EFSA's work and vision regarding modernisation of meat inspection

RIBMINS Cost Action Network 7. November 2019

Birgit Nørrung, DVM, PhD
Head of Department of Animal and Veterinary Science

KØBENHAVNS UNIVERSITET

Short about my role in EFSA work

- 2003-2012, 2015-2018 member, vice-chair and chair (2011-2012) in the Scientific Panel on Biological Hazards, EFSA.

- 2012-2015 member of EFSA's Scientific Committee

Presentation content

- Introduction to “old” traditional meat inspection and its challenges
- EFSA’s work and visions:
  - Deciding which biological meat safety hazards are most relevant
  - New approaches to risk reduction/control for the most relevant biological hazards
- Summary of key aspects

Traditional meat inspection

Fundamentals developed in second half of 19th century

- see Von Ostertag (1899)

Traditional meat inspection's main elements:

- Ante-mortem examination of live animals
- Post-mortem examination of meat (visual, palpation, incision)

Practically nothing changed until 2000-2010

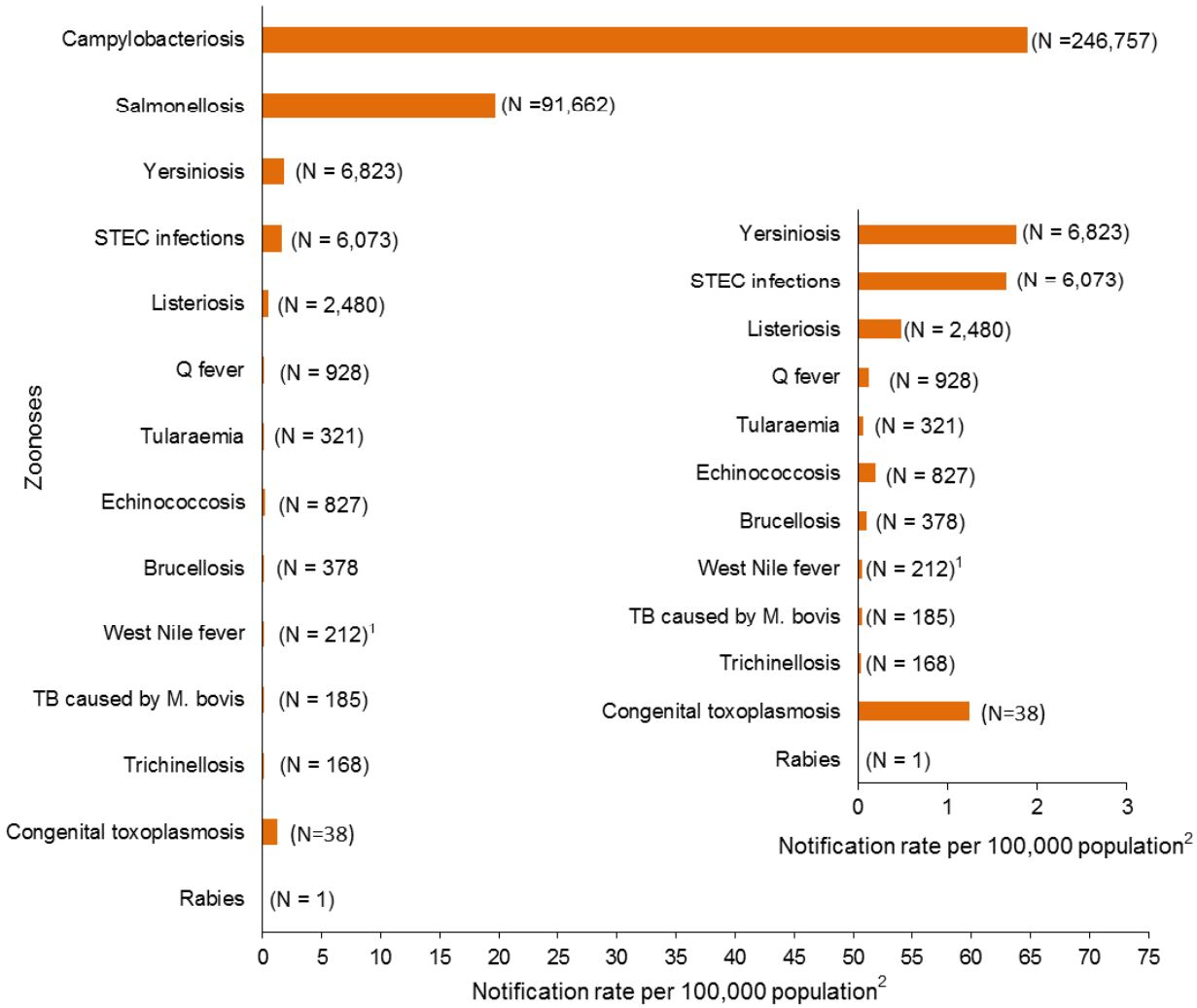
- Since, in the EU, much effort put into development of modernized approach better protecting public health through meat safety
- The current science and EU legislation on meat inspection state: *risk*- and *food chain-based* approach should be used

