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**RIBMINS**

Risk-based meat inspection and  
integrated meat safety assurance

# Modern, flexible and risk-based approaches to poultry meat safety assurance systems

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**University of Liverpool**



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**BVPA Spring meeting: Poultry Management Innovations**  
**Double Tree by Hilton Harrogate Majestic Hotel & Spa, 13 & 14 March 2025**

# Content

- Needs for risk-based approach in meat controls: current situation
  - What are we (not) controlling?
  - What are we controlling in a risk-based way?
- Practical use of main components of risk-based meat safety assurance system (RB-MSAS)
  - Improving FCI: usefulness of precision livestock farming tools to detect diseases and poor welfare in broilers
  - Computer Vision Systems for post-mortem meat inspection
  - FSMS performance assessment, interventions, abattoir risk categorisation
- Risk-based meat inspection: **localised perihepatitis case**
- Risk-based code system for post-mortem inspection of broilers
- Training risk managers in future modern meat controls

# About me

- Doctor of Veterinary Medicine, PhD in Food safety (beef interventions)
- Diplomate (EBVS<sup>®</sup> European Specialist) of European College of Veterinary Public Health (subspecialty Food Safety)

## Educational role:

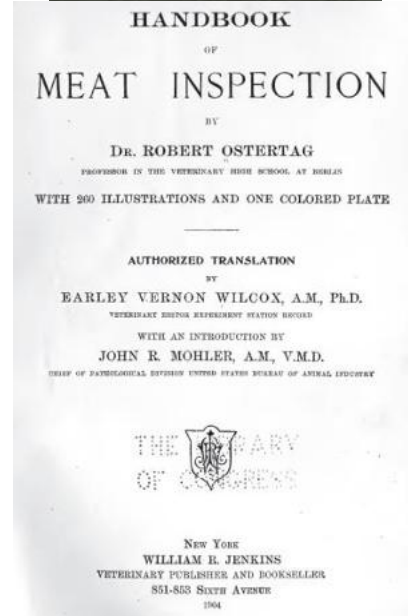
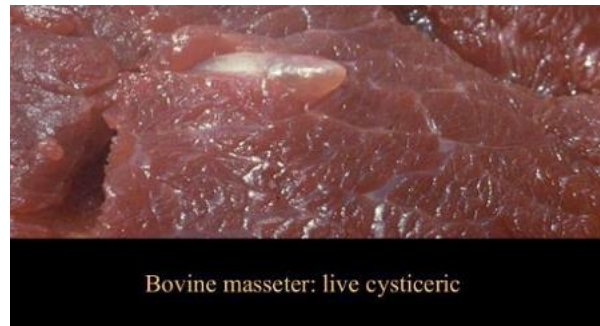
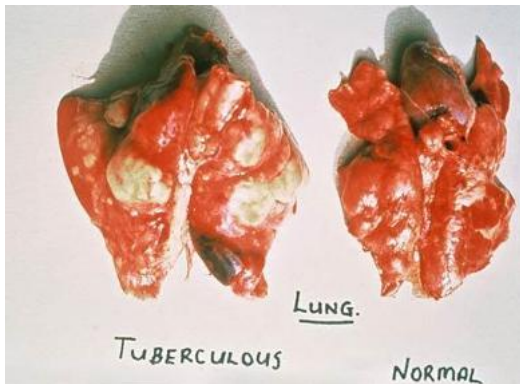
- Teaching VPH/Food safety/Food microbiology (Senior Lecturer in VPH)
- ECVPH Education Committee (Chair)

## Research role:

- Research interests: policy-led veterinary food safety research into epidemiology and controls (interventions) for foodborne pathogens in meat safety assurance systems
  - Meat inspection, process hygiene, Yersinia, Campylobacter, Salmonella, STEC, AMR, foodborne parasites
- Member of Food Standards Agency's Advisory Committee on the Microbiological Safety of Food (ACMSF)

# Background

- ‘Traditional’ meat inspection/controls developed in mid 1880’s, to address main transmissible diseases from animals that were endemic in Europe - practically unchanged since !
- Main problems:
  - zoonotic tuberculosis, trihinellosis, cysticercosis from infected meat and brucellosis from infected milk;
  - non-zoonotic animal health problems: foot and mouth disease, rinderpest, etc
- It was risk-based then, but not today: the hazards and relative risks changed
- Ostertag (1899). The use of flesh and milk of tuberculous animals. The Journal of Comparative Pathology and Therapeutics, 12, pp 240-250.



# Background

- The hazards and relative risks changed!



**Normal meat**



**Salmonella contaminated meat**



# Hazard identification: Non-zoonotic hazards in common conditions at *post-mortem* broiler inspection

Conditions (22 UK inspection codes)	Aetiology	Reasons / impact of detection	Condemnation
Abnormal Colour/Fever (septicaemia/toxaemia)	Infectious, APEC	AH	Total
Antemortem Rejects (Runts)	Infectious, PFM	AH, AW	Total
Ascites/Oedema	APEC, metabolic	AH, AW	Total
Bruising/Fractures	Processing failure	AW, Q	Partial, total
Cellulitis	APEC	AH	Total, partial
<b>Contamination (faecal, oil/grease, crop, bile)</b>	<b>Multiple</b>	<b>FS</b>	<b>Partial</b>
Dead on Arrival/Death in the Lairage	Multifactorial	AH, AW	Total
Death other than Slaughter (Uncut/Badly Bled)	Processing failure	Q	Total
Dermatitis	Clostridium, Staph, Streptococci	AH	Total, partial
Emaciation	Genetic, PFM	AH, AW	Total
Hepatitis	Clostridium perfringens	AH	<b>Partial</b> , total
Joint Lesions	Viruses, mycoplasma, trauma	AH, AW	Total, partial
Machine Damage	Processing failure	Q	Partial, total
Myopathies (Oregon disease/Green Muscle, White Muscle disease)	PFM	AW, Q	Total
Other Farm conditions (Jaundice, Oregon disease/Green Muscle, White Muscle disease, Congenital malformation)	PFM	AW, Q	Total
Other Processing conditions (Poor Plucking, poor evisceration)	Processing failure	Q	Partial, total
Overscald	Processing failure	Q	Total
Pericarditis	APEC, Mycoplasma	AH	<b>Partial</b> , total (Salm +)
<b>Peritonitis/Perihepatitis</b>	<b>APEC</b>	<b>AH</b>	<b>Total</b>
Respiratory Disease (Air Sacculitis)	APEC, Mycoplasma, PFM	AH	Total, partial
Salpingitis	APEC, Mycoplasma	AH	Total, partial
Tumours/Nodules	Viruses (Marek, etc)	AH	Total, partial

**APEC:** Avian pathogenic E. coli; **PFM:** poor farm management; **AH:** animal health; **AW:** animal welfare; **FS:** food safety; **Q:** quality

## Hazard identification: Non-zoonotic hazards in common conditions at *post-mortem broiler* inspection



Foodborne hazards not detected	Notifiable diseases detected on farm/ante-mortem	Batch level sensitivity
<i>Salmonella enterica</i>	Highly Pathogenic Avian Influenza (HPAI)	98%
<i>Campylobacter</i> spp.	Newcastle disease (ND)	92.5%
Antimicrobial resistant bacteria (ESBLs)		



