Need for reliable disease burden estimates to support food safety decision making: *the example of human campylobacteriosis in the EU*

János G. Pitter[1], Zoltán Vokó[1,2], Ádám Halmos[3], Ákos Jóźwiak[4]

[1] Syreon Research Institute Ltd., Hungary

[2] Department of Health Policy & Health Economics, Institute of Economics, Faculty of Social Sciences, Eötvös Loránd University, Hungary

[3] Graduate student at the Faculty of Social Sciences, Eötvös Loránd University, Hungary

[4] National Food Chain Safety Office (NÉBIH), Hungary

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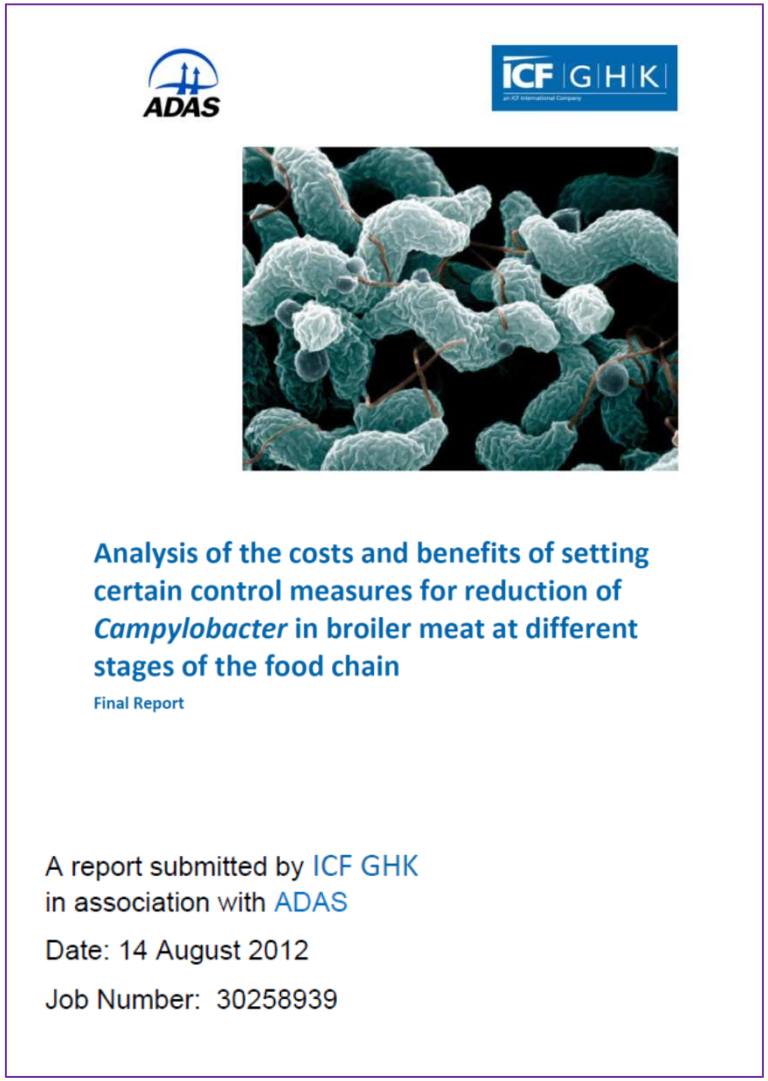
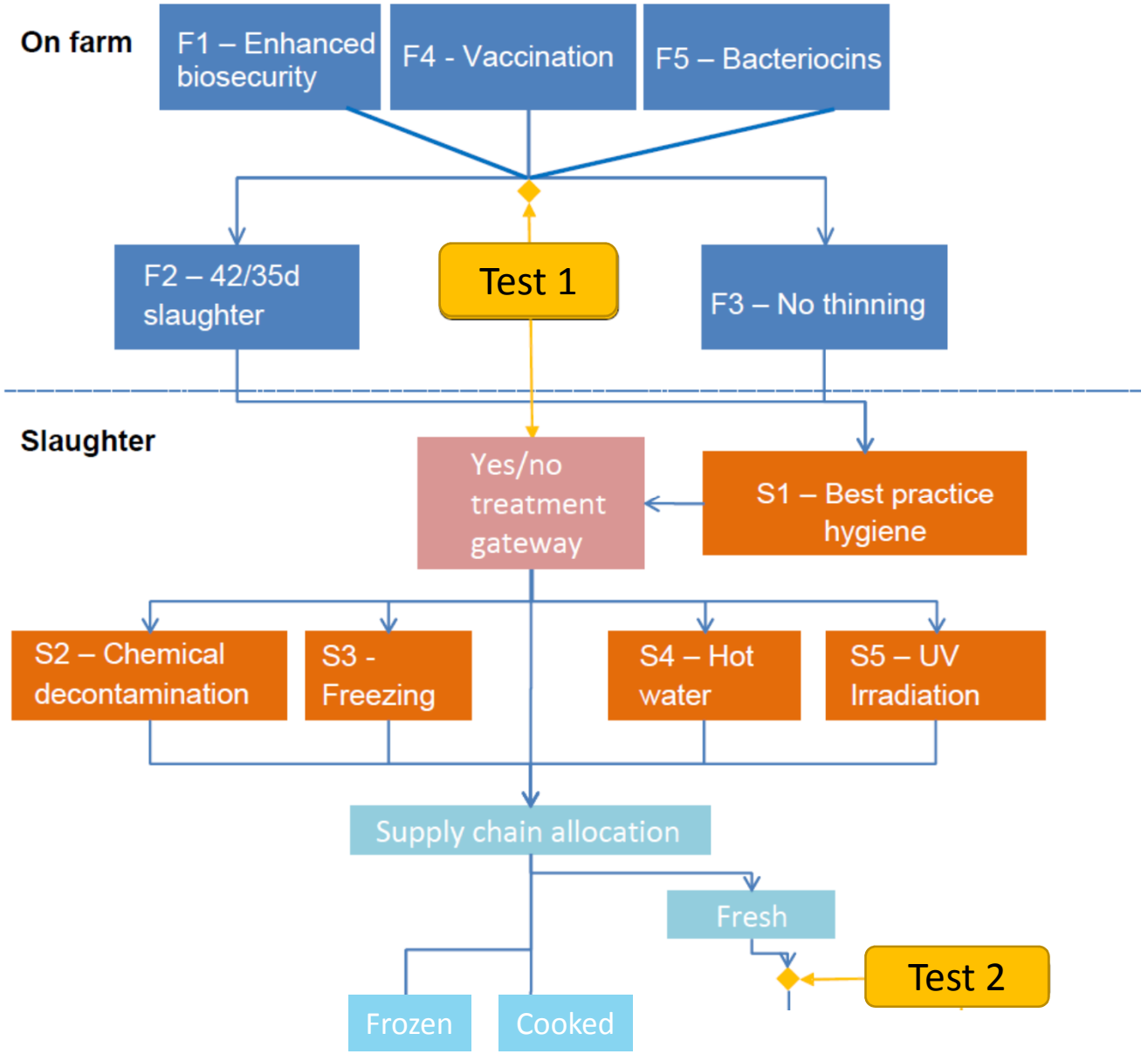
A published cost-utility analysis on potential Campylobacter control measures on the indoor broiler meat food chain