Non-meatborne hazards in common conditions at post-mortem inspection (pigs)

(Nordic Council of Ministers, 2006; Alban *et al.* 2008)

Condition	Microbial agents involved
Acute pneumonia	*A. pleuropneumoniae*, *Mycoplasma*
Chronic pneumonia	*A. pleuropneumoniae*, *Past. multocida*
Acute pleuritis	*A. pleuropneumoniae*, *H. parasuis*
Chronic pleuritis	*A. pleuropneumoniae*
Abscesses	*Arcanobacterium pyogenes*, *S. aureus*, *Streptococcus* spp.
Atrophic rhinitis	*Bordetella bronchiseptica*, *Past. multocida*
Arthritis	*H. parasuis*, *Erysipelothrix*, *Strept. suis*, *Strept.* spp., *S. aureus*
Osteomyelitis	*A. pyogenes*, *S. aureus*, *Strept.* spp.
Tail bite and infection	*A. pyogenes*, *S. aureus*, *Strept.* spp. (pyogenic), *Pseudomonas aeruginosa*
Peritonitis	*A. suis*, *A. pyogenes*
Pericarditis, endocarditis	*A. suis*, *Pasteurella* spp., *Strep.* spp., *E. rhusiopathiae*
Hepatitis	Several, often secondary
Infected wound	*A. pyogenes*, *S. aureus*, *Strept.* spp., *Pseudomonas aeruginosa*
Nephritis	*Strept.* spp., *Erysipelothrix*, *A. pyogenes*, *S. aureus*, *Proteus* spp.
Caseous lymphadenitis	*M. avium*, *M. bovis*, *R. equi*, *Nocardia farcinica*

Reported numbers and notification rates of confirmed human zoonoses in the EU, 2017



Top five agents causing foodborne zoonotic disease in the EU (2017)

Zoonotic agent	In humans		In pig meat chain		
	Total cases of disease (number)	Case fatality (%)	In feed for pigs (% positive)	In pigs (% positive)	In fresh pork (% positive)
Campylobacter	246,158	0.04	NA	17.6	6.9
Salmonella	91,662	0.25	0.47	12.7	1.6
Yersinia	6,823	0.07	NA	4.4	8.3
Shiga-toxin *Escherichia coli* (STEC)	6,073	0.50	NA	37.5*	3.0
Listeria	2,480	13.8	NA	NA	1.8**

* Report from one Member State, ** Ready-to-eat meat and products

Meatborne human hazards in traditional post-mortem inspection (pigs)

Not detected (examples):

Salmonella enterica

Yersinia enterocolitica

Campylobacter spp.

Clostridium spp.

Listeria monocytogenes

VTEC

Antimicrobial resistance

HEV

Sarcocystis suihominis

Toxoplasma gondii

Detected (examples):

T. solium cysticercosis

- low sensitivity

Trichinella spp.

- reliably

Very low prevalence of these two hazards

– in particular in controlled housing

EFSA's Working Group on biological hazards in swine meat inspection (2011)

EFSA (2011) Scientific Opinion on the public health hazards to be covered by inspection of meat from swine. *EFSA Journal, 2011, 9(10)*, 2351.

