FEDERATION OF VETERINARIANS OF EUROPE

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FVE guidance document on Food Chain Information

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Acronyms

AM	Ante mortem
CCIR	Collection & communication of inspection results
DL-PCBs	Dioxin-like polychlorinated biphenyls
EASVO	European Association of State Veterinary Officers
EC	European community
EI	Epidemiological indicators
EFSA	European Food Safety Authority
ESBL	Extended-spectrum beta-lactamase
EU	European Union
EVERI	European Veterinarians in education Research and industry
FBO	Food business operator
FCI	Food chain information
HACCP	Hazard analysis control critical point
HEI	Harmonized epidemiological information
HHP	Herd Health Planning
MS	Member States
OV	Official veterinarian
PVP	Private veterinary practitioner
PM	Post mortem
UEVP	Union of European Veterinary Practitioners
UEVH	Union of European Veterinary Hygienists
VTEC	Vero toxin producing *Escherichia coli*
VMPs	Veterinary medicinal products

Scope

The aim of this guidance is to help all key players to be aware of the legislative origin, scientific background, purpose, and implementation of the modernisation of meat inspection with meaningful Food Chain Information linked to herd health planning. It also acknowledges the possible use of the harmonized epidemiological indicators relevant to livestock intended for slaughter.

This guidance is intended for use by all stakeholders involved in the food chain from the farm to the processing of meat, including food business operators, veterinary practitioners and official veterinarians.

This guidance and the annexes must not be used to replace any of the official documents;
The authors of the guidelines cannot be held responsible for any claim, damage or loss which may occur as a result of different interpretations of the information contained in this document.

Summary

The purpose of this FCI guidance is to promote the meaningful use of FCI as part of modernisation. Initially, we explore the historical scientific and legislative drivers prompting change and modernisation in meat inspection and in particular the opinions of the EFSA risk assessments. Subsequently we consider the positive role of the veterinary profession in utilising modernisation and food chain information for the enhancement not only of food safety but also animal health and welfare public health and the environment. In particular we envisage modernisation conferring three advantages, firstly by promoting a longitudinally integrated approach to food safety. Secondly, by demonstrating how food chain information can act as a key constructive link to herd health on farm. We also explore how harmonised epidemiological indicators (HEI) from the farm can inform the food business operator and the official veterinarian about key parameters that may influence decisions around methods of slaughter.
Thirdly, we consider the inherent flexibility and adaptability in modernisation in consideration of the varying socioeconomic and cultural factors that exist in the member states in the EU.
The attached Annexes (I, II, III) provide templates, testimonials and practical tools for all stakeholders to reference for practical application of modernisation and FCI.

Annex I outlines how harmonised epidemiological indicators (HEI) related to food-borne biological hazards are particularly useful for risk categorization of both farms, herds and slaughterhouses, and for setting appropriate targets for final chilled carcasses.

Annex II presents species specific FCI templates for practical use.

Annex III are species specific photographic and written description the most common ante and post mortem findings that may affect food safety, animal health and welfare.

Finally conclusions and recommendations are discussed.

Conclusions & recommendations

1. Meaningful food chain information and collection & communication of inspection results (FCI/CCIR) interpreted and advised by the veterinarians can be the vehicle for positive change as part of modernization of meat inspection.

2. Animal health, welfare and food safety are inextricably linked and influence each other both positively and negatively;

3. FVE embrace the multidisciplinary approach to risk assessment, management and communication;

4. Within the European Union, the Government and the Regulatory Authority role is changing from control via law enforcement to supporting the FBO (including the farmer) to take responsibility and ownership of standards through integrated animal health and welfare and food safety in their businesses;

5. The consumer and markets, at the end of the day will dictate the values they require in the food chain including on farm. There is the need to be mindful of this during the process of communicating risk and change during the modernization process;

6. There is a need for a comprehensive FCI/CCIR supplemented by harmonized epidemiological information (HEI) which can be reported to a central (European) data base for further interrogation;

7. Modernization with good quality FCI/CCIR linked to herd health planning supports in a positive manner not only animal health & welfare and food safety but also environmental protection and sustainability;

8. Excellence in knowledge transfer is a pre requisite in the ability to share and use food chain information up and down the food chain for positive change.

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1 - Introduction

The Federation of Veterinarians of Europe (FVE) is an umbrella organisation of veterinary organisations from 38 European countries. FVE also represents 4 sections, each of which representing key groups within our profession: Practitioners (UEVP), Hygienists (UEVH), Veterinary State Officers (EASVO) and veterinarians in Education, Research and Industry (EVERI).

Internationally, the issue of how meat inspection should be carried out is the subject of intense discussion. The EU risk assessor, the European Food Safety Agency (EFSA) has published a number of opinions, (June 2013) that "*provides the scientific basis for the modernisation of meat inspection across the EU".* These opinions cover cattle, sheep, goats, game and horses and follow previously published opinions on pigs and poultry published in 2011 and 2012. The approach taken by EFSA was to identify foodborne biological and chemical hazards and rank them according to their risk for public health. For biological hazards, the priority ranking was based on assessment of impact on incidence of disease, the severity of the disease in humans and evidence that consumption of meat from the various species is an important risk factor for the disease. As regards **pigs,** EFSA concluded that the main hazards with public health significance to be considered are *Salmonella, Yersinia enterocolitica, Toxoplasma gondii, Trichinella* spp. Chloramphenicol has been identified as of high potential concern and dioxins and DL-PCBs as of medium concern. For **poultry**, main biological hazards are *Salmonella* and *Campylobacter spp.* while chemical hazards are represented by DL-PCBs, Chloramphenicol (banned), nitrofurans and nitroimidazole.

As regards **cattle**, EFSA concluded that the main biological hazards are *E. Coli* (VTEC) and Salmonella spp. while dioxins and PCBS are the chemical hazards of greatest concern. Findings for **sheep** were similar, with the addition of *Toxoplasma spp.*, while in **horses,** *Trichinella spp.* and phenylbutazone were the main concerns.

The EFSA reports have found that traditional meat inspection techniques are not always the most effective or efficient methods to deal with the hazards identified and have recommended changes and improvements.

In the EU context, the DG Health and Food Safety of the European Commission functions as the risk manager and is now examining the EFSA reports. with a view to tabling legislative proposals. Further to the EFSA scientific opinion on pig meat inspection (2011[1]) the EU Commission has issued the Regulation (EU) No 219/2014[2] of 7 March 2014 which amends Annex I to Regulation (EC) No 854/2004 which aims at making meat inspection for pigs (ante-mortem and post-mortem) more effective and risk-based. The

[1] http://www.efsa.europa.eu/en/efsajournal/pub/2351.htm

[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:069:0099:0100:EN:PDF

Regulation provides the option to remove the requirement for obligatory palpation and incision of lymph nodes and organs, moving instead to visual inspection, because of the risk of microbial cross-contamination. To prevent cross-contamination, those palpations and incisions are not required anymore but only when abnormalities are identified. Palpation and incision techniques are to be limited to cases where the epidemiological or other data from the holding of provenance of the animals, the FCI or the findings of AM or PN visual examination indicate possible risks to public health[3], animal health and animal welfare. In such situations it is the responsibility of the OV to decide which palpations and incisions must be carried out during PM inspection separately from the slaughter line, in order to decide if the meat fits for human consumption. Palpation/incision can be accompanied by laboratory testing if required.

The Annex III of this document provides examples of most common found conditions during post-mortem inspection for the different species that might be significant for animal health, animal welfare and public health.

The Commission has also recently circulated a draft of Implementing Regulation amending Regulation (EC) No 2074/2005[4] as regards model documents for FCI. The main objective is to develop a harmonized and easy-to-interpret FCI model in order to support the slaughterhouse operator to organise slaughter operations and to assist the Official Veterinarian to determine the required inspection procedures.

2 - Technical background

Organoleptically detecting zoonotic disease in animals that are slaughtered and eliminating them from our food supply has been the classical method for meat inspection. However the food chain has become elongated and unfortunately microbial pathogens now causing the majority of food borne diseases (e.g. *Campylobacter, Salmonella* and *E Coli 0157*) can be shed by animals showing no clinical signs and these pathogens are undetectable by conventional meat inspection. Traditionally inspection techniques (visual, palpatory and by incision) for the presence of gross lesions or flaws have satisfied public health objectives. However these techniques are not always suitable for detecting food-borne diseases such as

[3] The risk-related abnormalities that require the traditional inspection procedure might include (but are not limited to) generalized conditions such as multiple abscesses; emaciation/generalized oedema; jaundice, poly-arthritis; suspect pyoemia, suspect pleurisy; mastitis (if associated with general signs); moribund/recumbent animals; orchitis (marked to consider *Brucell*a)*;* suspect emaciation, poor condition, suspect fever, slaughtered in lairage.

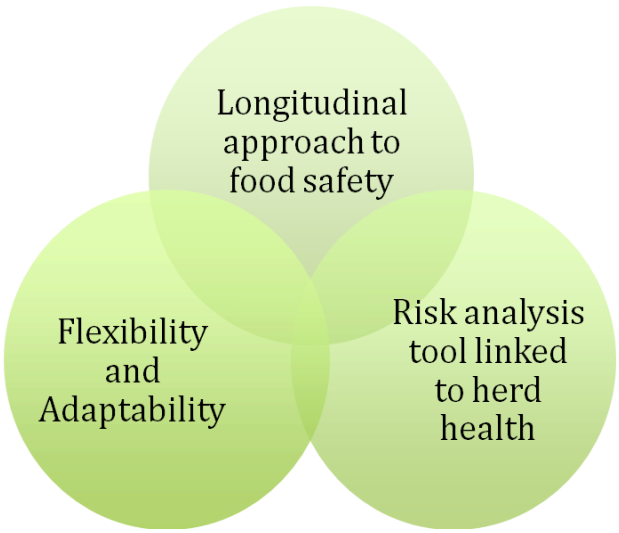
[4] According to Commission Regulation (EC) No 2074/2005[4], food business operators raising animals dispatched for slaughter have to ensure that the food chain information referred to in Regulation (EC) No 853/2004 is included as appropriate in the documentation relating to the animals dispatched in such a way as to be accessible to the slaughterhouse operator concerned.

campylobacteriosis, salmonellosis and virulent strains of *E. coli* or contamination by chemical substances such as steroids or veterinary medicine residues. Nor can we rely on end product testing of our meat products to guarantee safety as tests are somewhat insensitive and it is not possible to sample every meat product. These two traditional methods are retrospective in nature and reactive to problems after they have appeared. Biological, chemical and physical hazards may enter the food chain at different multiple points.