# Needs for modernisation of the traditional system

- ✓ Flaws of traditional meat safety assurance system well recognised for decades
- ✓ Food safety legislation from 2002 foresees **risk analysis** and **food chain** approach
- ✓ Initiative of the EU Commission and EFSA's work on meat inspection revision (2011-2013)
- ✓ Main aim of modernisation of meat safety systems is to be risk-based



- ✓ Concept addressed in former Meat Inspection Regulation 854/2004
  - Allowed use of *risk assessments*, when considering changing meat inspection
    - **From traditional to a more visual inspection**

- The need for a new effective overall control system: **risk-based, meat-chain orientated and comprehensive**

# Risk-based meat safety assurance system (RB-MSAS)

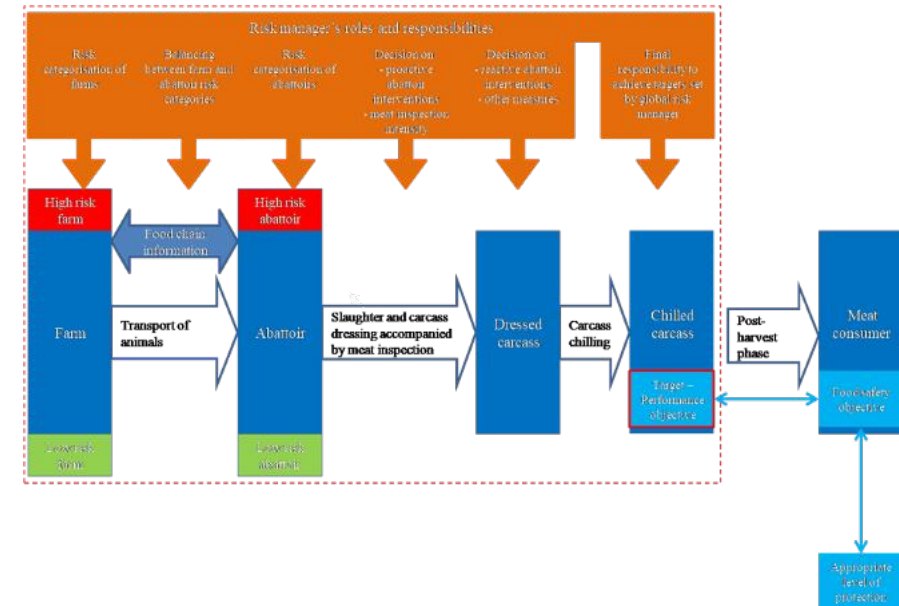
- **Risk-based:** focused on high-risk meat-borne hazards in/on chilled carcasses
- **Longitudinally integrated:** multiple preventative and control measures along the food chain to achieve required meat safety goals
- **Flexible and dynamic:** adaptable to changes while it still fulfils functional demands

# EFSA's work (2011-2013)

- Priority hazards

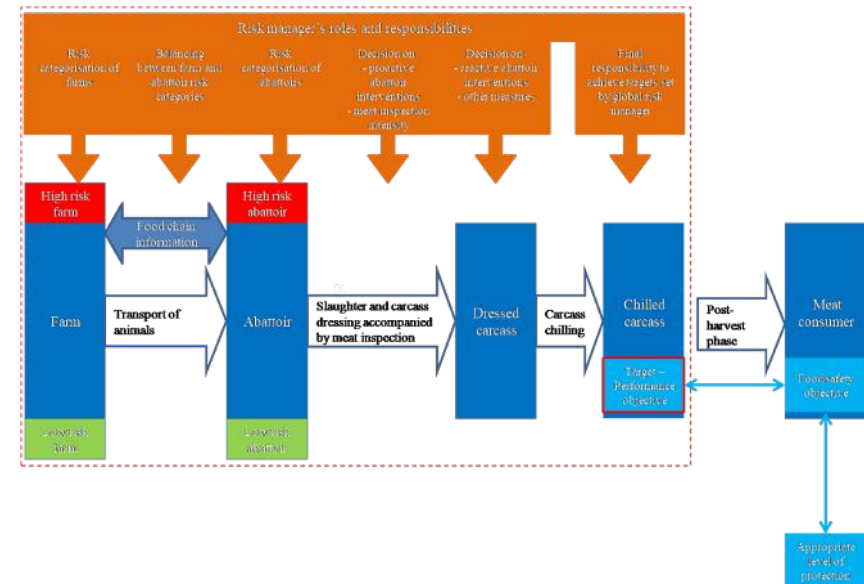
Species	Biological hazards	Chemical hazards
Poultry	<ul style="list-style-type: none"> <li>- <i>Campylobacter</i></li> <li>- <i>Salmonella</i></li> <li>- ESBL-AmpC gene-carrying bacteria</li> </ul>	<ul style="list-style-type: none"> <li>- dioxins</li> <li>- dioxin-like polychlorinated biphenyls</li> <li>- chloramphenicol</li> <li>- nitrofurans</li> <li>- nitroimidazoles</li> </ul>

