

# **The foodborne disease burden in Japan: a pilot study**

16<sup>th</sup>, December 2015, FERG symposium

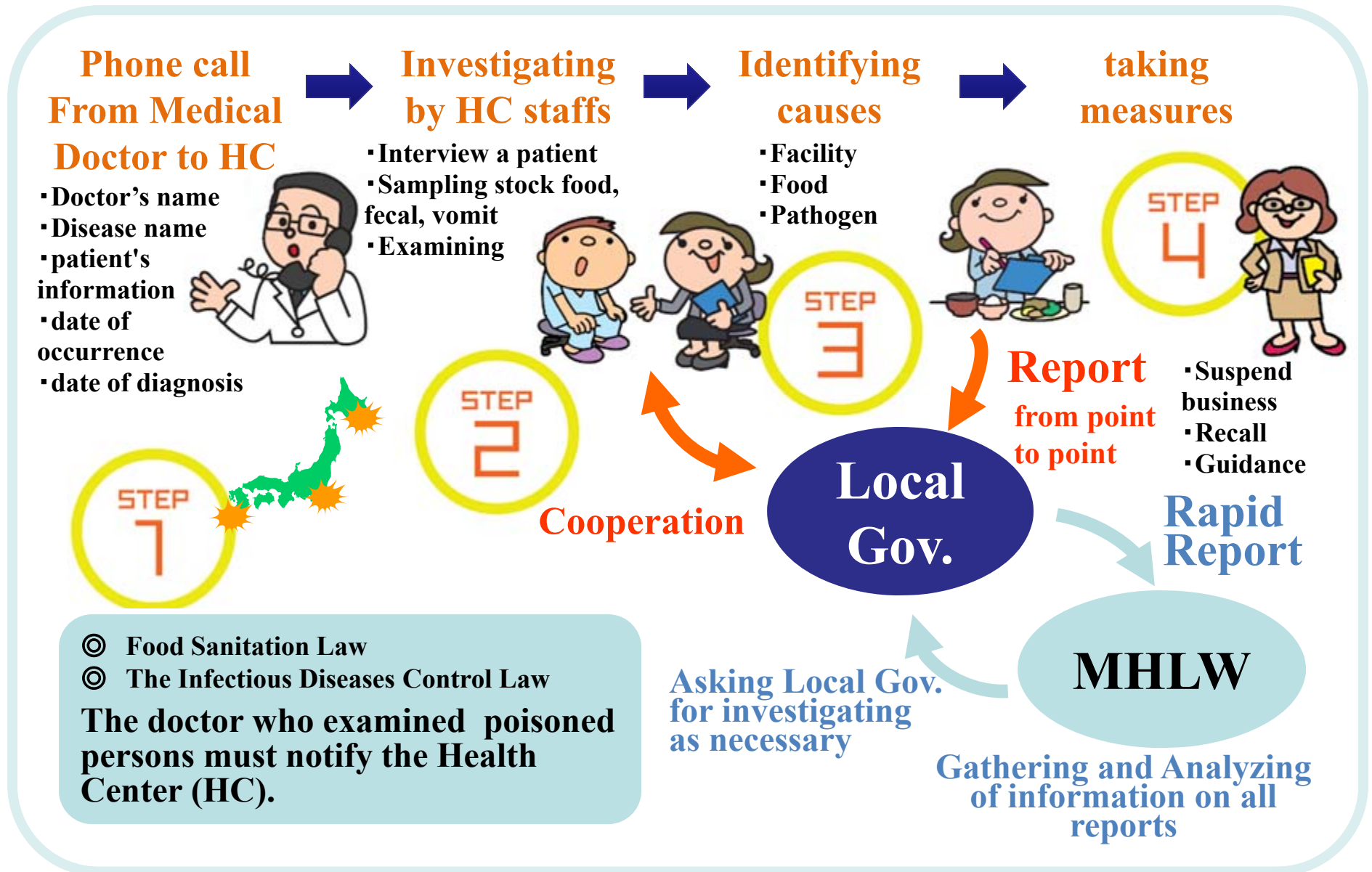
Yuko KUMAGAI

The National Institute of Infectious Diseases,  
the Ministry of Health, Labour and Welfare, Japan

