Veterinary Laboratories Agency

Probabilistic Risk Assessment

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Agenda

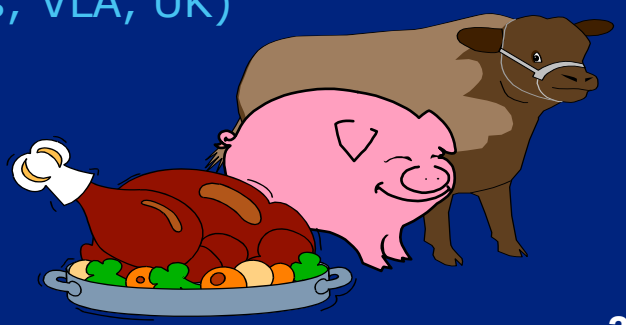
- Background information
- Probabilistic risk assessment
  - Overview of process
  - Data requirements
  - Risk estimate
- The outputs
- Advantages and disadvantages
- Discussion

Background information

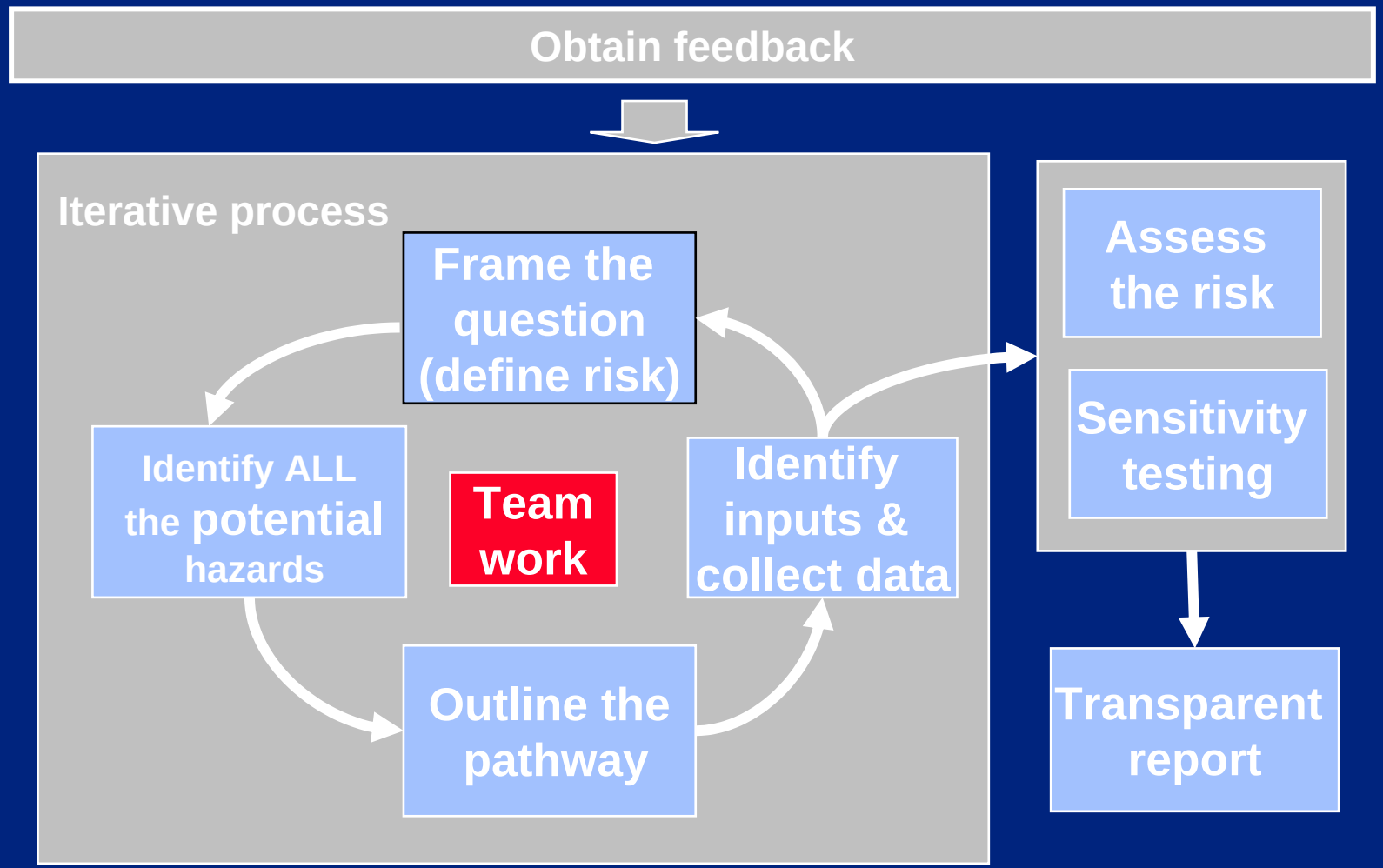
- Food safety risk assessment
  - Origins in chemical risk assessment
    1. Codex Alimentarius Commission framework
  - Methods & approaches continuous development