- Generic framework of RB-MSAS

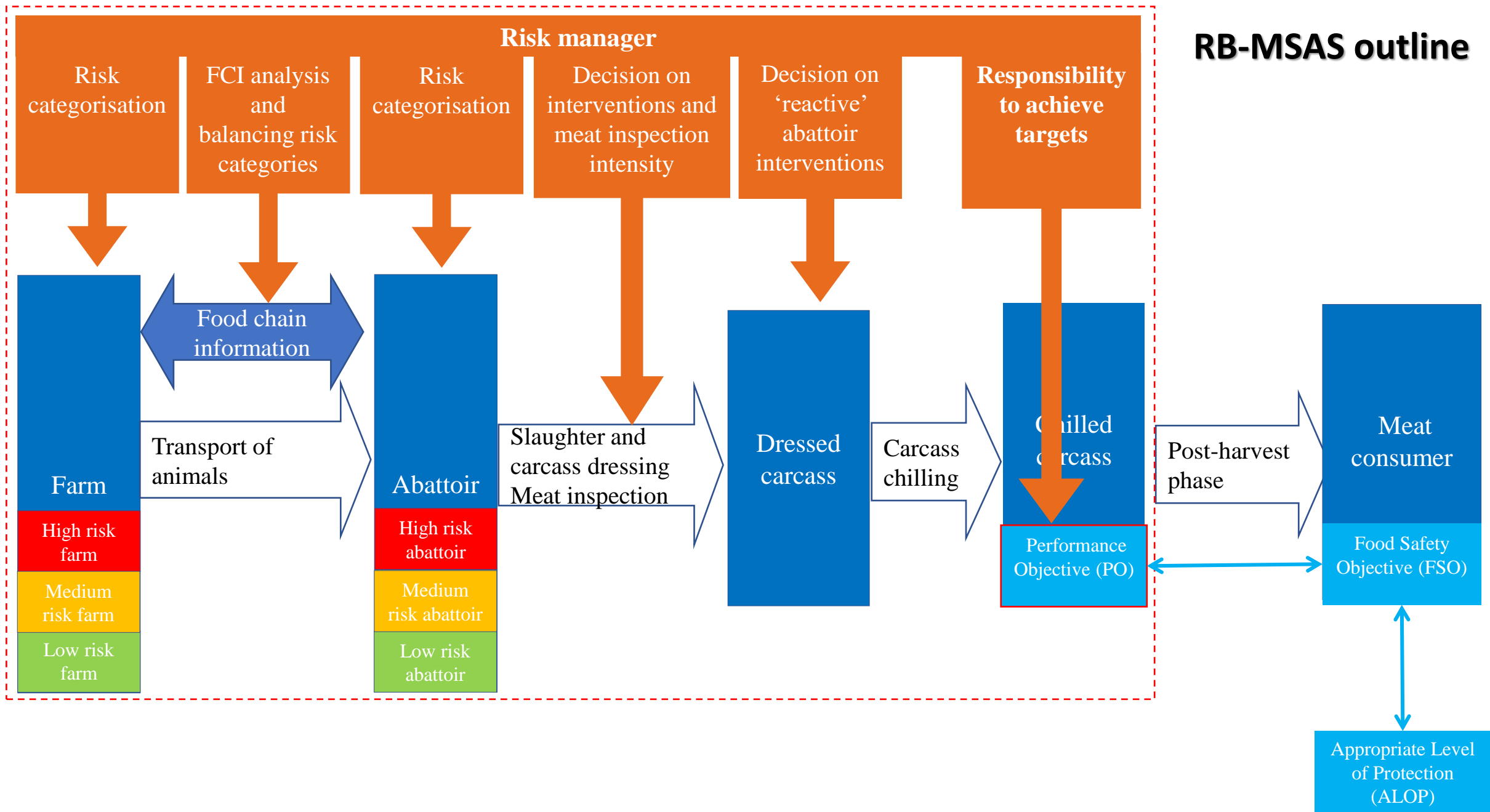


# EFSA's work (2011-2013): Main elements of RB-MSAS

- ✓ **Risk categorisation** of farms and abattoirs
  - ✓ harmonised epidemiological indicators; microbiological targets; improved FCI; performance
- ✓ Analysis of the food chain information: **improved FCI**
- ✓ Risk-based **meat inspection**
- ✓ Food safety management systems assuring process hygiene of abattoirs
  - ✓ use of **interventions** when needed
- ✓ **Risk manager**
  - ✓ FBO, CA



# RB-MSAS outline



More than 10 years have passed...

# RIBMINS

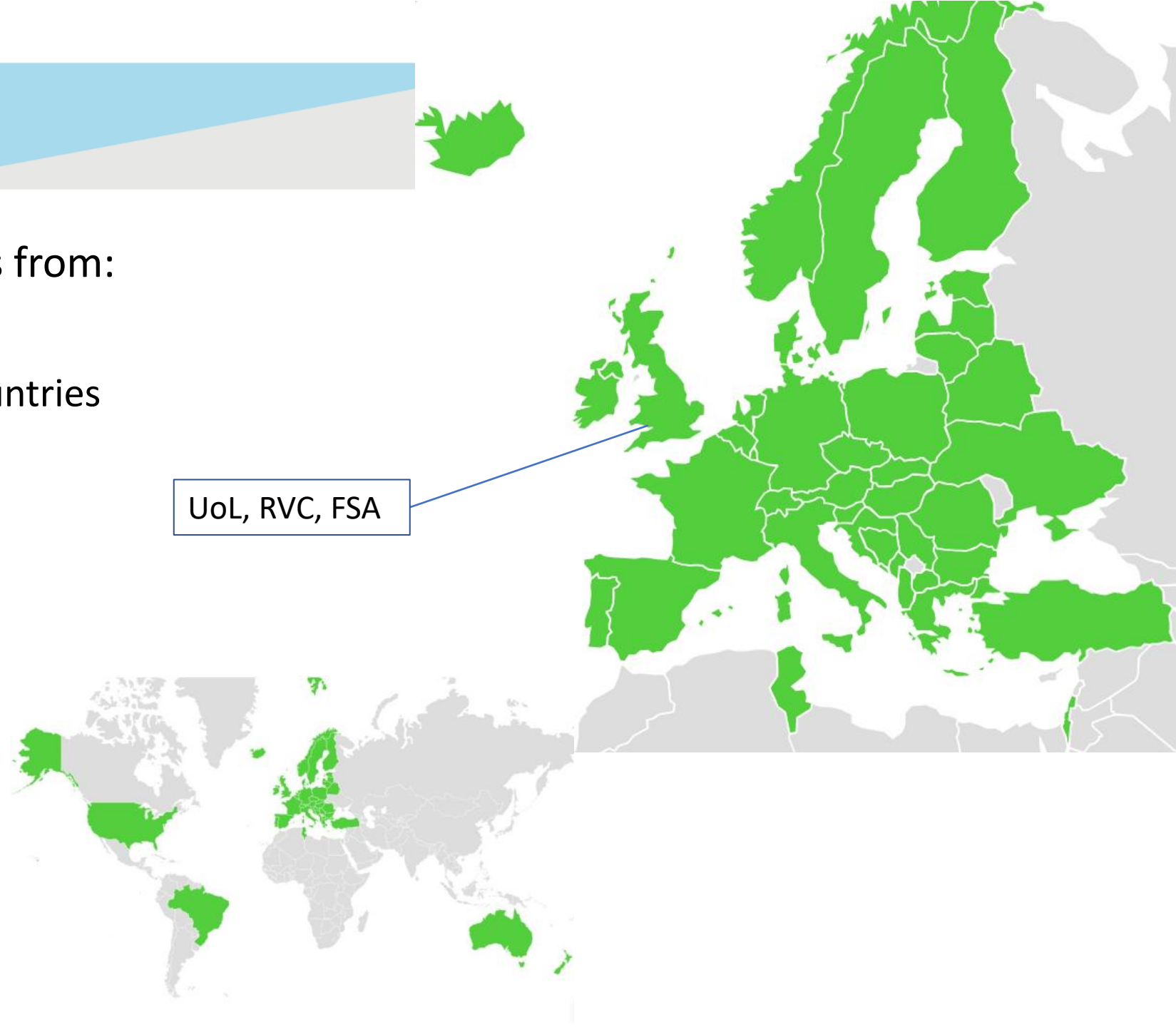
- **risk-based meat inspection** and integrated meat safety assurance  
COST-Action 18105
- **aim:**  
developing a network to combine and strengthen European-wide research efforts on modern meat safety control systems
- Mar-19 until Sept-23    **4 years (+6 months extension)**
- action chair: Prof Bojan Blagojevic [Univ. of Novi Sad | RS]  
action vice: Dr Lis Alban [Danish Agric. & Food Council | DK]

# RIBMINS network

More than 270 participants from:

- 36 European countries
- 4 international partners countries
- 3 near neighbour countries

UoL, RVC, FSA

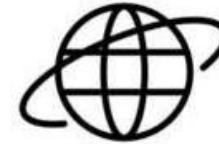


# RIBMINS activities and outputs ( <https://ribmins.com/> )

- Expert elicitation
  - Systematic reviews & meta-analyses
  - Surveys of European FBOs and CAs
  - Development of models
  - Combining research at national level
- <https://ribmins.com/reports-publications/>
- Dissemination:
    - Workshops
    - Training schools (3)
    - RIBMINS scientific conferences (4)
    - Short term scientific missions (20)
    - Conference grants
    - Stakeholder events (Brussels 26/04/2023)
    - Newsletters and digests
    - Collection of training materials (>1000 pages)
    - Scientific papers (36 and counting)



