



Risk based meat safety assurance system – An introduction to key concepts for future training of official veterinarians

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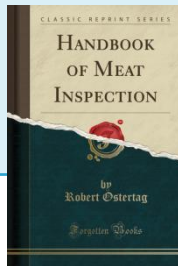
30.03.23 Bucharest [Rumenia]

This lecture

- RIBMINS COST 18105 and the EU modernisation of meat inspection
- Weaknesses & challenges of meat inspection: the EFSA scientific opinions
- Knowledge gaps in RB-MSAS and new challenges to OV
- OV Training Manual on RB-MSAS
- Recap

Why modernisation of meat inspection?

- Conventional meat inspection not able to detect invisible hazards with public health impact
- Salmonella, Campylobacter, Yersinia, E.coli VTEC
- afterwards not cost/benefit



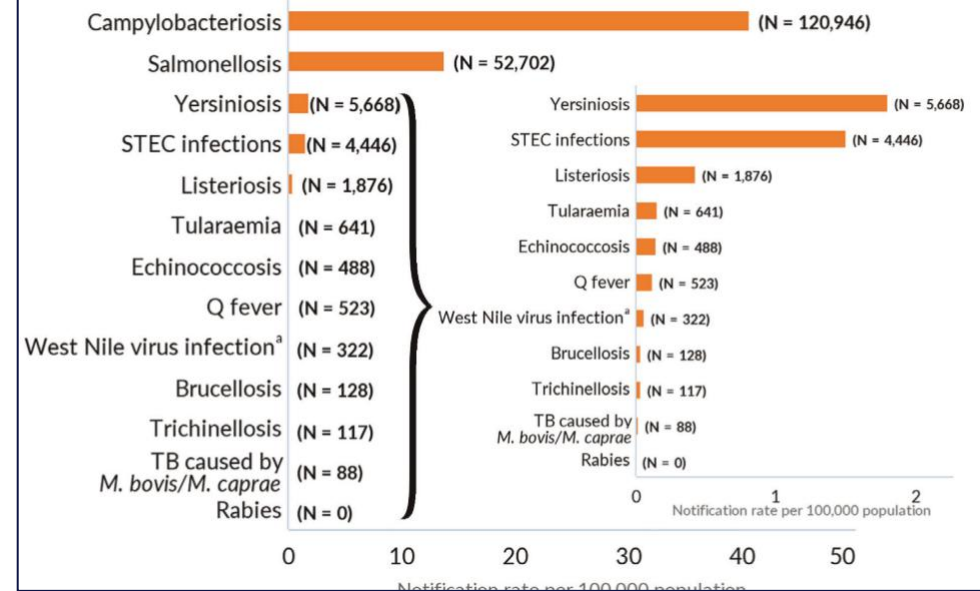
SCIENTIFIC REPORT

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The European Union One Health 2020 Zoonoses Report

European Food Safety Authority
European Centre for Disease Prevention and Control



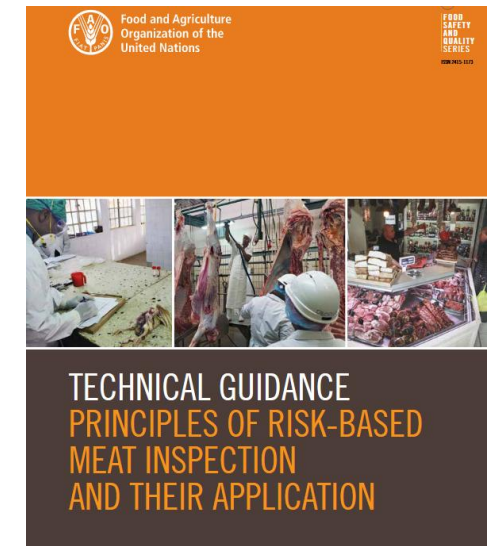
Flaws of the traditional meat inspection

- **limited food safety impact**: risk-based inability to proactively detect safety problems (e.g. 'invisible' meat borne pathogens) and provide food higher safety assurances
- **not enough flexible** to reflect epidemiological status
- PM procedure increase cross-contamination (eg. incision, palpation)
- based on final product rather than the whole meat chain: lack of integrated meat safety assurance (data, collaboration)
- lack of fully-fledged FCI/CCRI
- lack of awareness of FBOs on RB-MSAS

