CHAPTER 6.8.

HARMONISATION OF NATIONAL ANTIMICROBIAL RESISTANCE SURVEILLANCE AND MONITORING PROGRAMMES

Article 6.8.1.

Objective

This chapter provides criteria for the development of national antimicrobial resistance surveillance and monitoring programmes, and the harmonisation of existing national antimicrobial resistance surveillance and monitoring programmes in food-producing animals and in products of animal origin intended for human consumption.

Article 6.8.2.

Purpose of surveillance and monitoring

Active surveillance and monitoring are core parts of national antimicrobial resistance surveillance programmes. Passive surveillance and monitoring may offer additional information (refer to Chapter 1.4.). The OIE encourages cooperation among all Member Countries conducting antimicrobial resistance surveillance and monitoring.

Surveillance and monitoring of antimicrobial resistance is necessary to:

1) assess and determine the trends and sources of antimicrobial resistance in bacteria;
2) detect the emergence of new antimicrobial resistance mechanisms;
3) provide the data necessary for conducting *risk analyses* as relevant to animal and human health;
4) provide a basis for policy recommendations for animal and human health;
5) provide information for evaluating antimicrobial prescribing practices and for prudent use recommendations;
6) assess and determine effects of actions to combat antimicrobial resistance.

Article 6.8.3.

General aspects of antimicrobial resistance surveillance and monitoring programmes

Surveillance of antimicrobial resistance and monitoring of the prevalence of, and trends in, resistance in bacteria from *animals*, food, environment and humans, constitutes a critical part of animal health and food safety strategies aimed at limiting the spread of antimicrobial resistance and optimising the choice of *antimicrobial agents* used in therapy. *Feed* should also be considered according to national priorities.

Surveillance or monitoring of bacteria from products of animal origin intended for human consumption collected at different steps of the food chain, including processing, packing and retailing, should also be considered.

National antimicrobial resistance monitoring and surveillance programmes should be scientifically based and may include the following components:

1) statistically based surveys;
2) sampling and testing of food-producing animals on the farm, at live animal markets or at *slaughter*;
3) organised sentinel programme, for example targeted sampling of food-producing animals, *herds*, *flocks*, and *vectors* (e.g. birds, rodents);
4) analysis of veterinary practice and diagnostic *laboratory* records;
5) sampling and testing of products of animal origin intended for human consumption;
6) sampling and testing of *feed ingredients* or *feed*.

Article 6.8.4.

Sampling

1. Sampling strategies

   a) Sampling should be conducted on a statistical basis. The sampling strategy should ensure:
      – the sample is representative of the population of interest and meets the objectives of the surveillance;
      – the robustness of the sampling method.

   b) The following criteria are to be considered:
      – sample source such as food-producing animal, food, animal *feed*;
      – animal species;
      – category of *animal* within species such as age group, production type;
      – health status of the *animals* such as healthy, diseased;
      – sample selection method such as targeted, systematic random, non-random;
      – type of sample such as faeces, caeca, carcass, food product;
      – sample size.

2. Sample size

   The sample size should be large enough to allow detection or determine prevalence of, or trends in, existing and emerging antimicrobial resistance phenotypes.

   The sample should avoid bias and be representative of the animal *population*, process, product or other unit of interest whilst taking into account the expected prevalence of the bacteria in the sample type, the expected prevalence of the resistance phenotype and the desired level of precision and confidence.

   The sample size calculation should be based on independent samples. However, if there is any clustering at the *establishment* or animal level, the sample size should be adjusted accordingly. At low levels of expected prevalence, exact methods of sample size calculation should be preferred to approximate methods. Samples from which bacteria were not isolated cannot be used in the calculation of prevalence of the resistance phenotype.

3. Sample sources (Table 1)

   Member Countries should examine their livestock production systems on the basis of available information and assess which sources are likely to contribute most to a potential *risk* to animal and human health.

   a) Food-producing animals

      Categories of food-producing animals considered for sampling should be relevant to the country's production system. Resource allocation should be guided by criteria such as production volume of the food-producing animal species and the prevalence of resistant bacteria.

   b) Food

      Member Countries should consider including products of animal origin intended for human consumption, produced locally or imported, in surveillance and monitoring programmes, as foodborne transmission is considered to be an important route for the transfer of antimicrobial resistance.

   c) Feed

      Member Countries should consider including *feed* in surveillance and monitoring programmes as they may become contaminated with antimicrobial resistant bacteria, e.g. *Salmonella*.

   d) Environment

      Member Countries should consider including the environment in surveillance and monitoring programmes as the environment of animals can be an important route for transfer or persistence of antimicrobial resistance.

4. Type of sample to be collected (Table 1)

   Faecal samples should be collected in amounts sufficient for isolation of the resistant bacteria of concern (at least 5 g from bovine and porcine and whole caeca from *poultry*).

   Feed samples representative of the batch should be collected in amounts sufficient for isolation of resistant bacteria of concern (at least 25 g) and should be linked to any pathogen *surveillance* programme that may be in place.

