Επίδραση χρονικής καθυστέρησης διενέργειας κρεοσκοπικού ελέγχου στον εντοπισμό *Salmonella* spp. σε σφάγια

Impact of delayed post-mortem meat inspection on the probability of Salmonella detection on carcasses

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SCIENTIFIC OPINION

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Evaluation of public and animal health risks in case of a delayed post-mortem inspection in ungulates

EFSA Panel on Biological Hazards (BIOHAZ),
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Delayed post-mortem inspection

shows how uncertainty, was quantitatively embedded in the assessment, via stochastic modelling and EKE

Terms of reference

EFSA is asked to assess the effectiveness of PMI (in terms of its sensitivity in detecting the diseases/conditions listed below) when carried in both the following delays:

- a) up to 24 hours after slaughter or arrival in the game-handling establishment, or
- b) up to 72 hours after slaughter or arrival in the game-handling establishment,

in comparison to when it is carried out immediately after slaughter or arrival in the game handling establishment.

Terms of reference

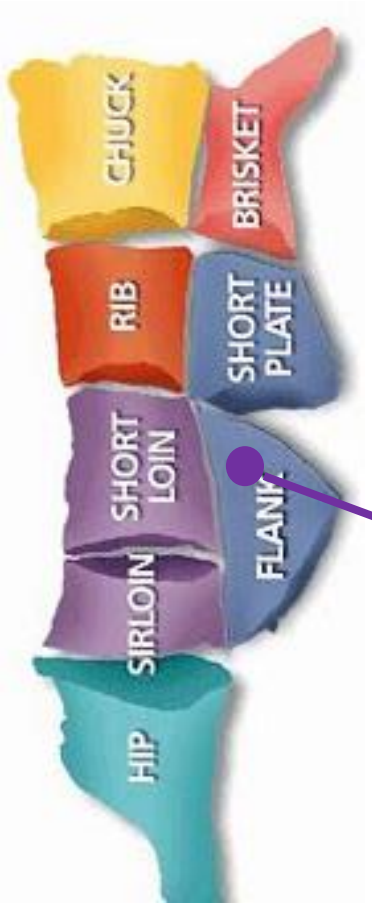
- Animal diseases Art. 5 Reg (EU) 2016/429 in all ungulates — AHAW
- Septicaemia, pyaemia, toxaemia, viraemia in all ungulates
- Cysticercosis in domestic bovine animals and Suidae
- Glanders in solipeds
- Tuberculoid lesions in all ungulates
- *Brucella* in all ungulates
- *Trichinella* in Suidae and solipeds — BIOHAZ
- TSEs in cattle, sheep, goats and cervids
- *Salmonella* spp. (PHC on carcasses) in all ungulates
- Chemical residues and contaminants in all ungulates — CONTAM

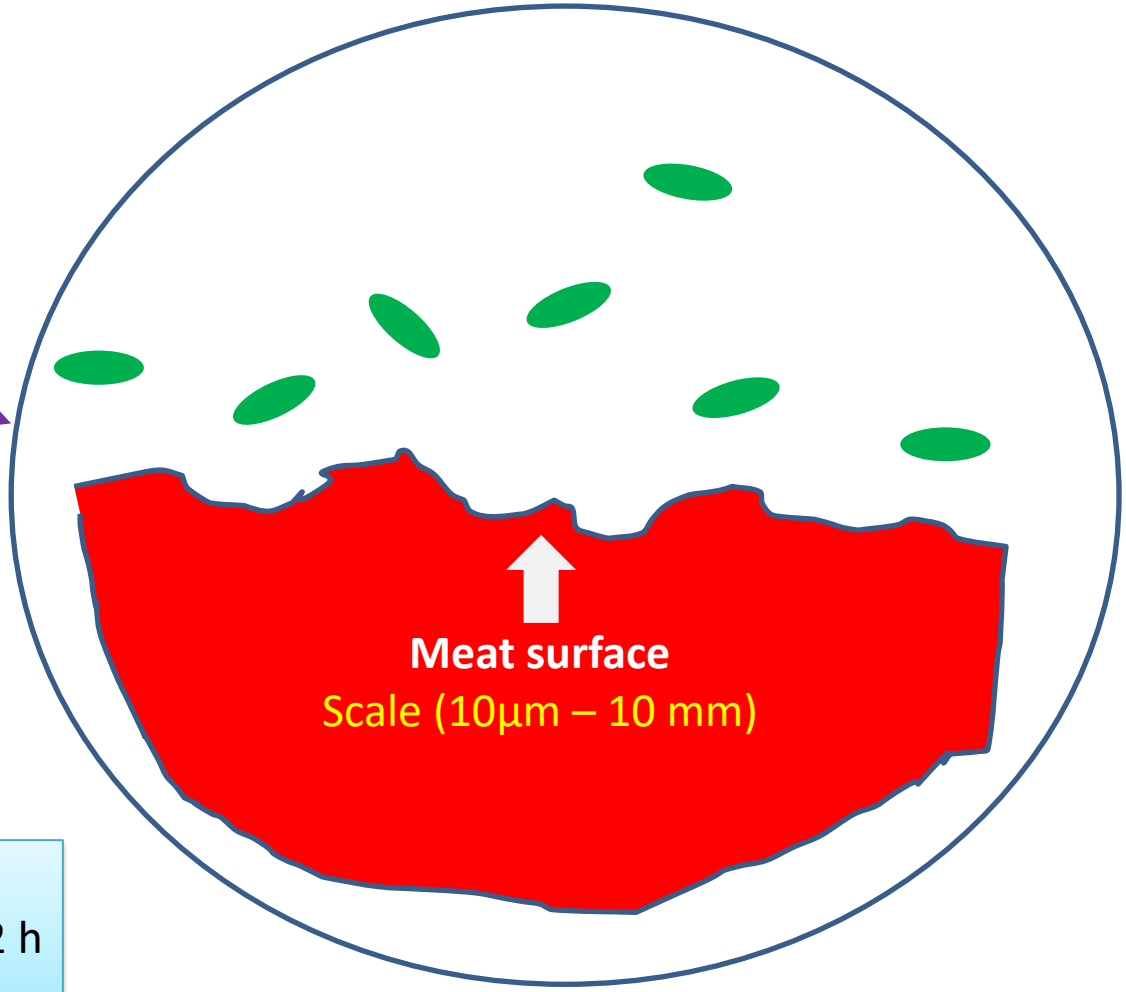
Scope

- Opinion focuses on reduction in sensitivity of detecting diseases/conditions after 24-h and 72-h delay of PMI as compared to PMI immediately after slaughter
- Public health risk due to a delayed PMI is not assessed in this opinion
- *Salmonella* as a Process Hygiene Criterion (PHC), which is only defined for domestic ungulates and, therefore, is not assessed for wild game
- All parts of the slaughter carcass are stored under refrigeration temperature as required by legislation and available for (delayed) PMI

