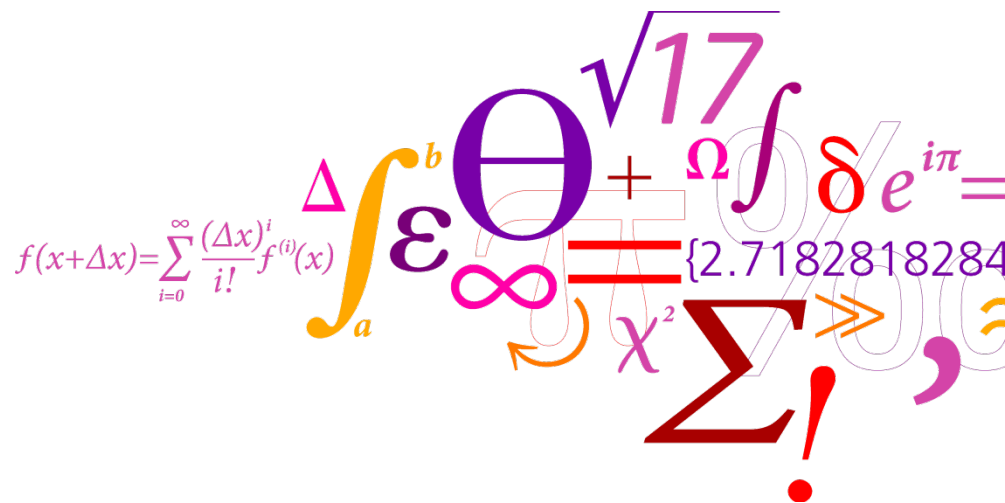


Risk Assessment

Can a performance objective (PO) guarantee safe meat?

Maarten Nauta



The food safety problem of meat

- Pathogen free fresh meat production is not possible
- Consumers are not able to perform perfect hygiene

QUESTION:

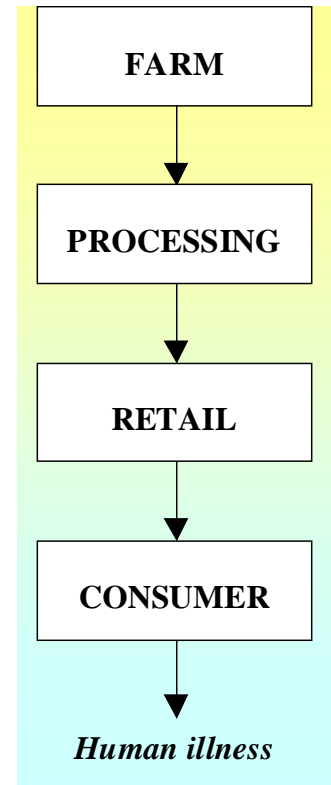
- Can human exposure be prevented? How?
- If 100% safety is not possible, how safe should a product be?

This presentation

- Illustrate the value of risk assessment when dealing with this question
- Example:
Case of *Campylobacter* on chicken meat
- Question:
How safe is a critical level (Performance objective) of 100 cfu/g at retail?