Modernisation of global meat inspection



- World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (WTO, 1995)
- WHO/FAO Codex Committee on Meat Hygiene (CAC, 2005)- Code of Hygiene Practice
- 2019: FAO technical guidance specifying principles and application of risk-based meat inspection
- 2019 OIE recommends that meat inspection protocols should be risk-based

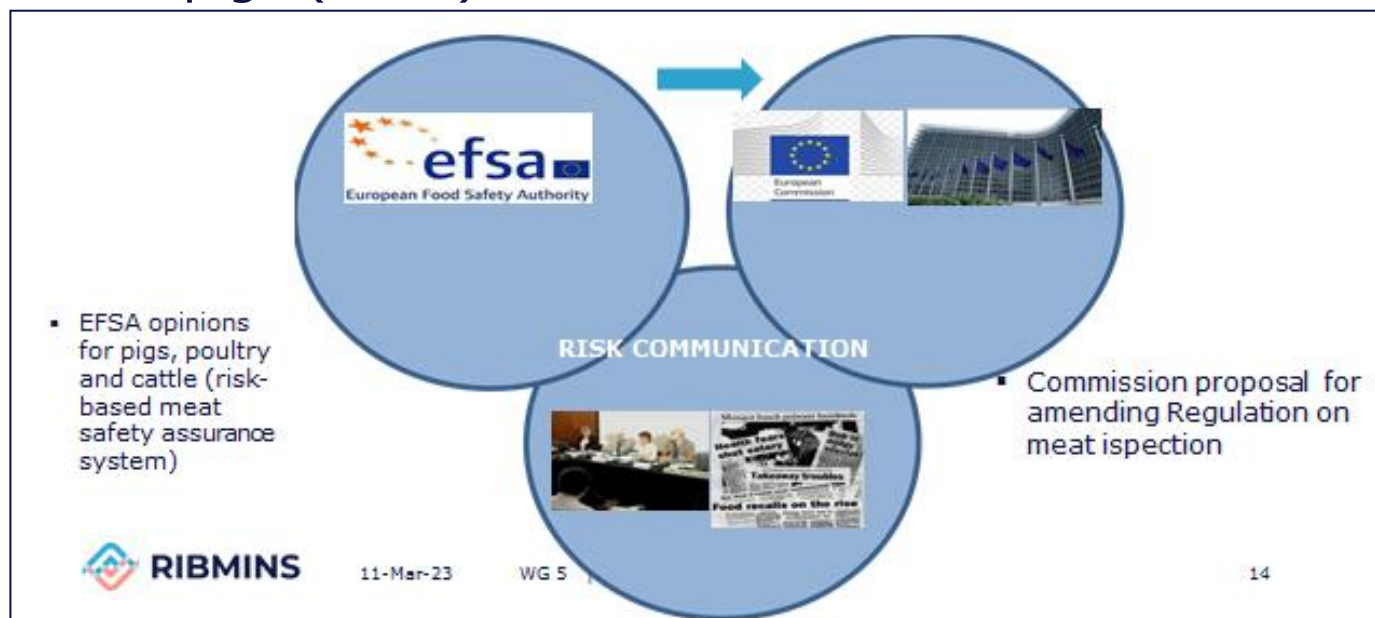


Modernisation of EU meat inspection

- European Food Safety Authority (EFSA) published a range of opinions to (2011 to 2013):
 - to develop a generic framework for a new **risk-based meat safety assurance system (RB-MSAS)**
 - better target the most relevant meat-borne hazards to protect human health, animal health and welfare
 - incorporates official meat inspection with FSMS managed by FBOs into a coherent whole
 - Official veterinarian (OV) is expected to take a lead role as risk managers in RB-MSAS with new training needs

From science to legislative changes

- EU Commission (risk manager) based on EFSA scientific outputs (risk assessor) initiated amendments of regulations and implemented risk-based inspection: → **visual only inspection** for all pigs (2014)



Modernisation of EU meat inspection

- EFSA identified and ranked priority (invisible) main biological and chemical hazards in different animal species



