Importance of Codex's Quantitative, Risk-Based Metrics and Innovation

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Since 1962

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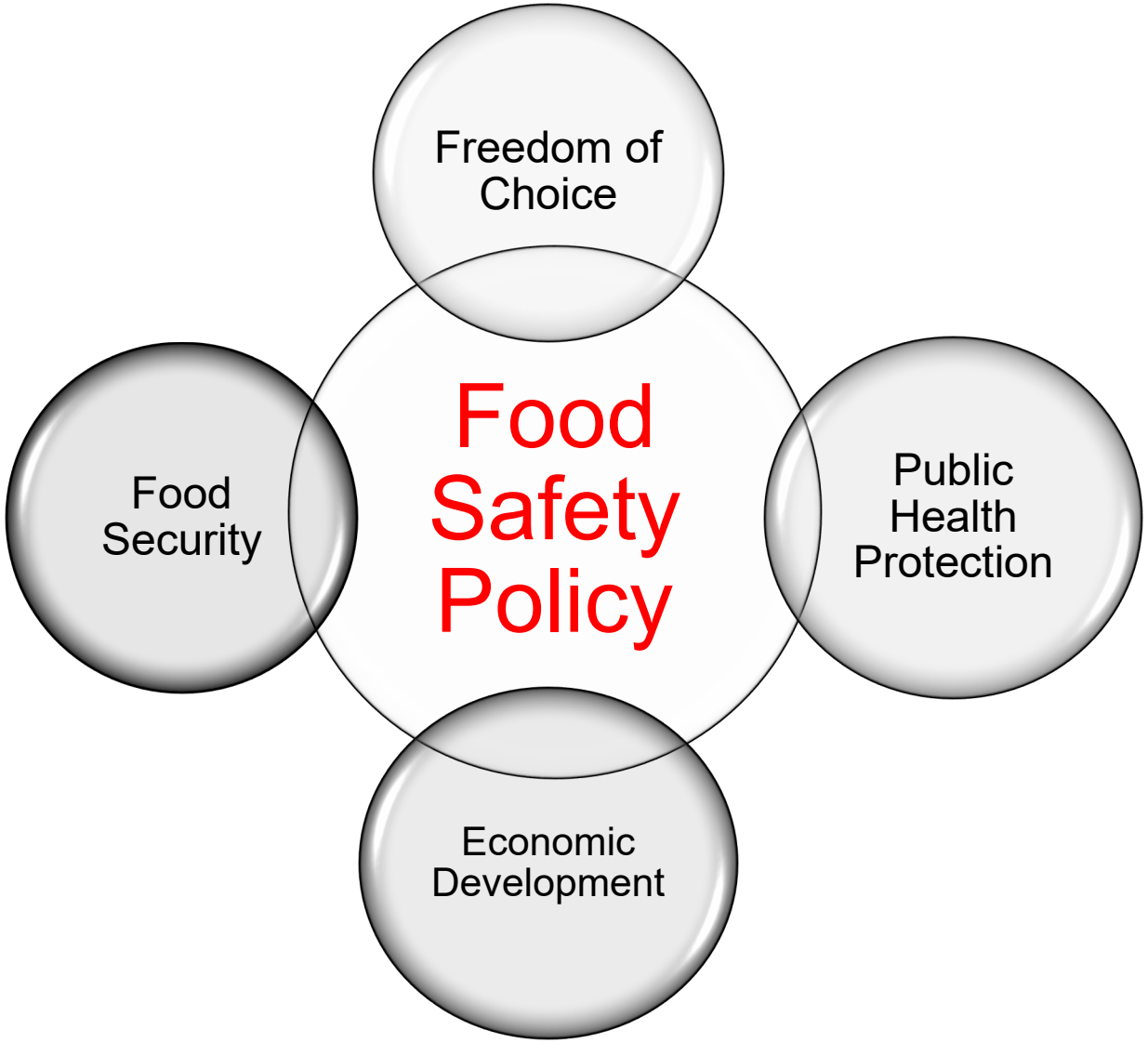
Responsibility of Governments as it Relates to Food Safety



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Codex: Microbiological Risk Management - Annex II 2007

Traditional Metrics

- *Product criterion (PdC)*
  - Chemical and physical characteristics of a food
- *Process criterion (PcC)*
  - Specific treatment for safety
- *Microbiological criterion (MC)*
  - Acceptability of a 'lot' of food or verification of a process
- Food Safety Objective (FSO)
  - maximum frequency and/or concentration of a pathogen in a food at the time of consumption that provides or contributes to the ALOP
- Performance Objective (PO)
  - maximum frequency and/or concentration of a microbiological hazard in a food at that point in the food chain
- Performance Criterion (PC)
  - outcome that should be achieved by a control measure or a series or a combination of control measures

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Example: Product and Process Criteria

