食品安全分野における
データの意義と課題

Data for Food Safety
- Significance and Challenges

第7回国際ワークショップ
「社会イノベーションを誘発する情報・システム」
2015年2月16日
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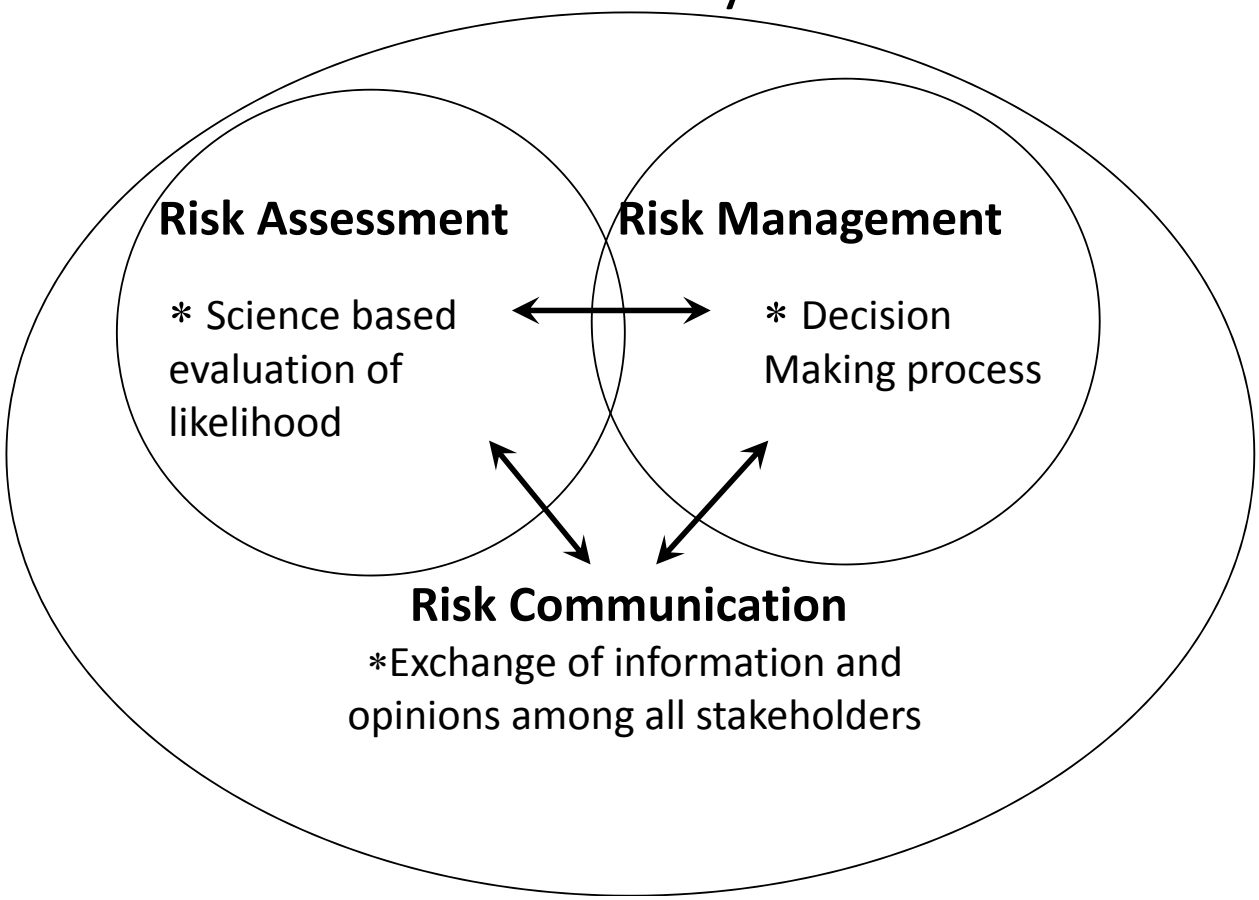
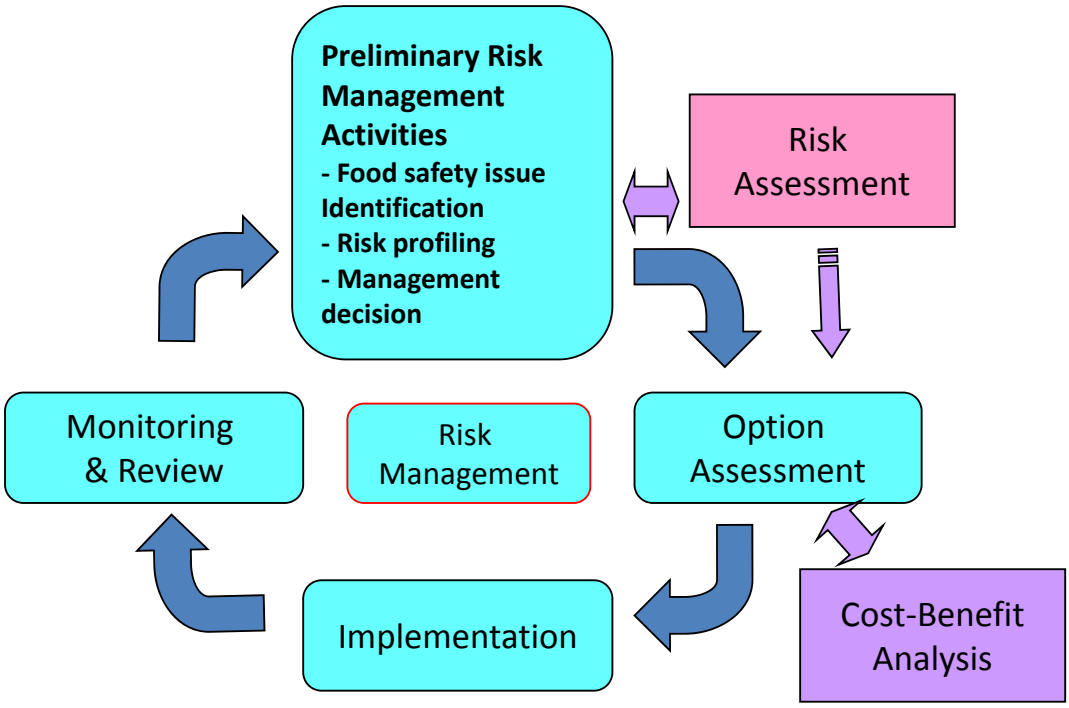
Dr. Fumiko Kasuga
Director, National Institute of Health Sciences



Risk Management Framework



Preliminary Risk Management Activities

- Recognition of food safety problems
- Preparation of risk profiles
- Consideration on the needs for risk assessments to be requested to the Food Safety Commission, and if yes, on the risk management questions

Food Poisoning Statistics (mostly outbreaks)

Year	Number of outbreaks	patients	fatality
2003	1,585	29,355	6
2004	1,666	28,175	5
2005	1,545	27,012	7
2006	1,491	39,026	6
2007	1,289	33,477	7
2008	1,369	24,303	4
2009	1,048	20,249	0
2010	1,254	25,972	0
2011	1,062	21,616	11

※Most of causative agents for fatality cases are natural toxins, such as puffer fish toxin (tetorodotoxin) and phytotoxin

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Annual trends in patient numbers by pathogens (mainly microorganisms)