Species	Biological hazards	Chemical hazards	EFSA scientific opinions
Pigs	<ul style="list-style-type: none"> - <i>Salmonella</i> - <i>Yersinia enterocolitica</i> - <i>Toxoplasma gondii</i> - <i>Trichinella</i> 	<ul style="list-style-type: none"> - dioxins - dioxin-like polychlorinated biphenyls - chloramphenicol 	EFSA Panel on Biological Hazards [BIOHAZ] (2011b)
Poultry	<ul style="list-style-type: none"> - <i>Campylobacter</i> - <i>Salmonella</i> - ESBL-AmpC gene-carrying bacteria³ 	<ul style="list-style-type: none"> - dioxins - dioxin-like polychlorinated biphenyls - chloramphenicol - nitrofurans - nitroimidazoles 	EFSA Panel on Biological Hazards [EFSA Panel (2012a)]
Cattle	<ul style="list-style-type: none"> - pathogenic <i>Escherichia coli</i> - <i>Salmonella</i> 	<ul style="list-style-type: none"> - dioxins - dioxin-like polychlorinated biphenyls 	EFSA Panel on Biological Hazards [BIOHAZ] (2013b)
Sheep and goats	<ul style="list-style-type: none"> - pathogenic <i>Escherichia coli</i> - <i>Toxoplasma gondii</i> 	<ul style="list-style-type: none"> - dioxins - dioxin-like polychlorinated biphenyls 	EFSA Panel on Biological Hazards [BIOHAZ] (2013a)
Horses	<ul style="list-style-type: none"> - <i>Trichinella</i> 	<ul style="list-style-type: none"> - phenylbutazone - cadmium 	EFSA Panel on Biological Hazards [BIOHAZ] (2013d)
Farmed game	Deer	- <i>Toxoplasma gondii</i>	EFSA Panel on Biological Hazards [BIOHAZ] (2013c)
	Wild boar	- <i>Salmonella</i>	
		- <i>Toxoplasma gondii</i>	
		- <i>Trichinella</i>	
	Other	None	

Modernisation of EU meat inspection

- Visual only inspection extension to other species
 - Regulation (EU) 2017/625
 - Regulation (EU) 2019/627
 - uniform practical arrangements
 - risk-scientific based meat inspection (post-mortem) based on EFSA opinions.

REGULATIONS

REGULATION (EU) 2017/625 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 15 March 2017

on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 853/2004, (EC) No 1831/2003, (EC) No 1831/2003, (EC) No 1107/2009, (EU) Regulation 2017/625 of the European Parliament and of the Council

COMMISSION IMPLEMENTING REGULATION (EU) 2019/627

of 15 March 2019


laying down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council and amending Commission Regulation (EC) No 2074/2005 as regards official controls

(Text with EEA relevance)

WG 5 Objectives: 5.1 Development of the training manuals for MSAS

- overview of the components of an RB-MSAS
- key future challenges for conceptual and practical implementation of a RB-MSAS and give potential solutions
- advanced training tools for OVs enabling them to operate as risk managers in the future RB-MSAS

