National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Burden of Foodbornne diseases
The Dutch approach

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Estimating the foodborne disease burden in the NL

The Ministry of VWS has requested RIVM to present an annual update on the number of illnesses, disease burden and cost-of-illness caused by 14 food related pathogens.

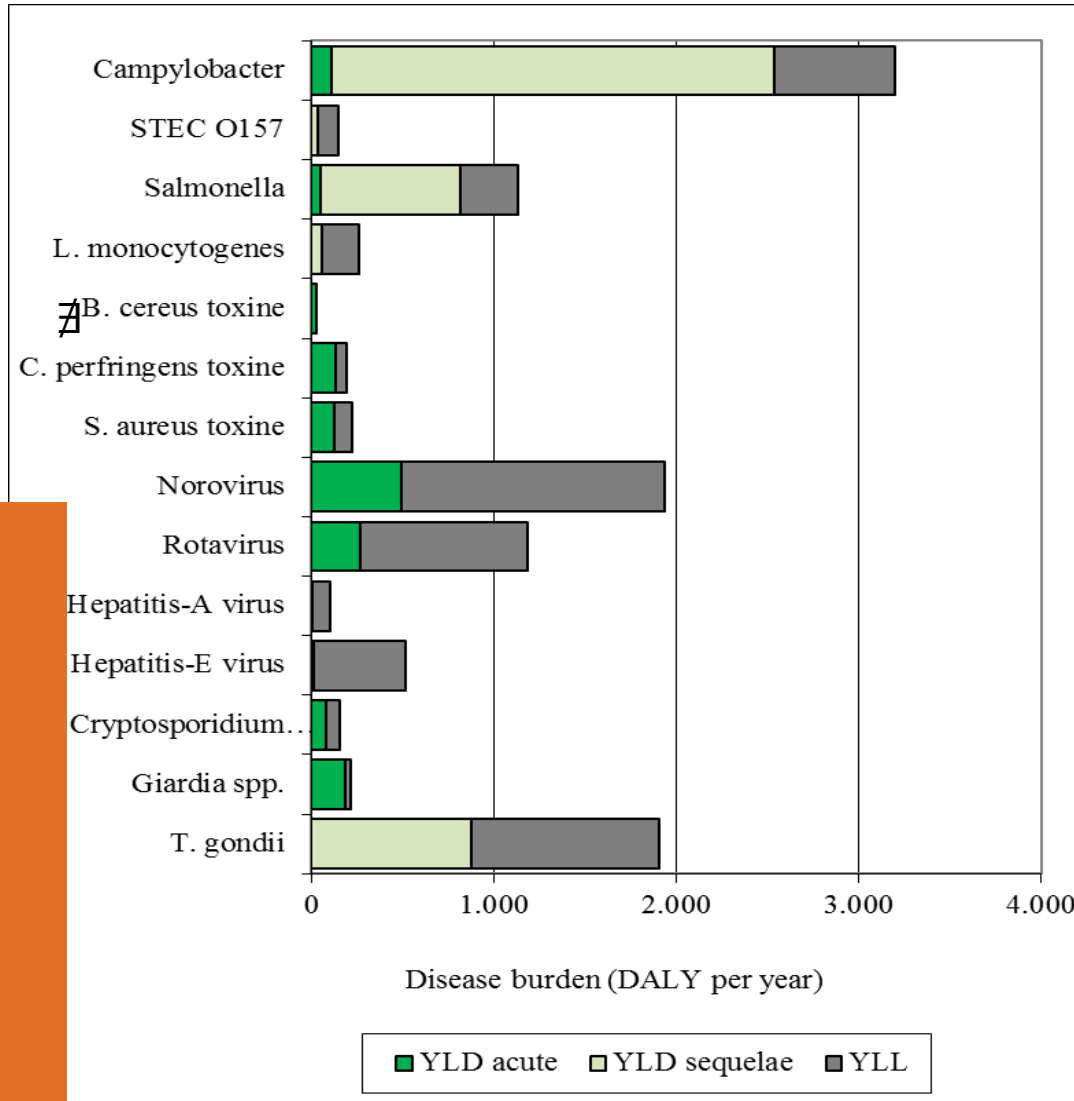
The disease burden is expressed in **DALYs** (Disability Adjusted Life Years).

