CA18105

RIBMINS

Risk-based meat inspection and integrated meat safety assurance

Principles for risk-based surveillance and control

Lis Alban | 3 February 2021 | Virtual Training school

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the 2020 Framework Programme of the European Union

www.cost.eu

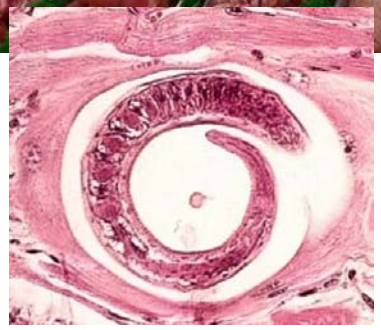
Challenges regarding food safety are plenty - Risk-based surveillance offers a solution

Salmonella

Lack of hygiene

Toxoplasma gondii

Food fraud



Trichinella

Inspection fraud

Yersinia enterocolitica

Taenia solium

Risk-based surveillance systems

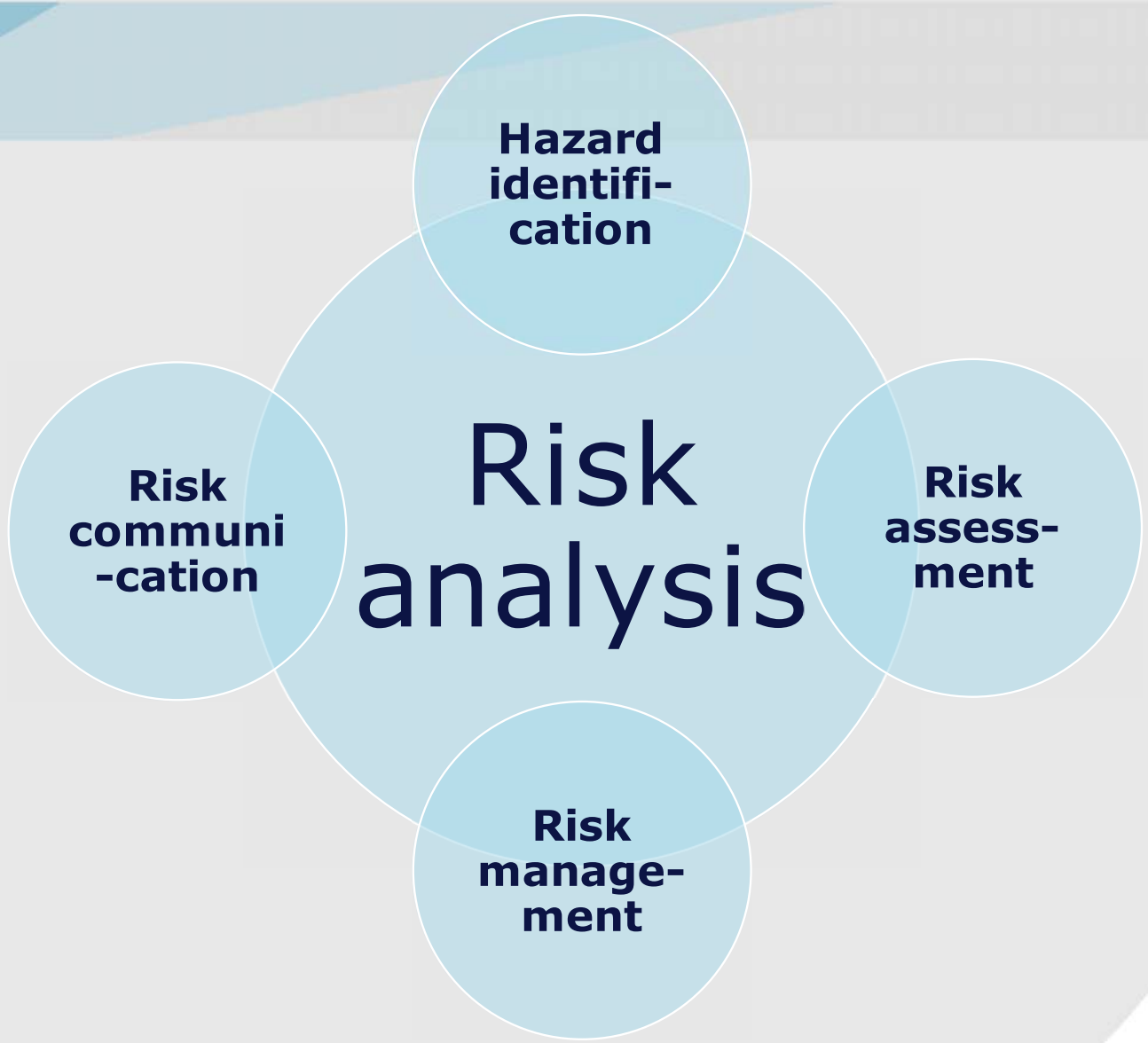
Grown out of veterinary services' world

- Applying risk analysis methods, when designing surveillance-and-control programmes
  - To assure appropriate and cost-effective data collection

Objective

- Identify surveillance needs to protect health of livestock and consumers
  - Including trade
- Set priorities and allocate resources effectively and efficiently
- Focus on high benefit-cost ratio

RIBMINS


Hazard identifi-cation
Risk assess-ment
Risk manage-ment
Risk communi-cation
Risk analysis

RIBMINS

Introduced into veterinary public health in 2006

By Katharina Stärk et al.

- Since then, the concept has been further developed

In the following, the concept will be described

- Advantages, requirements, and limitations

BMC Health Services Research

BioMed Central

Debate

Open Access

Concepts for risk-based surveillance in the field of veterinary medicine and veterinary public health: Review of current approaches

