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en Milieu

*Ministerie van Volksgezondheid,
Welzijn en Sport*

Current public health problems related to pork

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Main hazards associated with pork consumption

- *Campylobacter* spp.
 - *Listeria monocytogenes*
 - *Mycobacterium* spp.
 - *Salmonella* spp.
 - *Staphylococcus aureus*
 - VTEC
 - *Yersinia* spp.

 - Hepatitis E virus
- *Ascaris suum*
 - *Echinococcus* spp.
 - *Cryptosporidium* spp.
 - *Taenia solium*
 - *Trichinella* spp.
 - *Toxoplasma gondii*

 - Antimicrobial resistance

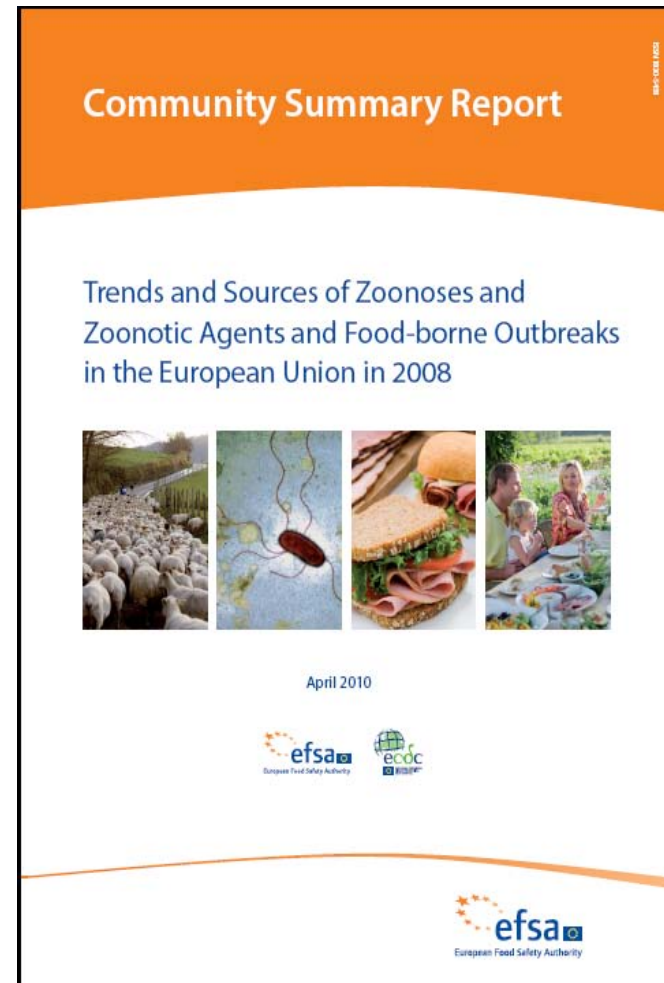
What are the risks and how do they compare?

- Epidemiology
 - Incidence
 - Mortality
 - Severity
 - Attribution

- (Comparative) risk assessment
 - Risk Ranger
 - sQMRA
 - iRisk

Data on human illness at EU level

- Available data in Annual Community Summary Report on Trends and Sources of Zoonoses and Zoonotic Agents and Food-borne Outbreaks in the European Union (Annual)



Main hazards associated with pork consumption: data availability EU

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Foodborne outbreaks in 2008

Figure OUT4. | *Distribution of implicated foodstuffs in verified outbreaks in the EU, 2008*