3 - The role of the veterinarians in maintaining the integrity of the food chain

The veterinary role, either in public or in the private sectors, has four pillars - animal health, animal welfare, public health and the environment. The veterinarian plays a key role in ensuring the safety of foods of animal origin from farm through to the consumer through providing professional integrity, competent advice and knowledge transfer of key information through the food chain. The veterinary practitioner's role on farm includes advice on animal husbandry, animal health and animal welfare, surveillance, diagnosis and control of disease. This must be informed by timely receipt of information from the slaughterhouse as it relates to food safety, and animal health and welfare and to a productive interplay with the Official Veterinarian.

4 - Modernisation promotes three advantages to the food chain



Modernisation of meat controls

Fig. 1

4.1 - Longitudinal approach to food safety using quality FCI

Modernisation of meat inspection and its components provides an opportunity for development of longitudinally integrated food safety systems for meat in the EU. The most effective approach to control the

main hazards in the context of meat inspection is a comprehensive meat safety assurance system for all animals, combining a range of preventive measures and controls applied both on the farm and at the slaughterhouse in a longitudinally integrated way. FCI as defined in the legislation is a two way process linking the veterinary practitioner with the Official Veterinarian at the slaughterhouse. There are many examples of excellent format of Inspection Results providing information from the slaughterhouse back up the chain to the farm.

Denmark

With modern technology it is possible to collect PM/AM results on line by computerized systems but this works is only for industrialized production. In small scale slaughterhouses a paper model is used. Some farmers and veterinary practitioners may request specialized recordings and feedback of PM findings.

The FCI is a self-declaration with no independent verification and no link to any Herd Health Plan or to any regular veterinary farm visits.

France

In the poultry sector farmers send the FCI document (usually by fax, sometimes electronically) to the slaughterhouse 24 hours in advance. Poultry cannot be slaughtered without this document. The veterinary practitioner in charge of the farm is not involved. The veterinary practitioner never receives any feedback from the abattoir.

Switzerland

The Swiss FCI document, originally created for animal health reasons, contains additional information relevant for food safety. A set of documents always accompany animals on the way to establishments as well as to the abattoir. They are filled in by the owner of the animals. In case of doubt, owners as well as veterinary practitioners can be reached for further information regarding VMPs, identification etc. FCI documents are not verified by any veterinary practitioner. All depends on the honesty of the animal keepers. As regards animal welfare there is yet room for improvement.

Spain

The development and control of the FCI is under the responsibility of the autonomous community through the Department of Agriculture. The control of the information at the slaughterhouse level is carried out by the CA of the Department of Health.

FCI's main features:

- Self-declarative paper signed by the farmer (not always complete and/or correct)
- Great different between large integrated farms (e.g. pig and poultry) and small farms;
- Feedback information is only working with integrated farms.
- Information between Competent Authorities from different Ministries or from the autonomous Governments are not always going fluently.

Italy

In Italy animal farms are risk categorized by the OV according to Regional health schemes which provide a list of risk factors related to animal welfare, animal health, veterinary medicines management, biosecurity systems etc. The frequency of farm visit is risk-based. Despite this, FCI is almost a farmer's declaration not always complete and/or correct and there is there is yet room for improvement. Generally in the slaughterhouse if there is any non-compliance at AM and/or PM, FCI is the document to refer to. PM checks are adapted according to the relevant findings. FCI declaration is compiled.

Ireland

The situation at present for sheep involves *"self declaration"* by the farmer who signs the FCI declaration as part of the sheep dispatch movement document.
The slaughter plant representative checks that the FCI is correct. Furthermore the official veterinarian declares that he/she is satisfied that the FBO has reviewed and checked the FCI and further certifies ante mortem has been carried out. The information flows only in one direction whereas there is huge potential to feed back very useful ante and post mortem information.

Romania

The National Veterinary and Food Safety Authority is the Competent Authority in Romania for implementing the EU Food Legislation. FCI Information on farm animals and registration is conveyed via a "*self declaration"*.

FCI should include information on animal welfare in order to complement the slaughterhouse surveillance systems (ante-mortem and post-mortem inspection) and the latter could be used to identify and highlight the on farm welfare status. CCIR from the slaughter house to the farm can assist the farmer and his/her advisors, including the PVP, makes informed decisions to improve animal and herd health, welfare and public health and efficiency with respect to carbon emissions.

Food Chain Information of course must be linked back to a herd health planning (FVE position paper on herd health planning adopted in the General Assembly on 06 June 2015) and confirmed by veterinary checks on farm. This involvement of the veterinary practitioner from '*farm to fork'*, especially at pre-harvest level, is central to an integrated process control. FCI/CCIR together with the Harmonized Epidemiological Indicators can facilitate disease prevention on farm.

FCI and modernisation links EU animal and food legislation

Key CCIR from the slaughterhouse as required under the Hygiene Package is fundamental to the '*modernisation of meat inspection'*. In addition to simplification and harmonization, the EU Commission is keen to integrate existing and proposed new legislation affecting the food chain from farm to fork. Such key legislation includes modernisation of meat inspection, review of Medicines Directive (while tackling antimicrobial resistance), the new Animal Health Law[5] and possible a new Animal Welfare Law. While all the new proposals and past regulations have identified the key role of vets there is the responsibility for the production of safe food, the keeping of healthy animals and the ensuring of good welfare standards lay down with the food business operator and the farmer.

4.2 - Risk Analysis tool linked to Herd Health Planning

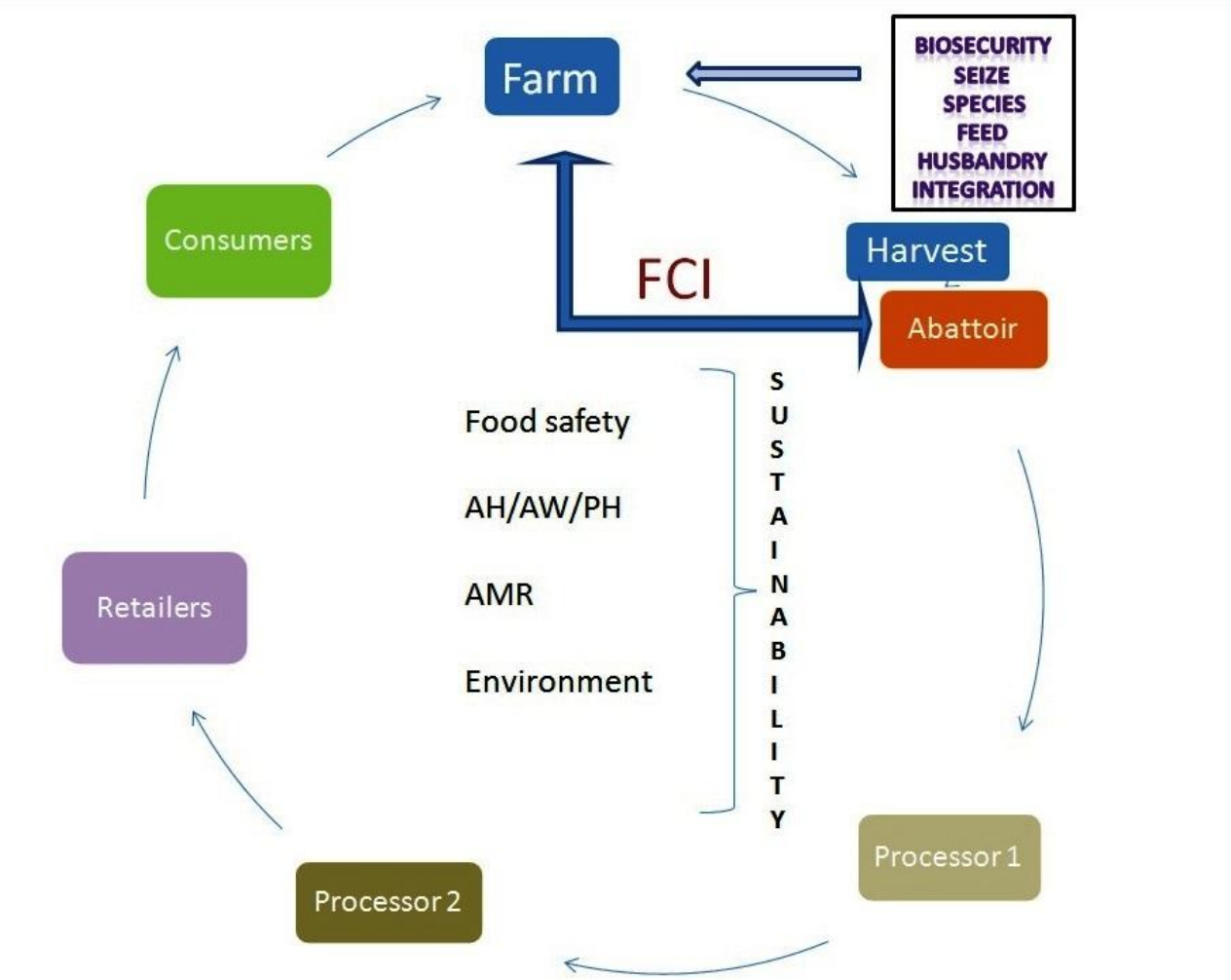
Currently from the experience of most MSs, CCIR and HEI are often absent with poor meaningful linkage to and from the farm. Quality FCI and HEI will facilitate a multidisciplinary approach including veterinary lead risk assessment and risk management on farm to improve not only animal health and welfare but also food safety and production. Our vision is that various key parameters from all sections of the food chain could be gathered and measured creating a typical bell-graph curve that quantitatively"*provides a benchmark facilitating improvement literally from farm to fork. You can only improve what you can measure*".

FCI can provide assurance on herd health standards, welfare compliance and that withholding periods for medicines are observed. FCI should be robust, easy to collect and be useful to the farmer and FBO. Meaningful FCI can allow the FBO or the OV exercise target residue testing from animals from farms

[5] http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A7-2014-0129&language=EN

with poor animal health and welfare or where meaningful CCIR are absent. This means that in the future those who are consistently delivering on their responsibilities will be rewarded by less inspection and reduced costs. In the new EU Commission proposal on the Official Controls[6] the "*Bonus malus*" principle has been introduced aiming to lower fee level for compliant businesses: this means that those FBOs with good performance may be rewarded and those with bad performance will have to pay with additional visits. Meat inspection is moving towards visual for low risk and acknowledgment of good FCI and CCIR.

Fig. 2



What are the potential outcomes and benefits from quality FCI and CCIR?