Pdf report:
http://ec.europa.eu/food/food/biosafety/salmonella/docs/campylobacter_cost_benefit_analysis_en.pdf

MS Excel model:
http://ec.europa.eu/food/food/biosafety/salmonella/docs/campylobacter_excel_model_en.xls

Farm-level and slaughterhouse-level interventions



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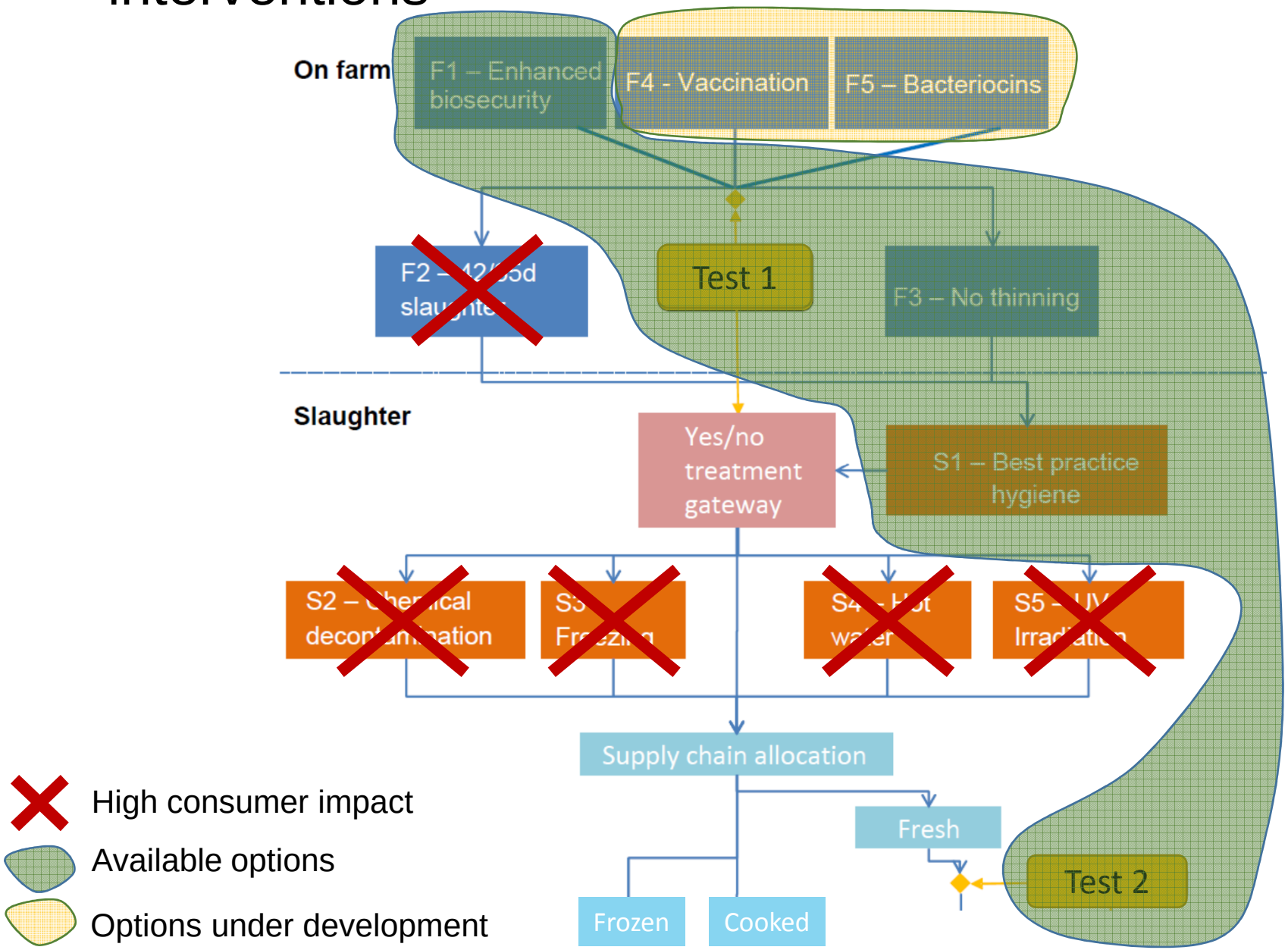
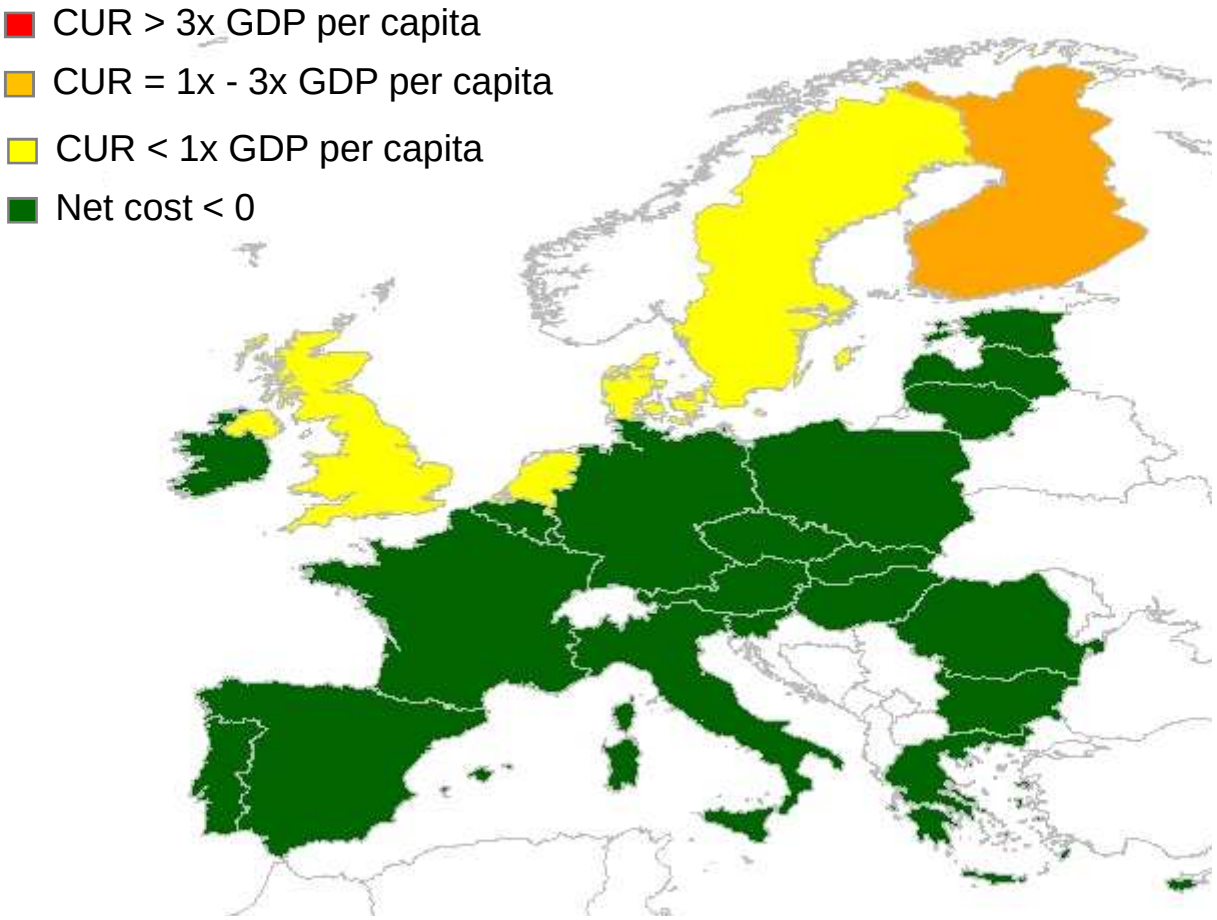


Model-derived cost-effectiveness of the selected strategy



Enhanced biosecurity (F1)
+ No thinning (F3)
+ Best practice hygiene (S1)
+ Testing (T1, T2)