Risk assessment

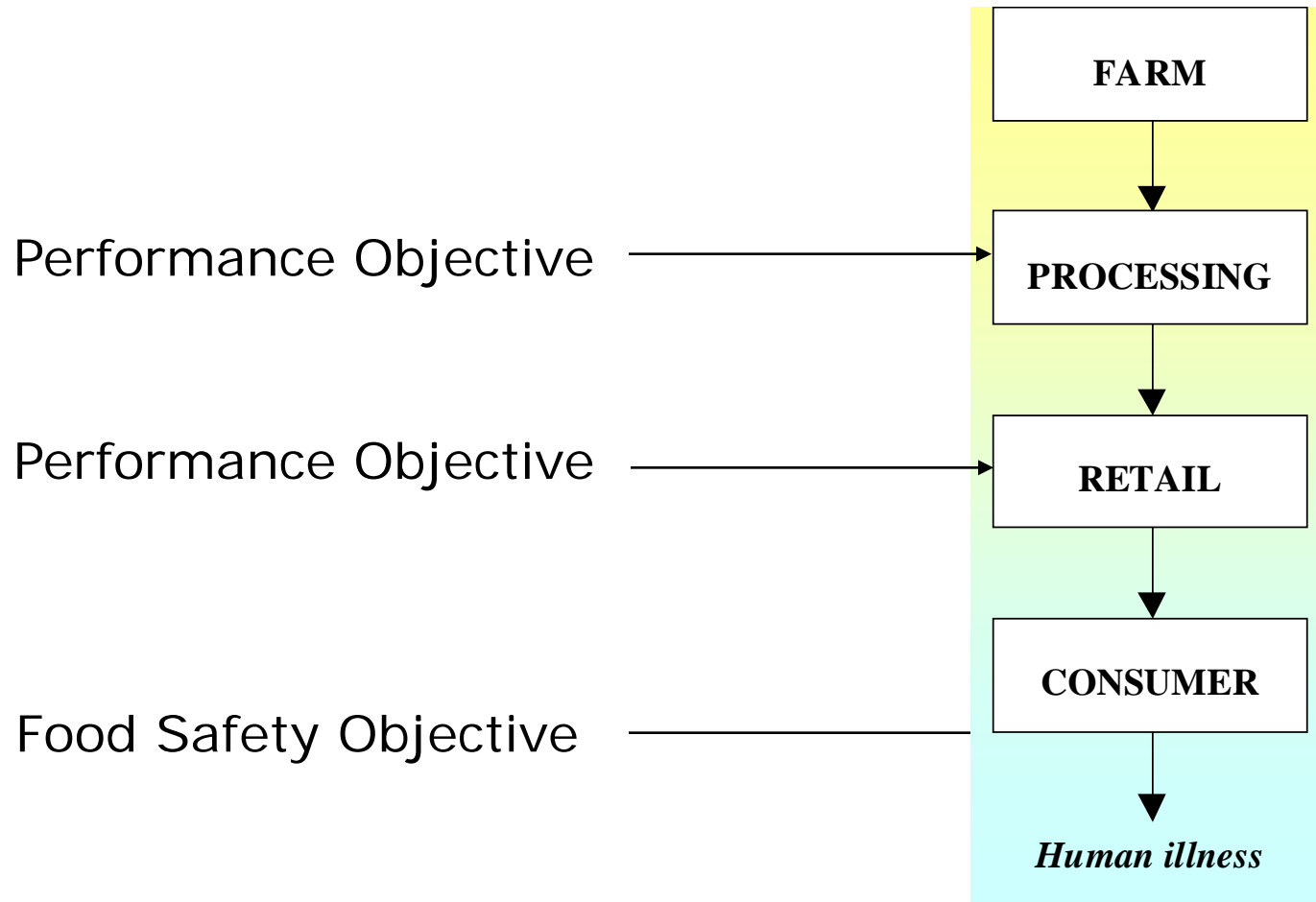
- Science based process combining
 - exposure assessment
 - dose-response relation
- Uses mathematical modelling
 - stochastic models
- Can be used to
 - estimate current health risks (human incidences)
 - explore the effects of control measures
 - evaluate food safety targets



Targets

- There is a need for *TARGETS* in the food chain
 - critical pathogen level that may not be exceeded
 - should be met by the producers
 - if based on risk assessment: *risk-based* target.