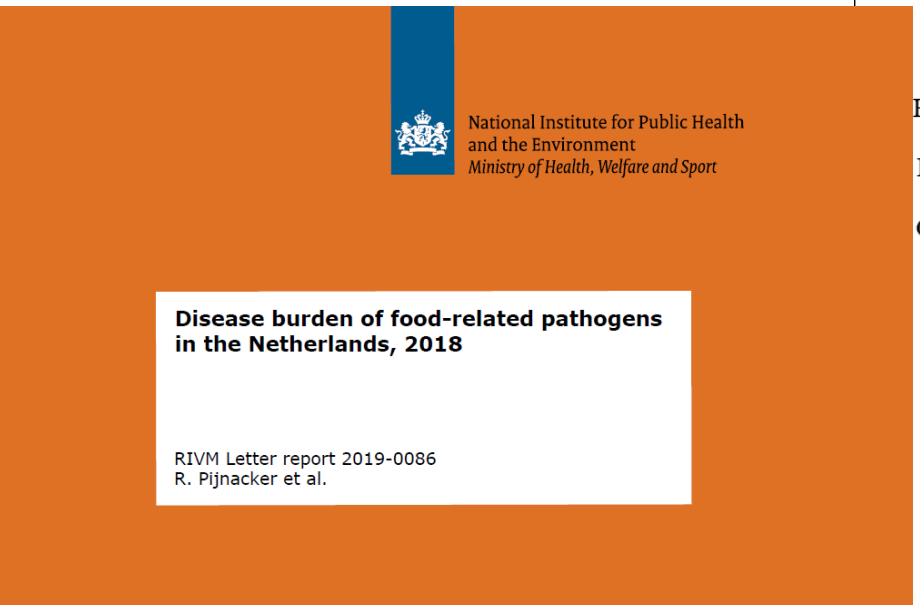
The **Cost of Illness (COI)** estimate includes healthcare costs, the costs for the patient and / or his family, such as travel expenses, as well as costs in other sectors, for example due to productivity losses.