Visualization of the process micro-environment

Variability in initial contamination from hides or viscera



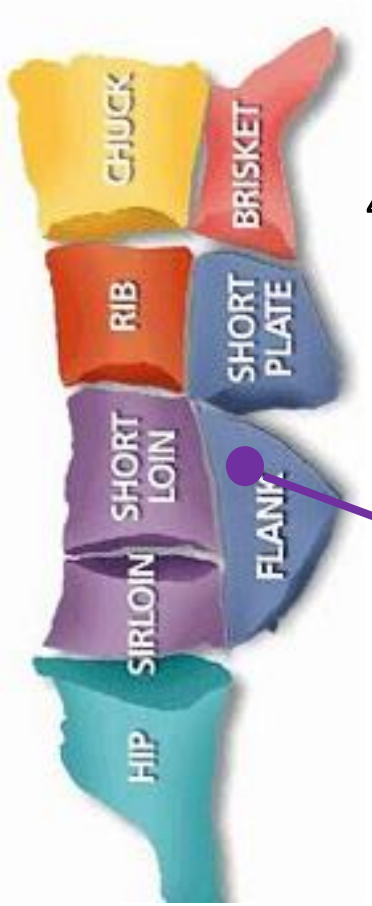


To be inspected immediately or 24-72 h after slaughtering

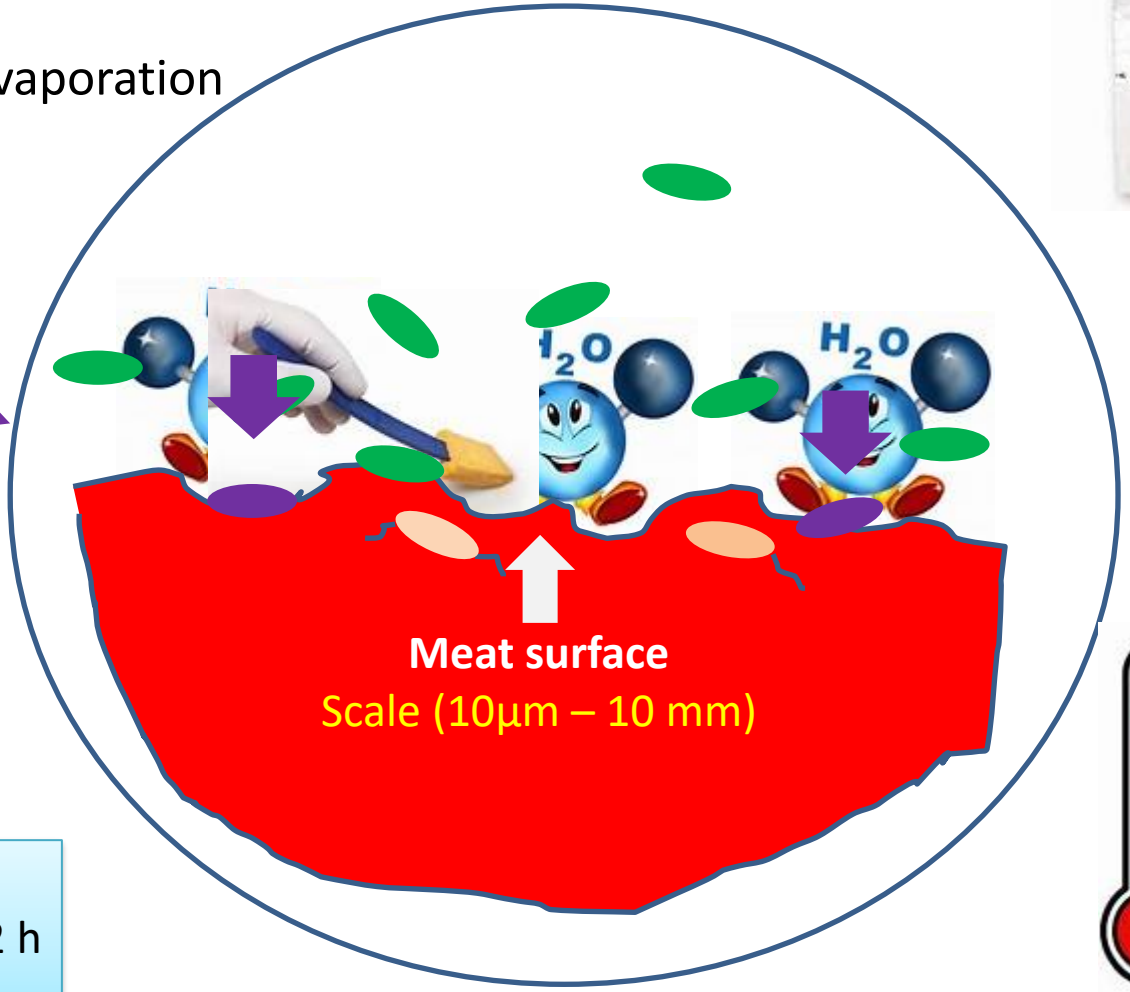
Visualization of the process micro-environment