   Existing food processing microbiological monitoring, *risk*-based management and other food safety programmes may provide useful samples for surveillance and monitoring of resistance in the food chain after *slaughter*.

Table 1. Examples of sampling sources, sample types and output

Source	Type	Output	Additional information required or additional stratification
Herd or flock of origin	Faeces or bulk milk	Prevalence of resistant bacteria originating from animal populations (of different production types). Relationship between resistance and antimicrobial use	Age categories, production types, etc. Antimicrobial use over time
Slaughterhouse/Abattoir	Faeces	Prevalence of resistant bacteria originating from animals at slaughter	
	Caeca or intestines	As above	
	Carcass	Prevalence of resistant bacteria after carcass dressing, representative of the hygiene of the process and the contamination during slaughter	
Processing, packing	Food products	Prevalence of resistant bacteria after processing, representative of the hygiene of the process and the contamination during processing and handling	
Point of sale (Retail)	Food products	Prevalence of resistant bacteria originating from food, exposure data for consumers	
Various origins	Animal feed	Prevalence of resistant bacteria originating from animal feed, exposure data for animals	
Various origins	Environment	Occurrence of resistant bacteria originating from the animal-immediate or the wider environment	

Article 6.8.5.

Bacteria subjected to surveillance and monitoring

The following categories of bacteria may be included in surveillance and monitoring programmes:

1. Animal bacterial pathogens relevant to the countries' priorities

   a) Surveillance and monitoring of antimicrobial resistance in animal bacterial pathogens is important to:

      – detect emerging resistance that may pose a concern for animal and human health;
      – detect changes in susceptibility patterns;
      – provide information for *risk analysis*;
      – provide data for *veterinarians* to inform their treatment decisions;
      – provide information for epidemiological studies and trend analysis.

   b) Information on the occurrence of antimicrobial resistance in animal bacterial pathogens is in general either derived from clinical material sent to veterinary diagnostic *laboratories* or from an active monitoring programme. Although antimicrobial resistance information provided by diagnostic *laboratories* is primarily for treatment purposes, it is also useful for identification of novel resistance patterns and can possibly assist in identifying emerging resistance. However, in order to estimate accurately the prevalence of antimicrobial

resistance in the bacterial pathogen, in a larger population of animals, an active sampling programme should be implemented.

c) To promote a harmonised global approach to the selection of animal bacterial pathogens for inclusion in national surveillance and monitoring programmes, bacteria should be selected using one or more of the following criteria:

- impact on animal health and welfare;
- implication of antimicrobial resistance in the bacterial pathogen on therapeutic options in veterinary practice;
- impact on food security and on production (economic importance of associated diseases);
- bacterial diseases responsible for the majority of veterinary antimicrobial usage (stratified by usage of different classes or their importance);
- existence of validated susceptibility testing methodologies for the bacterial pathogen;
- existence of quality assurance programmes or other pathogen reduction options that are non-antimicrobial, such as vaccines and Good Agricultural Practices.

The table below, derived using the above criteria, lists suggested animal bacterial pathogens for inclusion in a surveillance or monitoring programme of food-producing animals. This list is not exhaustive and should be adapted according to the situation in the country.

Table 2. Examples of target animal species and animal bacterial pathogens that may be included in resistance surveillance and monitoring programmes

Source	Respiratory pathogens	Enteric pathogens	Udder pathogens	Other pathogens
Cattle	*Pasteurella multocida*	*Escherichia coli*	*Staphylococcus aureus*	
	Mannheimia haemolytica	*Salmonella* spp.	*Streptococcus* spp.	
Pigs	*Actinobacillus pleuropneumoniae*	*Escherichia coli*		*Streptococcus suis*
		Salmonella spp.		
Poultry		*Salmonella* spp.		*Escherichia coli*

2. Zoonotic bacteria

a) *Salmonella*

Salmonella should be sampled from food-producing animals, animal-derived food products and, if relevant, *feed*. For the purposes of consistency and harmonisation, animal samples should preferably be taken from healthy animals at the *slaughterhouse/abattoir* and *feed* samples should preferably be taken at the *feed* mill.

Surveillance and monitoring programmes may also include sampling of the environment at places where animals are kept or handled or bacterial isolates originating from other sources obtained from designated *laboratories*.

Isolation and identification of bacteria and bacterial strains should follow nationally or internationally standardised procedures.

Serovars of public health importance such as *S.*Typhimurium and *S.* Enteritidis should be included in surveillance and monitoring programmes. The inclusion of other relevant serovars will depend on the epidemiological situation in each country.

All *Salmonella* isolates should be characterised by serotype and, where appropriate, by genotype at designated *laboratories*.

b) *Campylobacter*

Campylobacter should be isolated from food-producing animals or associated food products. Isolation and identification of these bacteria should follow nationally or internationally standardised procedures. *Campylobacter* isolates should be identified to the species level.

c) Other bacteria that are pathogenic for humans

Other bacteria that are pathogenic for humans, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Listeria monocytogenes*, may be included in resistance surveillance and monitoring programmes.