1) The PVP can add integrity to the Food Chain Information through advice to the farmer on Good Farming

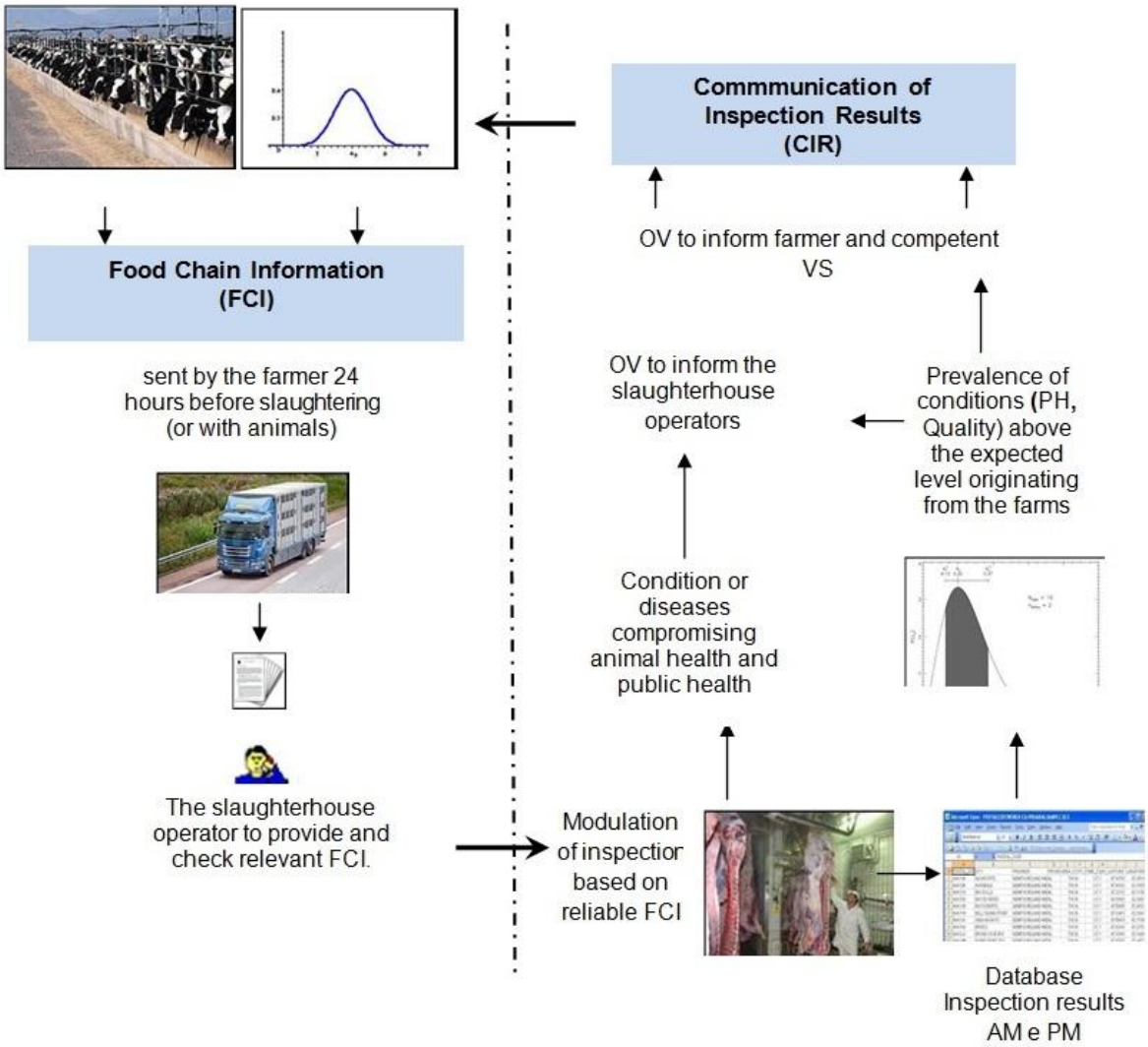
[6] http://www.europarl.europa.eu/sides/getDoc.do?type=TA&language=EN&reference=P7-TA-2014-0380

Practices, biosecurity measures, quality assurance, HACCP plan, Herd Health "*Planning"* and collection and interpretation of data. Epidemiology serves two major purposes in herd health management:

- Risk factor analysis (identify high risk animals)
- Monitoring (use of key indicators/trends)

CCIR provide the farmer and vet with up to date information on health parameters and allow comparison of previous FCI. This provides a mechanism of assessing previous herd health improvements on farm. Herd Health Planning is specific to individual farms where unique circumstances require individual farm targets to be set and improvement measured.

Fig. 3



2) CCIR from the slaughterhouse can integrate the information related to production, health and welfare status derived from many sources such as (production data from farm software, feed analysis, analysis from

veterinary laboratory, clinical and health data, weight gain, mortality, morbidity etc. This data could be stored in a central database and accessed by veterinary and other service providers. Harmonisation of the FCI and of the epidemiological indicators will facilitate benchmarking and epidemiological comparison for various farming sectors (e.g. dairy, beef, sheep etc) and other demographical variation, not only at farm level but also at regional and country level.

3) At veterinary practice level veterinary practitioners must communicate what the emerging needs of the farmers are. This will inevitably lead to an expansion in the range of services provided. They must also promote the services available from the practice and cannot assume that farmers are aware of the range of services provided. At macro level farm quality assurance is becoming the marketing standard used to signify levels of farm excellence in many aspects. Farm quality assurance needs to be based on objective measures that focus on outputs relevant to quality.

4. 3 - Flexibility and adaptability in modernisation of meat controls

European Legislation and standards care about animal health and welfare, food safety and sustainability. Modernisation with high quality FCI recognizes the different cultures and geographical and farming diversity that exists in the EU. For a number of reasons, including socio-economic factors, there is no one global answers to modernisation. Each Member State, compartment or region, must be given time and flexibility to adapt an approach appropriate to local circumstances while delivering the equivalent '*food safety objective'*. Any change introduced should be gradual: many Member States may lack facilities or the capacity to fulfil the pre-requisites for the changes.

The speed of modernisation will therefore vary between Member States with a long transition period for some. Member States have different farming demographics affected by diverse socioeconomic factors. For example, small farm size, farm structural development and expansion (with overcrowding at housing) and biosecurity challenges may affect the animal health, welfare and food safe status as they enter the slaughterhouse. In these situations traditional meat inspection (including palpation and incision) may be deemed necessary by the official OV.

However FCI and CCIR when collated and analysed together with other HEI may prompt the farmer, farmer groups or indeed competent authority to centrally support efforts to improve herd health back on the farm. The veterinary practitioner has a significant role to play here in providing professional input into Herd Health Planning and farm quality assurance. The PVP has to adapt to the new circumstances and recognize the new opportunities by promoting and marketing and winning business rather than in the past waiting for government to act as "*sponsor"* of various schemes.

Firstly the PVP can provide clinical and herd health and welfare services for his farmer client including advising and prescribing appropriate veterinary medicines. Secondly, when on farm the veterinary practitioner may be carrying out duties of public good for the regulator such as providing surveillance and feeding, could forward accurate FCI for interpretation by the FBO and the OV at the slaughterhouse.

5 - Recommendations

1. Meaningful FCI/CCIR as part of modernization, interpreted and advised by the veterinarians can be the vehicle for positive change.

2. Animal health, welfare and food safety are inextricably linked and influence each other both positively and negatively;

3. FVE embrace the multidisciplinary approach to risk assessment, management and communication;

4. Within the EU, the government and regulatory authority role is changing from control via law enforcement to supporting the FBO (including the farmer) to take responsibility and ownership of standards through integrated animal health & welfare and food safety in their businesses;

5. The consumer and markets, at the end of the day will dictate the values they require in the food chain including on farm. We must be mindful of this during the process of communicating risk and change during the modernization process;

6. There is a need for a comprehensive food chain information (FCI) – CCIR supplemented by harmonized epidemiological information (HEI) which can be reported to a central (European) data base for further interrogation;

7. Modernization with good quality FCI/CCIR linked to herd health planning support not only animal health & welfare and food safety but also environmental protection and sustainability;

8. Excellence in knowledge transfer is a pre requisite in the ability to share and use food chain information up and down the food chain for positive change.

ANNEX I

Harmonised epidemiological indicators (HEI)

In the recent scientific opinions, EFSA based on scientific and epidemiological data, provides a risk ranking of the most important hazards (chemical and biological) that need to be covered and managed by modern methods of meat inspection at slaughterhouse. The risk ranking related to different hazards and animal species (cattle, pigs, sheep, goats, game and horse) is based on:

- the magnitude of the human health impact (incidence);
- the severity of the disease in humans;
- the proportion of human cases that can be attributed to the handling, preparation and consumption of meat;
- the prevalence and concentration of the hazards in farms and carcasses.

The main hazards identified by EFSA are invisible at *post mortem* inspection, hence the only way to ensure their effective control is through a more reliable, systematic and scientific food chain information (FCI).

Also EFSA proposes for each biological hazards harmonized epidemiological indicators [7] that in the framework of comprehensive carcass safety assurance, combine measures applied on-farm and at-abattoir. These indicators are particularly useful for risk categorization of both farms, herds and slaughterhouses, and for setting appropriate targets for final chilled carcasses.

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[7] - Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of poultry. EFSA Journal 2012;10(6):2764 [87 pp

. Technical specifications on harmonised epidemiological indicators for public health hazards to be covered by meat inspection of swine. EFSA Journal 2011; 9(10): 2371.

Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of bovine animals. EFSA Journal 2013;11(6):3276.

Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of domestic sheep and goats. EFSA Journal 2013;11(6):3277.

Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of domestic solipeds. EFSA Journal 2013;11(6):3268.

Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of farmed game. EFSA Journal 2013;11(6):3267

Why are HEIs important? The case of EU mandatory *Salmonella* control program for poultry

The HEI generally refers to "*key epidemiological finding for a given hazard which can be the prevalence or the concentration of the hazard at certain stage of the food chain (in the animal population or in the food) or the indirect measure of the hazard (such as audits or evaluation of process hygine) that correlates to a human risk of the hazard*". Indicators are assessed for their relevance based on quality, appropriatenes, data availability and, feasibility.

In the EU, based on MSs's experience and recent evaluation, FCI is lacking adequate and standardised indicators for the main public health biological hazards identified by EFSA *(eg. Salmonella* and *Campylobacter* in poultry*; Salmonella, Yersinia enterocolitica* in pig) and shows a limited use for microbial food safety purposes.

The only exception is *Salmonella* control established by Regulation (EC) No. 2160/2003[8] which obliges MSs to set up national control programmes for *Salmonella* serovars in broiler and turkey flocks before slaughter to protect human health against *Salmonella* infections transmissible between animals and humans. The animal populations which are currently targeted also include breeding flocks and laying hens. These national control programmes, based on effective measures for prevention, detection and control of *Salmonella* at all relevant stages of production, processing and distribution, particularly in primary production, are established to achieve EU reduction targets to decrease the *Salmonella* prevalence in those animal populations at the primary production level (see Table 1).