6. Sampling

1. Attachment
2. Embedding
5. Inactivation

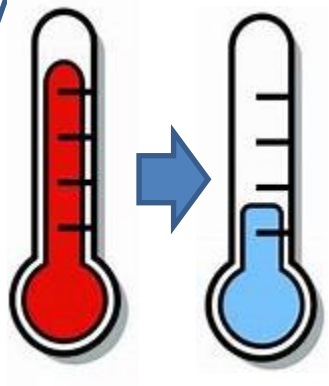


4. Evaporation



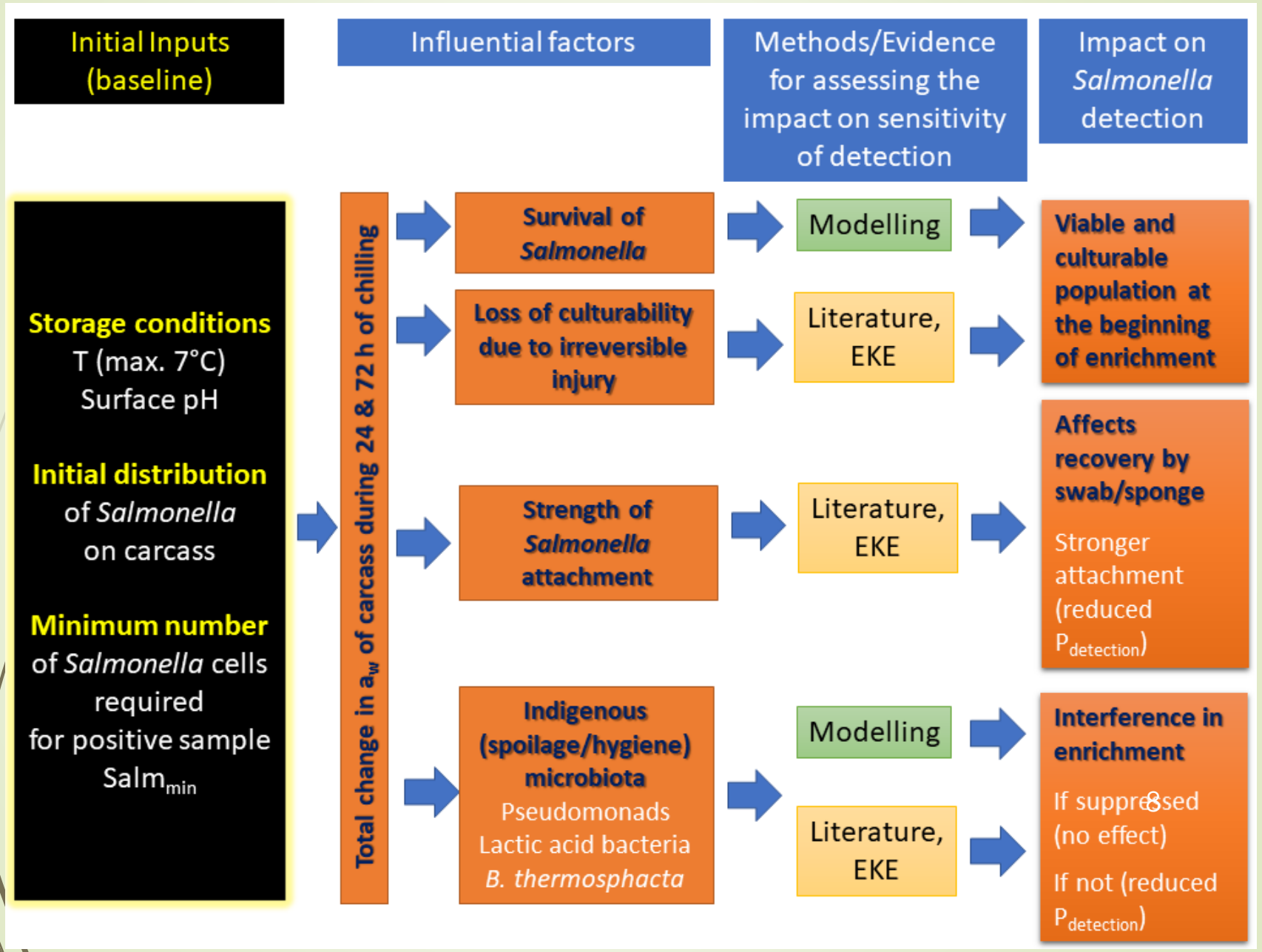
7. Probability of detection?

3. Chilling



To be inspected immediately or 24-72 h after slaughtering

Salmonella model



The model concept

Total shift caused by chilling

$$\text{Log } Nt_{(24 \text{ or } 72 \text{ h})} = \text{Log } No_{(\text{time } 0)} - SR + \text{Log } (1\text{-Phys}) + \log (\text{SpEff}) + \log (1\text{-Compt})$$

Model variables:

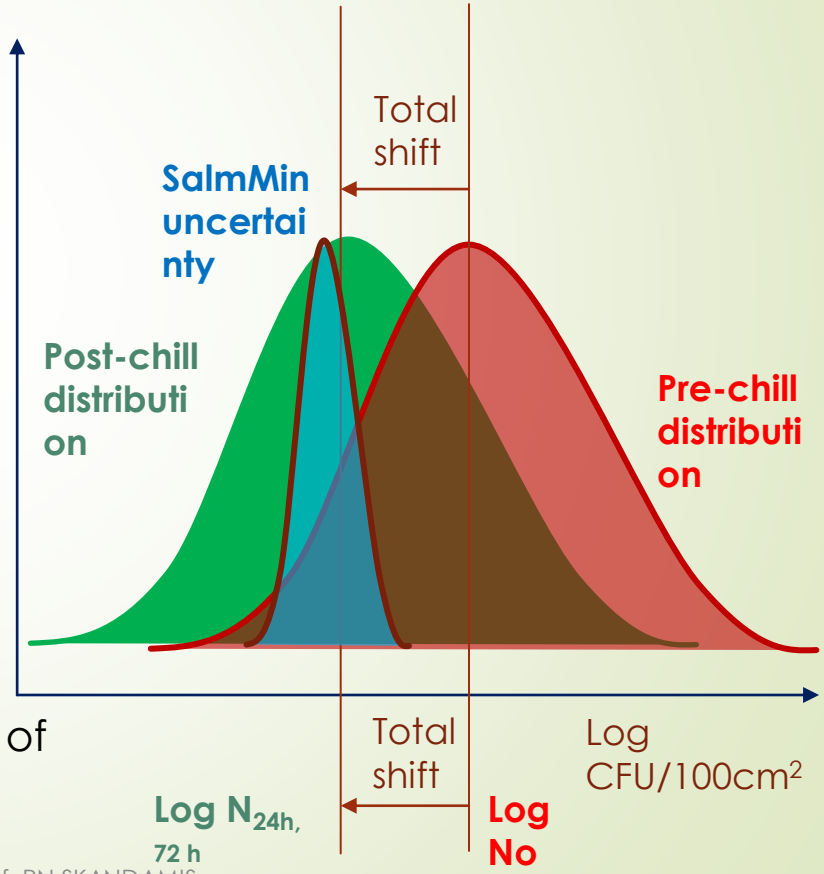
- **Initial levels**
- **Inactivation** = loss of viability
- **Injury** = loss of culturability
- **Sponging efficacy**
- **Out-competition** during
- Enrichment

Comparison of:

(a) Initial levels (pre-chill Log No) &

(b) Levels after 24 h (post-chill) with SalmMin

- Estimation of difference In the number of positive carcasses



Variability & uncertainty

Variability refers to:

Actual variation or heterogeneity in the real world

- it cannot be reduced by additional data

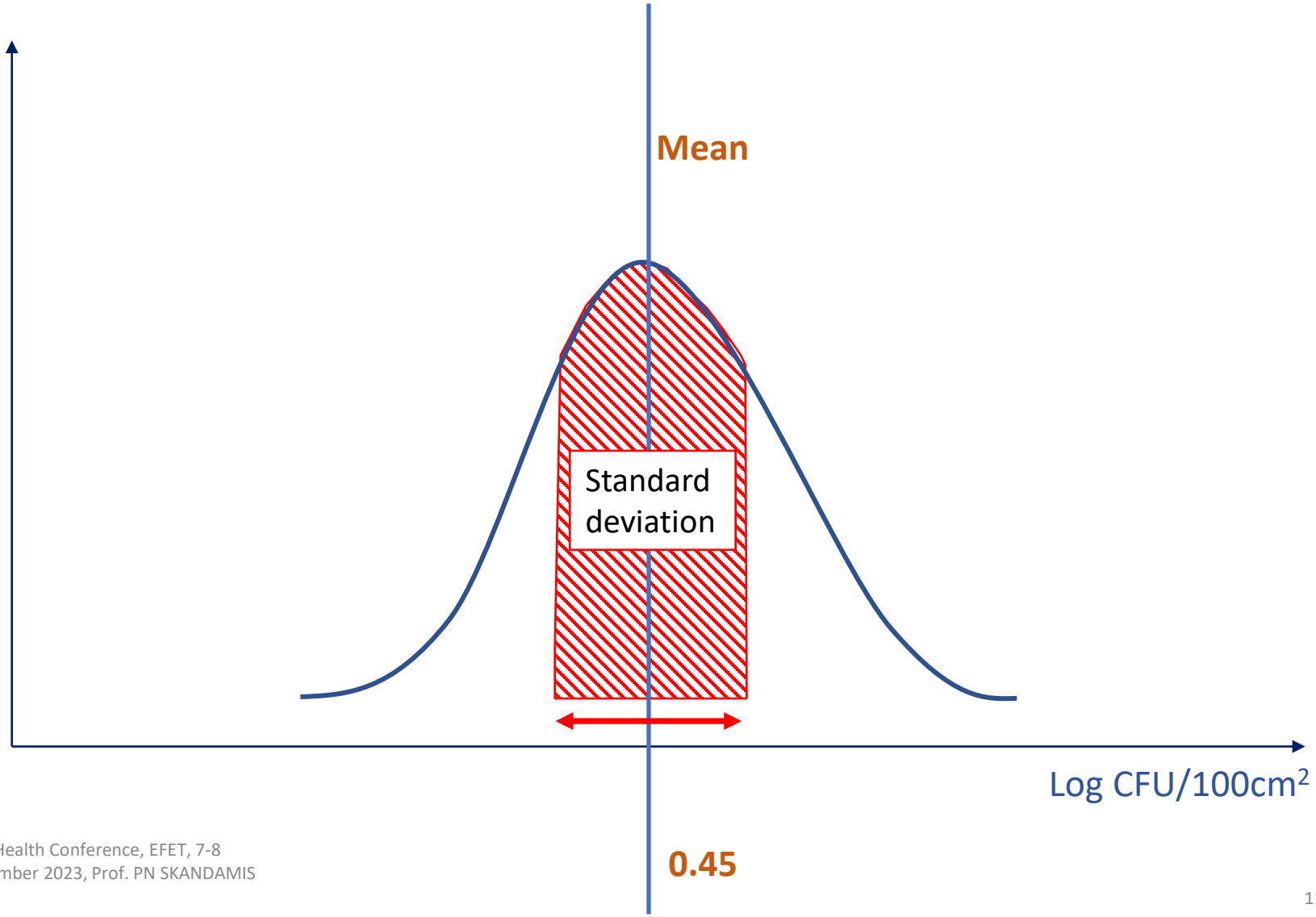
Uncertainty refers to:

All types of limitations in the knowledge available to assessors at the time an assessment is conducted and within the time and resources agreed for the assessment

- it may be reduced by further research

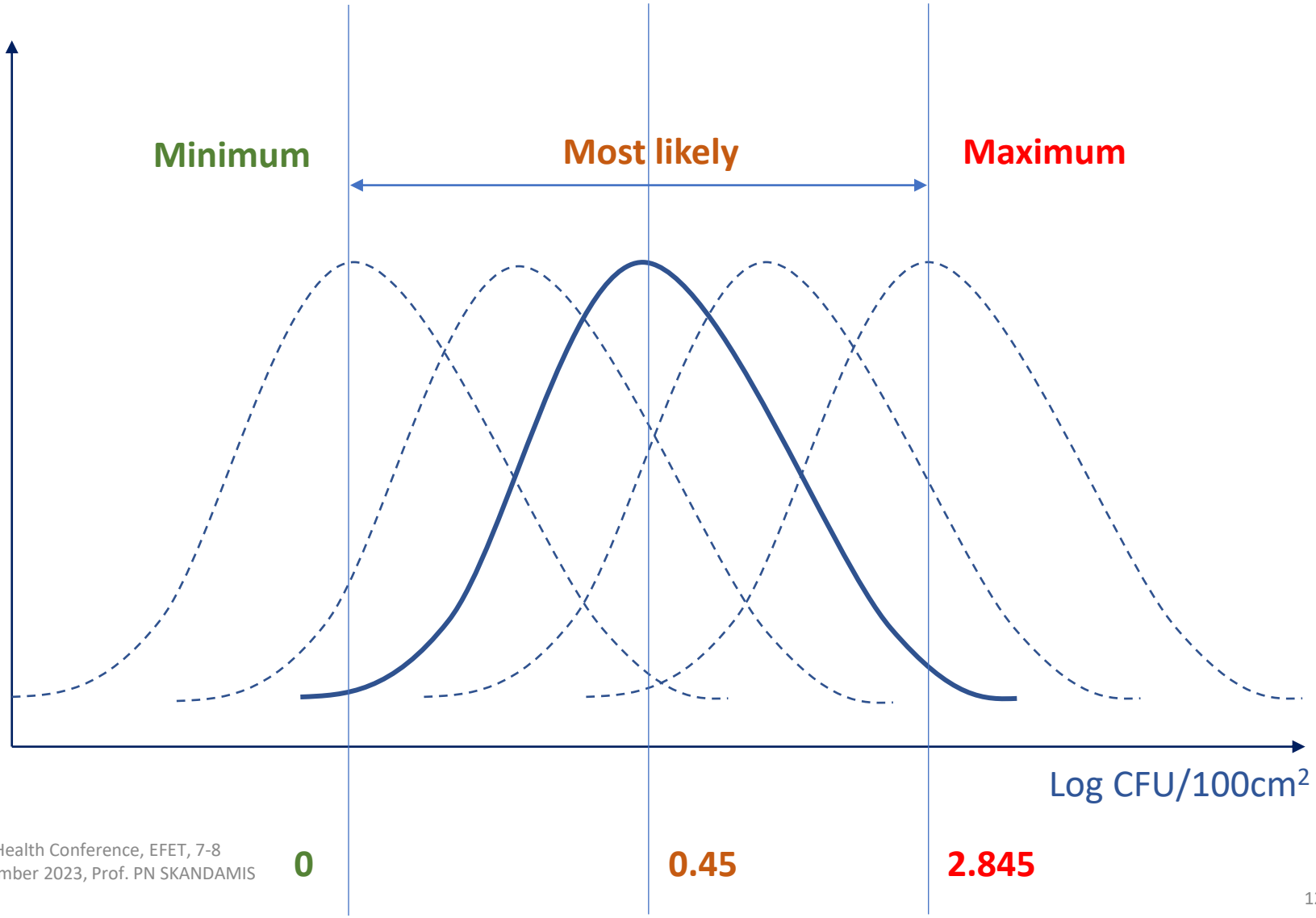
Log No: Pre-chill distribution of Salmonella population on carcass
Describing VARIABILITY of the average population

1



Log No: Pre-chill distribution of Salmonella population on carcass
Introducing UNCERTAINTY of the average population