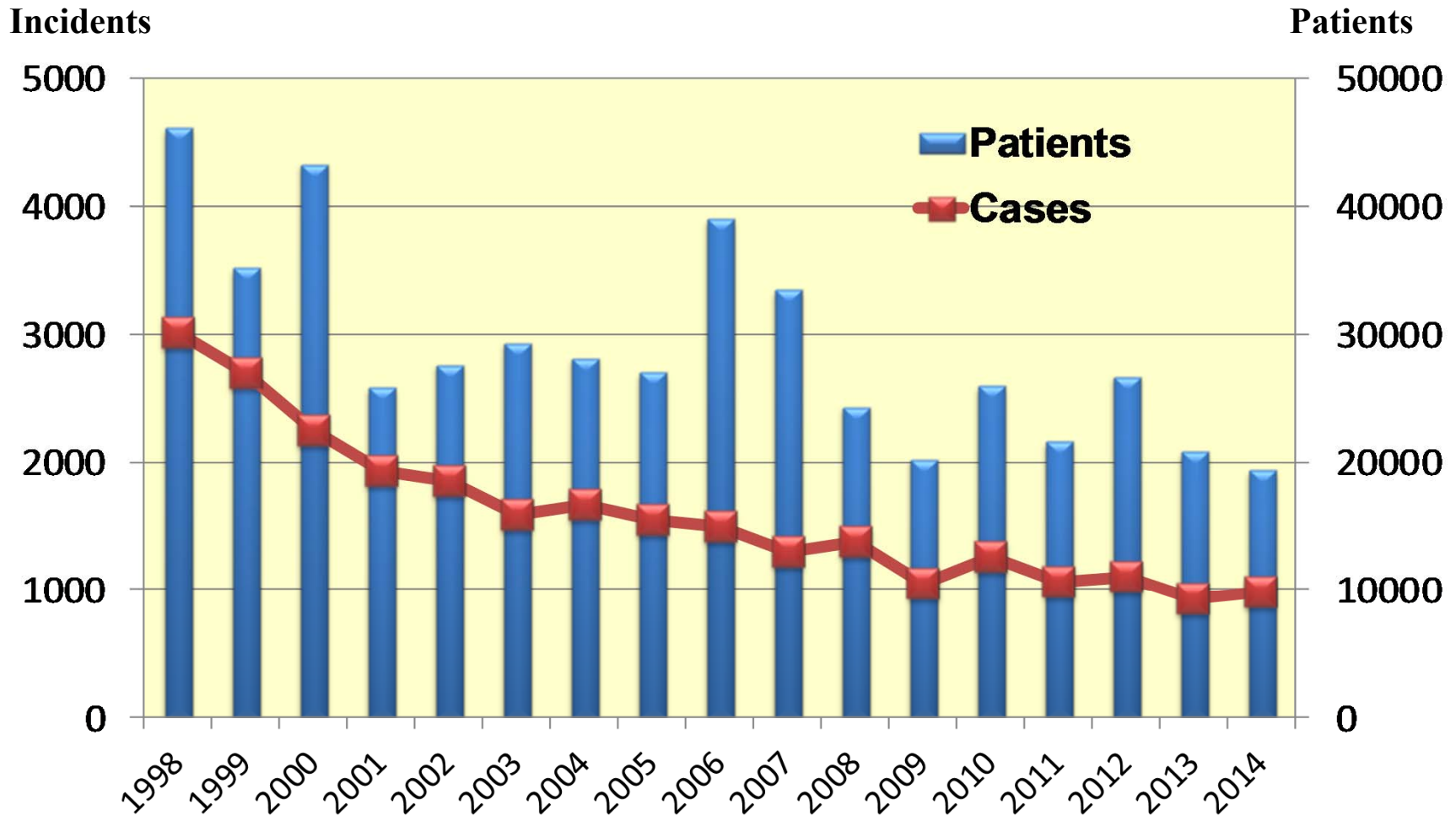
# Agenda

1. Action taken against outbreaks of foodborne diseases
2. Estimating the number of real incidences for foodborne diseases
3. Estimation of the burden for foodborne diseases

# Action taken against outbreaks of foodborne diseases



# Occurrence of food poisonings



※ **Cases: 976, Patients: 19,935, Fatality: 2 (2014)**

# Food poisoning more than 500 patients fell ill with

<2014>

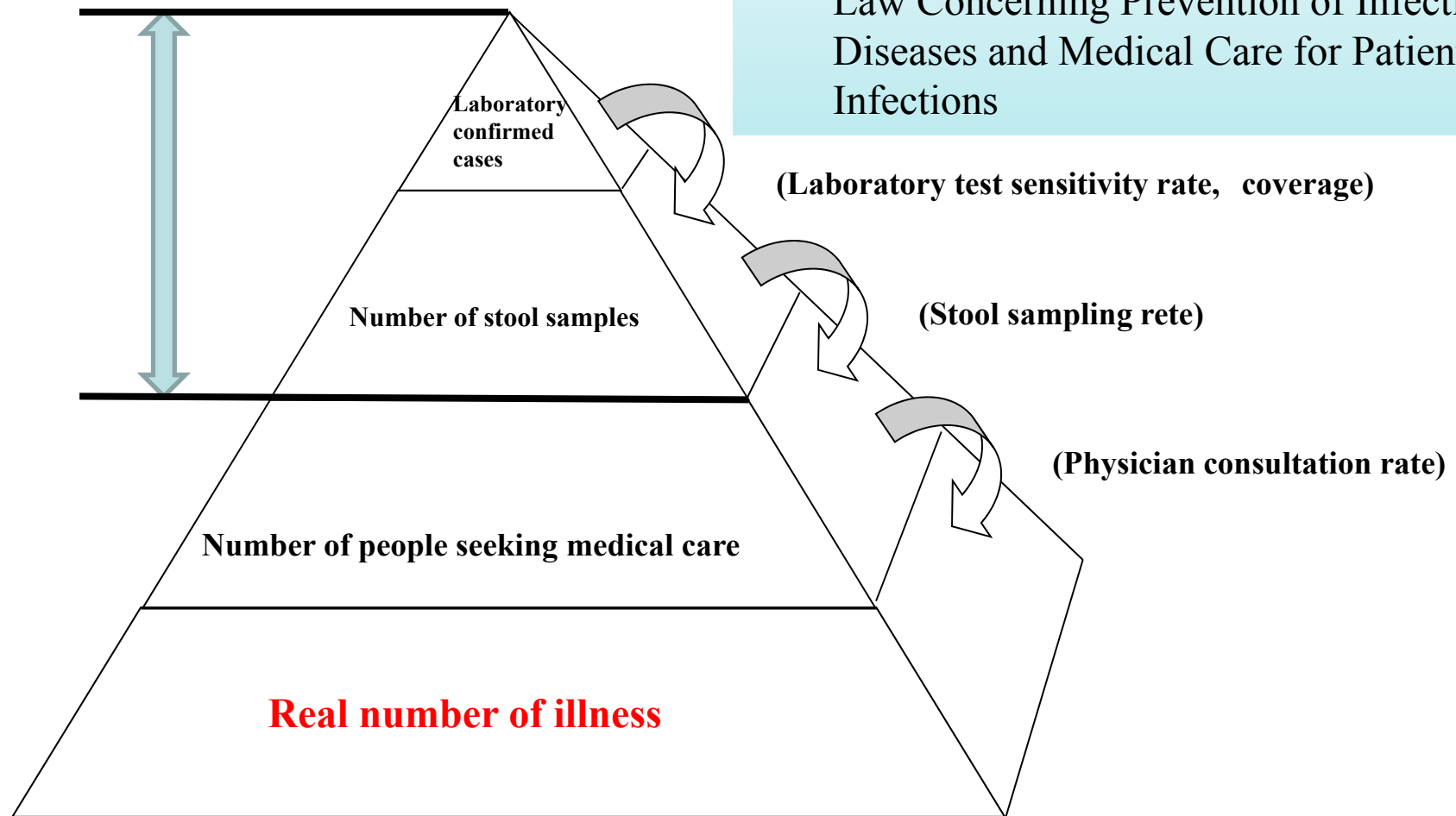
Month	Causative foods	Causative pathogens	Patients	fetal	People who ate
January	Sliced Bread	Norovirus	1,271	0	8,027
May	Keema Curry	<i>Clostridium perfringens</i>	900	0	1,696
July	Lunch box with chicken meat	<i>Stapylococcus aureus</i>	741	0	2,518
July	Chilled Cucumber	Enterohemorrhagic <i>Escherichia coli</i>	510	0	unknown
	Total		3,422	0	12,241 (except for unknown)