- Typical overall aims:
  - Model the change in the number (prevalence) of bugs within foodchain
  - Provide estimate of
    1. Number of bugs per serving
    2. Number of cases of human illness

- Undertaken world-wide
  - Campylobacter & chicken (RIVM, Netherlands; VLA, UK)
  - VTEC & steak tartar (RIVM, Netherlands)
  - VTEC & mince meat (Teagsac, Ireland)
  - Salmonella & poultry (WHO-FAO)

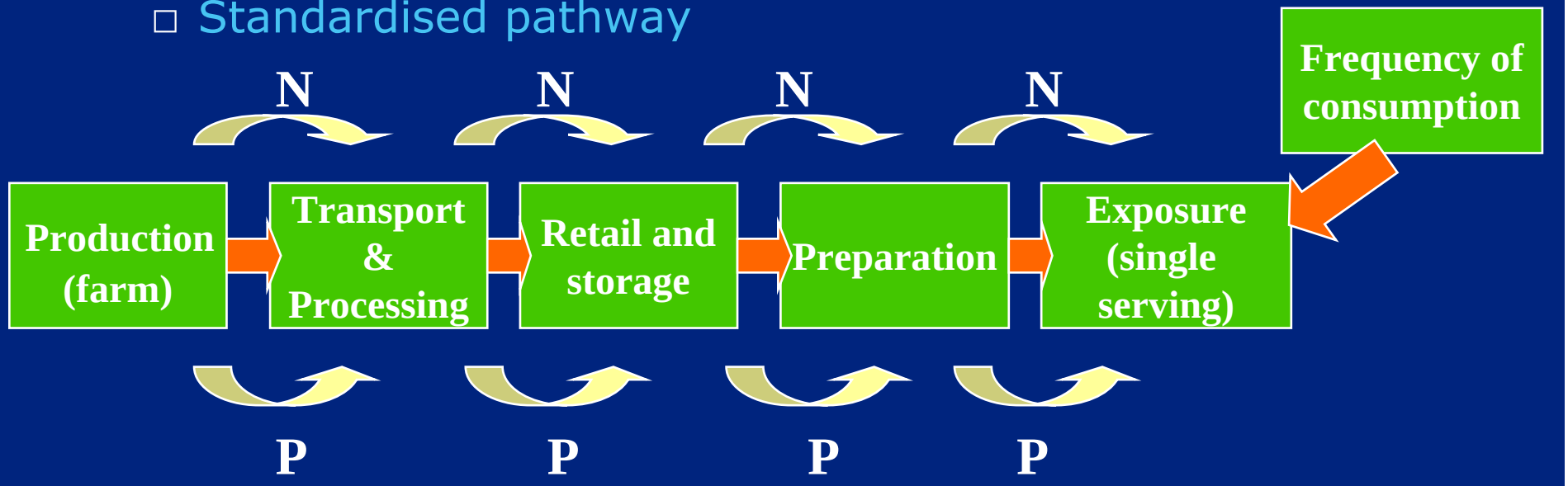


Quantitative risk assessment process



Model pathway

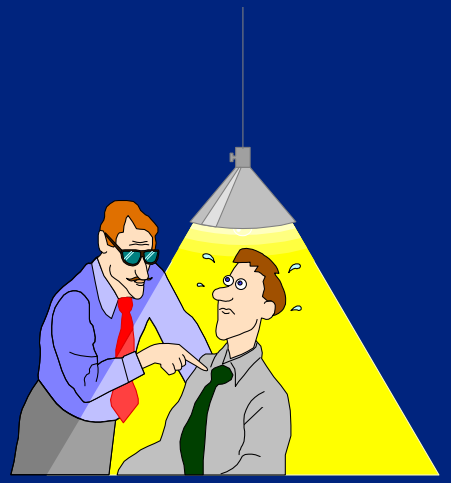
- Follow CAC framework
  - Hazard identification
  - Hazard characterisation
  - Exposure assessment
  - Risk characterisation
- Exposure assessment
  - Standardised pathway