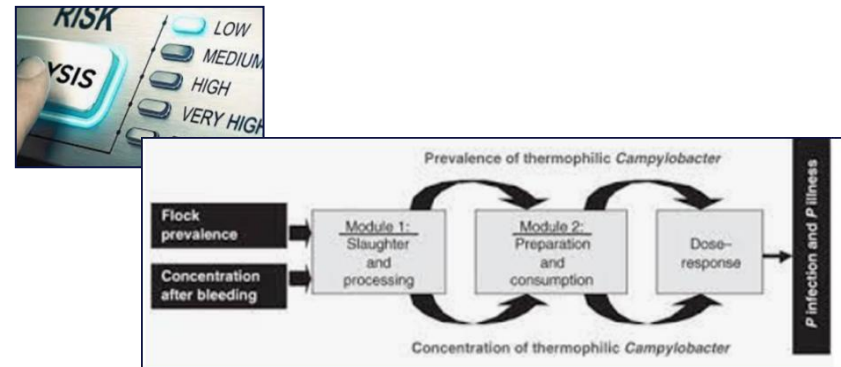




Overview of the components of an RB- MSAS

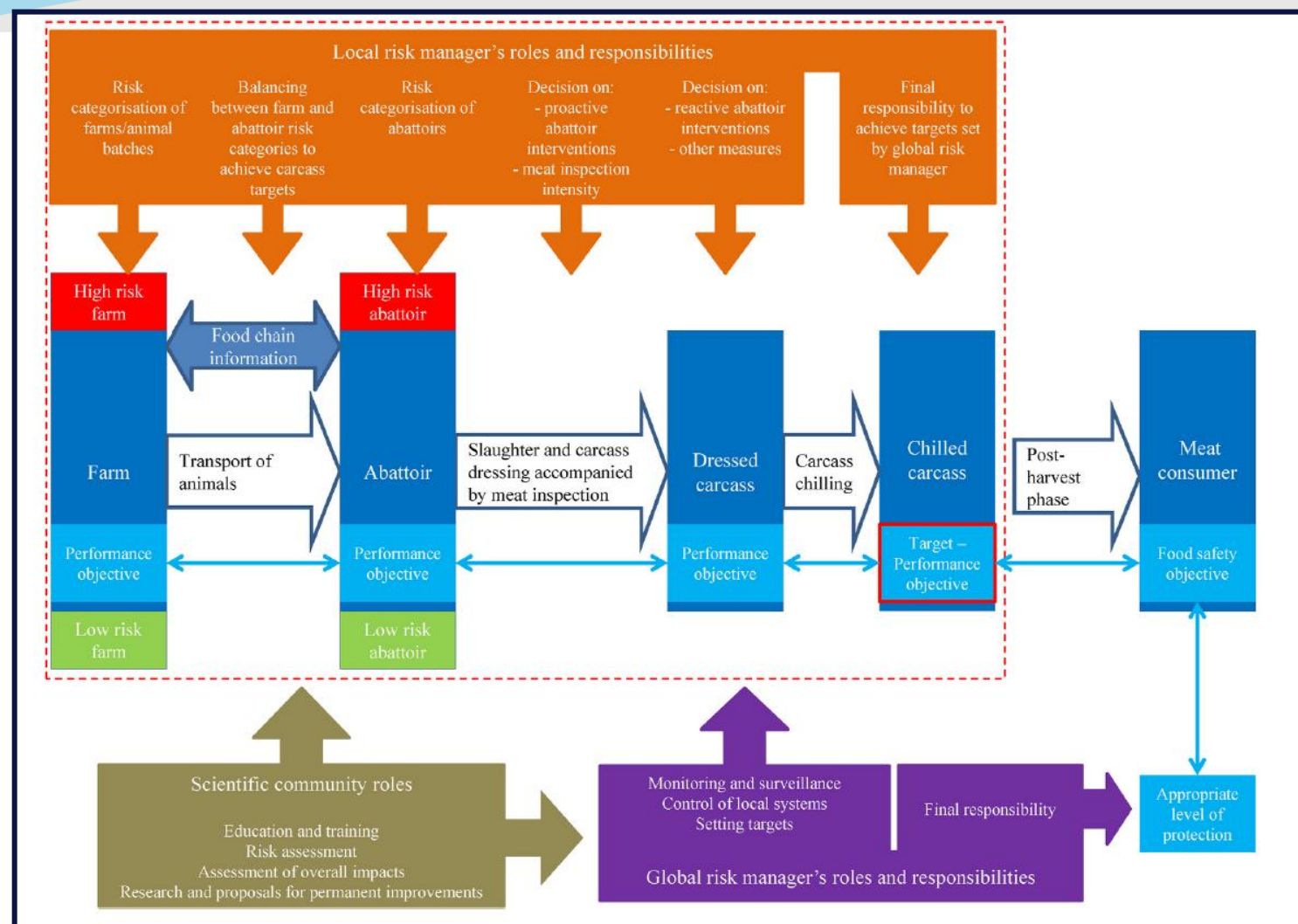
Aims and advantages of the RB-MSAS

- Aims:
 - to address widely recognised weaknesses of the EU traditional meat inspection systems
 - to take into account epidemiological data
 - to widely promote the sharing of integrated data
- Advantages
 - risk-based
 - longitudinally integrated
 - flexible and dynamic