PdC
a_w <0.6

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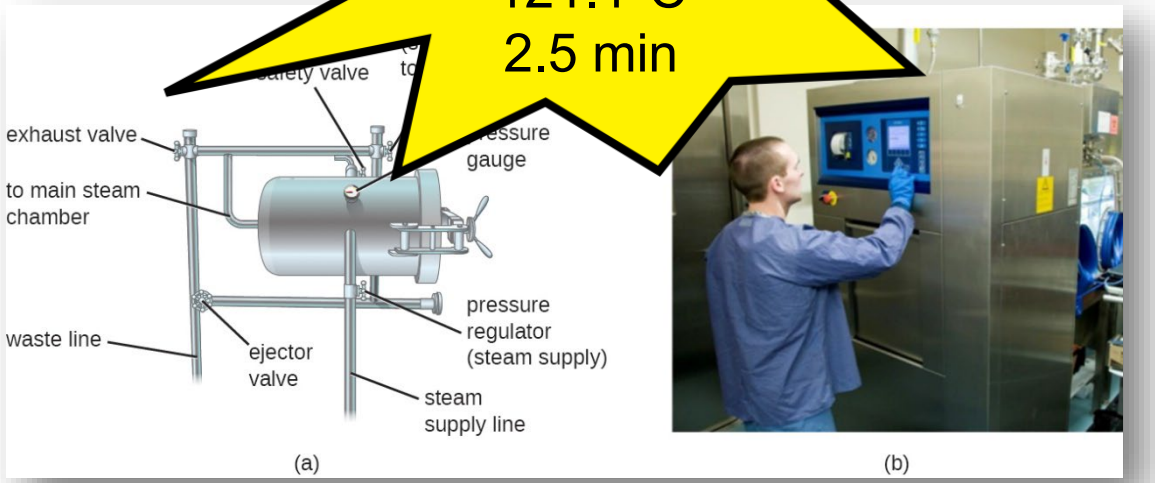
PcC
121.1°C
2.5 min



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Reg. 2073/2005: Micro Criteria

Food category	Micro-organisms/their toxins, metabolites	Sampling plan (1)		Limits (2)		Analytical reference method (3)	Stage where the criterion applies
		n	c	m	M		
1.5 Minced meat and meat preparations made from poultry meat intended to be eaten cooked	*Salmonella*	5	0	Absence in 25 g		EN/ISO 6579	Products placed on the market during their shelf-life

e.g. turkey mince, chicken sausages, Chinese-style duck breasts

What the lab tests for

No. samples to test

Result

Lab testing method

Where samples should be taken

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'Newer' Metrics

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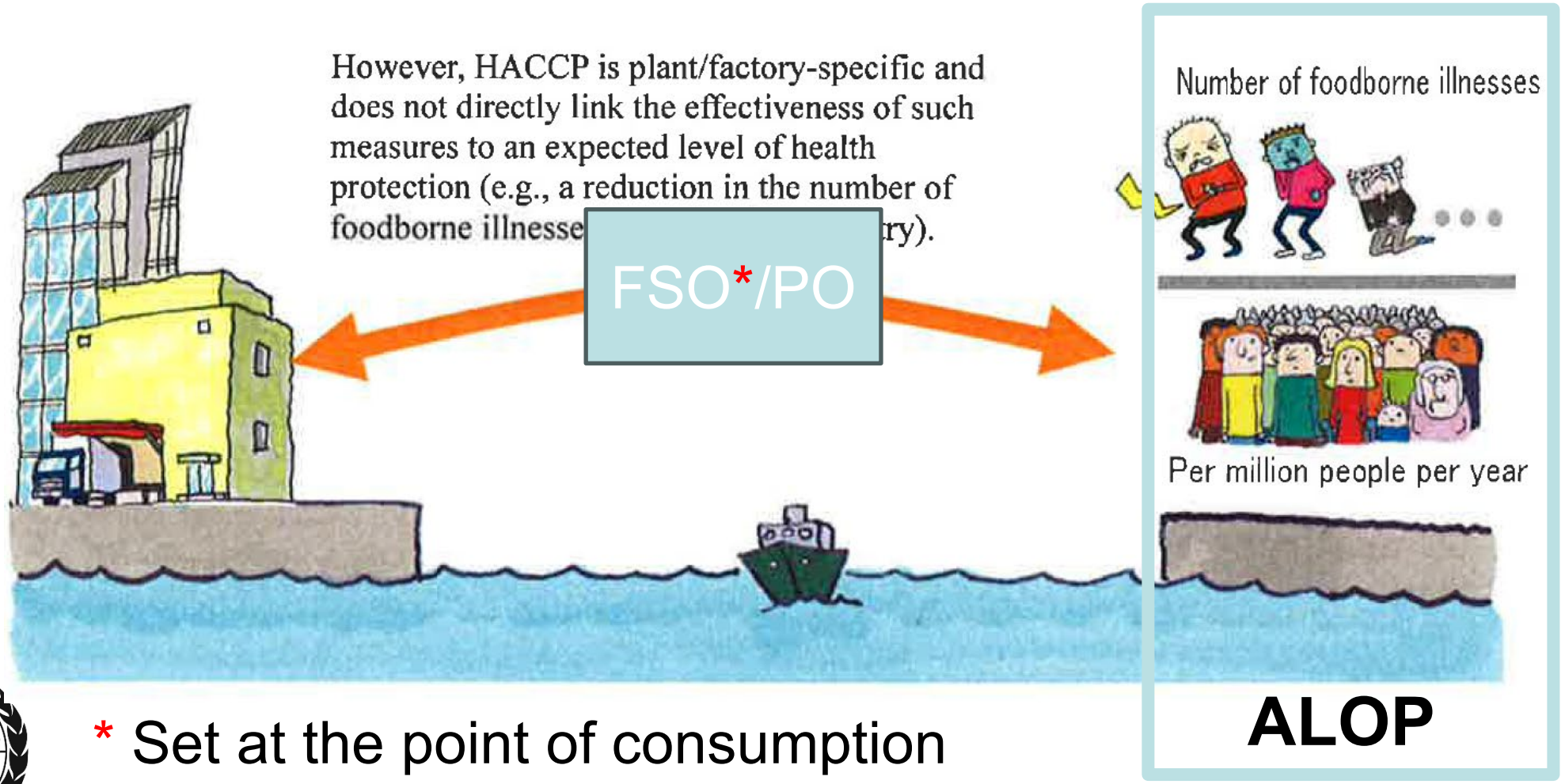
What we are trying to achieve



