



C O N S T R U I S O N S E N S E M B L E V O T R E F U T U R

**OIE study:
“Listing and Categorisation of Priority
Animal Diseases, including those
Transmissible to Humans”
-
Methodological Manual**



Table of Contents

1 - Introduction	1
2 - General sequence of the method	2
2.1 - Global characterisation of the disease: intrinsic analysis	2
2.1.1 - Objectives	2
2.1.2 - Notion of categorisation	2
2.1.3 - Analysis of control measures.....	3
2.2 - Local approach	3
2.2.1 - Characteristics of the country	3
2.2.2 - Characterisation of the epidemiology of the disease within the territory.....	3
2.2.3 - Characterisation of the impact of the disease.....	6
2.2.4 - Analysis of control strategies and their local feasibility and implementability	6
2.2.5 - Synthesis.....	7
2.2.6 - Assessment of the impact of control measures for the determined priority diseases	7
2.3 - Table to gather the data	8
2.4 - Structure and organisation of the modules	9
3 - General organisation of the categorisation and prioritisation process in a given country 10	
3.1 - Step 1: Identification of the country's political objectives	10
3.2 - Step 2: Define what diseases are to be included in the analysis	10
3.3 - Step 3: Constitute the team of experts	11
3.4 - Step 4: Collect all the required data and characterise the country	11
3.5 - Step 5: Perform the profiling of the diseases	13
3.6 - Step 6: Appraising the situation in the country through an open discussion on the disease	13
3.7 - Step 7: Perform the local approach for disease-related impacts using the tool...	13
3.8 - Step 8: Perform the local approach for control measures	14
3.9 - Step 9: A preliminary internal interpretation	14
3.10 - Step 10: Discussions with professionals in the various sectors	15
3.11 - Step 11: Iterative process	15
4 - Phase 1: Characterisation of the disease	16
4.1 - Method and objectives	16
4.2 - Step 1.1: Characterisation of a disease	16
4.2.1 - Epidemiological profile	17
4.2.2 - Economic profile	23
4.2.3 - Zoonotic profile	28
4.3 - Step 1.2: Characterisation of control measures	33



4.3.1 - Detailed criteria	34
4.3.2 - Visualisation of results	40
4.4 - Conclusion of phase 1.....	41
5 - Phase 2: Local approach.....	42
5.1 - Step 2.1: Characterisation of the country	42
5.1.1 - Local production data	43
5.1.2 - Qualitative elements about the local organisation of production systems and the food supply 50	
5.1.3 - Local population and regulation data.....	53
5.2 - Case of a disease that is absent.....	54
5.2.1 - Analysis of the risk of introduction	54
5.2.2 - Prioritisation regarding the predictable local impact of the disease.....	58
5.2.3 - Analysis of current strategies to prevent the introduction of high-risk diseases.....	59
5.3 - Case of a disease that is present	61
5.3.1 - Step 1: Analysis of the local disease surveillance strategy and current disease knowledge	61
5.3.2 - Step 2: Impact study	68
5.4 - Identification and characterisation of control measures	98
5.4.1 - Diagnosis and surveillance	99
5.4.2 - Trade and movement measures.....	103
5.4.3 - Vaccination	105
5.4.4 - Medical treatment.....	106
5.4.5 - Biosecurity.....	107
5.4.6 - Compensated culling	107
5.4.7 - Visualisation of results	110
5.5 - Assessment of the impact of control measures	112
5.5.1 - Economic impact.....	112
5.5.2 - Societal and environmental impacts	115
5.6 - General results and elements of interpretation	121
5.6.1 - Reminder of the different numerical results	122
5.6.2 - Mathematical correction.....	122
5.6.3 - Example of table of results	125
5.7 - Elements of interpretation of the results.....	127
5.7.1 - Results of the profiling	127
5.7.2 - Local approach	127
5.7.3 - Categorisation of the diseases.....	132
5.7.4 - Final decision.....	135
6 - Conclusion.....	136
<i>Appendix 1 - Glossary of terms used in the study “Listing and Categorization of Priority Animal Diseases, including those Transmissible to Humans”</i>	<i>I</i>
<i>Appendix 2 - OIE/CFSPH list of Bioterrorism Agents/Diseases</i>	<i>IV</i>
<i>Appendix 3 - HHS and USDA Lists of Select Agents and Toxins</i>	<i>IX</i>
<i>Appendix 4 - Principles of calculation of simplified DALYs for zoonoses.....</i>	<i>XI</i>
<i>Appendix 5 - Calculation of the local zoonotic impact indicator (for diseases that are present)</i>	<i>XIII</i>



This study was commissioned by the World Organisation for Animal Health (OIE) and co-funded by the World Bank and the European Union. The views and recommendations presented in this study are those of the authors and do not necessarily represent the views of the OIE or one of the co-funding institutions.

**List of figures**

<i>Figure 1 - Schematic sequence of the local approach according to the local disease status.....</i>	<i>5</i>
<i>Figure 2 - General architecture of the categorisation and prioritisation tool.....</i>	<i>9</i>
<i>Figure 3 - High-risk sources and flows liable to introduce a disease into a territory</i>	<i>55</i>
<i>Figure 4 - Risk of introduction of a disease that is absent</i>	<i>57</i>
<i>Figure 5 - Analysis of the results, synthesis and interpretation</i>	<i>121</i>
<i>Figure 6 - Principles of the mathematical correction of the results.....</i>	<i>123</i>
<i>Figure 7 - Graphical analysis of the impacts of the diseases and control measures</i>	<i>133</i>

Note: The report should be printed in colour as colour codes are used in the text and figures.

**List of acronyms and abbreviations**

ADNS/ADIS	(EU) Animal Disease Notification System (ADNS) / Animal Disease Information System (ADIS)
CDC	Centers for Disease Control and Prevention
CFSPH	Center for Food Security and Public Health (Iowa State University)
CVO	Chief Veterinary Officer
DALYs	Disability adjusted life years
DG-SANCO	(EU) Directorate General for Health and Consumers
DIVA	Differentiating infected from vaccinated animals
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database
GDP	Gross domestic product (economic indicator)
GLEWS	(FAO/OIE/WHO) Global Early Warning and Response System for Major Animal Diseases, including Zoonoses
HHS	United States Department of Health and Human Services
INFOSAN	International Food Safety Authorities Network
KUSD	Thousand USD
N/A	Not applicable
OFFLU	Joint OIE-FAO Network of Expertise on Animal Influenza
OIE	World Organisation for Animal Health
RASFF	(EU) Rapid Alert System for Food and Feed
USD	United States Dollar (currency)
USDA	United States Department of Agriculture
VS	Veterinary Services
WAHID	(OIE) World Animal Health Information Database
WAHIS	(OIE) World Animal Health Information System
WB	World Bank
WHO	World Health Organization
WTO	World Trade Organization
YLDs	Years lived with disability
YLLs	Years of life lost



1 - Introduction

This study is part of a project entrusted to PHYLUM by the OIE, entitled “***Listing and Categorisation of Priority Animal Diseases, including those Transmissible to Humans***”. This study was co-financed by the European Commission and the World Bank, through the OIE World Animal Health and Welfare Fund.

The objective of this study is, according to the Terms of Reference, “*to facilitate regional/national veterinary authority management decision making on priorities and categorisation of all animal diseases and animal-related threats.*”

This would facilitate possible priority management decisions on (i) legislation (regional versus national); (ii) surveillance of animal diseases; (iii) on farm biosecurity measures; (iv) control and monitoring of animal movements; (v) import and export of animals and animal products; (vi) assistance to developing countries and trade partners; (vii) border inspection control measures; (viii) public/private partnerships (e.g. on surveillance or on solidarity mechanisms); (ix) awareness campaigns; (x) new research programs; etc.

This would also facilitate priority setting to maintain, to further strengthen or to set up (new) financial mechanisms for the control of the different categories of animal diseases identified: regional/national emergency funds; regional versus national financing; public/private partnerships; setting up of regional/national insurance schemes; etc. Eventually, it will be the basis for the definition of schemes for sharing responsibilities and costs.

In addition, the OIE stresses that the links between (i) animal health and food security (food supply) and (ii) animal health and public health (not only as regards zoonoses) should not be forgotten when weighing different criteria and setting categories and priorities. This is why OIE lists of diseases of terrestrial and aquatic animals should be strongly taken into consideration to cover both the animal diseases which have an impact on production and also zoonoses.”

This tool is designed to assist decision-makers with elaborating animal health policies. It is not intended to modify the existing OIE list of diseases.

This part of the report is a methodological manual, providing a detailed presentation of the method and the corresponding modules of the developed tool, as well as some directions and hints on how to deal with certain specific points or key notions of the study. The last paragraph summarises some essential aspects of the approach, which must be kept in mind during all the preparatory and operational phases of the study, in order to optimise the process and obtain the most relevant results.



2 - General sequence of the method

The method consists of two sequential steps in the analysis of a disease:

- A global characterisation of the disease, aimed at assessing inherent aspects of the disease, independently of any particular local context.
- A local approach, aiming at refining the study of the disease within the specific context of the country or region in question.

2.1 - Global characterisation of the disease: intrinsic analysis

2.1.1 - Objectives

The objectives of this first step are as follows:

- To find out the characteristics of a disease that will enable a description to be made of its profile and potential nuisance in terms of three main aspects:
 - epidemiology;
 - economic consequences;
 - human health issues.
- To create a consensus between all those participating in the analysis on a global or regional scale on the fundamental data on which the detailed analysis will be built.
- To identify possible gaps in terms of disease knowledge. If insufficient data are available, it may not be possible to perform all parts of the analysis.

2.1.2 - Notion of categorisation

This global characterisation includes some aspects of disease categorisation. These are taken into account in this step:

- The nature of the disease (i.e. whether or not it is a potential zoonosis) is considered in a specific module on its possible impact on human health;
- The possibility of vector-borne transmission of the pathogen is addressed through several criteria, regarding epidemiology (transmissibility and persistence in animals) and human health (transmissibility in humans). This will also have a bearing on the assessment of possible control measures and any disease-related societal impact (developed in the local analysis).
- The absence or presence of the disease: this point is obviously only relevant in the local analysis of a given territory.



2.1.3 - Analysis of control measures

Once the disease has been characterised, the same procedure has to be followed with regard to possible control measures. This is needed to obtain an overview of the availability and efficiency of means to control the disease in the event of an outbreak. This is likely to have a strong influence on the relative threat caused by the potential impact of the disease itself. For example a disease that has a moderate potential impact but is very difficult to control might in certain cases pose a greater problem than a disease that has a huge potential impact but is fairly easy to prevent or control.

In conclusion, this “profiling” step is expected to provide an overview of the disease and its control options, so as to perform a first global categorisation.

2.2 - Local approach

The objective of this step is to refine the previous analysis by considering the disease in the particular context of a given country or region. The impact a disease may have in a territory – as well as the way it may be perceived – is highly dependent on local geography, production and trade systems, socio-cultural background, etc.

On this basis, it will be possible to prioritise the different diseases with regard to their respective level of concern at the local level.

2.2.1 - Characteristics of the country

In order to properly assess the impact an animal disease may have in a given country or region, it is necessary to obtain an overview of the structure of this territory, particularly as regards its production systems, the global importance of animal production, and the respective importance of the different categories of animals and animal products for the local economy. For instance, a disease affecting bovines is clearly unlikely to represent a major threat in a territory where there is no bovine production.

It may also be important to be aware of the other economic sectors liable to be affected, as well as of general population, including organisational, regulatory and cultural factors. Indeed, in addition to its direct economic impact on animal production, a disease may cause a wide variety of indirect concerns (human health issues, societal or environmental impact, etc.).

2.2.2 - Characterisation of the epidemiology of the disease within the territory

Once we have obtained a general view of the national or regional background, the differential analysis of animal diseases starts with the study of their respective local epidemiology. The objective here is to define whether the disease is locally:



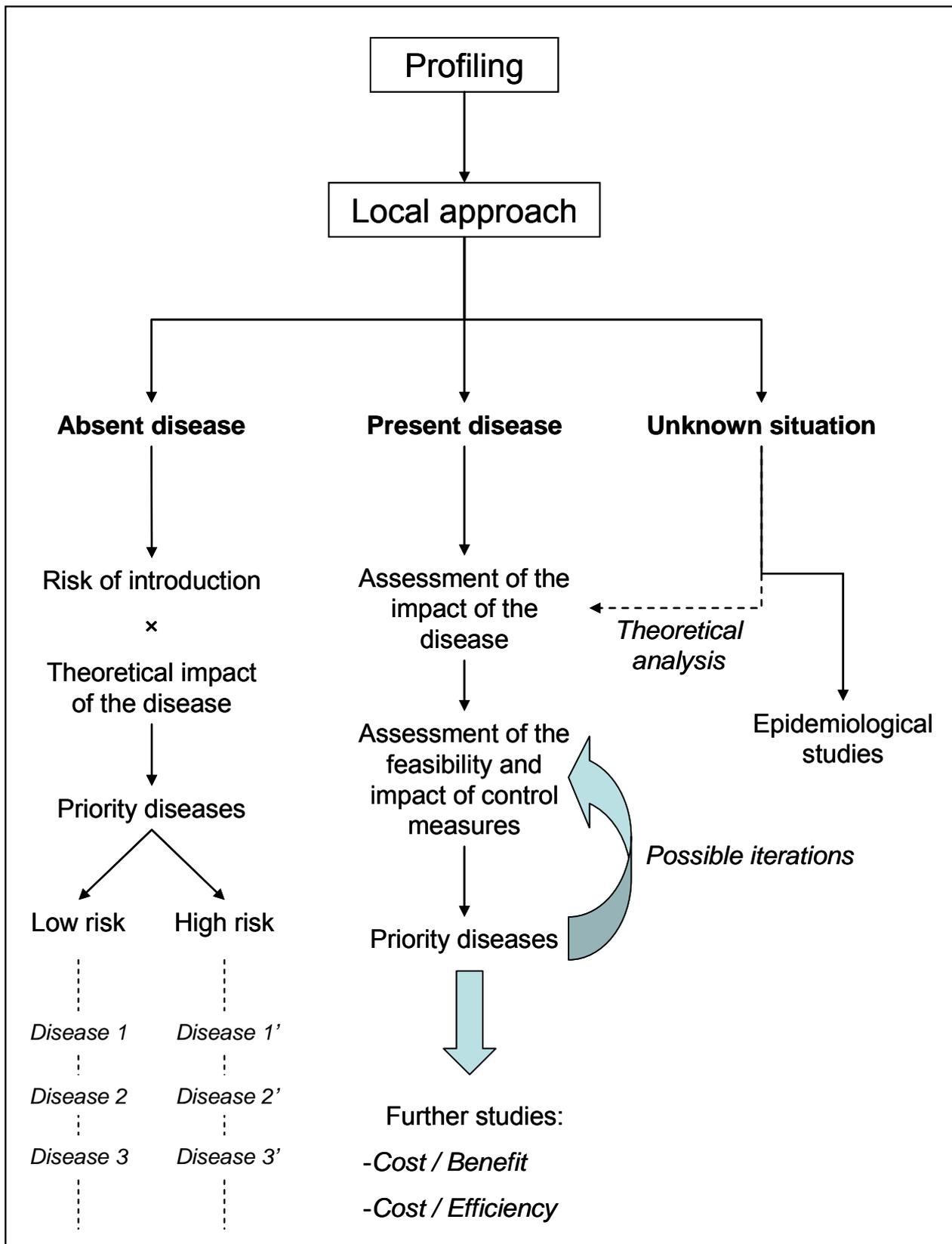
- Absent: in this case the point will be to assess the risk of introduction of the disease into the territory.
- Present: in this case it is necessary to differentiate between:
 - Endemic diseases, with a possible chronic distribution and episodic flare-ups.
 - Epidemics, with limited focal peaks or regular outbreaks.

If insufficient data are available on the local epidemiology of diseases, it will be necessary to adapt the subsequent analysis and conclusions to allow for (and maybe correct) the lack of knowledge.

A simplified representation of the local analysis sequence, depending on the presence or absence of the disease in the country, is provided in Figure 1.



Figure 1 - Schematic sequence of the local approach according to the local disease status





2.2.3 - Characterisation of the impact of the disease

The epidemiological study in the previous step is expected to give an idea of the distribution of the disease among local epidemiological units. As a further development, it is necessary to assess the impact each disease is liable to have in an affected epidemiological unit (in terms of clinical severity, transmission modalities, etc.).

- In the case of a disease that is absent (or if its epidemiological status is unknown), we will have to consider a theoretical impact. This will be based on the interpretation of the corresponding impact assessment modules, using estimates of the disease's epidemiological importance in the event of its introduction.
- In the case of a disease that is present, with a known epidemiological status, we will try to estimate its effective impact using the corresponding modules of the tool.
- In the case of a disease whose status is unknown, further epidemiological studies will be needed in order to determine whether the disease is actually present or absent. The outcome of profiling may then be used to obtain a preliminary idea of its possible importance and, if further elements are required, a hypothetical assessment of its impact can be made in the same manner as for diseases that are absent.

This approach aims at obtaining an idea of the following theoretical / effective impact of the disease in the country or region, each one being assessed by a separate module in the tool:

- Economic impact (taking into account the direct impact on production as well as the indirect consequences on trade or other activities);
- Impact on human health, in the case of a zoonotic disease or if the animal production losses raise a food security issue.

Remark: The possibilities in terms of control measures in humans are not taken into account in this part. Indeed, our study is designed to help with decisions concerning animal health policies: our purpose is not to dwell on human health issues, though the possibility (or otherwise) of controlling the disease in humans must be considered as an attenuating (or aggravating) factor as regards the potential impact of the disease on human health.

- Societal impact of the disease, in that it may cause a crisis phenomenon in population;
- Environmental impact, if the disease is liable to result in biological contamination of the environment, or threaten animal and/or plant biodiversity in local biotopes.

2.2.4 - Analysis of control strategies and their local feasibility and implementability

As for the intrinsic analysis, all statements about the potential impact of a disease must be considered in relation with the available control options for this disease. Thus it is important to have a precise idea of what can (or cannot) actually be done to control the disease in the particular local context.



These aspects will involve not only technical capability aspects (scientific background, technical skills, trained staff, etc.), but also elements of implementation capacity (financial means, proper regulation, logistics, etc.).

Crossing the interpretation of these conclusions with the epidemiological situation of the country with regard to the disease should provide the necessary elements to define which control strategies are possible and can be expected to be the most relevant to control the disease in the country or the region.

2.2.5 - Synthesis

As a result of the previous steps, the tool should provide qualitative and quantitative elements of prioritisation for the different diseases in the following three categories:

- Diseases absent;
- Diseases present and with known epidemiology;
- Disease present but with unreliable local epidemiological knowledge.

As the corresponding modules of the tools are sometimes different (or should be interpreted differently) from one category to another, the result of the analysis will not in any case be a general ‘turnkey’ solution. Indeed, an additional decision-making step is necessary to finalise the prioritisation process, as regards:

- The respective priority level of diseases that are absent and those that are present: from a general point of view, the old adage “prevention is better than cure” often proves correct and it is always preferable to protect a territory against diseases that are currently absent. However, some diseases that are present may have such a huge local impact that it is far more important to control them than to prevent others from being introduced.
- The possible weighting of each type of impact (economic, human health, societal, environmental), to fit in with the local political and cultural orientations and levels of concern.

Remark: In the particular case of diseases for which control plans are already in place in the country, the protocol can be used to assess the general relevance of these plans, or to perform iterations regarding the particular pattern of measures that they include. However, a change in the control strategy could be possible in an epidemiologically stable situation; nevertheless, an eradication plan is always very costly when it comes to eliminating the last remaining cases.

2.2.6 - Assessment of the impact of control measures for the determined priority diseases

When the local high-priority diseases have been determined, the last step of the prioritisation process is to define which control strategies are the most relevant and should be addressed in priority in order to prevent, limit, eradicate or control these diseases.



This assessment will be made taking into account:

- the local feasibility of each strategy;
- the subsequent cost, societal acceptance and environmental consequences of the different control options.

In conclusion, the result of the process will be a prioritised list of the most relevant diseases in the particular local context, as well as the corresponding control strategies that should be developed and implemented.

It is essential to keep in mind that the tool **will not** provide this list as an automatic output: a comparative and interpretative step, involving interdisciplinary experts and local decision-makers and integrating the different components of local geopolitical and socio-cultural orientations, will always be essential to carry out this analysis.

2.3 - Table to gather the data

Here are a few general hints on using the tool:

- The answer for each criterion must be entered in the corresponding box, according to the attached definition.
- The “Comments” box serves to identify precisely the particular choices that had to be made in order to fill in the box. For example, if there is an ongoing discussion between scientists as regards the role of a transmission route, we can choose to ignore it and focus on currently confirmed routes. These boxes ensure traceability of such choices as well as the reasons for validating the chosen option.
- The “Lack of knowledge” box serves to identify criteria that were answered but for which additional research may be useful (due to inadequate current knowledge). It provides an indication of the reliability of the analysis, according to the number or topics which are subject to hypothesis and need to be validated.

The following is an example of the general presentation of criteria in the tool. Most of the impact assessment modules have a similar format.

THEMATIC AXIS	Group of criteria	Criterion 1 (definition)	Decision rule	Answer	Comments	Lack of knowledge
		Criterion 2 (definition)	Decision rule	Answer	Comments	Lack of knowledge
	

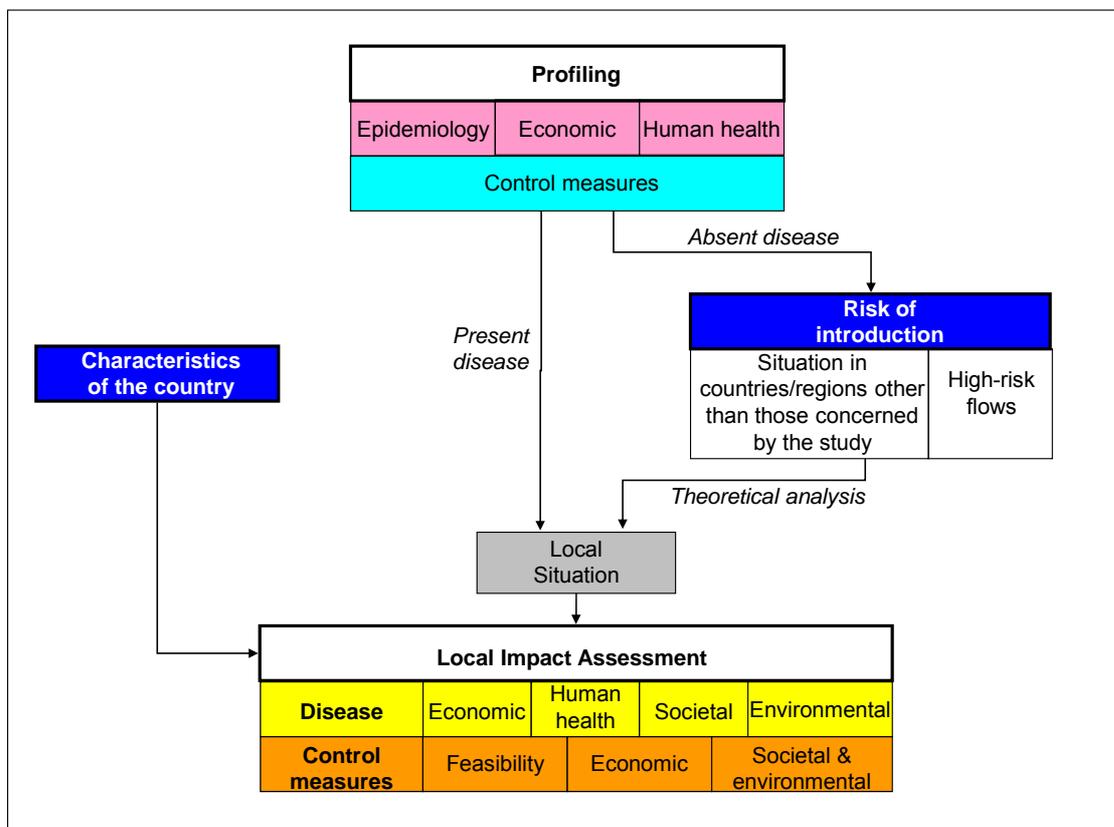
2.4 - Structure and organisation of the modules

The categorisation and prioritisation tool is proposed as an aid for the analytical steps of the protocol. This tool consists of an Excel® file, organised in different modules. Each module corresponds to a separate spreadsheet, assessing a particular impact or type of data.

The different spreadsheets in the tool are arranged in a chronological sequence, which is the same as in this report. A colour code indicates which spreadsheets belong to a given level of analysis: for example the three modules assessing the profile of the disease (epidemiology, economic and zoonotic impact) have tags of the same colour (in this case pink); in the same way, all the modules devoted to the local analysis of control measures will be coloured orange.

The general architecture and sequence of the tool are shown in the following diagram. This system will be used in the corresponding chapters of this report to help visualise the methodological sequence.

Figure 2 - General architecture of the categorisation and prioritisation tool





3 - General organisation of the categorisation and prioritisation process in a given country

Here follows a summary of the methodological sequence required for the ‘categorisation and prioritisation of animal diseases’ protocol.

3.1 - Step 1: Identification of the country’s political objectives

Before beginning such an approach, the country’s political objectives must be determined:

- What kind of objectives for farming sectors, especially the livestock sector?
 - ✓ Food security, food safety, intensification of animal production, development of animal products exports, etc.
 - ✓ What kind of targets in the population? Poor people? Intensive farming? Other?
- What kind of objectives for human health systems?
 - ✓ Place of zoonoses in public health policy?
 - ✓ What kind of targets in the population? Poor people? Children?

This will be useful to determine the appropriate weighting between the different types of indicators.

3.2 - Step 2: Define what diseases are to be included in the analysis

It is not useful to try to include all the animal diseases in the process. However, it is essential to select a sufficient number (i.e. more than 10) of relevant diseases for prioritisation:

- For developing countries the approach will focus on the most important diseases with the heaviest impact on the country. The tool could help to select the 2, 3 or 4 most important diseases, which could be the subject of public policies.
- For developed countries there is often a consensus on the most important diseases. The main objective of this approach will be to differentiate diseases with an intermediate impact.

It is important to take into account which diseases are present or absent in the country.