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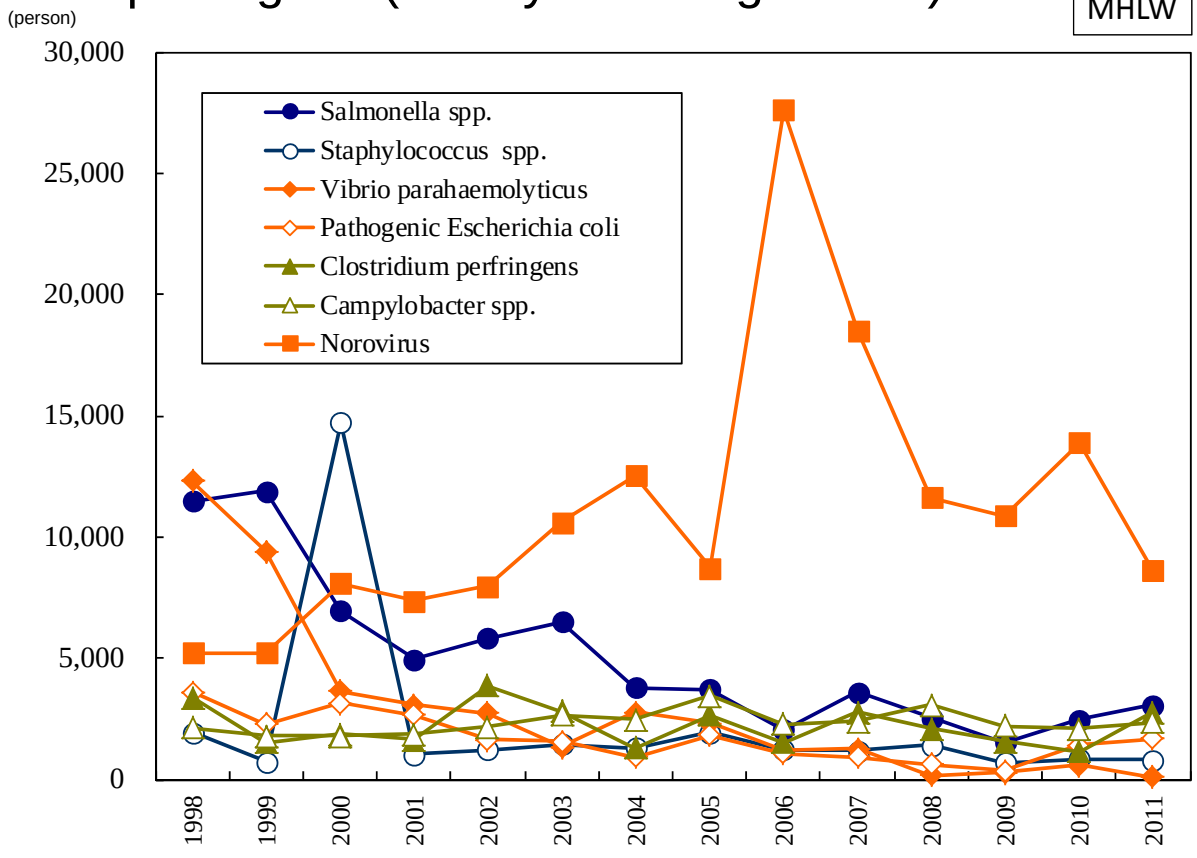


Different laws, different statistics

- Enterohaemorrhagic *E. coli* (VT-positive) infections (2010)

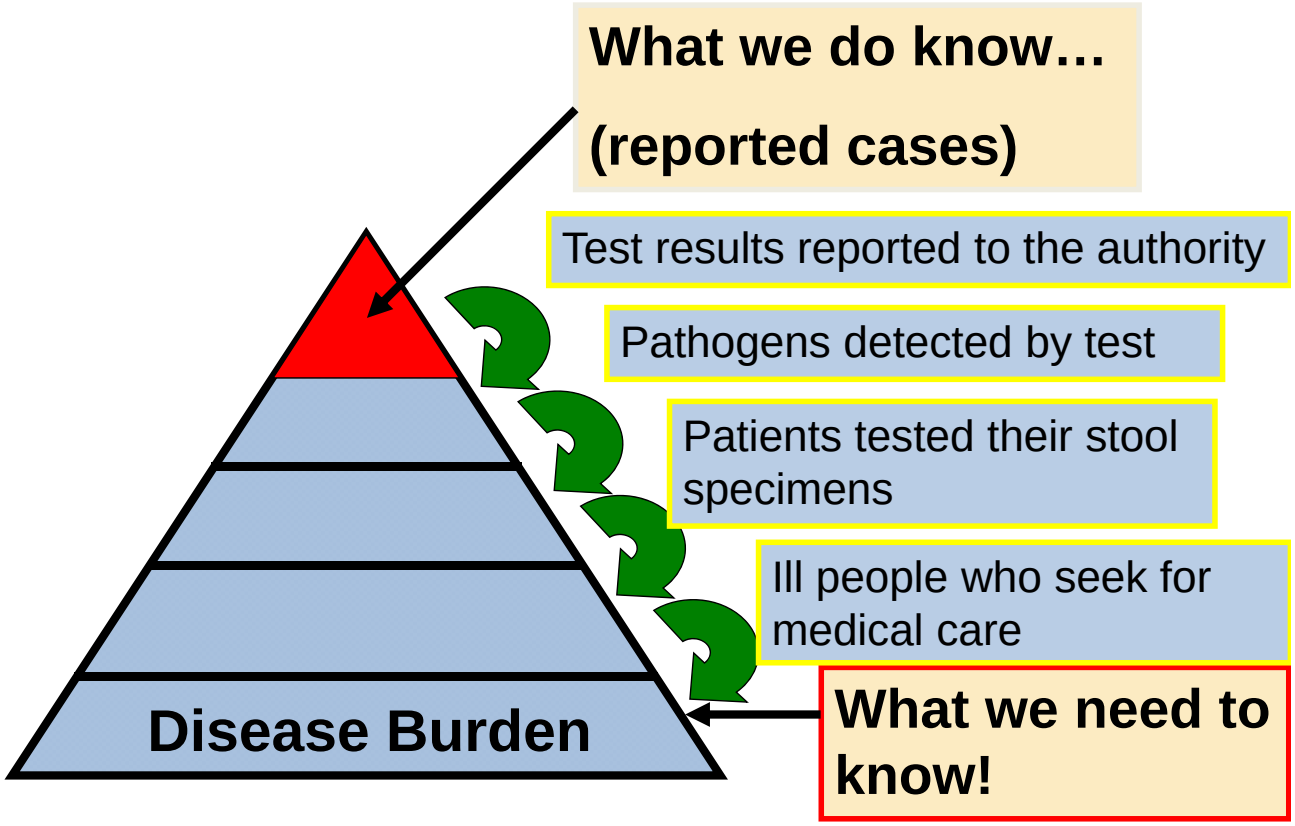
Food Sanitation Law	Infectious Diseases Law
358	2, 719*

* only symptomatic, including infections from other sources than foods

- *Salmonella* infections (2010)