# WG5 RIBMINS collection of training materials



[www.ribmins.com](http://www.ribmins.com)

**Training school: Farm and abattoir interventions in a risk-based meat...**

RIBMINS  
28 videos 157 views Last updated on Aug 7, 2022

Play all Shuffle

**RIBMINS Training School 2021**

RIBMINS  
16 videos 394 views Last updated on Feb 10, 2021

Play all Shuffle

Training School on Future Meat Safety was held online on February 3 - 5, 2021 under the umbrella of the EU COST Action "Risk Based Meat Inspection and Integrated Meat Safety Assurance"

## TABLE OF CONTENTS

1	Introduction	4
	<b>WG1: Scope &amp; targets of meat safety assurance</b>	<b>5</b>
	Main topics	5
	Publications	5
	Reports	5
	Main conclusions	5
	Training school	7
	<b>WG2: Farm-level controls &amp; risk categorization</b>	<b>8</b>
	Main topics	8
	Publications	8
	Reports	8
	Papers	8
	Conclusions	9
	Pre-harvest meat safety interventions of broiler, pigs and bovines	9
	FCI and improvements	11
	Training school	16
	<b>WG3: Abattoir level controls &amp; risk categorization</b>	<b>17</b>
	Main topics	17
	Current papers	17
	Main conclusions	17
	Training school	17
	<b>WG4: Impact of changes &amp; alternatives to traditional meat inspection</b>	<b>18</b>
	Main topics	18
	Current papers	18
	Main conclusions	19
	Training school	19
5	<b>WG5: Meat safety assurance system training, communication, monitoring</b>	<b>20</b>
	Main topics	20
	Current papers	20
	Main conclusions	20
	<b>Conclusion</b>	<b>21</b>
	<b>Helpful links</b>	<b>22</b>

# Practical use of the risk-based approach

# Improved FCI

At present:

- Status of the holding of provenance / regional animal health status (movement restrictions)
- Animal health status (diagnosed disease, cause of high mortality)
- Knowledge of residues ← foodborne hazard
- Occurrence of diseases that may affect the safety of meat
- Salmonella testing ← foodborne hazard
- Relevant reports about previous ante- and post-mortem inspections of animals from the same holding
- Production data: total mortality rate

# Improving FCI: a systematic review of the usefulness of precision livestock farming tools to detect diseases and poor welfare in broilers

## Applications Of Microphones, Sensors And Computer Vision Systems For Ante-mortem Inspection Of Broiler Chickens: A Systematic Review

Michal Majewski<sup>1</sup>  
Lis Alban<sup>2</sup>, Dragn Antic<sup>3</sup>, Sergio Ghidini<sup>4</sup>, Mirosław Rozycki<sup>5</sup>, Joana Pessoa<sup>1</sup> and Marianne Sandberg<sup>6</sup>

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<sup>6</sup> National Food Institute-Danish Technical University (DTU-Food), Research Group for Foodborne Pathogens and Epidemiology

### Body of the Abstract

**Introduction:** Early detection of disease and poor welfare in poultry is essential in surveillance. Ante-mortem inspection (AMI) allows for assessment of broiler health before slaughter. However, the official control is limited to inspection of Food Chain Information document and mortality during transport. New technologies could ensure more accurate information. Video and audio-based analysis methods could allow detection of diseases in their early stage. Internet of things uses sensors assessing environmental conditions in broiler houses in precision livestock farming (PLF). In this systematic review, the authors answer the question: *which health and welfare indicators can be measured with computer vision systems, sensors and microphones for AMI purposes on broiler farm level?*

**Methods:** A protocol has been developed using the Cochrane methodology. Only primary research studies published between 2000 and 2024 have been used for data extraction. Articles from Scopus and Google Scholar databases are being investigated. The systematic review team consists of people with experience in broiler meat inspection and veterinary epidemiology.

**Results:** The work is ongoing. 6,135 scientific papers have been found using the search string. The next step is to screen the abstracts, reference lists and other sources for grey literature.

**Discussion:** New technologies show great potential. In addition to the mandatory inspection at arrival to the abattoir, cameras installed in the chicken house for monitoring broiler behavior as well as sensors monitoring ventilation efficacy in the house could be a possibility. In Denmark, the two largest broiler producing facilities have already implemented digitalized quality assurance systems, where data from the production chain are entered in real time. Adding behavior and other data to the digitalized system would be an improvement, allowing more accurate flock diagnoses set in a timely way.

**Conclusion:** These new technologies can provide accurate information about welfare and work as an early warning of disease.



Food chain information for broilers, pigs and bovines in Europe: Comparison of report forms and definitions of the relevant period for reporting treatments with veterinary medicinal products with withdrawal periods

Ting Ting Li<sup>a,\*</sup>, Diana Meemken<sup>a</sup>, Boris Antunovic<sup>b</sup>, Truls Nesbakken<sup>c</sup>, Susann Langforth<sup>a</sup>

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- Following on a survey of European stakeholders: FCI need optimisation and improvement

Systematic review ongoing:

- What health and welfare indicators can be measured with **computer vision systems, sensors and microphones** for ante-mortem inspection purposes on poultry farm level?



**to improve FCI**

# Computer vision systems for meat inspection

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Food Control

journal homepage: [www.elsevier.com/locate/foodcont](http://www.elsevier.com/locate/foodcont)



## Applications of computer vision systems for meat safety assurance in abattoirs: A systematic review

Marianne Sandberg<sup>a,\*,\*\*</sup>, Sergio Ghidini<sup>b</sup>, Lis Alban<sup>c,d</sup>, Andrea Capobianco Dondona<sup>e</sup>, Bojan Blagojevic<sup>f</sup>, Martijn Bouwknegt<sup>g</sup>, Len Lipman<sup>h</sup>, Jeppe Seidelin Dam<sup>i</sup>, Ivan Nastasijevic<sup>j</sup>, Dragan Antic<sup>k,\*</sup>

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### ARTICLE INFO

#### Keywords:

Computer vision  
Imaging  
Meat inspection  
Meat safety assurance  
Lesions  
Carcass contamination

### ABSTRACT

Introduction In 2017–2019 of the new EU legislation on official controls in food production allowed use of computer vision systems (CVSs) as complementary tools in meat inspection of bovines, pigs and poultry. A systematic literature review was performed to identify and analyse relevant articles reporting on the performances of CVSs used in abattoirs for ante- and post-mortem veterinary inspection and meat safety assurance, including systems for detecting carcass/organ contamination and lesions. In this review, 62 articles were identified and analysed. There were 35 articles reporting on CVS performance in the detection of carcass/organ lesions and 27 in the detection of carcass contamination. CVSs for broiler chicken, pig and bovine meat safety assurance were reported in 53, 5 and 4 articles, respectively. Not all developed CVSs were validated, and only three articles reported results from real-time evaluation of CVS performance in an abattoir vs performance of the official veterinarian. Most of the reported CVS performance measures (i.e., sensitivity and specificity) were >80%. A high specificity in detecting lesions and carcass contamination (i.e., a low number of false positives) is of importance for the food business operator in order to minimise food waste, whereas a high sensitivity (i.e., a low number of false negatives) is required for production of wholesome and safe meat. At present, the existing CVSs developed for overall meat safety assurance of broiler chicken carcasses and organs demonstrate very high sensitivities but suboptimal specificities, indicating the need for further CVS development and optimisation.