20% decrease in annual human campylobacteriosis cases in the EU-27

EU-27:
intervention costs – cost of illness avoided **≈ -353** million EUR / year

Key underlying assumptions

Avoided DALYs = *avoided human cases* * 0.0389 DALY

Avoided cost of illness = *avoided DALYs* * 6857 EUR

EFSA Scientific Opinion, 2011

Objectives of the presentation

- Generate country-specific cost of illness estimates in the EU-27
- Express the EU health burden of campylobacteriosis in QALYs
- Re-run the published Campylobacter model with the adjusted input parameters
  - re-evaluate the selected strategy
  - (strategic pricing for interventions in development)

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Cost of illness estimates are based on data from The Netherlands

EU-27 annual cost of illness = 2400 million EUR, for 9 million cases (EFSA, 2011)
cost of illness per case = **267 EUR**

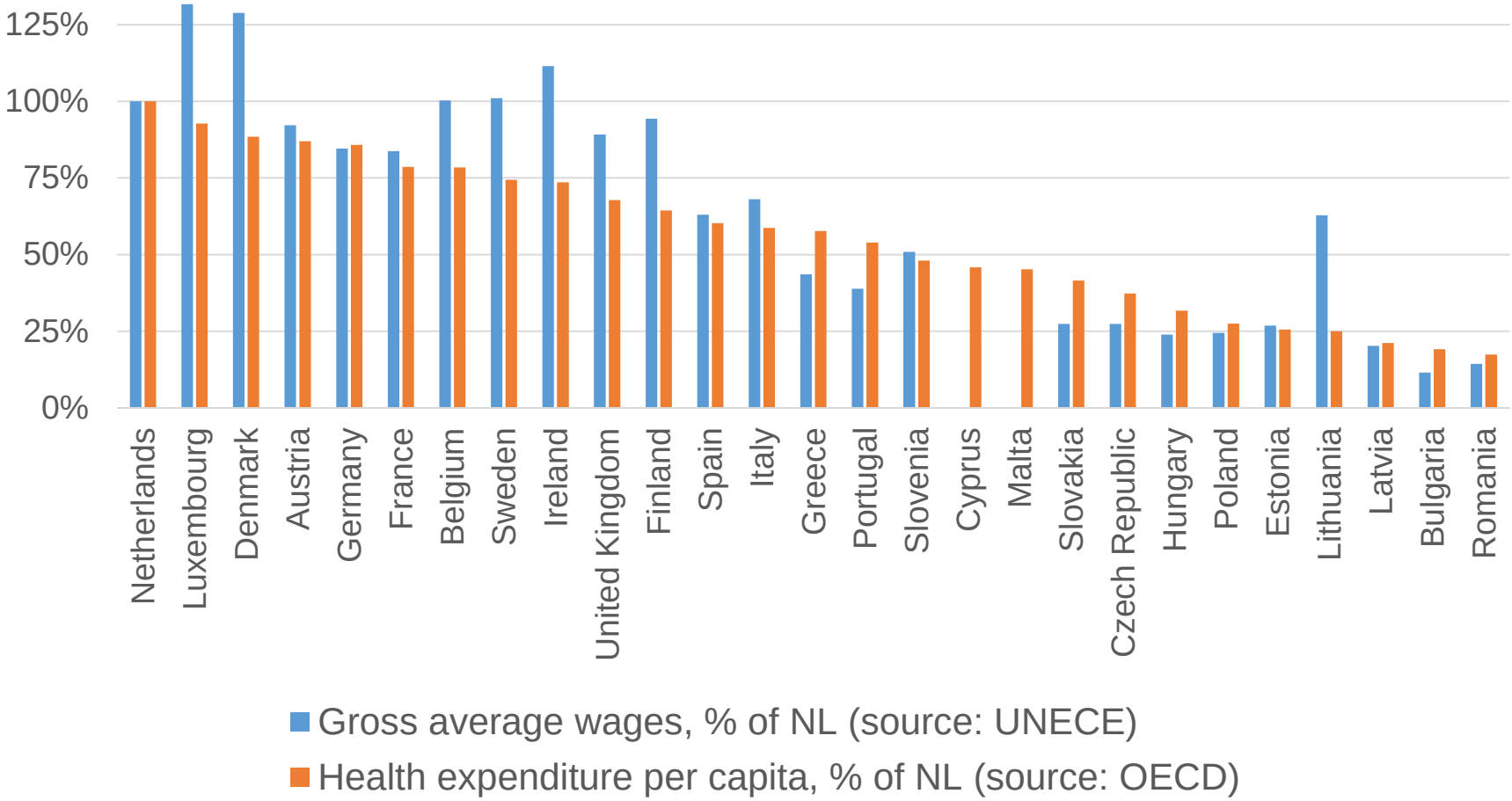
In The Netherlands, cost of illness per case = **261 EUR** (Mangen, 2005)

Cost types in Mangen, 2005	Examples	Cost per case
Direct healthcare costs	Drug costs, visits, investigations, hospitalisation	82 EUR
Other direct costs	Travel costs to/from GP or hospital	1 EUR
Other indirect costs	Productivity loss	177 EUR

