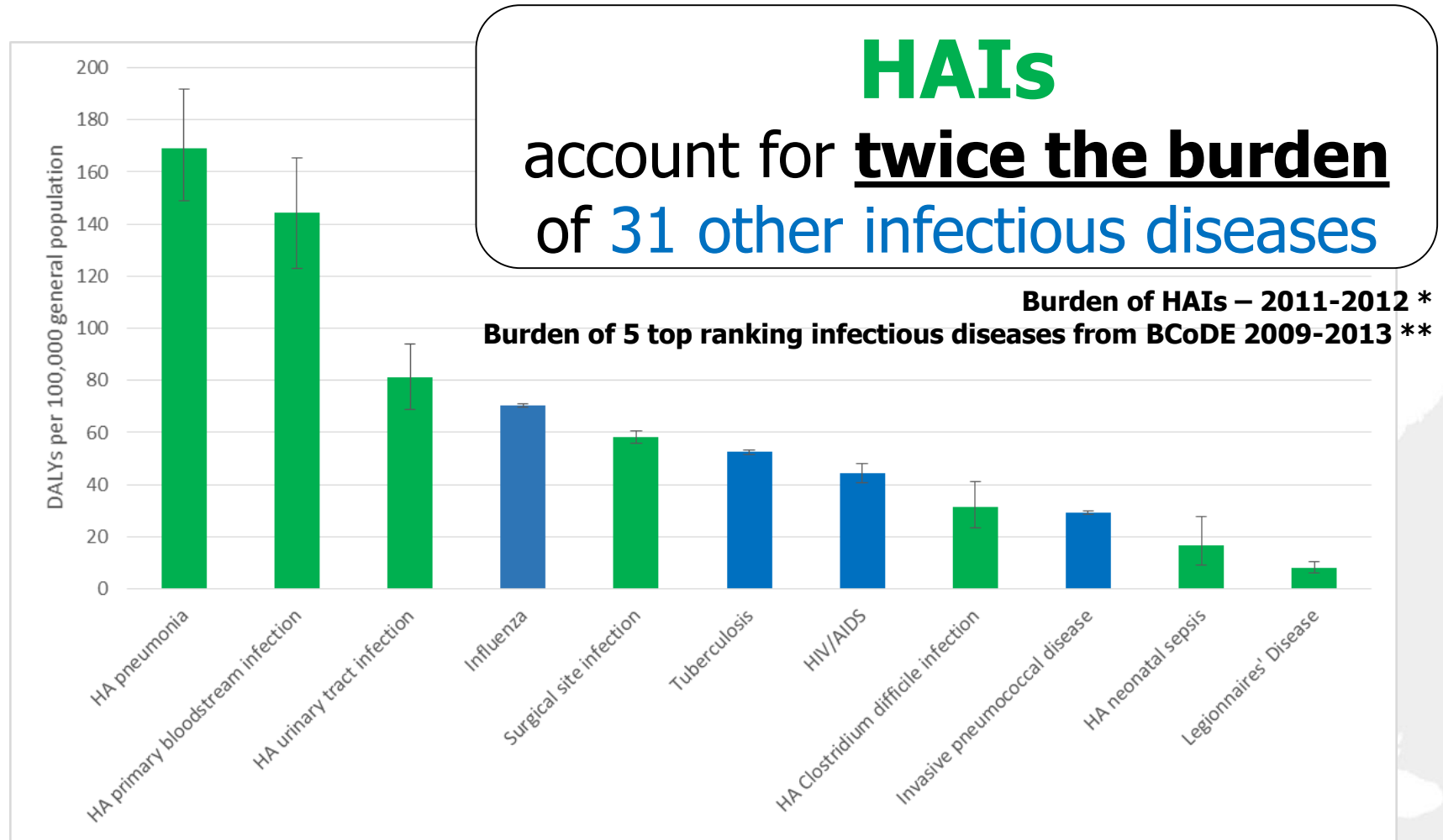
# Contribution of incidence and mortality to the burden of HAIs

**Burden of HAIs in EU/EEA Member States – 2011-2012**  
Diameter of bubble reflects DALYs per 100,000.



Source: Cassini A and Plachouras D, et al. PLoS Med 2016;13(10):e1002150 (18 October 2016).

# Comparing the burden of HAIs with other infectious diseases (BCoDE project 2015)



Source: \*Cassini A, et al. PLoS Med 2016;13(10):e1002150 (18 October 2016) . \*\* Cassini A, et al. PLoS Med (submitted).

# Burden of Communicable Diseases in Europe (BCoDE) project



The BCoDE project assesses of the comparative impact of infectious diseases and:

- introduces an evidence-based approach to health description
- fosters an overview of surveillance data quality and availability
- facilitates the communication of complex information to decision makers
- provides a tool for planning and prioritisation



# Next steps: burden of AMR

*Klebsiella pneumoniae*

*Escherichia coli*

*Acinetobacter* spp.

*Pseudomonas aeruginosa*

Resistant to colistin, carbapenems, 3rd generation cephalosporins (*K. pneumoniae* & *E. coli*) and multidrug-resistant (*Acinetobacter* spp. & *P. aeruginosa*)

*Enterococcus faecalis* and *E. faecium*, vancomycin-resistant

*Staphylococcus aureus*, meticillin-resistant

*Streptococcus pneumoniae*, resistant to penicillin and macrolides

## Still under investigation:

*Campylobacter* spp.

non-typhoidal *Salmonella* spp.

*Salmonella* Typhi and Paratyphi

MDR and XDR Tuberculosis

*Neisseria gonorrhoeae*





## Under construction:

- EARS-Net as main data source for resistant BSI
- For HAIs, PPS data provides information on other infection sites and on severity of co-morbidity
- For non-HAIs, literature reviews fill the gaps on non-BSI
- Literature reviews also help design outcome trees

In collaboration with OECD for the Economic burden of AMR



# Acknowledgments



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# Questions

For further suggestions, comments and questions please email:

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Thank you!