- CVS's for meat quality assurance date back to the mid-nineties and the extensive work conducted by the USDA Agricultural Research Service
- Post-mortem inspection presents a challenge for the high-speed slaughter of poultry – hence it was recognized long ago that applying CVS was the key to solve this problem

Already in place or in the pipeline for:

- Food pad dermatitis (poultry)
- Correct bleeding (pigs)
- Lesions in organs (poultry)
- Carcass contamination (pig and beef carcasses)
- Lung scoring (pigs)
- Tail length (pigs)

# Computer vision systems for meat inspection

- New EU legislation on official controls (2017-2019) permitted use of Computer Vision Systems (CVS) as a complementary tool in meat inspection of bovines, pigs and poultry
  - Article 6 of Reg 2019/627 lays down “The Member States shall inform the Commission and other MSs on **scientific and technological developments**, as referred to in Article 16 2 )(b) of Regulation (EU) 2017/625 for consideration and further action as appropriate.”
- In our systematic review:

Most of the reported CVS’s performance measures (i.e., sensitivity and specificity) were >80%

A **high specificity** in detecting lesions and carcass contamination (a low number of false positives) is of uttermost importance for the food business operator in order to minimize food waste, whereas

A **high sensitivity** (a low number of false negatives) is required for production of wholesome and safe meat

# VetInspector: a Computer Vision System tool for postmortem inspection of chicken

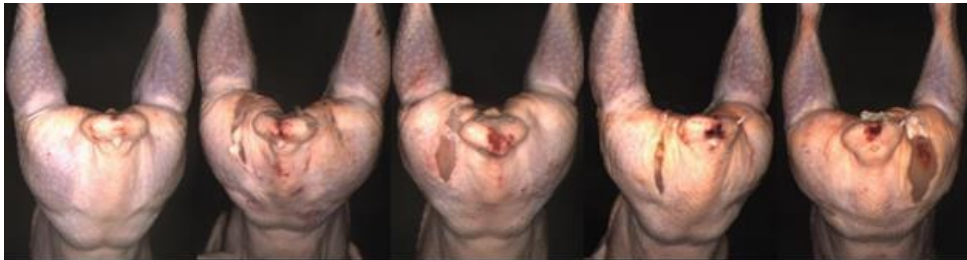
Detects lesions on carcasses (dermatitis, scratches, arthritis, ascites) and viscera (hepatitis, serositis)

- based on the Danish code list for poultry meat inspection
- not for faecal contamination
- Feasibility and validation studies from 2011-2018
- Implementation 2018-
- Full use only after a station for faecal/bile/gastrointestinal content contamination is developed

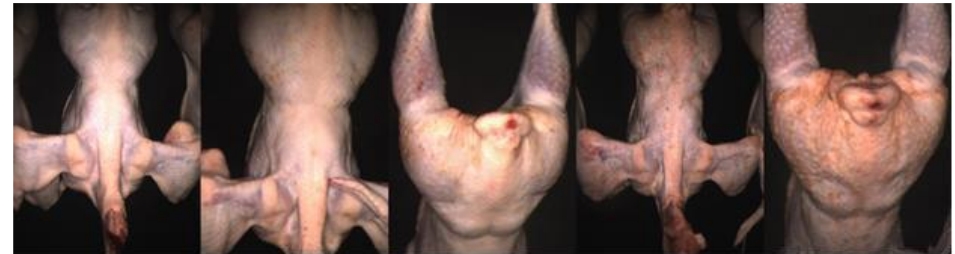


# VetInspector: a Computer Vision System tool for postmortem inspection of chicken

- Camera place on the line, 9 images per carcass, angle to optimise image quality
- Machine learning algorithms to analyse images (continuous learning)
- 1000s of images to teach the algorithm, then validation of agreement vs vets



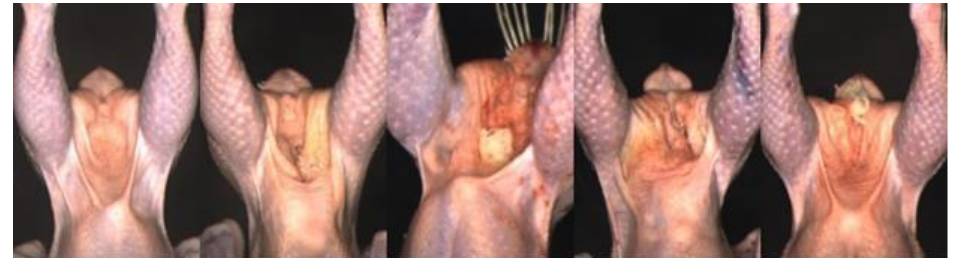
**Scratches:** pass PMI first image from the left



**Superficial dermatitis:** pass PMI first image from the left



**Bleeding:** pass PMI first image from the left



**Deep dermatitis:** pass PMI first image from the left

# Evaluation of the public health risks from broiler carcasses rejected with **localised perihepatitis** during post-mortem inspection

- 2022 data: 0.078% carcasses with perihepatitis condemned (1.13 million)

## Conditions for rejection of poultry at Post Mortem

### Peritonitis/Perihepatitis

#### Post mortem disposition

**Fig 1: Perihepatitis:** Note the fibrinous exudate covering the liver.

**Fig 2: Perihepatitis** with associated pericarditis.

**Fig 3: Peritonitis** with associated perihepatitis and pericarditis.

**Fig 4: Peritonitis** in a broiler: note the yellowish fibrinous material behind the gizzard, possibly *E. coli*.

**Fig 5: Peritonitis** in a turkey, fibrinous material also found.



### FSA Responsibilities

#### Post-mortem disposition

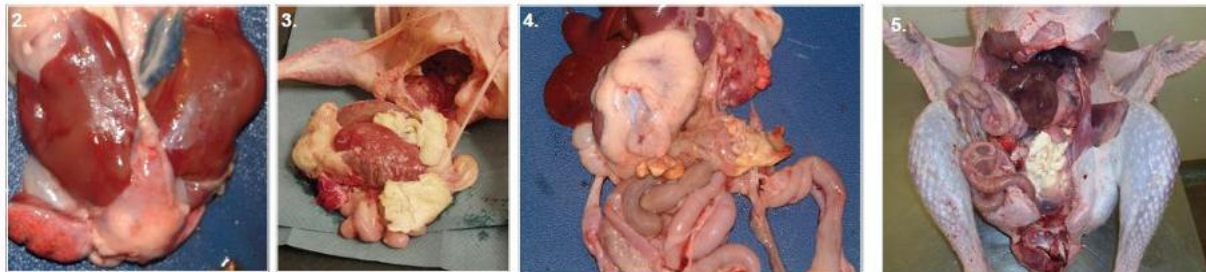
**Total rejection** of carcase and offal.