Remarks:

- 1- *All stakeholders should be involved in the choice of diseases to be included.*
- 2- *It is important to include diseases with different characteristics (e.g. diseases that are rare but have severe consequences, diseases that are more frequent but with a lower severity, zoonoses, production diseases, etc.)*



3.3 - Step 3: Constitute the team of experts

The level of expertise needed to carry out the categorisation and prioritisation process should not be underestimated. The general relevance of the output will depend on the richness and balance of skills within the team of experts:

- It is essential to keep in mind that this work is not only a matter for veterinarians and animal health experts. This analysis is a rather complex protocol, involving many particular skills and specialities. If all the appropriate disciplines are not represented, it may bias the final conclusions.
- In order to gather all the required knowledge and appraisals, representatives of the following bodies or experts with the following skills may need to be involved in the study, as appropriate (the list is not exclusive):
 - National Veterinary Services;
 - Local Sanitary Authorities;
 - Veterinarians:
 - ✓ Epidemiologists,
 - ✓ Pathologists and clinicians;
 - Economists, with particular experience of animal production and trade systems;
 - Researchers and academics;
 - Public and private laboratories;
 - Human medicine and local public/human health systems;
 - Sociologists and communication experts;
 - Experts in environmental conservation;
 - Livestock specialists;
 - Wildlife experts.
- All participants should calibrate their appraisal, and harmonise their perception of the different diseases as well as of the project method and tool. This explains why the first profiling step should be performed, or at least reviewed, collectively to ensure that everyone is familiar with the general objectives and operating sequence.
- This is a collective task: even if all the members of the team do not actually participate in the desk analysis, all should be involved in the review and interpretation of the results and in the final decision.

3.4 - Step 4: Collect all the required data and characterise the country

Before beginning the actual process of prioritisation and categorisation, the information required to carry out the categorisation and prioritisation protocol must be gathered. The required data include:

- **General knowledge about the diseases and the corresponding control measures**, corresponding to the profiling step. These data can be retrieved either from the databases of international organisations (OIE-WAHID/WAHIS, GLEWS, OFFLU, INFOSAN, WHO, etc.) or relevant regional institutions (e.g. ADNS/ADIS, RASFF), as appropriate, or from a review of the scientific literature.
- **General national data to characterise the country:**
 - Economic and production data:



- ✓ Animal production local economic figures (production and trade);
- ✓ National economic figures (share of industry and tourism in GDP);
- ✓ Structural data about the animal and crop production systems (breeding systems, importance of animal draught power in agriculture, etc.);
- ✓ Existing flow of trade, tourism, etc. with other countries.
- Human population data:
 - ✓ Key figures: population, mean life expectancy, etc.
 - ✓ Qualitative and quantitative food supply information (consumer habits, food security, etc.);
 - ✓ Sociological factors: public concerns, interest in animal welfare, role and perception of the media, etc.
 - ✓ Public health.
- Local environmental data:
 - ✓ Geo-climatic particularities;
 - ✓ Biotopes;
 - ✓ Animal species (including vectors);
 - ✓ Environmental conservation concerns.
- General data on the **organisation of the Veterinary Services¹**:
 - Local regulatory framework for animal health, food safety, environment linked with animal production, etc.;
 - Local organisation of Veterinary Services:
 - ✓ Structure and available means (financial, technical, etc.);
 - ✓ Skills;
 - ✓ Operational veterinary and laboratory networks.
- **Specific data on the different diseases:**
 - health status of the territory; epidemiology of diseases that are present or whose presence is suspected;
 - Qualitative and quantitative elements regarding the impact of diseases that are present;
 - Distribution of the disease in neighbouring countries and in other countries with which the country has exchange with high risk of transmission of the disease (trade, animal movements, human trips...);
 - Existence of local surveillance and control systems for the diseases.

A variety of methods can be used to gather the required data. In all cases, however, collaboration between the organisations involved (Veterinary Services, Health Services, Wildlife Services, Economic Institutes, Ministries, etc.) is helpful and often essential.

At the end of this step, it will be possible to complete the spreadsheet “Characterisation of the country” in the Excel tool.

In each category, the relevance and reliability of the data should be assessed. If the quality is uncertain or if insufficient data are available, this will have to be taken into account in the final conclusion.



3.5 - Step 5: Perform the profiling of the diseases

In this step, the team of experts begins the profiling of each disease using the spreadsheets “Epidemiological profile of the disease”, “Economic profile of the disease”, “Zoonotic profile” and “Profiling of the control measures in animals”.

First, the profile must be assessed disease by disease. This could be prepared by the experts with the most relevant expertise.

The data for each disease must then be recorded in a summary table. The whole team of experts validates the profile of each disease. During the validation, the experts can discuss any points needing clarification and identify any that require further bibliographic review and/or expert appraisal.

It is essential for the experts to reach a consensus on the intrinsic characteristics of each disease. Through this process, all participants will calibrate their approach and become familiar with using the tool. That is why the profiling should be performed (or at least reviewed) by all the team of experts, and must be validated before moving on to the local analysis.

3.6 - Step 6: Appraising the situation in the country through an open discussion on the disease

It is often easier to start with an open discussion before beginning the local assessment.

This gives the experts an opportunity to share their knowledge and expertise regarding the actual situation in the country and will facilitate filling in the criteria in the local approach.

The spreadsheet “Open questions on the local situation regarding the disease” can be used.

3.7 - Step 7: Perform the local approach for disease-related impacts using the tool

After the open discussion, the experts can fill in the criteria to assess the local impact of the disease (spreadsheets “Local economic impact”, “Local human health impact”, “Local societal impact”, “Societal impact”, “Environmental impact”).

After an analysis disease by disease, the results are recorded in the summary table. The table can be used to check the results of a disease in comparison with others for one group of criteria. This thematic approach by groups of diseases has several advantages:

¹ Where available, Country PVS Reports may also be used i.e. (Evaluation of Performance of Veterinary Services using the OIE-PVS Tool).



- It reduces the influence of individual interpretations in the analysis. Thus, if some experts in the team have a particular interest in a disease (greater knowledge or experience), the permanent comparison with the other diseases from the studied group should help them to maintain an objective approach instead of subconsciously highlighting a disease they are more concerned with.
- It reduces the potential bias in the interpretation of the different criteria. Indeed, the juxtaposition of several diseases with different profiles allows the operators to constantly challenge their own interpretation. In some cases, they may be led to correct the answers they gave for a given disease in light of the results for a subsequent disease, so as to ensure a consistent appraisal of the different criteria.
- It allows a global view of the analysis, with an overview of the thematic sequence. This may simplify the interpretation of each criterion for the different diseases, by avoiding misunderstandings and confusion between the different criteria in the same thematic module.

These recommendations do not correspond to strict compulsory methodological issues, but we consider that if they are borne in mind it could considerably improve the accuracy and precision of the results.

3.8 - Step 8: Perform the local approach for control measures

As in the previous step, the experts fill in the criteria for control measures, this time using the spreadsheets “Local feasibility of the control measures”, “Economic impact of the control measures”, “Societal and environmental impact of the control measures”.

It is better to deal with the current local situation regarding control measures, before assessing what could be done in future. An iterative process can be used to assess this part.

In the same way as for the impact of the disease, it is interesting to compare the results between the diseases after an analysis disease by disease.

3.9 - Step 9: A preliminary internal interpretation

Following the recommendations of paragraph 5.7, the results for all the diseases are compared in the summary table:

- First, the results for each kind of indicator should be compared to validate the local characteristics of the diseases.
- Second, a global prioritisation of diseases that are present or absent can be assessed with a different weighting for each indicator of impact.
- Third, a comparison is performed with the control measures.

At the end of this step, a first prioritisation is available.



3.10 - Step 10: Discussions with professionals in the various sectors

At the end of the process, it would be helpful to have discussions with some (relevant) local professionals in the sectors involved (veterinarians, farmers, etc.) to validate the results of the prioritisation and to obtain information on their own prioritisation criteria.

3.11 - Step 11: Iterative process

It is essential to keep in mind that the categorisation and prioritisation of diseases is NOT a rigid and permanent assessment. On the contrary, this analysis must be progressive and subject to constant updating and iterations regarding:

- Advances in scientific knowledge;
- Changes in the local situation (eradication of a disease, introduction of a new disease, etc.);
- Changes in the economic context: development of animal product exports, development of different types of animal production, etc.

In the same manner, the analysis will need to be updated if there are changes in the epidemiological situation in neighbouring countries (or countries trading with the territory under study).



4 - Phase 1: Characterisation of the disease

4.1 - Method and objectives

The aim in this part is to define the main characteristics of the disease, enabling its profile to be described in terms of three aspects:

- Epidemiology;
- Economic nuisance potential;
- Human health issues, in the case of a zoonosis.

For some pathogens, different strains or types may have a markedly different profile. Should this be the case, the analysis should be performed separately for each variant, as if they were distinct diseases (for instance, in the case of bluetongue, BTV-8 and BTV-1 should be studied separately).

As regards the scientific consensus, the best way be to adopt a global approach. Nevertheless, this might be a difficult exercise as there may be extreme variations from one continent to another. Thus, performing the profiling of diseases on a regional basis can sometimes be a suitable compromise to obtain a good basis to reach agreement on the epidemiological and technical elements to be taken into account.

Note: *The examples provided in this report are the result of a disease analysis performed by the experts involved in the project. These data should in no case be interpreted as an international consensus or as an official recommendation.*

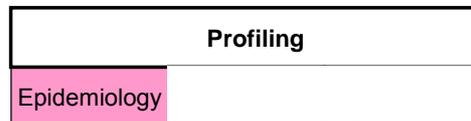
4.2 - Step 1.1: Characterisation of a disease

The coming chapter provides a sequential approach to the method, in parallel with a description and comments about the different modules of the profiling tool. Each step of the disease characterisation process described here is associated with the corresponding spreadsheet in the tool.

Remark: *For the sake of clarity and to facilitate discussion about the tool, each criterion and group of criteria has been given a reference number within each module.*



4.2.1 - Epidemiological profile



The epidemiological profiling aims at determining the expected level of complexity of a disease, taking into account four groups of criteria:

- Susceptible species, through their distribution among three groups livestock, wildlife and pets.
- The zoonotic character of the disease, including its ability to affect humans and to pass from humans back to animals.
- The persistence of the pathogen in infected animals (and potentially in wildlife), vectors or the environment.
- Transmission modalities, including infection routes as well as an additional factor for diseases liable to affect flying susceptible species or vectors (and thus have a natural potential for wide geographical spread).



4.2.1.1 - Detailed criteria

1. AFFECTED SPECIES	1.1. Types of susceptible species	Livestock	Yes=1 / No=0	
		Wildlife	Yes=1 / No=0	
		Pets (excluding exotic species)	Yes=1 / No=0	

These first criteria deal with the different animal species susceptible to the disease, among the three compartments:

- If one or more livestock species are susceptible, then set the “Livestock” criterion box to **1** (otherwise keep it at 0).
- If one or more wildlife species are susceptible, then set the “Wildlife” criterion box to **1** (otherwise keep it at 0).
- If one or more pets species are susceptible, then set the “Pets” criterion box to **1** (otherwise keep it at 0). In this criterion we exclude exotic species that may be regarded as pets, and we only consider “classical” pet species (dogs, cats, etc.).

Remark: This definition of “classical” pet species is closely linked to each local cultural context, and may vary from one place to another. However, in this global approach, only the most common pet species should be considered so as to avoid double counting.

The goal here is to get an idea of the likely complexity of the control strategies that would be necessary, because the disease will be addressed differently in each one of these compartments. Thus, we assume that a disease affecting for example two livestock species will be relatively simpler to deal with than a disease affecting both one livestock species and one wildlife species. However, in some cases, a single species may belong to two different compartments. In this case, control strategies adapted to both compartments will be necessary and both the corresponding criteria may be set to **1**. For example, in the case of diseases affecting horses (e.g. African horse sickness and equine viral arteritis), both the “livestock” and “pets” compartments may be involved (in some regions, it may also be relevant to consider wild horses).

2. EPIDEMIOLOGY IN HUMANS	2.1. Transmission TO humans	Human form of the disease	Yes=1 / No=0	
	2.2. Transmission FROM humans	Possible (common) human-to-animal transmission	Yes=1 / No=0	
		Possible (common) interhuman transmission	Yes=1 / No=0	



This second category addresses the role of humans in the epidemiology of the disease, as a susceptible species but also as a potential source of infection:

- If the disease can infect humans, the “Human form of the disease” criterion should be set to **1**. By default, we only consider human forms in the case of diseases where a human form has actually been proven. When the possibility of human contamination is only suspected and has not been proven, we assume that there is no human disease (another hypothesis might be used, but it should be specified in the corresponding “Comments” field, so that every operator will be working with the same reference).
- As regards possible transmission from humans:
 - If transmission from humans to animals is possible, the “Possible human-to-animal transmission” criterion should be set to **1**.
 - If interhuman transmission exists, the “Possible interhuman transmission” should be set to **1**.

Once again, we only consider here the cases where these transmission modalities exist and may be relatively common in normal conditions. When there is no more than a suspicion that transmission to or from humans can take place, or when it has only been reported in experimental or exceptional conditions, we assume that such modalities do not exist in the general analysis.

3. PERSISTENCE	3.1. Pathogen in animals	Possibility of persistent infection with possible horizontal or vertical infection of next generations (chronic carriers, healthy carriers, etc.)	Yes=1 / No=0	
	3.2. Pathogen in the environment	Survival of the pathogen in the environment (cysts, soil agents) or survival time > 1 year	Yes=2 / No=0	
	3.3. Pathogen in wildlife	Wildlife is a reservoir of the pathogen	Yes=2 / No=0	
	3.4. Pathogen in vectors	Biological cycles or persistence in vector or host species	Yes=2 / No=0	

The third group of criteria in this module concerns the possibility of persistence of the pathogen in a territory. Different modalities may be possible, however:

- The first possibility is a notable persistence of the pathogen in infected animals. Of course, all pathogens are present in infected individuals during the infectious phase, but we will consider it to be significant only if their presence is liable to cause infection in the following generation, that is to say if vertical transmission occurs, or if the infected animals may be healthy or chronic carriers and carry the pathogen long



enough to contaminate the next generation. In these cases, the “Possibility of persistent infection” criterion should be set to **1**.

- The second possible modality is a significant passive persistence of the pathogen in the environment (soil, water, etc.), for example through specific persistent forms such as spores. Whatever the case, we consider that persistence in the environment is significant if the pathogen is liable to remain infectious for more than one year. In this case, the “Survival of the pathogen in the environment” criterion should be set to **2** (this additional coefficient corresponds to an extended risk of exposure for healthy animals, in comparison with a pathogen that is only transmissible through direct contact with infected individuals).
- The third possibility is that the pathogen may persist in a given territory through biological cycles in some wildlife species (in which it may or may not be asymptomatic). In this case, the “Pathogen in wildlife” criterion should be set to **2** (as for the above criterion, this additional coefficient corresponds to an extended risk of exposure for healthy animals, in comparison with a pathogen that is only transmissible through direct contact with infected domestic individuals).
- The last modality is a persistence of the pathogen in vector species through biological cycles, persistent infection or particular persistent forms. In this case, the “Biological cycle or persistence in vectors” criterion should be set to **2** (here again, this additional coefficient corresponds to an extended risk of exposure for healthy animals).

As already stated for previous aspects, these persistence modalities will only be taken into account if they have actually been proved to exist. Suspected modalities or hypothetical models should not be considered (if this is the case, it should be notified as a commentary in the corresponding field).

4. TRANSMISSION	4.1. Speed of spread	Air-borne diseases, or diseases transmitted by flying vector and/or susceptible species	Yes=2 / No=0	
	4.2. Modalities of transmission	Direct close contact	Yes=1 / No=0	
		Proximity or indirect contact (e.g. fomites, equipment)	Yes=1 / No=0	
		Soil agent	Yes=1 / No=0	
		Water- or feed-borne disease	Yes=2 / No=0	
		Vector-borne	Yes=3 / No=0	
		Air-borne	Yes=4 / No=0	



The last group of criteria in the epidemiological module relates to the transmission characteristics of the disease:

- The first criterion concerns the expected speed of spread of the disease. It gives additional weight to diseases that are liable to be air-borne, or to affect flying vector or host species. We assume that these modalities carry a higher risk of spread between non-contiguous epidemiological units. Of course, diseases with only direct transmission may sometimes spread faster than vector-borne diseases, in particular situations or local conditions with large-scale movements of animals for example. However, this criterion remains an indicator of the disease's potential to spread geographically, independently of human activities, and to cross natural barriers. Consequently, if the disease is air- or vector-borne or affects flying species, this "Speed of spread" criterion should be set to **2** (corresponding to a relative importance of these factors in the epidemiological 'weight' of the disease).
- The "Modalities of transmission" group of criteria serves to define the routes of transmission of diseases between animals. For each one, if the route is a possible source of contamination, the corresponding criterion should be set to the appropriate value. Note that the coefficient is different for some modalities, reflecting the level of risk in terms of spreading the disease:
 - The "Direct close contact" criterion corresponds to all cases of transmission through direct physical contact with infected individuals: muzzle-to-muzzle, reproduction route, bites or scratches, etc. This category also includes invasive contacts, when for example infected tissues such as placenta are a source of transmission. The corresponding weight is **1** because this modality has relatively little chance of causing a massive spread of the disease, at least outside of the infected epidemiological units (provided that biosecurity requirements are fulfilled).
 - The "Proximity or indirect contact" corresponds to all cases of transmission by contaminated fomites, equipment, aerosols, etc. As in the case of direct contact, the corresponding weight is **1** because any spread may easily be limited through biosecurity measures.
 - The "Soil agent" criterion corresponds to persistent telluric forms of the pathogen, such as spores. The corresponding weight is also **1** because such agents are only liable to infect individuals within the contaminated area.
 - The "Water- or feed-borne disease" criterion corresponds to pathogens transmitted by water (this does not take into account the possible involvement of sanitation systems) or animal feed. The coefficient is **2** because such modalities may be associated with 'anademics' or downstream contamination of multiple epidemiological units.
 - The "Vector-borne" criterion corresponds to all diseases caused exclusively or facultatively by vector-borne pathogens. All kinds of vectors are considered here: arthropods, molluscs, etc. The corresponding weight is **3** because this modality is highly likely to cause massive spread the disease.
 - The "Air-borne" criterion corresponds to the case in which the pathogen may be carried passively over distances of several kilometres without any material or

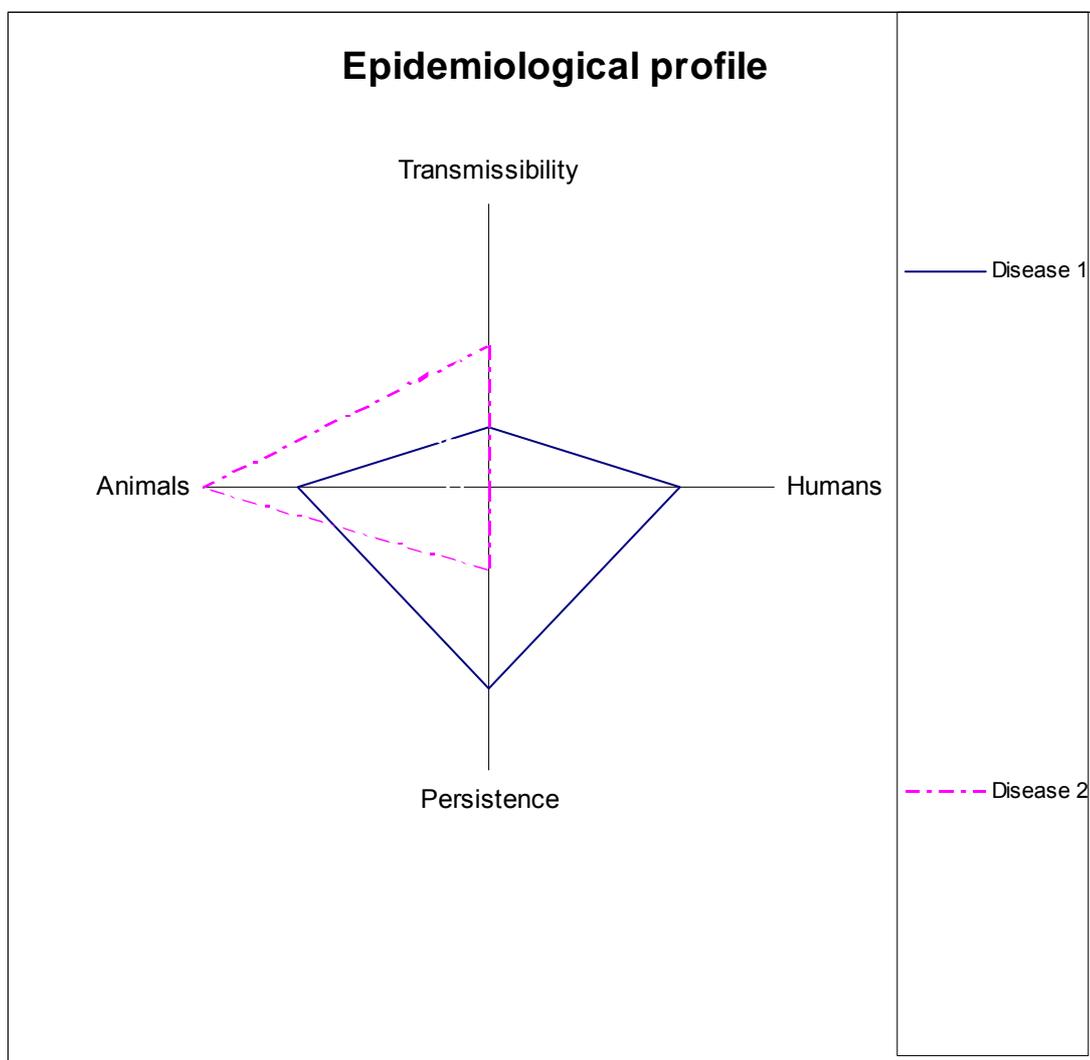


biological support other than dust or micro-aerosols. As this is the modality with the highest risk of mass dissemination, the corresponding weight is **4**.

4.2.1.2 - Visualisation of results

The results of the aforementioned criteria, for the epidemiological profiling module, can be visualised in a radar chart as follows, allowing different profiles to be compared. The result for each branch is the sum of the corresponding criteria divided by the number of criteria (ranging from 0 to 1).

For pedagogical purposes, examples are displayed using completely theoretical models of diseases. The same goes for all the examples of visualisation provided in this report.

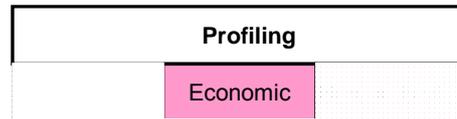


In this example, disease 1 affects livestock and wildlife, with possible transmission to humans. The pathogen is persistent in infected animals and in the soil, and transmission is by contact between infected animals or with the soil-borne agent.

Disease 2 affects livestock, wildlife and pets but not humans. It can only persist in arthropod vectors and is transmitted by direct and indirect contact as well as by vectors.



4.2.2 - Economic profile



The economic profiling of a disease aims at determining its nuisance potential for the local economy, and takes into account the following axes:

- Direct impact:
 - Affected species, weighed by their respective importance in production systems (assessed through global production figures);
 - Disease-related impact in affected epidemiological units (mainly due to clinical expression);
 - The possible aggravating effect of seasonal or local peaks or epizootics.
- Indirect impact:
 - Effect on consumption, essentially for zoonotic diseases (and particularly for food-borne zoonoses);
 - Effect on international trade, related to the existence of an officially recognised sanitary status for the disease, or official certification requirements for animals and/or products from affected zones (see OIE *Terrestrial Animal Health Code* [the *Terrestrial Code*] Vol. 2).



Other indirect effects may exist in the field of disease-related economic issues, such as the impact on tourism, industry or agricultural crop production (when it relies on working animals), etc. However, those effects are closely linked to specific national or regional contexts and have a low significance in a global analysis. Thus, they will only be addressed in the local modules.

4.2.2.1 - Detailed criteria

5. DIRECT LOSSES	5.1.Affected production species	Bovines	Yes=3 / No=0	
		Sheep & goats	Yes=2 / No=0	
		Pigs	Yes=3 / No=0	
		Poultry	Yes=3 / No=0	
		Camels	Yes=1 / No=0	
		Horses & donkeys	Yes=1 / No=0	
		Rabbits & hares	Yes=1 / No=0	
		Bees	Yes=1 / No=0	

The first group of criteria in the economic profiling module concerns the affected production species and sectors. For each species or group of species, if it is susceptible to the disease, the corresponding criteria should be set to the appropriate value. Note that the respective weight of each species is different: it will depend on the importance of that species in the global economy. The values have been determined through an analysis of the global production statistics for 2007 in FAOSTAT:

- Bovines, pigs and poultry were given a coefficient of 3 as they account for between 10 and 50% of the total value of global animal production;
- Sheep and goats were given a coefficient of 2 as they account for between 1 and 10% of the total value of global animal production;
- Other species were given a coefficient of 1 as they account for less than 1% of the total value of global animal production. This places at the same level production categories with a low and a very low contribution to global animal production, but it has the advantage of highlighting those impacts that are liable to endanger production sectors related to these comparatively minor species (which should not be neglected, however).

We assume that the annual variation in the respective weight of the species at the global level is not large enough to warrant a change in the category of the species.



5. DIRECT LOSSES	5.2. Impact on production in herds	No clinical expression => 0	
		Only individual cases or 'anazootic' cases (i.e. sporadic cases in the herd) => 1	
		Clinical disease affecting production at herd level => 2	
		Herd-level abortions, stillbirths or infertility => 3	
		Herd-level mortality (≥ 20%) => 4	

The second criterion relates to the severity of the expected disease-related loss in affected production units (herds). It ranges from 0 to 4 according to the level of impact:

- **0** if the disease has no symptomatic expression in animals;
- **1** if the disease only causes individual or very few 'anazootic' cases (i.e. sporadic cases at the herd level);
- **2** if the disease has noticeable clinical consequences at herd level, with a negative effect on production,
- **3** if the disease causes reproduction issues at herd level with significant rates of abortion, stillbirth or infertility;
- **4** if the disease is liable to cause herd-level mortality upwards of around 20%.

5. DIRECT LOSSES	5.3. Spatiotemporal profile	Disease with a seasonal peak	Yes=1 / No=0	
			No => 0 Series of flare-ups in a zone => 1 'Ripple spreading' effect in the whole zone => 2	
		Massive focal outbreaks		

The last group of direct impact criteria allows added weighting to be given to diseases with an unfavourable spatial or temporal profile:

- If the disease is linked to seasonal contingencies (for example proliferation of arthropod vector species) leading to a seasonal recrudescence of cases, it will be more complicated to deal with than a disease with regularly distributed cases. When this is the case, the "Disease with a seasonal peak" criterion should be set to **1**.
- If the disease is liable to produce massive geographically concentrated outbreaks, the "Massive focal outbreaks" should be set to:
 - **1** if it produces a series of flare-ups in a zone, with a limited number of animals affected within herds (for example a vector-borne disease);
 - **2** if it causes a 'ripple spreading' effect, affecting a large majority or all animals in the infected area.