- Formal targets:
 - Food Safety Objectives (FSO)
 - Performance Objectives (PO)



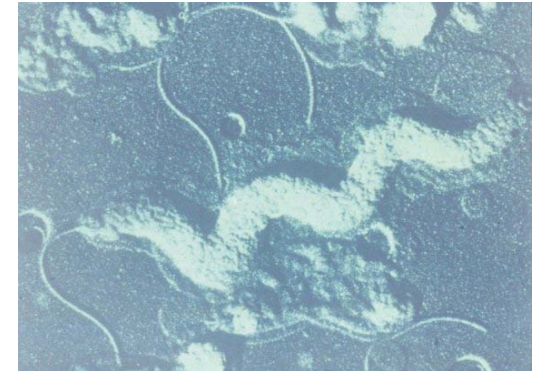
Performance objective (PO)

- What is the maximum allowable prevalence and/or concentration at the PO point?
- The safety of a PO depends on
 1. exposure consequential to concentration at PO point
 2. effect of exposure: probability of illness
- Risk assessment models can be used to evaluate these

EXAMPLE

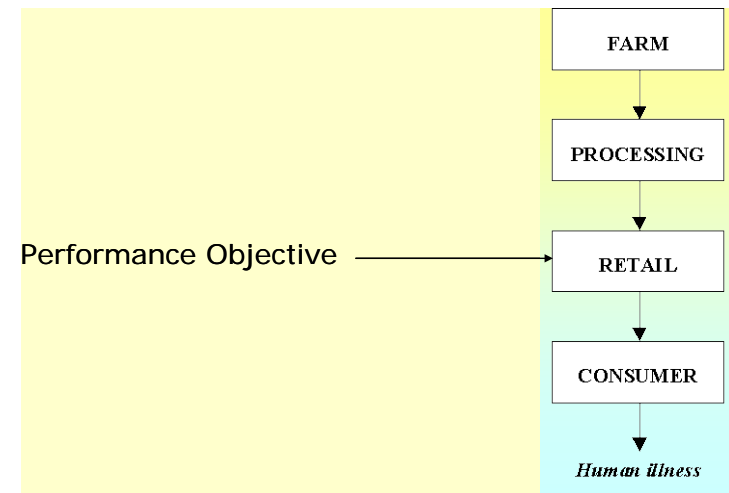
Campylobacter in broiler meat

- Most frequently reported bacterial zoonoses in the EU
- Poultry meat considered as major source
- Control is difficult
 - requires food chain approach
- Several food chain risk assessments performed
 - can we derive targets?



PO for *Campylobacter* in chicken meat at retail

- How safe is a PO of **100 cfu/g** chicken meat at retail?
- The effect of the retail PO depends on
 - effect of consumer food handling
PO concentration \Rightarrow ingested dose
 - effect of exposure:
ingested dose \Rightarrow probability of illness



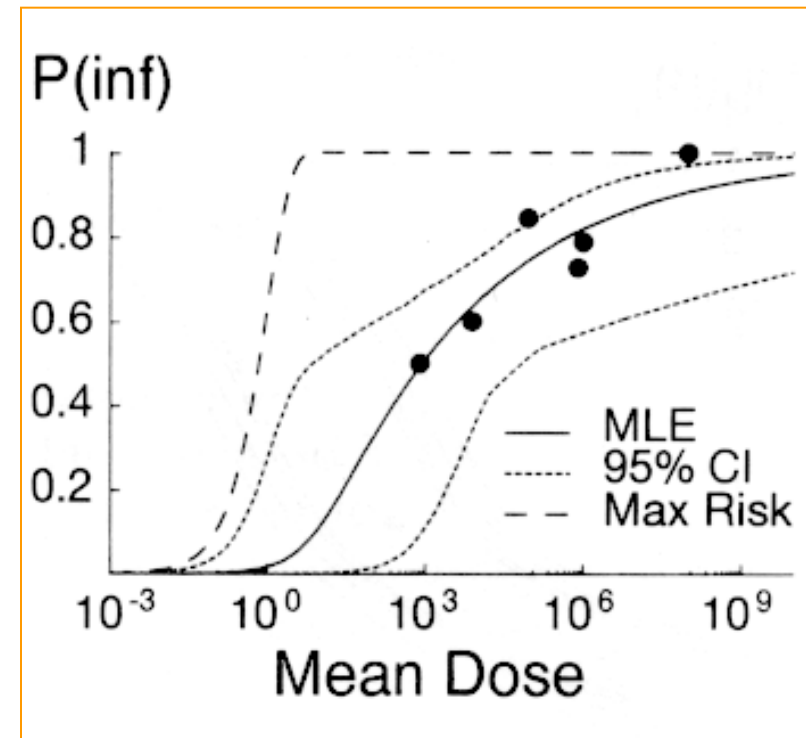
1. Simple, deterministic approach
2. Stochastic (risk assessment) approach