Chair:

Prof. Sava Buncic (*Serbia*)

Members:

Prof. Frans van Knapen (*The Netherlands*)

Prof. Gunter Klein (*Germany*)

Prof. Marcelo De Las Heras (*Spain*)

Prof. Birgit Noerrung (*Denmark*)

Prof. Truls Nesbakken (*Norway*)

Prof. Katharina Staerk (*United Kingdom*)

Prof. Iva Steinhauzerova (*Czech Republic*)

EFSA's Secretariat: Pablo Romero Barrios

Terms of Reference

the BIOHAZ Panel was asked:

to identify and rank the main risks for public health that should be addressed by meat inspection, to assess the strengths and weaknesses of the current meat inspection methodology,

to recommend inspection methods fit for the purpose of meeting the overall objectives of meat inspection for hazards currently not covered by the meat inspection system and

to recommend adaptations of inspection methods and/or frequencies of inspections that provide an equivalent level of protection.

The Panel on Animal Health and Welfare (AHAW) was asked to consider the implications for animal health and animal welfare of any changes suggested in the light of public health risks to current inspection methods.

Which hazards to target by risk-based meat inspection?

Assumption 1

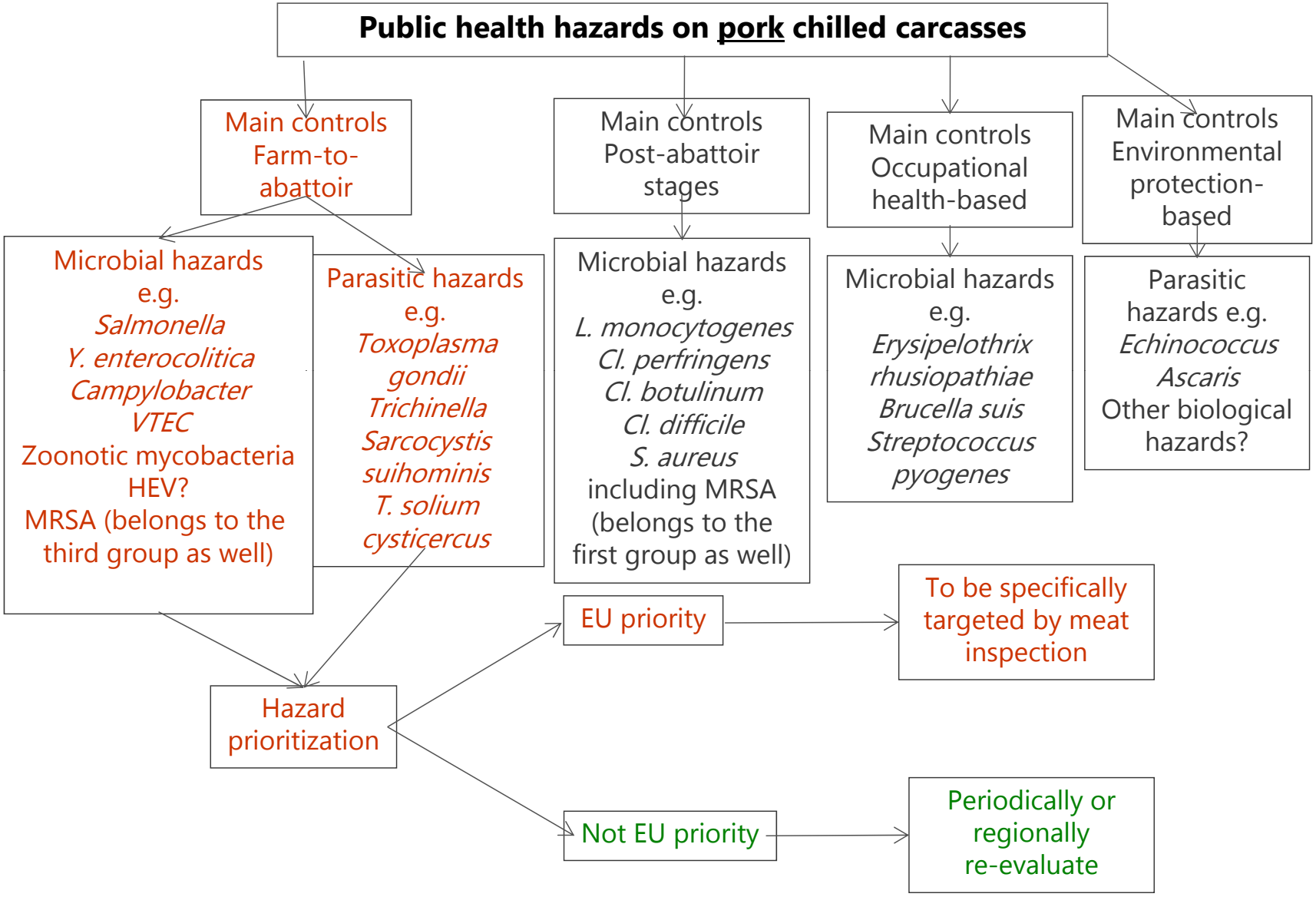
- Public health is a priority goal in meat inspection
  - *Animal health* and *animal welfare* hazards are important but secondary to public health if/where opposing interests exist