6. INDIRECT LOSSES	6.1. Effect on consumption	Non zoonotic disease => 0		
		Zoonosis affecting production species (not food-borne) => 1		
		Food-borne zoonosis (via animal products) => 2		
	6.2. Impact on trade	Official disease status (OIE)	Yes=2 / No=0	
Particular measures for the trade of live animals or/and animal products (OIE)		Yes=1 / No=0		

The last two criteria of the module concern the indirect economic losses liable to be caused by the disease:

- The effect on consumption corresponds to the possible impact of the disease on consumer habits. We assume that all zoonoses may have such an impact, but it will be more important in the case of a food-borne zoonosis potentially transmitted by animal products. As a consequence, the “Effect on consumption” criterion should be set to:
 - **1** if the disease is a non-food-borne zoonosis;
 - **2** if the disease is a food-borne zoonosis with possible presence of pathogens in animal products.

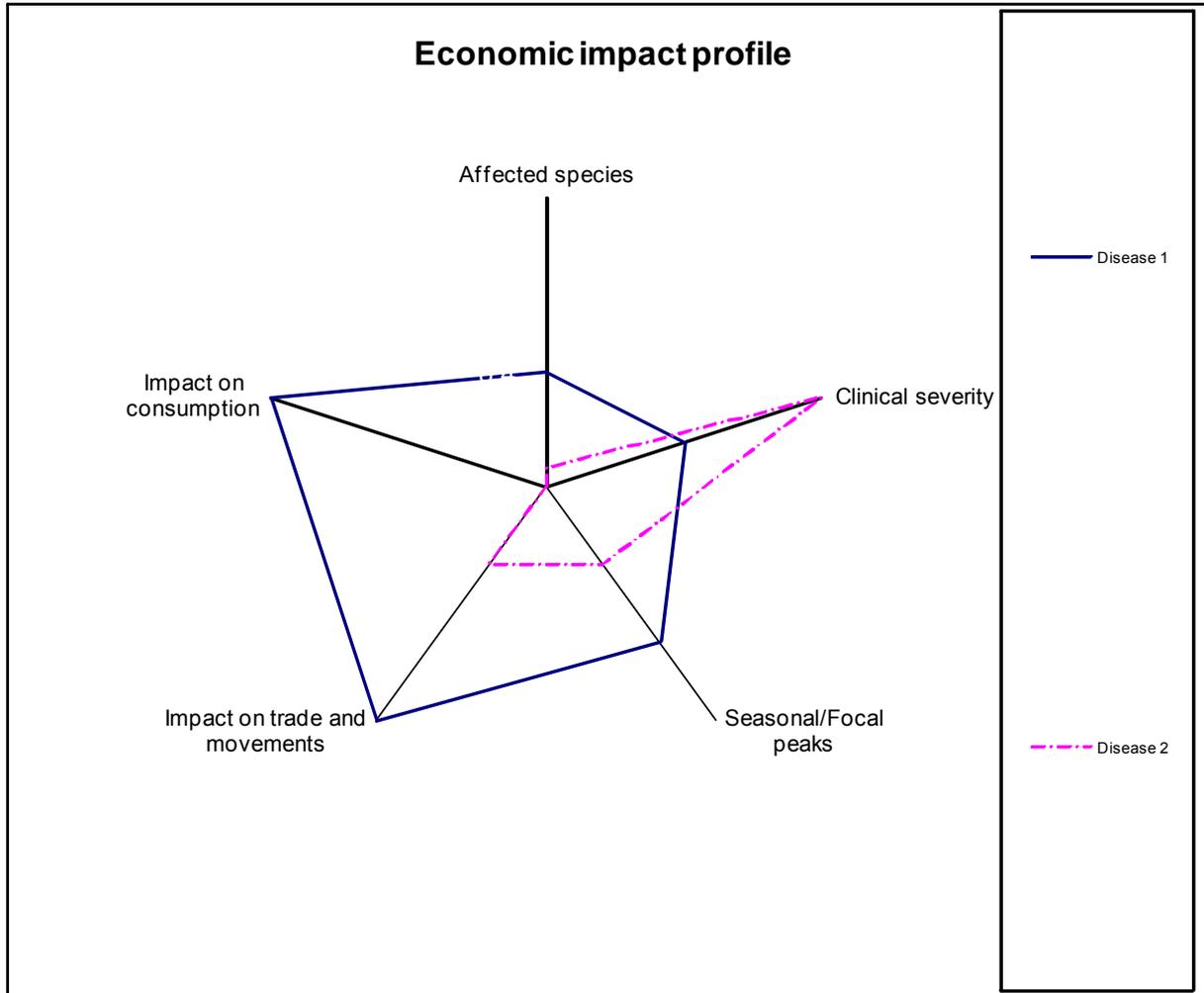
In certain cases, even diseases that are not zoonoses may have an impact on consumption. However, this is linked to particular local contexts and it is not possible to assess this at the global level.

- The impact on trade is related to the existence of an official disease status or recommendations for particular measures for the trade of animals and products from potentially infected areas. As it is currently the only animal health standard recognised at the global scale, the OIE *Terrestrial Code* should be used as a reference to determine whether or not a disease is subject to such measures:
 - The “Official disease status” criterion should be set to **2** only in the case of diseases that are subject to an official national animal disease status. At present, this is the case for four diseases only: foot and mouth disease (FMD), bovine spongiform encephalopathy (BSE), contagious bovine pleuropneumonia (CBPP) and rinderpest.
 - The “Particular measures for the trade of animals or/and animal products” criterion should be set to **1** in the case of diseases for which the *Terrestrial Code* contains specific recommendations on trade in animals and products from potentially contaminated areas (certification, control, etc.). The relevant details will be found in Volume 2 of the OIE *Terrestrial Code*.

4.2.2.2 - Visualisation of results

In the same way as for the epidemiological profile, the result of the economic impact assessment can be visualised on a radar chart. The result for each branch is the sum of the corresponding criteria divided by the number of criteria (ranging from 0 to 1).

The examples provided correspond to entirely theoretical models of diseases.

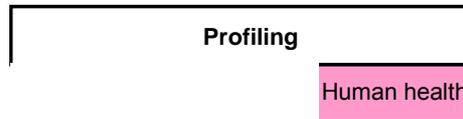


In this example, disease 1 is a hypothetical disease affecting ruminants, with herd-level symptoms but no significant reproduction disorders or death. It is a vector-borne disease with seasonal peaks and is a food-borne zoonosis (pathogen in meat) and is subject to official OIE recognition of national status, with specific trade recommendations.

Disease 2 only affects bees and causes massive mortality of hives. It is not seasonal but it may cause a series of flare-ups in a given zone; it has no human form and is only subject to OIE recommendations for the trade of live bees and honey.



4.2.3 - Zoonotic profile



This step aims at determining the nuisance potential of the disease in terms of human health (for zoonoses), taking into account two complementary notions:

- The strictly disease-related threat to human health:
 - Severity of human cases;
 - Animal-to-human transmissibility;
 - Interhuman transmissibility.
- The possibility of controlling the disease in humans:
 - Diagnosis of human cases;
 - Prevention and treatment in humans.

We choose here to consider in parallel the human form of the disease and its control options. This allows us to give highest priority to diseases with a strong nuisance potential in humans AND few possible means of control.



4.2.3.1 - Detailed criteria

7. HUMAN CASES	7.1. Zoonoses	Possible human form of the disease	Yes=1 / No=0	N/A
	7.2. Severity of human form (if untreated)	Invariably fatal => 4 Potentially fatal in complicated cases => 3 Symptomatic expression without mortality => 2 Asymptomatic or mild disease in humans => 1		

N/A: not applicable.

The first group of criteria corresponds to the existence and severity of human cases of the disease:

- This first criterion, “Possible human form of the disease”, is automatically filled in by the tool based on the answer given to the “transmission to humans” criteria in the epidemiological profiling module. (As a convention, all fields that are completed automatically are shown in blue throughout this report.)
- The “Severity of human form” criterion ranges from 1 to 4, according to the seriousness of the human disease. We only take into consideration cases where the disease in humans is left untreated, so as to determine a “nuisance potential in human health” for the disease. This criterion should be set to:
 - **1** if the disease is asymptomatic or only causes mild symptoms in humans;
 - **2** if the disease has a symptomatic expression in humans, possibly leading to sick-leave but with no risk of death;
 - **3** if the disease may cause death, but only in complicated cases or in predisposed individuals;
 - **4** if the disease is invariably fatal in humans.

8. DIAGNOSIS	8.1. Clinical diagnosis	No clinical diagnosis elements => 3 Clinical suspicion only => 2 Pathognomonic signs => 1	
	8.2. Laboratory diagnosis	No laboratory test or confirmation technique => 3 Difficult or unreliable confirmation technique => 2 Good diagnostic test => 1	

The second group of criteria regards the diagnosis in humans, with distinct assessments of clinical and experimental diagnosis:

- The “Clinical diagnosis” criterion ranges from 1 to 3 depending on its difficulty:



- **1** if the clinical signs are pathognomonic and clinical diagnosis is easy and certain;
- **2** if clinical symptoms provide only an indication of the diagnosis (this is the most common case);
- **3** if no clinical diagnosis is possible (asymptomatic expression, excessively mild or nonspecific signs, etc.).
- The “Laboratory diagnosis” criterion also ranges from 1 to 3 on the same principle:
 - **1** if there is a good laboratory diagnostic test;
 - **2** if there are only difficult or unreliable diagnostic tests;
 - **3** if no laboratory diagnostic tests exist.

9. PREVENTION & TREATMENT	9.1. Vaccine	No vaccine => 3	
		Intermediate efficacy or availability => 2	
		Effective vaccine => 1	
	9.2. Medical treatment	No effective treatment => 3	
	Intermediate efficacy or availability (or emergency curative vaccination) => 2		
	Total recovery without relapse => 1		

The third group of criteria concerns the possibility of vaccination and treatment in humans. As with the diagnosis, the corresponding criteria range from 1 to 3 according to whether they exist and their degree of efficacy:

- The “Vaccine” criterion should be set to:
 - **1** if there is an effective vaccine;
 - **2** if there is only a vaccine with intermediate efficacy or availability (e.g. if the vaccine exists but has not yet been imported or produced in the country, or if it only provides partial protection);
 - **3** if no vaccine exists.
- The “Medical treatment” criterion should be set to:
 - **1** if there is an effective treatment, allowing good recovery without relapse;
 - **2** if existing treatments are difficult to obtain or to put in place, or if their efficacy is limited. Those cases where the only possibility of treatment is an emergency vaccination, such as for rabies, also belong to this category (because even if it may be totally effective, it is only possible during a short time and requires correct diagnosis and good patient management).
 - **3** if no treatment exists.



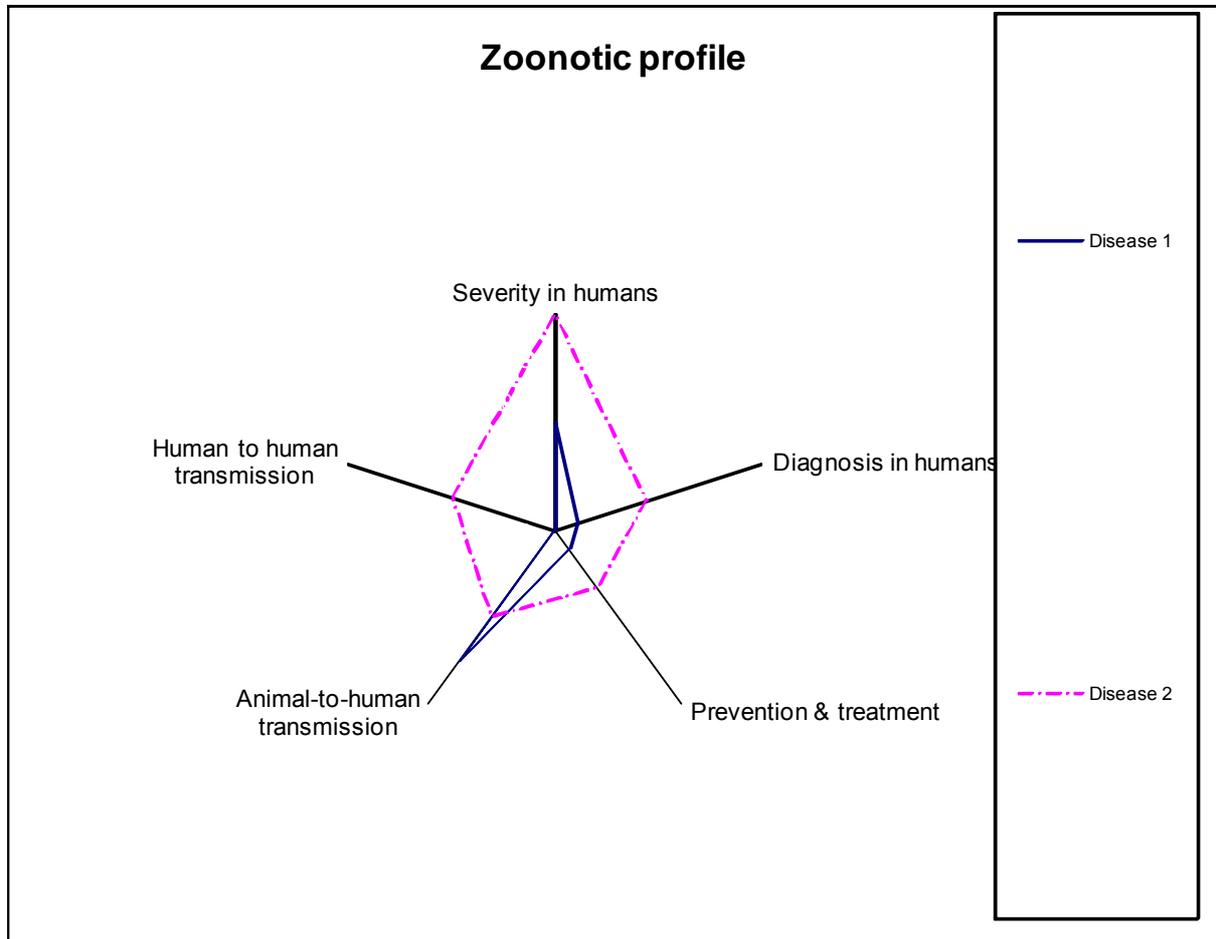
10. TRANSMISSIBILITY	10.1. Animal-to-human transmission	High risk (e.g. flying human-adapted vector) => 4 Significant public risk (e.g. hazardous widely consumed food products, non flying human-adapted vectors) => 3 Professional or occupational risk disease => 2 Only accidental human cases => 1	
	10.2. Interhuman transmission	High risk (e.g. flying human-adapted vector) => 4 Easy transmission by proximity or indirect contact => 3 Transmission by direct close contact => 2 Only vertical or accidental transmission, in high-risk persons or by particularly invasive contact => 1 Epidemiological dead-end in humans => 0	

The last group of criteria in the profiling of the disease-related impact on human health concerns the transmissibility of the pathogen from animals to humans as well as between humans:

- The “Animal-to-human transmission” criterion ranges from 1 to 4 depending on the corresponding risk:
 - **1** if transmission to humans may only occur in exceptional and accidental situations;
 - **2** if the disease may be considered an occupational or professional risk, that is to say if it affects people working or having particular contacts with animals (farmers, hunters, etc.);
 - **3** if there is a significant risk that the disease may be transmitted to the public, for example if a frequently consumed animal product may be hazardous, or if there is a possibility of vector-borne transmission by a vector non-specific to humans (accidental bites);
 - **4** if the risk of transmission to the public is high, for example if the pathogen may be carried by flying arthropod vectors adapted to humans (casual bites).
- The “Interhuman transmission” criterion ranges from 0 to 4 on the same principle:
 - **0** if human carriers are a dead-end for the pathogen;
 - **1** if there is only a risk of accidental transmission, involving predisposed persons or particularly invasive contact (this includes vertical transmission);
 - **2** if interhuman transmission is possible and requires at least direct close contact;
 - **3** if transmission is possible between humans by proximity or indirect contact;
 - **4** if there is a particularly high risk of interhuman transmission, for example in the case of an air-borne zoonosis, or of a vector-borne zoonosis with vector species specifically adapted to humans.

4.2.3.2 - Visualisation of results

The aforementioned aspects are summed up and visualised in a radar chart compiling the zoonotic characteristics of the disease on five axes corresponding to each thematic category. The result for each axe is the sum of the corresponding criteria divided by the number of criteria (ranging from 0 to 1).



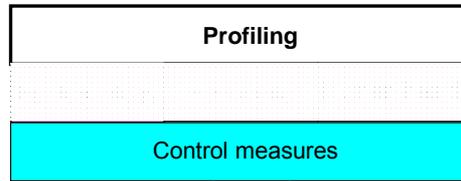
In this example, we consider a hypothetical disease 1 causing clinical symptoms but no mortality, with rather indicative signs and effective laboratory test, vaccine and treatment; this disease has a significant risk of affecting humans (it is vector-borne and, even if the vector is not specifically adapted to humans, bites may be unexceptional). Humans are a dead-end for the pathogen.

Disease 2 is a severe zoonosis that is invariably fatal if left untreated. Moreover, clinical signs are difficult to interpret and laboratory techniques are difficult. This disease requires close contact with animals to infect humans, and thus is mainly an occupational issue. However, it can be transmitted between humans by direct close contact.

N.B.: It is important to keep in mind that, for all the control measure criteria and groups of criteria, the higher the score, the less effective the corresponding measures are likely to be.



4.3 - Step 1.2: Characterisation of control measures



Once the epidemiological, economic and zoonotic (where relevant) profiles of an animal disease have been established, the next step is to assess whether or not control measures are available to prevent, control or eradicate it. However, the relevance of these control strategies may only be assessed at the local level, since they depend on the particular situation in each country or region. Thus, in this first global analysis, we will only address the availability and expected efficiency of technical means to control the disease in animals:

- Diagnostic means:
 - Clinical diagnosis: depending on the specificity of signs;
 - Laboratory techniques: quality and availability of tests, capacity to detect seroconversion in herds and to identify the pathogen (including its serotype, strain, etc.);
- Territory protection mechanisms:
 - Control of trade and other movements of live animals and animal products, depending on their respective safety level;
 - Zoning and compartmentalisation, if relevant for this disease;
- Vaccination in animals:
 - Efficacy of immune protection against clinical expression, excretion of pathogens, or infection;



- Possibility of differentiating vaccinated animals from naturally infected pathogen carriers (DIVA vaccines);
- Medical treatment in animals;
- Biosecurity measures in epidemiological units:
 - Relevance of good practices in herds to prevent or limit the disease;
 - Importance of water sanitation systems (for water-borne diseases);
 - Vector-proofing (protection of animals from vectors) or anti-vectoral efforts (destruction of vector populations) in the case of vector-borne diseases.

Apart from their effectiveness, control measures may also have a significant cost and non-negligible societal and environmental consequences. However, these aspects are related to each particular local situation (nature of the control policies, socio-cultural background, etc.) and so will not be considered in this first part.

Remark: If no (or insufficient) data are available regarding control measures applicable to the disease, this may orientate further research work (this underlines the importance of completing the “comment” fields in the tables, where appropriate).

4.3.1 - Detailed criteria

11. DIAGNOSIS & SURVEILLANCE	11.1. Diagnosis in animals	Clinical diagnosis: ante- and post-mortem diagnosis (autopsy or slaughter inspection)	Pathognomonic signs => 1 Clinical signs suggestive of the disease => 2 Asymptomatic disease or nonspecific signs => 3	
		Laboratory diagnosis in biosafety cabinet (precise identification of the pathogen, including serotype)	Possible and safe indirect isolation and identification of the pathogen (serology or safe handling of the pathogen) => 1 Direct identification of the pathogen or requiring biosafety cabinets => 2 No identification possible => 3	
		Laboratory surveillance (detection of seroconversion in animals)	Easy test without handling the pathogen (serology on antibodies) or safe handling of the pathogen => 1 Delicate test, requiring specialised laboratories or biosafety cabinet => 2 No confirmation in live animals, or no test => 3	



The first group of criteria in the control measures assessment module concerns the possibilities for diagnosis and surveillance of the disease in animals:

- The “Clinical diagnosis: ante- and post-mortem” criterion ranges from 1 to 3 depending on the difficulty of identifying the disease in animals by its clinical signs in infected cases, or even by anatomopathological clues (during autopsies or slaughter inspection):
 - 1 if pathognomonic signs are easily perceptible during the inspection or clinical examination;
 - 2 if only indicative signs may be detected, requiring further confirmation;
 - 3 if the disease is asymptomatic or causes nonspecific signs or lesions.
- The “Laboratory diagnosis in biosafety cabinet” criterion aims at determining if a precise identification of the pathogen (including determination of its serotype, strain, pathotype, etc.) is possible, and whether or not it requires particular biosafety measures. This criterion should be set to:
 - 1 if identification is both possible and safe, and can be easily performed in application laboratories;
 - 2 if direct identification of the pathogen is possible but requires an adapted biosafety cabinet;
 - 3 if no precise identification of the pathogen is possible.
- The “Laboratory surveillance” criterion aims at determining if monitoring of seroconversion in herds is possible using laboratory techniques, and whether or not such tests can be easily implemented. This criterion should be set to:
 - 1 if there is an easy and safe test (no or safe handling of the pathogen);
 - 2 if there is only a delicate test (complex or insecure), requiring either specialised laboratories or enhanced biosafety conditions;
 - 3 if no confirmation is possible in live animals (even if a post-mortem test exists, the criterion should be set to this value).

12. TRADE AND MOVEMENT MEASURES	12.1. Control of disease movement	Live animals (including wildlife)	Secure (no possible transmission) => 0	
		Raw products (including food and feed)	Possible inspection, sanitation or treatment (technique certification) => 1	
		Processed products (including food and feed)	Certification of status regarding origin (traceability) => 2	
		Semen & embryos (eggs)	Unpreventable risk => 3	
		Possible contamination of waste food and feed		
		Others (vectors, human carriers, etc.)		
	12.2. Relevant Compartmentalisation / zoning	Yes => 0 No => 1		



The second group of criteria concerns the possible trade and movement measures regarding the disease:

- The “Control of disease movement” criteria analyse the different possible contamination routes for the pathogen: live animals (including wildlife), raw animal products, processed animal products, semen and embryos (including eggs), waste and other routes such as human carriers or particular vector species. Each one of these routes should be scored 0 to 3, depending on the corresponding risk of contamination:
 - **0** if the route is secure, that is to say the corresponding animals or products cannot be infected by the pathogen;
 - **1** if a simple treatment or sanitation is sufficient to ensure the absence of the pathogen (e.g. pasteurisation of milk);
 - **2** if the only way to avoid contamination by this route is to operate strict traceability, associated with certification of the origin of the animals or products (i.e. from free countries, zones or farms).
 - **3** if the risk associated with the route is unpreventable (e.g. wildlife migration flows).
- The “Relevant compartmentalisation or zoning” criterion aims at determining whether or not compartmentalisation or zoning may be relevant in the event of an occurrence of the disease (depending on its characteristics and transmissibility). As with international trade measures (see Economic profiling), the only globally recognised standard as regards animal diseases is the OIE *Terrestrial Code*. Thus, this criterion should be set to **1** only when the *Terrestrial Code* refers to compartments or zones for the disease in question.

13. VACCINATION	13.1. Vaccine in animals	Level of immune protection (with authorised vaccine)	Preventing infection => 1 Preventing carriage and excretion => 2 Only limiting clinical expression => 3 No vaccine => 4	
		DIVA vaccine	Yes => 0 No => 1	

The third group of criteria in this module is about possible vaccination against the disease in animals:

- The first criterion, “Level of immune protection”, is an indicator of the expected quality of available solutions in terms of vaccine. This criterion ranges from 1 to 4:
 - **1** if the vaccine provides total immune protection, preventing infection;
 - **2** if the level of protection is intermediate and prevents carriage and excretion of the pathogen, but does not prevent animals from being infected;



- **3** if the level of protection is poor and merely limits the clinical expression of the disease and its consequences in sick animals;
- **4** if no vaccine exists.
- The “DIVA vaccine” criterion allows additional weight in terms of impact to be given to diseases for which no DIVA vaccine exist, as such diseases may be more difficult to address – as regards vaccination policies – than those with the possibility of differentiating between vaccinated and naturally infected animals. This criterion should be set to **1** if no DIVA vaccine is available for the disease.

14. MEDICAL TREATMENT	14.1. Medical treatment in animals	Total recovery and clearing of infection => 1	
		Only limiting signs and transmission => 2	
		No treatment (or unauthorised) => 3	

As in the case of vaccines, the following criterion aims at determining the existence and expected efficacy of medical treatments for the disease. Note that this criterion deals only with treatments that are specific to the disease. It does not take into consideration symptomatic or palliative generic treatments. The “Medical treatment in animals” criterion should be set to:

- **1** if there is a specific treatment allowing total recovery without relapse and clearing of infection in affected individuals;
- **2** if there is a treatment that merely limits signs and transmission, or allows recovery but with a risk of long-term carriage of the pathogen;
- **3** if no treatment exists, or if treatment is either unauthorised or subject to strong negative recommendations in world animal health standards (OIE).