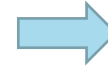
Generic outline of the RB-MSAS

B. Blagojevic et al.
Food Control 124 (2021)
107870



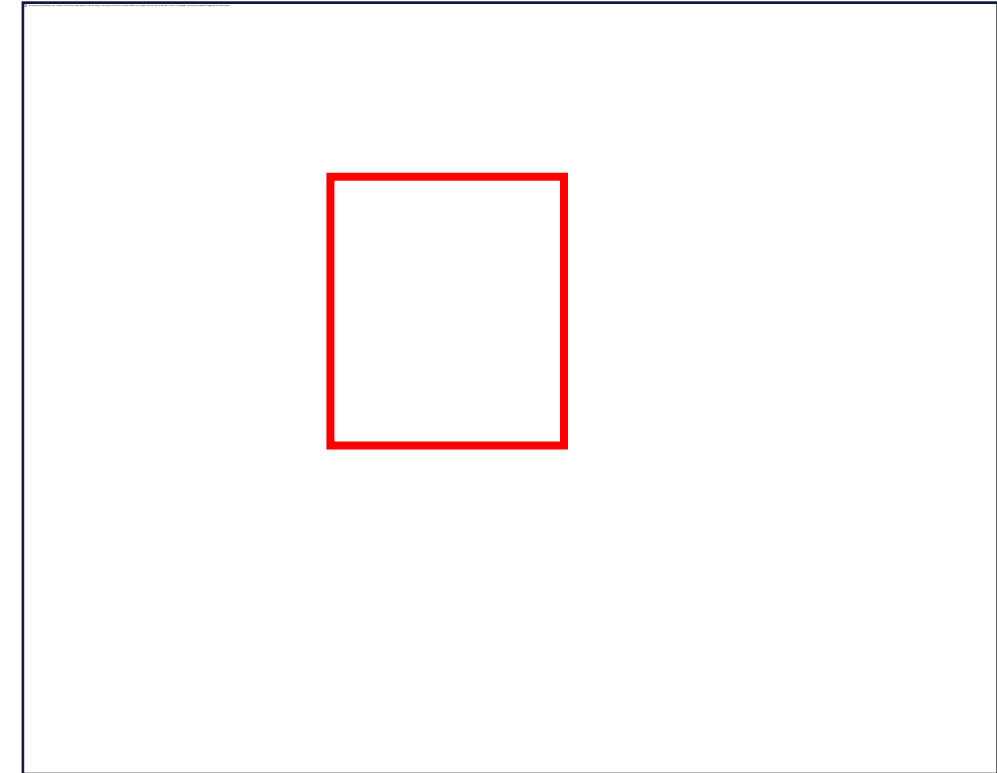
Key components of RB-MSAS

- Food chain information (FCI)/CCIR
- Harmonized epidemiological indicators (HEIs)
 - risk categorization of farms and abattoirs
- Risk-based meat inspection
- Additional reactive intervention (e.g. chemical or thermal treatment)



Key components of RB-MSAS

- FCI provides fully longitudinally integrated information on epidemiological, herd health and production data (farm-slaughterhouse-farm) (better implemented in pig and poultry sector)
- to be integrated with priority hazards and/or indicators in line with HEIs → risk-based inspection
- CCIR provides info from slaughterhouse-to-farm continuum



Key components of RB-MSAS

- HEIs can supplement the FCI/Collection and Communication of inspection results (CCIR)
 - for setting appropriate targets for final chilled carcasses
 - modulate inspection methodologies procedures (high risk *versus* low risk- visual only).



Key components of RB-MSAS

- Harmonized epidemiological indicator (HEI) for pigs



HEI	Food Chain Stage	Analytical/ diagnostic method	Specimen	Auditing procedure
<i>Salmonella</i>	Farm	Microbiology	Pooled faeces	Controlled housing conditions Transport time, mixing batches, reuse of pens
		Auditing		
	Transport/ lairage	Auditing		
<i>Yersinia</i>	Abattoir	Microbiology	Ileal content Carcass swabs Tonsils or rectal content Carcass swabs	Separation of heads Controlled housing conditions
		Auditing		
	Farm	Auditing		
<i>Toxoplasma</i>	Farm	Auditing		
<i>Trichinella</i>	Abattoir	Serology	Blood	Controlled housing conditions
	Farm	Auditing		
<i>Cysticerci (Taenia solium)</i>	Abattoir	Digestion	Meat	
	Abattoir	Visual meat inspection + PCR		
<i>Mycobacteria</i>	Abattoir	Visual meat inspection + Microbiology	Suspected lesions	

Training in RB-MSAS

Challenges for the OV under the RB-MSAS

- new epidemiological, economic, technological, and scientific contexts
- Scientific & legislative changes
- new way risk-based meat inspection has to be carried out by the OV in the framework of the RB-MSAS