Disease burden estimates of 14 foodborne diseases

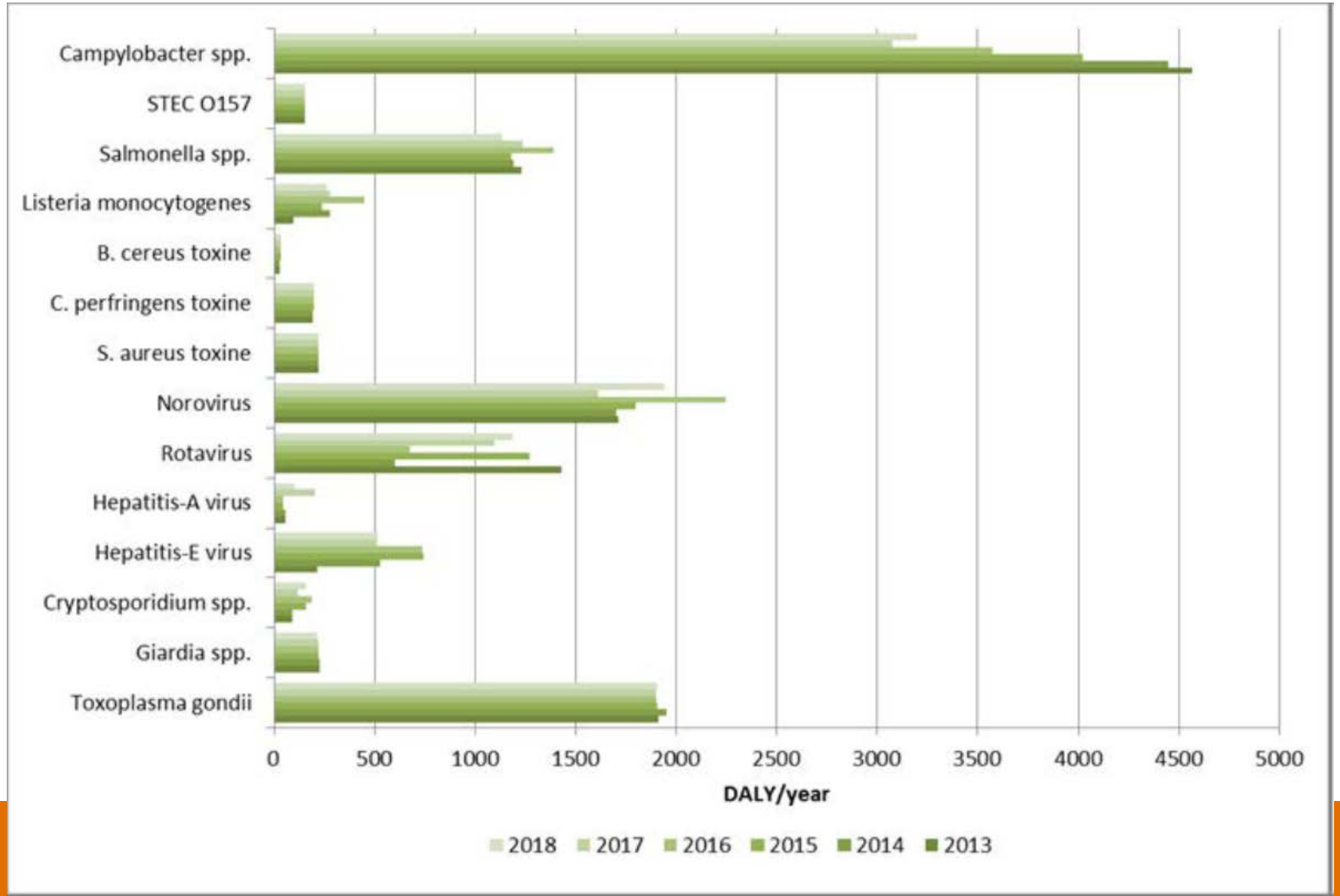
Annual update: 2018

11.000 DALYs
426 MEuro COI





Trends disease burden in DALY's 2013-2018



Requirements for DALY-estimation

- *N*: Morbidity rate; number of patients; Incidence

  Population based studies and surveillance (SENSOR, NIVEL, GEOPS)

- *t*: Duration of diseases

  clinical and case control studies

- *w*: disability weight

  European expert panels (Haagsma et al., 2015)

$$YLD = \sum_{all\ symptoms} N \times t \times w$$

- *D*: Mortality rate: number of deaths

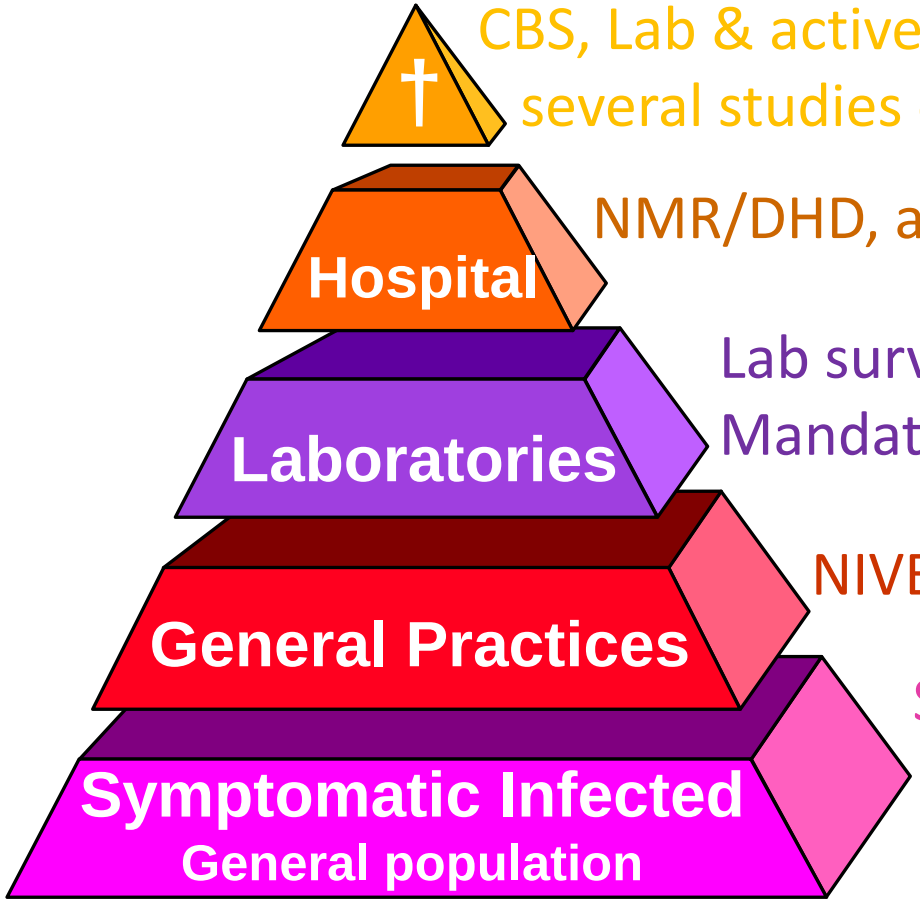
  populationstatistics (CBS) and epidemiological studies