The effect of consumer food handling

- Models
 - Bacterial survival during storage and preparation
 - Cross contamination
 - transfer rate of bacteria with contact
 - routes of cross contamination
 - frequencies of related human behavior
 - meals
 - social aspects of eating
- Observational data
 - Survival and transfer of bacteria in chicken salads prepared by consumers
 - Nauta et al. *Risk Analysis* 2008 28:179-192.
 - De Jong et al. *J. Appl. Micr.* 2008 105: 615-624.

Dose response relationship

- Relation between ingested dose and probability of illness
- Single hit models:
 - Each cell can lead to infection, but with low probability
 - No minimum infectious dose
- At least 1 cfu must be ingested



Teunis and Havelaar , 2000

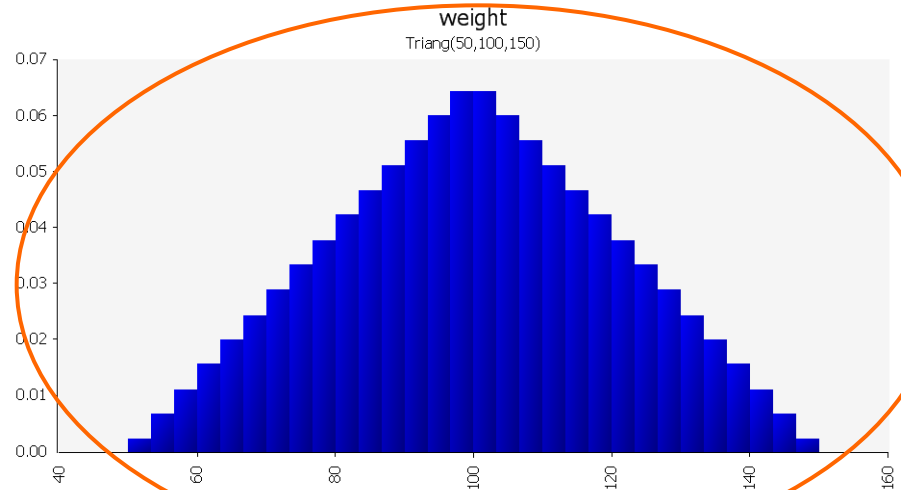
Simple deterministic approach

- PO of 100 cfu/g
- Data: people eat about 100 g per meal
- The mean transfer rate per bacterium during meal preparation is 10^{-5}
- Expected exposure $100 \times 100 \times 10^{-5} = 0.1$ cfu
- No response with this dose:
100 cfu/g seems to be a safe concentration