The multidimensional context and drivers of future RB-MSAS.	
Context	Drivers
Epidemiologic	Globalisation, changes of animal health status lead to an increasingly complex food safety environment with new food safety hazards, including environmental contaminants and residues
Technological	The deployment of emerging technologies in different areas of the meat sector requires close collaboration between farmers and veterinarians: e.g., precision livestock farming uses biosensors to early detect animal health and welfare problems; camera-based technologies that use computerised vision systems to detect carcass contamination and gross pathologies post-mortem, which are mainly developed and used in the poultry industry
Socio-economic	The unprecedented development of the EU meat sector towards intensified farming with increased productivity led to a close link between animal health, animal welfare and concern about food safety and quality and sustainable waste management.
Scientific	New scientific evidence (ref: EFSA scientific reports) supports the shift towards the evidence (risk)-based approach of the official control system and FBOs' food safety management programmes.

Training in RB-MSAS: EU legal framework

- Delegated Regulation (EU) 2019/624: qualifications for OVs and requirement for continuing education

- Art. 13 - Annex II - specific minimum requirements

- **Chapter I- official veterinarian (OV)**

- Chapter II - official auxiliary (OA)

- Chapter III - staff designated by the competent authority

- EFSA recommends organizing training to ensure the HEIs are applied uniformly

Current EU regulations on official veterinarian (OV) training.

Regulation and EFSA scientific opinions	Title	Relevant sections pertaining to OV training
(EU) 2017/625	On official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products	Article 5 no 4 a-c, Article 18 no 3, Article 81
(EU) 2019/624	Qualifications for OVs and requirement for continuing education	Appendix II: Chapter I, Chapter II
(EC) No 852/2004	On the hygiene of foodstuffs	Chapter XII ^a
EFSA Journal 2011; 9(10): 2371 (pigs) EFSA, 2011	Scientific Opinion on the public health hazards to be covered by inspection of meat (swine)	"Member States are invited to organize training to ensure harmonised implementation...." "It is recommended that the Commission and the Member States organize training to ensure harmonised implementation of the monitoring and inspection requirements."
EFSA Journal 2012; 10 (6):2764 (poultry) EFSA 2012	Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of poultry	"Member States are invited to organize training to ensure harmonised implementation..." "It is recommended that the Commission and the Member States organize training to ensure harmonised implementation of the monitoring and inspection requirements for the HEIs."
EFSA Journal 2013; 11 (6):3276 (bovines) EFSA 2013	Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of bovine animals	"Member States are invited to organize training to ensure harmonised implementation" "It is recommended that the EC and the MSs organize training to ensure harmonised implementation of the monitoring and inspection requirements for the HEIs."

Training in RB-MSAS: EU legal framework

- OV training differs in the EU due to the level of implication of RB-MSAS, the FCI system used, and existing trade agreements with third-party countries
- more attention should be focused on practical training in official controls in the undergraduate veterinary curriculum +
- ESEVT: Minimum training requirements, RB-MSAS is missing

d. Food Safety and Quality, Veterinary Public Health and One Health Concept:

- Veterinary legislation including official controls, regulatory veterinary services, forensic veterinary medicine and certification
- Control of food, feed and animal by-products
- Zoonoses
- Food hygiene and food microbiology
- Food technology



+



European System of Evaluation of Veterinary Training (ESEVT)

Knowledge gaps in RB-MSAS training

- lack of overview available on the different training programmes for OVs in MSs
- lack of internationally coordinated training programme
- lack of information available on how the requirements for OV training within the EU regulations are implemented in the different MSs.
- poorly implemented exchange programmes for staff amongst MSs to ensure uniform conditions for the implementation of the EU rule (Commission Delegated Regulation (EU) 2019/624)

CA & professionals challenges

- diverse MS socio-economic and cultural conditions
- to evaluate the OV training systems in the different MSs
- to design OV training roadmap towards successful implementation of RB-MSAS with tailored, modular training systems that can be implemented across the MSs
- training program based on sustainability, animal health, animal welfare, fraud prevention, AMR, new technology and innovation, FCI, HEIs, risk-based meat inspection