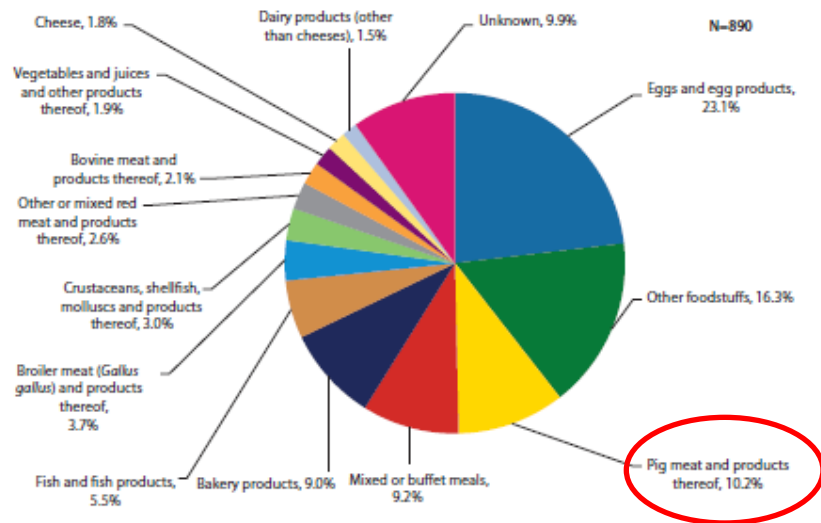
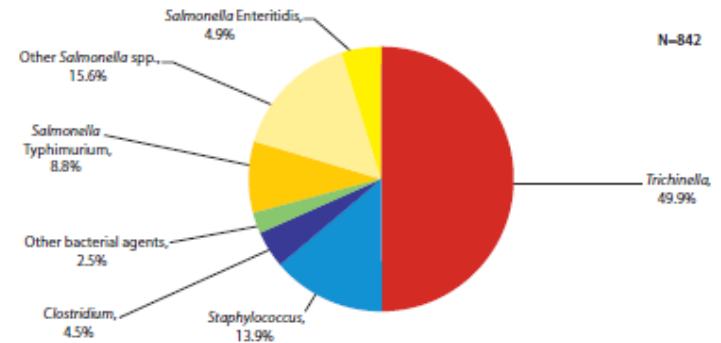
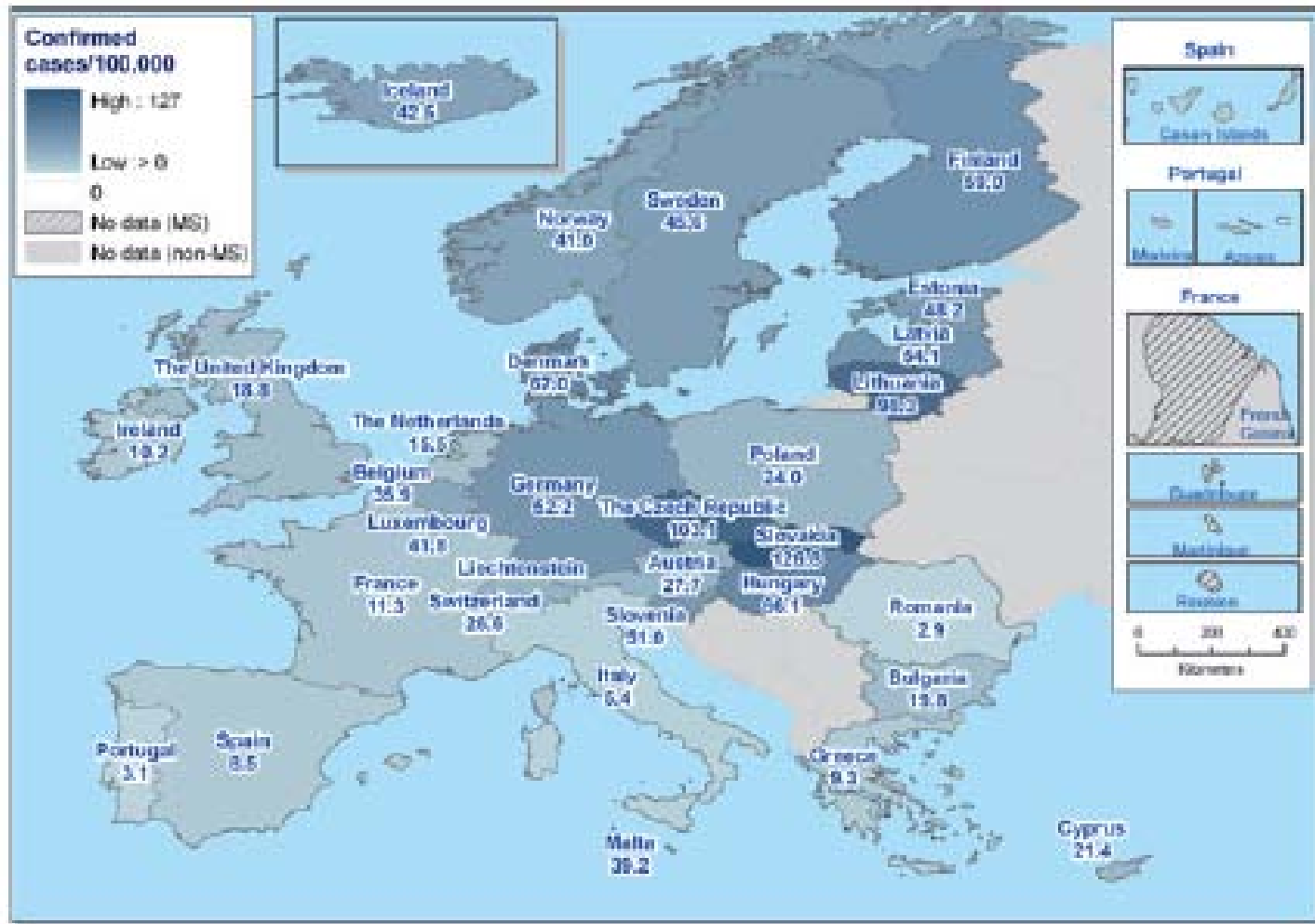


Figure OUT7. | *Distribution of human cases caused by pig meat and products thereof in the EU, 2008*