Limits of transferability from The Netherlands to the EU-27

- differences in direct healthcare costs;
- differences in price for productivity

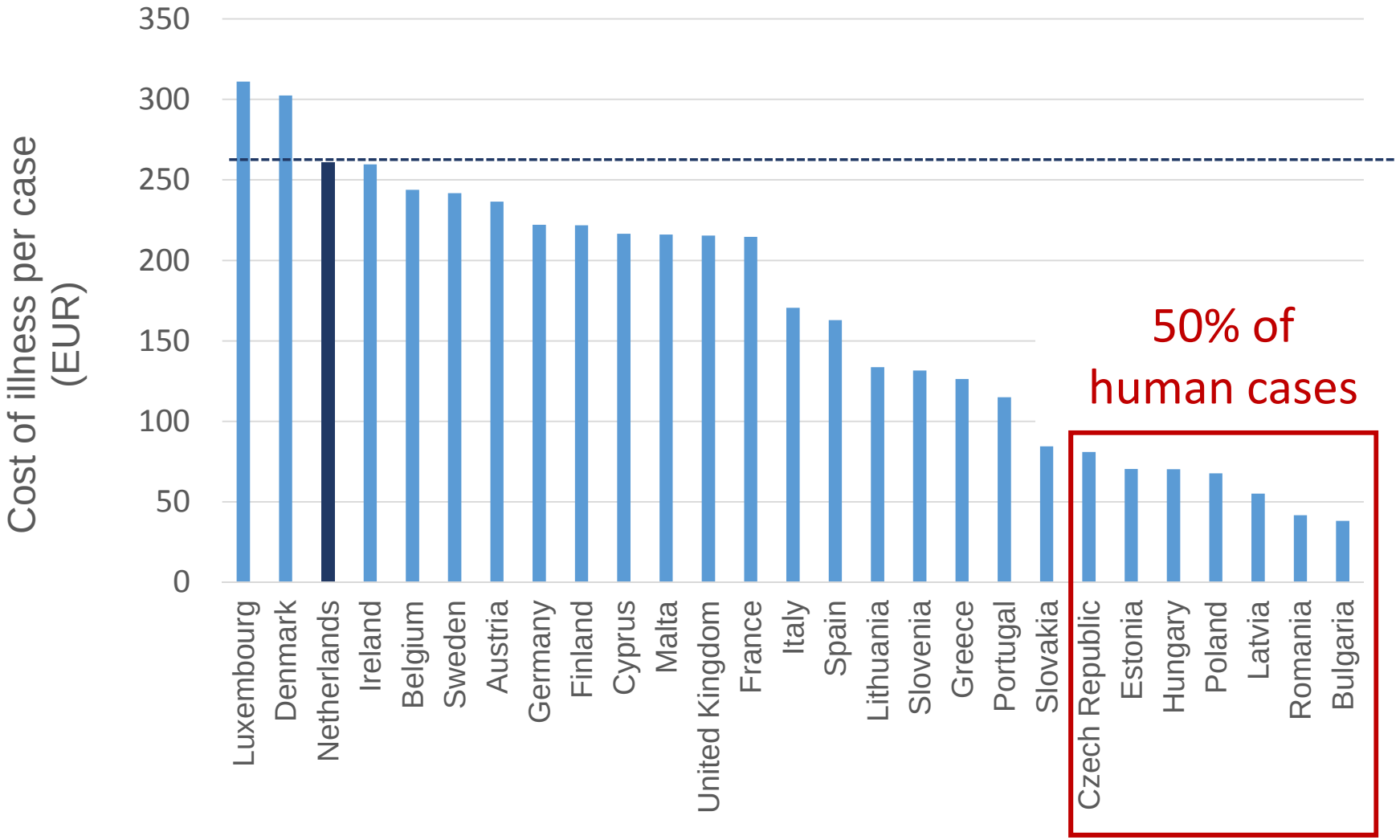
Cost of illness: country-specific correction factors



Loss of productivity / case*: **177 EUR** → from **20** (Bulgaria) to **233 EUR** (Luxembourg)
Direct medical costs / case*: **82 EUR** → from **14** (Romania) to **82 EUR** (Netherlands)