Training Manual on RB-MSAS

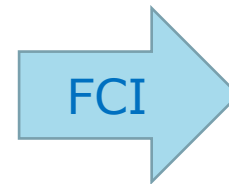
- Risk analysis framework - risk assessment- epidemiology (emerging and re-emerging pathogens)
- On-farm risk assessment and monitoring:
 - eg. pig herds *Salmonella* spp., *Yersinia* spp. *T. gondii* (**assessment**)
 - levels of acute phase proteins (APP) in blood (Haptoglobin, fibrinogen) (**monitoring**)
 - standardization of animal welfare and biosecurity **audit protocols**
 - **risk categorization** of herds/farms



Training Manual on RB-MSAS

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ad hoc risk-based meat inspection

Training Manual on RB-MSAS

- post-mortem inspection methods
 - improvement of the PM abnormality recording by using automated computer system
 - use of HEI (e.g. pigs: - *Salmonella* status of ileal contents; *Yersinia* status of tonsils or rectal content- bovine: *Cisticercus* (blood-serology)
 - meat juice serology
 - process hygiene criteria (PHC) thresholds → risk-reduction capacity of abattoir
 - risk categorization of slaughterhouses



Training Manual on RB-MSAS

- automated **classification for visual-only post-mortem inspection** with pattern recognition system based on machine learning to identify those organs that exhibit signs of the pathology of interest: e.g. porcine pleurisy (convolutional neural networks)
- computerized meat inspection systems: **multispectral imaging system** technologies based on cameras, PC analysis and AI to detect pathological lesions
- use of for detecting faeces (from duodenum, ceca, and colon) and ingesta on the surface of poultry carcasses

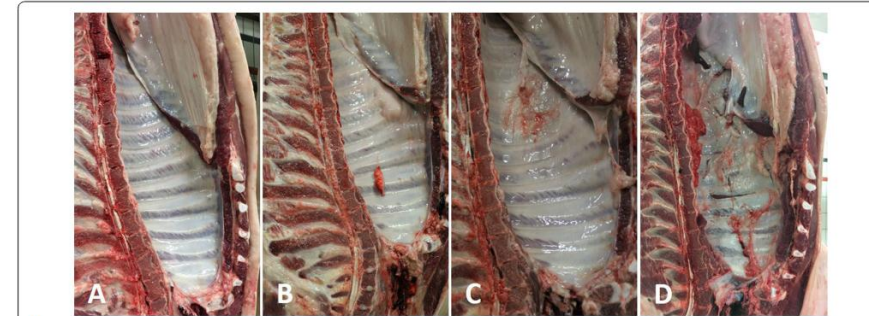
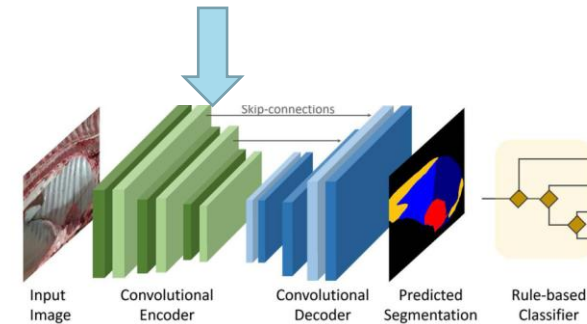


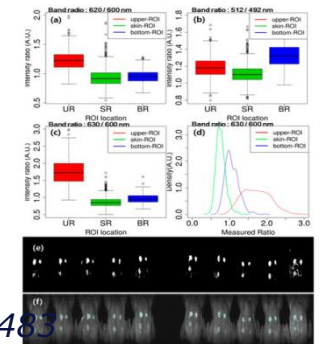
Figure 1 Scoring pleurisy according to the simplified PEPP method. A In healthy half-carass the parietal pleura appears smooth wet



Trachtman et al. Vet Res (2020) 51:51



Sensors 2019, 19(16), 3483



Recap

- FCI and HEIs are key elements of the RB-MSAS to optimize the exchange of information flow through the farm-to-fork continuum

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- advance education and practical training of OV in epidemiology, risk assessment, FCI and HEIs and new technologies

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- overcoming of numerous gaps including the RB-MSAS training of the OV as risk manager
- advance education and practical training of OV in epidemiology, risk assessment, FCI and HEIs and new technologies
- [Training Manual](#) to fill the gaps in the knowledge of RB-MSAS

WG 5 Objectives: 5.1 Development of the training manuals for MSAS

- Work in progress
 - collect material (publications) from WG 1-4
 - Lay-out finished
 - further training material available only after WG 1-4 is finished by June 15th 2023

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