**Average rejection levels in GB**

Poultry: 0.085 %

#### Recording of the condition

The condition must be recorded under the perihepatitis/peritonitis entry on the INNOVA system.



## Conditions for rejection of poultry at Post Mortem

### Pericarditis in poultry

#### Post mortem disposition

**Fig 1:** Normal heart compared against a chronic pericarditis in a duck with no secondary condition. Partial rejection of affected offal.



**Fig 2:** Severe active pericarditis in a broiler. No secondary lesions were found and salmonella test result was negative resulting in partial rejection



**Fig 3:** Pericarditis with associated perihepatitis in ducks. Carcase and offal rejected.



**Fig 4:** Minor lesions of the pericardium compared to a healthy heart in turkeys. No associated lesions were noted resulting in sole rejection of affected parts.

### FSA Responsibilities

#### Post-mortem disposition

**Total rejection:** on pericarditis associated with secondary conditions or when salmonella test results received within the FCI are positive to *S. Enteritidis* or *S. Thyphurium*

**Partial rejection:** in all other cases.

**Note:** When Salmonella test results are not received the OV must take the professional decision that he deems necessary as regards to the level of rejection.

**Average rejection levels in GB**

Poultry: 0.034%

#### Recording of the condition

The condition must be recorded under the pericarditis entry on the INNOVA system.

# Evaluation of the public health risks from broiler carcasses rejected with **localised perihepatitis** during post-mortem inspection

---

- 300 carcasses sampled:
  - 1) control (fit for human consumption); 2) perihepatitis; 3) generalised disease
- Methodology developed to aseptically sample deep breast muscles
- Three abattoirs
- Microbiology: Indicator bacteria (aerobic colony counts (ACC), Enterobacteriaceae and generic E. coli; Salmonella and APEC presence (O1, O2 and O78)
- Full-Length Amplicon Metagenomics Sequencing (PacBio), muscles and livers

## Evaluation of the public health risks from broiler carcasses rejected with **localised perihepatitis** during post-mortem inspection

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- Current perihepatitis code and policy is not risk-based, policy change is needed
- Clarification of the code, creating separate code for LP ?
  - **or simply: fit for human consumption as there is no real public health risk !**
- Other conditions merit further research (cellulitis, ascites...)
  - Sustainability, waste reduction, cost cutting.
- Potentially the overhaul of the coding system needed (see later)

# Risk-based code system for post-mortem inspection of broilers

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## Development of a harmonized and risk-based code system for post-mortem inspection of broilers

Michał Majewski <sup>a,b,\*</sup>, Lis Alban <sup>c,d</sup>, Désirée S. Jansson <sup>e</sup>, Thomai Lazou <sup>f</sup>, Nina Langkabel <sup>g</sup>, Dragan Antic <sup>j</sup>, Eija Kaukonen <sup>h</sup>, Helena Wall <sup>i</sup>, Madalena Vieira Pinto <sup>k</sup>, Laila Østergaard <sup>l</sup>, Ole Gyvelgaard Nielsen <sup>1</sup>, Sergio Ghidini <sup>m</sup>, Marianne Sandberg <sup>a</sup>

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### ARTICLE INFO

#### Keywords:

Broiler  
Post-mortem inspection  
Condemnation codes  
Meat safety  
Official control

### ABSTRACT

In most European countries, findings detected at post-mortem inspection (PMI) of broilers at slaughter are registered using national or regional code systems. The aim of this study was to map and compare existing national broiler PMI code systems in Europe and to suggest a new harmonized and risk-based code set intended to be interpreted in the same way in all countries. Information about the code systems, condemnation criteria, and the proportion of unfit broiler carcasses in 2022, as well as reasons justifying condemnation, were collected from nine European countries through an online survey. The reasons for declaring meat as unfit for human consumption were divided into food safety, meat quality, broiler health, or broiler welfare. The data were analyzed, and a risk-based code set consisting of 13 codes was developed. Ten of these new codes cover 80% of all condemnations listed in the data retrieved from the countries in the study. The remaining three codes are indicators of broiler welfare. The results were presented in the form of spider diagrams, indicating massive differences between the countries. Harmonization of the code list and the associated decision criteria will allow PMI to be conducted in the same way in different abattoirs and countries. This standardization of the PMI of broilers will enable detailed analysis of PMI results for further use in risk-based meat safety assurance systems and the implementation of computer-based vision systems at PMI in the future.

- Mapping codes across Europe and propose new harmonised system

Characteristics of national systems for recording broiler PMI findings in the eight European countries with a national code system in place.

Country	Number of available codes	National system allows registration of <sup>a</sup>	Maximum number of codes used per carcass
Denmark	11	TC	1
Finland	7	TC, PC	1
Germany	29 (19) <sup>b</sup>	TC, PC	Unlimited
Greece	7 <sup>c</sup>	TC, PC	Unlimited
Poland	17	TC	1
Portugal	30	TC	1
Sweden	19	TC	1
United Kingdom	22 (20) <sup>d</sup>	TC, PC	1

<sup>a</sup> TC – total condemnation, PC – partial condemnation.

Total broiler condemnation figures in eight European countries in 2022.

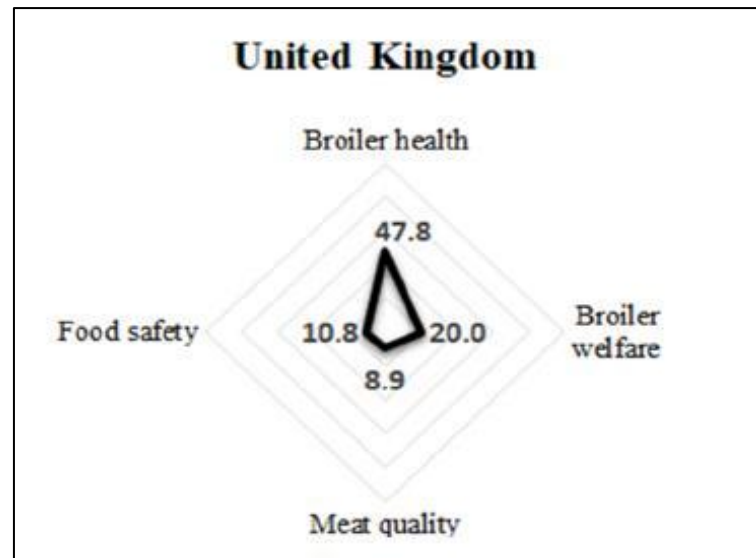
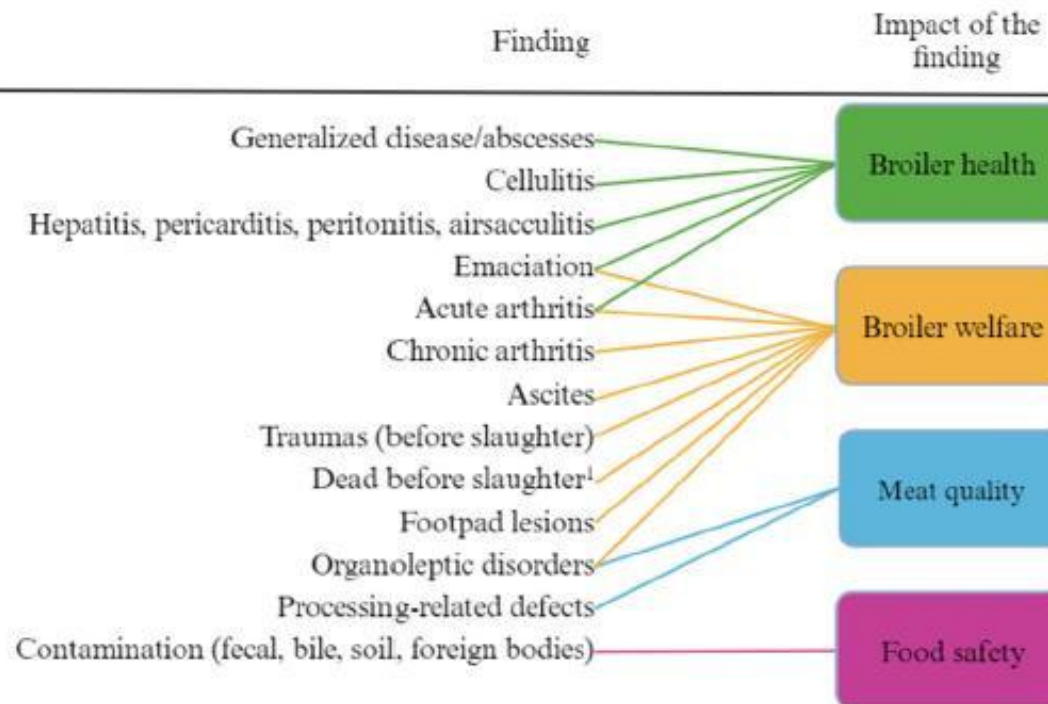
Country	Proportion of condemned broiler carcasses (%)
Denmark	0.90
Finland	1.54
Germany	1.97
Greece	0.02
Poland	0.54
Portugal <sup>e</sup>	1.07
Sweden	2.47
United Kingdom	1.89