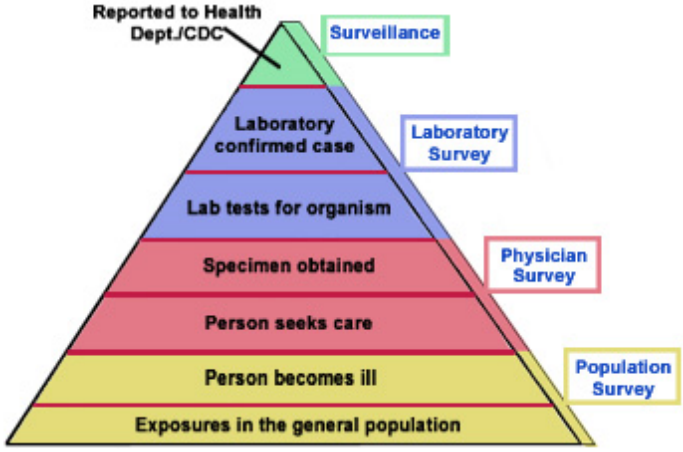
Food Sanitation Law	Infectious Diseases Law
2, 476	904

Reporting Foodborne Diseases



Estimating the burden of illnesses

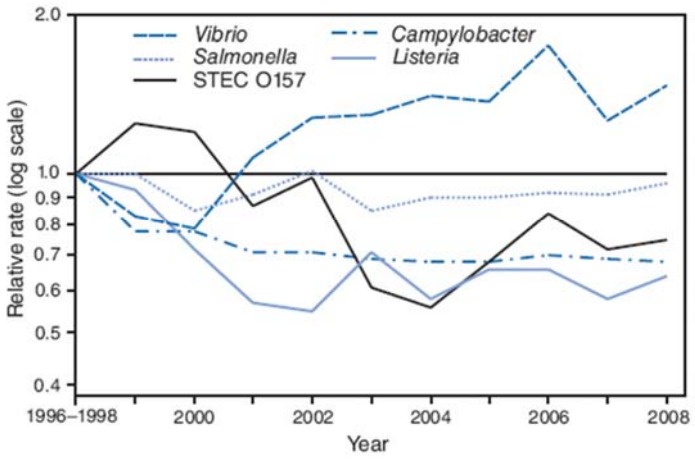
US FoodNet



Burden of Illness Pyramid (http://www.cdc.gov/foodnet/)

FoodNet - active, population-based surveillance for laboratory-confirmed cases in USA

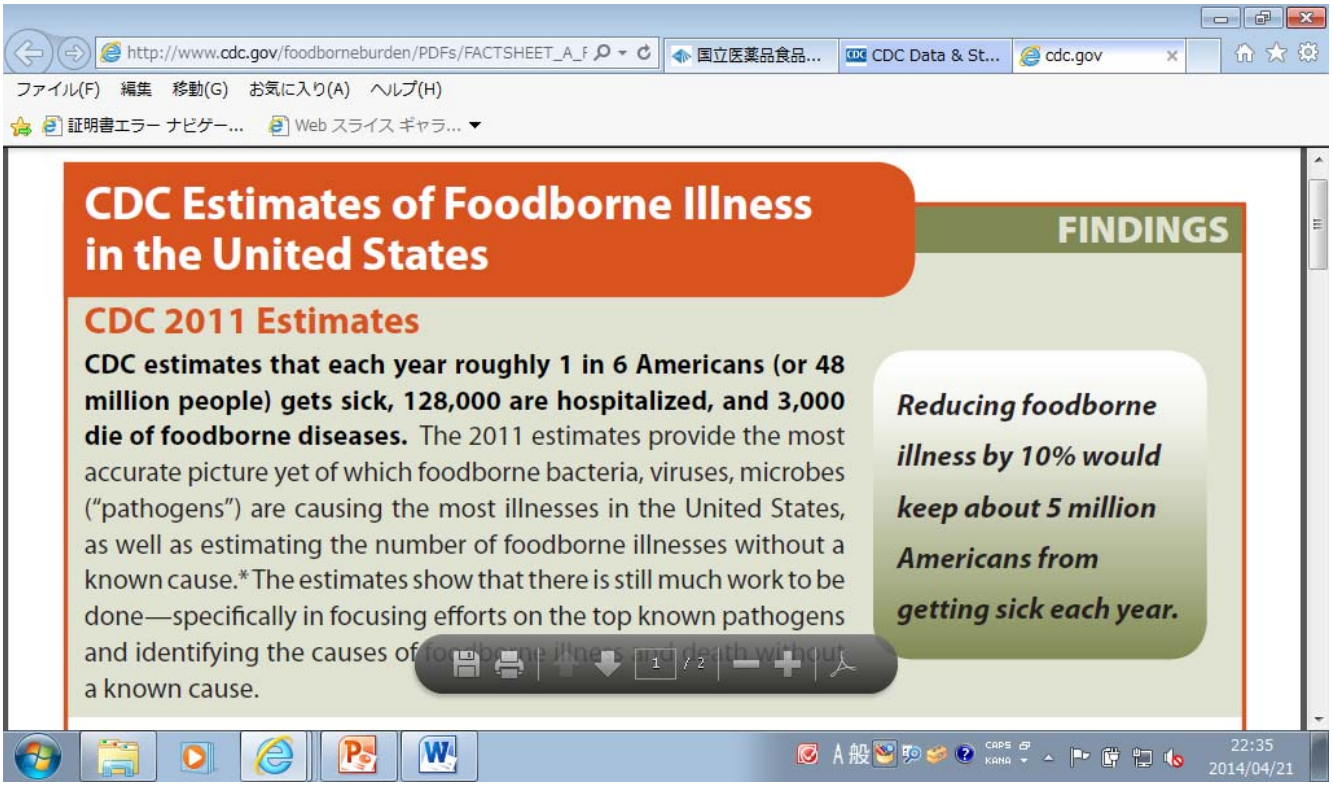
FIGURE 2. Relative rates of laboratory-confirmed infections with *Vibrio*, *Salmonella*, STEC* O157, *Campylobacter*, and *Listeria* compared with 1996–1998 rates, by year — Foodborne Diseases Active Surveillance Network, United States, 1996–2008†



* Shiga toxin-producing *Escherichia coli*.
† The position of each line indicates the relative change in the incidence of that pathogen compared with 1996–1998. The actual incidences of these infections can differ. Data for 2008 are preliminary.

MMWR April 10, 2009 / 58(13);333-337

- Estimated on the data from participating sites (10 states)
- Determine the frequency and severity of foodborne diseases in the United States
- Determine the proportion of foodborne diseases attributable to specific foods and settings



A pilot study in Miyagi Prefecture

- Miyagi Prefecture
- Size: 6,861km^2
- Population: 2.36 million (ca. 2% of Japanese population)
- Clinical laboratories run by Miyagi Medical Association have certain share in the Prefecture and had agreed to collaborate

Kubota, Kasuga *et al.* by research grants from MHLW

Study design

Burden of illness in Miyagi prefecture, Japan, associated with *Vibrio parahaemolyticus, Campylobacter*, and *Salmonella* was estimated based on the lab confirmed cases.

Laboratory-confirmed cases per year in two clinical labs

- *Vibrio parahaemolyticus* (*Vp*) : 36 (2005) 27 (2006)
- *Campylobacter* : 542 576
- *Salmonella* : 75 43

The labs conduct about 50% of stool sample tests performed in Miyagi prefecture.

The sensitivities of the test methods utilized in these labs were assumed as 100%.