* Set at the point of consumption

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SPS Agreement and the Appropriate Level of Protection

Sanitary and Phyto-Sanitary Agreement (SPS) Annex A: Definitions No. 5:

"Appropriate level of sanitary or phytosanitary protection — The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory."

- NOTE: Many Members otherwise refer to this concept as the "acceptable level of risk".

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Problems with the ALOP Concept

- Expression : Qualitative or Quantitative (SPS Agreement)
- Qualitative examples exist but are vague
  - e.g. “A high level of protection of human life and health should be assured in the pursuit of Community policies.” EU General principles of food law 178/2002
- Quantitative examples don’t seem to exist at Government level

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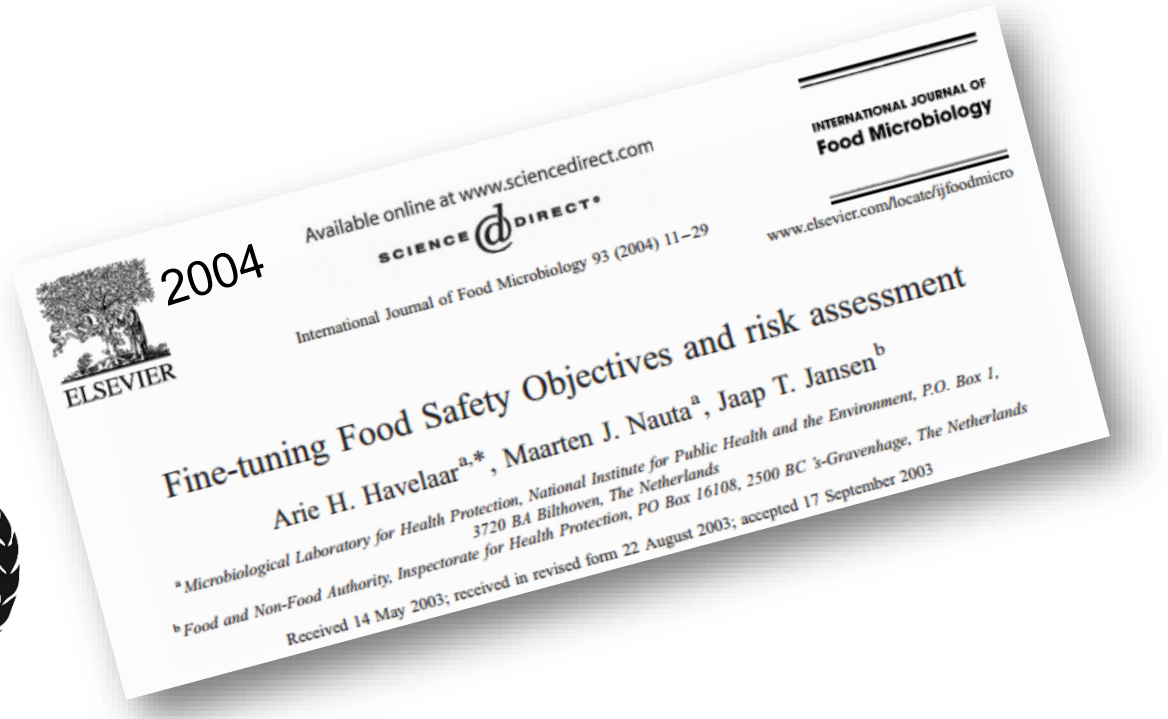
To set an FSO you need a Quantified ALOP

- "A common factor in all documents [Kiel MRM 2000, 2002] is that the ALOP is preferably expressed as the (allowable) incidence of illness in a certain exposure scenario (per 100,000 population per year, per 10,000 servings, etc.)."

- "the ALOP would be specified as the maximum incidence of illness or infection in a population that is considered tolerable under the current conditions"



Current conditions e.g.:

- Food safety controls
- Population variability
- Food consumption patterns

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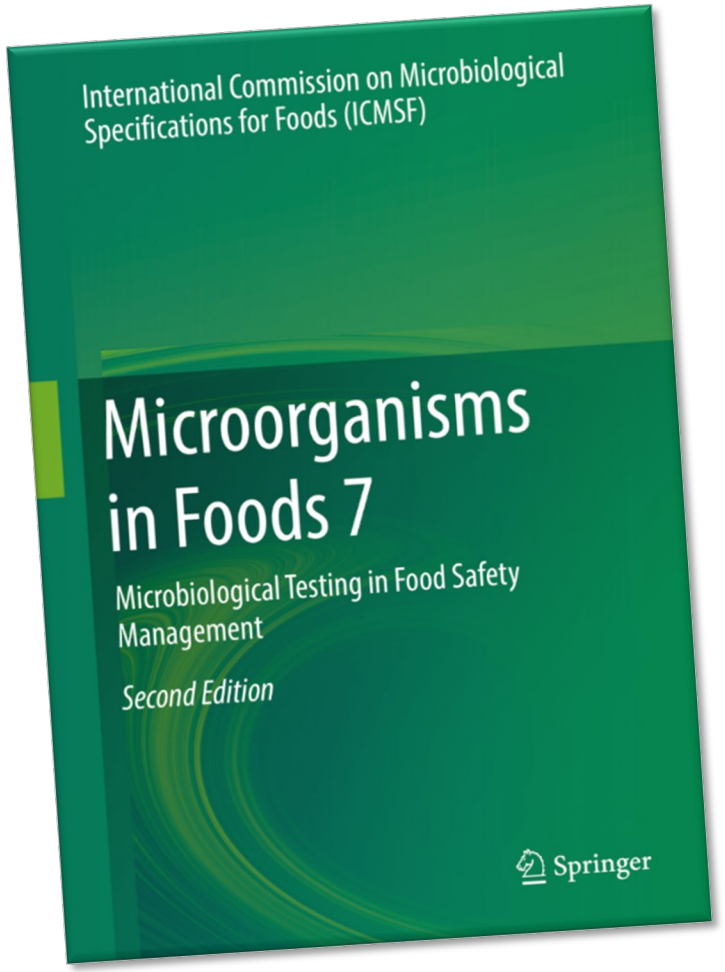
Illustration: How ALOP, FSO and POs could be set to control *Campylobacter* in Chicken.



Chapter 19
Campylobacter in Chicken Meat

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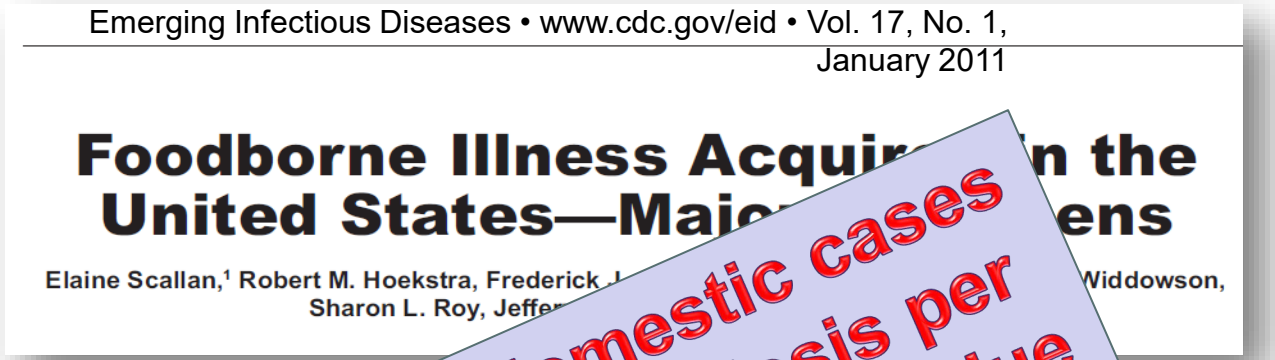
Example: Quantified ALOP for *Campylobacter* in Chicken meat


Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 17, No. 1, January 2011

Foodborne Illness Acqui n the United States—Maj ens

Elaine Scallan,[1] Robert M. Hoekstra, Frederick J Widdowson, Sharon L. Roy, Jeffe

ALOP= 848 domestic cases of campylobacteriosis per million population USA due to consumption of broiler meat

Good Quantified Epidemiological Evidence

orne cases campylobacteriosis
26 cases / million population)


Sci osed by broiler meat to s in the EU[1]

gical Hazards (BIOHAZ)[2,3]

Food Safety Authority (EFSA), Parma, Italy

Good Quantified Attribution Evidence

"Handling, preparation and consumption of broiler meat may account for 20% to 30% of human cases of campylobacteriosis"

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Relating FSO to ALOP

ALOP = **S *1E6*r* D** ⟹ Dose (cfu) =M* (10^{FSO})

Where:
ALOP = the Appropriate level of protection (cases per million population)
S = number of servings of chicken consumed per person per year
r = the probability of illness following ingestion of one *Campylobacter* cell
D = the dose (number of *Campylobacter* cells) consumed on an eating occasion