Table 1- EU Salmonella control program *

Targeted animal population	*Reduction target (as maximum percentage of flocks)*	*Targeted serovars*	*Minimum requirements for detection*	*Results on 2012*
Breeding flocks (commercial-scale adult breeding flocks, during the production period)	1 % or less	*S. Enteritidis*, S. *Typhimurium*, S. *Infantis* , *S. Virchow* and *S. Hadar*, including monophasic *S. Typhimurium*	sampling three times during the rearing period and every two to three weeks during the production (laying) period.	*Salmonella* was found in 2.0 % of breeding flocks in the EU compared with 1.9 % in 2011 Decrease of five targeted *Salmonella* serovars (from 0,6 to 0,4 in 2011)
Laying hen flocks (of	2 %	*S. Enteritidis* and *S.*	sampling twice during the	decreased

[8] Regulation (EC) No 2160/2003 of the European Parliament and of the Council and Regulation of 17 November 2003 on the control of Salmonella and other specified food-borne zoonotic agents.

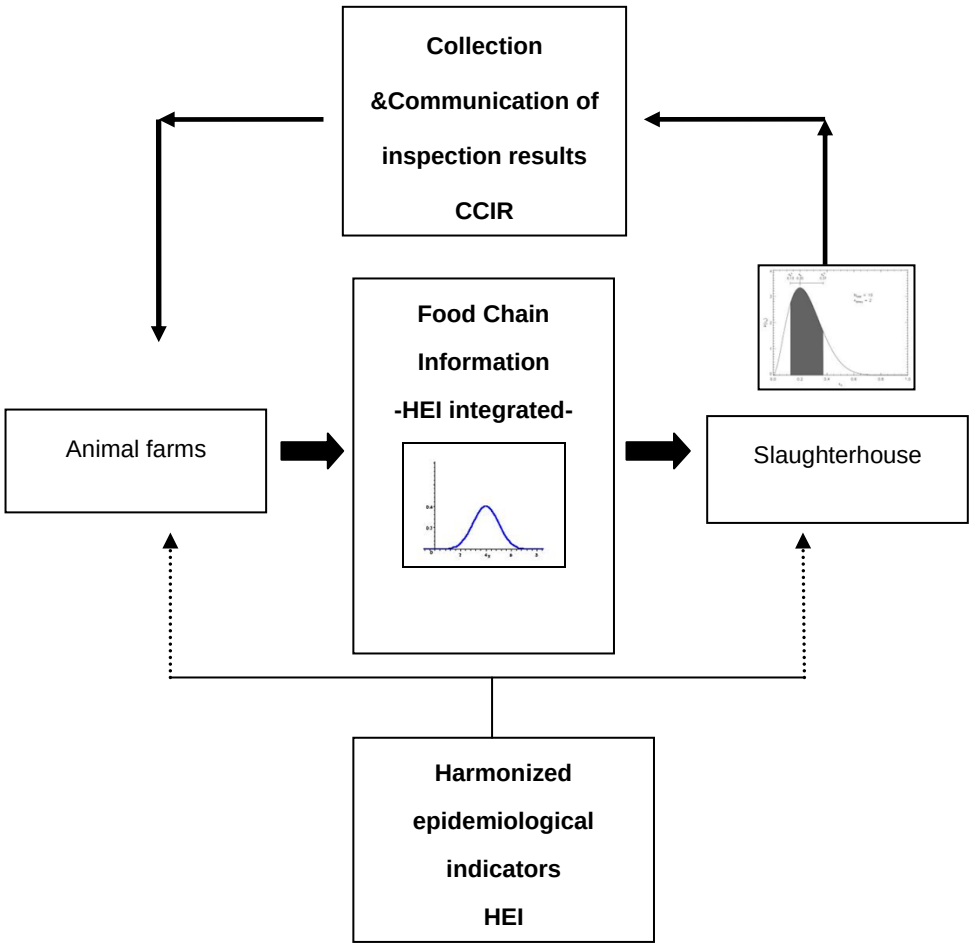
Gallus gallus)		*Typhimurium*	rearing period (day-old chicks and at the end of the rearing period before moving to the laying unit), as well as sampling every 15th week during the production period, starting at a flock-age between 22 and 26 weeks.	from 1.5 % in 2011 to 1.3 %
Broiler flocks **	1 % or less	S. *Enteritidis* and/or *S. Typhimurium (*including monophasic *S. Typhimurium)*	sampling of flocks within the three weeks before the birds are moved to the slaughterhouse, taking at least two pairs of boot/sock swabs per flock	24 MSs and 3 non-MSs met the target.
* Regulation (EC) No 2160/2003 ** Regulation (EC) No 200/2012				

Test results of monitoring target population of broilers flock for *Salmonella* have to be reported in the FCI to slaughterhouses along with any relevant additional information. EFSA in the Summary report published in 2014, describes an overall EU decreasing trend of *Salmonella* prevalence in flocks for all target populations in 2012. Contextually there is a corresponding statistically significant decreasing trend (p<0.001 with linear regression) of human salmonellosis infection compared to previous years. **To provide some figures, the 92,916 salmonellosis cases reported by 27 EU MSs represents a 4.7% decrease in confirmed cases compared with 2011.** This provides an example of how, by including appropriate epidemiological indicator, the public health risk of hazard *"Salmonella* during the post-mortem inspection is consistently reduced. Based on this epidemiologic evidence we can certainly argue that the provisions of Regulation (EC) No 2160/2003, with mandatory monitoring program and target reduction, had a positive impact on public health by contributing to the reduction in the incidence of *Salmonella* human infections in the EU. This results clearly demonstrate the public health advantage of having a proper and well implemented monitoring system of HEI for food animals. The same system (control and related results) if extended to other biological hazards of public health relevance (eg. *Campylobacter*) would be beneficial to risk categorisation of flocks/batches and risk management. For these reasons the current FCI system needs further development to include additional information important for food safety and public health. Differently from poultry, most of national monitoring programmes for *Salmonella* in pig meat and products thereof are based on sampling at the slaughterhouse (food safery criteria) and/or processing or cutting plants (process hygiene criteria).

Which HEI can be included in the FCI?

Among the HEIs indicated by EFSA for each animal species is possibile to identifiy the ones that can be relevant for the FCI and be incorpored in its revised form (Fig.1).

Fig. 1- Information cycle farms–slaughterhouse



For each epidemiological indicator EFSA defines key elements of minimum monitoring or inspection requirements. The following tables taken from the *EFSA Technical reports* illustrates the HEI for the main hazards of different species and the FCI applicability.

Poultry

The main biological hazards identified by EFSA are: *Salmonella, Campylobacter* and ESBL/AmpC R.

Salmonella spp.

Based on epidemiological data, *Salmonella* spp. represents a high risk hazard that need to be addressed and managed consistently at farm level and at slaughterhouse[9].

Table 2. *Salmonella*

HEI Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Salmonella in breeding parent flocks	Farm	Microbiology (detection and serotyping)	Pooled faeces (e.g. boot swabs) possibly combined with dust samples	✓
Salmonella in poultry flocks prior to slaughter(a)	Farm	Microbiology (detection and serotyping)	Pooled faeces (e.g. boot swabs)	✓
Controlled housing conditions at farm for laying hens and fattening flocks (including biosecurity)	Farm	Auditing	Not applicable	✓
Salmonella in birds - carcasses after slaughter process and chilling	Slaughterhouse	Microbiology (detection and serotyping)	Neck and breast skin	

The relevant HEI information that can be included in the FCI are:

- Monitoring of *Salmonella* in breeding parent flocks
- Monitoring of *Salmonella* in poultry flocks prior to slaughter
- Audit's result's of controlled housing conditions at farm for laying hens and fattening flocks (including biosecurity)

With the exemption of control housing conditions, the proposed HEIs utilise the testing of poultry flocks (FCI) or carcases (CIR) already foreseen by existing EU legislation on *Salmonella* controls. The other indicator (*Salmonella* in birds carcasses after slaughter process and chilling) is related to the CCIR.

Campylobacter

Based on EFSA Opinion, several HEIs for *Campylobacter* can be used at the farm level at present as illustrated in the table 3.

Table 3. *Campylobacter*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Campylobacter in poultry flocks prior to slaughter	Farm	Microbiology - real-time PCR	Caecal droppings	✓
Controlled housing conditions at farm for poultry flocks (including biosecurity)	Farm	Auditing	Not applicable	✓
Use of partial depopulation in the flock	Farm	Food chain information	Not applicable	✓
Campylobacter in birds - incoming to slaughter process (evisceration stage)	Slaughterhouse	Microbiology - enumeration	Caecal content	
Campylobacter in birds - carcases after slaughter process and chilling	Slaughterhouse	Microbiology - enumeration	Neck and breast skin	

[9] In regards to the prevalence Berends et al. (1997) showed that there was a strong correlation between the number of live animals that carry *Salmonella* in their faeces and the number of contaminated carcases at the end of the slaughter line. The found that 70 % of all carcase contamination resulted from the animals themselves being carriers, and 30 % because other animals were carriers (i.e. cross-contamination).

The ones that can be included in the FCI are:

- results of sampling of caecal droppings for *Campylobacter* in poultry flocks prior to slaughter: (positive or negative classification of flocks):
- audit's results of controlled housing conditions at farm (including biosecurity);
- information on partial depopulation of flocks for each slaughter batch.

The remaining indicators are relevant for CCIR.

ESBL/AmpC-producing bacteria (E.coli and Salmonella)

Poultry and related products are the ones most frequently reported to be contaminated with ESBL-/AmpC-producing bacteria. There are reports that provide public health consequences of this contamination [10].

Based on EFSA Opinion several HEI for ESBL Ampc producing-bacteria can be used at farm level as illustrated in the table:

Table 4. ESBL-/AmpC-producing bacteria

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
ESBL-/AmpC-producing *E. coli* in elite, grandparent and parent breeding flocks producing chicks for meat production lines	Farm	Microbiology, enumeration, molecular methods for characterisation on a subsample	Pooled faeces (boot swabs)	✓
ESBL-/AmpC-producing *E. coli* in incoming 1-day-old chicks for fattening purposes	Farm	Microbiology, detection with enrichment, molecular methods for characterisation on a subsample	Paper used in transport boxes	✓
ESBL-/AmpC-producing *E. coli* in poultry flocks prior to slaughter	Farm	Microbiology, enumeration, molecular methods for characterisation on a subsample	Pooled faeces (boot swabs)	✓
Controlled housing conditions	Farm	Auditing	Not applicable	✓
Use of antimicrobials during the whole life time of the flock (including *in ovo*, hatching, rearing, laying, all types of flocks)	Hatchery/farm	Food chain information (from hatchery to farm, from farm to slaughterhouse)	Not applicable	✓
ESBL-/AmpC-producing *E. coli* in birds - carcasses after slaughter process and chilling	Slaughterhouse	Microbiology, enumeration, molecular methods for characterisation on a subsample	Neck (and breast) skin	

[10] ESBL-producing *E. coli* can be associated with its transmission from food to humans (Lavilla et al., 2008). Recent studies suggest transmission of *E.coli* that produce ESBL from poultry to humans (Leverstein-van Hall et al., 2011). There is also evidence (Fey et al., 2000; Zansky et al., 2002) of direct association of transmission of *Salmonella* resistant to third-generation cephalosporins during an outbreak in humans (from EFSA, 2011d).