Reported incidence of human salmonellosis in the EU

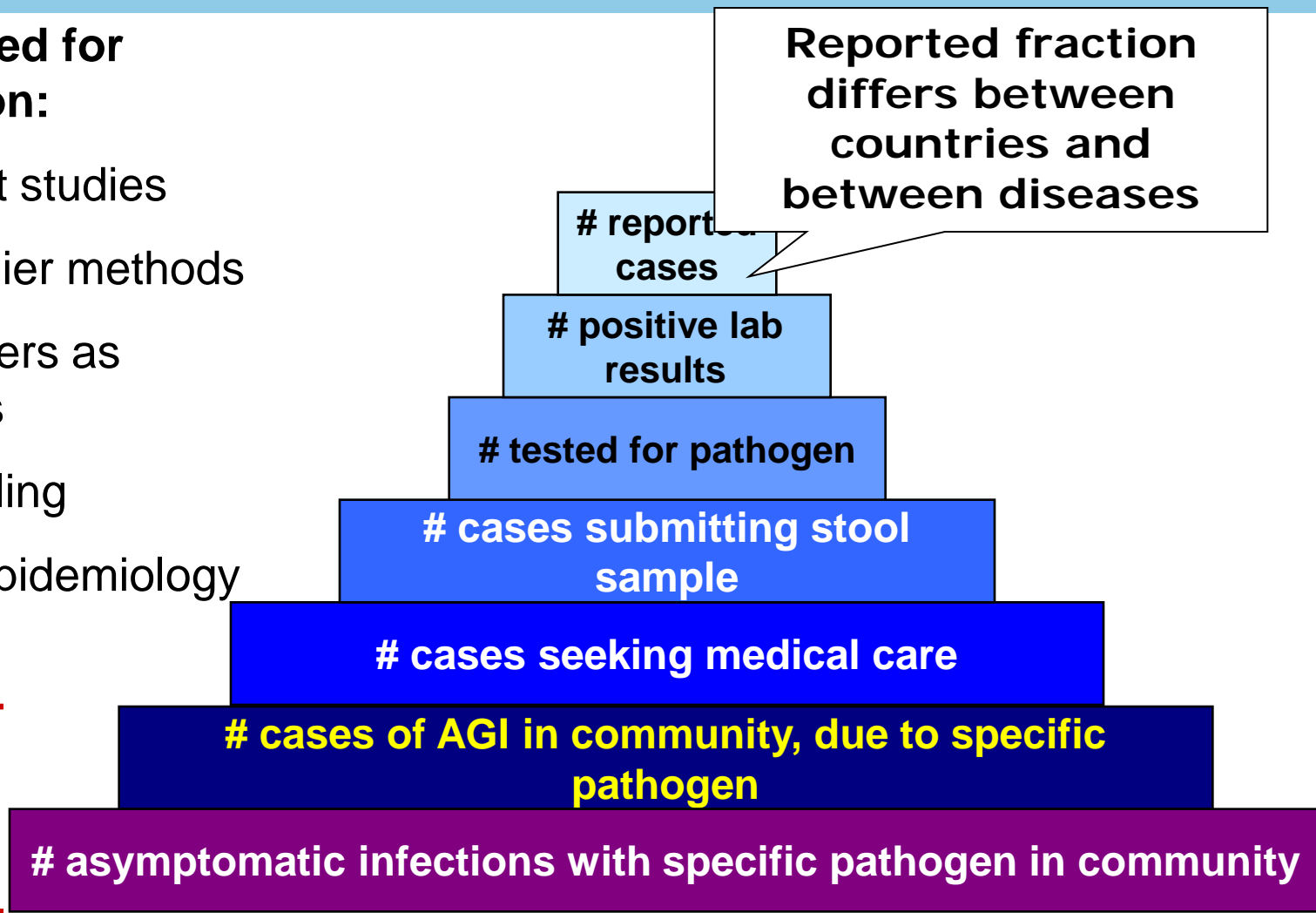


The surveillance pyramid for gastrointestinal pathogens

Methods used for calibration:

- Cohort studies
- Multiplier methods
- Travelers as sentinels
- Modelling
- Seroepidemiology