Assumption 2

- Chilled carcass is the main issue for meat inspection;
  - Food chain stages post-abattoir are relevant for foodborne risk but could be presumed as a "fixed" factor in this context

Assumption 3

- Focus is on priority hazards:
  - most relevant in EU;
  - meatborne;
  - related controls during farm-to-chilled carcass phase
- **Selecting the priority hazards**: through risk-ranking


Public health hazards on pork chilled carcasses
Main controls Farm-to-abattoir
Main controls Post-abattoir stages
Main controls Occupational health-based
Main controls Environmental protection-based
Microbial hazards e.g. Salmonella Y. enterocolitica Campylobacter VTEC Zoonotic mycobacteria HEV? MRSA (belongs to the third group as well)
Parasitic hazards e.g. Toxoplasma gondii Trichinella Sarcocystis suihominis T. solium cysticercus
Microbial hazards e.g. L. monocytogenes Cl. perfringens Cl. botulinum Cl. difficile S. aureus including MRSA (belongs to the first group as well)
Microbial hazards e.g. Erysipelothrix rhusiopathiae Brucella suis Streptococcus pyogenes
Parasitic hazards e.g. Echinococcus Ascaris Other biological hazards?
Hazard prioritization
EU priority
To be specifically targeted by meat inspection
Not EU priority
Periodically or regionally re-evaluate