# Estimating the number of real incidences for foodborne diseases

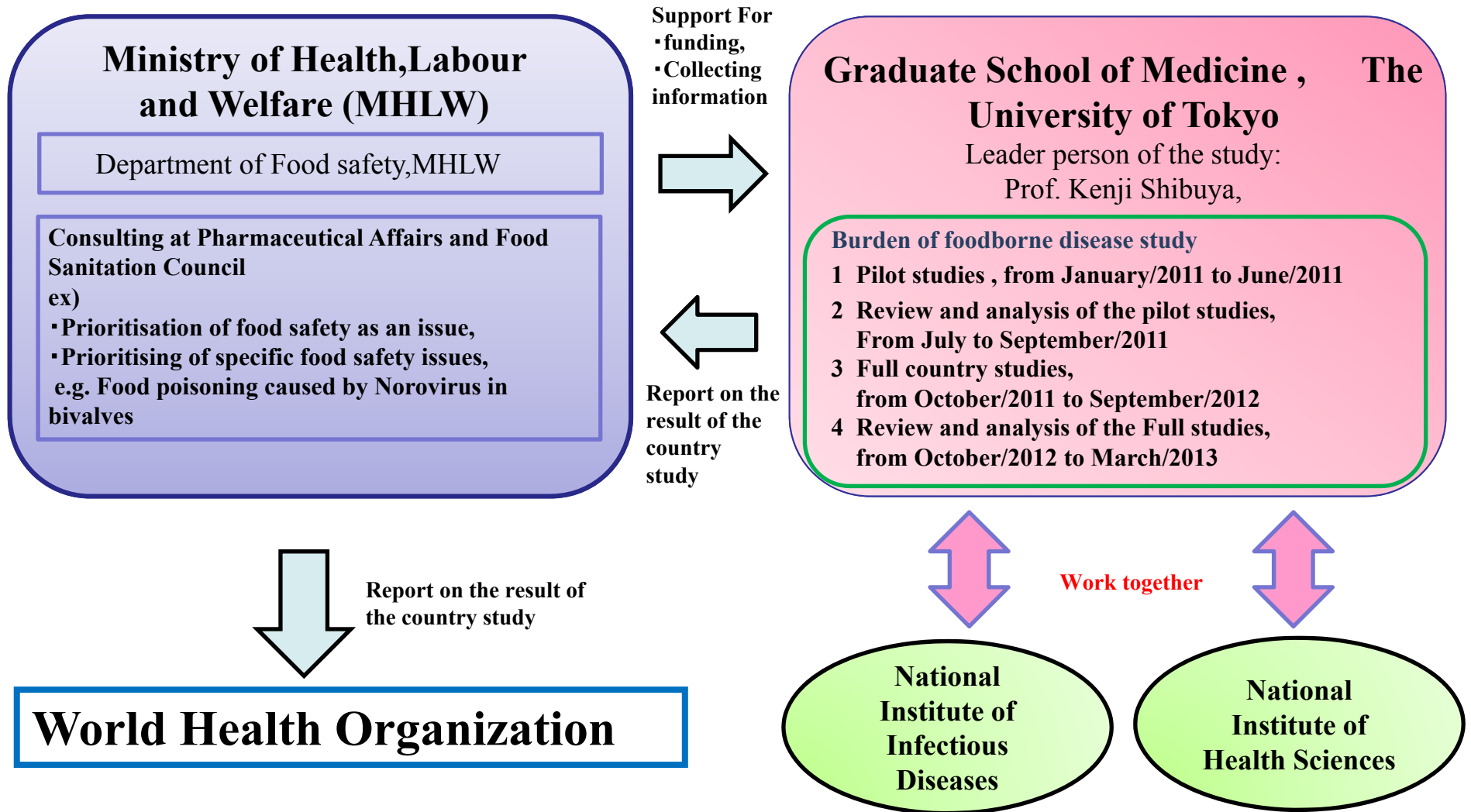
➤ Patient survey by MHLW

**Cases are reported partially.**

- Food poisoning statistics based on the Food Sanitation Law
- Infectious disease statistics based on the Law Concerning Prevention of Infectious Diseases and Medical Care for Patients of Infections