15. BIOSECURITY MEASURES	15.1. Good practices in herds or epidemiological units	Cleaning & disinfection	Useless => 0		
		Limiting and control of contact between animals and the public		Useful and effective => 1	
		Isolation of sick and parturient animals			
	15.2. Access to uncontaminated water		Useful but moderate effectiveness or availability => 2		
	15.3. Exposure to vectors	Vector-proofing	Useful but impossible or unavailable => 3		
Anti-vectoral solutions					

The last group of criteria in this module concerns biosecurity measures likely to be effective against the disease. These measures are divided into three categories:



- General good practices that should be implemented (preventively or curatively) in epidemiological units:
 - Regular cleaning and disinfection (C&D) of facilities and equipment, maintaining a general, good level of hygiene and preventing the persistence of pathogens (at least those which are excreted into the environment and which are susceptible to cleaning and disinfection products. This “Cleaning and disinfection” criterion should be set to:
 - ✓ **0** (Useless) if the pathogen is not liable to be excreted into the environment or to be present on equipment, so that C&D would be ineffective as a control measure for the disease;
 - ✓ **1** (Useful and effective) if standard and regular C&D effectively limits the presence of the pathogen in the farm and is a good way of limiting new infections in animals;
 - ✓ **2** (Useful but moderate effectiveness or availability) if C&D may be effective against the pathogen, but requires particular products and/or protocols;
 - ✓ **3** (Useful but impossible or unavailable) if the pathogen is excreted and thus a source or new infections, but no effective product exists or corresponding protocols are not feasible in farms.
 - Limiting and controlling contacts between animals and the public is a good measure if humans are susceptible to the disease or may simply act as passive carriers. This control implies isolating animals from people, as well as specific measures (clothing, C&D) for any persons in contact with herds (farmers, veterinarians, etc.). This criterion should be set to:
 - ✓ **0** (Useless) if there is no risk of transmission of the pathogen to humans, and no risk of passive carriage of the pathogen by humans;
 - ✓ **1** (Useful and effective) if isolating animals from humans is an effective way of preventing a zoonosis (e.g. in the case of a zoonosis only transmitted to humans by direct contact), or if passive carriage by humans is a common route for spreading the disease in animals;
 - ✓ **2** (Useful but moderate effectiveness or availability) if these measures are effective, but the pathogen has other routes besides direct contact to spread to other animals or humans (for example a zoonosis that could be transmitted by direct contact but also by air-borne dissemination);
 - ✓ **3** (Useful but impossible or unavailable) if contacts between animals and the public cannot be avoided (e.g. in the case of pets).
 - Isolating sick and parturient animals may also be a way to limit the spread of the disease. This avoids exposing healthy animals to infected animals or contaminated materials such as placenta (which can be highly contaminated in the case of some pathogens). This criterion should be set to:
 - ✓ **0** (Useless) if there is no risk of direct transmission from infected animals or placenta;
 - ✓ **1** (Useful and effective) if ensuring isolation and good biosecurity for sick and parturient animals is sufficient to prevent the spread of the disease;
 - ✓ **2** (Useful but moderate effectiveness or availability) if isolation of sick and parturient animals merely allows a discrete reduction of contamination of



healthy animals (e.g. if the only possibility is belated diagnosis and several healthy animals may already have been infected before sick individuals are isolated);

- ✓ **3** (Useful but impossible or unavailable) if isolation of sick and parturient animals would be useful in preventing the spread of the disease, but is impossible to implement (e.g. in the case of vector or air-borne diseases, as it will be impossible to completely isolate sick animals).
- The “Access to uncontaminated water” criterion measures the relevance of sanitised drinking trough systems to control the disease, in comparison with animals’ drinking from natural water sources. This criterion should be set to:
 - **0** (Useless) if the pathogen cannot be water-borne;
 - **1** (Useful and effective) if the pathogen is mainly water-borne and vulnerable to standard water sanitation;
 - **2** (Useful but moderate effectiveness or availability) if the pathogen is water-borne but partially resistant to sanitation, or if water-borne dissemination is only an anecdotal route of disease spread;
 - **3** (Useful but impossible or unavailable) if the pathogen is potentially water-borne, but cannot be destroyed by sanitation protocols.
- For vector-borne diseases, additional biosecurity measures should be implemented to reduce the exposure of animals to vectors. Possible strategies are:
 - Vector-proofing, that is to say means of preventing vectors from coming into contact with susceptible animals. This may imply specially equipped or suitably adapted facilities and the use of repellents or similar techniques. This criterion ranges from 0 to 3 depending on the relevance and effectiveness of such measures:
 - ✓ **0** (Useless) if the disease is not vector-borne;
 - ✓ **1** (Useful and effective) if the disease is vector-borne and vector species are relatively easy to avoid;
 - ✓ **2** (Useful but moderate effectiveness or availability) if the disease is vector-borne and vector contact with animals is difficult to prevent completely (though it may be possible to reduce it effectively);
 - ✓ **3** (Useful but impossible or unavailable) if the disease is vector-borne, but vector contact with animals is impossible to avoid and cannot be effectively reduced.
 - Anti-vectorial efforts, that is to say measures implemented in order to destroy the vector population in the environment so as to prevent the persistence and spread of the disease. This criterion ranges from 0 to 3 depending on the effectiveness of such measures:
 - ✓ **0** (Useless) if the disease is not vector-borne;
 - ✓ **1** (Useful and effective) if the disease is vector-borne and the vector population may be easily and effectively destroyed by coordinated actions (pesticide treatments for example);
 - ✓ **2** (Useful but moderate effectiveness or availability) if the disease is vector-borne but the vector population is difficult to control (this is the most frequent case for vector-borne diseases);

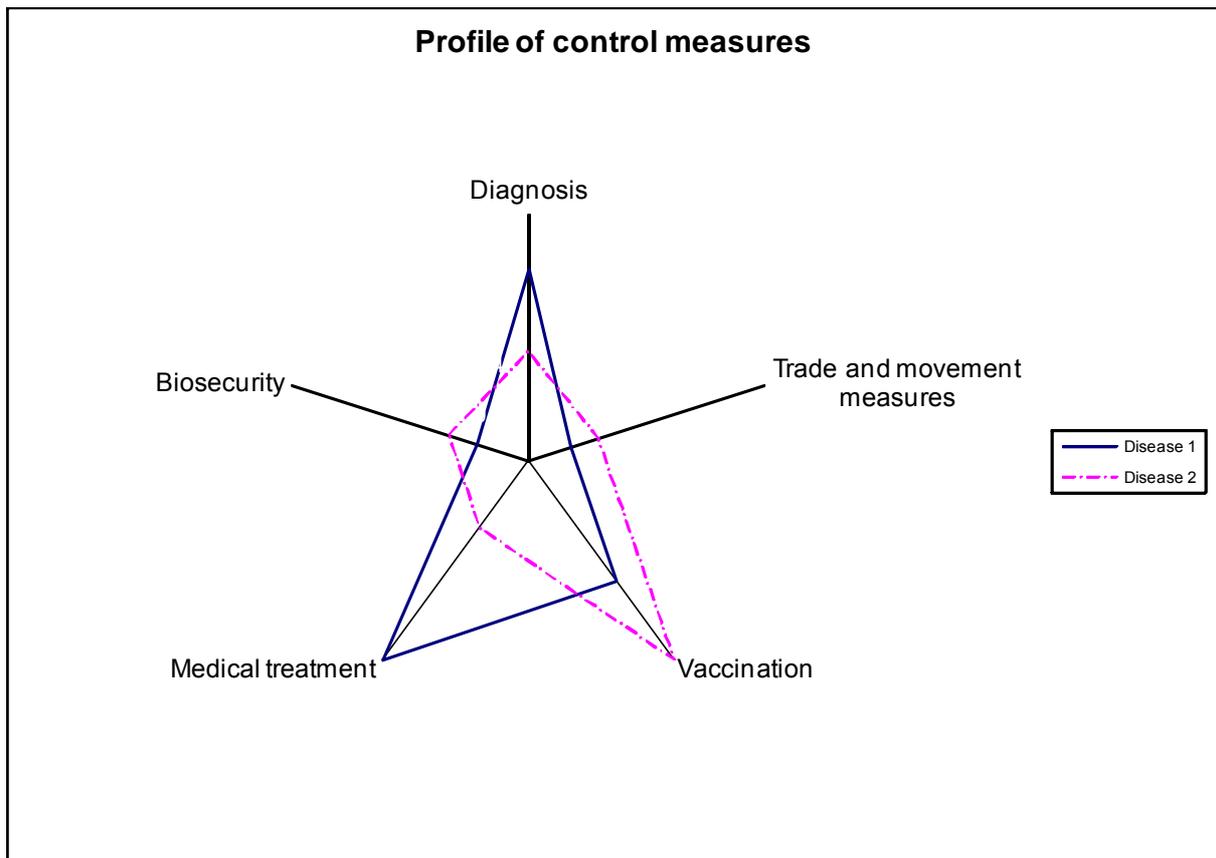


- ✓ **3** (Useful but impossible or unavailable) if the disease is vector-borne and it is impossible to regulate the population of vectors.

4.3.2 - Visualisation of results

In the same manner as for the previous modules, a radar chart can be used to visualise and compare the profiles of different diseases as regards possible control measures.

The result for each branch is the sum of the corresponding criteria divided by the number of criteria (ranging from 0 to 1).



In this hypothetical example, disease 1 causes evocative lesions usually found during slaughter inspection. No laboratory confirmation is possible in live animals (only post-mortem test) and handling the pathogen for identification requires enhanced biosafety. The disease may be introduced in contaminated live animals and in milk (but pasteurisation is effective). A vaccine is available (limiting carriage and excretion) but there is no specific treatment. Cleaning and disinfection (C&D) is a good way to limit the presence of the pathogen in farms. Isolating sick animals is not an option since the disease can only be diagnosed post mortem.

Disease 2 causes symptoms that are indicative but not pathognomonic in affected animals; however, laboratory confirmation and identification of the pathogen are easy and



safe. The disease can be introduced in live animals (importance of traceability) and vectors (impossible to control). There is no vaccine, but a very effective treatment is readily available. C&D is relevant but rarely fully effective (the pathogen is quite resistant); vector-proofing and anti-vectoral measures are useful, even if total control over exposure to vectors and over the vector population is impossible.

4.4 - Conclusion of phase 1

At the end of this first phase, the analysis of global data should provide a good overview of the profile of the disease and possible control measures. It is essential to keep in mind that the goal of this preliminary analysis is *not* to perform a global prioritisation: the profiling information is strictly qualitative, and the second phase of local analysis is essential to assess quantitative elements of prioritisation of the disease in a particular country or region.

However, the results of the profiling must be regarded as a consensus about the disease and control measures, allowing all the team of experts (cf. definition in 3.3 step 3) involved to agree on the corresponding elements so as to obtain a harmonised perception before performing the local prioritisation step.

This consensus on a disease can be very helpful when it comes to performing the local approach, particularly for diseases that are absent or little known in the country.

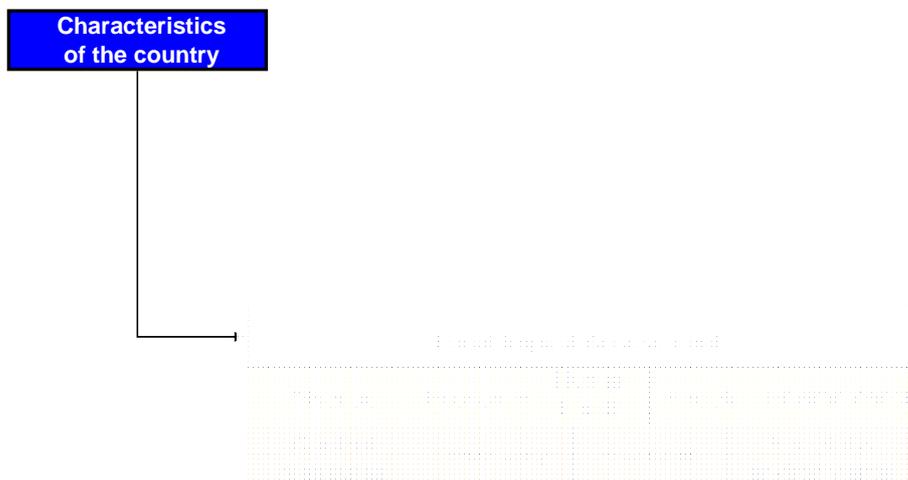
Once again, no score is provided for this profiling, to avoid an artificial and false global ranking of the diseases.



5 - Phase 2: Local approach

The local assessment step is a complex process because it has to take into consideration all the particularities of each local situation so as to ensure the relevance of the analysis. For this reason, this part will describe the organisation and use of the tool (as was the case in the previous chapter), but will also focus on some specific methodological points that need to be considered in order to figure out relevant local information to fill in the tool.

5.1 - Step 2.1: Characterisation of the country



This first spreadsheet is a preliminary to the local analysis of the disease. It aims at gathering and organising some general data about the country or region, in order to provide a good basis to assess the possible impact of a disease in the previously described local context.



Even if the protocol is designed for different geographic scales (country, region, etc.) it is essential to apply it only to a geographically contiguous territory. For example, remote enclaves or island territories should be analysed separately from the mainland territory, as significant differences may exist due to the distance.

5.1.1 - Local production data

The first section of this spreadsheet concerns the collection of general data on national or regional animal production and exports. To limit the amount of data required, we deal here only with live animals, meat and milk production for the most common production species. Additional fields have been added to take into account other specific categories of production (such as wool, eggs and honey) and any other production species of particular relevance to the country.

5.1.1.1 - Quantitative data

A first possible source consists of the data available in the FAOSTAT² database, and the corresponding figures are proposed by default to perform the local analysis. However, the quality of these data depends on the quality of reporting and may not always be the most accurate or relevant. Clearly, if local data can be obtained from the national or regional authorities, they can be used here to replace the default values and refine the approach.

For a better understanding, the screen captures in this section will display indicative numerical examples.

² <http://faostat.fao.org/default.aspx>

**Example of a production data table**

Species	Livestock number (1000)	Meat and live animals:							
		Yearly production (tonnes)	Mean price in USD (tonnes)	Total production KUSD	Meat production in the global market (KUSD)	Live animals in the global market (KUSD)	Production kg/head	Imported meat (KUSD)	Auto-consumption (%)
Cattle	19 359	1 531 820	4 745	7 268 486	1 466 089	1 648 872	79	1 630 263	102.26%
Buffalo	0	0		0			0		0.00%
Camels	0	0		0			0		0.00%
Goats	1 254	7 350	6 700	49 245	1 010	827	6	5 210	108.53%
Horses & donkeys	420	7 210	3 378	24 355	49 115	51 468	17	124 996	411.56%
Sheep	8 284	95 000	6 478	615 410	82 514	67 551	11	685 997	198.06%
Pigs	14 736	2 281 000	1 882	4 292 842	790 038	97 230	155	304 598	88.69%
Ducks	22 600	271 500	3 412	926 358	212 226	0	12	7 666	77.92%
Turkeys	28 105	471 000	1 432	674 472	214 800	0	17	62 627	77.44%
Geese and guinea fowl	670	127 700	5 923	756 367	15 992	0	191		97.89%
Chickens	175 000	993 300	1 974	1 960 774	743 803	0	6	546 440	89.93%
Rabbits & hares		51 700	4 128	213 429	30 827	4 112		13 714	91.98%
Bees	1 015					0			
Other									0.00%

This table summarises production data for live animals and meat. The tool also takes into account milk and additional annex production categories that may vary from species to species (skins, wool, eggs, honey, etc.). The corresponding sections of the table are similar to this one and will therefore not be illustrated in this report.

Remark: Geese and fowl have been grouped together in the data fields because they are often associated in the available databases.



In the above table, only the fields in yellow have to be completed (this convention will be used throughout the report, yellow fields and are for local general data for the country or region). The fields in white are calculated automatically.

Remarks:

- *If a species that is not in the default list is of particular local importance in terms of production, it can be added in the “Other” field, and corresponding production figures should then be entered in the appropriate cells (live animals, meat, milk, and any other specifiable category of production. Among the calculated indicators, an autoconsumption value is provided. It is calculated by a comparative balance analysis:*

$$\text{Autoconsumption}(\%) = \frac{\text{Pr oduction}(K\$) + \text{Im ports}(K\$) - \text{Exports}(K\$)}{\text{Pr oduction}(K\$)}$$

- *An additional indicator is provided in an appendix table as follows:*

Species	Criticality for food Supply (10% loss simulation)
Cattle	4.39%
Buffalo	0.00%
Camels	0.00%
Goats	0.03%
Horses & donkeys	0.01%
Sheep	0.37%
Pigs	2.59%
Ducks	0.56%
Turkeys	0.41%
Geese and fowl	0.46%
Chickens	1.18%
Rabbits & hares	0.13%
Bees	0.00%
Other	0.00%

This “Criticality for food security” indicator is calculated on the basis of a 10% decrease in the corresponding meat production. The result expresses the subsequent loss in the total share of national meat production devoted to local consumption (Production + Imports – Exports). Thus, this value is an indicator of the respective importance of each species in the local meat supply.



From these data, the tool automatically calculates the respective share of each species and production in the total national production and export figures.

Species and production		Share of national animal production	Share of national exports of animals and animal products
Cattle	Live animals		25.77%
	Meat	26.04%	22.91%
	Milk	33.88%	5.42%
	Skins	0.00%	5.98%
	Total Cattle	59.92%	60.08%
Buffaloes	Live animals		0.00%
	Meat	0.00%	0.00%
	Milk	0.00%	0.00%
	Total Buffaloes	0.00%	0.00%
Camels	Live animals		0.00%
	Meat	0.00%	0.00%
	Milk	0.00%	0.00%
	Total Camels	0.00%	0.00%
Goats	Live animals		0.01%
	Meat	0.18%	0.02%
	Milk	0.73%	0.00%
	Skins	0.00%	0.00%
	Total Goats	0.91%	0.03%
Horses & donkeys	Live animals		0.80%
	Meat	0.09%	0.77%
	Total Equids	0.09%	1.57%
Sheep	Live animals		1.06%
	Meat	2.20%	1.29%
	Milk	0.50%	0.00%
	Wool	0.11%	0.31%
	Total Sheep	2.82%	2.66%
Pigs	Live animals		1.52%
	Meat	15.38%	12.35%
	Total Pigs	15.38%	13.87%
Ducks	Live animals		0.00%
	Meat	3.32%	3.32%
	Total Ducks	3.32%	3.32%
Turkeys	Live animals		0.00%
	Meat	2.42%	3.36%
	Total Turkeys	2.42%	3.36%
Geese and fowl	Live animals		0.00%
	Meat	2.71%	0.25%
	Total Geese/Fowl	2.71%	0.25%
Chickens	Live animals		0.00%
	Meat	7.02%	11.62%
	Eggs	4.46%	2.70%



	Total Chickens	11.48%	14.32%
Rabbits & hares	Live animals		0.06%
	Meat	0.76%	0.48%
	Total Rabbits/Hares	0.76%	0.55%
Bees	Live animals (hives)		0.00%
	Honey	0.20%	0.00%
	Total Bees	0.20%	0.00%
Other	Live animals		0.00%
	Meat	0.00%	0.00%
	Milk	0.00%	0.00%
	Other	0.00%	0.00%
	Total Species	0.00%	0.00%

From the figures presented in this table, the goal is to determine a ranking of the production species compared to the whole local animal production and exports of live animals and primary animal products. As a result, each species is given an indicator of local importance, firstly for production and secondly for exports, as follows:

- **0** if the species is absent in the country (or no data are reported);
- **1** if the species accounts for less than 1% of local animal production or the total value of exports of animals and primary animal products;
- **2** if the species accounts for 1 to 10% of local animal production or the total value of exports of animals and primary animal products (in pale green in the table);
- **3** if the species accounts for 10 to 50% of local animal production or the total value of exports of animals and primary animal products (in bright green in the table);
- **4** if the species accounts for more than 50% of local animal production or the total value of exports of animals and primary animal products (in dark green in the table).

Remarks:

- 1- Organising the different types of animal production into classes (0, 1, 2, 3, 4) means that the share of some minor species, which might otherwise be neglected in the protocol, can be taken into account.
- 2- In the data collection process, it is essential to exclude all atypical years, for example when there was a major drought or epizootic in the country. Such atypical data would introduce a bias and could compromise the balance between the different types of animal production.



Species	Index calculation	Importance for production	Importance for exports			
			Live animals	Meat	Milk	Eggs / Honey / Other
Cattle	0 => 0	4	3	3	2	
Buffalo		0	0	0	0	
Camels	<1% => 1	0	0	0	0	
Goats		1	1	1	0	
Horses & donkeys	1-10% => 2	1	2	1		
Sheep		2	2	2	0	1
Pigs	10-50% => 3	3	2	3		
Ducks		2	0	2		
Turkeys	>50% => 4	2	0	2		
Geese and fowl		2	0	1		
Chickens		3	0	3		2
Rabbits & hares		1	1	1		
Bees (hives)		1	0			0
Other		0	0	0	0	0

These indicators will then be used in the further local analysis, in combination with disease-related elements of impact on production groups, to get an idea of the potential (for a disease that is currently absent) or actual (for a disease that is present) economic loss caused by the disease.

5.1.1.2 - Qualitative elements

Additional elements about the respective importance of tourism and the food processing industry are also considered here, to give an overview of the country's economic profile. However, these points are assessed only in a qualitative or semi-quantitative manner.



Crop production	Importance of animal draught power	Bovines	Negligible => 0	
		Equids	Adjunct to mechanised means => 1	
		Camelids	Only or predominant source => 2	
	Existence of a local market for manure		Yes=1 / No=0	

The first group of criteria concerns some aspects related to the importance of animals in local crop farming:

- Animals may have a marked local importance as a source of draught power. An animal disease that has the effect of reducing the availability draught power is liable to affect crop production. For each of the three main draught species, the criterion should be set to:
 - **0** if this species' importance as a source of draught power is negligible in the country;
 - **1** if the species is commonly used as a source of draught power in the country, but only as an adjunct to mechanised power;
 - **2** if the species is the only or predominant source of draught power (several species may be set to 2 if their respective importance as a source of draught power is equivalent).
- Animals may also have an influence on crop production through the role of manure as fertiliser. However, this aspect is rather complicated to assess precisely. As a simplified indicator, the “Existence of a local market for manure” criteria should be set to **1** if manure (at least from major species) has a recognised commercial value in the country.

Other economic sectors potentially affected	Importance of tourism (as a source of income or as a development axis) in the local economy.	Important sector (>5% GDP) => 2	
		Non-negligible sector (1-5% GDP) => 1	2
	Importance of animal products industry in the local economy.	Negligible => 0	

In the same manner, this table provides a semi-quantitative estimate of the local importance of other economic sectors that are liable to suffer an indirect impact of the disease:



tourism and food industry (for animal products). For each one, the corresponding criterion should be set to:

- **0** if the local economic importance of the sector is negligible;
- **1** if it is non-negligible, that is to say ranging from 1 to 5% of national GDP;
- **2** if it is an important sector, which is assumed to be the case if the sector represents more than 5% of the national GDP.

5.1.2 - Qualitative elements about the local organisation of production systems and the food supply

These elements are not quantitative data to be included in further calculations. However, they consist of qualitative statements about the country that we assume are essential to take into account before moving to the next steps.

Respective importance of production systems (proportion of the production category in question)	Absent or negligible => 0	Bovines	Meat	Pastoral + transhumance Sedentary pastoral Fenced Housed	
	Present and non-negligible => 1		Milk	Pastoral + transhumance Sedentary pastoral Fenced Housed	
		Sheep	Meat	Pastoral + transhumance Sedentary pastoral Fenced Housed	
			Milk	Pastoral + transhumance Sedentary pastoral Fenced Housed	
		Present and dominant => 2	Goats	Meat	



				Housed	
			Milk	Pastoral + transhumance Sedentary pastoral Fenced Housed	
		Pig	Meat	Pastoral + transhumance Sedentary pastoral Fenced Housed	
				Poultry	Meat
			Eggs	Pastoral and transhumance Village free range Small-scale semi-commercial Commercial intensive farms	

This first table refers to the respective national or regional importance of the different types of production systems, for each main species and production category:

- Pastoral system with transhumance, implying wide-ranging livestock movements and numerous possible contacts between herds;
- Sedentary pastoral systems, with limited animal movements but common pastures and contact with neighbouring herds;
- Fenced farming, with no possible contact between neighbouring herds;
- Housed system, with complete enclosure of animals and no possible contact with other herds or even wildlife, pets, etc. (Some vector species, particularly rodents or flying arthropods may nevertheless be able to enter such systems.)



Remark: The “generic” wording of the different systems may look inappropriate for some species. However, some systems may exist that are equivalent. For example, “Pastoral and transhumance” sounds odd concerning poultry; yet, in South East Asia, systems exist in which ducks are made to graze on rice fields after harvesting. This system, with regular movements of animals from place to place between different fields, can be included under the heading ‘pastoral + transhumance.

For each type of system in each production species, the corresponding criteria should be set to:

- **0** if the system is locally absent or negligible for this species;
- **1** if the system is present and non-negligible for this species, but is not predominant;
- **2** if the system is predominant for this species. At least one system should be given a score of 2 for each of the species present (two systems may be scored 2 in a given species if their respective importance is equivalent).

Relevance of the production for food security in the country	Absolutely essential for national food security => 2	Cattle	
	Highly relevant => 1	Buffalo	
		Camels	
		Goats	
		Horses & donkeys	
		Sheep	
		Pigs	
		Ducks	
	Not relevant => 0	Turkeys	
		Geese and fowl	
		Chickens	
		Rabbits & hares	
		Bees	
	Other		

The above table is used to get an idea of the importance of each animal production species for food security as a potential supply of essential (from a quantitative as well as qualitative point of view, to prevent starvation and maintain nutritional balance) and non-substitutable food products either for specific sub-populations (particular way of living or ethnic groups), or for the whole national or regional population.



When no particular element is available to fill in the above table, the “Criticality for Food Security” indicator calculated above (see 5.1.1.1) may provide some indication. Thus, at least in countries where the substitution capacity is known to be limited, we assume that:

- A species with a criticality indicator of 1-2% will often be of definite relevance in the national food supply;
- A species with a criticality indicator superior to 5% could be regarded as absolutely essential.

5.1.3 - Local population and regulation data

The last tables in the country characterisation section are for human population figures (number of inhabitants, life expectancy) and specific regulation points. These elements will be used in subsequent steps of the analysis.

General population data	National / regional population	No.	
	Mean human life expectancy	Years	

The first series of data regard the characteristics of the national population. The required figures are:

- The total national (or regional) number of inhabitants;
- The mean human life expectancy in the country (or region).

These figures will be used in future steps to assess the local impact of a disease on human health, and can be found in databases (e.g. from WHO, United Nations, etc.) or in the World Factbook³.

Capacity to monitor wildlife health	Local wildlife observation (Wildlife Conservation Officers)	Yes=1 / No=0	
--	---	--------------	--

The last national general criterion considered in this module is the capacity of the country or region to perform effective monitoring of wildlife health, through established wildlife observation means (for example Wildlife Conservation Officers). If such means are actually present in the territory, this criterion should be set to **1**.

This value is liable to be used in the coming step of analysis of the local environmental impact of a disease, to moderate the impact of diseases that may severely affect wildlife species.