**A better approximation than flat costs – without data on resource utilization in EU-27*

Cost of illness:
country-specific estimates in the EU-27



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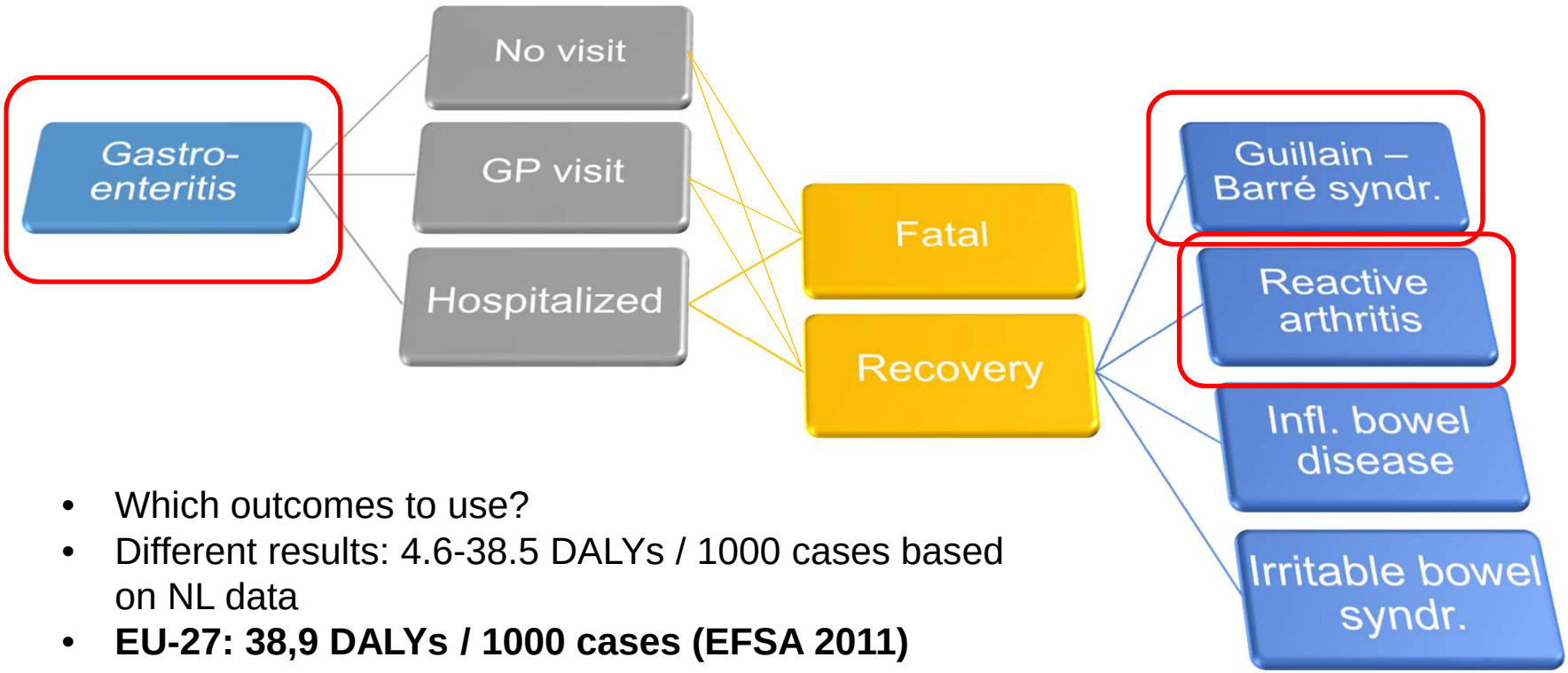
Disease outcome tree of human campylobacteriosis in the EU (2015)



- Which outcomes to use?
- Different results: 4.6-38.5 DALYs / 1000 cases based on NL data
- **EU-27: 38,9 DALYs / 1000 cases (EFSA 2011)**

- Our model:
  - GE, Guillain-Barré syndrome and reactive arthritis
  - QALY

Key advantages of QALY versus DALY estimates

	DALY	QALY
Life expectancy	Lost years are assumed based on Japanese or national statistics	Gained years are directly observable
Disability weight factor determination	Expert panel preferences	Societal preferences (tax payers)
Use in health technology assessment in the EU	Marginal	Extensive
Explicit cost-effectiveness thresholds	In theory (WHO)	In practice (in some EU countries)

A QALY based estimate of acute gastroenteritis, Guillain-Barré Syndrome and reactive arthritis burden due to human campylobacteriosis in the EU

	EQ-5D[1]	Disutility[2]	Duration[3]	Outcome probability[3]	QALY loss / 1000 cases
GE mild (no GP)	11221	-0.227	3.48 days	76.27%	1.64
GE moderate (GP)	11321 (25%) 21321 (25%)	-0.491 -0.551	9.72 days	22.72%	3.12
GE severe (hospital)	11311 (25%) 21331 (25%)	-0.406 -0.616	14.39 days	0.97%	0.20
GE mortality	death	-1	15.6 years	0.0424%	6.61
GE Total					**11.58 QALYs**