# Implementation structures for Burden of foodborne diseases study

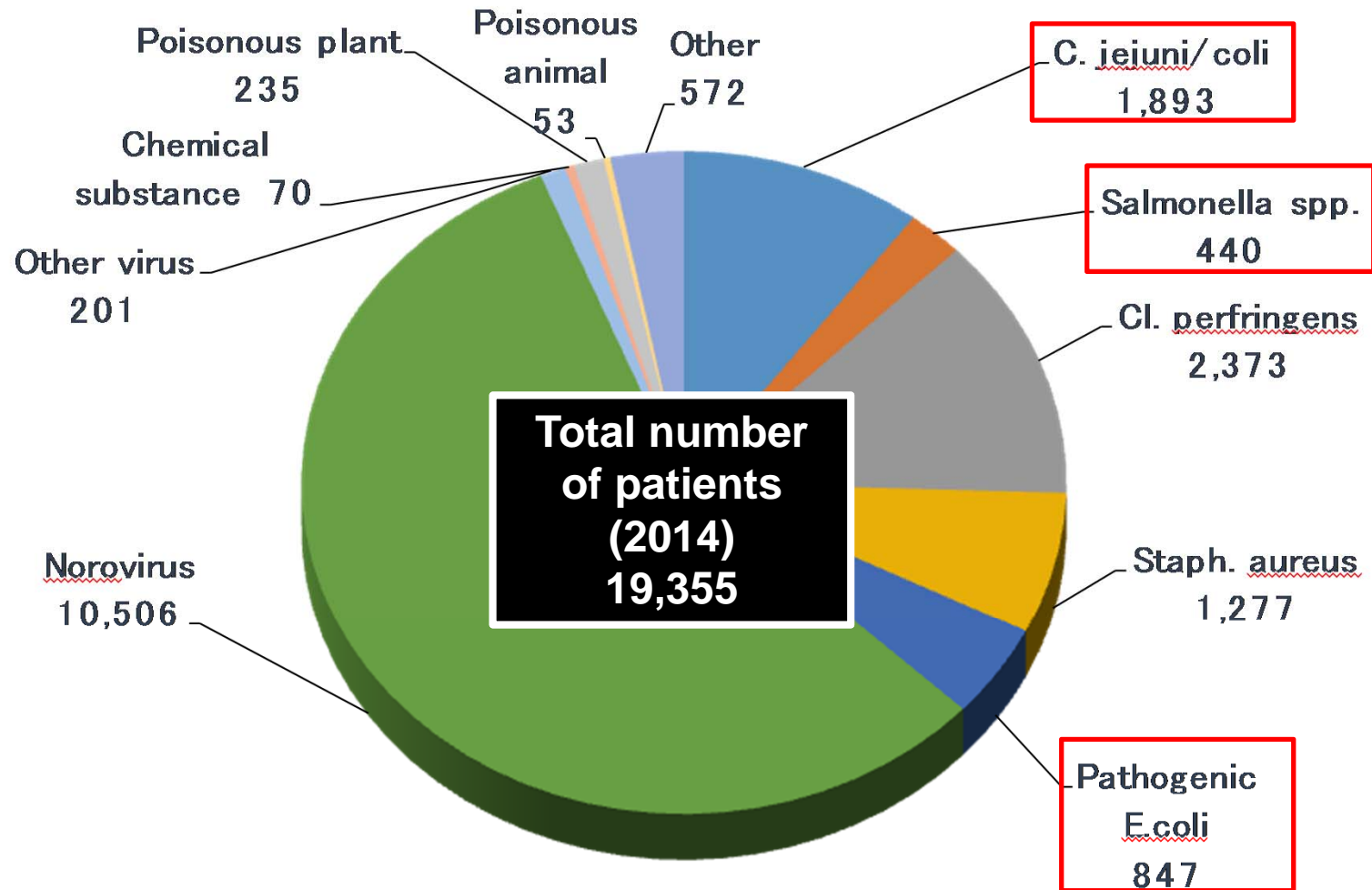


# Estimating the number of real incidences for foodborne diseases

- ◆ Disease selection
- ◆ Data sources
- ◆ Food attribution by expert elicitation