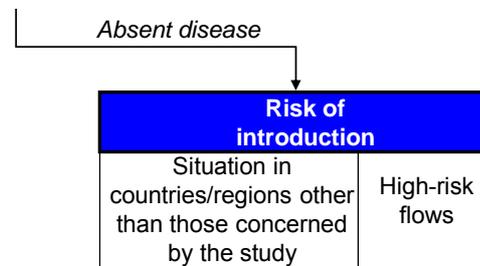
³ <https://www.cia.gov/library/publications/the-world-factbook/index.html>



5.2 - Case of a disease that is absent

For animal diseases that are absent in the studied territory, the objective of prioritisation is to determine those that should be subject to special surveillance and those that require a contingency plan in the event of an occurrence.

5.2.1 - Analysis of the risk of introduction



5.2.1.1 - Possible routes of introduction: infectious sources and high-risk flows

Depending on the characteristics of the disease, different infectious sources are possible, and thus different corresponding types of flows can be of relevant concern as regards the risk of introduction of a given animal disease in a particular territory (see Epidemiological profiling).

The categories defined hereafter only correspond to the main potential routes of introduction. Anecdotal or accidental occurrences may result from other mechanisms.



Figure 3 - High-risk sources and flows liable to introduce a disease into a territory

INFECTIOUS SOURCES		HIGH-RISK FLOWS							
		Trade		Migration		Human movements			
Animals	Livestock	X	<i>Waste in trade products</i>	X	<i>Transhumance</i>		<i>Pets travelling with their owners</i>		
	Wildlife			X					
	Pets	X				X			
Animal products	Raw	X							
	Processed	X							
	Swill and other waste of animal origin	X				X		<i>Food waste from travellers</i>	
Vectors	Arthropods	X		<i>Arthropods or rodents may be present in containers</i>	X	<i>Arthropods may infest animals or spread on their own</i>		X	<i>Arthropods may be present in vehicles</i>
	Others	X			X			<i>For migratory vector species</i>	
Human carriers								X	

5.2.1.2 - Country analysis

The next step is to assess whether or not there is a possibility of the disease being introduced into the territory by at least one of the infectious routes defined above. That is to say:

- If there is a likelihood of potentially infectious sources entering the territory;
- If there are regular flows from infected foreign territories to the studied territory.

Finally, the risk of introducing the disease in the territory is considered as:

- **HIGH** if at least one of the following statements are fulfilled:
 - The disease is present in at least one adjacent territory. In this situation, even if no regular flow exists, cross-border exchanges (official or otherwise) are always assumed to represent a substantial threat.
 - The disease is present in at least one distant foreign territory with which the territory under study has at least one type of regular high-risk flow with respect to the disease (trade, tourism, etc.; see table in part 1).
- **LOW** if the disease is absent in all adjacent territories and may only be present in distant foreign territories with which there is no significant exchange.



The tool includes a module dedicated to this step, organised as described below.

16. ADJACENT TERRITORIES	16.1. Presence of the disease in an adjacent territory	Yes=1 / No=0	
---	---	--------------	--

If the disease is actually present in at least one directly neighbouring territory, the corresponding criterion should be set to **1**. The corresponding risk of introduction will then be high, because the “High-risk flows” criterion is assumed to be fulfilled in any case for directly neighbouring territories.

17. DISTANT TERRITORIES	17.1. High-risk flows with at least one infected or possibly infected distant territory	No => 0 Anecdotal => 1 Common => 2 (See the manual for details about high-risk flows)	
------------------------------------	--	--	--

For distant countries, the “Presence of the disease in a distant territory” is assumed to be always fulfilled, because at least one place in the world may be infected. The determining factor is then whether or not high-risk flows (see definition in previous paragraph) are liable to exist between the studied territory and an infected territory. The corresponding criterion should be set to:

- **0** if there is no existing flow;
- **1** if only anecdotal flows may occur;
- **2** if there are regular and/or large-scale high-risk flows.

In some cases, there may be uncertainty about the animal disease status of a neighbouring territory or a territory with which flows may exist, or informal or unidentified flows may be suspected with a potentially infected area. It is then impossible to assess the real risk of introduction, and further statements will have to be considered cautiously. Moreover, among the recommended measures, attention will have to be paid to updating the corresponding knowledge.

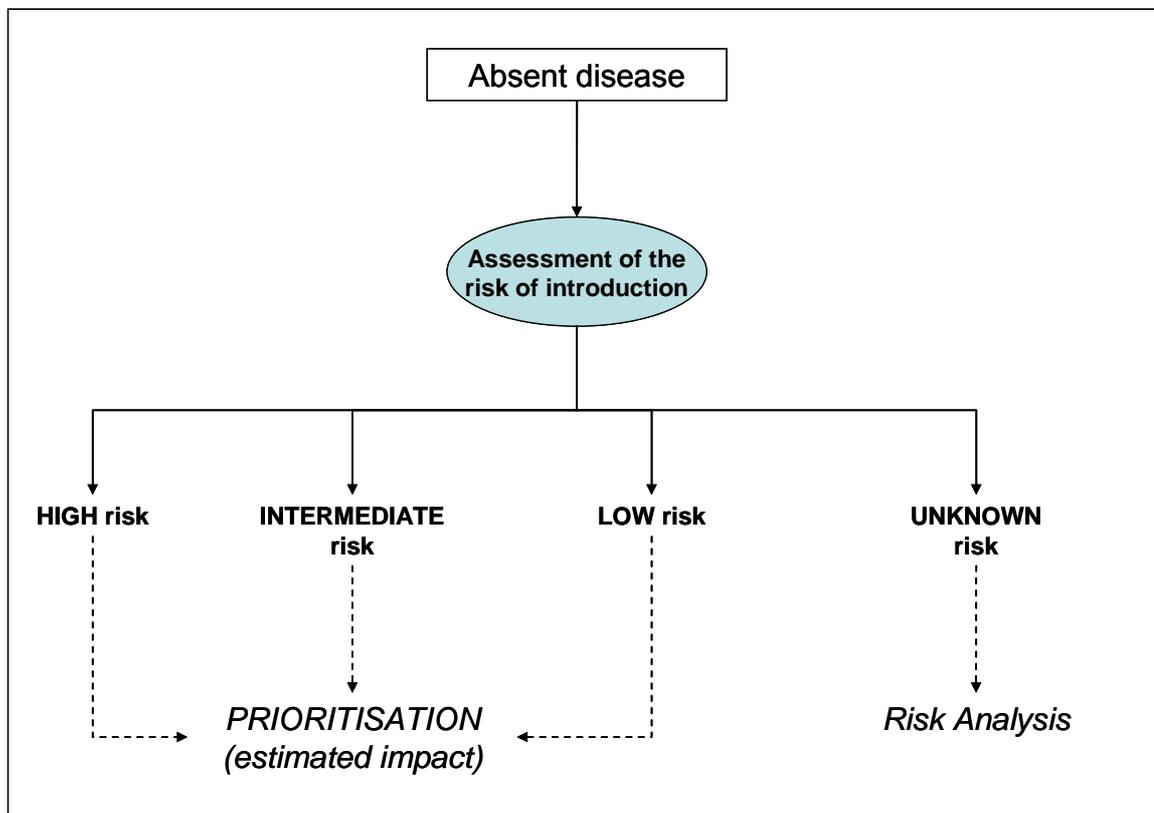


5.2.1.3 - Link with the prioritisation process

Once the risk of possible introduction of the disease in the country has been assessed, it will determine the following step of the analysis:

- If the risk is high, then the prioritisation process must be pursued to discuss the local nuisance potential of the disease, taking into account the previously studied characteristics of the country.
- If the risk is unknown, it should be considered potentially high. This will minimize the risk of neglecting a disease with the potential to cause outbreaks in the country. However, in addition to the prioritisation process, some recommendations can be made in this situation:
 - Carry out precise studies to characterize the real risk in terms of exchange flows;
 - Put in place monitoring of animal disease alerts in all neighbouring countries and trade partners, with permanent updating;
 - If it is justified, implement active surveillance systems at all potential introduction sites (border zones, control of imported products, etc.).
- If the risk is low, some recommendations can nevertheless be made. In particular, there should be permanent vigilance for possible changes in the risk components:
 - Animal disease alerts in neighbouring countries or trading partners;
 - Flows and statistics based on information from the customs services;
 - Surveillance of uncontrolled flows.

Figure 4 - Risk of introduction of a disease that is absent





Remarks:

- 1- *The assessment of the risk of introduction is relevant for diseases that are absent. A deeper analysis may be necessary to refine the prioritisation of diseases regarding risk. This can be done by weighting the aforementioned high-risk flows to reflect their importance and/or frequency.*
- 2- *If the risk of introduction is unknown (i.e. impossible to quantify), a risk analysis is necessary. Estimating the hypothetical impact in case of introduction (as for diseases that are absent with a known risk of introduction) may help to prioritise the risk analysis to be carried out.*
- 3- *For a disease that is present, it is possible to assess the risk of introduction in order to get an idea of the importance of territorial protection (to avoid reintroduction). However, in most cases, the disease is also present in neighbouring countries and therefore the risk will be high.*

5.2.2 - Prioritisation regarding the predictable local impact of the disease

The predictable impact of a previously absent disease if it enters the studied territory may be inferred from the corresponding modules of the tool. These modules are **the same as for diseases that are present**, but with estimated **theoretical data**; they will be presented in more detail in the following part concerning the case of diseases that are present (see 5.3.2). This analysis may provide qualitative and estimated information enabling the following points to be assessed:

- Predictable economic impact: this can be approximated by running the local economic impact assessment module, using estimated predictable elements of epidemiology in the event of a local introduction of the disease. These elements may be estimated by crossing the profiling data about the transmissibility disease and its clinical consequences in herds (and affected species) with the local characteristics of animal production systems (the respective importance of the different types of system may also be considered). The tool will then provide an estimated predictable impact regarding:
 - Direct impact on production, as a direct consequence of the aforementioned elements (epidemiology and clinical consequences);
 - Indirect impact on trade, depending on the local trade channels and certification systems;
 - Possible ripple or spill-over effect of the disease, according to the characteristics of local tourism, food industry and crop production (if linked to animal draught power or manure).
- Predictable impact on human health: here again, the corresponding module should be used, with estimated values of epidemio-clinical indicators.
 - Zoonotic impact: it may be deduced from the global zoonotic severity of the disease (morbidity and mortality), in parallel with local characteristics regarding the possible transmission to humans (proximity between humans and animals,



urbanisation, consumer habits, presence of vector species, particular customs, etc.).

- Food security issues: if the disease may harm species or production sectors that are essential and non-substitutable food supplies for a part (or the whole) of the local population.
- Predictable societal and environmental impact of the disease: both are rather complicated to predict because they depend on a huge number of parameters. However, indicative elements may be provided by the corresponding modules of the tool, provided they remain associated with a case-by-case analysis of the local context (regarding geography, political directions, popular concerns, socio-cultural background, etc.).

Once this analysis has been completed, the final output should be a recapitulative list of diseases that are absent, organised according to their respective risk of introduction in the country. Then, within each category, the predictable impacts lead to relevant priority levels. An example of the resulting table is provided below.

Priority ranking for diseases that are absent	High risk of introduction	Unknown or uncertain risk of introduction	Low risk of introduction
1	Disease A	Disease B	Disease D
2	Disease C	Disease H	Disease E
3	Disease F		Disease G

5.2.3 - Analysis of current strategies to prevent the introduction of high-risk diseases

5.2.3.1 - Border control

In order to properly address the prevention of diseases with the highest risk of introduction, it is essential to assess the control measures that are already in place in the country regarding the main high-risk flows (trade or transhumance of animals, exchange of animal products, circulation of vectors, etc.). For each one, it is necessary to consider:

- The risk of introducing the disease via this particular flow;
- The existence of a national or regional regulation concerning this flow type;
- The presence of skilled staff, aware of border control procedures;



- The availability of laboratory analysis capabilities in the event of a suspicion, provided either by:
 - National laboratories (depending on their capability and capacity); or
 - Foreign reference laboratories (preferably with a well-founded agreement and regular analysis plan);
- The proportion of exchanges in the flow that are currently under control, which implies:
 - Certification and control of imported live animals and animal products;
 - Control and traceability of movements of animals and products over the territory (including migration and transhumance);
 - Management and proper disposal of hazardous swill and waste;
 - Control of vectors that could potentially be introduced (disinsectisation, rat-proofing, etc.).

5.2.3.2 - Contingency plan to deal with a disease introduction or outbreak

In addition to the previous statements, the second major aspect of the protection mechanisms a country must have in order to manage disease-related risk is a proper and effective contingency plan, in order to implement a quick and efficient response in the event of an occurrence of the disease (introduction of the pathogen or outbreak). To provide the highest level of protection, a contingency plan must be written for at least each high-risk disease (and possibly for low-risk ones), and it must be kept up-to-date on a very regular basis.

The expected effectiveness of a contingency plan is closely dependent on what proportion of the aforementioned high-risk flows is actually controlled by the local Veterinary Services, as regards live animals, animal products, swill and waste, etc.

Moreover, the contingency plan has to be developed in parallel with an assessment of the local possibilities in terms of control measures, to ensure that the plan will be properly implemented should the need arise (see 5.4).



5.3 - Case of a disease that is present

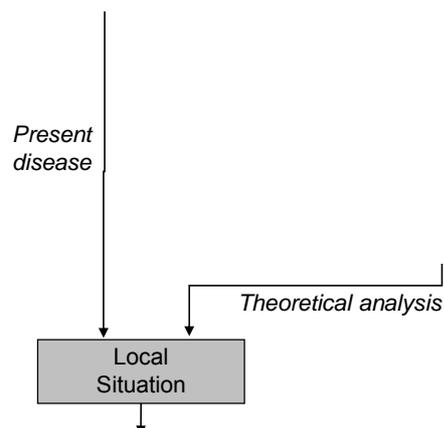
For diseases that are present in the territory (regular outbreaks or endemic with flare-ups), the objectives of the study are:

- To define and prioritise the diseases that should be subject to control policies;
- To identify relevant control actions to be implemented.

In order to approach the required data and elements for this step, the simplest way may be to start with the assessment of what is actually possible or currently done in the country, regarding the diseases in question.

The various test missions have shown that the best approach to address these points is in the form of open questions and discussions. Indeed, the issues and points raised in this step will be helpful to fill in the impact assessment modules (as well as the analysis of the control measures). Moreover, this kind of discussion is less disconcerting for the persons interviewed than addressing numerical criteria directly, and as a result the information collected is often more precise and trustworthy.

5.3.1 - Step 1: Analysis of the local disease surveillance strategy and current disease knowledge





To assess the actual impact of a disease in a country where it is present, one must obtain further information about its local epidemiology. The objective is here to estimate the quantitative and qualitative distribution of the disease in the territory, that is to say the number of outbreaks (or flare-ups) that occur each year, and its geographical distribution (in targeted zones or the whole territory).

Four sources can be relevant to obtain these epidemiological data, depending on the characteristics of the country and of the disease:

- Passive surveillance system, based on reporting of cases by private veterinarians and official veterinarians;
- Active surveillance systems, with particular investigation protocols for the diseases in question;
- Veterinary laboratory statistics;
- Data from human health systems, in the case of zoonotic diseases.

5.3.1.1 - Passive surveillance

5.3.1.1.1 - Organisation of passive surveillance

The organisation of a local passive surveillance system for the disease is linked to several points:

- *Is the disease subject to any form of passive surveillance?*

Of course, if it is not the case, no reliable data will be available this way.

- *Is the disease notifiable under local regulations?*

This is the only way to ensure that the corresponding data will be globally available.

- Assessment of the quality of passive surveillance:

- *Is clinical diagnosis a good element of identification of the disease by clinicians (private veterinarians or official veterinarians) in charge of the passive surveillance?*

Several scenarios are possible:

- ✓ Pathognomonic signs and well known diagnostic criteria;
- ✓ Differential diagnosis required: laboratory diagnostic services available locally;
- ✓ Differential diagnosis required: laboratory diagnostic services not readily available locally.

- *What is the proportion of reported cases?*

This will depend on the veterinary network, skills and training, awareness, etc.

- *Is sanitary inspection in slaughterhouses relevant for the disease and, if so, is it effective?*

This could be assessed through the inspection rate (ante- and post-mortem) of slaughtered animals:

- ✓ Inspection not relevant;
- ✓ Less than a 20% ante- and post-mortem inspection rate;
- ✓ 20 to 50% ante- and post-mortem inspection rate;



- ✓ 50 to 80% ante- and post-mortem inspection rate;
- ✓ More than 80% ante- and post-mortem inspection rate.

Finally, this approach should provide an estimate of the number of outbreaks actually reported to the Veterinary Services.

5.3.1.1.2 - *Analysis of the results of passive disease surveillance*

The objective is there to process passive surveillance data in order to get an idea of the following points:

- Number of cases reported to the Veterinary Services during the last year, corrected by a factor corresponding to the proportion of cases actually reported;
- Proportion of national livestock population (geographic distribution) exposed to the disease:
 - Entire territory;
 - Focal exposure of:
 - ✓ Less than 10% of the national livestock;
 - ✓ 10 to 50% of the national livestock;
 - ✓ More than 50% of the national livestock.
- Characterisation of the distribution of clinical outbreaks:
 - Sporadic (or isolated) clinical outbreaks;
 - Regular clinical outbreaks but limited in number (1-2% of epidemiological units);
 - Seasonal or geographic peaks of clinical outbreaks;
 - Significant proportion of epidemiological units (20-50%) involved in clinical outbreaks;
 - Majority (>50%) of epidemiological units involved in clinical outbreaks.

The results can be summed-up in a table as follows.

Geographical zone	Proportion of the local livestock susceptible to the disease	Number of reported outbreaks (suspicions)	Estimate of the proportion of outbreaks actually reported to the Veterinary Services	Characterisation of outbreaks: - Isolated cases - Regular cases - “Peaks” of cases - Majority of herds affected
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–



If passive surveillance data are sufficient, it is also of major interest to gather information about the clinical description of outbreaks, particularly to obtain a quantitative estimate of the respective importance of:

- Mortality;
- Abortions, stillbirths and infertility;
- Production losses.

5.3.1.2 - Active surveillance

For some diseases, active surveillance programmes may already be in place in the country. If this is the case, they can be a valuable source of information.

5.3.1.2.1 - Organisation of active surveillance

As for the passive surveillance, a few questions must be answered as regards the general organisation of active surveillance before one can interpret the results:

- *Is the disease (or has it been) subject to active surveillance in the country?*
 - If no, data from passive surveillance or other sources should be used;
 - If yes, it is important to consider the geographical scale of the active surveillance:
 - ✓ Surveillance in the entire territory;
 - ✓ Surveillance in only a part of the territory.
- *What surveillance method is (or was) used?*
 - Serology (systematic testing or sampling protocol);
 - Participatory epidemiological surveys.

5.3.1.2.2 - Results of active surveillance

If active surveillance data are available, the aim is to obtain the same type of epidemiological data as described above for passive surveillance:

- *What proportion of the national livestock (geographical distribution) is exposed to the disease?*
 - Entire territory;
 - Focal exposure of:
 - ✓ Less than 10% of the national livestock;
 - ✓ 10 to 50% of the national livestock;
 - ✓ More than 50% of the national livestock.
- *What is the distribution of clinical outbreaks?*
 - Sporadic (or isolated) clinical outbreaks;
 - Regular clinical outbreaks, but limited in number (fewer than 1-2% of epidemiological units);
 - Seasonal or geographical upsurge of clinical outbreaks;
 - Significant proportion of epidemiological units (5-20%) involved in clinical outbreaks;
 - Major proportion (>20%) of epidemiological units involved in clinical outbreaks.



- *What is the clinical description of animal cases?*
 - Mortality;
 - Abortions, stillbirths and infertility;
 - Production losses.

5.3.1.3 - Veterinary laboratories

Laboratories can be a third source of relevant epidemiological data. Laboratory tests may of course be a part of the aforementioned passive or active surveillance systems but, even if no such systems exist, laboratories can provide useful statistics.

5.3.1.3.1 - *National organisation of laboratories*

It is not always easy to assess the global effectiveness of a national laboratory network, as this will depend on various technical, human and logistic parameters:

- *What is the capability of local laboratories to perform the diagnostic tests for the disease?*
 - Are national laboratories able to implement the diagnostic techniques recommended by the OIE for the disease?
 - Are there enough, sufficiently skilled staff?
 - Is equipment and are buildings sufficient and adapted?
 - Are all the required consumables easily available?
 - Is the country involved in inter-laboratory trials to maintain its technical competence?
- *What is their ability to identify precisely the strains or types of pathogens?*
 - In a local reference laboratory;
 - In a foreign reference laboratory, with a regular collaboration programme;
 - No existing links with any foreign reference laboratories.
- *Is there a sufficient material capacity to perform the required analysis?*
 - Is the national budget for laboratories sufficient for them to carry out a sufficient number of analyses to maintain their technical skills and to ensure proper surveillance of the disease in the territory?
 - Does the country have the necessary logistics to obtain rapid confirmation in the event of a suspicion?

5.3.1.3.2 - *Interpretation of laboratory statistics*

The following data can be analysed in order to get an idea of the local epidemiology of the disease:

- *How many tests were laboratories required to carry out?*
 - To confirm suspicions;
 - In the context of survey protocols.
- *How many of the tested samples were confirmed positive?*



These results can provide an estimate of the number of outbreaks, as well as a confirmation of their geographical distribution.

5.3.1.4 - Disease surveillance in human health systems

In the case of a zoonotic disease, the last relevant source of data on the disease is human health statistics. The corresponding data are not usually well known by the Veterinary Services, and must therefore be obtained from the relevant human health/public health services and organisations. So, it is important to involve them in the team of experts (see. 5.1.1.1)

- *What is the number of reported human cases (and maybe their link with outbreaks in animals)?*
 - Is the disease (in humans) notifiable in the country?
 - What proportion of cases is reported?
 - Is there a laboratory confirmation of the diagnosis? (For example, in countries where both brucellosis and malaria are present, few cases of brucellosis are reported as they are often interpreted as malaria due to the absence of systematic laboratory confirmation.)
 - Are there any known under-reporting issues? Why?
- *What is the morbidity rate in humans, and the description of clinical signs?*
 - What are the clinical signs in humans?
 - What is the age of infected populations?
 - What is the geographical distribution of the disease in humans?
- *What is the mortality rate in humans?*
- *What is the risk of transmission to humans in the country?*
 - Eating habits of local populations;
 - Contacts between people and animals.

5.3.1.5 - Remark concerning the “open questions” approach

As stated above, an approach based on open questions and discussion is often a good starting point for the protocol in countries. In addition to these general data about the surveillance of the disease, it may also be applied to more technical issues such as control measures:

- *What kind of control measures are implemented in the country? Vaccination? Culling?*
- *What is the actual level of territorial protection in the country?*
- *Is it possible to implement vaccination policies in animals and/or in humans (availability of the vaccine, logistical means, etc.)?*
- *What is the cost and what are the consequences of health policies in the country?*

In the same manner as for epidemiological issues, information collected in this informal step may be very useful when filling in the corresponding modules of the tool.



5.3.1.6 - Conclusion of step 1

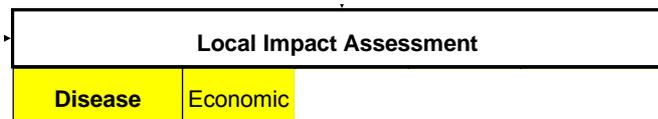
At the end of the epidemiological analysis, there are two possible scenarios:

- Sufficient data are available to estimate epidemiological indicators, and so the next step will be to perform an analysis of the actual impact of the disease in the country.
- Data are not sufficient or precise enough, in which case we recommend:
 - An indicative prioritisation based on the profiling data and general characteristics of the country;
 - Additional investigation measures, to refine the local knowledge about the disease:
 - ✓ Research and development;
 - ✓ Epidemiological inquiries;
 - ✓ Impact studies;
 - ✓ Other.



5.3.2 - Step 2: Impact study

5.3.2.1 - Economic impact



From here on, we will focus on the prioritisation method in parallel with the presentation of the corresponding modules of the tool.

5.3.2.1.1 - *Presence and frequency of the disease*

The first part of the economic impact assessment module deals with the description of the disease distribution in the country. According to the situation and to the results of the previous steps, this can either be determined from surveillance data or estimated. In all cases, the previously described dialogue step may considerably ease this analysis.

The goal here is to assess:

- If there is an endemic presence of the chronic disease in the entire territory;
- What proportion of the national livestock is exposed to the disease;
- What proportion of epidemiological units suffer from outbreaks or flare-ups of acute forms.



18.1. Incidence & prevalence of the disease	Is the infection continuously present in the country (endemics in at least one part of the territory)?	Endemic situation in at least one part of the country = 2 Sporadic introduction or emerging disease = 1 Not present = 0	
--	--	---	--

This first criterion aims at determining the level of presence of the disease in the territory. Several situations are possible, and correspond to the different possible values:

- **0** if the disease is absent in the country, with no or extremely rare cases of introduction;
- **1** if the disease is absent in the country but with sporadic introduced cases, or if the disease is considered to be emerging in the territory;
- **2** if the disease is present and endemic in at least one part of the territory.

18.2. Incidence & prevalence of the disease	Is the infection geographically restricted? Proportion of livestock animals in the infected area:	Not present = 0 <10% => 1 10-50% => 2 >50% => 3 100%=> 4	
--	---	--	--

This second criteria is linked to the previous one. Its goal is to estimate the proportion of livestock animals of susceptible species that is present in the infected (or potentially infected) area where the disease may be present (endemic zones, or zones exposed to regular introduced or resurgent cases). The criterion should be set to the value corresponding to this proportion of livestock exposed:

- **0** if the disease is absent;
- **1** if less than 10% of susceptible livestock may be exposed;
- **2** if 10 to 50% of susceptible livestock are in zones liable to be infected;
- **3** if more than 50% of susceptible livestock are in zones liable to be infected;
- **4** if all national livestock may be exposed to the disease.

It is important to keep in mind that the proportion of exposed livestock is not always correlated to the geographical extent of the disease. For example, if only a limited region is infected, but this region is a major farming zone for susceptible species, about 10% of the exposed territory may represent 80% or more of the national livestock.