The HEI that can be included in the FCI are:

- results of microbiological testing of pooled faeces of birds at farm, including paper used in transport boxes
- results of auditing for controlled housing conditions
- information on use of antimicrobial during the whole life time of the flock

The remaining indicator is relevant for CCIR at slaughterhouse, whose objective is to assess the capacity to limit the contamination.

Pigs

The main biological hazards identified for pigs by EFSA are: *Salmonella,Yersinia,Toxoplasma and Trichinella*.

Salmonella spp.

Similarly to poultry, *Salmonella* spp. represent a high risk hazard that need to be addressed/managed consistently at farm level and at slaughterhouse[11].

Table 5. *Salmonella*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Salmonella in breeding parent flocks	Farm	Microbiology (detection and serotyping)	Pooled faeces samples	✓
Salmonella in fattening pigs prior to slaughter	Farm	Microbiology (detection and serotyping)	Pooled faeces samples	✓
Controlled housing conditions at farm (both for breeding pigs and fattening pigs)	Farm	Auditing	Not applicable	✓
Transport and lairage conditions (both for breeding pigs and fattening pigs)	Transport and slaughterhouse	Auditing of time, mixing of batches and reuse of pens in lairage	Not applicable	
Salmonella in fattening pigs incoming to slaughter	Slaughterhouse	Microbiology (detection and serotyping)	Ileal contents[12]	

[11] In regards to the prevalence Berends et al. (1997) showed that there was a strong correlation between the number of live animals that carry *Salmonella* in their faeces and the number of contaminated carcases at the end of the slaughter line. Furthermore they found that about 70 % of all carcase contamination resulted from the animals themselves being carriers, and 30 % because other animals were carriers (i.e. cross-contamination).

[12] Ileal content is a more sensitive indicator of *Salmonella* infection during transport and lairage than the lymphnodes (De Busser et al., 2011).

process (evisceration stage)				
Salmonella fattening pigs carcasses incoming to slaughter process before chilling	Slaughterhouse	Microbiology (detection and serotyping)	Carcase swabs	
Salmonella in fattening pigs carcasses incoming to slaughter process after chilling	Slaughterhouse	Microbiology (detection and serotyping)	Carcase swabs	

Relevant HEIs that can be included in the FCI are:

- Monitoring's results of *Salmonella* in breeding pigs and fattening pigs
- Audit's resulta of controlled housing conditions

The remaning indicators can be included in the CCIR.

Yersinia

Yersinia spp. is the third most often reported zoonotic disease in the EU. Pigs are considered to be a major reservoir and pork products are considered to be the most important source for this pathogen.

Table 6. *Yersinia enterocolitica*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Yersinia enterocolitica in fattening pigs in coming to slaughter process (evisceration stage)	Slaughterhouse	Microbiology (detection and biotyping)	Tonsils or rectal content	
Slaughter methods: separation of head *Salmonella* in fattening pigs prior to slaughter	Slaughterhouse	Auditing	Not applicable	
Yersinia enterocolitica in fattening pigs-carcases after slaughter process before chilling	Slaughterhouse	Microbiology (detection and biotyping)	Carcase swabs	
Yersinia enterocolitica in fattening pigs-carcases after slaughter process after chilling	Slaughterhouse	Microbiology (detection and biotyping)	Carcase swabs	

Based on EFSA opinion, no useful HEI for *Y.enterocolitica* can be used at the farm level at present[13]. None of them can be included in the FCI.

Toxoplasma

Despite no useful HEI for *Toxoplasma* can be used at the farm level at present, the results of auditing on controlled housing conditions might be relevant for the FCI.

[13] For animal welfare reasons, taking tonsil samples routinely from pigs cannot be justified. On the other hand, examination of faeces leads to considerable underestimation of the number of positive pigs at the farm level (Nesbakken et al., 2006).

Table 7. *Toxoplasma*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Farms with officially recognized controlled housing conditions (including control of cats and boots)	Farm	Auditing	Not applicable	✓
Toxoplasma in breeding pigs from officially recognized controlled housing conditions	Slaughterhouse	Serology	Blood	
Toxoplasma in breeding pigs from non- officially recognized controlled housing conditions	Slaughterhouse	Serology	Blood	

Trichinella

Based on EFSA opinion useful HEI for *Trichinella* at farm level is related to the controlled housing condition and disease free status. This information can be included in the FCI. The remaing indicators are relevant for the CCIR.

Table 8. *Trichinella*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Trichinella in free range and backyard pigs (both fattening and breeding pigs)	Slaughterhouse	Digestion	Meat	
Trichinella in pigs from from non-officially recognized controlled housing conditions officially recognized controlled housing conditions (both fattening and breeding pigs)	Slaughterhouse	Digestion	Meat	
Farms with officially recognized controlled housing conditions and *Trichinella* free status [(a)]	Farm	Auditing	Not applicable	✓
Trichinella in wildlife (eg. wild boar, bear, racoon, dog, fox, jackal, wolf, lynx, wild cats, genet, mustelids)	Environment	Digestion	Meat	

(a) E.g. according to the Commission Regulation EC N° 2075/2005

Bovine

The main biological hazards for bovine are represented by: *Salmonella, E.coli VTEC, Cysticercus* (*Taenia saginata*) and *Mycobacterium tuberculosis* complex.

Salmonella spp.

Relevant HEI that can be included in the FCI are:

- monitoring's results of *Salmonella* status of the group(s) of bovine animals containing animals to be slaughtered within one month
- audit result of on-farm practices and conditions which increase the risk of introducing *Salmonella*

The remaining HEIs are applicable to slaughterhouse and can be used in the CCIR.

Table 9. *Salmonella*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Practices which increase the risk of introducing *Salmonella* into the farm (purchase policy, mixing with other herds, access to pasture, access to surface water)	Farm	Auditing	Not applicable	✓
On-farm practices and conditions	Farm	Auditing	Not applicable	✓
Salmonella status of the group(s) of bovine animals containing animals to be slaughtered within one month	Farm	Microbiology	Pooled faeces	✓
Transport and lairage conditions	Transport and lairage	Auditing	Not applicable	
Visual inspection of hide conditions of animals at lairage (clean animal scoring system)	Slaughterhouse	Visual inspection	Not applicable	
Salmonella on incoming animals (after bleeding and before dehiding)	Slaughterhouse	Microbiology (detection and serotyping)	Hide swabs	
Salmonella in incoming animals (evisceration stage)	Slaughterhouse	Microbiology (detection and serotyping)	Lymph nodes	
Salmonella on carcases pre-chilling	Slaughterhouse	Microbiology (detection and serotyping)	Carcase swabs	
Salmonella on carcases post-chilling	Slaughterhouse	Microbiology (detection and serotyping)	Carcase swabs	

E.coli VTEC

Bovines are reservoirs of a diverse range of VTEC, which can cause serious illness in humans, with symptoms including diarrhoea ranging from mild to bloody (haemorrhagic colitis), haemolytic-uremic syndrome (HUS) and thrombocytopenia.

Table 10. *E.coli VTEC*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Practices which increase the risk of introducing pathogenic VTEC into the farm (purchase policy, mixing with other herds, access to pasture, access to surface water)	Farm	Auditing	Not applicable	✓
On-farm practices and conditions	Farm	Auditing	Not applicable	✓
Pathogenic VTEC status of the group(s) of bovine animals containing animals to be slaughtered within one month	Farm	Microbiology	Pooled faeces or floor samples	✓
Transport and lairage conditions	Transport and lairage	Auditing	Not applicable	
Visual inspection of hide conditions of animals at lairage (clean animal scoring system)	Slaughterhouse	Visual inspection	Not applicable	
Pathogenic VTEC on incoming animals (after bleeding and before dehiding)	Slaughterhouse	Microbiology	Hide swabs	
Pathogenic VTEC on carcases pre-chilling	Slaughterhouse	Microbiology	Carcase swabs	
Pathogenic VTEC on carcases post-chilling	Slaughterhouse	Microbiology	Carcase swabs	

Based on EFSA opinion, the relevant HEI to be included in the FCI are

- monitoring's result's of pathogenic VTEC status of the group(s) of bovine animals containing animals to be slaughtered within one month
- audit's results of on-farm practices and conditions which increase the risk of introducing VTEC.

The other HIS are related to visual inspection of bovine hide, which will a give more general assessment of microbiological risk and, when used in combination with microbiological HEIs, will support assessment and knowledge of VTEC risk. This can be sued in the CCIR.

Cysticercus

Taenia saginata (the beef tapeworm) is one of the three species causing taeniasis in humans. The bovine is the intermediate host. Almost in the 30% of infected bovine, 23 % of the cysticerci will establish in the so-called predilection sites consisting of heart, masseter muscles, tongue, oesophagus and diaphragm, which

are examined by routine meat inspection as required by Regulation (EC) No 854/2004. Human infection occurs trough consumption of raw or undercooked meat containing cysticerci.

Table 11. *Cysticercus*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Audit of farming practices	Farm	Auditing	Not applicable	✓
Prevalence of *T. saginata* cysticerci-positive slaughter animals (excluding white veal calves)	Slaughterhouse	Serology. At individual level. Direct method to detect circulating parasite antigens	Blood	
T. saginata cysticerci in suspected lesions from all types of farms (excluding white veal calves)	Slaughterhouse	Visual meat inspection and polymerase chain reaction (PCR) for confirmation of *Taenia* DNA in the lesion	Suspect lesion (meat)	

Based on EFSA opinion, the relevant HEI to be included in the FCI is related to audit's results at the farm. The others HEI are related to CCIR with the visual meat inspection and PCR for confirmation of *Taenia* DNA in the lesion.

Mycobacteria

Tuberculosis is a serious disease of humans and animals caused by the bacterial species of the family *Mycobacteriaceae*, more specifically by species of the *Mycobacterium tuberculosis* complex (MTC). This group includes *Mycobacterium bovis* (*M. bovis*), causing bovine tuberculosis. In humans, infection with *M. bovis* causes a disease that is indistinguishable from that caused by infections with *M. tuberculosis*, the primary agent of human tuberculosis The main transmission route of *M. bovis* to humans is through unpasteurised milk from infected animals or through unpasteurised milk products from infected animals. Tuberculosis due to *M. bovis* is rare in humans in the EU, with 132 confirmed human cases reported in 2011 (EFSA and ECDC, 2013).