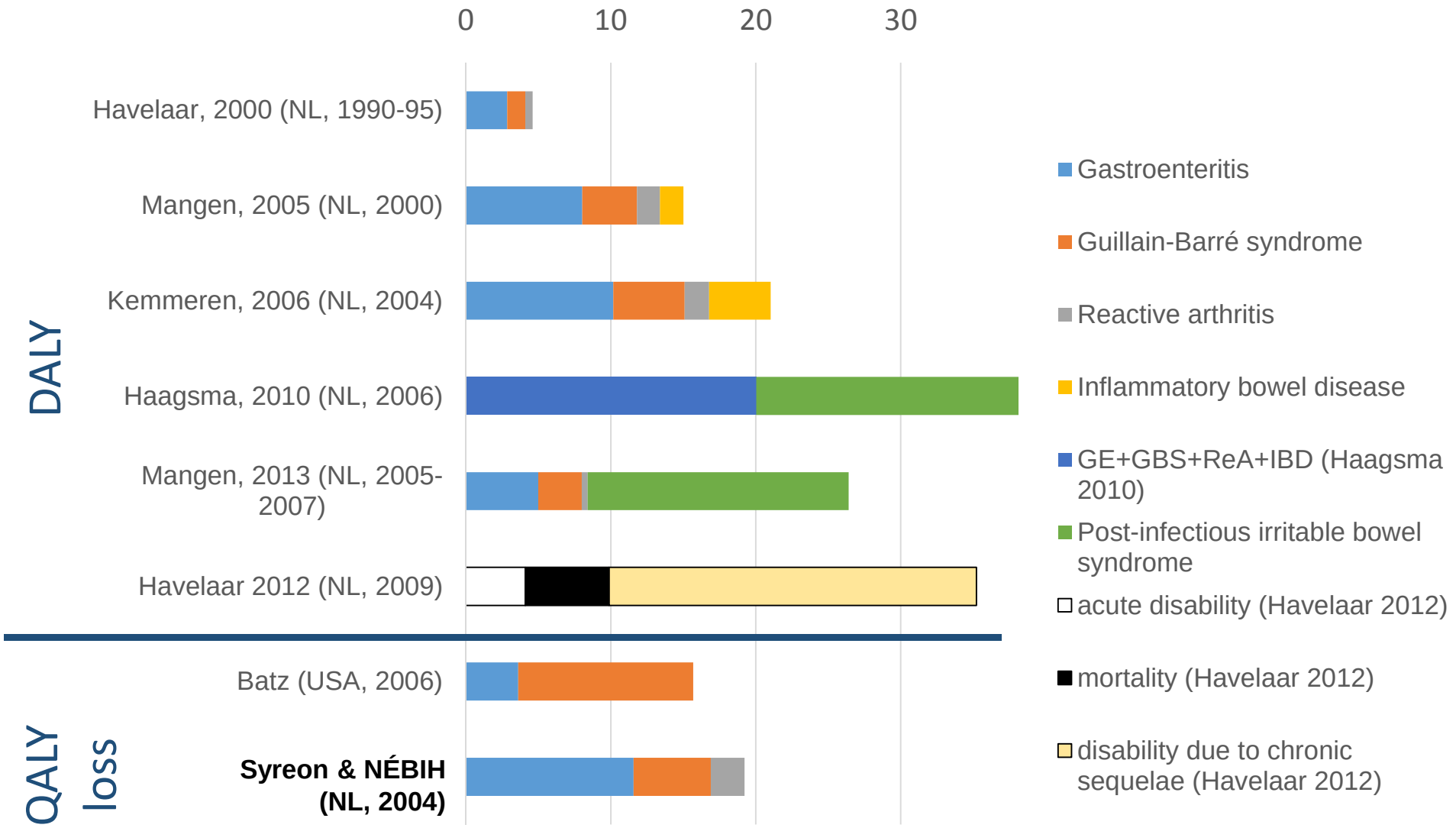
	QALY loss per case[4]	Outcome probability[3]	QALY loss / 1000 cases
Guillain-Barré Syndrome	5.32	0.1%	**5.32 QALYs**

	EQ-5D[5]	Disutility[2]	Duration[3]	Outcome probability[3]	QALY loss / 1000 cases
Reactive arthritis	11221	-0.227	222 days	1.69%	**2.33 QALYs**

[1] Havelaar 2000
[2] Greiner 2003
[3] Kemmeren 2006
[4] Batz 2014
[5] Hurst 1997 (median of RA mildest class)

TOTAL QALY loss / 1000 cases
19.23 QALYs

A QALY-based burden of disease estimate for the EU, per 1000 cases



Discounted model input parameters

Preference for gains of all types occurring earlier → future amounts shall be discounted

- **Intervention costs** are discounted in the model (annual rate 4%)
- **Cost of illness discounted:** minimal change

	GE	GBS	ReA
Effect of 4% discount rate (Kemmeren 2006)	No change	-1.3 EUR/case	No change

- **Health burden estimate:**

	Undiscounted	Discounted (4%)
GE	11.58 QALYs	9.96 QALYs
GBS	5.32 QALYs	2,94 QALYs
ReA	2.33 QALYs	2.33 QALYs
Total	19.23 QALYs / 1000 cases	**15.23 QALYs / 1000 cases**

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Cost-effectivenes of the selected strategy (F1,F3,S1,T1,T2)