Katharina DC Stärk*[1], Gertraud Regula[1], Jorge Hernandez[2], Lea Knopf[1], Klemens Fuchs[3], Roger S Morris[4] and Peter Davies[5]

RIBMINS

Part 1 - The strategic decisions

What does the risk manager want to achieve?

- Improve human and animal health

  And/or

- Improve access to export market

Hazard identified and prioritized

- If human/animal health => based upon Burden of Disease
- If access to export market => based on trade requirements

RIBMINS

Part 2 - The operational decisions

Evaluate the entire value chain to ensure overview

- If focus is on parasite: Use knowledge of life cycle
- Look at number of human and animal cases
  - Describe consequences

Identify risk factors/commodities

- Evaluate easiness and costs of sampling
  - Together with a view on intended use of meat/food
  - Similar for risk management options
- Intensify sampling to specific subpopulations
  - Often stratum with highest risk (Risk=probability*consequences)

RIBMINS

Risk mitigation – different approaches

Before embarking on anything, plan which actions may be needed

- Do nothing, if risk is low and acceptable
  - Use auditing to document this, if needed
- Surveillance where risk may be perceived as too high
  - And where surveillance is expected to result in lower risk
  - Would involve some kind of control
- Direct action, if risk is known to be unacceptable
  - Not necessarily a need to go for costly surveillance

RIBMINS

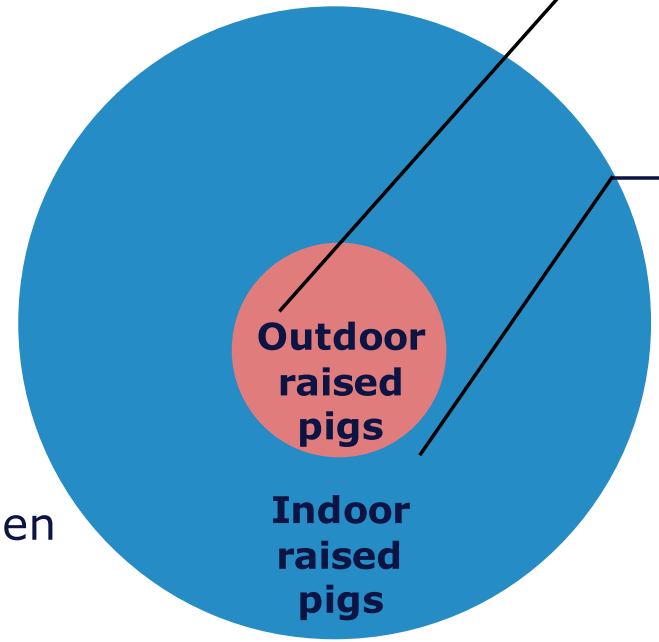
Sampling in high-risk stratum – Early warning/freedom