Table 12. *Mycobacteria*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Official status of bovine herd as regards bovine tuberculosis (OTF status)	Farm	Food chain information	Not applicable	✓
Human pathogenic mycobacteria in bovines at slaughter (identification of tuberculosis-like lesions through visual *post mortem* inspection and microbiology of suspect lesions)	Slaughterhouse	Visual meat inspection and microbiology(a)	Suspected lesions	

Based on EFSA opinion, the relevant HEI to be included in the FCI is related to the official status of bovine herd as regards bovine tuberculosis (OTF status).

The other HEI is related to CCIR with the visual meat inspection and microbiology at slaughterhouse. It may be possible to combine the sampling or audits at farm for *Salmonella*, pathogenic VTEC and *Cysticercus.*

Sheep and goats

Toxoplasma gondii

The infection may be acquired by humans through the consumption of undercooked meat containing tissue cysts, through consumption of food or water contaminated with oocysts, or through accidental ingestion of oocysts when handling contaminated soil or cat litter trays. Levels for *T. gondii* seroprevalence among human populations may depend on regional origin and local consumer habits. According to EFSA there are only a few toxoplasmosis outbreaks which have been attributed to the consumption of sheep and goat meat in the past, and raw or improperly heated lamb meat was considered as the most probable source of infection.

Table 13. *Toxoplasma gondii*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Farms with controlled husbandry conditions	Farm	Auditing	Not applicable	✓
Information on the age of the animals	Slaughterhouse	Food chain information	Not applicable	✓
Detection of *T. gondii* infection	Slaughterhouse	Serology	Blood	
Detection of *T. gondii* infection in older animals (more than one year) from farms with controlled husbandry conditions	Slaughterhouse	Serology	Blood	
Absence of *T. gondii* infection in younger animals (less than one year) from farms without controlled husbandry conditions	Slaughterhouse	Serology	Blood	

Based on EFSA opinion, given the endemic nature of this hazard, the relevant HEIs to be included in the FCI is the audit's result of farms for controlled husbandry conditions (including control of cat access to the farm, feeding, water, etc.). The other HEIs are related to the CCIR, such as information on the age of animals since the prevalence increases with age and older animals are considered of higher risk than young animals or the serology for the detection of *T. gondii* infection in older animals.

Pathogenic VTEC

Table 14. *Pathogenic VTEC*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Occurrence of pathogenic VTEC in slaughter batch/group of animals one month before slaughter	Farm	Microbiology	Pooled faecal samples	✓
Occurrence of pathogenic VTEC on fleece/pelt samples (after bleeding and before fleece/pelt removal)	Slaughterhouse	Microbiology	Fleece sample/pelt swab	
Occurrence of pathogenic VTEC on carcases pre-chilling	Slaughterhouse	Microbiology	Carcase swabs	
Occurrence of pathogenic VTEC on carcases post-chilling	Slaughterhouse	Microbiology	Carcase swabs	

The relevant HEI to be included in the FCI is the monitoring results of VTEC in the slaughter batch/group of animals one month before slaughter.

Mycobacteria

Table 15. *Mycobacteria*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Official bovine tuberculosis status	Farm/region/Member State	Official records, food chain information	Not applicable	✓
Human-pathogenic mycobacteria in sheep and/or goats at slaughter	Slaughterhouse	Visual meat inspection and Microbiology	Suspected lesions	

The relevant HEI to be included in the FCI is the official bovine tuberculosis status

Farmed game (wild boar and deer)

Salmonella in wild boar

Table 16. Salmonella

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Salmonella in farmed wild boar before slaughter	Farm	Microbiology (detection, isolation and serotyping)	Pooled faeces sample	✓
Salmonella in/on farmed wild boar carcasses after slaughter but before chilling	Slaughterhouse	Microbiology (detection, isolation and serotyping)	Carcass swabs	

Based on EFSA opinion the HEI to be included in the FCI is reated to the monitoring of *Salmonella* before slaughter. The other HEI is related to CCIR (results of carcasses monitoring).

Toxoplasma in deer and wild boar

Based on EFSA opinion as regards *Toxoplasma* audits of farmed deer or farmed wild boar for controlled conditions were considered not useful as a HEI. Therefore not HEIs can be included in the FCI.

Trichinella in wild boar

Pork is an important source of human *Trichinella* infection both worldwide and in Europe, but meat of horses and wild boar have also played a significant role during the last three decades. Based on EFSA opinion there are not HEIs that can be included in the FCI. The only HEI is related to the CCIR with testing's results of carcasses at slaughterhouse.

Mycobacterium in deer and wild boar

Based on EFSA opinion the HEI that can be included in the FCI is the official bovine tuberculosis status of farm. The other HEI is related to the CCIR with results of visual meat inspection of suspected lesions at slaughterhouse.

Table 17. *Mycobacteria*

Indicators	Food chain stage	Analytical/diagnostic method	Specimen	FCI applicability
Official bovine tuberculosis status	Farm/region/Member State	Official records, food chain information	Not applicable	✓
Human pathogenic mycobacteria in farmed wild boar and deer at slaughter	Slaughterhouse	Visual meat inspection and microbiology	Suspected lesions	

Domestic solipeds

Trichinella

Based on EFSA opinion there are not HEIs referring to the farm that can be included in the FCI. Since the horse origin is an important epidemiological indicator risk for consumers of raw horse meat to acquire

trichinellosis it follows that the identification document and horse traceability are very important to reduce the *Trichinella* risk. Based on this is necessary that at slaughterhouse tre FCI provides the information on the country where the domestic soliped has been kept during its life. The only HEIs are related to CCIR such as testing of carcasses of all domestic solipeds including those originating from countries with *Trichinella* findings in pigs and wildlife.

Conclusions and recommendations

There is a general agreement on the following minimal requirements of FCI: appropriateness, reliability, relevance and accessibility. The appropriateness is related to the publich heath significance; reliability refers to trustworthy and correct information provided by farmers and veterinary practitioners; the relevance is associated to the type of animal species and existing integrated system or controlled housing conditions; accessibility refers to the ease of dissemination of information among interested actors making use, as much as possible, of electronic forms of communication.

It is also evident how the requirement of reliable and scientifically-based food chain information (FCI) is related to an effective monitoring/control activity of pathogens on animal farms and their risk/hazards-based categorization. For this reason FCI must be linked to a herd health planning (HHP), confirmed by a farmer/farm veterinarian and checked by an operator/official veterinarian (OV) in the slaughterhouse during ante-mortem. The role of the OV is crucial for the interpretation of FCI and for ensuring that the risk assessment of the status of the animal consignment is correctly performed.

The main biological hazards associated to food-producing animals can be effectively managed at the farm and slaughterhouse level by implementing harmonized epidemiological indicators (HEIs) which represent the most important tools for knowing the prevalence and concentration of pathogens in the framework of an integrated meat safety assurance programme.

A properly structured and reliable FCI, based on updated epidemiological data on main biological hazards and others data related to production and mortality rate, represents the necessary basis for the implementation of risk-based meat inspection and risk categorization of slaughterhouses, both leading to a more efficient hygiene/hazard process control.

Based on this and the EFSA recommendation on HEIs for the identified hazards, in the FCI "revised" sections related to "*animals' health status*" and "*occurrence or positive tests results of diseases that might affect the safety of meat*"), more focus should be placed on the results of the control of biological hazards other than *Salmonella,* such as the *Campylobacter* health status of animals and ESBL-/AmpC-producing *E. Coli* for poultry and related auditing techniques on farms.

The "*strenghtened"* FCI would also be functional regarding the meat inspection modernization process with the shift from traditional (incision and palpation) to visual *post-mortem* inspection for all animals.

Based on the above considerations and with the aim of strengthening the FCI, a series of activities can be envisaged from the side of both the competent authorities/veterinary services and farmers/VP.

Farm level

CA to:

- carry out risk analysis of farm taking into account different animal species, farming methods and geographical location;
- identify data and information needed for evaluating animal health/welfare and for risk categorization of farms and/or groups of animals;
- integrate the animal health epidemiological surveillance and monitoring activity with HEI for the main pathogens of public health significance (e.g., *Salmonella*, *Campylobacter*, *E. coli* VTEC).

Farmers, associations to:

- promote the awareness campaign among farmers and veterinary practitioners on the importance of a reliable, timely and accurate ICA;
- support the development of an electronic platform for sending ICA from farm to slaughterhouse (e.g., electronic movement licensing, Ealm2.org.uk) to also be accessible by the veterinary service.

Slaughterhouse level

CA to:

- introduce a system for ICA verification (control and corrective action) by the OV responsible for the slaughterhouse to improve the reliability/quality of data and information forwarded by farmers;
- improve the backward flow of information from slaughterhouse to farms by streamlining the inspection records (CCIR-collection and communication of inspection results);
- communicate to farmers conditions critical to public health and animal health by establishing a threshold level, for instance on the number of cases (incidence, prevalence) of clinical and subclinical condition/diseases.

ANNEX II
FCI templates

CATTLE

I. Identification Data

Consignor (name, address, postal code):	Consignee (name, address, postal code):
Competent/Local Authority:	Certificate reference No.:
Country of origin:	Country of destination:
Place of origin (name address postal code approval number): Place of loading:	Place of destination (name address postal code approval number):
Date departure:	Time of departure:
Means of transport:	Transporter:
Commodity/Good (name, quantity):	ID commodity (Species, Official identification, Quantity):

II. Animals' health status

II.1 Do the animals show any signs of health problems? II.2. If yes, please describe possible signs

III. Veterinary medicinal products

III.1 I declare that the animals presented for slaughter are in compliance with veterinary medicines legislation including observation of withdrawal periods ☐(*tick the box*)

IV. Occurrence or positive test results of diseases that might affect the safety of meat

IV.1 Is the holding under movement restriction for bovine Tuberculosis (TB)* or Brucellosis? YES/NO
IV.2 Is the holding under movement restrictions for other animal disease or public health reasons (excluding a 13-day standstill) YES/NO
IV.3 Are there other finding(s) at the farm that to my best knowledge might affect the safety of the meat? YES/NO
IV.4 If Yes, please describe the findings

V. Previous ante- and post-mortem inspection results

V.1 Previous ante and post-mortem inspection results shall be communicated to the farmers and the veterinarian regularly attending the holding of provenance. Do any of the previous three inspection results indicate relevant finding(s) for public health, animal health and/or animal welfare
V.2 If yes, please attach a copy to this food chain information model document only when the next group is sent to another slaughterhouse than the last group.

VI. Health and Production data

VI.1 Is the holding under any health restrictions by the Authorities? YES/NO VI.2 Is there a formal herd health plan (HHP) currently in place in the holding of provenance ? YES/NO VI.3 Name, telephone number of the Veterinary Practice / Veterinarian associated with the herd.