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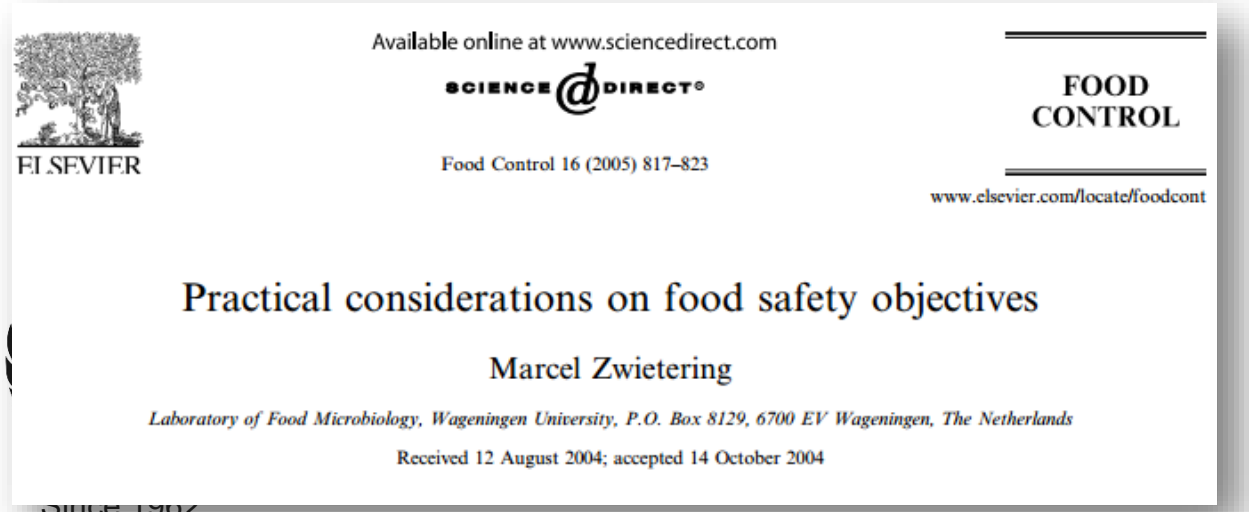
Relating FSO to ALOP Needs Data

ALOP
848 cases/million population

Consumption data
1. Number of servings per person per year **(S)**
2. Mass of chicken consumed per person per serving **(M)**

$$FSO = Log_{10}(ALOP/(S * 1E6 * r * M))$$



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Food Control 16 (2005) 817–823

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Practical considerations on food safety objectives

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Received 12 August 2004; accepted 14 October 2004

Dose Response data
1. Probability of infection given consumption of 1 bacterium **(P_{inf})**
2. Probability of illness given infection **(P_{ill})**

Example: FSO for *Campylobacter* in Chicken meat

Calculate 'FSO'

$$FSO = Log_{10}(ALOP/(S * 1E6* P_{ill}*P_{inf} * M))$$

$$\mathbf{FSO = Log_{10}(848 / (106 * 1E6 * 0.33 * 0.0035 * 100))}$$

FSO= -4.16 log_{10} cfu/g
(geometric mean 1cfu per ~14.5kg *cooked* broiler meat)

Where
M=100 g/person/serve – Irish food consumption data
S=106 serves/year/person– Irish food consumption data
ALOP = 848 cases/million population (slide 12)
Pill=0.33 - WHO/FAO *Campylobacter* RA dose response curve
Pinf=0.0035 - WHO/FAO *Campylobacter* RA dose response curve

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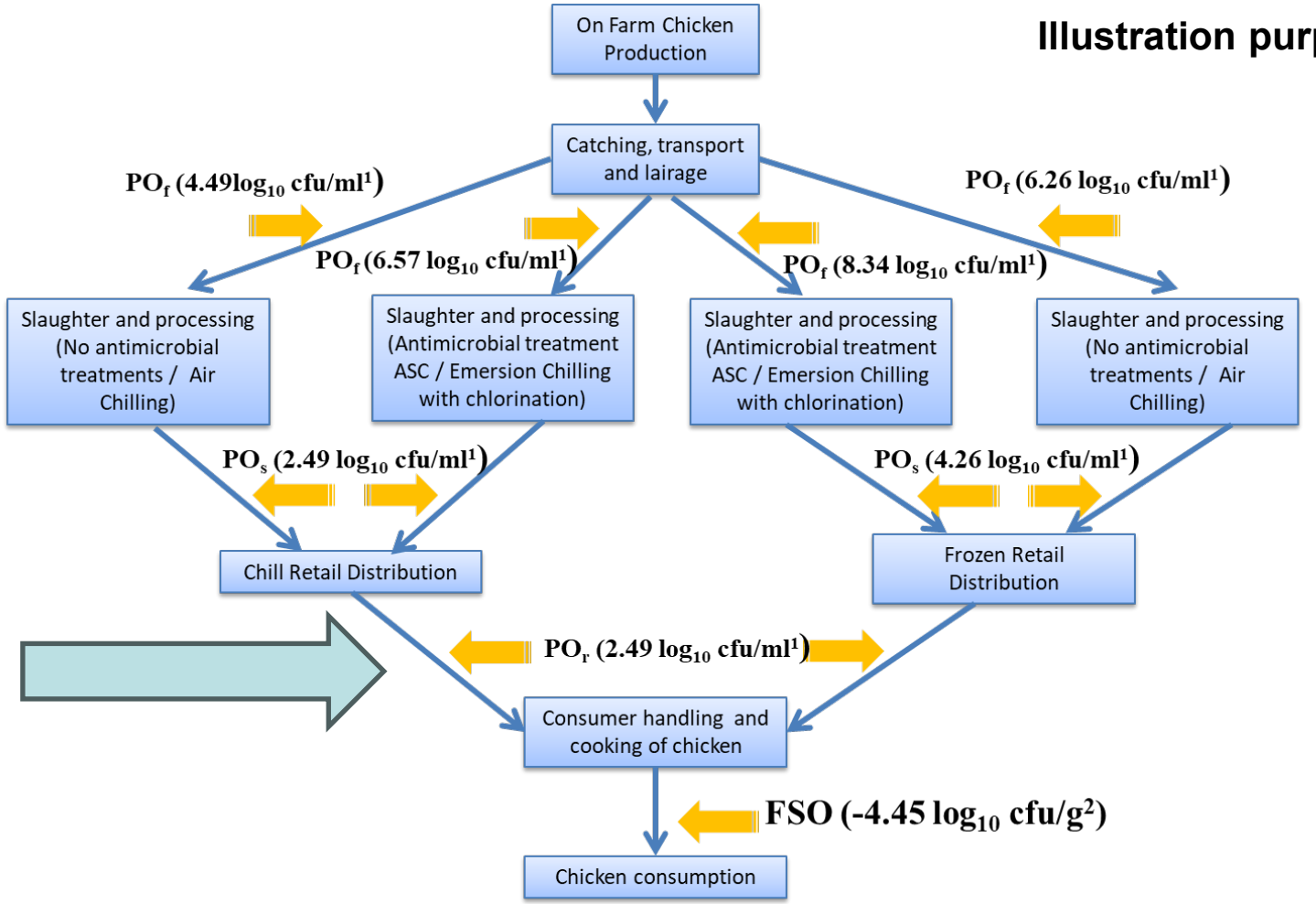
Farm to Fork Performance Objectives