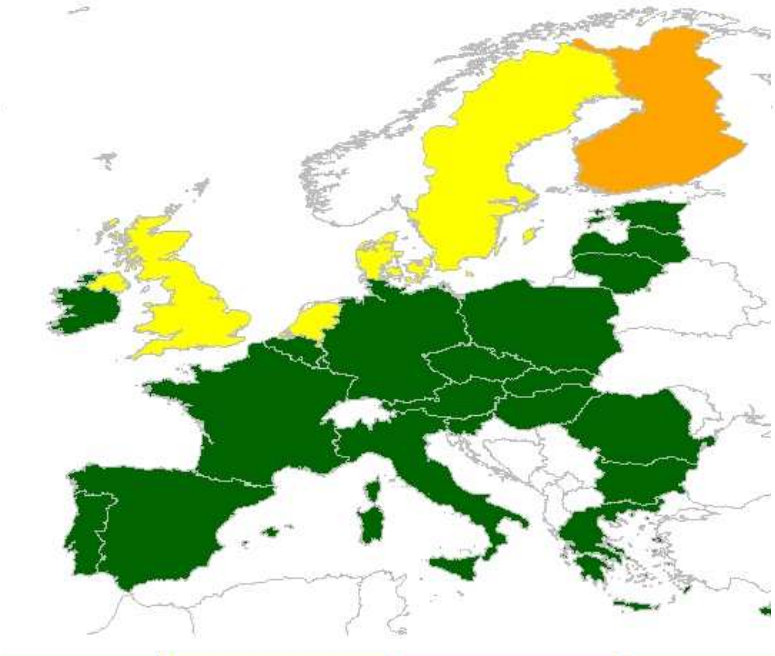
ICER > 3x GDP per capita

ICER = 1x - 3x GDP per capita

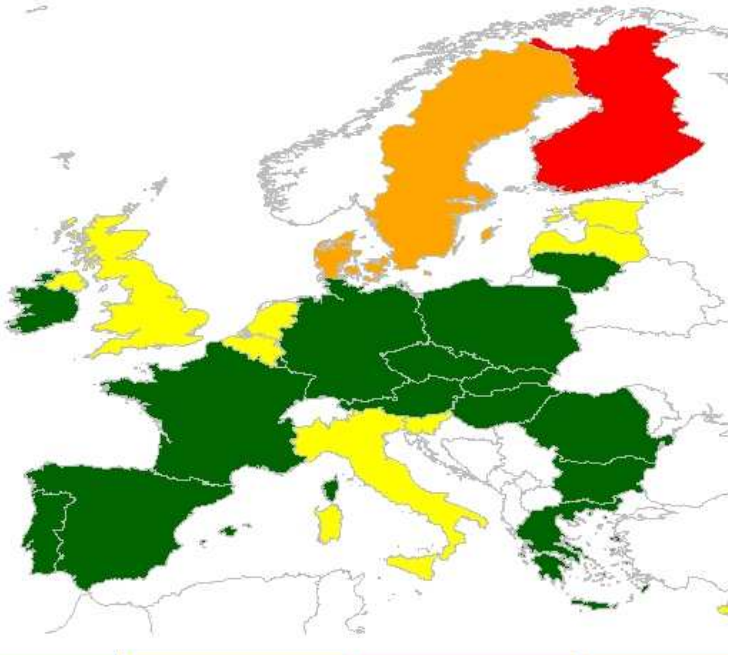
ICER < 1x GDP per capita

Net cost < 0

Original model



Adapted disease burden estimates

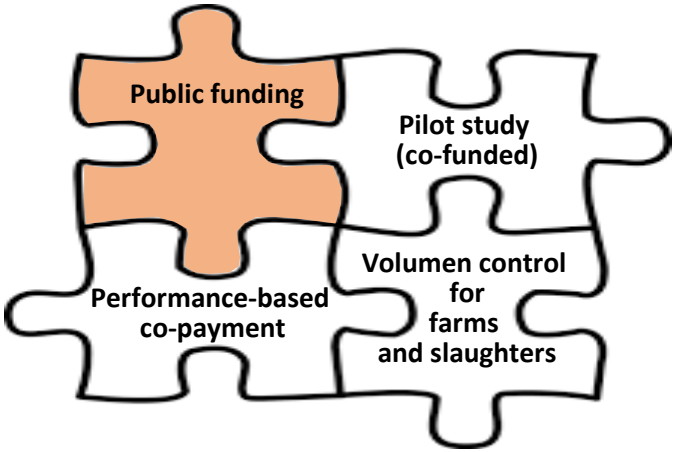


EU-27 net cost	-353 million EUR / year	**-85 million EUR / year**
EU-27 health gain	-67 300 DALY / year	**26 400 QALY / year**

The presented model conclusions are subject to several limitations

- **Key sources of uncertainty include**:
  - Disease burden data
  - Efficacy of interventions
  - Real-world uptake
  - Interventions in other countries exporting broilers…

- **Dealing with uncertainty in/of cost-effectiveness evaluations**:
  - Fine-tuning of model input parameters
  - Sensitivity analyses
  - Risk sharing of stakeholders



Summary

- Need for country-specific cost of illness data
- QALY is a suitable methodology for disease burden estimation, with significant advantages
- Even re-running the original model with the adjusted (more conservative) input parameters results in a highly cost-effective intervention policy in case of *Campylobacters*
- There are similarities in food safety analysis and health technology assessment
    - funded from public resources;
    - with the primary aim of generating health benefits;
    - must consider disease burden, intervention feasibility, effectiveness, cost, equity, stakeholder interests …
    - Use different methodology and metrics…
      … time to move towards integration?

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Thank You
for your attention!

Ákos Bernard Jóźwiak
National Food Chain Safety Office, Hungary (NÉBIH)
jozwiaka@nebih.gov.hu