PIGS[14]

I. Identification Data

Consignor (name, address, postal code):	Consignee (name, address, postal code):
Competent/Local Authority:	Certificate reference No.:
Country of origin:	Country of destination:
Place of origin (name address postal code approval number): Place of loading:	Place of destination (name address postal code approval number):
Date departure:	Time of departure:
Means of transport:	Transporter:
Commodity/Good (name, quantity):	ID commodity (Species, Official identification, Quantity):

II. Animals' health status

II.1 Do the animals show any signs of health problems?
II.2 If yes , please describe possible signs:
II.3 Are the pigs kept under officially recognized controlled housing conditions in relation to *Trichinella* spp.? YES/NO
II.4 Are the animals over five weeks of age and weaned? YES/NO

[14] This model has been developed in collaboration with the European Livestock & Meat Trades Union (UECBV) in Brussels on 28 August 2014, Ref. FVE_UECBV_5125_FINAL

III. Veterinary medicinal products

III.1 I declare that the animals presented for slaughter are in compliance with veterinary medicines legislation including observation of withdrawal periods ☐(*tick the box*)

IV. Occurrence or positive test results of diseases that might affect the safety of meat

IV.1 What is the *Salmonella* spp. status of the farm of provenance? Free / positive / unknown
IV.2 Are there other finding(s) at the farm that to my best knowledge might affect the safety of the meat? YES/NO
IV.3 If Yes, please describe the findings:

V. Previous ante- and post-mortem inspection results

V.1 Previous ante and post-mortem inspection results shall be communicated to the farmers and the veterinarian regularly attending the holding of provenance. Do any of the previous three inspection results indicate relevant finding(s) for public health, animal health and/or animal welfare
V.2 If yes, please attach a copy to this food chain information model document only when the next group is sent to another slaughterhouse than the last group.

VI. Health and Production data

VI.1 Was the mortality rate during the fattening period over 5%? YES/NO IV.2 Has the farm been put under any health restrictions by the Authorities? YES/NO

IV.3 Is there a formal herd health plan (HHP) currently in place in the holding of provenance ? YES/NO IV.4 Name, telephone number of the Veterinary Practice / Veterinarian associated with the herd

SHEEP

I. Identification Data

Consignor (name, address, postal code):	Consignee (name, address, postal code):
Competent/Local Authority:	Certificate reference No.:
Country of origin:	Country of destination:
Place of origin (name address postal code approval number): Place of loading:	Place of destination (name address postal code approval number):
Date departure:	Time of departure:
Means of transport:	Transporter:
Commodity/Good (name, quantity):	ID commodity (Species, Official identification, Quantity):

II. Animals' health status

II.1 Do the animals show any signs of health problems? II.2. If yes, please describe possible signs

III. Veterinary medicinal products

III.1 I declare that the animals presented for slaughter are in compliance with veterinary medicines legislation including observation of withdrawal periods ☐(*tick the box*)

IV. Occurrence or positive test results of diseases that might affect the safety of meat

IV.1 Is the holding under movement restrictions for other animal disease or public health reasons (excluding a 13-day standstill). YES/NO
IV.2 Are there other finding(s) at the farm that to my best knowledge might affect the safety of the meat? YES/NO
IV.3 If Yes, please describe the findings:

V. Previous ante- and post-mortem inspection results

V.1 Previous ante and post-mortem inspection results shall be communicated to the farmers and the veterinarian regularly attending the holding of provenance. Do any of the previous three inspection results indicate relevant finding(s) for public health, animal health and/or animal welfare?
V.2 If yes, please attach a copy to this food chain information model document only when the next group is sent to another slaughterhouse than the last group.

VI. Health and Production data

VI.1 Is the holding under any health restrictions by the Authorities? YES/NO VI.2 Is there a formal herd health plan (HHP) currently in place in the holding of provenance? YES/NO VI.3 Name, telephone number of the Veterinary Practice / Veterinarian associated with the herd.

HORSES

I. Identification Data

Consignor (name, address, postal code):	Consignee (name, address, postal code):
Competent/Local Authority:	Certificate reference No.:
Country of origin:	Country of destination:
Place of origin (name address postal code approval number): Place of loading:	Place of destination (name address postal code approval number):
Date departure:	Time of departure:
Means of transport:	Transporter:
Commodity/Good (name, quantity):	ID commodity (Species, Official identification, Quantity):

II. Animals' health status

II.1 Do the animals show any signs of health problems? II.2. If yes, please describe possible signs:

III. Veterinary medicinal products

III.1 I declare that the animals presented for slaughter are in compliance with veterinary medicines legislation including observation of withdrawal periods ☐ (*tick the box*)

IV. Occurrence or positive test results of diseases that might affect the safety of meat

IV.1 Is the holding under sanitary movement restrictions? YES/NO
IV.2 Is the holding under movement restrictions for other animal disease or public health reasons? YES/NO

IV.3 Are there other finding(s) at the farm that to my best knowledge might affect the safety of the meat? YES/NO
IV.5 If Yes, please describe the findings:

V. Previous ante- and post-mortem inspection results

V.1 Previous ante and post-mortem inspection results shall be communicated to the farmers and the veterinarian regularly attending the holding of provenance. Do any of the previous three inspection results indicate relevant finding(s) for public health, animal health and/or animal welfare
V.2 If yes, please attach a copy to this food chain information model document only when the next group is sent to another slaughterhouse than the last group.

VI. Health and Production data

VI.1 Is the holding under any health restrictions by the Authorities? YES/NO VI.2 Is there a formal herd health plan (HHP) currently in place in the holding of provenance? YES/NO VI.3 Name, telephone number of the Veterinary Practice / Veterinarian associated with the herd.

POULTRY

I.a Identification Data

Consignor (name, address, postal code):	Consignee (name, address, postal code):
Competent/Local Authority:	Certificate reference No.:
Country of origin:	Country of destination:
Place of origin (name address postal code approval number): Place of loading:	Place of destination (name address postal code approval number):

Date departure:	Time of departure:
Means of transport:	Transporter:
Commodity/Good (name, quantity):	ID commodity (Species, Official identification, Quantity):

I.b Identification Detailed Data

	Flock 1	Flock 2	Flock 3	Flock 4
Species (Scientific name)				
Breed or Hibrid broilers only				
Age				
Production type				
Official identification				
No of birds				
Batch identification Reference number				
Slaughter date				
Maximum stocking density (broilers only)				
Mortality % at 14 days				
Mortality % to date or for broilers only: Cumulative daily mortality rate				

II. Animals' health status

II.1 Do the animals show any signs of health problems?

II.2. If yes, please describe possible signs:

III. Veterinary medicinal products

III.1 I declare that the animals presented for slaughter are in compliance with veterinary medicines legislation including observation of withdrawal periods (*tick the box*)

IV. Occurrence or positive test results of diseases that might affect the safety of meat

IV.1 Is this flock required to be tested under the requirements of the Salmonella National Control Programme (NCP)? YES/NO If Not or Exempted Please provide date and result of the test Have any other tests been carried out on the flock for any agents with the potential to cause food-borne disease in humans? YES/NO If YES Please provide name of the agent, date and result of the test
IV.2 Is the holding under movement restrictions for other animal disease or public health reasons? YES/NO
IV.3 Are there other finding(s) at the farm that to my best knowledge might affect the safety of the meat? YES/NO
IV.5 If Yes, please describe the findings:

V. Previous ante- and post-mortem inspection results

V.1 Previous ante and post-mortem inspection results shall be communicated to the farmers and the veterinarian regularly attending the holding of provenance. Do any of the previous three inspection results indicate relevant finding(s) for public health, animal health and/or animal welfare?
V.2 If yes, please attach a copy to this food chain information model document only when the next group is sent

to another slaughterhouse than the last group.

VI. Health and Production data

VI.1 Is the holding under any health restrictions by the Authorities? YES/NO

VI.2 Is there a formal herd health planning (HHP) currently in place in the holding of provenance ? YES/NO

VI.3 Name, telephone number of the Veterinary Practice / Veterinarian associated with the herd

ANNEX III
MOST COMMON LESIONS

These tables summarize the most frequent conditions for the main food-producing animals that may have significance in animal health (AH) in animal welfare (AW) and in public health (PH). Most of them are considered as defects leading to carcasses (or part of it) condemnation for aesthetical reason. The different prevalence of each condition might reflect the specific geographical area.

Generalized conditions such as septicaemia, pyaemia and toxaemia are not always determined while conducting post-mortem inspection. But they should be considered of public health significance due to the presence of pathogenic microorganisms and their associated toxins in the blood that may likely pose a threat to public health.

SHEEP	**Picture**	**Justification**
Liver Hepatitis *- Liver flukes*	 *Photo credit: F. O'Sullivan*	***AH/AW issue.*** *Major flock health issue.Issues around immature and mature liver fluke damage. Anthelmintic resistnace is also of concern (fluikicide resistance e.g. triclabendazole). Sheep with fluke often have reduced immunity and open to concomitant infections.*
Lungs Pneumonia (pleurisy)	 *Photo credit: F. O'Sullivan*	***AH/AW issue and indirectly PH (use of antimicrobials on farm)*** *Sheep farmers, especially those who house sheep often report sudden death or ill-thrift and coughing. Lung pathology is readily identifiable during the slaughter process and reporting of this to the farmer and his vet would allow them to consider a differential diagnosis, whether pasteurella, viral, or indeed lungworm causes. These sheep are difficult to butcher with a high risk for contamination, because of adhesions in the thorax. A reduction in pneumonia cases will reduce antimicrobial use on farm.*
Kidneys		***Food safety & quality issue that may lead to carcass condemnation.*** *Hydronephrotic kidneys (caused by too much magnesium in the*

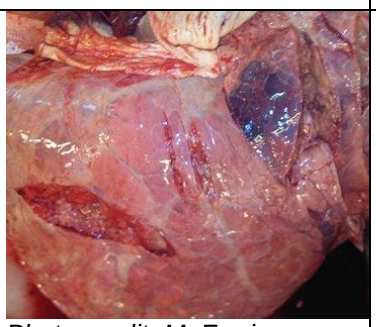
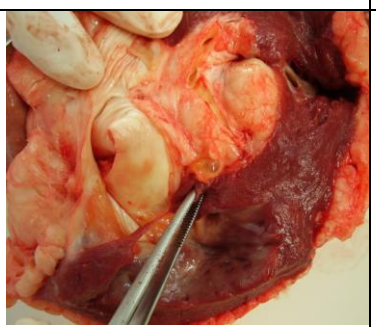
Hydronephrosis (magnesium crystals, Urolithiasis)	 *Photo credit: F. O'Sullivan*	*ram lambs diet), is a post mortem finding. The urethra becomes blocked with magnesium crystals causing a damming back of urine in the kidney. This usually happens when ram lambs access ewe meal fortified with magnesium for tetany prevention. Post mortem feedback on this condition will save immediately save further losses.*
Joints Arthritis/Polyarthritis	 *Photo credit: F. O'Sullivan*  *Photo credit: National Animal Disease Information Service, UK*	***AH/AW issue and indirectly PH (use of antimicrobials on farm)*** *When joints are inflamed or infected, this can lead to partial or total condemnation of the lamb or ewe. Feedback would allow the farmer and vet review the causal factors, including hygiene in the lambing shed, where joint infections often begin. The farmer often reports ill-thrift in these lambs. Prevention of Arthritis will reduce antimicrobial usage on farm*
Subcutaneous abscess		***AW/AW issue.*** *It is not uncommon to find subcutaneous abscesses subsequent to injection or vaccination. Extensive trimming is then often necessary in many lambs in the affected batch resulting in a poorer quality carcass with loss to the factory and the farmer. Feedback from the factory floor to the farmer would allow a review of injection technique and equipment, and prevent such blemishes on the carcasses from happening again.*