Kubota, Kasuga *et al.* by research grants from MHLW

Telephone population surveys in Miyagi Prefecture

Telephone survey dates:	**22 Nov - 4 Dec 2006**	**14 Jul - 27 Jul 2007**
Response rate:	**21.2%(2,126/10,021)**	**17.7%(2,121/11,965)**
Acute GI rate:	**3.3%(70/2,126)**	**3.5%(74/2,121)**
Physician consultation rate:	**38.6% (27/70)**	**31.1%(23/74)**
Stool submission rate:	**14.8% (4/27)**	**8.7%(2/23)**

Case definition :

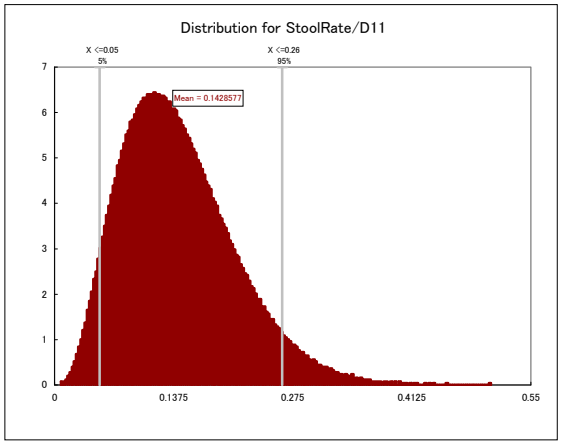
>3 diarrhea in 24 hours, vomiting and/or bloody diarrhea

Kubota, Kasuga *et al.* by research grants from MHLW

Estimation of Stool Sampling Rate and Physician Consultation Rate (2006 Tele-surv data) [Data weighted by population distribution]

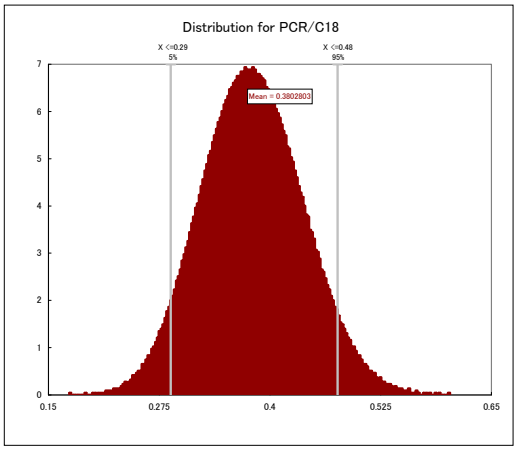
Estimated Stool Sampling Rate

Beta(5,24) mean=14.3%
5%tile=5.2%, 95%tile=26.3%



Estimated Physician Consultation Rate

Beta(28,44) mean=38.6%
5%tile=28.8%, 95%tile=47.6%



Kubota, Kasuga *et al.* by research grants from MHLW

A comparison between the estimation of the burden of foodborne disease and patients of foodborne statistics in Japan, from 2005 to 2009

Causative agents	year	the estimation of the burden of foodborne disease※	patients of food poisoning statistics
Vibrio.parahaemolyticus	2005	83,312	2,301
	2006	62,579	1,236
	2007	55,541	1,278
	2008	18,568	168
	2009	13,912	280
Campylobacter. spp	2005	1,545,363	3,439
	2006	1,641,396	2,297
	2007	1,494,152	2,396
	2008	1,328,177	3,071
	2009	1,079,540	2,206
Salmonella .spp	2005	253,997	3,700
	2006	145,512	2,053
	2007	165,867	3,603
	2008	176,098	2,551
	2009	118,608	1,518

* Assumed to be the same as in the US

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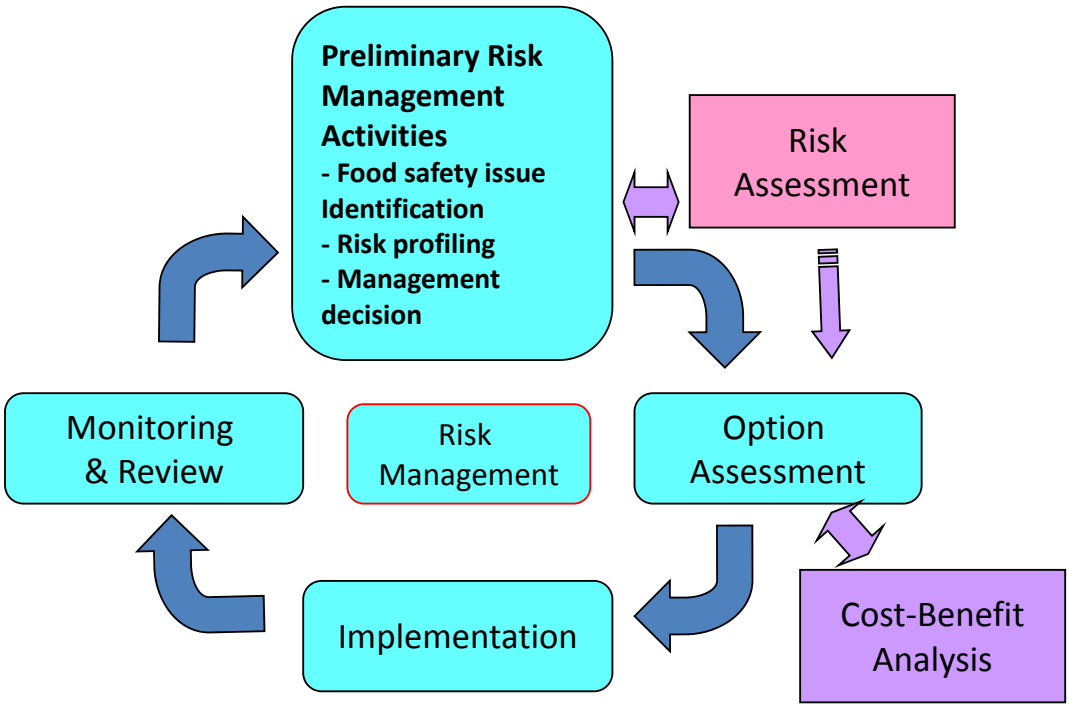
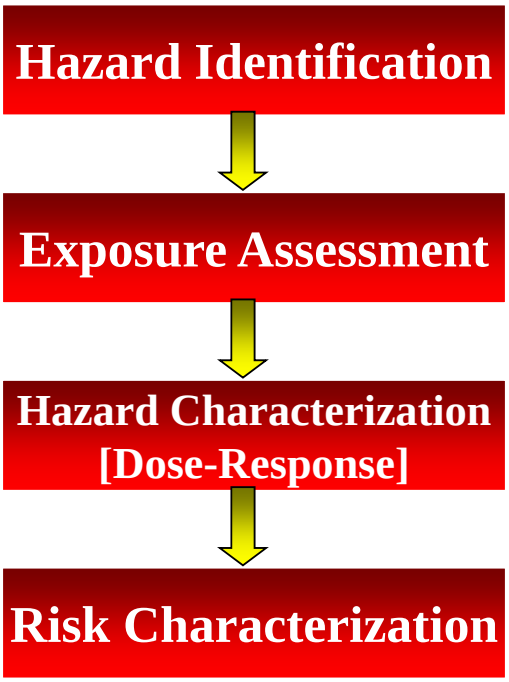
Challenges 1

- Under-reporting in government statistics
- Complementary studies
- Sample size and small numbers
- Attribution, *e.g.* proportion of foodborne, sometimes requires expert elicitation