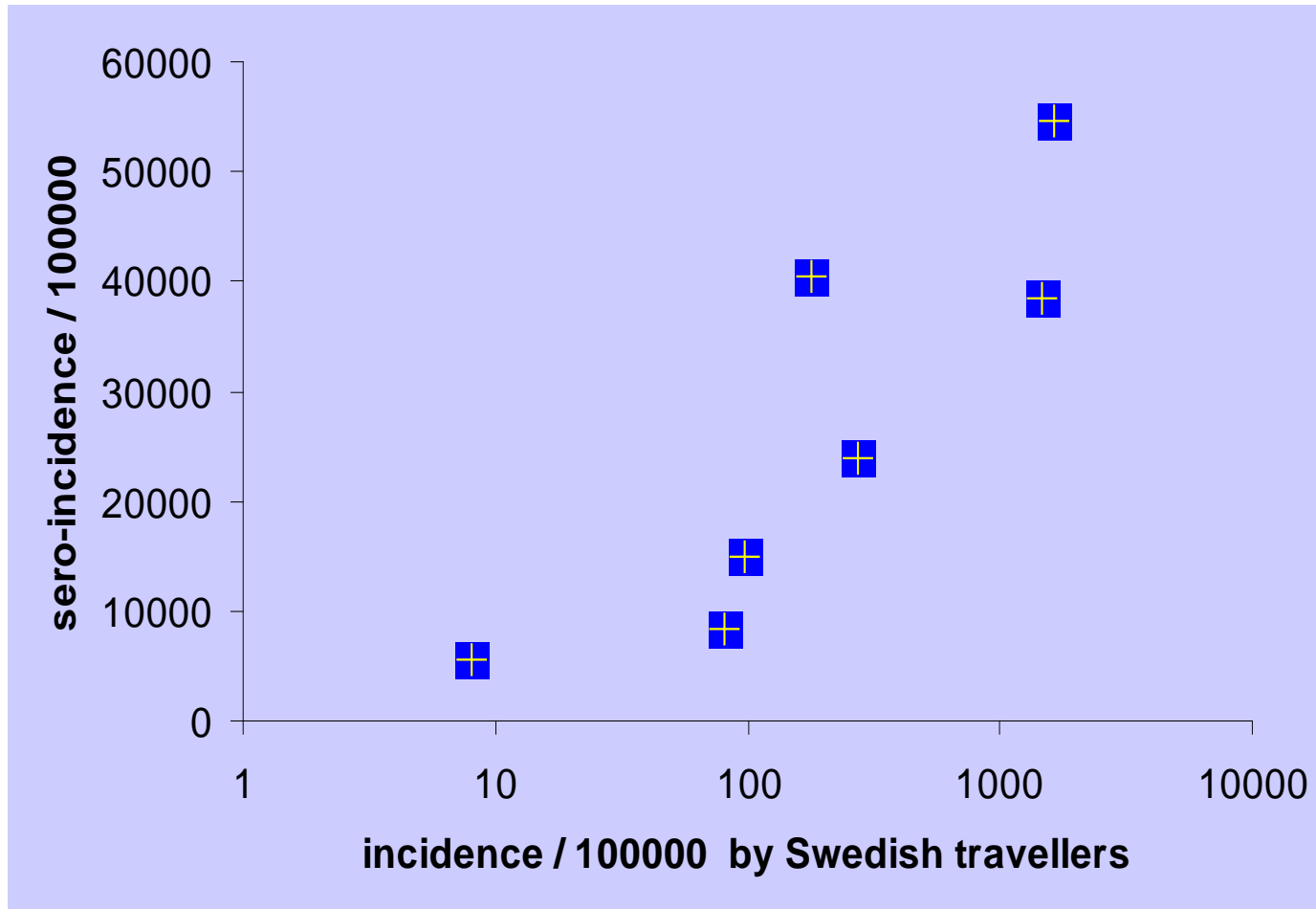
sero-
survey of
population







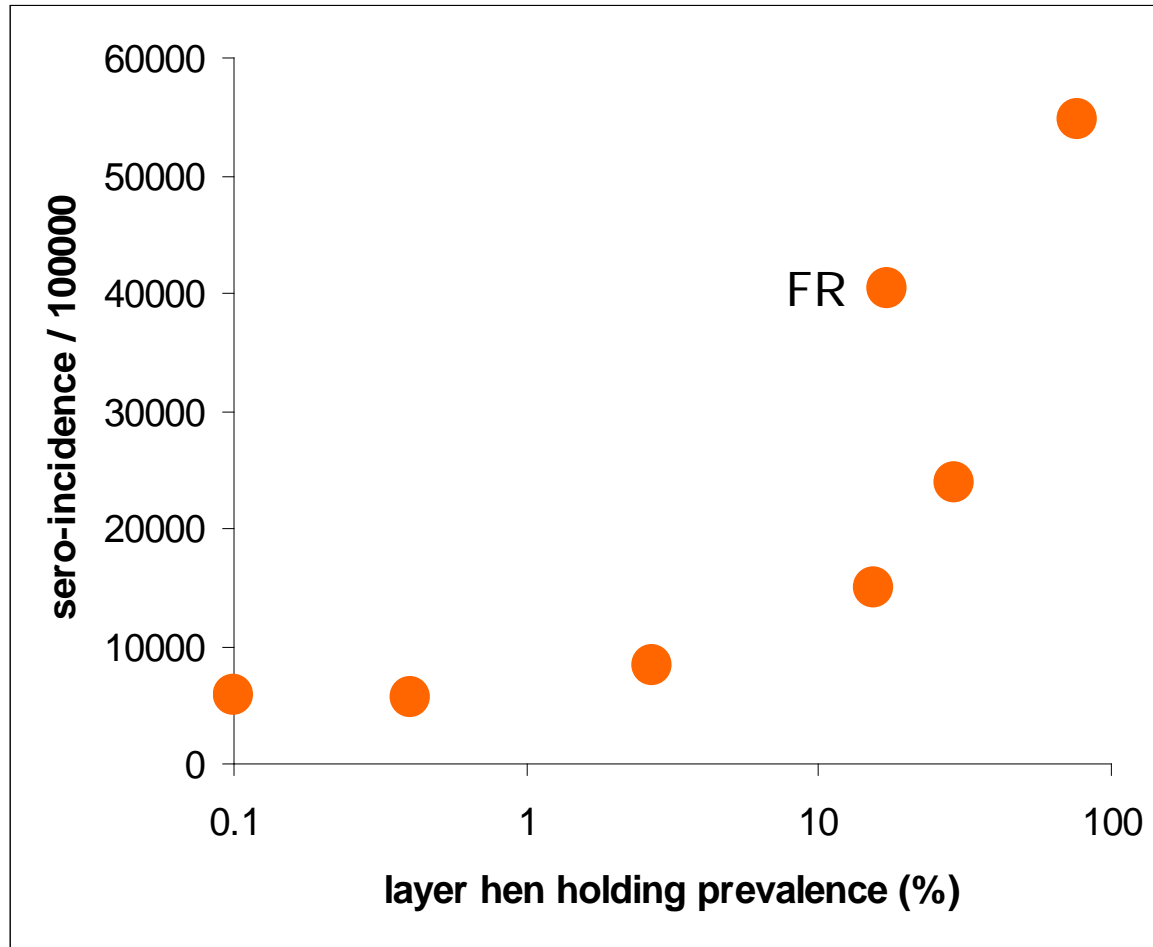
Salmonella sero-incidence and incidence estimates in Swedish travelers



Spearman's rho=0.9, p=0.007

* Data from: de Jong B, Ekdahl K. The comparative burden of salmonellosis in the European Union member states, associated and candidate countries. BMC Public Health 2006; 6:4 doi:10.1186/1471-2458-6-4

Salmonella prevalence in layers (baseline study, all serovars) and sero-incidence



Spearman's $\rho=0.90$, $p=0.005$

What are the priorities?

Outcome	Norovirus	Rotavirus	Campylobacter	Salmonella
Gastro-enteritis	640,000	300,000	79,000	43,000
GE – visit to GP	16,000	21,000	19,000	7,600
GE – hospital	2,000	4,400	570	650
GE – death	6	2	46	47
Reactive arthritis	-	-	1,500	1,700
Guillain-Barré S.	-	-	65	-
Irr. Bowel Syndrome	-	-	6,900	3,900

HALYs: integrated measures of disease burden

- Integrate morbidity and mortality
- Incorporate age and health status of those affected
- Address incidence, severity and duration of adverse health consequences
- One example, frequently used in public health:
Disability Adjusted Life Years