3. Commensal bacteria

E. coli and *enterococci* (*Enterococcus faecium* and *E. faecalis*) may be sampled from *feed*, food-producing animals, their environment and products of animal origin intended for human consumption.

These bacteria are commonly used in surveillance and monitoring programmes as indicators, providing information on the potential reservoir of antimicrobial resistance genes, which may be transferred to pathogenic bacteria. For the purposes of consistency and harmonisation, these bacteria should preferably be isolated from healthy animals, at the *slaughterhouse/abattoir*.

Article 6.8.6.

Storage of bacterial strains

If possible, isolates should be preserved at least until reporting is completed. Preferably, appropriate isolates should be permanently stored. Bacterial strain collections, established by storage of all isolates from certain years, will provide the possibility of conducting retrospective studies.

Article 6.8.7.

Antimicrobial susceptibility testing

Clinically important *antimicrobial agents* or classes used in human and veterinary medicine should be included in antimicrobial resistance surveillance programmes. Member Countries should refer to the OIE list of antimicrobials of veterinary importance for surveillance and monitoring purposes, recognising that the number of tested *antimicrobial agents* may have to be limited according to financial resources.

Appropriately validated antimicrobial susceptibility testing methods should be used in accordance with Chapter 2.1.1. of the *Terrestrial Manual*, concerning laboratory methodologies for bacterial antimicrobial susceptibility testing. Antimicrobial susceptibility data should be reported not only qualitatively (susceptible or resistant), but also quantitatively (minimum inhibitory concentrations [MICs] or inhibition zone diameters).

Article 6.8.8.

Recording, storage and interpretation of data

1) Because of the volume and complexity of the information to be stored and the need to keep these data available for an undetermined period of time, careful consideration should be given to database design.
2) The storage of raw (primary, non-interpreted) data is essential to allow the evaluation in response to various kinds of questions, including those arising in the future.
3) Consideration should be given to the technical requirements of computer systems when an exchange of data between different systems (comparability or compatibility of automatic recording of laboratory data and transfer of these data between and within resistance surveillance and monitoring programmes) is envisaged. Results should be collected in a suitable national database and recorded quantitatively:
   a) as distributions of MICs in micrograms per millilitre;
   b) or inhibition zone diameters in millimetres.
4) The information to be recorded should include, where possible, the following aspects:
   a) sampling programme;
   b) sampling date;
   c) animal species and production type;
   d) type of sample;
   e) purpose of sampling;
   f) type of antimicrobial susceptibility testing method used;
   g) geographical origin (geographical information system data where available) of *herd*, *flock* or animal;

h) animal factors such as age, condition, health status, identification, sex;

i) exposure of animals to *antimicrobial agents*;

j) bacterial isolation rate.

5) The reporting of laboratory data should include the following information:

a) identity of *laboratory*,

b) isolation date,

c) reporting date,

d) bacterial species,

and, where relevant, other typing characteristics, such as:

e) serotype or serovar,

f) phage type,

g) antimicrobial susceptibility result or resistance phenotype,

h) genotype.

6) The number of isolates regarded as resistant should be reported as a proportion of the number of isolates tested, including the defined interpretive criteria used.

7) In the clinical setting, breakpoints are used to categorise bacterial strains as susceptible, intermediate or resistant. These clinical breakpoints may be elaborated on a national basis and may vary between Member Countries.

8) The bacterial isolation methods, antimicrobial susceptibility testing methods, standards and guidelines used should be recorded.

9) For surveillance and monitoring purposes, use of the microbiological breakpoint (also referred to as epidemiological cut-off point), which is based on the distribution of MICs or inhibition zone diameters of the specific bacterial species tested, is preferred. When using microbiological breakpoints, only the bacterial population with acquired resistance that clearly deviates from the distribution of the normal susceptible population will be designated as resistant. Clinical breakpoints, when available, should also be reported.

10) Ideally, data should be collected at the individual isolate level. This will allow antimicrobial resistance patterns to be recorded over time, along with, when available, relevant data on usage of *antimicrobial agents* and management practices.

Article 6.8.9.

Reference laboratory and annual reports

1) Member Countries should designate a national reference centre that assumes the responsibility to:

a) coordinate the activities related to the antimicrobial resistance surveillance and monitoring programmes;

b) coordinate and collect information from participating laboratories within the country;

c) produce an annual report on the antimicrobial resistance situation in the country.

2) The national reference centre should have access to the:

a) raw data;

b) complete results of quality assurance and inter-laboratory calibration activities;

c) inter-laboratory proficiency testing results;

d) information on the structure of the surveillance or monitoring system;

e) information on the chosen laboratory methods.

NB: FIRST ADOPTED IN 2003; MOST RECENT UPDATE ADOPTED IN 2018.