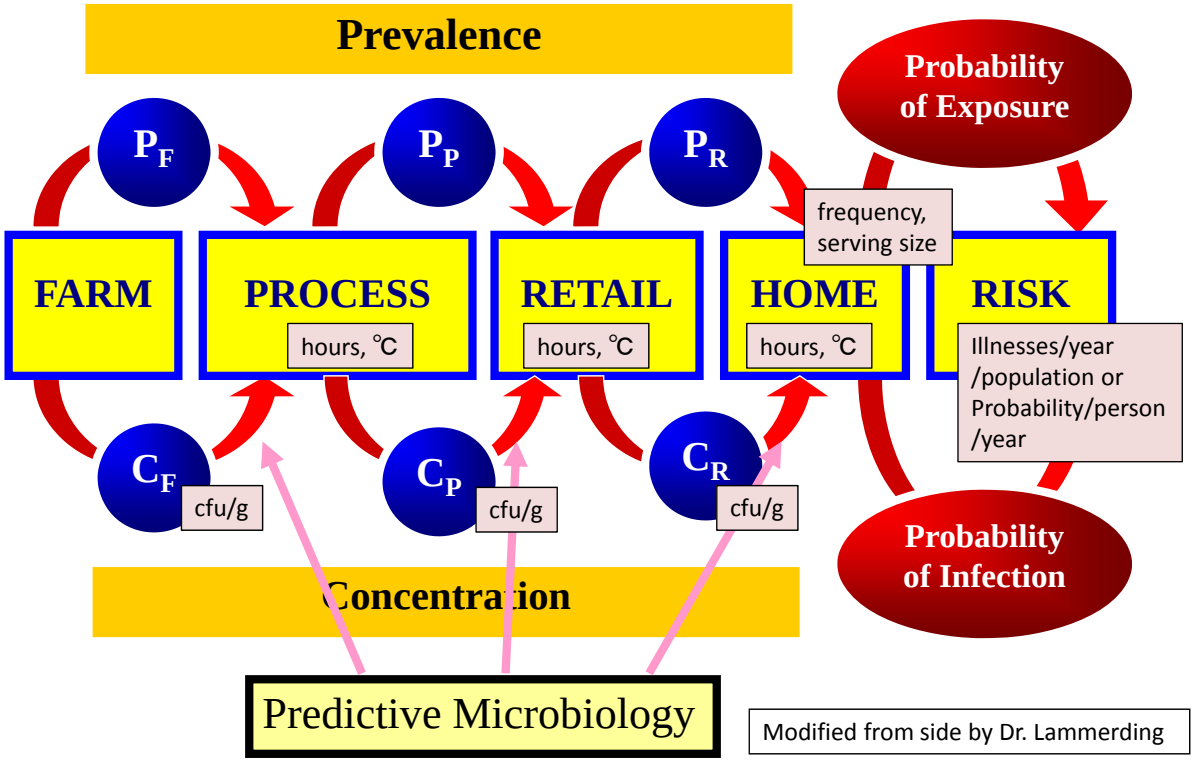
Risk Management Framework



Risk Assessment Framework

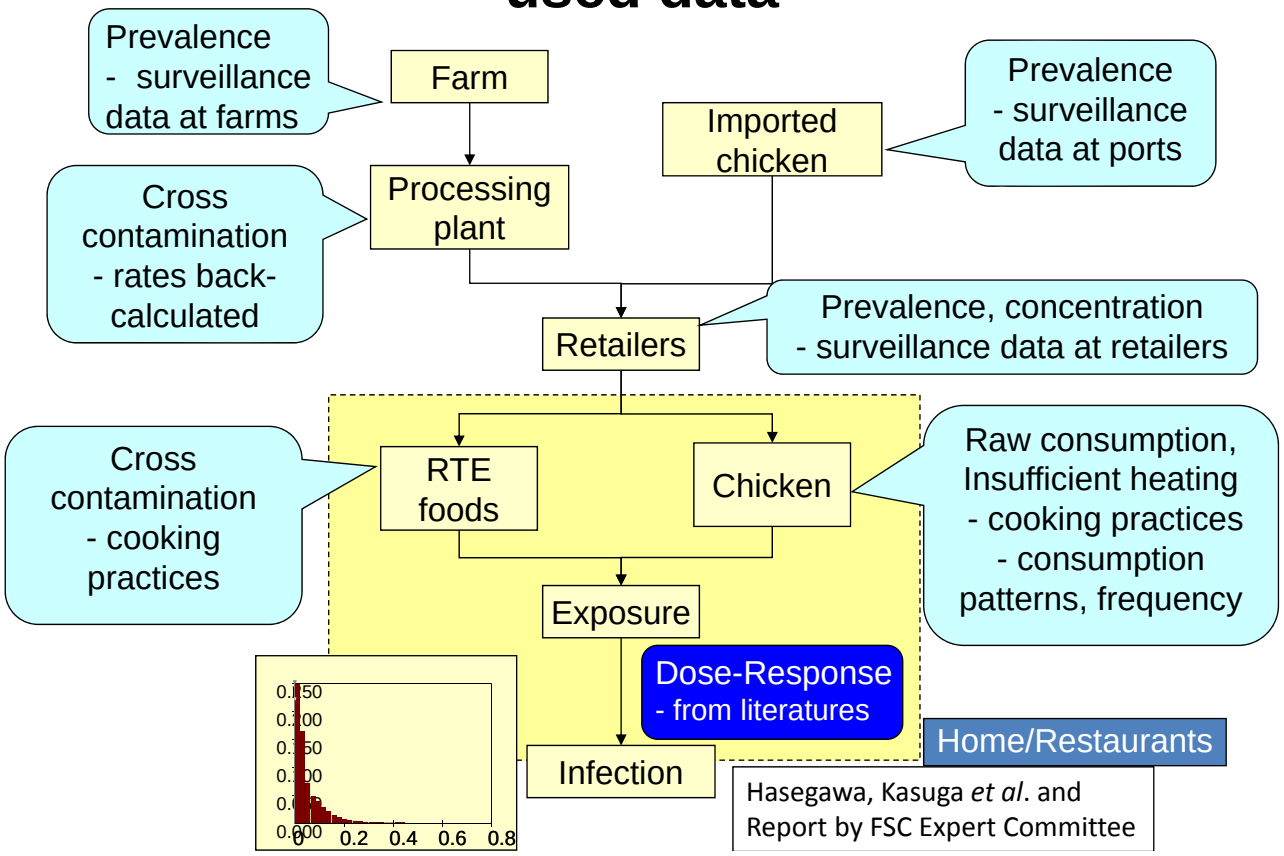


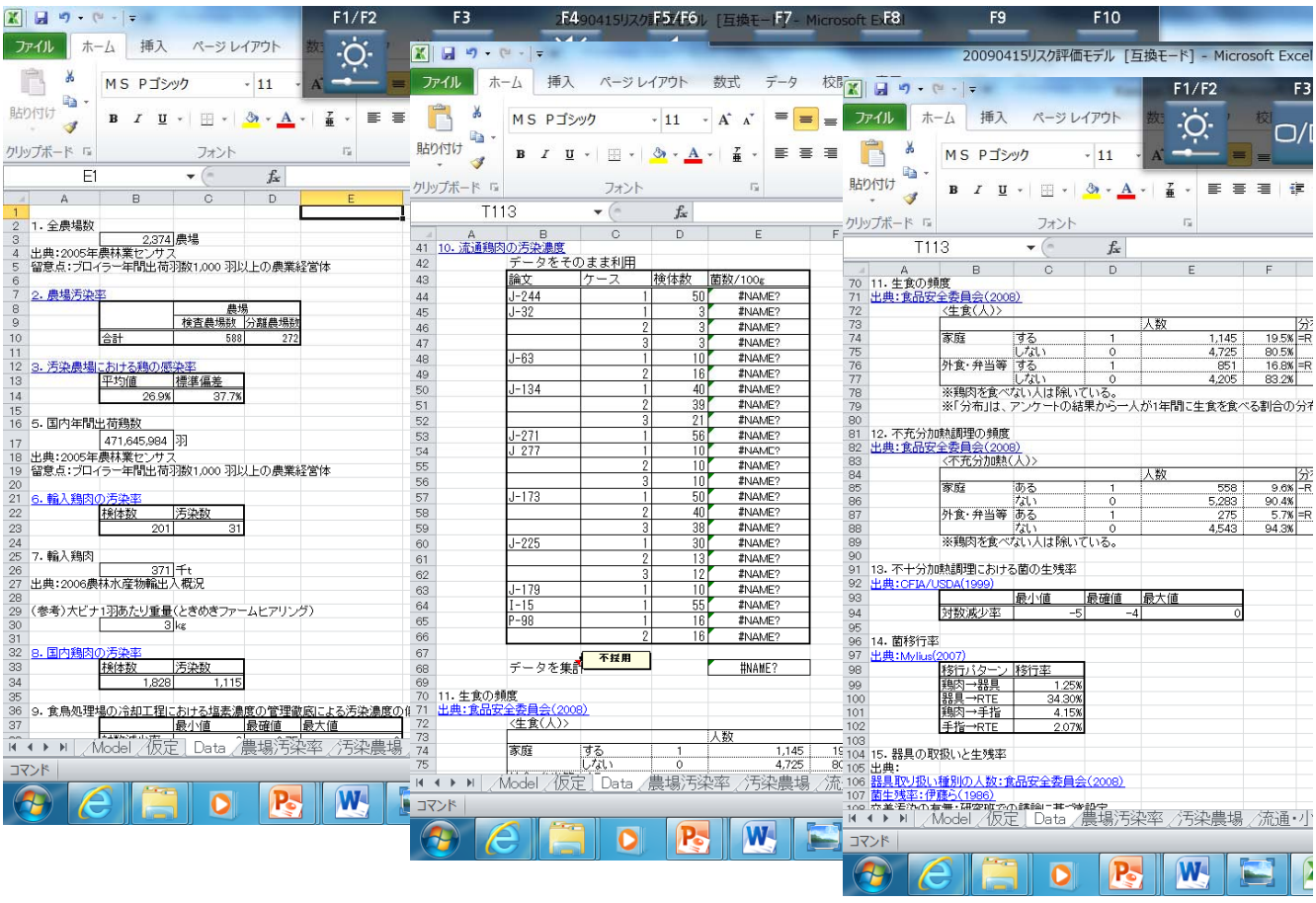