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

- mortality: years of life lost

$$\text{YLL} = \sum_{\text{all diseases}} (D \times e)$$

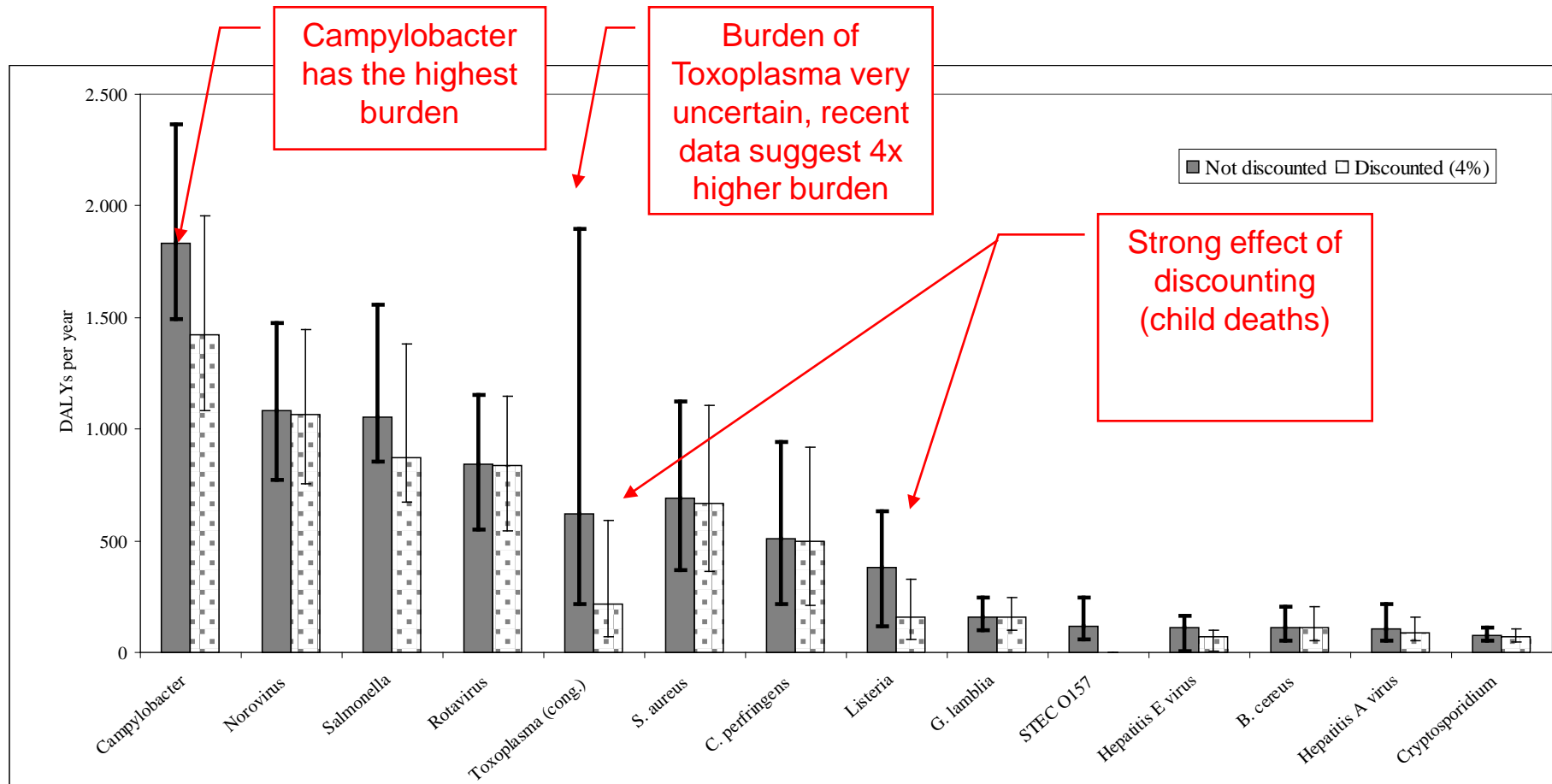
D: number of deaths; e: life expectancy of fatal cases

- morbidity: years lived with disability, weighted for severity of illness

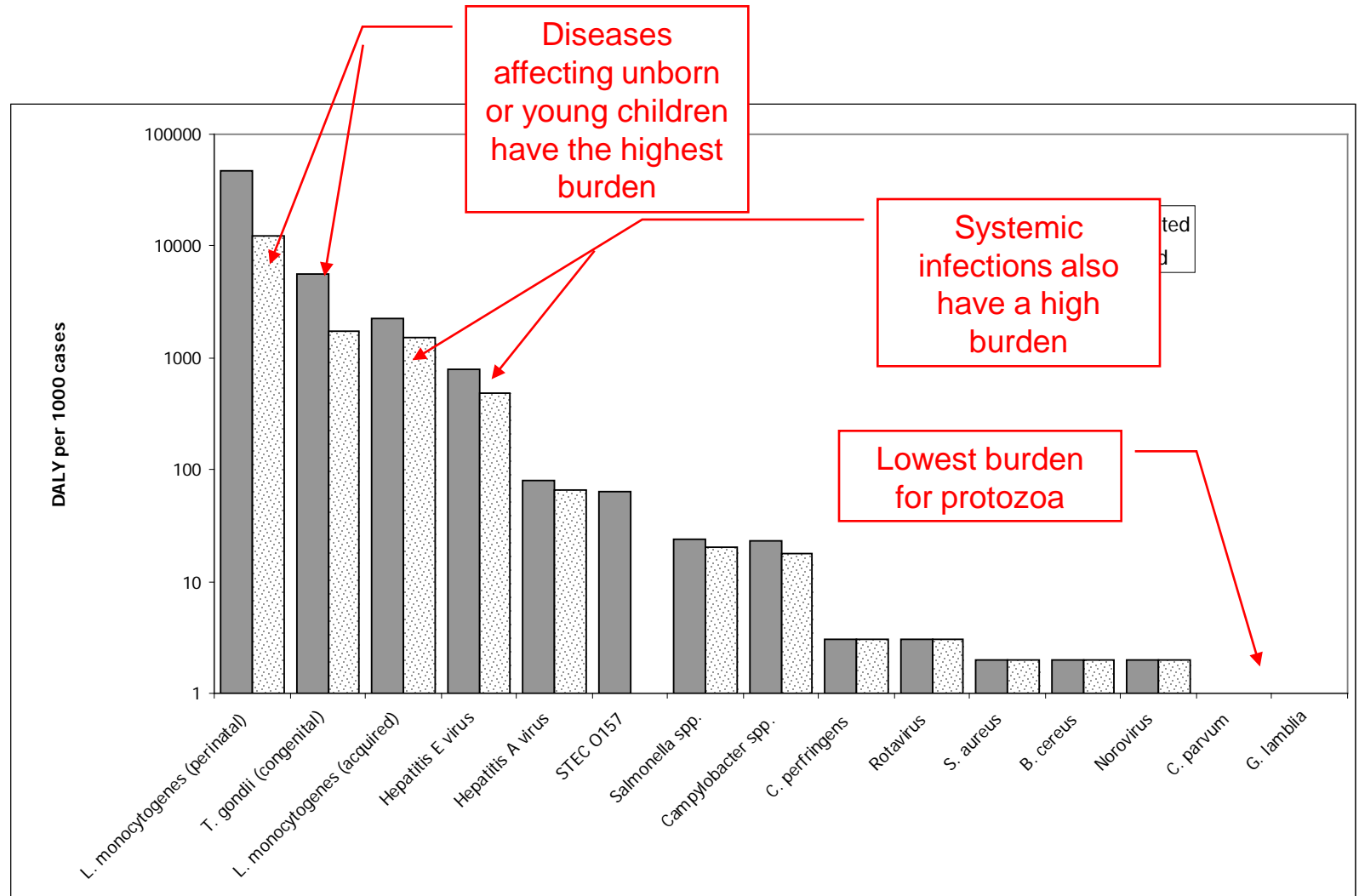
$$\text{YLD} = \sum_{\text{all diseases}} (N \times t \times w)$$