Methodology when ranking meatborne hazards – as part of prioritization

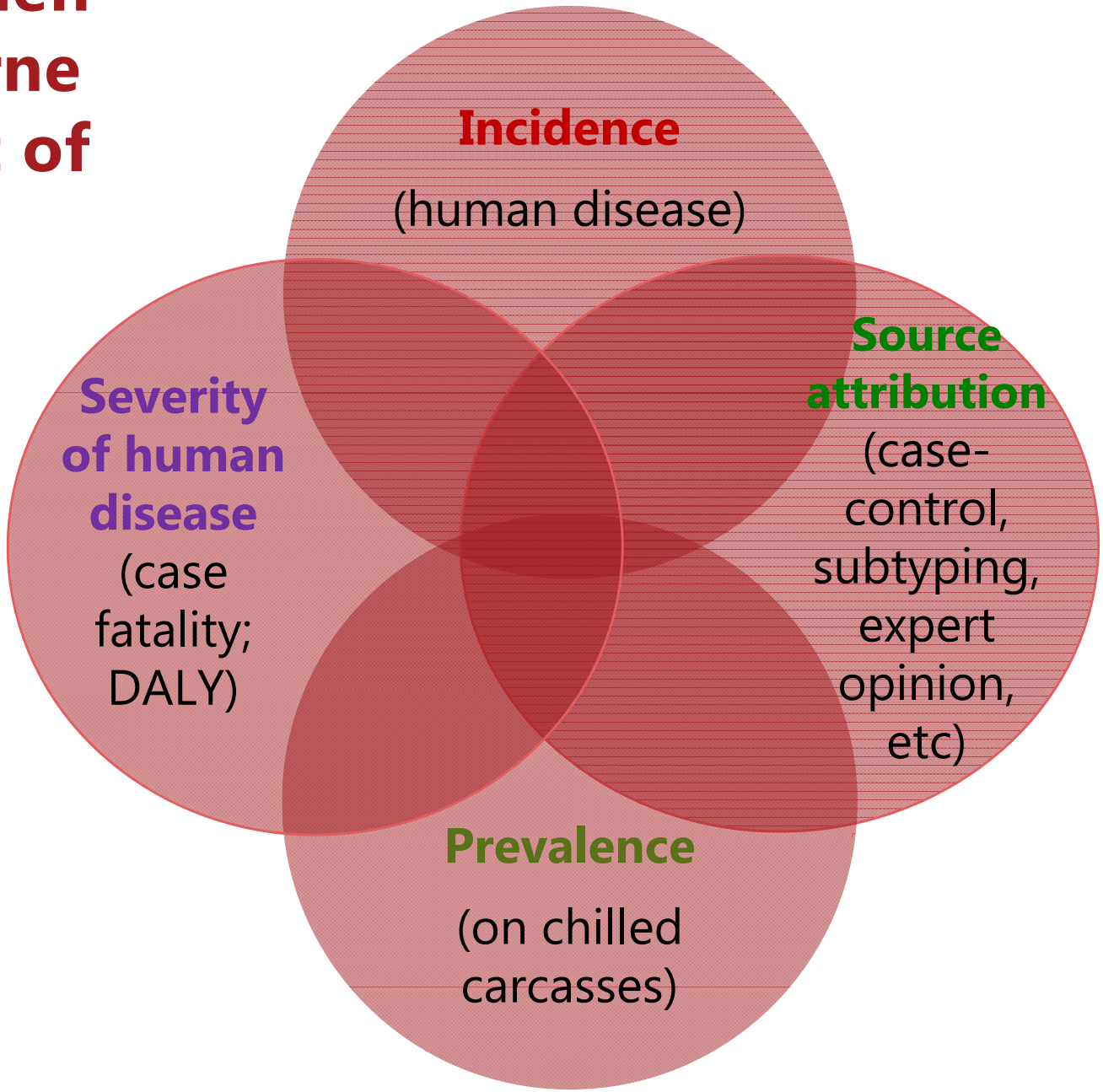


Table 4: Preliminary qualitative risk assessment of foodborne hazards associated with chilled pork carcasses (combining information from Tables 2 and 3)

Preliminary qualitative evaluation of the risk level: probability of occurrence against severity of consequences		Severity of consequences			
		High severity of consequences: human cases >10/100,000, and case-fatality <0.1%	**Medium severity of consequences: human cases 1-10/100,000, and case-fatality <0.1%**	**Low severity of consequences: human cases <1/100,000, and case-fatality >0.1%**	**Low severity of consequences: human cases <1/100,000, and case-fatality <0.1%**
Probability of occurrence	High probability: incidence on chilled carcass >5%	HIGH RISK *Salmonella* spp.			
	Medium probability: incidence on chilled carcass 0.1-5%	MEDIUM RISK *Campylobacter*[3] spp.	MEDIUM RISK *Yersinia enterocolitica*	MEDIUM RISK *L. monocytogenes*[5] VTEC[4]	LOW RISK *Toxoplasma gondii*
	Low probability incidence on chilled carcass <0.1%			LOW RISK *Cl. botulinum*[1,5]	LOW RISK *Sarcocystis suihominis*[1,2] *T. solium cysticercus* *Trichinella* spp. *Cl. difficile*[1,5] *Cl. perfringens*[1,5] *Mycobacterium* spp. *Staph. aureus* (MRSA)[5] HEV[1,2]

[1] Unknown occurrence on carcasses, but the experts considered them to be low at present (excluded from present considerations; to be monitored in the future)

[2] Unknown incidence of human disease, but the experts considered them to be low at present (excluded from present considerations; to be monitored in the future)