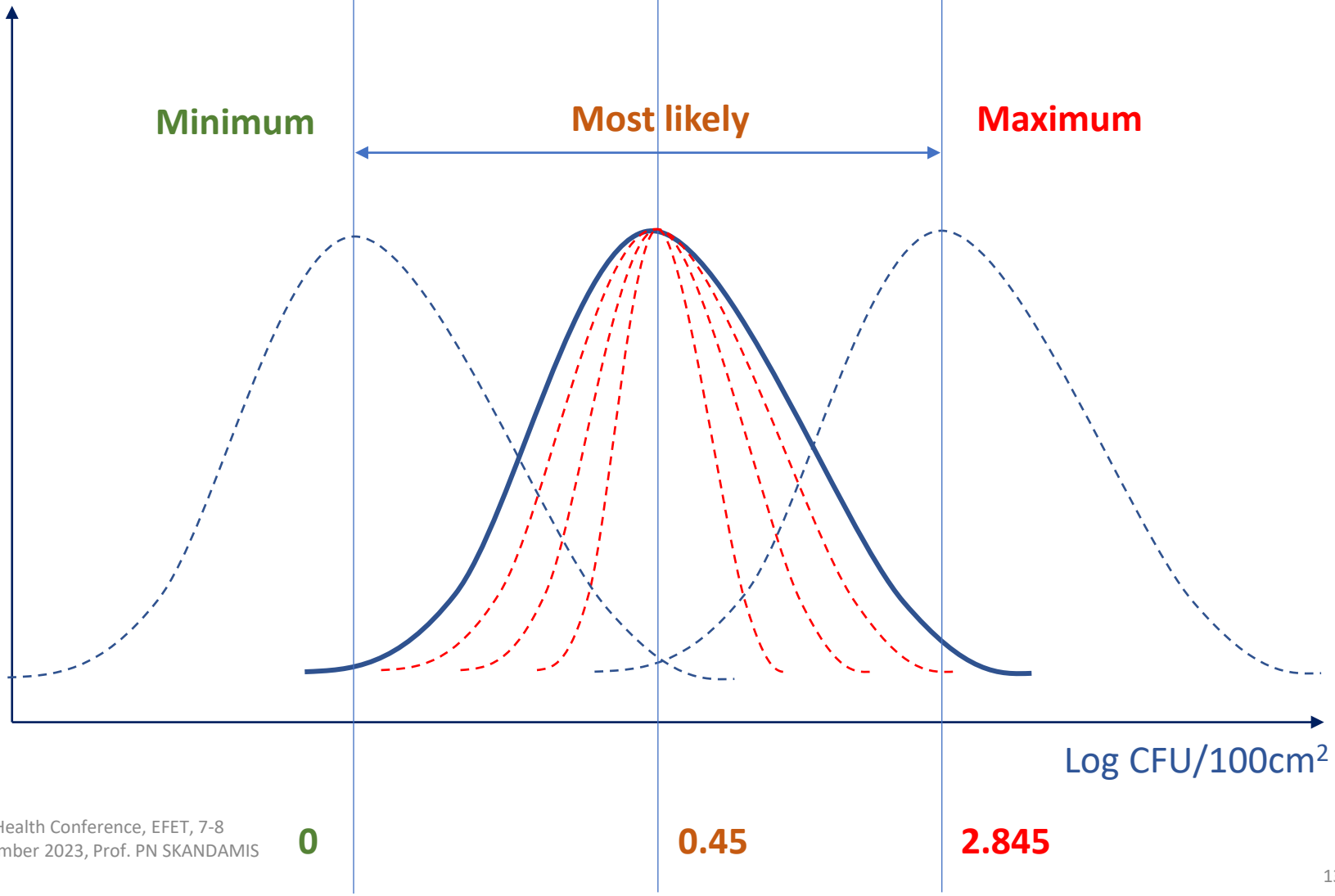
2



3

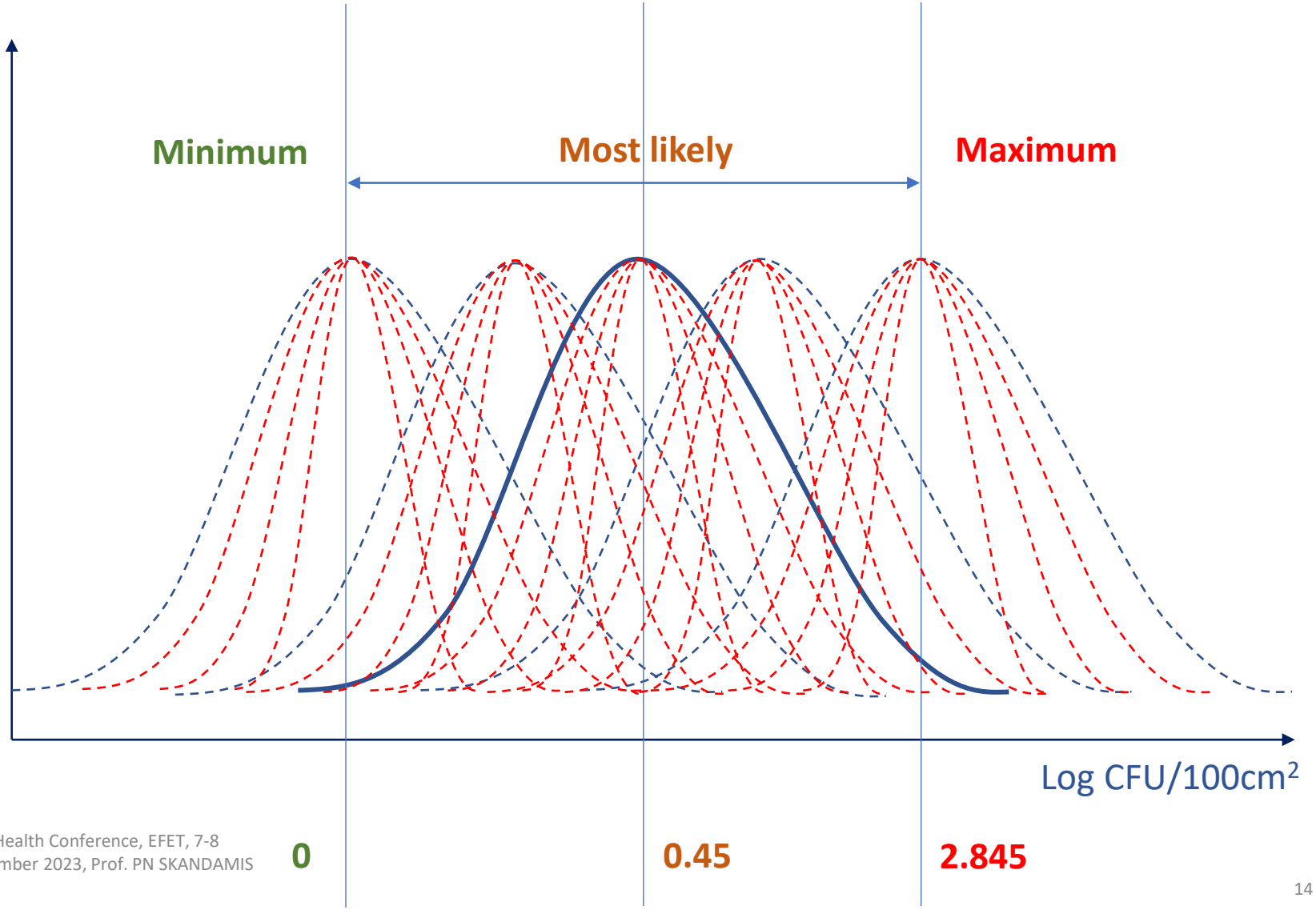
Log No: Pre-chill distribution of Salmonella population on carcass
VARIABILITY & UNCERTAINTY of the average population