# Number of patients from foodborne diseases by pathogenic substance



# Collection of Data

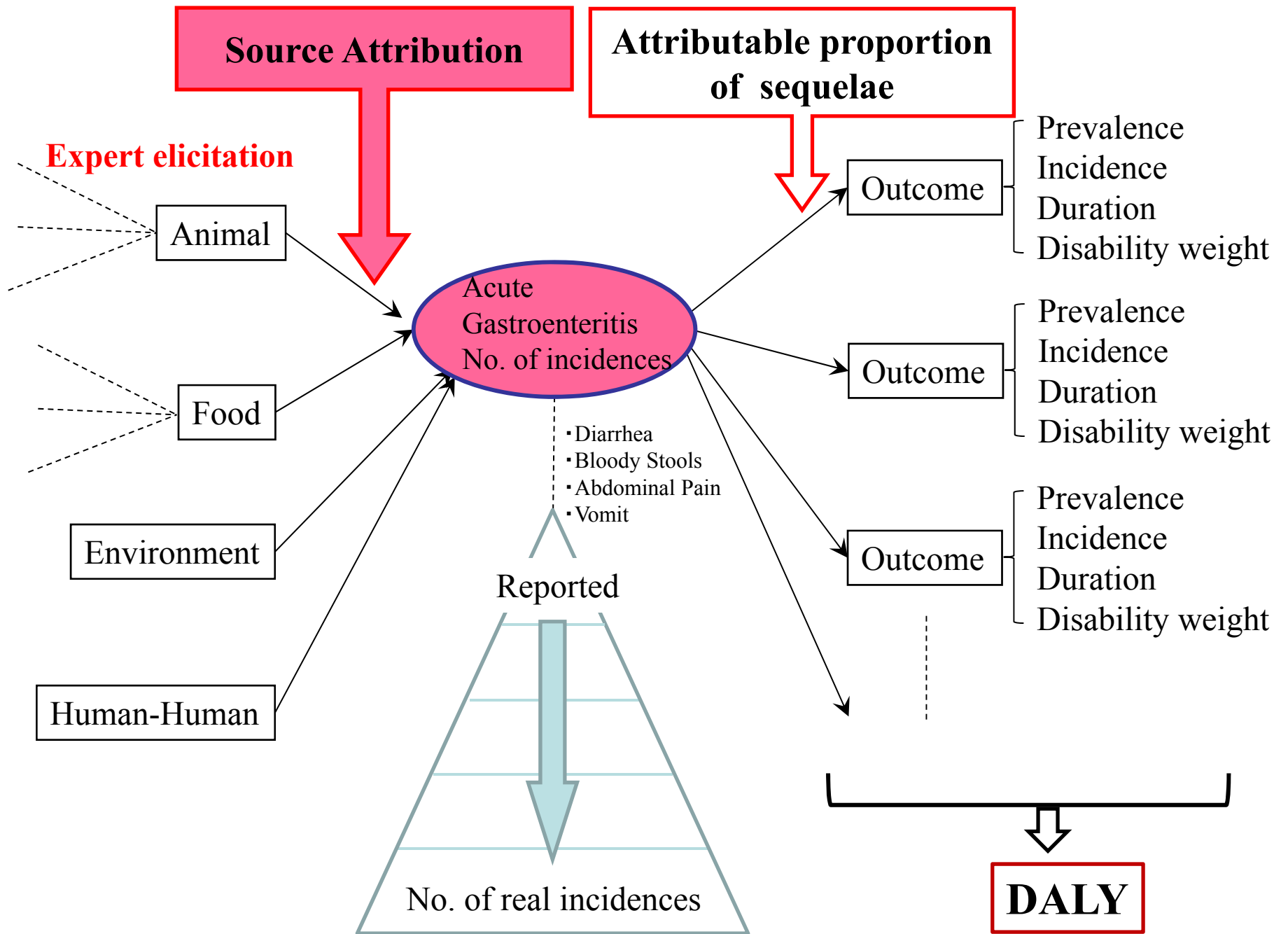
---

## Data sources

---

Incidence rate	<ul style="list-style-type: none"><li>▪ patients survey (sporadic cases)</li><li>▪ food poisoning statistics (outbreak cases)</li><li>▪ Infectious diseases surveillance data</li><li>▪ proportion of incident cases confirmed by stool examination (telephone survey, kubota et al.)</li><li>▪ proportion of incident cases who visited a physician (telephone survey, kubota et al.)</li><li>▪ source attribution (expert elicitation)</li><li>▪ attributable proportion of sequelae (systematic reviews (sequelae: GBS, ReA, IBD))</li></ul>
Mortality rate	<ul style="list-style-type: none"><li>▪ the vital statistics of Japan</li><li>▪ source attribution (expert elicitation)</li></ul>
Age distribution	<ul style="list-style-type: none"><li>▪ food poisoning statistics</li></ul>
Duration of illness	<ul style="list-style-type: none"><li>▪ overseas studies (Netherlands)</li></ul>
Disability weight	<ul style="list-style-type: none"><li>▪ overseas studies (Netherlands)</li></ul>

---



# Estimation of source attribution by expert elicitation

## Participants:

- Experts in microbiology, epidemiology, and food science.
- 88 invited and 30 (34.1%) agreed to participate.

## Contents:

Probability of transmission through a particular pathway with 90% certainty. Attributable proportions of food in five major pathways (food, environment, human, animal, travel) for each pathogen.

Method: Questionnaire sent to experts by mail and e-mail.

Analysis: Expert opinion merged by a Bayesian statistical model

## Result: estimation of source attribution

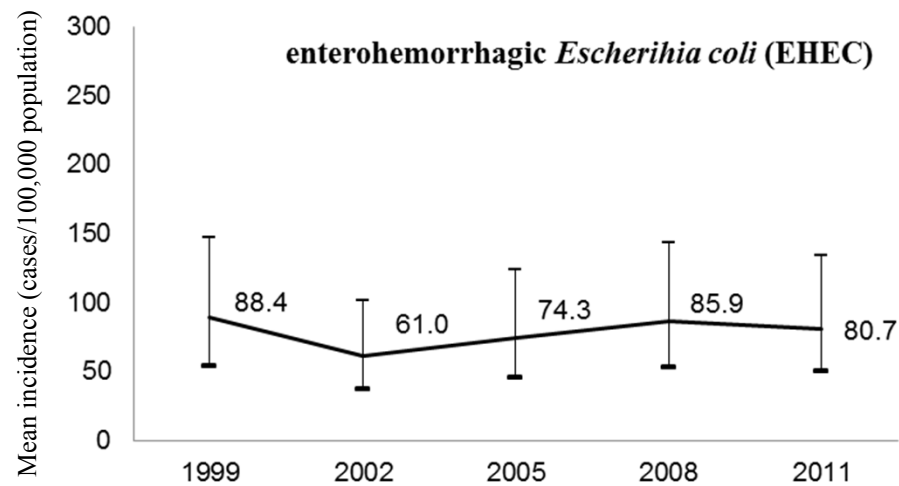
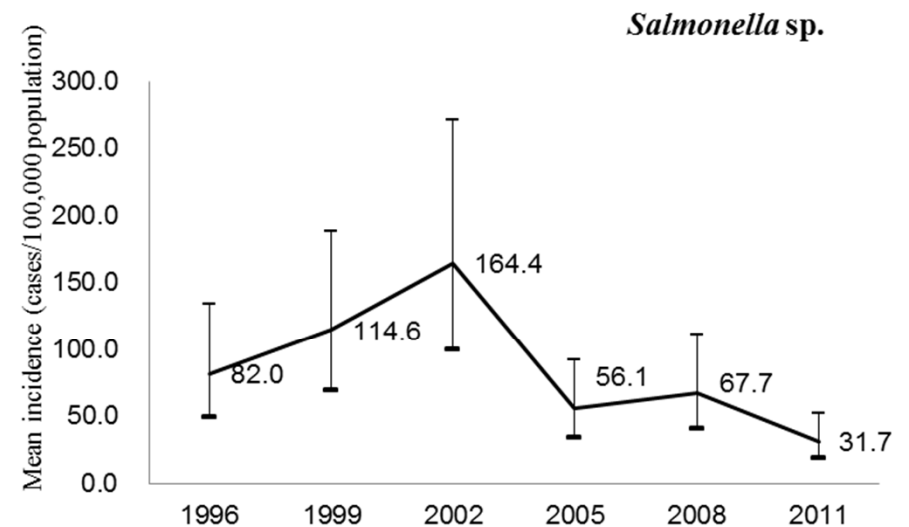
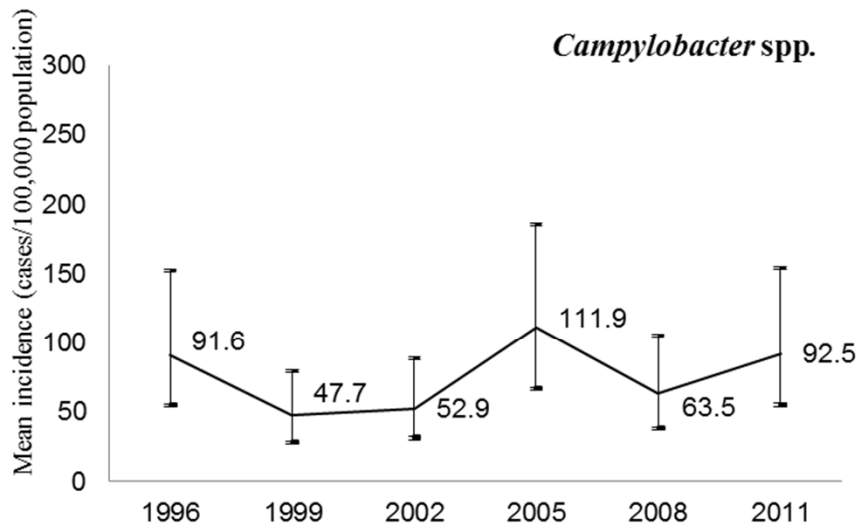
Causative agent	No. of experts <sup>a</sup>	Transmission pathway				
		Food % of cases	Environment % of cases	Animal– human % of cases	Human– human % of cases	Travel % of cases
<i>Campylobacter</i> spp.	15	82.0 (78.5–85.5) <sup>b</sup>	8.3 (6.7–10.1)	3.1 (2.1–4.3)	0.2 (0.0–0.5)	6.4 (5.0–8.0)
<i>Salmonella</i> sp.	14	79.3 (74.7–84.0)	2.7 (1.7–3.8)	10.1 (8.4–12.0)	3.4 (2.4–4.7)	4.5 (3.2–5.9)
Enterohaemorrhagic <i>Escherichia coli</i>	20	77.6 (73.4–81.8)	4.0 (2.8–5.3)	8.5 (6.9–10.4)	6.0 (4.6–7.6)	3.9 (2.8–5.2)