# Risk-based code system for post-mortem inspection of broilers

- Risk based code set consisting of 13 codes was developed
- 10/13 of these cover 80% of all condemnations in all countries
- Codes standardisation would enable easier implementation of computer vision systems for meat inspection

Letter from Article. 45 of  
Commission Implementing  
Regulation (EU) 2019/627

f - generalised disease  
f - generalised disease  
f - generalised disease  
o - pathological changes  
f - generalised disease  
o - pathological changes  
p - emaciation  
o - organoleptic changes  
c - dead before slaughter  
o - pathological changes  
o - organoleptic changes  
o - organoleptic changes  
r - contamination



Relative distribution (% of all condemnations) of PMI findings

# RIBMINS surveys: a survey of CAs on abattoir risk categorisation

- To identify and fill gaps, a survey was conducted to
  - investigate the extent of the use of **risk categorisation** systems for abattoirs in Europe
  - poultry, pig, bovine and small ruminant abattoirs: competent authorities

More than 80% of respondents expressed their wish to be provided with a **practical method for categorising abattoirs** according to their pertained food safety risks.



Need to develop a **fit-for-purpose** and **science-based** framework for risk categorisation of abattoirs in Europe

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## Risk categorisation of abattoirs in Europe: Current state of play

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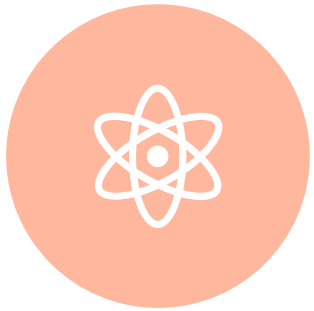
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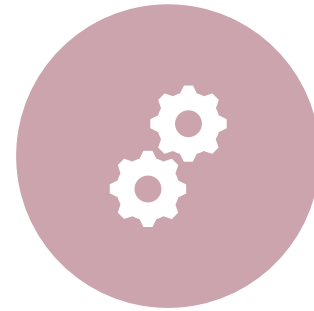
# What should the risk categorisation system look like?



Should be **science-based, fit-for-purpose**, and as objective as possible



Should provide a practical tool, based on a sound methodology



Should be designed for both FBOs (e.g. as a tool to for **control & internal benchmarking**) and CAs (e.g. as a tool to **adapt the frequency of official audits** based on the risk level of the establishments)



Should focus on the main public health risks

# FSMS 'Holistic' model

Support tool for Competent Authorities and Food Business Operators to assess the performance of the food safety management system (FSMS) of a slaughterhouse

**Instructions:**

Fill all orange fields in this tab; they are the inputs of the model

Grey and black areas are for information only and can not be edited

Green fields are outputs of the model; they are automatically updated/calculated based on the provided inputs

Species	
Please select the species you are interested in:	Poultry
Country	United Kingdom

Relevant biological hazards to be covered by meat inspection	
For the species you have selected, the most relevant biological hazards identified by EFSA are:	Campylobacter, Salmonella, ESBL

Hazard ranking			
	Hazard	Incidence	Hazard weights
For the identified hazards, please indicate the incidence in your country as number of cases per 100,000 population	Campylobacter	114	0.72
	Salmonella	13	0.27
	ESBL	10.0	0.01

Score components separately

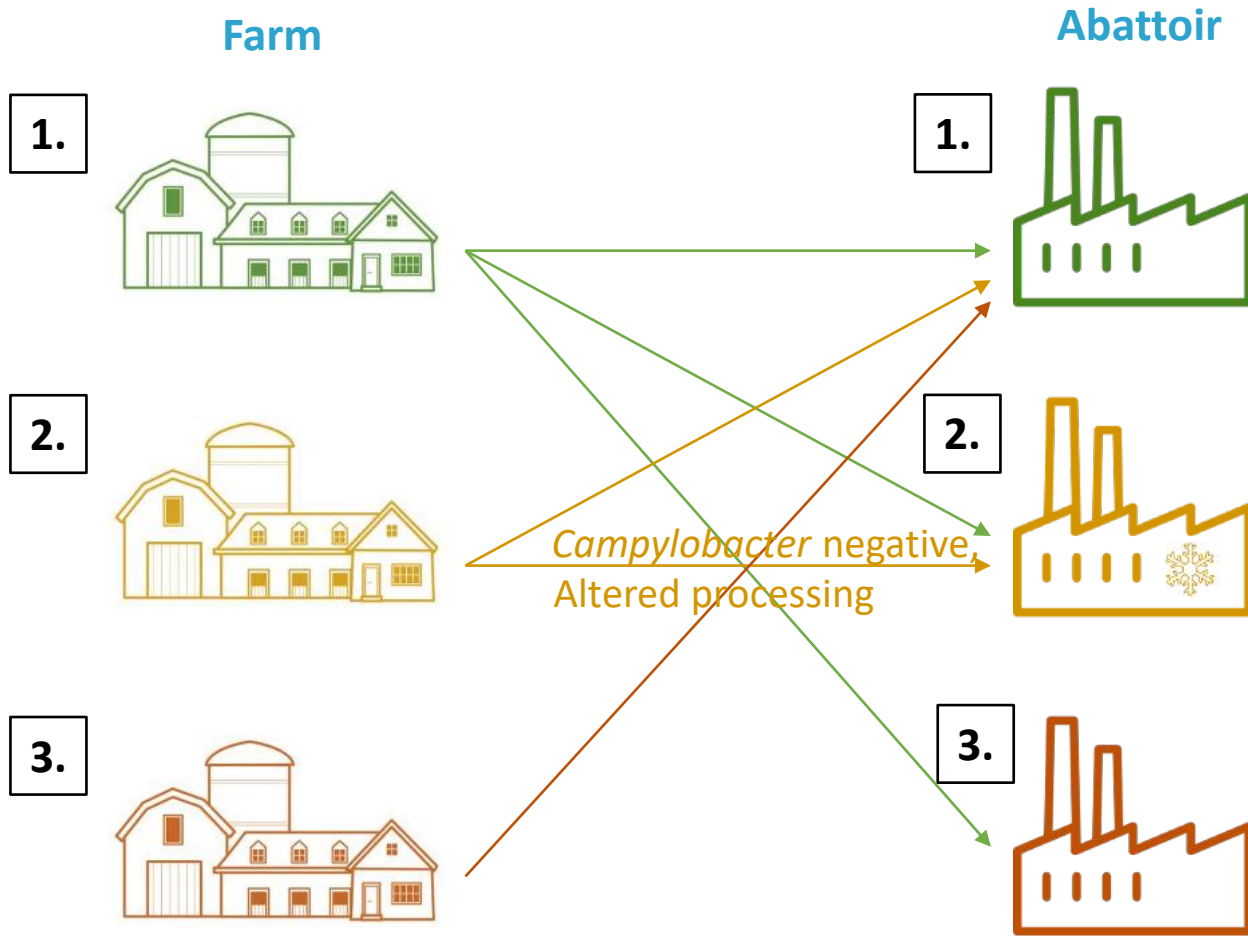
Break FSMS down into individual components