N: number of non-fatal cases; t: duration, w: severity weight

Disease burden in the Netherlands (all sources)



Disease burden per case

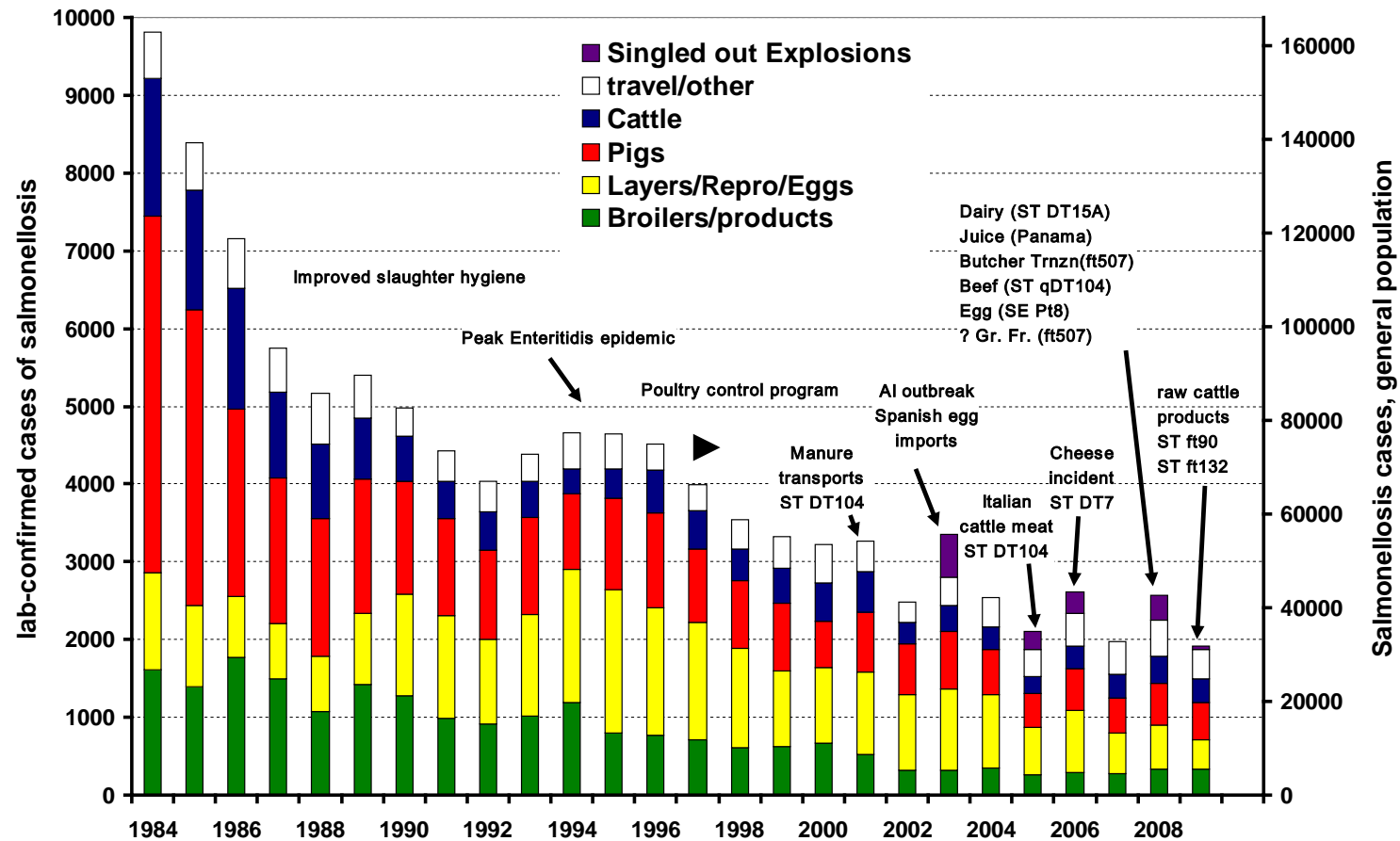


Attribution

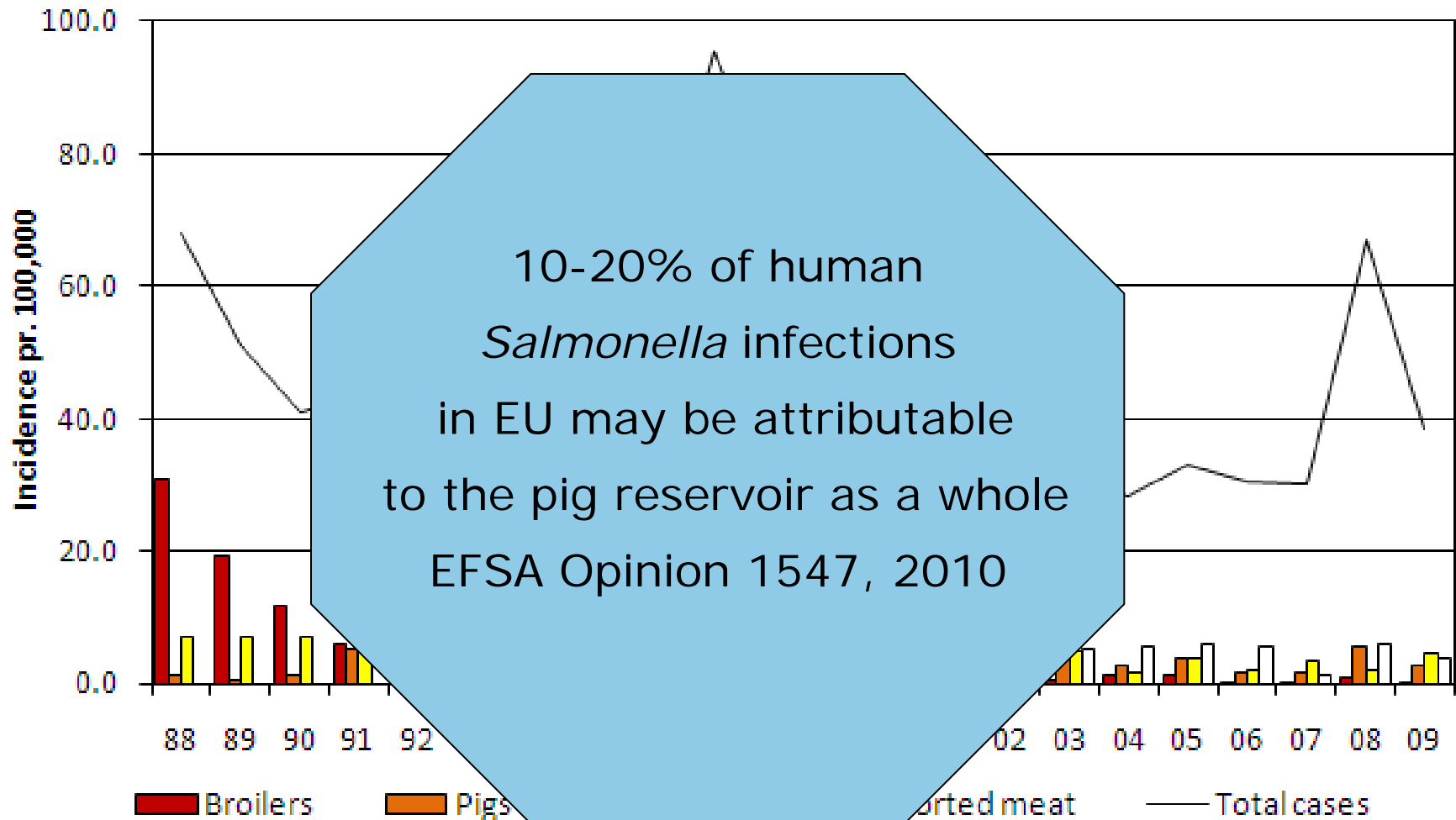
- The partitioning of the human disease burden of one or more foodborne infections to specific sources (animal reservoirs and vehicles such as foods)
- Microbiological approaches
 - Microbial subtyping