Introducing Uncertainty to the Stand. Deviation



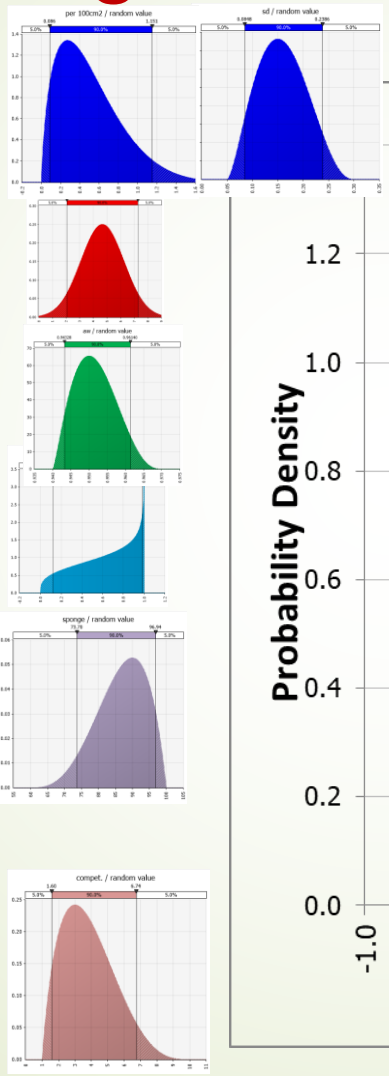
Integrating VARIABILITY & UNCERTAINTY

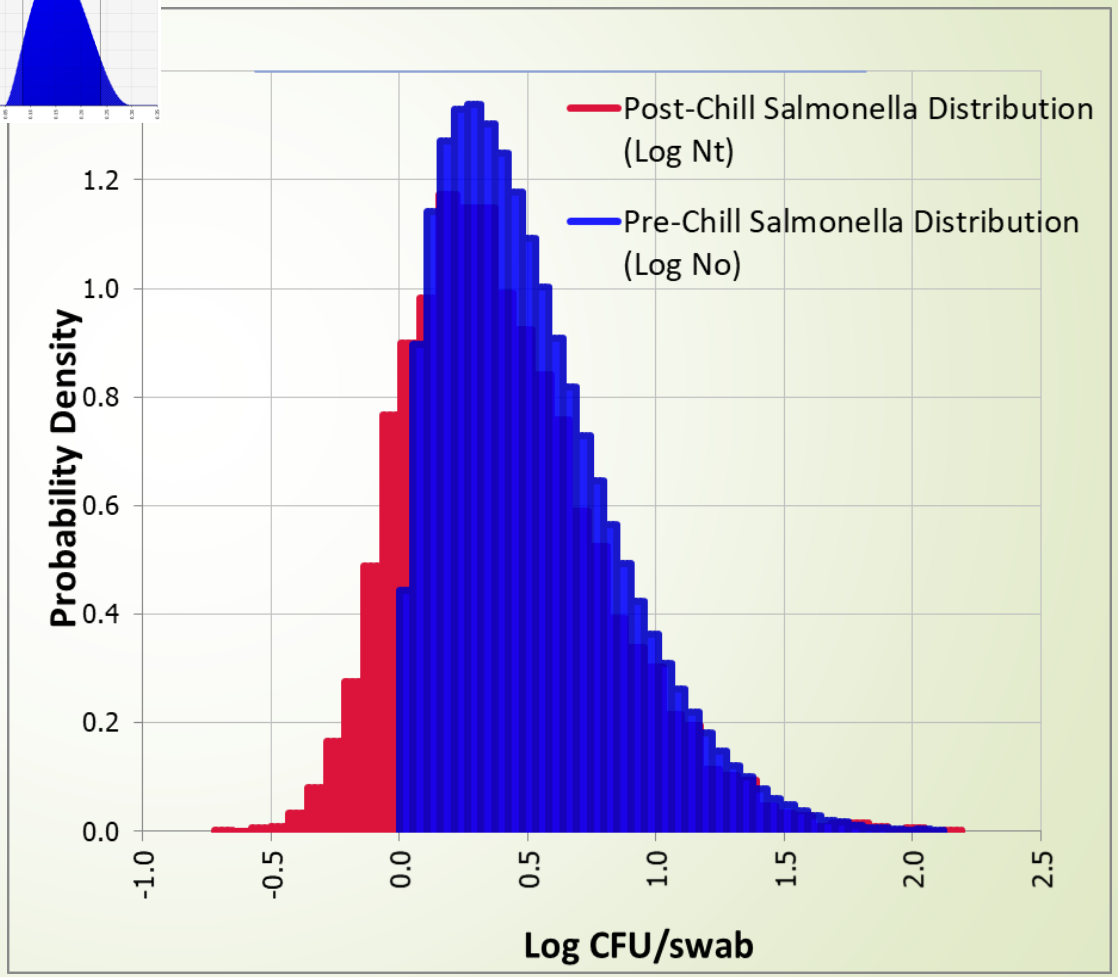
4



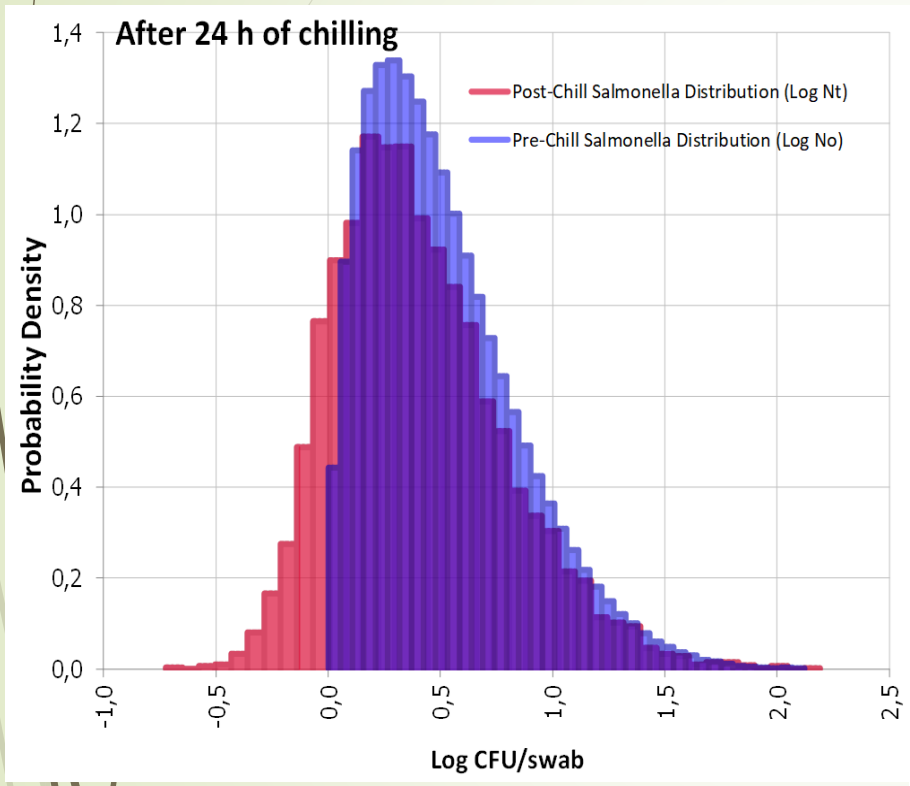
In need of data to inform the distributions describing variability & uncertainty