Design prevalence: minimum prevalence to observe, if hazard is present

Trichinella: 1 per million

N = 18 million pigs
⇒ 18 infected pigs

Assuming RR ≈ 8 between the two compartments
=>
(6inf/1M)/(12inf/17M) ≈ 8



Pigs raised under low biosecurity
N = 1 million => ≈ 6 infected

Pigs raised under high biosecurity
N = 17 million => ≈ 12 infected

Probability (P) of overlooking infection, when testing all low-biosecurity pigs, and assuming test Se=0.7:

$P_{0pos} = (1-0.7)^6 = 0.0007$
$P_{\geq 1pos} = 1-0.0007 = 0.9993 = 99.93\%$

Meat inspection is surveillance

All slaughter animals are subjected to inspection

- Consists of *ante* and *post mortem* inspection
  - As well as associated tests and treatments

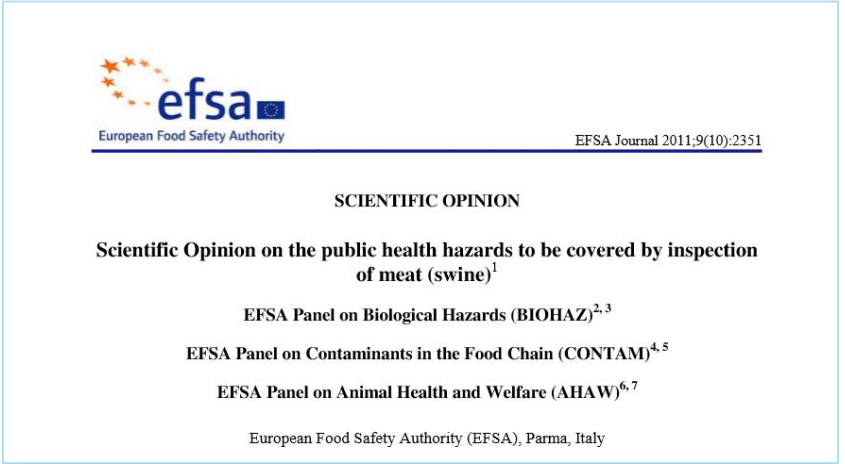
EFSA Opinions reg. relevant hazards to look for at meat inspection

Pigs: Salmonella, Yersinia, Trichinella and Toxoplasma

Cattle: Cysticercus bovis, bovine TB, Salmonella Dublin

Examples of surveillance and control will be presented

- for Trichinella and residues of antimicrobials in meat


efsa
European Food Safety Authority
EFSA Journal 2011;9(10):2351

SCIENTIFIC OPINION

Scientific Opinion on the public health hazards to be covered by inspection of meat (swine)[1]

EFSA Panel on Biological Hazards (BIOHAZ)[2, 3]

EFSA Panel on Contaminants in the Food Chain (CONTAM)[4, 5]

EFSA Panel on Animal Health and Welfare (AHAW)[6, 7]

European Food Safety Authority (EFSA), Parma, Italy


efsa
European Food Safety Authority
EFSA Journal 2013;11(6):3266

SCIENTIFIC OPINION

Scientific Opinion on the public health hazards to be covered by inspection of meat (bovine animals)[1]

EFSA Panel on Biological Hazards (BIOHAZ)[2,3]

With the contribution of the EFSA Panels on Contaminants in the Food Chain (CONTAM) and Animal Health and Welfare (AHAW)

European Food Safety Authority (EFSA), Parma, Italy

RIBMINS

Trichinella

Humans get infected when consuming meat from infected animals that has not been thoroughly cooked, frozen or curred