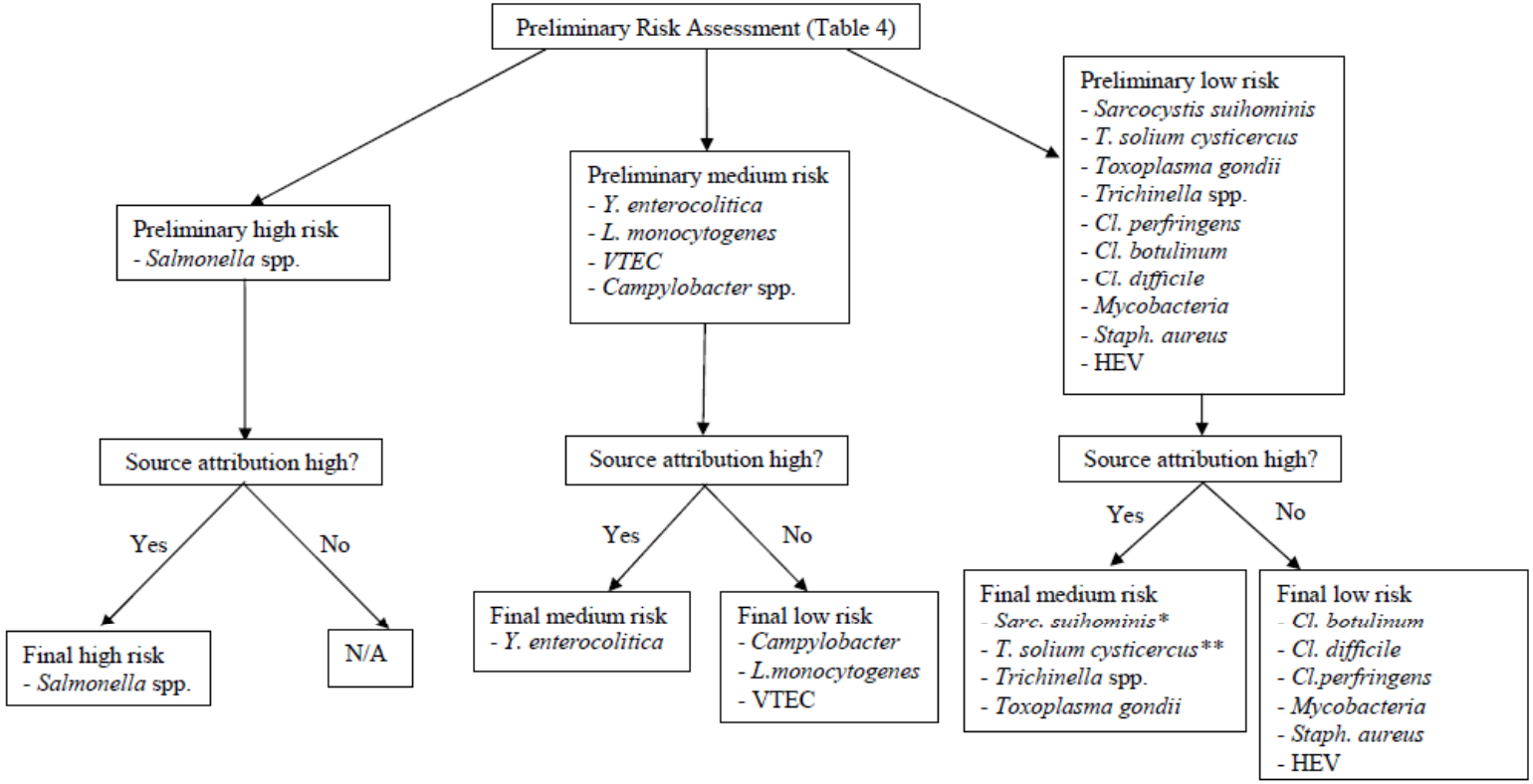
[3] The consideration included occurrence data collected at slaughterhouse/processing plant/cutting plant/retail or unspecified sampling point (see Tables 1 and 2), and not only on chilled carcasses, and also major dying off during chilling occurs, so probably actual occurrence on chilled carcasses was lower

[4] Data on occurrence on meats relate to processing-retail and not to abattoir-level, the main concern is ruminant carcasses and not porcine (excluded from present considerations; to be monitored in the future)

[5] The main risk factors include contamination and/or growth at processing-retail-domestic levels (excluded from present considerations; to be monitored in the future)

2.3. Risk ranking

Based on the input provided in the section above, the Panel reached a final classification of hazards (Figure 1).



*No information on occurrence in carcasses and human cases in EU (see Tables 1-4) so actual relevance in EU unknown; excluded from further considerations but to be monitored in future
**Not currently considered relevant in the EU pig population; excluded from further considerations but to be monitored in future

Figure 1: Final ranking of the main risks associated with chilled pork carcasses in the EU

Priority ranks of hazards (EFSA, 2011)

High risk

- *Salmonella* spp.