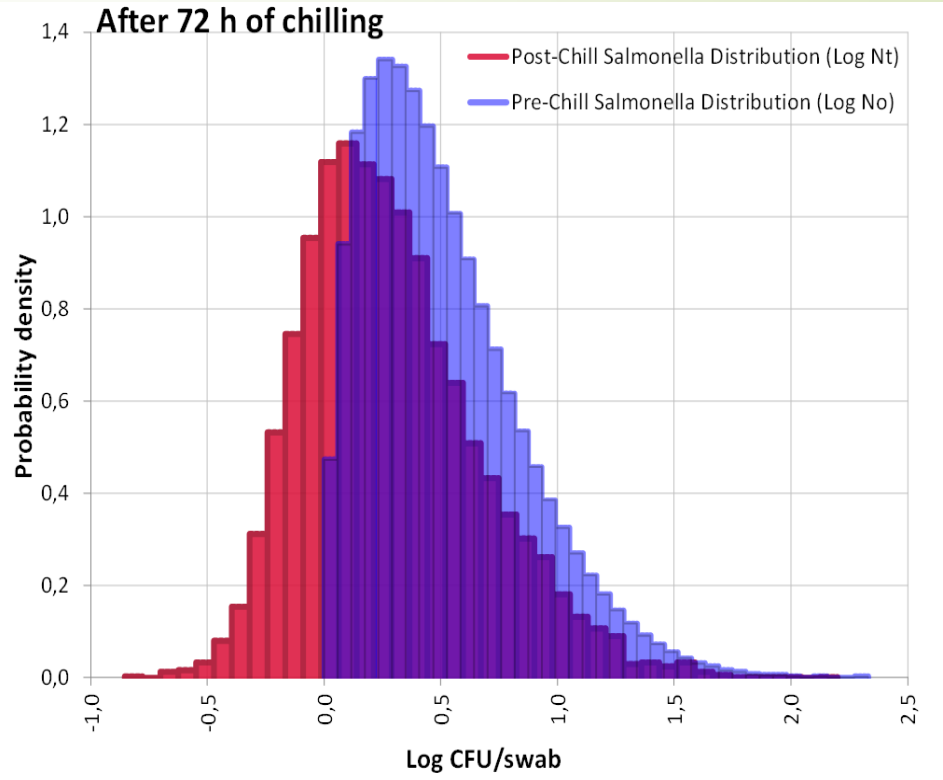
- **Initial *Salmonella* levels**
- **$Salm_{min}$**
- **Survival of *Salmonella***
- **Loss of culturability (Irreverible injury)**
- **Strength of *Salmonella* attachment**
- **Indigenous (spoilage/hygiene) microbiota**
  Pseudomonads
  Lactic acid bacteria
  B. thermphacta





Reduction in levels of *Salmonella* post chilling

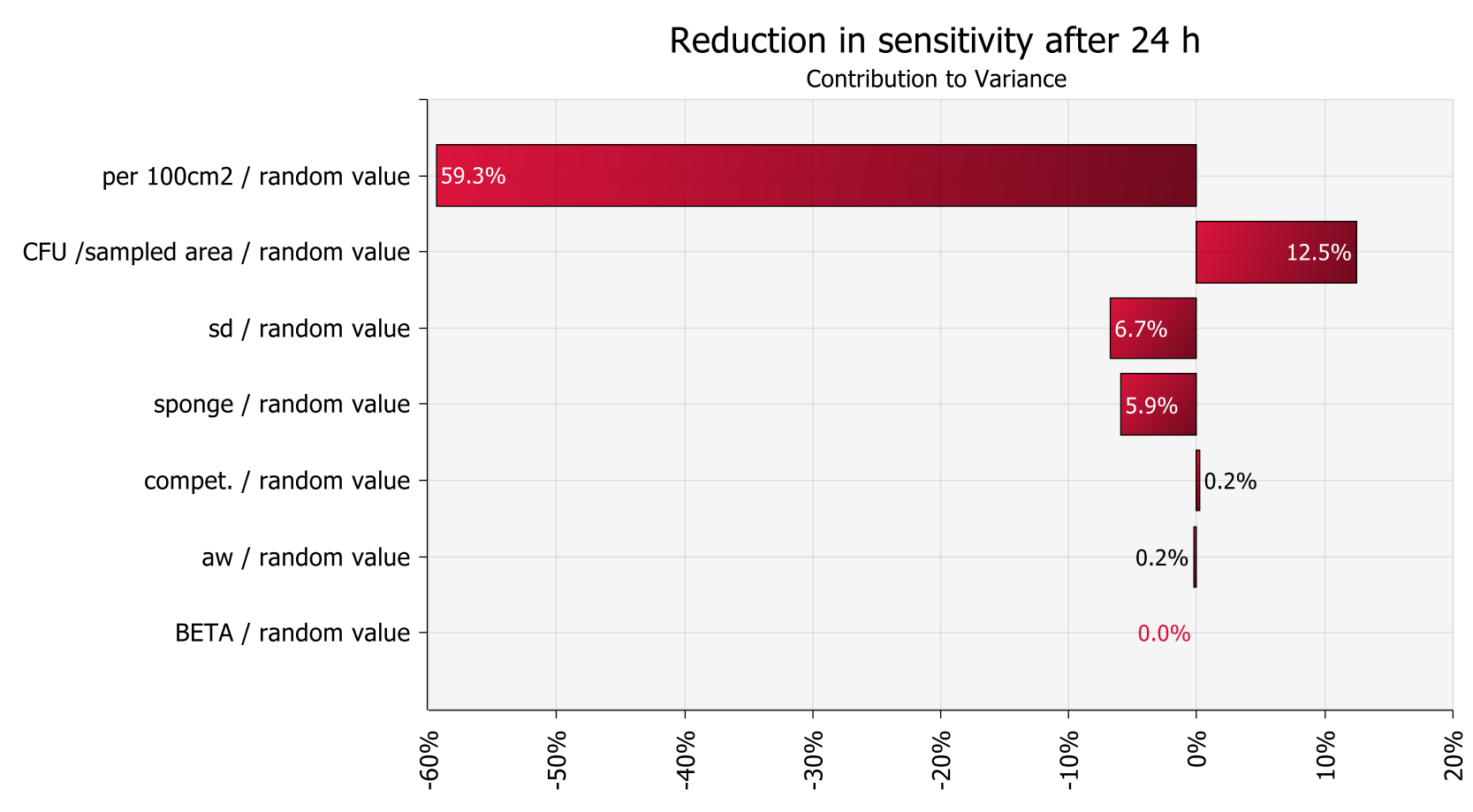




Cumulative probabilities of reduction in sensitivity of *Salmonella* detection after 24- and 72-h of chilled storage