- Infection may result in life-threathening disease

Million of test of pigs have been analysed every year

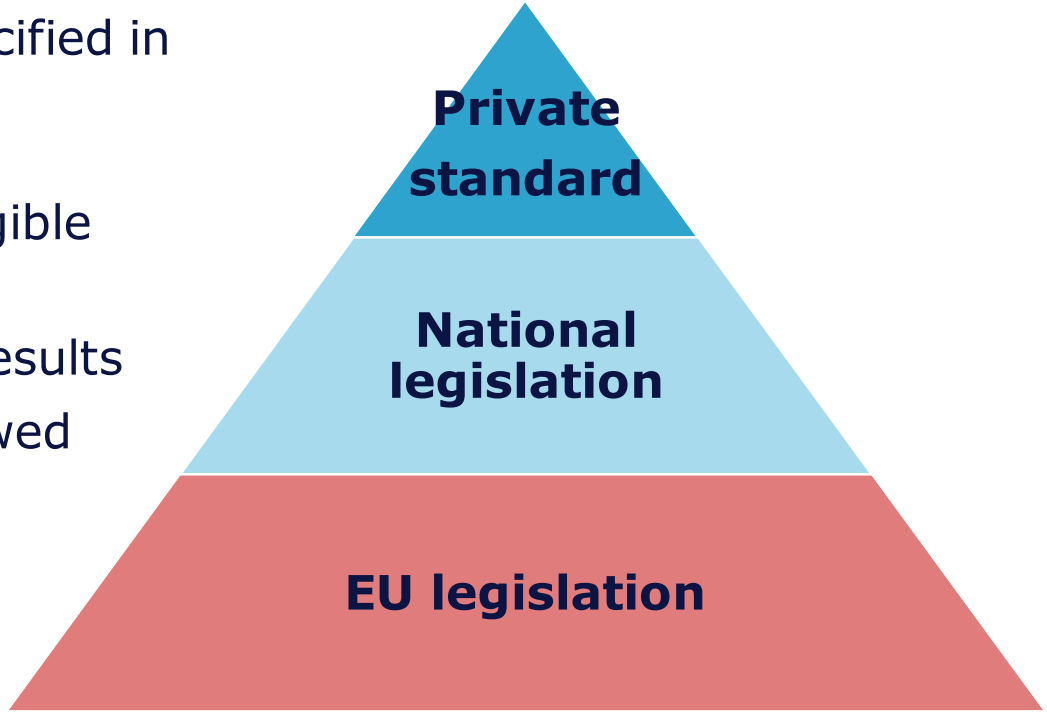
- Positives found in outdoor-reared pigs as well as on farms with poor biosecurity
- Negligible prevalence in pigs, raised under controlled housing

EFSA: auditing in low-risk group and surveillance in high-risk group

EU Trichinella Regulation 2015/1375

EU has adopted risk-based approach for surveillance

- Only testing of pigs raised in non-controlled compartment
  - Costs of sampling reduced substantially
  - Controlled housing requirements specified in Annex to Regulation
- Establishment and maintenance of negligible risk compartment
  - Based upon biosecurity and/or test results
  - Third-party independent auditor allowed
  - As part of private standards



RIBMINS

Residues of antimicrobials

Consumers dislike the idea of residues in their meat

- EU Directive 96/23 requires surveillance in place
  - Sample sizes are stipulated in the Directive

- In Denmark, own check + public surveillance
  - Large export of pig meat makes it valuable to have surveillance
  - Implying that thousands of samples are taken and analysed annually
  - Only few are positive
    - Findings results in visits to the farm of origin of the animal

Findings in own check
- population of around 16 M finishing pigs

Year	No. of samples	Positive samples >MRL	Substance found
2007	17,612	1	Benzylpenicillin
2008	22,806	2	Doxycycline & Benzylpenicillin
2009	21,686	1	Doxycycline
2010	16,191	2	Benzylpenicillin (2)
2011	19,361	0	n.r.
2012	14,240	1	Tularthromcin
2013	14,262	0	n.r.
2014	14,369	0	n.r.
2015	14,242	1	Benzylpenicillin