18.3. Incidence & prevalence of the disease	Frequency of outbreaks in livestock in the infected area	Asymptomatic disease = 0 Sporadic cases => 1 Rare but regular flare-ups => 2 Seasonal or geographic peaks (or <5% of herds with clinical cases) => 3 5-20% of herds with clinical cases => 4 >20% of herds with clinical cases => 5	
--	--	--	--

This last criterion is different from the previous ones because it may be estimated for diseases present and for diseases absent. Indeed, the “Frequency of outbreaks in livestock in the infected area” represents the manner in which a disease will affect animals (of susceptible species) within a given infected zone. If the disease is present, this value may be deduced from cases reported in infected zones. If the disease is absent, it may be estimated from the characteristics of the disease and situations in infected countries. The value of this criterion should then be set to:

- **0** if the disease is asymptomatic: no clinical signs on infected animals;
- **1** if the disease may only cause sporadic (or a few anazootic) cases;
- **2** if there are relatively rare but regular flare-ups of the disease;
- **3** if the disease may only cause clinical cases in less than 5% of the herds within an infected zone, or if the disease shows seasonal or geographical peaks of severity;
- **4** if 5 to 20% of herds within an infected zone may express clinical illness;
- **5** if more than 20% of herds within an infected zone may express clinical illness.

The values of the previous criteria are then added and the sum is divided by 11 (sum of the maximal values) to obtain a total **score for the geographical distribution of the disease in the country** (score ranging from 0 to 1).

5.3.2.1.2 - *Estimate of the disease-related loss in an affected epidemiological unit*

The direct loss in production attributable to an animal disease is estimated through its clinical severity in the main production species. Three types of causes are assessed in separate tables, which contribute to the global direct loss in animal production:

- Mortality;
- Effects on reproduction;
- Clinical signs causing loss in production (growth retardation, decrease in milk yield, etc.).



19.1. Mortality in affected epidemiological units	No or only individual mortality => 0	Cattle	
		Buffaloes	
	Only young or weakened animals => 1	Camels	
		Goats	
	Mortality of adult breeding animals => 2	Horses & donkeys	
		Sheep	
	Mortality higher than the turn-over of animals in herds => 3	Pigs	
		Ducks	
		Turkeys	
		Geese and fowl	
		Chickens	
		Rabbits & hares	
		Bees	
		Other	

The first table deals with the estimated mortality in herds (on a yearly basis). For each of the main production species, a score is assigned depending on the level of mortality the disease may cause in an affected epidemiological unit:

- **0** if there is no or only individual mortality in the species;
- **1** if only young or weakened animals may die from the disease;
- **2** if there is significant mortality in adult breeding animals;
- **3** if the disease causes mass mortality, higher than the normal local turn-over rate of animals.



19.2. Abortions, stillbirths and infertility in affected epidemiological units	No or only individual reproduction issues => 0	Cattle	
		Buffaloes	
	Chronic infertility => 0.5	Camels	
		Goats	
	Significant abortions, stillbirths, or prolificity loss => 1	Horses & donkeys	
		Sheep	
		Pigs	
		Ducks	
		Turkeys	
		Geese and fowl	
		Chickens	
		Rabbits & hares	
	Bees		
	Other		

The second table deals with the estimated abortion, stillbirth and infertility rate induced by the disease in epidemiological units (on a yearly basis). A corresponding score is assigned:

- **0** if there are no or only individual reproduction issues;
- **0.5** if the disease causes chronic infertility in herds;
- **1** if there is a significant increase in abortions, stillbirths or prolificity loss due to the disease in affected epidemiological units.



19.3. Loss in production due to clinical signs in affected epidemiological units	Negligible => 0	Cattle	Meat	
			Milk	
			Skins	
	Discrete (0-10% of annual production) => 0.2	Buffaloes	Meat	
			Milk	
		Camels	Meat	
			Milk	
		Goats	Meat	
			Milk	
			Skins	
		Horses & donkeys	Meat	
		Sheep	Meat	
			Milk	
	Wool			
	Pigs	Meat		
	Ducks	Meat		
	More than 10% of annual production => 0.5	Turkeys	Meat	
Geese and fowl		Meat		
Chickens		Meat		
		Eggs		
Rabbits & hares		Meat		
Bees	Honey			
Other	Meat			
	Milk			
	Other			

Estimated disease-related loss in main production categories is determined on a yearly basis, by species and by types of production. A score is assigned depending on the corresponding importance:

- **0** if the loss is negligible;
- **0.2** if the clinical signs cause a noticeable (<10%) loss in production;
- **0.5** if there is a major (>10%) loss in production.

Finally, those indicators are cumulated by species and weighted by the respective importance of each species in the local production systems (see the “Characteristics of the



country” module), to obtain a global indicator of the direct economic impact of the disease on production in the country, as follows:

- The total clinical impact for each species is calculated by adding the values of all criteria for this species:
 - Mortality (from 0 to 3);
 - Consequences for reproduction (from 0 to 1);
 - Loss in production (from 0 to 0.5 for each species and each type of production within that species).
- This total clinical impact is then multiplied by the respective importance of the species in national animal production (from 0 to 4, see the “Characteristics of the country”, in chapter 5.1.1.1).
- The above step is repeated for all the affected species, and the results for each one are finally added and the sum is divided by 50 (value corresponding to the “worst case scenario”) to get the total score for **disease-related direct impact on national production** (score ranging from 0 to 1).

5.3.2.1.3 - *Indirect economic impact of the disease on trade*

In addition to the direct loss in production, the disease may cause major disruption of local and international markets, leading to indirect losses that in some cases may even exceed the direct losses. Each level is assessed by a specific table in the tool.



20.1. Disease-related hindrance to the international trade of the species concerned (sanitary status, certification schemes, etc.)	Negligible => 0 Particular requirements for trade (certification, additional processing, etc.) => 1 Risk of ban on exported animals or products => 2	Cattle	Live animals Meat Milk	
		Buffaloes	Live animals Meat Milk	
		Camels	Live animals Meat Milk	
		Goats	Live animals Meat Milk	
		Horses & donkeys	Live animals Meat	
		Sheep	Live animals Meat Milk Wool	
		Pigs	Live animals Meat	
		Ducks	Live animals Meat	
		Turkeys	Live animals Meat	
		Geese and fowl	Live animals Meat	
		Chickens	Live animals Meat Eggs	
		Rabbits & hares	Live animals Meat	
		Bees	Hives Honey	
		Other	Live animals Meat Milk Other	



The disease may hinder international trade because of the existence of particular sanitary statuses, certification schemes, etc. The table can be used to indicate for each species and each product if any such hindrance may result from the disease, and to quantify it with a score:

- **0** if the disease has only a negligible impact or no impact on international trade of the animals or products in question;
- **1** if the presence of the disease imposes particular measures for trade of the animals or products in question, such as traceability or certification schemes, but does not prevent this trade (except for infected compartments or zones);
- **2** if the disease may cause a loss of sanitary status and a total ban on international trade of the animals or products in question.

Remark: These aspects must be considered according to the local context and the expected reaction of the country's trading partners.

The effect on each species and product is then cumulated and weighted according to its respective importance in national exports (see the “Characteristics of the country” module), to obtain a score for the impact on international trade:

- For each production category in each species, the disease-related impact on international trade of the product in question (from 0 to 2) is multiplied by the respective importance of the product in national exports of animals and animal products (from 0 to 4, see the “Characteristics of the country” 5.1.1.1).
- The corresponding results for all products and species are then added and the sum is divided by 45 (“worst case scenario”) to get the total **score of disease-related indirect impact on international trade** (score ranging from 0 to 1).

20.2. Disease-related impact on local trade and movements	Disease with a non homogeneous distribution in the territory and subsequent zoning, perturbing local trade flows.	Negligible => 0	
		Discrete => 1	
		Noticeable => 2	
		Major perturbation => 3	

Concerning local trade, a semi-quantitative approach is proposed to define the potential impact the disease may have due to the reorganising of production sectors to avoid infected zones. Indeed, this aspect is too dependent on local particularities (geographical organisation of production sectors and trade flows, particular markets, etc.) for a quantitative model to be proposed. Thus, this criterion should be set to:

- **0** if the disease may only cause negligible effects on local trade and/or animal movements;
- **1** if the disease may cause rather discrete effects on local trade and/or animal movements (occasional restrictions, additional biosecurity measures, etc.);
- **2** if the disease may cause noticeable effects on local trade, for example because of important restrictions on local trade and/or animal movements;



- **3** if the disease may cause a major perturbation of local trade and/or animal movements, by completely disrupting trade flows of animals of important production species.

A corresponding **score for the disease-related impact on local trade and movements** is then calculated by dividing the selected value by 3 (score ranging from 0 to 1).

5.3.2.1.4 - Ripple and spill-over effects on the national economy

As in the case of trade, the disease may also have secondary indirect effects on other economic sectors, which must also be taken into consideration (here in a semi-quantitative manner):

- Impact on crop production;
- Impact on food industry;
- Impact on tourism;
- Impact on consumption.

21.1. Impact on crop production	Disease-related threat to local crop production through the loss of animal draught power.	Negligible => 0	0
		Noticeable => 1	
		Severe => 2	

The impact on crop production is all the more a concern that the local crop production systems depend on animal draught power, manure, or natural pollination (in the case of diseases affecting bees). This criterion should be set to:

- **0** if the disease may have no or negligible impact on crop production;
- **1** if the disease may cause noticeable losses in crop production;
- **2** if the disease severe harms crop production by dramatically reducing the available animal draught power, which may cause very serious losses (for example, during the last FMD epizootic in South-East Asia, the disease indirectly caused considerable losses in rice production⁴).

21.2. Impact on food industry	Disease-related threat to the local food industry through the loss in animal production.	Negligible => 0	0
		Noticeable => 1	
		Severe => 2	

The disease is liable to have an impact on the food industry if there is a significant food processing sector in the country. Indeed, it may be threatened by the sudden decrease in the supply of primary materials (even if substitution mechanisms may exist through importation).

⁴ Perry, Gleeson, Khounsey, Bounma & Blacksell: *The dynamics and impact of FMD in smallholder farming systems in South-East Asia: a case study in Laos*. Rev. sci. tech. OIE, 2002, **21** (3), 663-673.



In the same manner as for the previous criterion, a score should be given according to the expected loss:

- **0** if it is negligible;
- **1** if it is noticeable, but does not endanger the corresponding sectors of industry;
- **2** if it is severe, endangering the survival of the industries concerned.

21.3. Impact on tourism	Potential indirect impact of the disease on local tourism and related service activities.	Negligible => 0 Noticeable => 1 Severe => 2	0
--------------------------------	---	---	---

An indirect impact on tourism may also exist, if the disease is liable to modify the behaviour of tourists. Here again, the assessment is semi-quantitative and leads to a corresponding score:

- **0** if it is negligible;
- **1** if it is noticeable, but does not endanger the local tourism economy;
- **2** if it is severe, possibly endangering the survival of the tourism sectors concerned.

21.4. Impact on consumption	Potential disease-related impact on consumption	Animal disease only => 0 Non food-borne or endemic food-borne zoonosis => 1 New or recent food-borne zoonosis introduced or identified => 2	0
------------------------------------	---	---	---

The last possible disease-related side-effect on the economy is an impact on consumption, assuming that food-borne zoonoses will have a stronger impact than non food-borne zoonoses, particularly for diseases recently introduced or identified in the country (endemic zoonoses, even if they are food-borne, may benefit from a certain acceptance on the part of the public, and so produce a lesser impact on consumers' habits). For this reason, this criterion should be set to:

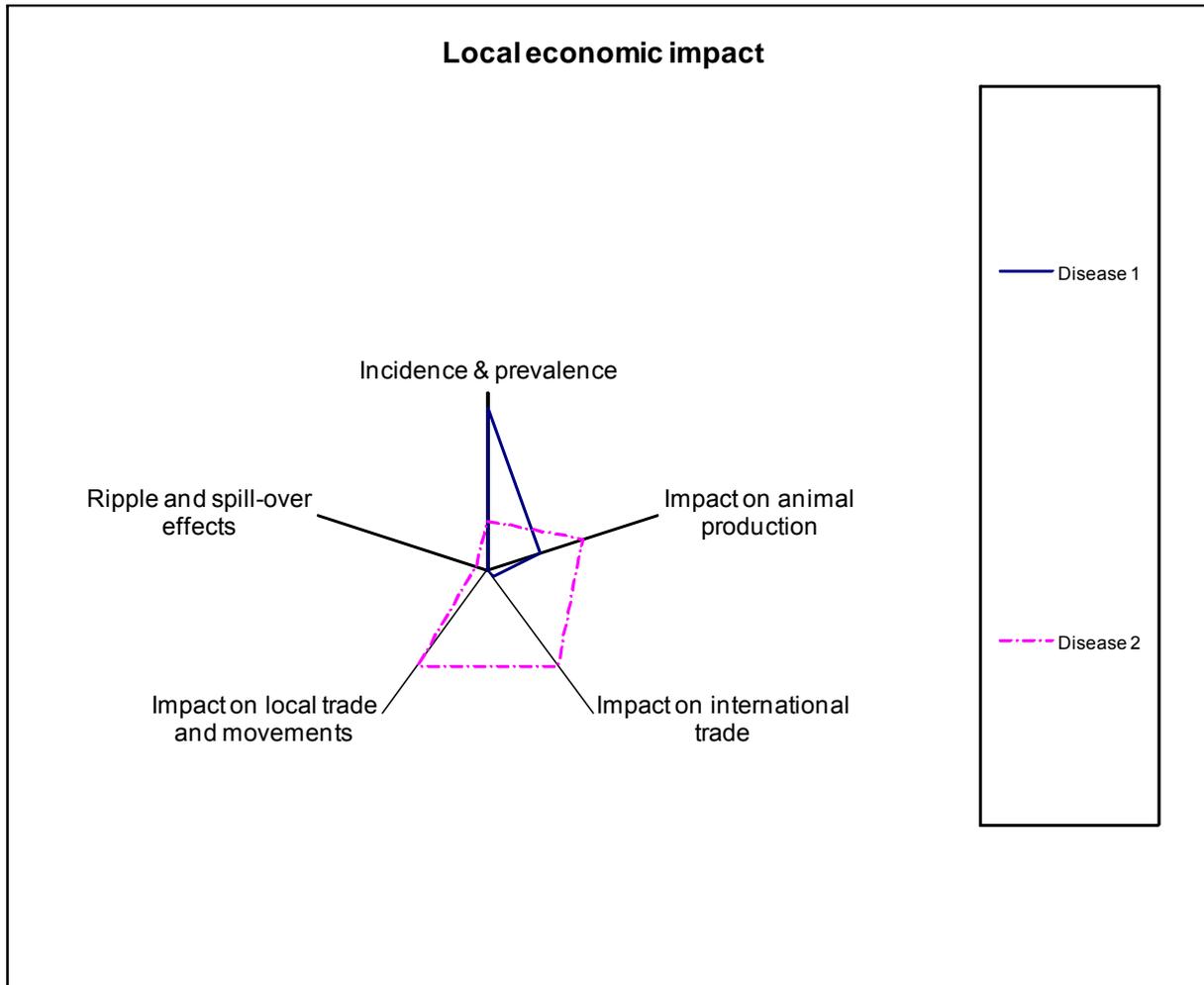
- **0** if the disease only affects animals;
- **1** if the disease is a zoonosis but is not liable to be transmitted to humans via food products of animal origin, or if the disease is a long-term endemic food-borne zoonosis;
- **2** if the disease is a potentially new or recent food-borne zoonosis.

All these ripple and spill-over effects are cumulated and weighted according to the characteristics of the country to provide a total **side-effects indicator** (ranging from 0 to 1), which is the sum of the values of the aforementioned four criteria, divided by 14 (sum of the maximal values).

5.3.2.1.5 - Visualisation of results

All the thematic scores described above are then compiled into a total **score for the local economic impact of the disease**, which is the average of their values multiplied by 10 (ranging from 1 to 10).

As was done for the visualisation of the different aspects of the disease profiles, a radar chart allows the visualisation and comparison of the different types of economic impact that may be caused by animal diseases in the studied country (or region).



This hypothetical example has been created with the local data used as an example in the “characteristics of the country” section, and relates to a country where animals are not used as a source of draught power and where the food industry is a significant sector and tourism a predominant sector.

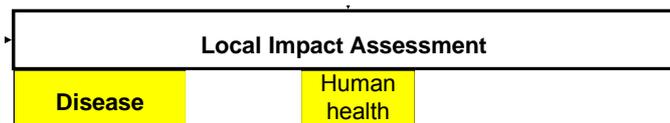
Disease 1 is an endemic disease (present on the whole territory) affecting all poultry species and about 10% of flocks. It may only cause mortality in young or weakened animals, but significantly reduces meat and egg production. Its presence has required the implementation of a certification system to certify the “disease free” origin of exported live animals, but it has a negligible impact on local trade and other economic sectors.



Disease 2 is a severe disease of cattle. It is an emerging disease with only sporadic cases, and has a seasonal cycle (is it vector-borne, and the vectors are only active in summer). It causes high mortality in affected herds and reduces production. Moreover, it is a contagious disease, causing a ban on all exports of live animals and products from susceptible species. It has also severely disrupted local trade circuits created noticeable supply problems for the corresponding food industries.



5.3.2.2 - Impact on human health



5.3.2.2.1 - Zoonoses

The first type of impact a disease may have on human health is through direct clinical expression in humans, in the case of zoonoses. In order to assess this impact, the tool compiles three groups of criteria:

- General data on the national population, and clinical elements about the disease expression and severity in humans;
- Information on possible animal-to-human transmission routes in the country;
- Any additional severity factors.

22.1. Zoonoses	Possible human form of the disease	Yes=1 / No=0	N/A
22.2. General data	Mean human life expectancy in the country / region	Years	75
	Total population	No.	20 000 000

The first series of criteria concerns general data about the disease and the country:

- The “Possible human form of the disease” line is automatically filled in by the tool (note the blue colour code) from the profiling modules. Its objective is simply to



improve the tool's readability by inactivating the fields corresponding to non-zoonotic diseases.

- The “General data” fields correspond to national (or regional) population data, automatically imported by the tool from the “Characteristics of the country” module (note the yellow colour code for general local data). As an example for the coming steps, we shall take as an example a country with a population of 20 million inhabitants, with a mean life expectancy of 75 years.

23.1. Human disease data	Mean incubation period	Days	0
	Mean duration of symptoms justifying sick-leave (in non-fatal cases)	Days	0
	% clinical cases / Infected	%	0.00%
	% fatal cases / Infected	%	0.00%

The following group of criteria corresponds to pathological data about human cases, including:

- The mean incubation period in humans (in days);
- The mean duration of clinical symptoms that would justify sick-leave in affected cases (in non-fatal cases);
- The proportion of cases with clinical illness among all infected people;
- The proportion of fatal cases among all infected people.

If these data cannot be found locally, it is possible to get an estimate of the human health impact of the disease by using corresponding global data (available through bodies such as the CFSPH or CDC, for example).

23.2. Local statistics for human cases	Mean age of newly infected people	Years	0
	Reported human cases	No. / year	0
	Reported fatal cases in humans	No. / year	0

The “Local statistics for human cases” section gathers local data from case reporting. The objective is to characterise human cases of the disease in the country, regarding:

- The mean age of newly infected people, as some diseases preferentially affect young people and others older people (this value is sometimes difficult to get precisely, but an estimate by expert appraisal may be sufficient in most cases to obtain relatively precise results);
- The number of reported human cases of the disease (per year);



- The number of human deaths due to the disease (per year).

Remark: The number of reported cases and deaths in humans should be calculated over several years, to limit the effect of short-term differences.

All the previously mentioned values are then compiled by the tool, to provide a series of indicators depending on the local characteristics of the disease:

- For diseases that are present and have been reported to cause cases in the country, the tool provides an estimate of the local disease-related direct impact on human health through three indicative values:
 - The simplified total DALYs, that is to say the total numbers of human life years lost (by death or disability) cumulated over all annually reported cases (see the principle of the calculation of simplified DALYs in *Appendix 4*).
 - The same value as above, expressed as the number per 100 000 inhabitants, in order to get an idea of the actual impact in terms of the local population;
 - A calculated **zoonotic impact indicator**, representing the relative local impact on human health by a 0 to 10 logarithmic score (see *Appendix 5* for details).
- For all diseases, the tool calculates a theoretical simplified DALY in affected people. It represents the average years lost (by death or disability) in a “standard” human case. This score is then divided by the mean human life expectancy in the country to get an **indicator of severity in humans** (ranging from 0 to a maximal theoretical value of 1).

24. THEORETICAL IMPACT	24.1. Transmissibility to humans in the local context	Contamination by direct close contact	1	Inexistent or impossible in the local context => 0 Only exceptional or accidental => 1 Common => 2	
		Contamination by indirect contact (fomites, tissues, equipment, etc.)	1		
		Water-borne disease	2		
		Food-borne diseases	2		
		Vector-borne diseases	3		
		Air-borne diseases	4		
		Interhuman transmission	4		
	24.2. Aggravating factor	"Epidemic" profile with peaks of human morbidity / mortality	Yes=2 / No=0		

The “Theoretical impact” table serves to gather more information in order to assess the theoretical impact of the disease on human health. Indeed, when zoonoses are locally absent (or are present in the territory but do not cause reported human cases), this theoretical value will be the only basis for comparison.



The “Transmissibility to humans” section is used to study the different possible routes of transmission of the disease to humans. Each one is weighed according to its potential for massive spread (from 1 to 4, see the fields in dark grey). Each corresponding box should then be set to the value corresponding to the respective risk of occurrence:

- **0** if the route does not exist or if it is impossible in the local context;
- **1** if the route is only possible in exceptional or accidental circumstances;
- **2** if transmission by this route may be common.

Note that the score given is relates to the local conditions only. For example, a vector-borne disease will be scored 0 if vector species cannot live in the country. The different scores and coefficients for each route are then compiled into a general index of transmissibility.

For each criterion, the value filled in is divided by 2 and multiplied by the corresponding weighting (1 to 4). The sum of the results for all criteria corresponds to an index of transmissibility.

An additional severity factor is to be considered if the disease may cause significant “peaks” in the number of human cases and deaths, as it will be more complicated for human health services to manage than episodic cases. If this is the case, the “Epidemic profile with peaks of human morbidity/mortality” criterion should be set to **2**.

The index of transmissibility is then divided by 4 (with a limited maximal value of 1), added to the value of the aggravating factor and the sum is divided by 6 (sum of maximal values) to get a total **score for the contagiousness of the disease in humans** (ranging from 0 to 1).

5.3.2.2.2 - Possible control measures in humans

In conjunction with the potential direct impact of the disease on human health, it is essential to assess whether or not solutions exist to control the disease.

25. PREVENTION & TREATMENT	25.1. Vaccine in humans	Global effectiveness and availability (see Profiling)	Effective vaccine => 1 Intermediate efficacy or availability => 2 No vaccine => 3	0
		Local situation	N/A => 0 Equivalent to global performance => 1 Lack of capacity in human health systems => 2	

With regard to vaccination in humans, the tool proposes a comparative approach between the global and local scales:

- The “Global efficacy and availability” criterion is a reminder of the profiling data about vaccination in humans. This field is automatically filled in (blue colour code).
- The “Local situation” criterion allows a local assessment of possible vaccination in humans in the country. It should be set to:



- **0** if the criterion is not applicable, that is to say if the disease is not a zoonosis;
- **1** if local possibilities in terms of vaccination are equivalent to global performance, that is to say if the country would be able to vaccinate its population effectively with the best available vaccine (even if none exists);
- **2** if the local human health system lacks the capacity to vaccinate people even if vaccines could be available.

25. PREVENTION & TREATMENT	25.2. Medical treatment in humans	Global efficacy and availability (see Profiling)	Total recovery without relapse => 1 Intermediate efficacy or availability (or emergency curative vaccination) => 2 No effective treatment => 3	0
		Local situation	N/A => 0 Equivalent to global performance => 1 Lack of capacity in human health systems => 2	

The “Medical treatment in humans” section is similar to the previous section on vaccination:

- The “Global efficacy and availability” criterion is a reminder of the profiling data about medical treatment in humans. This field is automatically filled in (blue colour code).
- The “Local situation” criterion allows a local assessment to be made of possible treatment in humans in the country. It should be set to:
 - **0** if the criterion is not applicable, that is to say if the disease is not a zoonosis;
 - **1** if local possibilities in terms of medical therapy are equivalent to global performance, that is to say if the country would be able to treat its population effectively with the best available treatment;
 - **2** if the local human health system lacks the capacity to treat people even if specific treatment could be available.

Both the vaccination and medical treatment criteria are compiled into a **score for prevention and treatment in humans**:

- For each group of criteria (prevention and treatment), the value from the profiling is modified depending on the “local situation” criterion:
 - If the “Local situation” is set to 0, the score for the corresponding group is set to 0;
 - If the “Local situation” is set to 1, the score for the corresponding group is equal to the “Global efficacy and availability” value (assuming that all forms of vaccination and treatment that are globally possible are possible in the country);
 - If the “Local situation” is set to 2, the score for the corresponding group is equal to the “Global efficacy and availability” value increased by one (corresponding to an aggravating factor due to the lack of means in human health systems).



- The results for both vaccination and treatment are added and the sum is divided by 8 (sum of the maximal values to get the total **score for prevention and treatment in humans** (ranging from 0 to 1).

5.3.2.2.3 - Food security issue

In addition to the aforementioned direct impact, animal diseases may cause a dramatic shortfall in food production, and so represent a threat to human health through food shortages.

26.1. Impact on the quality and/or quantity of food supply	Disease-related risk to essential and non-substitutable food production for human populations.	Negligible risk => 0	
		Slight nutritional imbalance or very limited susceptible population =>1	
		Significant risk of country-scale starvation or major nutritional imbalance => 2	

This section considers this aspect by determining whether or not the disease may cause a quantitative (by reducing the volume of production) or qualitative (by affecting nutritional balance) alteration of the food supply (for non-substitutable products). The corresponding criterion should be set to:

- **0** if the risk of a food security issue is negligible;
- **1** if the disease is liable to cause a food security problem for a very limited part of the population (in particular zones or ethnic groups);
- **2** if the disease may represent a threat to food security for the entire national population, with a significant risk of starvation.

The relevance of the different categories of animal production for national food security, which has been determined in the “Characteristics of the country” module, can provide indicative elements to fill in this criterion. For example, if the disease has a significant impact on a species that is marked 2 in the “Relevance of the production for food security in the country” criterion (see the “Characteristics of the country” module in chapter 3.1.2), there is a notable risk that it would threaten, at least partially, national food security. However, this may not be the case if the country has good possibilities of substitution (by local production or imports).

Finally, the value of this criterion is divided by 2 (maximal possible value), to get a **score for the disease-related impact on food security** in the country (ranging from 0 to 1).