Illustration purpose only



Opportunity to set a Micro-criterion to verify compliance

[1] per ml rinsate assuming testing by carcass rinse with100ml; [2] FSO per gram cooked chicken to meet the public health goal

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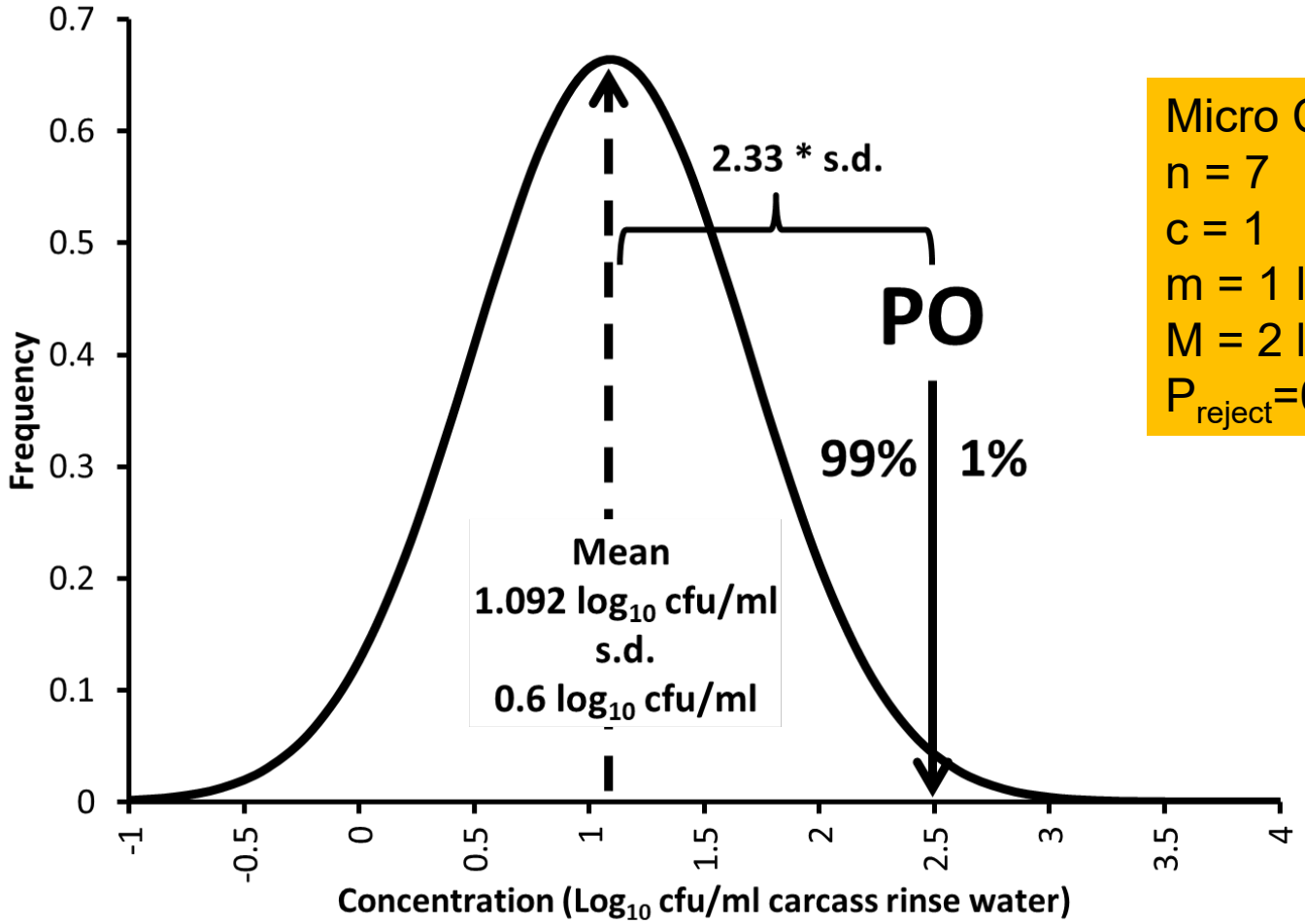
Verifying the PO at end retail with a Microbiological Criterion