EHEC; UI: uncertainty interval.

<sup>a</sup> These experts were asked to estimate the proportions of gastroenteritis cases resulting from each transmission pathway

<sup>b</sup> 95% UI (Uncertainty interval)

# Estimated incidences of acute gastroenteritis, Japan



# Estimated incidences of acute gastroenteritis, Japan, 2011

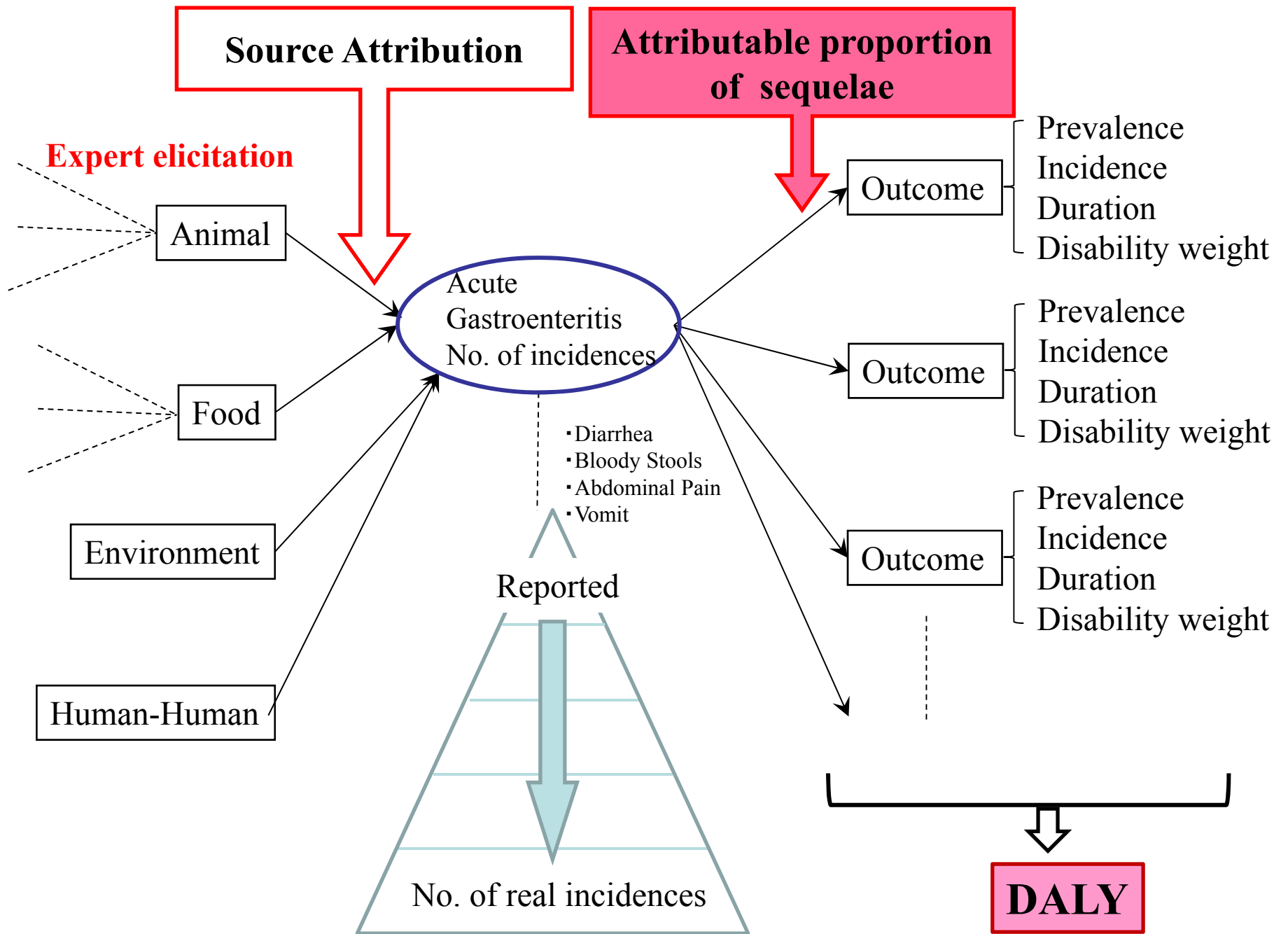
Data source	Causative agent	Estimated no. of incidences	Estimated incidence, cases per 100 000 population (95% UI)
Food poisoning statistics	<i>Campylobacter</i> spp.	2,341	1.8 (1.1–2.8)
	<i>Salmonella</i> sp.	3,068	2.4 (1.5–3.6)
	Enterohaemorrhagic <i>Escherichia coli</i>	714	0.6 (0.2–1.3)
Pyramid reconstruction	<i>Campylobacter</i> spp.	118,502	92.5 (55.2–154.5)
	<i>Salmonella</i> sp.	40,571	31.7 (19.2–51.8)
	Enterohaemorrhagic <i>Escherichia coli</i> ;	103,338	80.7 (49.5–133.1)