- *e*: life expectancy at the age of death

  populationstatististics (CBS)

$$YLL = \sum_{all\ symptoms} D \times e$$

Data required for incidence estimates



CBS, Lab & active surveillance,
several studies outside NL

NMR/DHD, active surveillance, ISIS

Lab surveillance trends per year
Mandatory notification: Listeria, STEC,

NIVEL 1996-1998

Sensor 1999

Transmission routes & fraction foodborne: expert elicitations

TABLE 3. TRANSMISSION OF 17 ENTEROPATHOGENS BY MAJOR PATHWAYS

		Fraction (%) transmitted by pathway[a]				
Pathogen	*Experts*	*Food*	*Environment*	*Human*	*Animal*	*Travel*
Campylobacter spp.	12	42 (16–84)	21 (0–73)	6 (0–12)	19 (0–60)	12 (0–29)
Shiga toxin–producing *E. coli*						
O157	3	40 (15–83)	17 (0–47)	10 (0–23)	21 (0–76)	12 (0–27)
Non-O157	3	42 (21–78)	14 (0–29)	10 (0–20)	28 (11–48)	6 (0–10)
Listeria monocytogenes	7	69 (47–98)	7 (0–18)	5 (0–13)	5 (0–13)	13 (0–40)
Mycobacterium avium	4	42 (0–79)	19 (0–58)	18 (0–57)	9 (0–27)	12 (0–39)
Salmonella spp.	8	55 (32–88)	13 (0–29)	9 (0–19)	9 (0–19)	14 (3–26)
Bacillus cereus toxin	4	90 (68–100)	1 (0–4)	1 (0–4)	1 (0–4)	7 (0–91)
Clostridium perfringens toxin	4	91 (72–100)	2 (0–5)	2 (0–5)	2 (0–5)	3 (0–9)
Staphylococcus aureus toxin	4	87 (73–100)	4 (0–9)	3 (0–8)	2 (0–5)	4 (0–10)
Enterovirus	2	6 (0–16)	25 (0–60)	60 (30–92)	2 (0–2)	7 (0–15)
Hepatitis A virus	2	11 (0–20)	11 (0–19)	18 (0–42)	0 (0–0)	60 (7–80)
Hepatitis E virus	2	14 (0–38)	25 (0–75)	8 (0–20)	11 (0–29)	43 (0–68)
Norovirus	5	17 (16–47)	14 (0–43)	55 (42–88)	5 (0–10)	9 (0–20)
Rotavirus	3	13 (13–28)	17 (0–46)	58 (43–90)	3 (0–5)	9 (0–19)
Cryptosporidium parvum	2	12 (0–20)	28 (10–39)	27 (10–38)	13 (5–19)	20 (4–29)
Giardia lamblia	3	13 (0–24)	24 (10–37)	35 (10–56)	11 (0–20)	18 (5–29)
Toxoplasma gondii	3	56 (26–88)	36 (6–66)	1 (0–1)	3 (0–3)	5 (0–9)

[a]Mean (5th and 95th percentile) after resampling. Bold type indicates poor fit with Decision Maker.

Attribution of DALYs to transmission routes

Main pathway	Food	Environment	Human	Animal	Travel	Total
Campylobacter spp.	1,366	683	195	618	390	3,252
STEC O157	50	21	13	26	15	125
L. monocytogenes	79	8	6	6	15	114
Salmonella spp.	699	165	114	114	178	1,270
B. cereus toxin	101	1	1	1	8	112
C. perfringens toxin	488	11	11	11	16	537
S. aureus toxin	669	31	23	15	31	769
Hepatitis-A virus	16	16	26	0	85	143
Hepatitis-E virus	3	6	2	3	10	24
Norovirus	251	207	812	74	133	1,477
Rotavirus	237	310	1,057	55	164	1,823
Cryptosporidium spp.	8	19	19	9	14	69
Giardia spp.	21	39	57	18	29	164
T. gondii	2,026	1,302	36	109	181	3,654
Total	6,014	2,819	2,372	1,059	1,269	13,533