Medium risk

- *Yersinia enterocolitica*
- *Trichinella* spp.
- *Toxoplasma gondii*

Low risk

- *Campylobacter*
- VTEC
- Mycobacteria
- Hepatitis E virus
- *Listeria monocytogenes*
- *Taenia solium*

Data lack, but considered as low/negligible

- *Sarcocystis suihominis*
- *Staph. aureus* (MRSA)
- *Cl. Difficile*
- *Cl. botulinum*

Harmonised epidemiological indicators

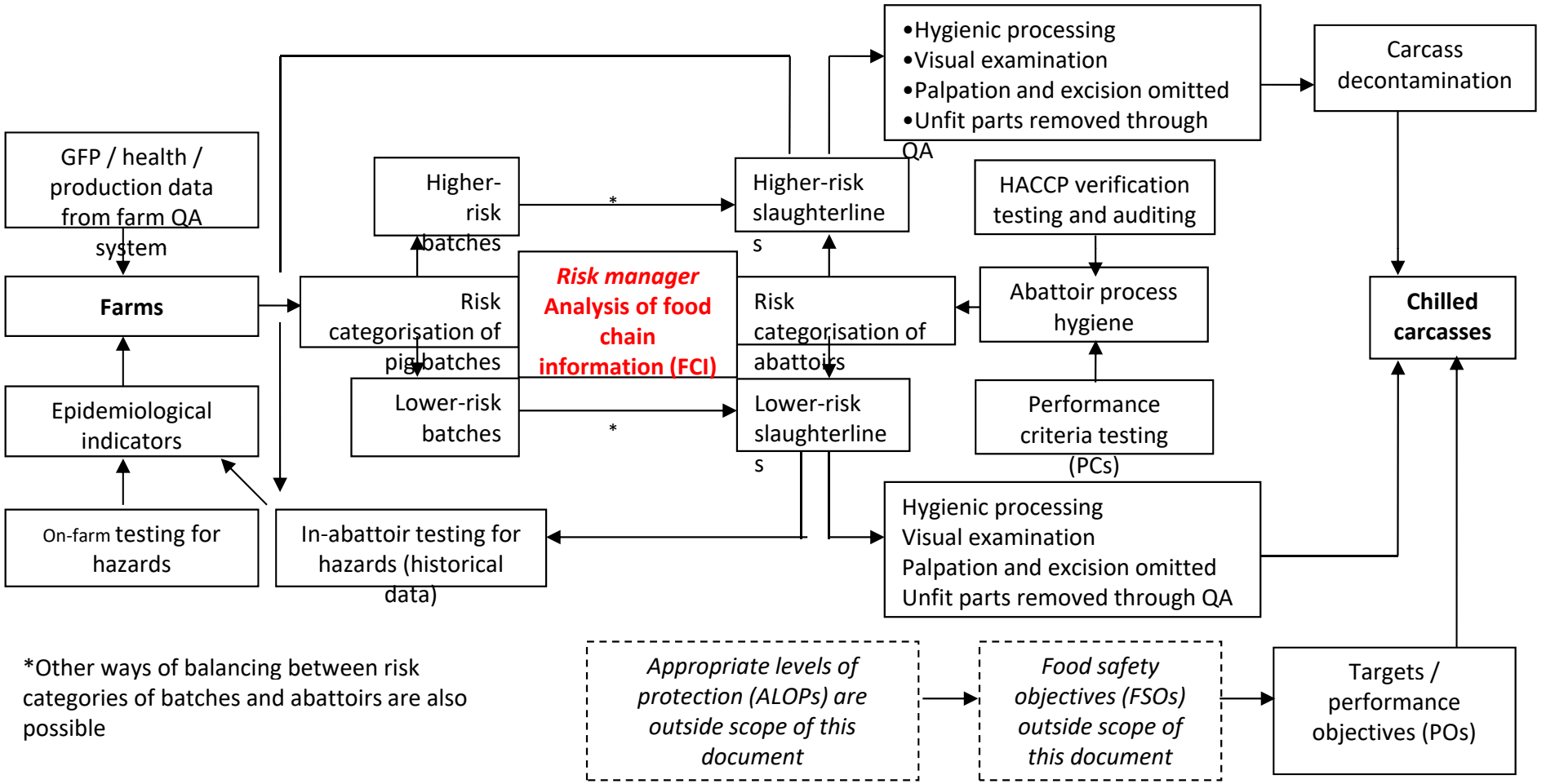
Direct measurement of hazard

- For example of *Salmonella* or *Yersinia*
- At different stages along stable-to-table