Microbiological Risk Assessment



Modified from side by Dr. Lammerding

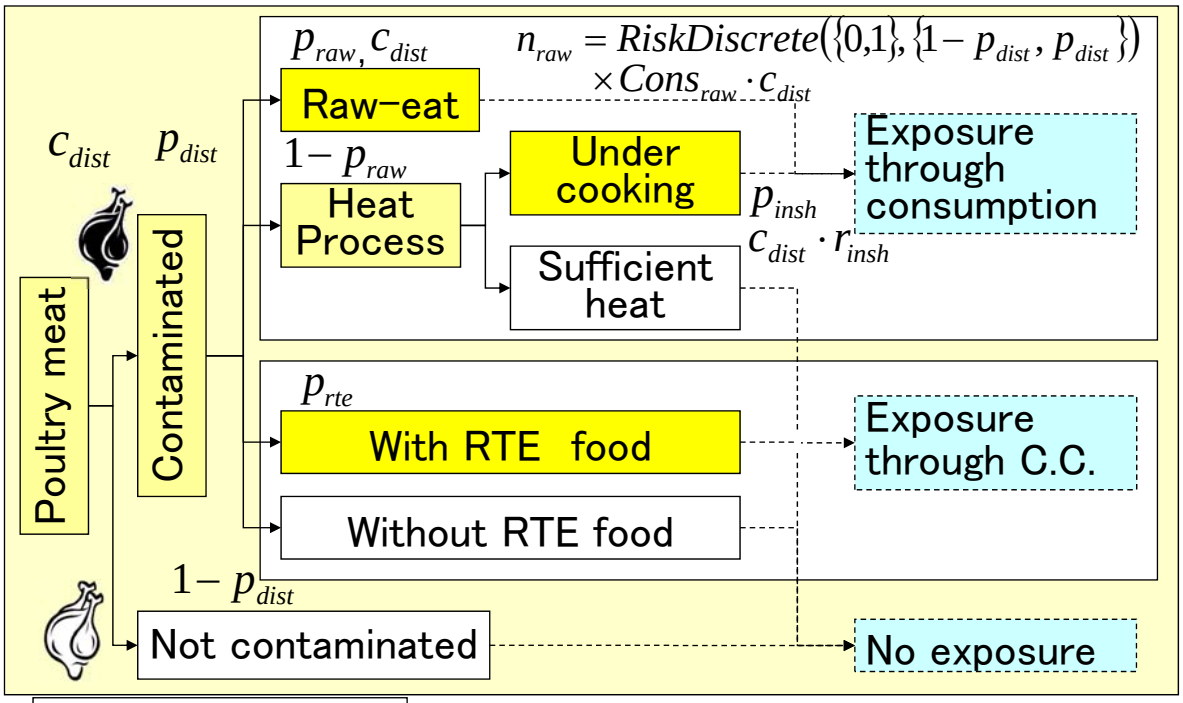
Campylobacter risk assessment model and used data