 - Comparative exposure assessment
- Epidemiological approaches
 - Case-control studies of sporadic infections
 - Outbreak investigations
- Intervention studies
 - Surveillance after new legislation
 - Natural experiments
- Expert elicitation

- Currently most data available for Salmonella

Attribution of salmonellosis in the Netherlands, 1984-2009



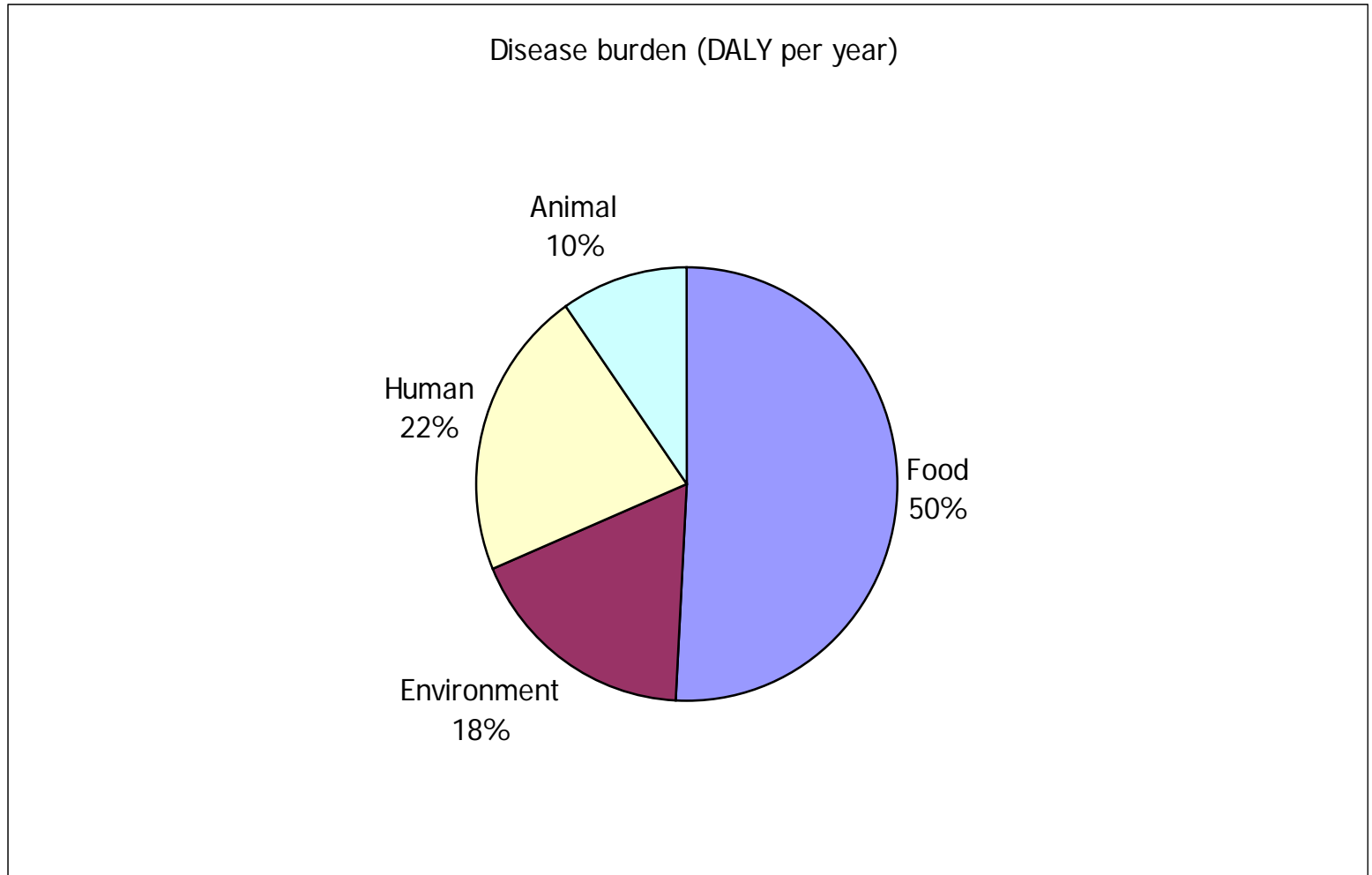
Estimated major sources of human salmonellosis in Denmark, 1988-2009