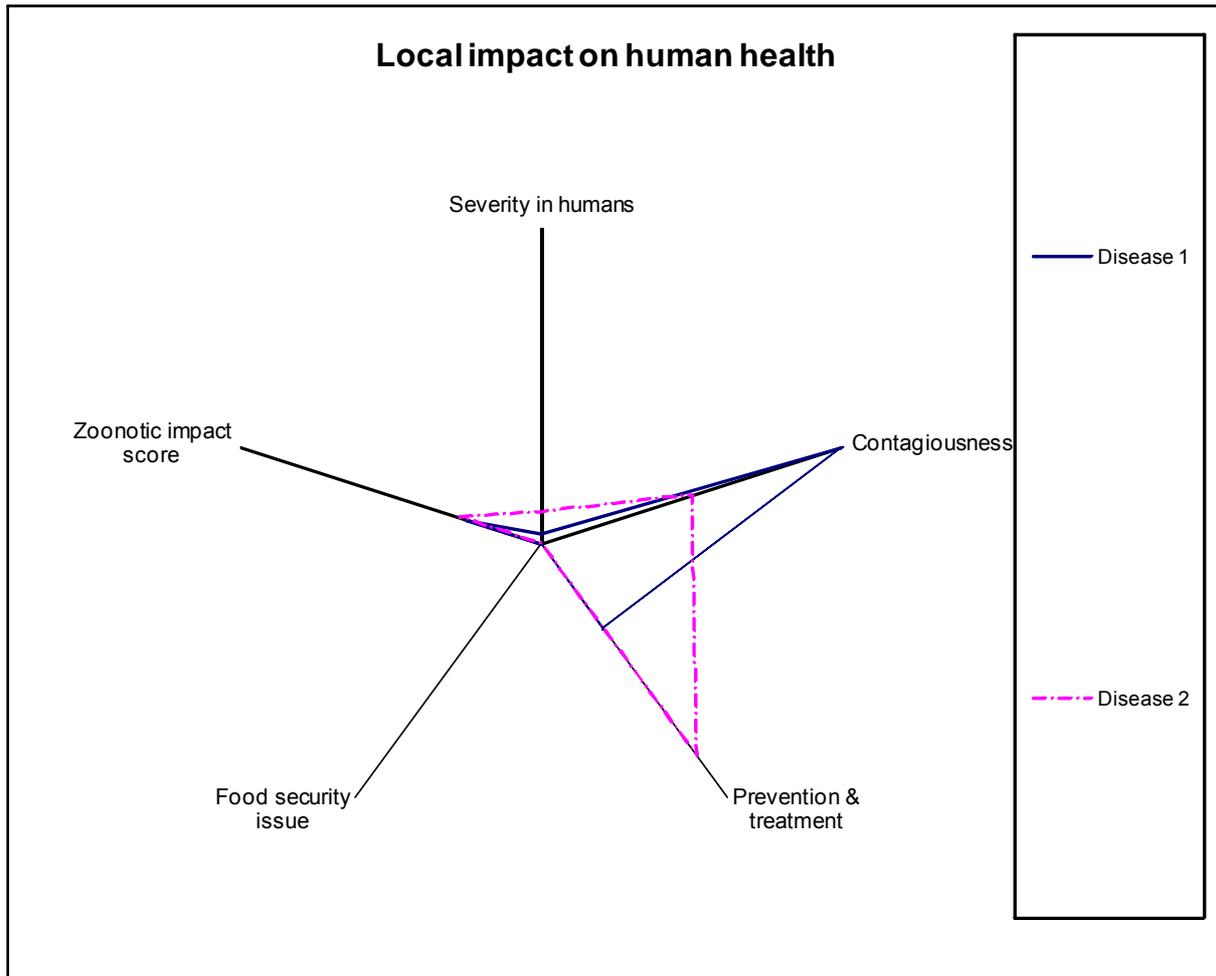


5.3.2.2.4 - Visualisation of results

All the thematic scores described above are then compiled into a total **score for the local disease-related impact on human health**, which is the average of their values multiplied by 10 (ranging from 1 to 10).

Remark: Note that for diseases that are absent (or diseases with no locally reported cases in humans), the “Zoonotic impact score” will always be 0.

As in previous chapters, the tool provides a radar chart enabling different zoonoses to be visualised and compared.

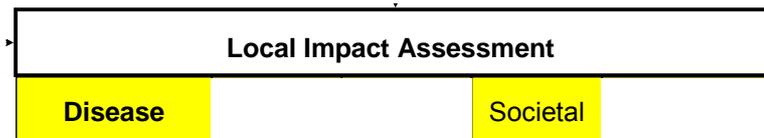


In this theoretical example, disease 1 is a zoonosis which is asymptomatic in half of all cases (5% of infected individuals may die from complications if left untreated). A hundred cases are reported annually in the country (hypothesis) of which only 1 is fatal. It is contagious by direct and indirect contact, including interhuman transmission. Both vaccine and treatment are effective and locally available and the disease causes no food security issues.

Disease 2 is quite rare but more severe: 80% of cases are symptomatic (causing signs for 3 months) and 30% may die. In the country, 10 cases are reported annually of which an average of 3 are fatal. The infection is food-borne and humans are a dead-end host. Neither vaccine nor treatment is available (although it could be feasible in the country), and the disease causes no food security issues.



5.3.2.3 - Societal impact



At the national level, animal diseases may in any case produce very important societal concerns that can sometimes evolve into crisis phenomena. However, this is subject to high variability depending on each local context, with significant differences in people's susceptibility to these topics. Three main axes will be considered here:

- Animal welfare;
- Crisis generation potential;
- Bioterrorism.



5.3.2.3.1 - *Animal welfare*

27. ANIMAL WELFARE	27.1. Nature of animal discomfort	Alteration of general state	Yes=1 / No=0	0
		Significant pain	Yes=1 / No=0	0
		Disablement	Yes=1 / No=0	0
		Chronically restricted breathing, feeding or sleep	Yes=1 / No=0	0
		Usually fatal	Yes=1 / No=0	0
	27.2. Duration of the animal welfare problem	Cases commonly involve permanent (long-term or lethal) alterations or relapses	Yes=2 / No=0	0

The analysis of the impact a disease may have in terms of animal welfare is related to:

- The nature of the possible disease-related discomfort or disablement caused in animals. Five types of animal health alterations are considered in this module ; the corresponding criteria should be set to **1** if the disease produces this kind of effect:
 - Alteration of general state;
 - Significant pain;
 - Disablement (physical or neurological);
 - Chronic effect on essential functions, such as breathing, eating or sleeping;
 - Death (we only take into account diseases that are commonly fatal; exceptional deaths may be ignored).
- The duration of the aforementioned discomfort (assuming that permanent disablement will be badly perceived). If long-term or lethal alterations of the animals' state are common with the disease, the corresponding criterion should be set to **2** (thereby providing incurable diseases or diseases causing frequent relapses with additional weighting).

Remark: As this section only considers the societal consequences of diseases, through the way they are perceived by the public, we have not included quantitative elements about the number of affected animals. Indeed, depending on the context, a disease causing traumatising symptoms (for example neurologic signs) in only a few animals may have a much stronger impact than a disease affecting many animals but with less significant symptoms.

The sum of these criteria is then divided by 7 (sum of maximal values), to get a total **score for the disease-related impact on animal welfare** (ranging from 0 to 1).



5.3.2.3.2 - Crisis potential

The second group of criteria in the societal analysis module concerns the “crisis potential” of the disease, that is to say the likelihood that it would create a major public concern. Indeed, depending on its characteristics and the national social context, a disease may in some cases generate a real crisis. The occurrence of such a phenomenon depends mainly on three “key components”:

- Is there a direct threat to humans (which will be all the more severe if transmission is easy and clinical severity is high, with the risk of fatality)?
- Is there a noticeable passive exposure to the disease, for example in the case of massive interhuman transmission, contamination of widely consumed food products, or high risk of vector-borne infection?
- Can the disease occurrence be perceived as having resulted from fraud, or may it have been profitable for any economic operator? In such cases the public will tend to react more strongly.

28. CRISIS GENERATION POTENTIAL	28.1. Perception of the threat to humans	Possible human cases	Yes=1 / No=0	0
		Direct exposure cases (occupational)	Yes=1 / No=0	0
		Indirect exposure cases (public)	Yes=1 / No=0	0
		Commonly fatal in human cases	Yes=1 / No=0	0

The first element of the disease’s crisis potential is the fact that it must be perceived as a threat by humans. The greater the likelihood that the disease will generate severe cases in a large number of people, the greater the likelihood that it will be perceived as a critical threat. Thus, several aspects are considered:

- The “Possible human cases” criterion corresponds to the zoonotic character of the disease. If human forms exist, this criterion should be set to **1**.
- The “Direct exposure cases” criterion should be set to **1** if the disease may be transmitted to humans by direct close contact (which means an enhanced risk for people who are occupationally exposed);
- The “Indirect exposure cases” should be set to **1** if the disease may spread easily to people without particular close contact with infected animals (for example vector-borne or food-borne transmission);
- The “Commonly fatal in human cases” criterion should be set to **1** if disease-related death in humans is not rare.

Note that these criteria are cumulative: as a result, a disease causing only exceptional human cases will get a total of 1, whereas an air-borne zoonosis (which means that it is easily transmissible to people in contact with animals as well as with the public) causing frequent death will get a total of 4.



28. CRISIS GENERATION POTENTIAL	28.2. Acceptability of the threat	Contagiousness	Animal-to-human transmission	Yes=1 / No=0	0
			Interhuman transmission	Yes=1 / No=0	0
		Food hazards	Food-borne zoonosis	Yes=1 / No=0	0
			Exposure to potentially contaminated products	Not a zoonosis; or consumption rare => 0 If more than 1 consumption/week => 1	0
		Environment	Vector-borne zoonosis	Yes=1 / No=0	0
			Human population exposed to vectors	Not a zoonosis; or exposure rare => 0 If >10% => 1	0

The second component of a disease’s potential to generate a crisis may be called the acceptability of the threat, that is to say that the people may accept or not the exposure to the risk. It is known that a risk is less acceptable for the people if it is not their own “choice” as vector exposure, than if it is their own choices or habit, as consumption of some food products that they could substitute. For example, a food-borne disease only present in particular products – and thus only concerning people who deliberately choose to consume those products – will be better accepted than a vector-borne disease liable to affect everyone regardless of their lifestyle.

- The first group of criteria in this category relates to the contagiousness of the disease, and the possible modalities of human contamination (from animals and/or from other humans):
 - If animal-to-human transmission is possible (even if it is indirect or vector-borne), the “Animal-to-human transmission” criterion should be set to **1**;
 - If interhuman transmission exists, the corresponding criterion should be set to **1**.
- The second criterion concerns food hazards. Food has strong psychological and social connotations, and thus food-borne diseases are particularly liable to cause major public concern:
 - If a disease-related food hazard exists, the “Food-borne disease” criterion should be set to **1**;
 - If the corresponding hazardous products are commonly consumed in the country (i.e. average consumption more than once a week), the “Exposure to potentially contaminated food-products” criterion should be set to **1**, to reflect a potential aggravating factor.
- The last group of criteria relates to the disease-related risk of contamination through the environment, and particularly by vectors. This modality may be perceived as one of the least acceptably because it is a permanent passive threat to people:
 - If a vector-borne transmission if possible, the “Vector-borne disease” criterion should be set to **1**.



- Moreover, if a significant part of the population (more than 10%) is believed to be commonly exposed to vector species, an additional weight should be given by setting the “Population exposed to vectors” criterion to **1**.

All the aforementioned criteria describing the “acceptability of the threat” are cumulative, so that if a disease is a zoonosis with both food-borne and vector-borne transmission, its total will be maximal for this section.

28. CRISIS GENERATION POTENTIAL	28.3. Perception of fraud	Economic operators involved in the threat	Yes=1 / No=0	0
	28.4. Authorities' preparedness	Up-to-date public awareness programme	Yes => 0 No => 1	0
	28.5. Amplifier effect of the media	Recent (< 3 years) occurrence of the disease reported in the media	Yes=1 / No=0	0
		Important disease-related media concern	Yes=1 / No=0	0

The last component of a crisis phenomenon is the public’s perception that the disease occurrence may be due to fraud. Indeed, in situations where economic operators may have profited from contingencies associated with the disease, people will be suspicious (wrongly or rightly) and are likely to react much more strongly. If such a disease-related concern is liable to occur in the country, the “Perception of fraud” criterion should be set to **1**. For example, during the BSE crisis in Europe, bone meal manufacturers were suspected of having caused the problem because they had changed their processes, even if all required studies had been carried out to assess the safety of the new process. Public opinion tended to consider that the change was made for economic reasons alone while neglecting possible safety issues (even if this was not the case).

Besides the aforementioned elements, the crisis generation potential of a disease may also be influenced by the state of public awareness, which itself depends on:

- The existence (or otherwise) of public awareness programmes, with updated and regular communication. If such programmes *do not* exist, the possible societal impact of the disease may be reinforced, and the “Authorities’ preparedness” criterion should be set to **1** (if such programmes exist, set it to **0**).
- The amplifier effect of the media:
 - If there has been another recent (i.e. within the past three years) similar crisis, set the “Recent occurrence of the disease reported in the media” criterion to **1**.
 - If the corresponding media effect is (or is likely to be) important, set the “Important disease-related media concern” criterion to **1**.

All these criteria are then added and the sum is divided by 10 (sum of maximal values) to get a total **score for the “crisis generation potential” of the disease**.



Remark: If a disease has no consequence in humans (i.e. if there is no human form of the disease), this score will be set to 0, given that a fundamental component of the crisis phenomenon is lacking.

5.3.2.3.3 - Bioterrorism potential

The last point about the societal impact of a disease is its capacity to be used as a bioterrorism agent.

29. BIOTERRORISM POTENTIAL	29.1. OIE/CFSPH classification of pathogens	Category A: High-priority	Yes=2 / No=0	0
		Category B: Secondary priority	Yes=1 / No=0	0
		Category C: Emerging agent or other listed pathogen	Yes=1 / No=0	0
	29.2. USDA List of Select Agents and Toxins	Listed pathogen	Yes=1 / No=0	0
	29.3. Local list	Existence of an official local list of potential bioterrorism agents, including the disease	Yes=1 / No=0	0

The corresponding module includes the following questions and statements:

- Is the disease listed in the OIE/CFSPH classification of pathogens (see *Appendix 2*) as a threat to humans? The criteria should be set to the corresponding value, depending on the pathogen’s category in the classification:
 - If it belongs to category A, set the corresponding criterion to **2** (the additional weight reflects the severity of the agents in this list);
 - If it belongs to category B, set the corresponding criterion to **1**;
 - If it belongs to category C, set the corresponding criterion to **1**.
- Is the disease listed in the USDA List of Select Agents and Toxins (see *Appendix 3*) as a threat to production systems? If this is the case, set the corresponding criterion to **1**.
- Is the disease included in a local list of potential bioterrorism agents? Here again, if this is the case, set the corresponding criterion to **1**.

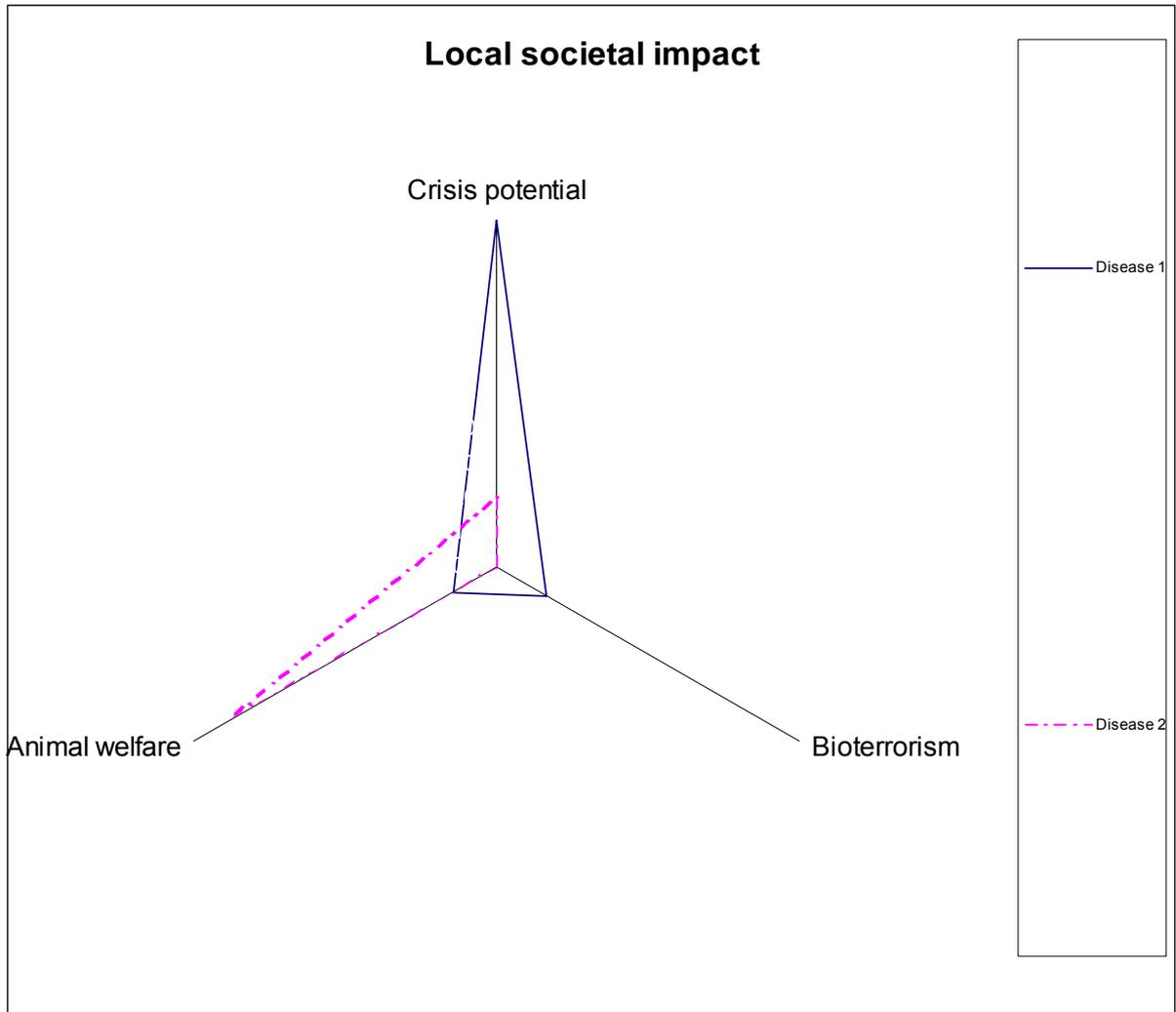
All the aforementioned criteria are added and the sum is divided by 6 (sum of maximal values) to get a total **score for the bioterrorism potential of the disease** (ranging from 0 to 1).



5.3.2.3.4 - Visualisation of results

All the thematic scores described above are then compiled into a total **score for the local societal impact of the disease**, which is the average of their values multiplied by 10 (ranging from 1 to 10).

A radar chart is provided in this module too, to visualise and compare the profiles of different diseases with regard to their potential local societal impact.

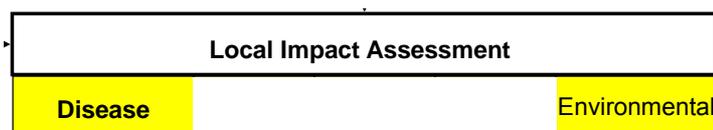


In this hypothetical example, disease 1 is relatively mild in animals (it only causes a brief alteration of the general state), but it is severe in humans (causing noticeable mortality and, through food-borne carriage, even affecting people not in close contact with animals). No interhuman transmission exists, though. Moreover, the hazardous food products are widely consumed in the country, and thus the disease is sometimes associated with a public perception of fraud by food industries (which are suspected of having insufficient safety procedures, even if this is not true). The authorities try to inform the public about this disease, but it is also a major concern in the media (a previous outbreak of this disease had occurred two years ago). Due to its human consequences and transmission, the disease is locally recognised as a possible bioterrorism agent.



Disease 2 is a severe disease in animals, causing alteration of general state, pain, physical disablement and in most cases death. However, it is not a zoonosis. No public information programme is in place, even if the disease has been regularly reported in the media during the past year. It is not recognised as a bioterrorism agent, either by the CDC and USDA or locally.

5.3.2.4 - Environmental impact



The last type of impact a disease may have is on the environment and relates to two aspects:

- Possible pollution issues with effluents in cases of massive mortality (causing disposal problems) or contamination of manure. In both cases, though, the existence of proper protocols and regulations will count as attenuating factors.
- Possible threat to biodiversity:
 - Animals, if the disease has a severe effect on wildlife (in this case, possible control measures in wildlife or specific monitoring systems will count as attenuating factors);



- Plants, if the disease jeopardizes natural pollination (e.g. if it affects bees) or fertilization functions.

30. POLLUTION: EFFLUENTS AND RESIDUES	30.1. Disposal of dead animals	Mortality	If >1% => 1	
		Existing protocol (adapted burial or incineration procedures)	Yes=0 / No=1	
		Corresponding regulation and control (exists and is applied)	Yes=0 / No=1	
	30.2. Manure processing	Contamination of manure	Yes=1 / No=0	
		Existing manure treatment process or disposal plan	Yes=0 / No=1	
		Regulation and control of effluent management (exists and is applied)	Yes=0 / No=1	

There are two main potential sources of pollution related to animal diseases:

- Biological pollution by cadavers of dead animals, if the disease-induced mortality is high:
 - If mortality is higher than 1% of the total animal population, set the “Mortality” criterion to **1**;
 - If **no** protocol is applied in the country for the proper disposal of dead animals, the “Existing protocol” criterion should be set to **1** as an aggravating factor;
 - If **no** local regulation exists (or is not applied) for dead animal disposal plants, the “Corresponding regulation and control” criterion should be set to **1** as an aggravating factor.

Remark: If the disease causes no significant mortality, the last three criteria will not be taken into account in the corresponding score.

- Pollution by contaminated biological effluents:
 - If the pathogen is excreted and liable to contaminate manure, set the “Contamination of manure” criterion to **1**;
 - If **no** process or plan for proper disposal of manure exists in the country, the “Existing manure treatment process or disposal plan” criterion should be set to **1** as an aggravating factor;
 - If **no** local regulation exists (or is not applied) for the management of biological effluents, the “Regulation and control of effluents management” criterion should be set to **1** as an aggravating factor.

Remark: If the disease causes no contamination of effluents, the last three criteria will not be taken into account in the corresponding score.



31. BIODIVERSITY ISSUES	31.1. Plant biodiversity	Significant threat to animal-dependent functions (pollination, fertilization...)	Yes=4 / No=0	
	31.2. Wildlife disease	Significant mortality or permanent injury in wildlife, susceptible to harm the natural balance of species.	Yes=4 / No=0	
	31.3. Capacity to monitor wildlife health	Local wildlife observation (Wildlife Conservation Officers)	Yes=0 / No=1	0
		Wildlife official surveillance system for the disease	Yes=0 / No=1	

The second group of criteria in the environmental module relate to possible disease-related threats to local biodiversity (animals or plants):

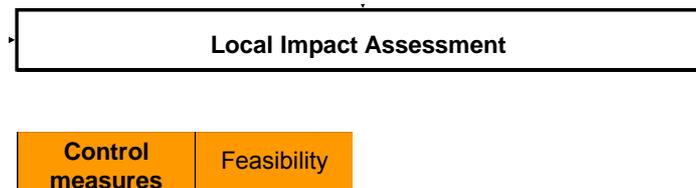
- When a disease is locally liable to significantly impact animal-dependent functions such as pollination, it may have noticeable consequences for plant biodiversity. In this case, the “Plant biodiversity” criterion should be set to **4** (the weighting is high because an impact of this kind is a major environmental issue with potentially huge side-effects).
- Similarly, if a disease affects wildlife and is liable to cause massive mortality and threaten entire populations, the “Wildlife disease” criterion should be set to **4** (the weighting is high because an effect of this kind is a potential threat to the natural balance of species over the whole territory).
- However, the potential impact of a disease on wildlife may be moderated if local wildlife monitoring structures are in place. Such structures may be able to carry out effective surveillance and detection of the disease in wildlife populations and possibly implement some safeguard measures. This will depends on two factors:
 - The presence of organised local wildlife surveillance, such as Wildlife Conservation Officers. This criterion is automatically filled in from the “characteristics of the country” module, as it is already included in the general national data (yellow colour code).
 - The existence of official surveillance for the disease in wildlife. This depends on whether or not the disease is the notifiable in the country and on the available means for surveillance in wildlife. If such surveillance ***does not*** exist in the country, the corresponding criterion should be set to **1** as an aggravating factor.

Remark: If the disease is not a significant threat to wildlife, these last two criteria will not be taken into account in the corresponding score.

All the aforementioned elements are added to get a total **score for the local environmental impact of the disease**. No graphic visualisation is provided here, as there are relatively few environmental impact criteria.



5.4 - Identification and characterisation of control measures



To address the selected priority diseases, adapted patterns of control measures have to be worked out. For this reason, it is essential to assess which measures should be locally relevant and available, regarding each one of these diseases. The corresponding module proposes an approach based on a limited number of fundamental points:

- Diagnosis and surveillance;
- Territory protection;
- Vaccination of animals;
- Medical treatment of animals;
- Biosecurity;
- Culling, disposal and financial compensation systems.

The approach used in this module is a sequential comparison, for each one of the aforementioned elements (except culling) between the global “state of the art” measures for the disease (those data are imported from the profiling steps) and the local feasibility of those measures. The hypothesis is that, in the best case scenario, local control options will be the



same as at the theoretical global scale: of course, if no vaccine exists for the disease, even a perfectly organised country with all the required means will not be able to implement a vaccination strategy; on the contrary, even if a good vaccine exists, a country that is not able to produce or buy it will be unable to vaccinate.

Remarks:

- 1- *The preliminary approach through open questions and discussions may provide valuable elements to fill in this section, particularly as regards the organisation of local structures concerning possible control measures (see 5.3.1).*
- 2- *This local characterisation is not only relevant for diseases that are present. Indeed, for diseases that are absent, it may allow the possibilities to be determined in terms of:*
 - ✓ *Territorial protection, to prevent any introduction of the disease;*
 - ✓ *Control strategies and procedures that are liable to be included in a contingency plan, in order to respond quickly and effectively in the event of the disease being introduced into the country (see 5.2.3.2).*

5.4.1 - Diagnosis and surveillance

Within the analysis of diagnostic and surveillance means, three aspects are distinguished:

- Clinical elements of diagnosis and organisation of the surveillance;
- Routine laboratory diagnosis (confirmation of cases);
- Laboratory techniques for precise identification of the pathogen and epidemiological monitoring of the disease.