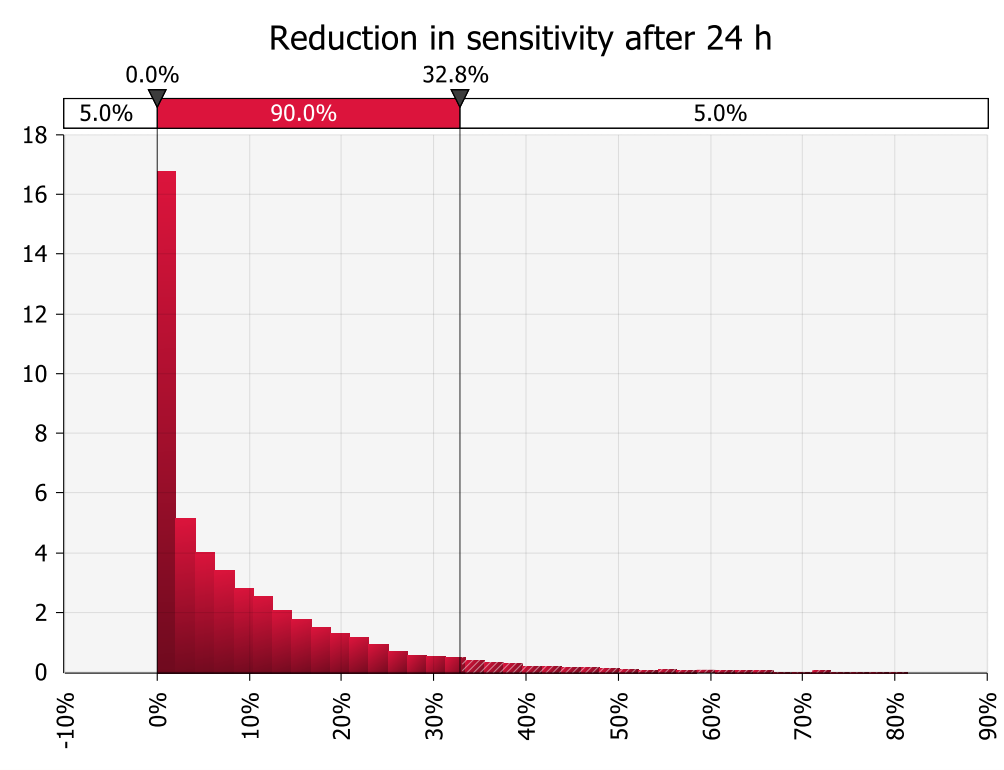
Percentage of reduction (%)	After 24 h		After 72 h	
	Cumulative probability	Probability of greater reduction	Cumulative probability	Probability of greater reduction
10	0.15	0.85	0.09	0.91
20	0.2	0.8	0.12	0.88
30	0.25	0.75	0.14	0.86
40	0.31	0.69	0.17	0.83
50	0.37	0.63	0.20	0.8
60	0.44	0.56	0.23	0.77
70	0.53	0.47	0.27	0.73
80	0.63	0.37	0.33	0.67
90	0.75	0.25	0.43	0.57

Sensitivity analysis
The most influential factors on the outcome



Having no uncertainty about the average Log No – **High** initial level

Average Log No = **1 Log CFU/100cm²**

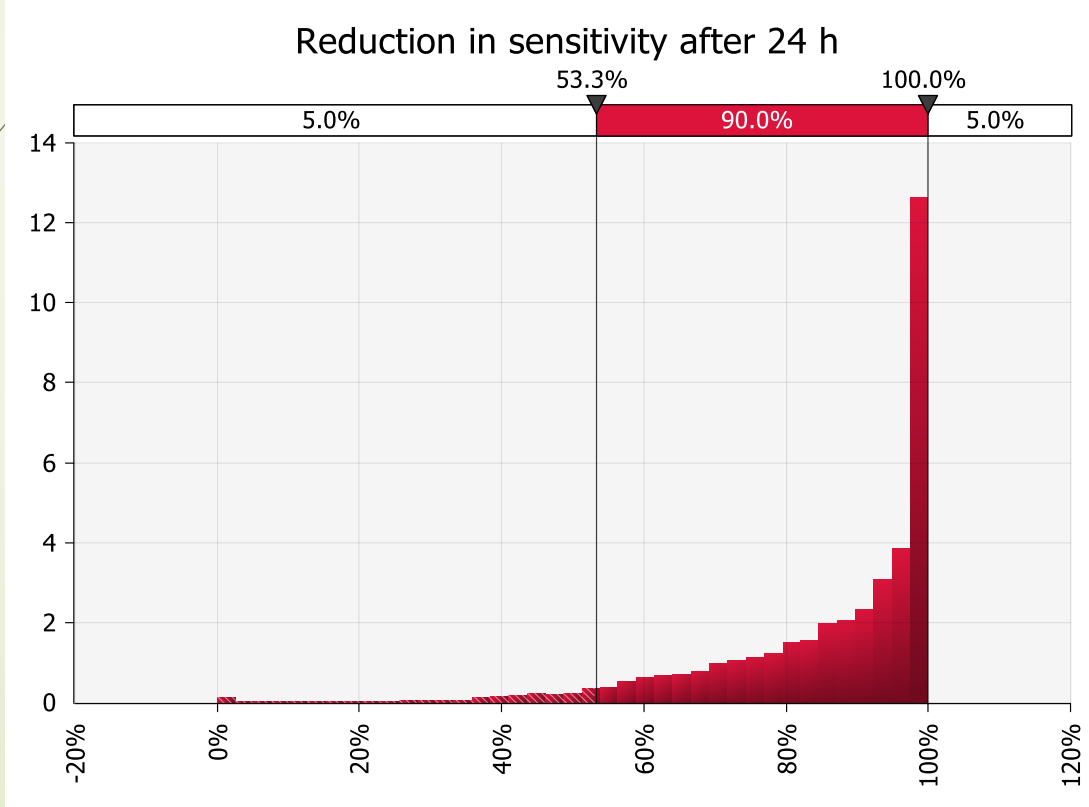


90% Probability Interval (5-95%): **0 - 32.8%**

Median = **5.2%**

Having no uncertainty about the average Log No – **Low** initial level

Average Log No = **0.1 Log CFU/100cm^2**



90% Probability Interval (5-95%): **53.3 - 100%**

Median = **92.4%**

Conclusions

What is the percentage of reduction (%) in sensitivity of *Salmonella* detection as a process hygiene criterion?

- 24h: The median estimate for the reduction in sensitivity is 66.5 % (90% probability interval 0.08-99.75%).
- 72h: The median estimate for the reduction in sensitivity is 94 % (90% probability interval 0.83-100%).
- High uncertainty originates mainly from the uncertainty in the initial *Salmonella* concentration on carcasses. In general, the lower the initial *Salmonella* counts, the higher the estimated reduction in the sensitivity of detection.

Thank you!

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