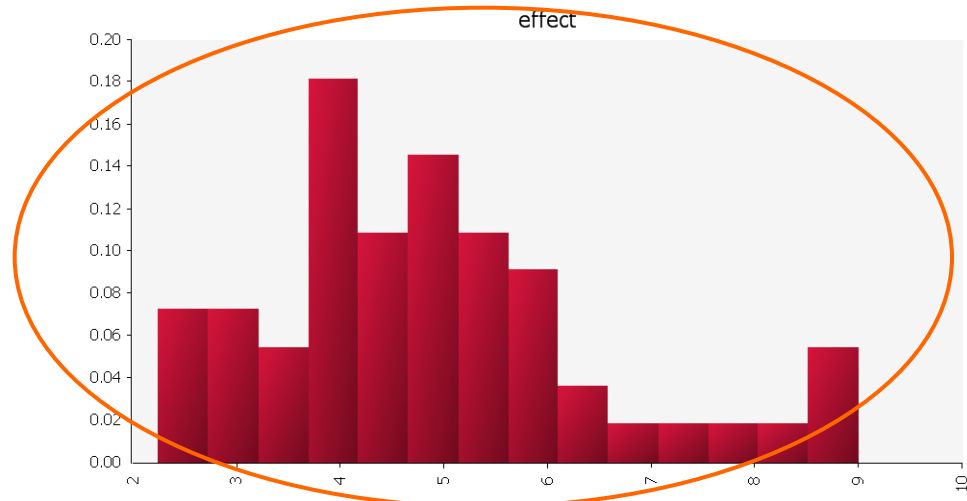
EXAMPLE

Stochastic (risk assessment) approach

- PO of 100 cfu/g
- Data: people eat between 50 and 150 g per meal



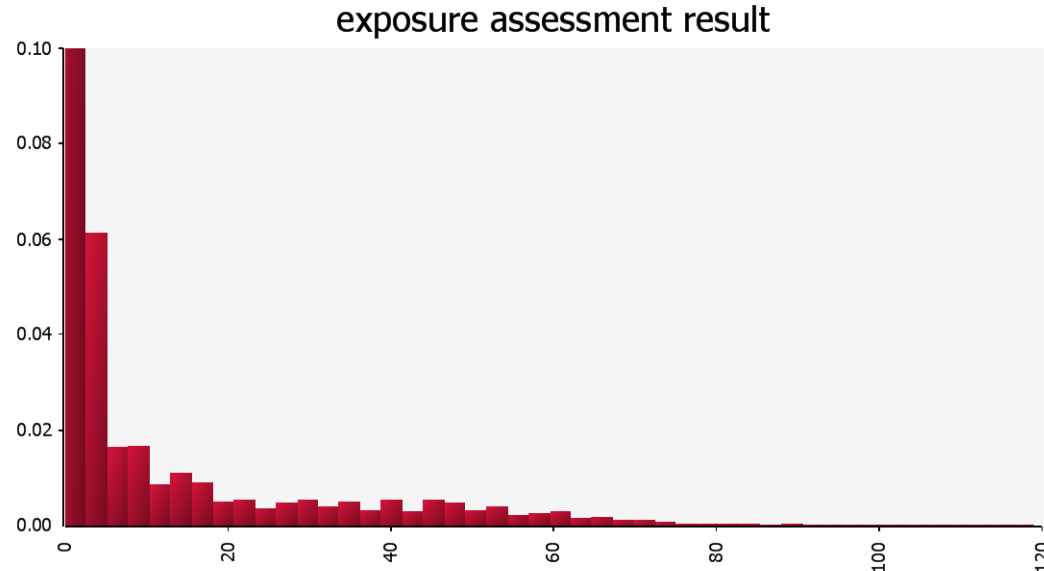
- The transfer rate per bacterium during meal preparation varies between $10^{-2.5}$ and $> 10^{-9}$



data: Nauta et al. 2008

exposure (and risk) assessment

- with 100 cfu/g 38% of people get exposed



- 10 % get exposed to > 10 cfu;
- mean exposure of exposed 11.3 cfu;
- dose response model:
- with 100 cfu/g the probability of human illness is 1%.

Conclusion

- The two approaches yield different results
- A simple approach is insufficient:
 - variability is essential
 - risk assessment provides the tools
- Example: 100 cfu/g is not safe (?)
 - when is “safe” safe enough?
- We can assess risks, decision makers have to decide which risks are acceptable

Discussion

- Performance objective must be
 - practically / economically feasible
 - testable
- Impact of Performance objective:
safety depends on consumer food handling
 - consumers make mistakes
 - quantitative data are very scarce
 - not fixed
- Consumer food handling needs more attention (and data)
if we are supposed to set targets