Micro Criterion
n = 7
c = 1
m = 1 log cfu/ml
M = 2 log cfu/ml
P_{reject}=0.95

Illustration purpose only

Distribution of *Campylobacter* on chickens in a compliant batch

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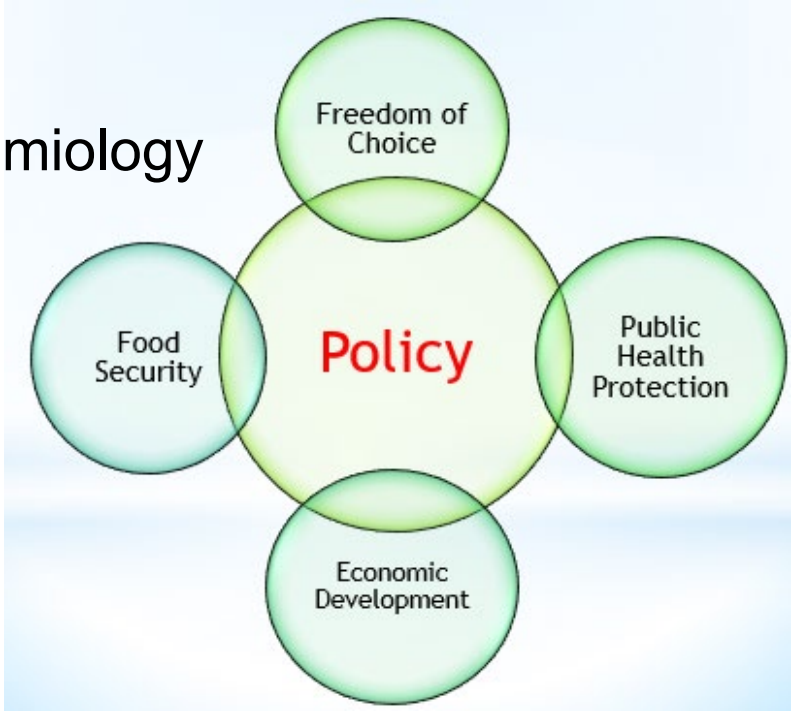
Thoughts on Barriers to Adoption of 'newer' RM Metrics by Governments

- Technical issues
  - Lack of good data on food-borne disease and epidemiology
  - Lack of attribution studies
  - Lack of good quantitative consumption data
  - Uncertainty in, or lack of dose response curves
  - Lack of quantitative data on steps in the food chain
- Political issues
  - Low Industry push and no public pull
    - Smaller industry lacks technical ability to meet FSO - prefers clear direction (PcC, PdC)
    - Consumers just want safe food
  - Political reluctance
    - Difficult to 'sell' a non-zero tolerance target for foodborne disease
    - Cost of data generation



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Summary and Conclusions

- Literature and the ICMSF has established routes for developing the 'newer' metrics, but there are extensive data requirements.
- The future is uncertain for the adoption of 'newer' metrics unless data and confidence in using it improves at Government level. ("*moving beyond the familiar*")
- Despite uncertainties and difficulties with data, even 'rough' estimates might be useful for scoping the possible impact of legal micro-criteria on public health ("*in the right ball-park*").
- Adoption of the 'newer' risk management metrics would facilitate innovation by food businesses whilst protecting public health.

"Rarely are opportunities presented to you in the perfect way, in a nice little box with a yellow bow on top. ... Opportunities, the good ones, they're messy and confusing and hard to recognize. They're risky. They challenge you." **– Susan Wojcicki, chief executive officer (CEO) of YouTube from 2014 to 2023**