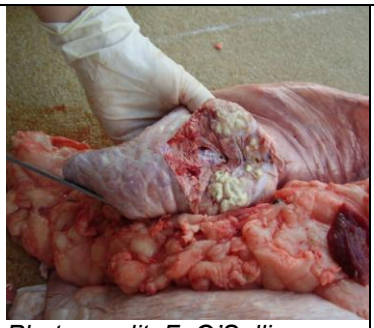
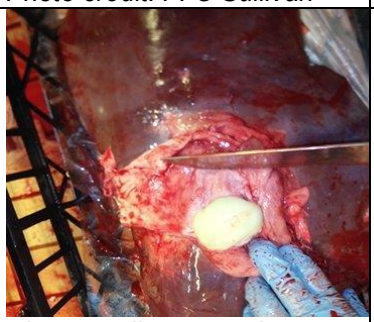
	Photo credit: F. O'Sullivan	
Pregnancy	 *Photo credit: F. O'Sullivan*	***AH/AW issue.*** *May happen where males and females are fattened together, slaughter of sheep in advanced pregnancy is a major welfare issue* .
Faecal contamination	 *Photo credit: Red Meat Safety & Clean Livestock, Food Standard Agency, UK*	***PH/AW issue.*** *Approx 4% of sheep excrete E Coli 0157-H7 without any clinical signs, therefore at AM sheep are scored for cleanliness and rejected for slaughter if too dirty. Fleece cleanliness a major welfare issue* *Faecal contamination conveys most of the PH significant hazards identified by EFSA opinions.*
Excessive lameness	 *Photo credit: National Animal Disease Information Service, UK*	***AW/AH and PH issue*** *Major flock health and welfare issue with a wide differential diagnosis possible, including notifiable disease (Foot and Mouth and Bluetongue)These lesions and lameness cases can be reported back to the farmer and vet both from ante mortem and post mortem examination to allow preventative strategies be put in place on farm with a resulting drop in antimicrobial use*
Body condition Skin Conditions	 *Photo credit: National Animal Disease Information Service, UK*	**AW/AH and PH issue.** *Poor body condition major flock health/animal welfare issue. Also consider the CLA (caseous lymphadenitis)* *Consider scrapie, exanthemous disease caused by parapox virus (zoonosis) and foot and mouth disease*

Abnormal central nervous signs	 *Photo credit: Colorado State University Extension*	***AW/AH and PH issue.*** *Important flock health issue e.g. Listeria spp. (zoonosis) and TSE, scrapie*

PIGS	**Picture**	**Justification**
<u>Lungs</u> • *Mycoplasma spp.* • *Actinobacillus pleuropneumoniae* • (Influenza virus, Porcine reproductive and respiratory syndrome)		***AH issue.*** *These conditions are mainly AH issues. A reduction in the incidence will increase production reduce the use of antimicrobials and thereby resistance, enhance animal eelfare and reduce carbon dioxide emissions.* *These conditions are mainly AH issues. PRRS is an AH issue. PRRS is the most economically significant disease. Financially, it can be a devastating disease for the farmer.*
Tail bite lesions	 *Photo credit: M. Laszlo*	***AW/AH issue.***
Scab (*Sarcoptes scabiei* or *Demodex phylloides)*	 *Photo credit: National Animal Disease Information Service, UK*	***AW/AH issue.*** *Hogs with mange will scratch so much the skin bleeds and scabs.*

Atrophic rhinitis		***AW/AH issue.*** *Disease mostly associated to <u>Bordetella bronchiseptica</u> or <u>Pasteurella</u> or esotoxins from these organisms. Turbinates look smaller than normal and nasal passages are larger.*

CATTLE	**Picture**	**Justification**
<u>Lungs</u>		
Pneumonia	 *Photo credit: M. Ferri*	***AH/AW/PH issue.*** *Consolidated lungs identified at post mortem indicate pneumonia. The most common bacteria affecting dairy calves with pneumonia are Mannheimia haemolytica and Pasteurella multocida.* *The PH significance (antimicrobial resistance) can be justified based on the use of antimicrobials on farm. A reduction in pneumonia cases will reduce antimicrobial use on farm*
Pleuritis	 *Photo credit: M. Ferri*	***AH/AW/PH issue.*** *Common causes of pleuritis include extension of pneumonia certain septicemias, wounds to the chest wall. Normally the carcass is condemned when the lesions are acute and extensive, or there is emaciation, or other systemic signs are present.* *The PH significance (antimicrobial resistance) can be justified based on the use of antimicrobials on farm. A reduction in pleuritis cases will reduce antimicrobial use on farm*
Hydatidosis / Echinococcosis	 *Photo credit: M. Ferri*	***PH/AH/AW issue.*** *Echinococcosis an infection caused by tapeworms of the genus Echinococcus, a tiny tapeworm just a few millimetres long.* *Echinococcosis is a zoonosis, a disease of animals that affects humans. Hydatid cysts, for E. granulosus, act like tumours that can disrupt the function of the organ where they are found, cause poor growth, reduced production of milk and meat and rejection of organs at meat inspection. In humans the disease can be severe, occasionally fatal, and the treatment is lengthy and expensive.*

Tuberculosis	 *Photo credit: F. O'Sullivan*	***AH/AW issue.*** *All meat from animals in which post-mortem inspection has revealed localised tuberculous lesions in a number of organs or a number of areas of the carcase is to be declared unfit for human consumption.* *However, when a tuberculous lesion has been found in the lymph nodes of only one organ or part of the carcase, only the affected organ or part of the carcase and the associated lymph nodes need be declared unfit for human consumption. (Chapter IX, Section IV, Annex I, Regulation EC 854/2004). These signs of generalised TB or TB lesions can be associated with emaciation of the entire carcase. In this case all the blood and offal should be rejected as unfit for human consumption.*
Emphysema	 *Photo credit: M. Ferri*	***AH/AW issue.*** *Interlobular septa are all expanded by air. When lungs are affected with emphysema they won't collapse when the chest is opened. Only the affected organs, or tissues are condemned*
<u>Liver</u>		
Fascioliasis	 *Photo credit: F. O'Sullivan*	***AH/AW issue.*** *Fasciola hepatica. Common in ungulates. The disease is of great economic importance because of liver condemnations.*
Abscesses	 *Photo credit: M. Ferri*	***AH/AW issue.*** *In the abscess the pus is separated from surrounding tissues by a layer of fibrous connective tissue. It will be trimmed or the affected area (organ or quarter) will be condemned.* *It is not a food safety concern (but abscesses and the surrounding tissues and/or area are not suitable for human consumption and if there is evidence of spread throughout the body the carcass and all organs will be condemned)*
Inflammatory processes		***AH issue.***

Degenerative processes. Fatty liver degeneration	 *PhPhoto credit : S. Jeckel, RVC-AHVLA Surveillance Centre*	***AH issue.*** *The liver shows several very definite pale areas under the capsule mostly associated with small thrombi in the portal vessels.*
Tumours and malformations		***AH/AW issue.***
Heart		
Inflammatory processes, traumatic Pericarditis, abscesses	 *Photo credit: M. Ferri*	***AH/AW issue.*** *The most common cause is penetration of the heart by a nail in "Hardware Disease". Pericarditis can also develop as an extension of pleuritis. In most cases there will be heavy accumulations of yellow clotted fibrin.*
Cisticercosis		***AH/AW/PH issue.*** *Meat infected with Cysticercus bovis (intermediate form of a tape worm called Taenia saginata) is to be declared unfit for human consumption. However, when the animal is not generally infected with cysticercus, the parts not infected may be declared fit for human consumption after having undergone a cold treatment. When present this parasite is most likely going to be detected in the heart, masseter muscles, tongue and diaphragm. (Regulation: (EC) 854/2004, Annex I, Section IV, Chapter IX, B)* ***** *It is of public health significance because (food safety concern) is transmissible to humans through meat products which are not treated in some manner to kill the larva.*
Tumours		***AH/AW issue.*** *The most common tumors include bovine squamous cell carcinoma, hemangiomas (blood vessel tumors) lymphosarcomas (tumors of the lymph nodes) and melanomas (tumors containing large amounts of black pigment).* ***Is not a food safety concern (i****f the tumor is considered benign and is localized, only the affected tissue is trimmed and condemned. The carcass is always condemned if there is evidence of metastasis beyond regional lymph nodes, or into other organs, or other systemic changes are present).*

Icterus (Jaundice)		***AH/AW issue.*** *The icterus condition (obstructive, haemolytic, and toxic) is characterized by an increase of amount of bilirubin in the blood and therefore in the tissues with a yellowish pigmentation of the connective tissues, sclera and visceral organs. This leads to carcasses condemnation.*

POULTRY	**Picture**	**Justification**
Emaciation / congestion	 *Photo credit: T. Chambon*	***AH/AW issue.***
Infected cutaneous lesions	 *Photo credit: T. Chambon*	***AH/AW issue.***
Ecchymosis	 *Photo credit: T. Chambon*	***AH/AW issue.***
Arthritis-Polyarthritis	 *Photo credit: T. Chambon*	***AH/AW issue.***
Abnormal colour or smell	 *Photo credit: T. Chambon*	***AH/AW issue.***

Ascites	 *Photo credit: T. Chambon*	***AH/AW issue.***

HORSES	**Picture**	**Justification**
Emphysema		***AH/AW issue***
Tongue Injuries (trauma)		***AH/AW issue***
Liver degeneration		***AH/AW issue***
Dystrophy and nephritis		***AH/AW issue***
Spleen bleeding		***AH/AW issue***
* Glanders (*Burkholderia mallei*)		***AH/AW & PH issue.*** *Glanders is not only a zoonotic disease, but also a biological weapon. Typical lesions are inflammatory nodules and ulcers in the nasal passages.*