Different food products: expert elicitations

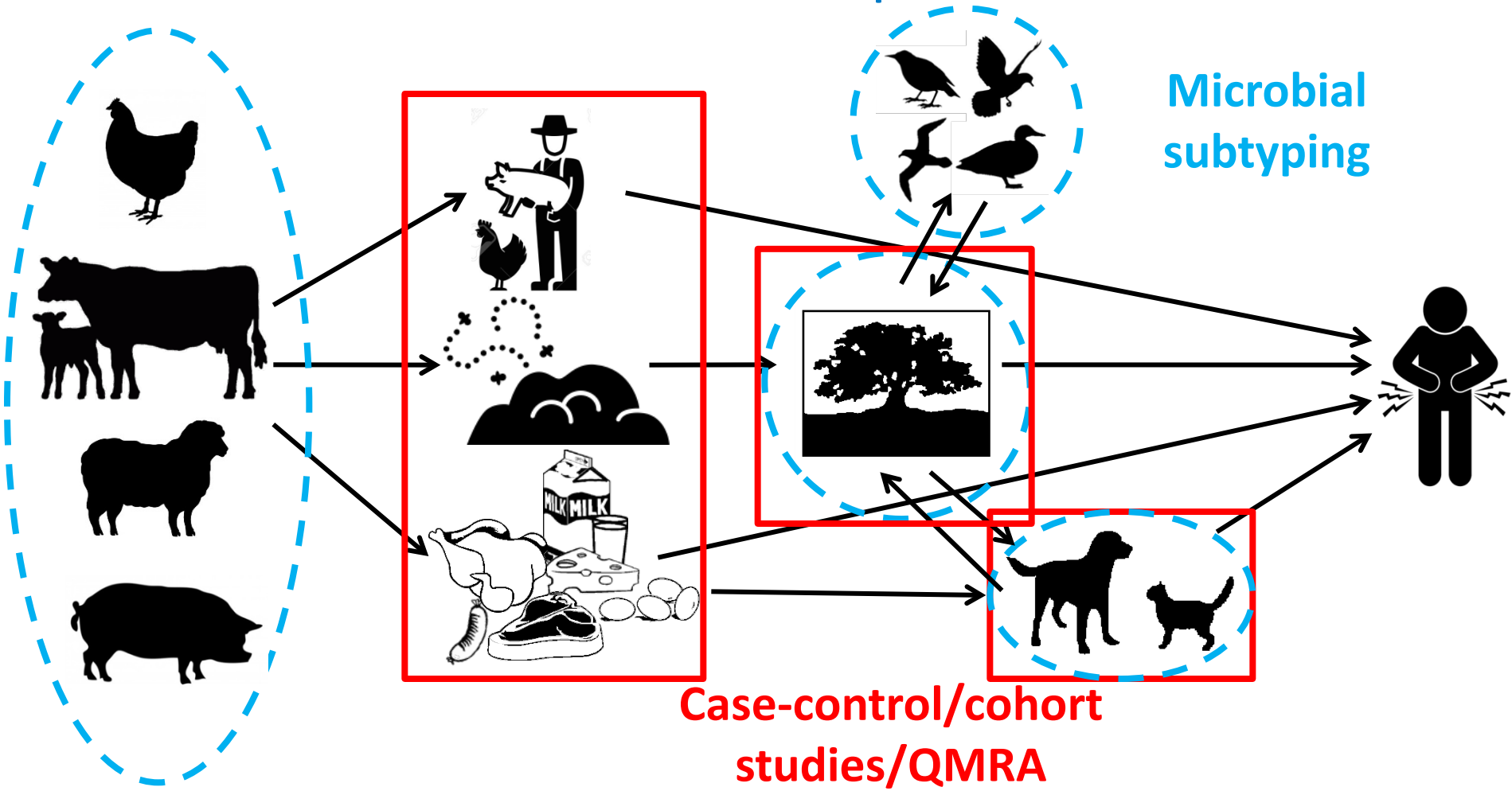
TABLE 4. TRANSMISSION OF 17 ENTEROPATHOGENS BY FOOD GROUPS WITHIN THE FOOD PATHWAY