UI: uncertainty interval

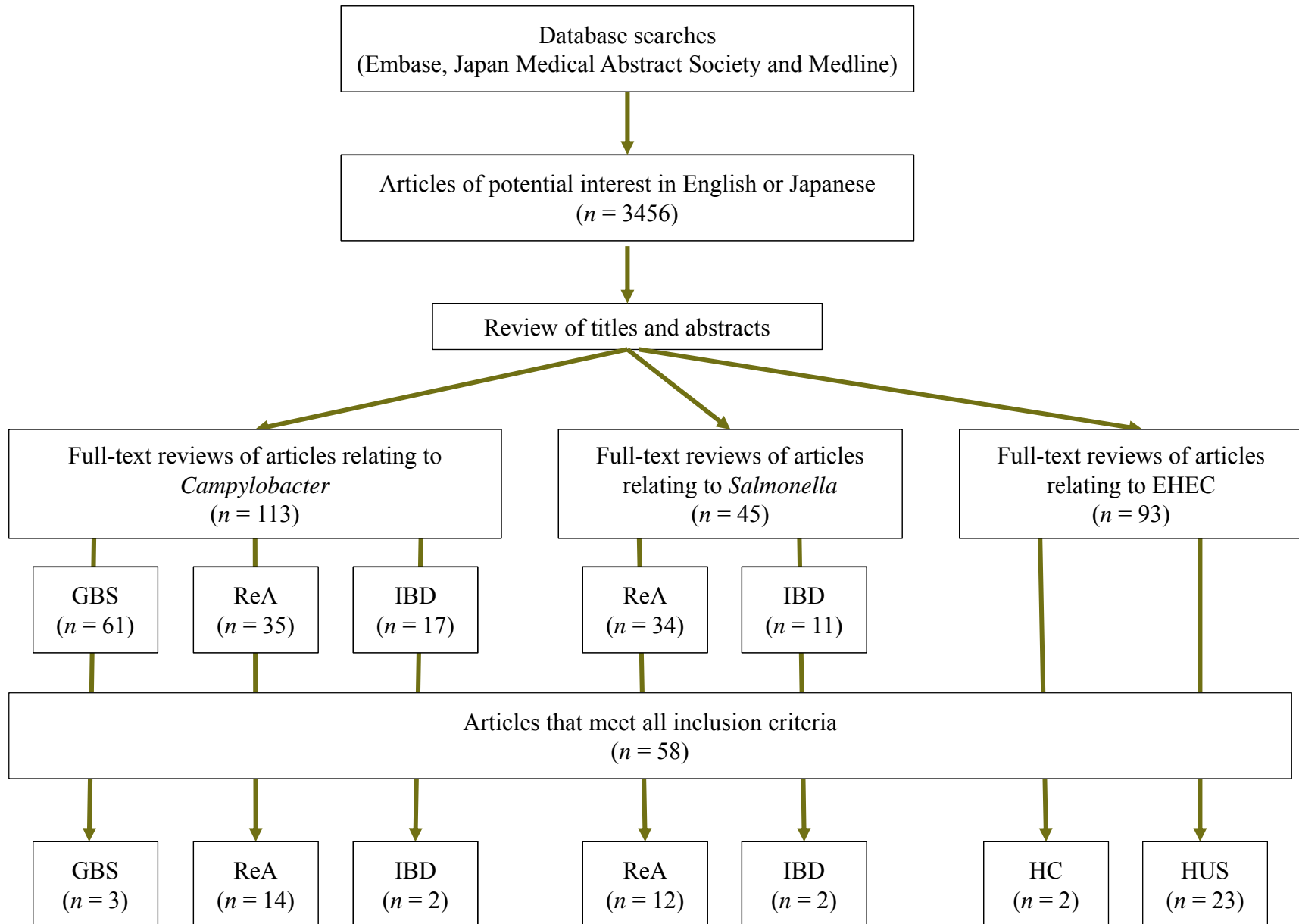
# Estimation of the burden for foodborne diseases

- ◆ Attributable proportion of sequelae Disease selection
- ◆ Age distribution
- ◆ Years of illness and disability weights
- ◆ Fetal cases