Cooking & Consumption stage

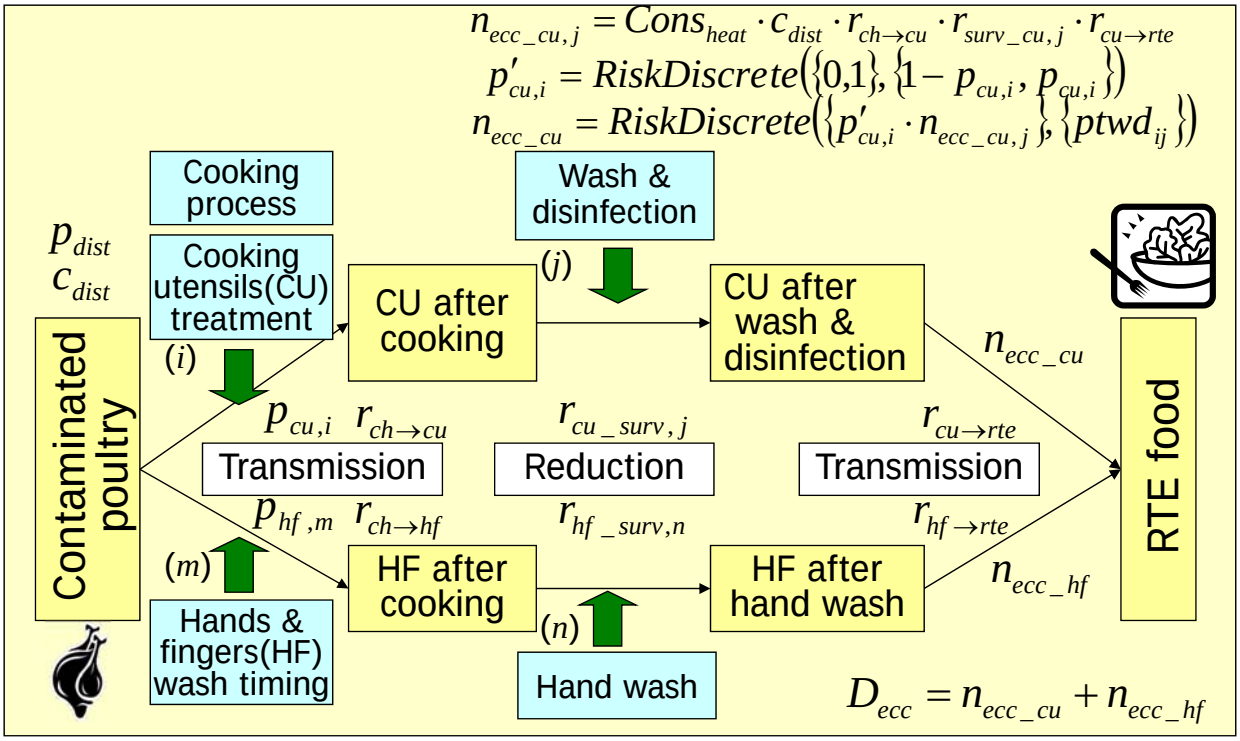
in *Campylobacter* risk assessment



Slide by Dr. A. Hasegawa

Exposure model of cross contamination during cooking

in *Campylobacter* risk assessment



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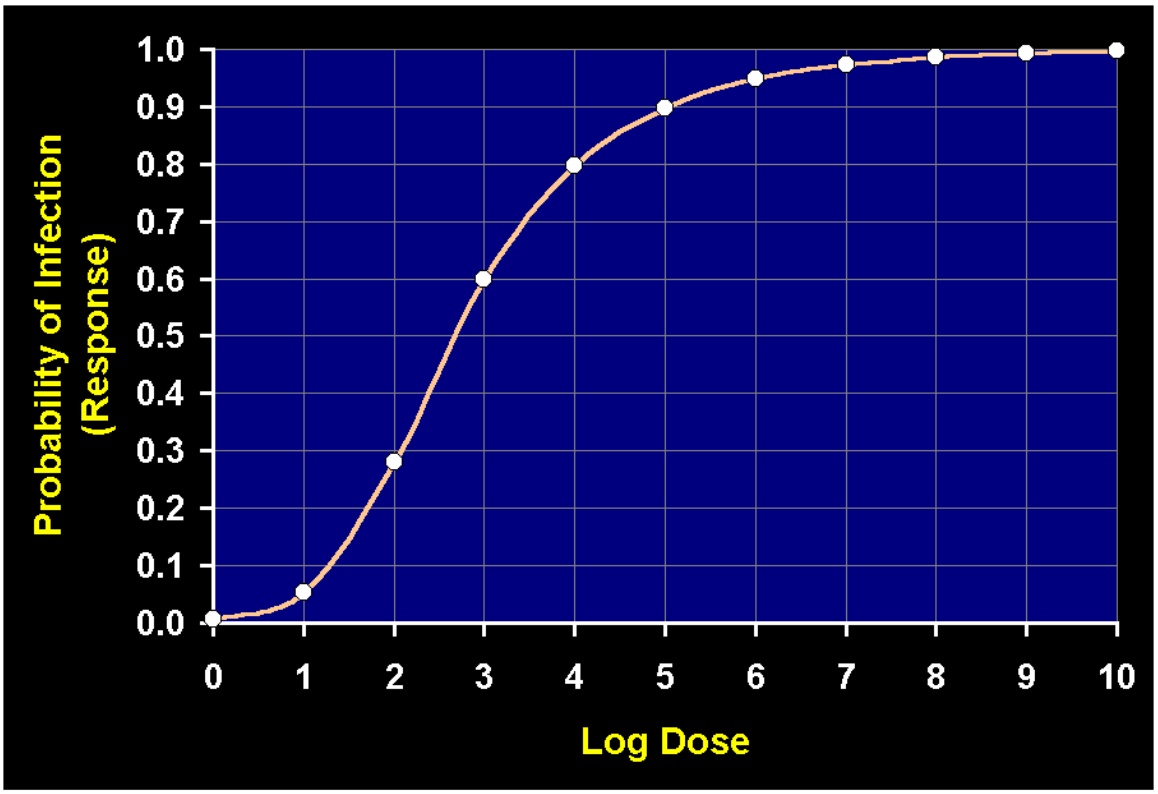
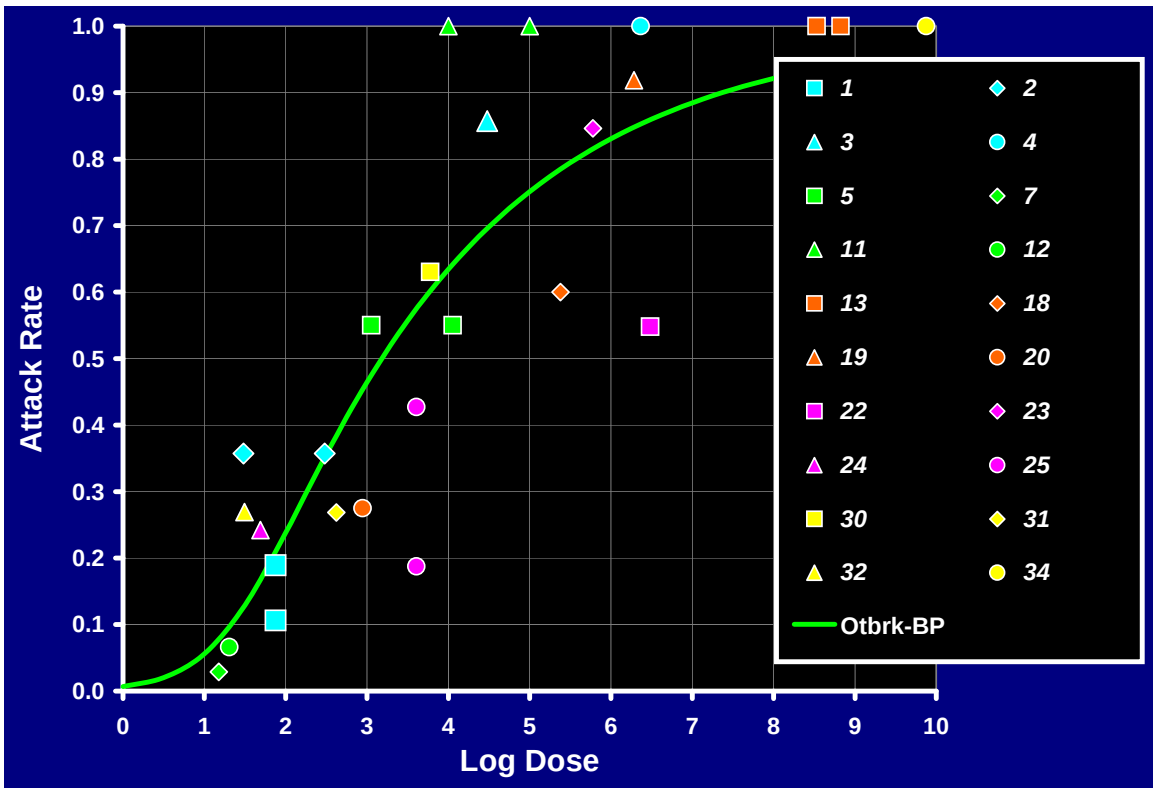
Dose Response