Presence of AM usually result of use of injectables

Because for most AM *per oral* use does not lead to absorption into body

n.r.= not relevant

In search of an indicator: Chronic pleuritis

Code/Lesion	Prevalence[a] of lesions in eight case herds								Average of company
	H1	H2*	H3	H4	H5*	H6	H7*	H8*	
Chronic pleuritis	**22.9**	**48.1**	8.1	**21.7**	**69.2**	**32.5**	**47.3**	**52.3**	18.8
Tail bite	0.1	0	0.1	0	0.9	0.1	0	0.4	0.2
Chronic pericarditis	0.2	0	3.1	4.2	13.1	0	0.2	0	2.0
Chronic pneumonia	0.7	0.8	0.5	1.0	0.9	0.4	0	0	0.5
Chronic peritonitis	0.9	0.2	0.8	0	1.9	0.4	0.1	2.5	0.8
Osteomyelitis	0.2	0	0.3	0.3	0.9	0.3	0.2	0.4	0.3
Abscess hindquarters	0.5	0.3	1.2	0.7	2.8	1.8	0.7	1.6	1.0
Abscess leg/toe	0.8	0.3	1.3	3.6	0	0.8	0.8	1.8	1.1
Abscess forequarters	0.1	0.1	0.5	1.0	0	0.3	1.0	0.4	0.5

New own check implemented

In 2016, Danish swine abattoirs introduced risk-based surveillance for residues of AM origin in finishing pigs

- Using HPLC LC-MS/MS
- 50% of samples in high-risk herds
  - Within-herd prev. of chronic pleuritis >40%
- 50% random samples

In 2016: 8,654 samples in total – 0 positives

- Sample matrix is **meat** and **not kidney**
- Costs comparable to those seen in previous program
- Because own check sample size was halved

Advantages and requirements

- Higher benefit-cost, if planned well
- Risk factors need to be identified and documented
- Resource-demanding to collect data
- Keep it simple
  - Divide population into low-risk and high-risk
  - Assume all animals/herds from high-risk compartment as potentially infected
  - Use indicators to divide population
    - E.g. through auditing of biosecurity

Limitations

Move towards higher demand for lean pork, based on local, animal welfare friendly, outdoor production

- Lower salt and less-thorough cooking (pink pork)

Effect should be foreseen and handled

- Increase in exposure of humans to hazards
  - Larger uncertainty

No common agreement on what low-risk means

- Documentation of effect of risk factors needed
  - If not, confidence among consumers and trade partners may be low

Trends outside the food supply system

Climatic changes may result in expansion of habitat of insects or parasites

Likewise, requirement for increased feed production may lead to establishment of agriculture in areas previously free from human activities

- May lead to introduction of new infection in animals that form part of supply chain

Emphasizes that food supply systems are nested in social-ecological context

- Unpredictable from production chain perspective and demands a broader approach
  - Early warning surveillance may be needed

RIBMINS

Structured prevention and control

Risk-based surveillance can be set up to allow fast and targeted implementation of risk mitigating activities, when/where needed

- Ideally, we should prevent unwanted events from happening
  - In a structured way, in all parts of the supply chain
  - However, we need to prioritise to spend the resources well

Chain view with different kinds of measurements

- Hazard itself (direct) – more costly
- Indicators (indirect) – usually cheaper

Collaboration needed

Between authority, academia and Food Business Operator (FBO)

- Authority should set the target
- FBO knows often best how to reach target in a cost-effective way
- Academia can help to document what works and how

Need for data

- HACCP and own check already in place in most supply chains
  - May include valuable data

Necessary to evaluate surveillance systems

Regular evaluation recommendable to ensure that

- Latest technical accichievements are incorporated
- Objectives are met
- Benefit-costs of existing system compared to alternatives

Use evaluation tool to ensure evaluation is performed systematically

- Several tools exist
  - SURVTOOLS looks at the individual parts of surveillance elements
  - NEOH is a broader framework using One Health elements
    - By focusing on thinking-planing-working-learning-sharing-systemic organisation

RIBMINS

Summing up

- Need for surveillance, but few resources available
- Risk-based surveillance-and-control based on risk analysis framework
- Helps to identify needs, set priorities, and allocate resources
- Focus on high benefit-cost ratio in surveillance /control
- Think about biology, look at supply chain
- Use direct or indirect indicators
- Collaboration between stakeholders needed
- Evaluate systems regularly using a pre-developed evaluation tool