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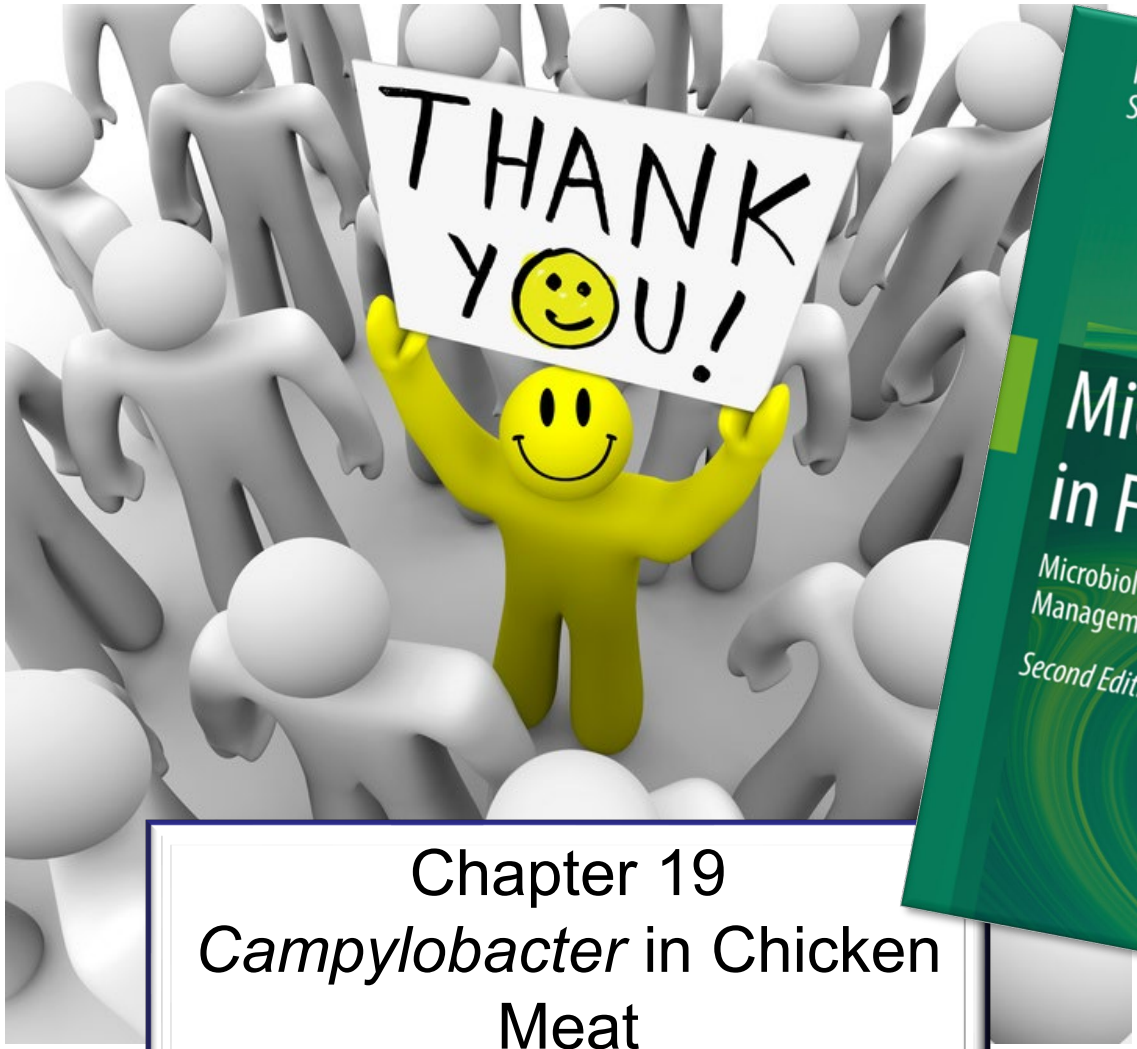

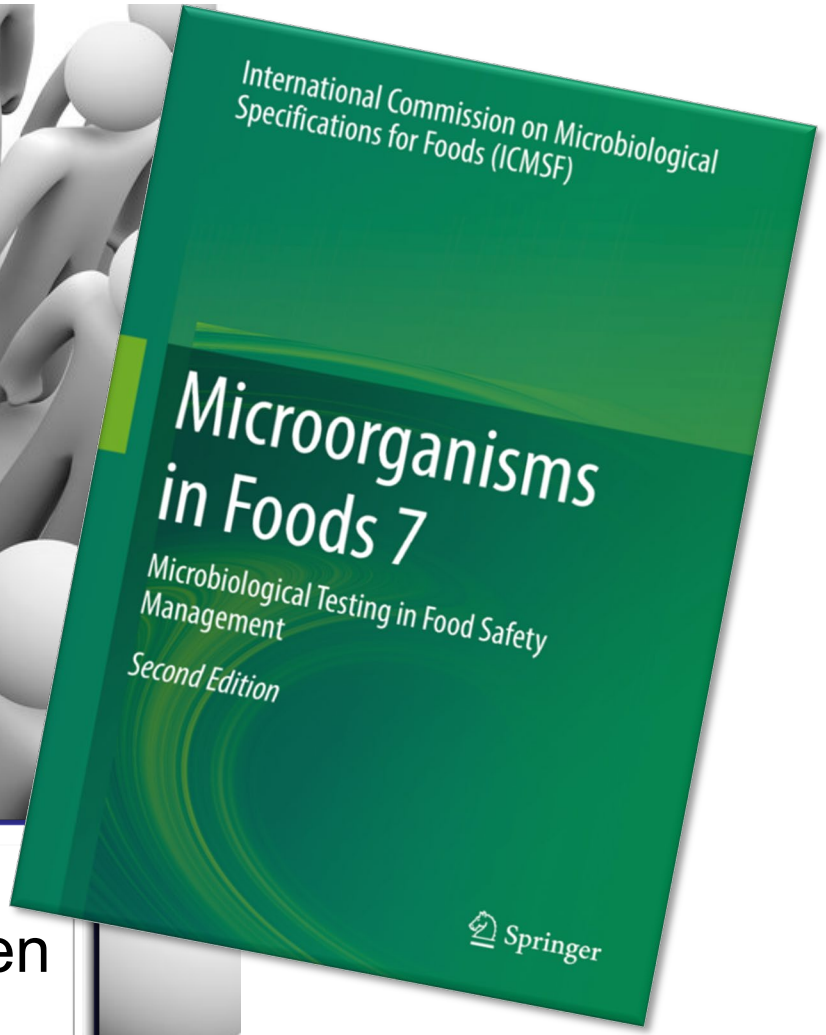

Chapter 19
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