Beta-Poisson model using outbreak data



Comparison of various kinds of data for dose–response models

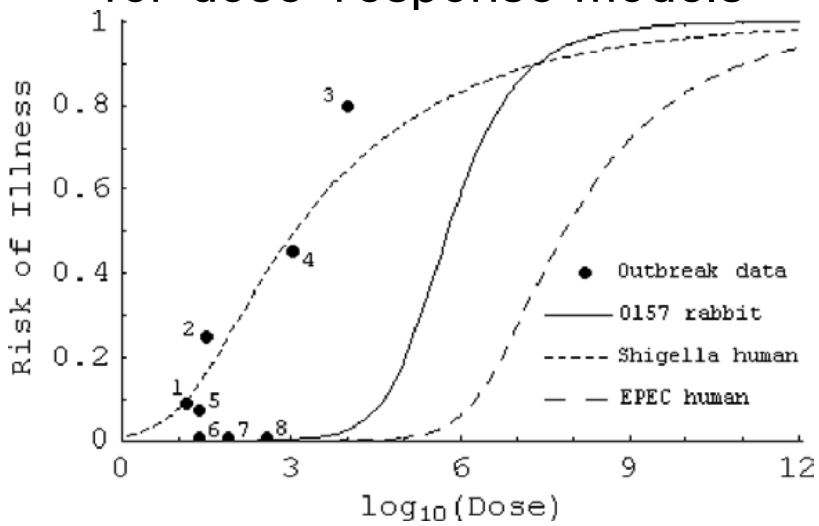
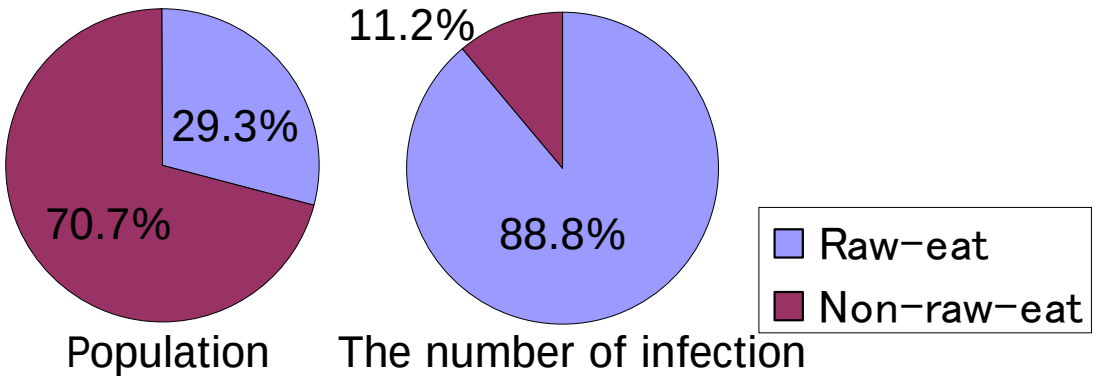


Fig. 1. Beta-Poisson dose response models for animal/human feeding studies with outbreak data superimposed ([1] UK, New Deer, [2] Japan, Morioka, [3] USA, Oregon, [4] Japan, Kashiwa, [5] USA, Washington, [6] USA, California/Washington, [7] USA, Illinois and [8] UK,Wyre).
Strachan, Doyle, Kasuga et al., International Journal of Food Microbiology 103 (2005) 35– 47

Result of *Campylobacter* risk assessment

- The number of infection per year

- "Raw-eat" consumers, only 30% of population, account for ca. 90% of the number of infection
- Ave. times of individual infection per year: Raw-eat consumers(3.5) are 19 times higher than non-raw-eat consumers(0.18)

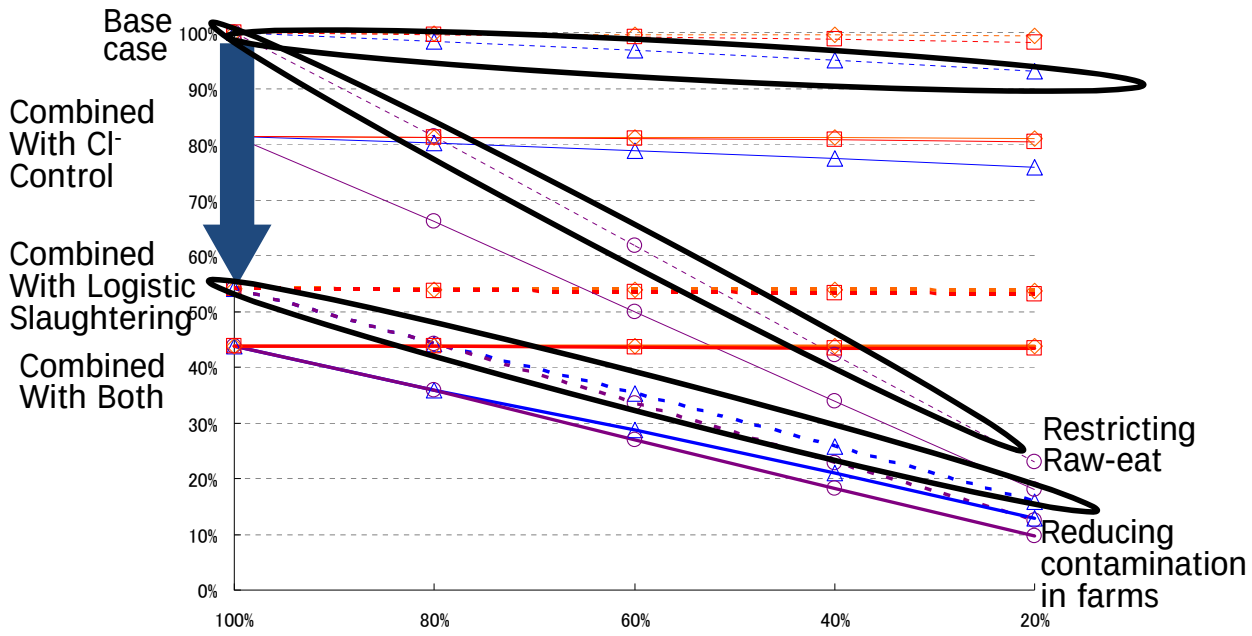


Slide by Dr. A. Hasegawa

Effects of risk reduction measures

Effects to "raw-eat" consumers

in *Campylobacter* risk assessment



Slide by Dr. A. Hasegawa

Challenges 2

- Quality data is more available but less quantitative data
- Sample size and small numbers
- Usefulness of behavioural data
- Restriction in obtaining data from industries or even from local governments
- Data for dose-response analysis: limited outbreak data, even few or less applicable animal experimental data