Indirect measurement of hazard

- For example through auditing of biosecurity
- Recommended for *Trichinella* and for *Toxoplasma*

Framework of carcass meat safety assurance: *Salmonella* and *Yersinia*



Interventions to control priority bacterial hazards
The problem – example of Salmonella

Edible tissues (random pigs, EU level)

Carcasses:	3.8% (1-8%)
Liver:	5.5% (2.7-12.2%)
Tongue:	7.9% (5.3-13.8)

Other samples (sero-positive pigs)

Tonsils:	49.0%
Rectum content:	27.0%
Mesenteric lymph nodes:	27.0%

Using palpation/incision during post-mortem inspection mediates bacterial cross-contamination

Interventions to control priority bacterial hazards
Process hygiene-based (main examples)

"Good" scalding (clean pigs, clean water, 62°C)

- >2 log reduction in TVC, virtual elimination of *Salmonella* on skin

Dehairing

- prevent squeezing out faeces from the anus, sanitation of the machine

"Good" singeing (1300-1500°C):

- 1.5-3 log reduction in TVC, 3-4 log reduction in *Salmonella* counts, up to 98% reduction of *Salmonella*-positive carcasses

Carcass polishing

- prevent 2 log increase in TVC (*Salmonella* in 10% machines in EU) by sanitation

Evisceration

- feed withdrawal, prevent faecal contamination (bung sealing), leave tongue untouched in the un-split head, prevent scalding water leaking from lungs at removal.

Carcass chilling

- $\leq$7°C within 24h (or before moved)

Interventions to control priority bacterial hazards *Antimicrobial treatments – carcass decontamination (examples)*

Normal water wash

- Average TVC reduction: 0.3 log

***Salmonella*-counts reductions on meat**

- Heat treatments (water 80-85°C; steam): 2.5-3.5 log
- Organic acids treatments: 2-3 log
- Combination of treatments: more effective
- Other treatments: variable

***Salmonella*-prevalence reductions on pig carcasses**

- Before 2% lactic acid treatment: 14%
- After treatment: 7%

Interventions to control priority parasitic hazards *Anti-parasitic treatments of meat*

Toxoplasma inactivation in meat

- Heat-treatment (e.g. 58°C/9.5 min)
- Freezing (e.g. -12°C/2 days)
- Curing (e.g. 3.3% salt in brine/3 days/20°C)

Main changes in EU legislation reflecting the modernized approach suggested by EFSA

- **Visual-only post-mortem inspection in routine pig slaughter**
- **Detailed inspection only of suspect pigs (FCI, abnormalities)**

Salmonella

- official sampling using same methodology as food business operators
- If process hygiene criterion not complied with repeatedly – action plan required by authorities
- total number and number of *Salmonella* positive samples shall be reported

Trichinella

Testing at meat inspection

- all pigs from uncontrolled housing
- all horses, wild boar and other susceptible farmed and wild species

Exempt from testing

- pigs from controlled housing
- meat of domestic swine that has undergone freezing treatment
- not weaned domestic swine less than 5 weeks

Current difficulties in implementation of the modernized framework in practice

Food chain information (FCI) not yet fully developed and under-utilized

Main aspects hampering uptake of recommended changes

- Insufficient explaining and communicating of the basis of the change
- Insufficient training in newly required risk-management skills
- Perception of the changes putting own position at risk
- Resource and time constraints

Summary of key aspects

1. Meat-chain and risk-based system with focus on priority hazards

2. Risk categorization of:
- incoming batches of pigs (farms) and abattoirs

3. **Balancing of risk categories of animal batches and abattoirs to decide:**
- "routine" slaughter or "suspect" slaughter inspection
- routine process hygiene only or also hazard-inactivation treatments

3. Post-mortem inspection in routine slaughter:
- Visual–only inspection wherever possible
- QA-based controls for abnormalities on *non-foodborne* and *meat quality* grounds

4. HACCP-based risk controls (verified-audited)

5. Setting targets and criteria for a) farms and animals; b) abattoirs and carcasses; and monitoring if/how they are met

6. Use harmonised epidemiological indicators (direct or indirect measurements)

7. Monitoring performance of the system and reviewing if/when necessary

Many thanks for your attention

- Good luck with your RIBMINS Cost Action Network

Sava Buncic is acknowledged for contributions to the presentation