Assessment of FSMS implementation in the audited slaughterhouse		
For each of the FSMS components below, evaluate its level of implementation in the abattoir you are auditing using the drop-down menu on the right side		
FSMS component	Qualitative assessment	Quantitative assessment
FCI as it is now	The abattoir systematically collects, analyses and responds to the information in Collected FCI includes FCI according to the legislation and the additional WG2	1.00
FCI with additional WG2 suggestions (= improved FCI)	The abattoir systematically applies financial penalisation of farmers as a response	1.00
Financial penalisation of farmers	High risk animals are not identified as part of routine practice for interventions to	1.00
Pre-slaughter, inside lairage interventions (shearing/clipping) (only C, S)	For all relevant hazards, the abattoir systematically applies risk based	1.00
Preselection of herds before slaughter	The abattoir systematically applies logistic slaughter principles (slaughtering order	1.00
Logistic slaughter	Abattoir systematically does proactively adapt the speed of the line to the level of	1.00
Adapting line speed	SCORE IN OWN, SEPARATE TAB	1.00
GMPs & GHPs	The abattoir is systematically hygiene assessed by external sources through audits	1.00
Hygiene assessment systems	SCORE IN OWN, SEPARATE TAB	1.00
Staff training	Visual inspection and documentary evidence (including from internal and external audits) in	1.00
Other PRPs	SCORE IN OWN, SEPARATE TAB	1.00
HACCP	(CATTLE & SHEEP ONLY) Multiple interventions, including high effectiveness ones and those	1.00
Carcass interventions at slaughter (select applicable species)	Crust freezing	1.00
Chilling	The abattoir systematically applies freezing of carcasses to respond to specific	1.00
Carcass freezing	The abattoir systematically uses different sales channels to control pathogens,	1.00
Use different sale channels	The abattoir systematically informs the source farms of meat inspection findings,	1.00
Inform and follow up with farms	SCORE IN OWN, SEPARATE TAB	1.00
Monitoring and continuous improvement	SCORE IN OWN, SEPARATE TAB	1.00
Microbiological testing	Evidence of an internal and external communication chain on food safety issues is	1.00
Communication	SCORE IN OWN, SEPARATE TAB	1.00
Internal auditing		1.00

Summarise individual scores into overall FSMS performance score

Performance of the FSMS of the audited slaughterhouse							
The performance of the FSMS of the audited slaughterhouse against:	Campylobacter		30.18	on a scale from	0.00	to	30.18
	Salmonella	is:	28.50		28.50		
	ESBL		30.23		30.23		
The overall performance of the FSMS of the audited slaughterhouse against all identified hazards is:			29.73	on a scale ranging from zero to			29.73
		or	100%				

# The case of *Campylobacter*



“Abattoir 1 **can** also receive broilers from Farm 3 (high risk farm)”

Or the other way around:

Farm 3 (high risk farm) **can** only send broilers to the best (low risk) abattoir

**Low risk farm: animals can go anywhere**

**Green: low risk**

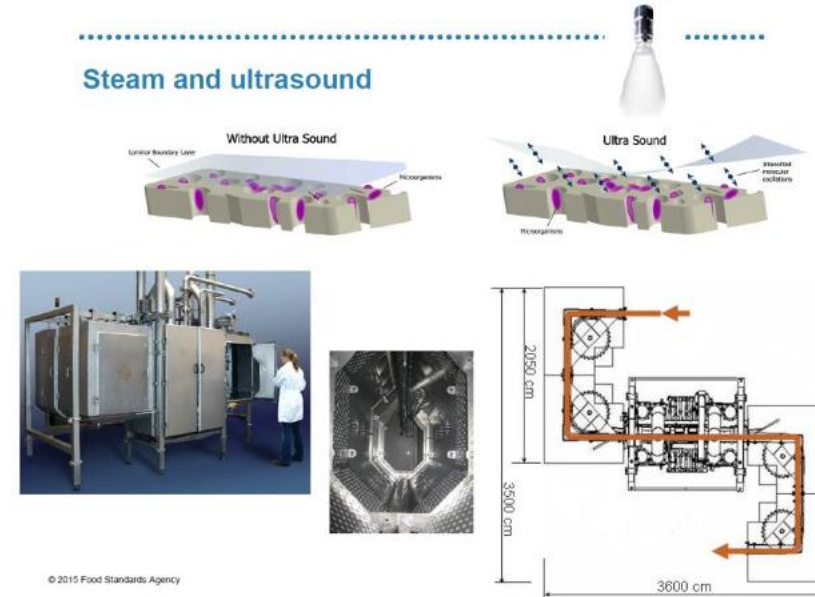
**Yellow: medium risk**

**Red: high risk**

# Poultry abattoir interventions

- **Ultrasound/ultrasonication:** sound waves with frequencies >20 kHz, used in liquid media (usually combined with hot water 70°C to 75°C) create microbubbles, which expand and then implode on contact with the chicken skin, creating localised heat and high-pressure water jets
- **Expected efficacy:** ~1 log<sub>10</sub> of *Campylobacter* and *E. coli*

## Steam and ultrasound



## Rapid Surface Chilling



- **Crust freezing :** freezing of the outer surfaces of the carcase only, while meat remains unfrozen; cell death due to osmotic stress and/or dehydration
- **Expected efficacy:** ~1 log<sub>10</sub> of *Campylobacter*

RIBMINS: <https://ribmins.com/>

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Thank you for your attention