P = Probability of contaminated unit N = Probable number of organisms

Identify & collect data

- Quantitative information
  - Presence/absence (prevalence)
  - Enumeration (numbers)
- Data sources
  - Literature – scientific studies
  - FSA surveys/research
    1. Retail studies
    2. Dietary consumption surveys
  - Expert opinion
  - Unpublished data
- QRA informs data collection studies



Data Sources & requirements – examples

Published information

- Farm prevalence
- Within herd/flock prevalence
- Impact of transport on N,P
- Impact of processing on N,P

Unpublished information

- Number of animals transported
- Duration of transport/lairage
- Temperature of fridge/freezers
- Storage durations
- Handling practices

Dietary surveys

- Serving size
- Amount consumed per serving

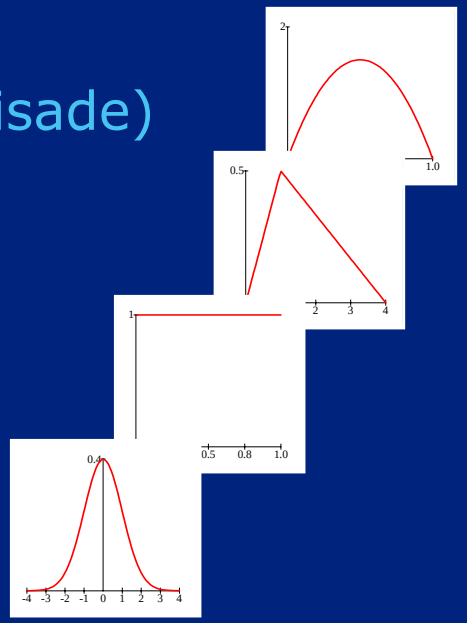
Modelling approaches along pathway

- Methods and approaches
  - Developed over years
  - Depend upon
    1. Data availability
    2. Detail required & aims

- Example approaches
  - On-farm transmission models
  - Probability distribution fitted to data
  - Change in log numbers of bugs
  - Predictive microbiological models
  - Model processes
    1. Growth, inactivation
    2. Mixing, partitioning, cross-contamination

Assess the risk: probabilistic approach

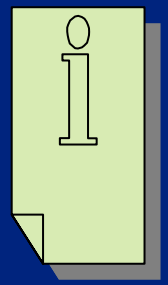
- Inputs described by probability distribution
  - Incorporate uncertainty and/or variability
- Extended what-if approach
  - Various combinations for each input value
- Monte-carlo simulation
  - Computer software –e.g. @Risk™ (© Palisade)
  - Simulate number of bugs in food chain
- Output
  - Distribution of risk
  - Measure of uncertainty and/or variability



Outputs

- Risk estimate – e.g.
  - Number of contaminated servings per year
  - Number of human cases of food-borne illness per year
- Validation –e.g.
  - Output
    1. Compare with the reported number of cases per year
  - Along pathway
    1. Retail survey data
    2. Abattoir survey data
- Peer reviewed

What information can the outputs provide?



- Examples include…..

- Quantification of impact of control measures
  - Impact of reduction in farm prevalence fi human illness?
- Quantified indication of critical control points in food chain
- Relative contribution of different food pathways to human illness
- Inform on data gaps and uncertainties

The pros and cons

- Advantages
  - Provide insight into key steps that ›/fl risk
  - Prioritise risk sources
    1. Environmental pathways versus food pathways
  - Identify scientific uncertainties and biological variability
  - Allows for sensitivity testing and scenario analyses

- Disadvantages
  - Useful data may be limited -> expert opinion
  - Lack of formal validation
  - Lack of information -> poor model
  - Misinterpretation of quantitative results

Discussion points

- QMRA is simplification of complex process
  - Balance between
    1. Parsimonious model
    2. Available and relevant data
    3. Aims & objectives
  - Scientific knowledge in food safety increased over years
    1. Key data gaps: e.g. cross-contamination from hide to carcass
    2. Modelling issue: e.g. lack of aerosol transmission
- Inclusion of predictive microbiological models
  - Designed for different purpose
  - Issue with incorporating uncertainty/variability in models
- QMRA scientific & transparent tool