		Fraction (%) transmitted by food group[a]										
Pathogen	*Experts*	*B&L*	*Pork*	*Poultry*	*Eggs*	*Dairy*	*(S)F*	*F&V*	*Bev*	*Grains*	*Comp*	*H&A*
Campylobacter spp.	11	4 (0–17)	5 (0–19)	54 (17–86)	3 (0–10)	9 (0–44)	7 (0–27)	5 (0–25)	2 (0–4)	2 (0–6)	3 (0–10)	5 (0–18)
Shiga toxin–producing *E. coli*												
O157	7	44 (16–88)	6 (0–25)	3 (0–9)	2 (0–5)	7 (0–28)	3 (0–8)	7 (0–28)	4 (0–12)	3 (0–8)	4 (0–12)	17 (0–7)
Non-O157	3	62 (0–79)	9 (0–19)	3 (0–9)	1 (0–4)	5 (0–25)	3 (0–5)	4 (0–19)	4 (0–13)	2 (0–9)	2 (0–9)	6 (0–22)
Listeria monocytogenes	9	11 (5–29)	9 (0–26)	7 (0–17)	4 (0–12)	25 (14–50)	18 (0–46)	8 (0–25)	3 (0–7)	6 (0–16)	6 (0–19)	5 (0–9)
Mycobacterium avium	4	6 (0–45)	41 (**0**–86)	6 (0–7)	2 (**0**–**0**)	5 (**3**–**3**)	7 (0–15)	2 (0–9)	5 (0–8)	1 (0–1)	4 (**0**–15)	20 (0–35)
Salmonella spp.	13	13 (5–28)	14 (6–36)	15 (5–47)	22 (11–54)	7 (0–25)	4 (0–10)	6 (0–20)	3 (0–9)	4 (0–12)	6 (0–18)	6 (0–18)
Bacillus cereus toxin	5	7 (**4**–**4**)	3 (0–18)	2 (**0**–**0**)	4 (**0**–2)	6 (0–30)	2 (**0**–0)	2 (**0**–10)	2 (0–7)	17 (7–95)	54 (**0**–75)	2 (0–4)
Clostridium perfringens toxin	4	48 (20–94)	8 (0–65)	7 (0–54)	3 (0–9)	4 (0–21)	6 (0–37)	7 (0–35)	2 (0–8)	3 (0–9)	8 (0–53)	4 (0–18)
Staphylococcus aureus toxin	4	8 (0–28)	8 (0–29)	8 (0–29)	3 (0–10)	15 (0–29)	6 (0–20)	2 (0–5)	2 (0–4)	7 (0–29)	30 (5–49)	12 (0–77)
Enterovirus	2	***Problem***	***in–feasible***									
Hepatitis A virus	2	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	13 (0–40)	13 (0–39)	4 (0–10)	4 (0–10)	3 (0–5)	63 (0–99)
Hepatitis E virus	2	0 (0–0)	74 (0–100)	0 (0–0)	0 (0–0)	0 (0–0)	5 (0–11)	7 (0–19)	4 (0–6)	0 (0–0)	0 (0–0)	10 (0–31)
Norovirus	5	3 (0–9)	3 (0–10)	3 (0–9)	2 (0–5)	2 (0–5)	16 (0–57)	7 (0–41)	3 (0–9)	5 (0–19)	5 (0–19)	51 (0–87)
Rotavirus	3	0 (0–0)	3 (0–5)	0 (0–0)	0 (0–0)	2 (0–2)	19 (0–59)	24 (2–59)	4 (0–9)	7 (0–19)	5 (0–10)	36 (5–77)
Cryptosporidium parvum	2	26 (**24**–56)	4 (**2**–9)	3 (**1**–5)	3 (**0**–5)	9 (**6**–20)	22 (**21**–38)	21 (**20**–38)	3 (**0**–4)	0 (0–0)	3 (**0**–5)	6 (**4**–11)
Giardia lamblia	3	20 (0–49)	5 (0–9)	3 (0–5)	0 (0–0)	8 (0–18)	13 (0–28)	33 (0–69)	3 (0–5)	0 (0–0)	3 (0–5)	12 (0–30)
Toxoplasma gondii	3	23 (0–47)	50 (21–99)	5 (0–14)	0 (0–0)	5 (0–14)	4 (0–10)	6 (0–18)	0 (0–0)	0 (0–0)	2 (0–50)	6 (0–19)