# Result: systematic review of estimated attributable proportion of sequelae



# Result: systematic review of estimated attributable proportion of sequelae

Pathogen, sequela	Attributable proportion		No. of studies	Countries
	% of cases of sequela	95% UI		
<b><i>Campylobacter</i> spp.</b>				
<b>Guillain-Barré syndrome</b>	0.03	0.02–0.06	3	Netherlands, Sweden
<b>Inflammatory bowel disease</b>	0.32	0.02–1.00	2	Denmark, Sweden
<b>Reactive arthritis</b>	5.01	2.60–8.08	14	Denmark, Finland, Netherlands, Norway, United Kingdom, USA
<b><i>Salmonella</i> sp.</b>				
<b>Inflammatory bowel disease</b>	0.40	0.01–1.37	2	Denmark, Sweden
<b>Reactive arthritis</b>	6.09	2.81–10.47	12	Australia, Denmark, Finland, Netherlands, Switzerland, United Kingdom, USA
<b>EHEC</b>				
<b>Haemorrhagic colitis</b>	10.39	2.86–21.20	2	Germany, United Kingdom,
<b>Haemolytic uraemic syndrome</b>	6.13	4.61–7.82	23	Austria, Belgium, Canada, Denmark, Finland, Germany, Hungary, Slovakia, United Kingdom, USA

EHEC: enterohaemorrhagic *Escherichia coli*; UI: uncertainty interval; USA: United States of America.

Sources: data are drawn from the results of 58 studies.

# Age distribution

---

Age (years)	Male(%)	Female (%)
0-4	2.3	3.0
5-14	20.8	19.9
15-29	51.6	53.2
30-44	17.5	15.2
45-59	5.9	5.8
60-69	1.3	1.5
70-79	0.4	0.9
80+	0.2	0.5
total	100	100

---

From “Food Poisoning Statistics of Japan (2001-2010)”

# Population in Japan by age group, 2011

Age (years)	Male	Female	Total	(× 1,000)
0-4	2,717	2,592	5,308	
5-14	5,905	5,626	11,531	
15-29	10,210	9,799	20,009	
30-44	13,721	13,372	27,093	
45-59	12,245	12,275	24,521	
60-69	8,919	9,466	18,384	
70-79	5,850	7,160	13,010	
80+	2,761	5,440	8,201	
Total	62,328	65,614	127,942	

(Vital statistics in Japan, 2011)

# Years of illness and disability weights

Causative agent, condition	Incidences (95% UI)	Fatal cases	Years of illness	Disability weight
<b><i>Campylobacter spp.</i></b>				
Gastroenteritis	118,502			
Visiting a general practice	4,833 (3,439-7,156)	0	0.027	0.393
Not visiting a general practice	114,219 (67,864-190,644)	0	0.009	0.067
Mild Guillain-Barré syndrome	30 (14-60)	0	1.00	0.25
Severe Guillain-Barré syndrome	5 (3-11)	1	29.26	0.16
Reactive arthritis	6,087 (2,956-11,156)	0	0.61	0.14
Inflammatory bowel disease	452 (93-1,051)	4	44.36	0.26
<b><i>Salmonella sp.</i></b>				
Gastroenteritis	40,571			
Visiting a general practice	3,866 (3,411-4,658)	3	0.031	0.393
Not visiting a general practice	36,667 (21,237-62,597)	0	0.015	0.067
Reactive arthritis	2,556 (1,190-4,774)	0	0.61	0.15
Inflammatory bowel disease	202 (36-481)	2	50.52	0.26
<b><i>Eenterohaemorrhagic Escherichia col</i></b>				
Gastroenteritis	103,338			
Visiting a general practice	2,064 (1,955-2,175)	10	0.015	0.393
Not visiting a general practice	101,982 (60,428-169,268)	0	0.008	0.067
Haemorrhagic colitis	299 (115-361)	0	0.015	0.393
Haemolytic uraemic syndrome <sup>a</sup>	132 (108-155)	3	NA	NA

<sup>a</sup> Every case was estimated to correspond to 1.05 years lived with disability.

Sources: Van Lier and Havelaar (2007) and Kemmeren et al. (2006)

# Burdens for foodborne diseases in 2011

Causative agent, condition	Burden metrics			YLD/DALY (%)
	YLD (95% UI)	YLL (95% UI)	DALY (95% UI)	
<i>Campylobacter</i> spp.	<b>6,003</b> (1651–13 687)	<b>96</b> (42–160)	<b>6,099</b> (1745–13 778)	<b>98.4</b>
<i>Salmonella</i> sp.	<b>2,979</b> (753–6795)	<b>166</b> (49–350)	<b>3,145</b> (906–6950)	<b>94.7</b>
Enterohaemorrhagic <i>Escherichia coli</i>	<b>211</b> (171–266)	<b>252</b> (129–395)	<b>463</b> (325–606)	<b>45.6</b>

DALY: disability-adjusted life-years; NA: not available; YLD: years lived with disability; YLL: years of life lost; UI: uncertainty interval.

# Conclusion

- What we did
  - Data collected from available country data
  - Systematic reviews for each sequelae
  - Experts elicitation
  - Calculating DALYs for foodborne diseases caused by *Campylobacter* spp., *Salmonella* sp., and EHEC
- What we will do
  - Apply to foodborne diseases caused by other pathogens
  - To develop a risk prioritization framework using DALYs calculation for foodborne diseases in Japan.



# Acknowledgements

- WHO/the Foodborne Epidemiology Reference Group (FERG)
- Department for Foodborne Surveillance Information Office and the Statistics Information, the Ministry of Health, Labour and Welfare, Japan (MHLW, JAPAN)
  
- Stuart GILMOUR, University of Tokyo
- Erika OTA, National Centre for Child Health and Development
- Yoshika MOMOSE, National Institute of Health Sciences
- Toshiro OHISHI, Kyusyu University
- Ver Luanni Feliciano Bilano, University of Tokyo
- Fumiko KASUGA, National Institute of Health Sciences
- Tsutomu SEKIZAKI, University of Tokyo
- Kenji SHIBUYA, University of Tokyo

Thank you for your attention!