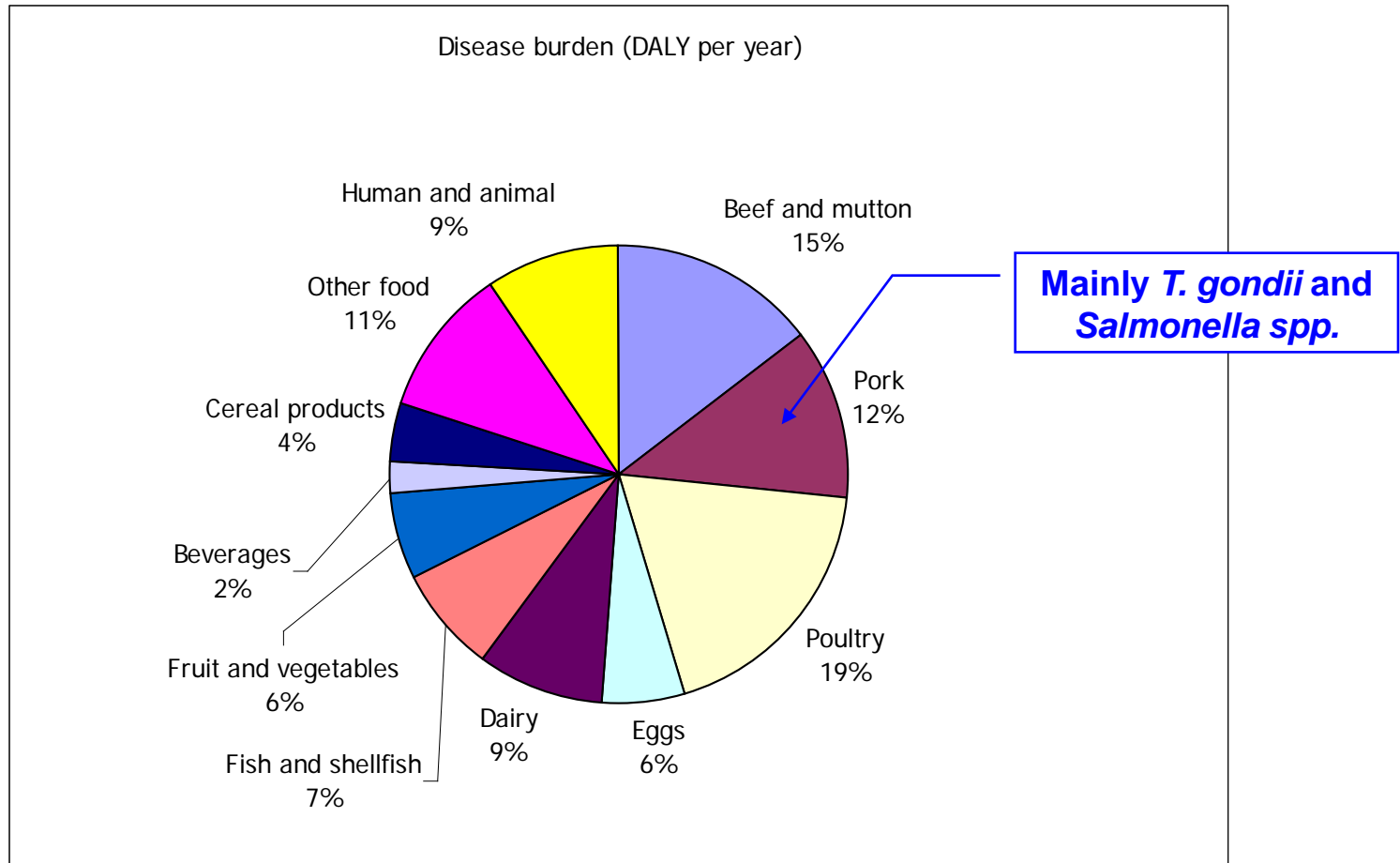
Monophasic Salmonella (1,4,[5],12:i)

- ... are regarded as variants deriving from *S. Typhimurium*
- ... have been shown to have similar virulence and antimicrobial resistance characteristics to strains of *S. Typhimurium*
- ... the third most common serovar from human infections
- the second most common serovar from pigs
- the third serovar from bovine samples

Attribution of the burden of 14 pathogens to major pathways in the Netherlands



Attribution of the foodborne burden of 14 pathogens to food groups in the Netherlands



Filling the data gaps

- ECDC
 - Burden of Communicable Diseases in Europe
 - Sero-epidemiology of Salmonella and Campylobacter
- WHO
 - Foodborne Epidemiology Disease Burden Reference Group

Conclusions

- Surveillance systems for the main pathogens in pork are in place in the EU, but coverage varies between Member States
- Reported data represent only a fraction of all cases in the population
- The reported fraction varies strongly between Member States and between pathogens
- Severity of acute illness, sequelae and mortality need to be taken into account when deciding about public health priorities
- Data for attribution of human illness to animal reservoirs and foods are poorly available
- Major international projects are on-going to fill data gaps, but Member States need to invest in more systematic surveillance
- Based on current evidence, *Salmonella* spp., *Toxoplasma gondii* and *Trichinella* spp. appear to be the most important pathogens in pork