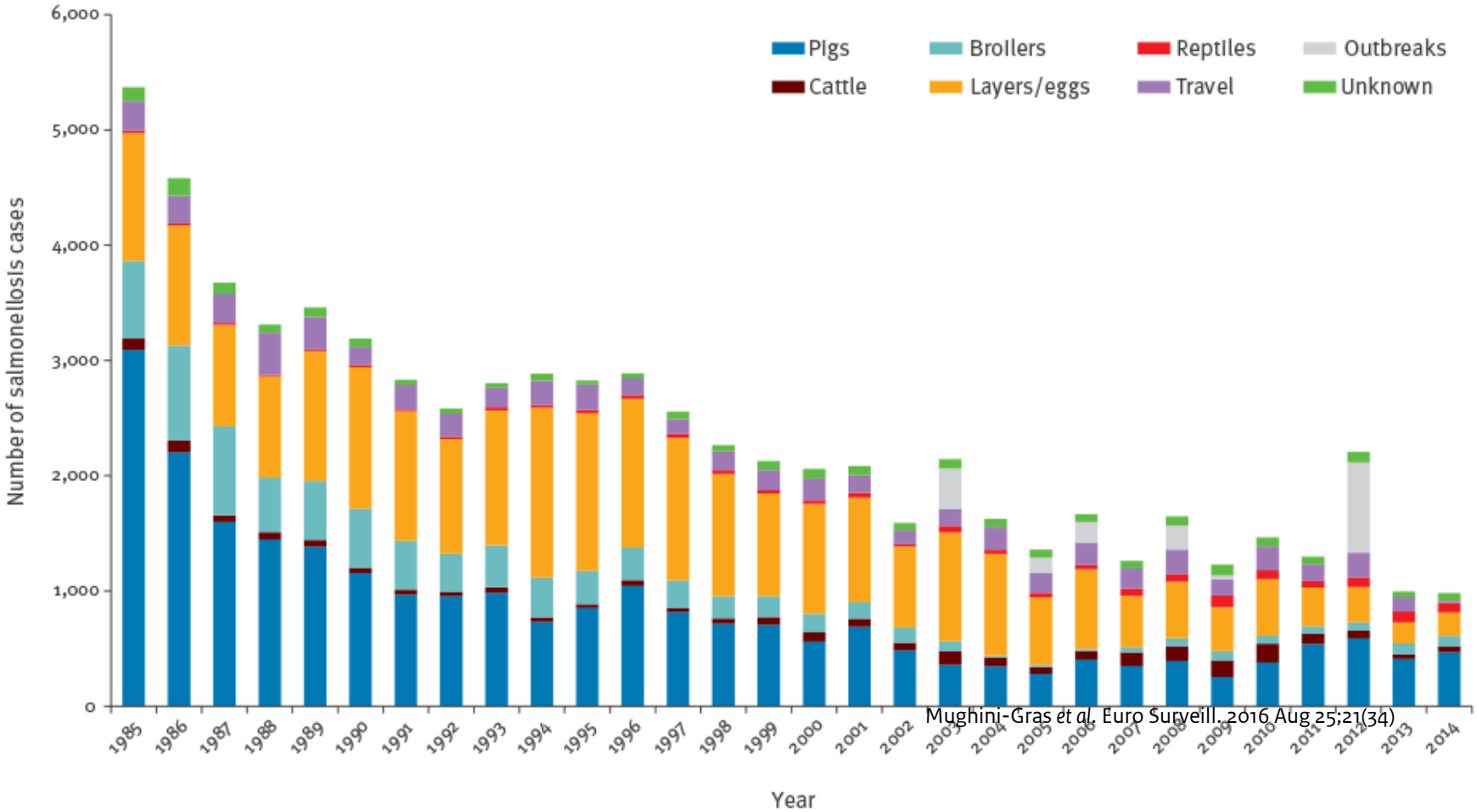
[a]Mean (5th and 95th percentile) after resampling. Bold type indicates poor fit with Decision Maker.

B&L, beef and lamb; (S)F, fish and shellfish; F&V, fruit and vegetables; bev, beverages; grains: bread, grains, pastas and bakery products; comp, other foods including composite foods; H&A, infected humans or animals.

Attribution to reservoir or exposure



Source attribution Salmonella by microbial subtyping



Mughini-Gras *et al.* Euro Surveill. 2016 Aug 25;21(34)

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Burden of Foodborne burden of diseases

Workshop Country studies

WHO Collaborating Centre Risk Assessment Pathogens in Water and Food - RIVM

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