32. DIAGNOSIS & SURVEILLANCE	32.1. Clinical diagnosis and surveillance	Global effectiveness and availability (see Profiling)	Not relevant => 0 Good => 1 Intermediate => 2 Poor => 3	0
		Local notification system	No regulation for the disease => 0 Notifiable disease => 1	
		Effectiveness of the local veterinary network	Adequate network of skilled operators with virtually all cases reported => 1 Occasional lack of staff or knowledge, with a majority of cases reported => 2 No effective surveillance network for the disease (or non notifiable disease) => 3	

The first group of criteria in this part relate to clinical diagnosis and surveillance systems for the disease:



- The “Global effectiveness and availability” line provides a reminder of the global effectiveness of the clinical diagnosis. This value is automatically imported from the profiling (blue colour code).
- The “Local notification system” criterion aims at defining whether or not the disease is a notifiable one in the studied country. This criterion should be set to:
 - **1** if the disease is notifiable in the country;
 - **0** if no particular regulation exists for the disease.
- The “effectiveness of the local veterinary network” aims at assessing the available human and technical means in the country to perform surveillance of the disease. It might be expressed as a “detection rate”, representing the proportion of cases that are reported in the country. This criterion ranges from 1 to 3 depending on the actual state of the veterinary network:
 - **1** if the network consists of enough skilled operators properly dispatched over the territory (more than 80% of cases reported);
 - **2** if the national network is sufficient to allow the reporting of most cases, but an occasional lack of staff, skills or means may result in some cases remaining undetected (between 50 and 80% of cases reported);
 - **3** if no surveillance network exists for the disease or if this network is clearly insufficient (less than 50% of cases reported), or if the disease is not notifiable (as in this case surveillance will be of poor efficiency).

32. DIAGNOSIS & SURVEILLANCE	32.2. Routine laboratory diagnosis (confirmation in live animals)	Global efficacy and availability (see Profiling)	Not relevant => 0 Good => 1 Intermediate => 2 Poor => 3	0
		Local technical capability	Skilled local structures (or contracts with foreign laboratories) with regular test assays => 1 Theoretical skills only => 2 No available skilled structure => 3	
		Local logistic capacity (sampling, transport, conservation, processing, etc.)	Sufficient logistical means to perform generalised active surveillance (with large numbers of tests) => 1 Confirmation of certain cases only => 2 Inability to collect, transport and/or process the samples properly => 3	

The following group of criteria concerns routine laboratory tests used to confirm clinical diagnosis or to perform systematic active surveillance in animals and herds. Three aspects are considered:

- The “Global efficacy and availability” criterion is a reminder of the efficacy and availability of existing laboratory diagnosis techniques, imported from the profiling (blue colour code).



- The “Local technical capability” criterion aims at assessing the technical ability of the country to perform the diagnostic tests, in terms of skills, reagents and equipment. This criterion ranges from 1 to 3 according to local contingencies:
 - **1** if the country possesses skilled local laboratories or has established contracts with foreign structures, with regular test assays to maintain their reactivity;
 - **2** if the country possesses the required theoretical skills and local laboratories, but no precise laboratory protocol is in place;
 - **3** if there are no skilled local structures (and no contracts with foreign laboratories).
- The “Local logistic capacity” criterion aims at measuring the ability of the country to manage the collection, transport, conservation and processing of large amounts of samples in the event of active surveillance in animals. This criterion ranges from 1 to 3 according to the local capacity:
 - **1** if the country has sufficient logistic means to perform generalised active surveillance;
 - **2** if the country may only be able to perform occasional screening in infected areas;
 - **3** if it is not possible to guarantee proper collection, transport (including conservation) and processing of samples in any part of the country.

32. DIAGNOSIS & SURVEILLANCE	32.3. Epidemiological laboratory resources for identification of pathogens: confirmation tests, serotyping, identification of the strain, etc.	Global effectiveness and availability (see Profiling)	Not relevant => 0 Good => 1 Intermediate => 2 Poor => 3	0
		Local technical capability	Skilled local structures (or contract with foreign laboratories) with regular test assays => 1 Theoretical skills only => 2 No available skilled structure => 3	
		Local logistic capacity (sampling, transport, conservation, processing, etc.)	Sufficient logistical means to confirm ALL suspicious cases => 1 Confirmation of certain cases only => 2 Inability to collect, transport and/or process the samples properly => 3	

The last group of criteria on diagnosis and surveillance relate to laboratory techniques to identify the pathogen. These techniques include isolation of the pathogen, serotyping, determination of the strain, etc. As in the case of diagnostic tests, three aspects are considered:

- The “Global effectiveness and availability” criterion is a reminder of the effectiveness and availability of existing laboratory identification techniques, imported from the profiling (blue colour code).



- The “Local technical capability” criterion aims at assessing the technical ability of the country to identify and study the pathogen, in terms of skills, reagents and equipment. This criterion ranges from 1 to 3 according to local contingencies:
 - **1** if the country possesses skilled local laboratories or has established contracts with foreign structures, with regular test assays to maintain their reactivity;
 - **2** if the country possesses the required theoretical skills and local laboratories, but no precise laboratory protocol is in place;
 - **3** if there are no skilled local structures (and no contracts with foreign laboratories).
- The “Local logistic capacity” criterion aims at measuring the ability of the country to manage the collection, transport, conservation and processing of large amounts of samples in the event of active surveillance in animals. This criterion ranges from 1 to 3 according to the local capacity:
 - **1** if the country has the logistic means to perform a complete identification of the pathogen in all suspicious cases, so as to perform an exhaustive epidemiological study of the disease in the country;
 - **2** if the country may only be able to perform occasional analyses in a limited number of cases;
 - **3** if it is not possible to guarantee proper collection, transport (including conservation) and processing of samples in any part of the country.

All the aforementioned criteria are then compiled into a local **score for the diagnosis and surveillance of the disease**:

- An intermediate score is calculated for each group of criteria:
 - The values of the criteria in the “Clinical diagnosis and surveillance” group are added and the sum is divided by 6 (sum of the maximal values);
 - The values of the criteria in the “Routine laboratory diagnosis” group are added and the sum is divided by 9 (sum of the maximal values);
 - The values of the criteria in the “Epidemiological laboratory resources” group are added and the sum is divided by 9 (sum of the maximal values);
- The average value of these three results is calculated to get the diagnosis and surveillance score.



5.4.2 - Trade and movement measures

The second axis of possible control measures in the country regards territorial protection. Indeed, both for diseases that are present and for those that are absent, it is essential to ensure that the disease will not be introduced (or reintroduced) into the territory.

33. TRADE AND MOVEMENT MEASURES	33.1. Global effectiveness and relevance (see Profiling)	Live animals (including wildlife)	Secure (no possible transmission) => 0	0
		Raw products (including food and feed)	Possible inspection, sanitation or treatment (technique certification) => 1	0
		Processed products (including food and feed)	Certification of status regarding origin (traceability) => 2	0
		Semen & embryos (eggs)	Unavoidable risk => 3	0
		Possible contamination of waste food and feed		0
		Others (vectors, human carriers, etc.)		0
	33.2. Local feasibility	Live animals (including wildlife)	Good surveillance of all exchange flows with proper sanitary measures => 1	
		Raw products (including food and feed)	Only partial control of transboundary exchanges => 2	
		Processed products (including food and feed)	No particular control => 3	
		Semen & embryos (eggs)		
		Possible contamination of waste food and feed		
		Others (vectors, human carriers, etc.)		

The principle of this section is to operate a systematic comparison between the risk of introduction associated with each possible route, and the local level of control of corresponding transboundary trade and movement.

- The first part of the table is a reminder of all possible introduction routes, and their respective level of risk regarding the disease (these data are imported from the profiling):
 - Live animals (including wildlife, which may increase the risk due to migratory movements);



- Raw animal products;
- Processed animal products (including food and feed);
- Semen, embryos and eggs;
- Possible presence of the pathogen in waste food and feed (frequently associated with human movements);
- Other sources that may be difficult to control, such as human carriers, or vectors (disinsectisation, for example, is not always done and is rarely totally efficient).
- The bottom part of the table allows each of the aforementioned routes to be associated with the corresponding level of control in the country. The corresponding criteria range from 1 to 3:
 - **1** if the corresponding exchange flows are under control, with adapted sanitary measures;
 - **2** if there is only partial control of the transboundary exchanges by this route;
 - **3** if there is no particular control for this route in the country.

All the aforementioned criteria are then compiled into a local **score for territorial protection against the disease**:

- For each possible route of introduction:
 - If the route is safe (profiling criterion set to 0), it will not be taken into account;
 - If the route presents a risk of disease introduction it is given a score equal to the sum of the two corresponding (profiling and local) criteria;
- The scores corresponding to all routes are then added and the sum is divided by 36 (sum of maximal values) to get the local score for territorial protection (ranging from 0 to 1).



5.4.3 - Vaccination

Vaccination may be used as a preventive measure for diseases that are absent but also as part of an eradication or control programme for diseases that are present.

34. VACCINATION	34.1. Vaccine in animals	Global efficacy and availability (see Profiling)	Good => 1 Intermediate => 2 Poor (no available vaccine) => 3	0
		Local supply of vaccines	Sufficient to allow national mass vaccination programmes => 1 Sufficient for individual herd vaccination in flare-ups => 2 Insufficient vaccine (or no vaccine or only unauthorized vaccine) => 3	
		Quality of locally available vaccines	Equivalent to the theoretical optimal quality => 1 Lower quality than optimal vaccines => 2 Ineffective vaccine or no locally produced vaccine (or no existing or authorized vaccine) => 3	
		Logistic means for vaccination (transport, conservation, operators, etc.)	Logistic means allowing national mass vaccination programmes => 1 Logistic means sufficient to manage local vaccination plans in outbreaks only => 2 No operational logistic means for vaccination in herds (or no existing or unauthorized vaccine) => 3	

This section proposes a comparative approach with on the one hand the global possibilities in terms of vaccines, and on the other hand the local capacity to implement vaccination programmes.

- The “Global efficacy and availability” criterion provides an indicator of the existence and efficacy of vaccines against the disease in animals. These data are imported from the profiling.
- The “Local supply of vaccine” criterion characterises the ability of the country to obtain vaccine stocks. This criterion should be set to:
 - **1** if the country can readily produce or buy a sufficient quantity of vaccine to perform a mass vaccination programme in animals;
 - **2** if the country can only mobilise enough vaccine for vaccination of individual herds/flocks in outbreaks;
 - **3** if the country is unable to obtain the vaccine or if no vaccine exists or is locally authorised.
- The “Quality of the available local vaccines” criterion characterises the ability of the country to obtain good quality vaccines. This criterion should be set to:
 - **1** if the country can produce or buy vaccines of the optimal theoretical quality (even if the best vaccine that exists is not totally effective);



- **2** if the country can only produce or buy vaccines of lower quality than the optimal vaccine;
- **3** if the country is unable to obtain the vaccine or if no vaccine exists or is locally authorised.
- The “Logistic vaccination means” criterion characterises the ability of the country to mobilise the logistic means to implement vaccination. This criterion should be set to:
 - **1** if the country has good logistic means enabling national mass vaccination programmes to be carried out;
 - **2** if the country has limited logistic means that are only sufficient for vaccination of individual herds/flocks in outbreaks;
 - **3** if the country has no particular logistic means for vaccination in animals (or if there is no existing or authorised vaccine).

All the aforementioned criteria are then added and the sum is divided by 12 (sum of maximal values) to get a **local vaccination score** (ranging from 0 to 1).

5.4.4 - Medical treatment

35. MEDICAL TREATMENT	35.1. Medical treatment in animals	Global efficacy and availability (see Profiling)	Good => 1 Intermediate => 2 Poor (no available treatment) => 3	0
		Local feasibility (only for specific treatments)	Locally affordable and available treatment for all cases => 1 Expensive or delicate treatment, for particular animals only => 2 No or unauthorised treatment => 3	

The study of locally possible medical treatments for the disease in animals is organised as for the previous points:

- The “Global efficacy and availability” criterion is a reminder of the theoretical existence and efficacy of specific medical treatments, automatically imported from the profiling (blue colour code).
- The “Local feasibility” criterion ranges from 1 to 3 according to the local ability to put in place medical treatment for affected animals:
 - **1** if there is an affordable and effective specific treatment for all cases;
 - **2** if the treatment is only possible for particular animals (for reasons of cost or availability);
 - **3** if no treatment exists or is locally authorised.

All the aforementioned criteria are then added and the sum is divided by 6 (sum of maximal values) to get a **local treatment score** for the disease (ranging from 0 to 1).



5.4.5 - Biosecurity

36. BIOSECURITY MEASURES	36.1. Biosecurity in herds	Global effectiveness and availability (see Profiling)	Not relevant => 0 Good => 1 Intermediate => 2 Poor => 3	0
		Local feasibility	Good biosecurity in herds and good farmer awareness in general => 1 Noticeable proportion of herds with insufficient biosecurity => 2 Globally insufficient biosecurity => 3	

For certain diseases, depending on their characteristics, biosecurity may be a good control option. Thus, it must be taken into consideration among the possible local control measures. The organisation of this section is the same as for previous sections:

- The “Global effectiveness and availability” criterion is a reminder of the theoretical possibilities in terms of biosecurity to control the disease. These data are automatically imported from the profiling (blue colour code).
- The “Local feasibility” criterion ranges from 1 to 3 according to the local level of biosecurity in herds:
 - **1** if the average level of biosecurity in local herds is good, in association with a good level of farmer awareness;
 - **2** if there is quite a good level of biosecurity in the country, but with a noticeable proportion of herds where it is known to be insufficient;
 - **3** if biosecurity in herds is generally poor in the country.

All the aforementioned criteria are then added and the sum is divided by 6 (sum of maximal values) to get a **local biosecurity score** for the disease (ranging from 0 to 1).

5.4.6 - Compensated culling

The approach for culling is slightly different from the approach used in previous sections. In theory, culling would be possible in all cases to control a disease. However, it may not always be relevant, depending on each particular local situation. For this reason, the criteria in this section do not include a global appraisal.



37.CULLING / DISPOSAL & COMPENSATION SYSTEMS	37.1.Culling & disposal	Relevance	Not relevant => 0 Relevant selective or mass culling in outbreaks => 1	
		Technical capacity	Local ability to manage mass culling and disposal of numerous herds => 1 Only selective culling or limited number of animals => 2 No organised culling and disposal facilities => 3	
		Regulatory framework	Specific regulation, with adapted management and control => 1 Elements of regulation, but non specific or with little control => 2 No regulation => 3	

The first group of criteria in this section concerns the relevance and feasibility of culling to control the disease locally:

- The “Relevance” criterion aims at determining if culling of infected animals or herds may be a locally relevant solution to control the disease, which may depend on the disease’s characteristics and presence in the territory (for example, mass culling will not be feasible if the majority of herds in the whole country are infected). If this is the case, this criterion should be set to **1**; otherwise it should be set to **0**.
Note that if culling is judged irrelevant here, all corresponding criteria will be set to 0 and only other types of control measures will be considered in the final result.
- The “Technical capacity” criterion aims at measuring the ability of the country to manage the culling of large numbers of animals for disease control purposes. It ranges from 1 to 3:
 - **1** if the country has the technical capacity to properly manage mass culling and disposal of a large number of animals;
 - **2** if the country may only be able to manage selective culling of a limited number of animals;
 - **3** if the country has no organised culling and disposal facilities.
- The last point concerning culling is about regulation. To ensure the relevance and efficiency of a culling policy, culling operations must be precisely regulated and controlled. The corresponding “Regulatory framework” criterion ranges from 1 to 3 according to the existence of local regulation and control:
 - **1** if there is a specific local regulation for culling for disease control purposes, with suitably adapted management and control systems;
 - **2** if local elements of regulation exist for culling, but are not specific to animal disease emergency situations with little control;
 - **3** if no regulation exists for culling in the country.



37.CULLING / DISPOSAL & COMPENSATION SYSTEMS	37.2. Compensation systems for livestock species	Financial means	Adapted compensation systems, with provisional reserve funds => 1 Insufficient compensation mechanisms, or insufficient reserve funds => 2 No compensation => 3	
		Regulatory framework	Precise regulations, associating culling and compensation policies => 1 Only generic animal health regulation => 2 No compensation systems in local regulations => 3	

The second group of criteria in this section relates to financial compensation systems in the event of culling:

- The “Financial means” criterion defines whether or not monetary systems are in place in the country to guarantee proper compensation for farmers if their herds are culled for disease control purposes. This criterion ranges from 1 to 3:
 - 1 if adapted compensation systems are in place in the country, including organised provisional reserve funds to ensure a good reactivity;
 - 2 if existing compensation systems or corresponding funds theoretically exist but are actually insufficient;
 - 3 if no compensation system is in place for the disease.
- The “Regulatory framework” criterion determines whether or not financial compensation for farmers is included in the national (or regional) sanitary regulation. This criterion ranges from 1 to 3:
 - 1 if precise regulation exists associating culling and compensation mechanisms;
 - 2 if there is only generic animal health regulation for culling and compensation with no precise disposition for the different diseases;
 - 3 if no compensation system is included in local sanitary regulations.

Remark: If culling has been judged irrelevant in the country for the disease, the above criteria relative to compensation will also account for 0 in the corresponding score (as there is no use for compensation if there is no culling).

All the aforementioned criteria are then added and the sum is divided by 12 (sum of maximal values) to get a **local culling and compensation score** for the disease (ranging from 0 to 1). As we said, if culling is not relevant, this score will be 0.

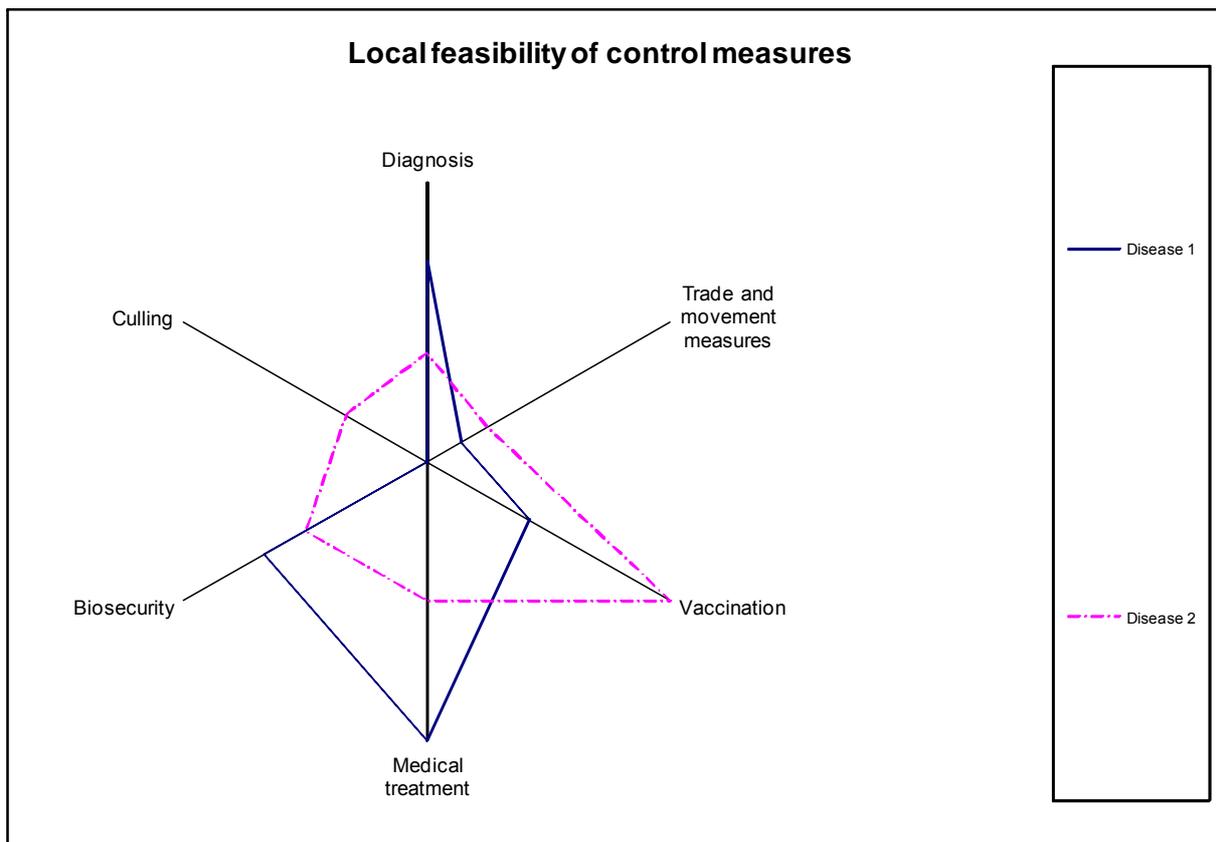


5.4.7 - Visualisation of results

All the thematic scores described above are then compiled into a total **score for local feasibility of control measures for the disease**, which is the average of their values multiplied by 10 (ranging from 1 to 10).

In this module, the higher the score for a type of control measure, the more difficult it will be to resort to it to control the disease (measures with a maximum score are locally unusable for the disease). Similarly, the higher the total score for local feasibility of control measures, the more difficult it will be to implement effective control strategies for the disease.

As with previous modules, a visualisation of those results on a radar chart is provided.



The theoretical diseases used here as examples are the same as for the profiling of control measures (see 3.3.2).

Disease 1 is not notifiable in the country. No laboratory test exists to confirm the disease in live animals, but the country has the technical skill to identify the pathogen (although there is no established protocol with regular assays). Possible transboundary routes for introduction of the pathogen via movements of live animals and raw products are well controlled. Vaccination is possible, and there are sufficient means to put in place a national vaccination programme but no treatment is used. Even though biosecurity is good in the country, it is not relevant for this disease; neither is culling relevant.

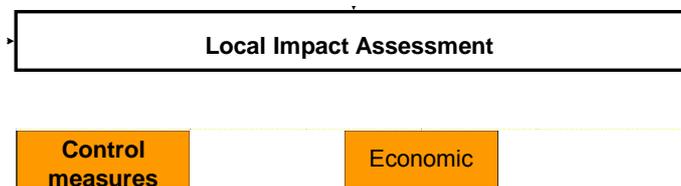


Disease 2 is a notifiable disease in the country, and the veterinary network is fully operational. Laboratory confirmation of cases and identification of the pathogen are both easy to perform and could be generalised for active surveillance in the country. Possible routes of introduction via movements of live animals are well controlled, but vector-borne introduction is impossible to control. No vaccine exists and medical treatment would be only be used for particularly valuable animals. Biosecurity is good and culling is a relevant method to control this disease (all the necessary mechanisms and regulations are in place in the country for proper culling, disposal and financial compensation).



5.5 - Assessment of the impact of control measures

5.5.1 - Economic impact



The economic impact of control measures can be:

- Indirect, if the corresponding measures are liable to hinder:
 - Local circulation of animals or even humans;
 - Local and/or international trade channels.
- Direct, relating to the economic cost of the mechanisms required:
 - Biosecurity measures only;
 - Vaccination (and/or treatment) in outbreaks only;
 - Generalised vaccination programmes;
 - Selective or mass culling, depending on the respective importance of the species concerned.

As these effects may be very difficult to assess precisely, a simplified semi-quantitative approach is proposed here.



38. Hindrance to movements within the country (or region)	Negligible => 0	
	Animal movements (involving non infected epidemiological units) => 1	
	Human movements => 2	

The first type of indirect impact liable to result from control measures is hindrance to movements within the country (or region). The corresponding criterion ranges from 0 to 2:

- **0** if control strategies involve no or negligible (limited to affected farms) hindrance to circulation;
- **1** if control strategies may hinder circulation of animals, even outside affected units (restricted perimeters, zoning, etc.);
- **2** if control strategies may hinder human movements.

39. Hindrance to live animal exports		
	Yes=1 / No=0	

In addition to this impact on movements, control measures may also hinder exports of live animals. For example, if the country has decided to vaccinate animals, some trade partners could refuse to import vaccinated animals (even if they are free of the disease). If this is the case, this criterion should be set to **1**.

40. Hindrance to trade of animal products	Negligible => 0	
	Local => 1	
	Local + International => 2	

As in the case of live animals, control strategies may hinder trade of animal products on local and international markets. The corresponding criterion should be set to:

- **0** if this effect is negligible;
- **1** if control strategies hinder local trade of animal products;
- **2** if control strategies hinder local AND international trade of animal products.

41. Cost of control measures	Negligible => 0	
	Biosecurity only => 1	



	Vaccination or medical treatment for affected animals => 2	
	Generalised vaccination => 3	
	Selective culling in a major production species or mass culling in a minor species => 4	
	Mass culling in a major species => 5	

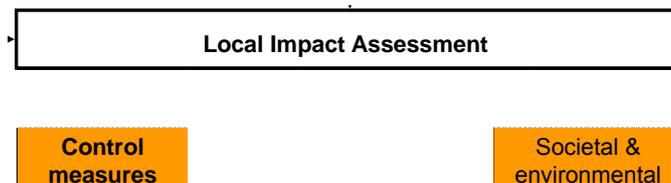
The last criterion in this section is an estimate of the direct economic impact of control measures (cost of required mechanisms). This “Cost of control measures” criterion ranges from 0 to 5:

- **0** if control measures have a negligible cost;
- **1** if control measures only imply general biosecurity (with no additional cost);
- **2** if control measures only imply individual vaccination or treatment in infected herds;
- **3** if control measures imply a generalised vaccination programme;
- **4** if control measures imply selective culling in a major production species, or mass culling in a species of secondary importance;
- **5** if control measures imply mass culling in at least one major production species.

The above criteria are then added to get an indicative **economic impact score for control measures**.



5.5.2 - Societal and environmental impacts



5.5.2.1 - Societal impact

Societal factors relating to the control of diseases include:

- Animal welfare issues, depending on the required animal handling, confinement or injury;
- Acceptance of the measures, in particular if they are liable to cause restrictions on movements or loss of property, or if people have a particularly bad perception of the method;
- Policy directions, as regards the existence (or otherwise) of proper compensation systems for farmers who are affected by disease control measures;
- Particular cultural or religious contingencies, interfering with the disease control measures (for example, some animal species may be considered sacred).



42. SOCIETAL CONCERNS	42.1. Animal Welfare	Control measures require animal handling	Yes=1 / No=0	
		Confinement of animals	Yes=1 / No=0	
		Control measures cause pain, injury or death	Yes=1 / No=0	

As for the local analysis of the disease, the first group of criteria on the potential societal impact of control measures relates to potential animal-related welfare issues:

- If the control measures require particular manipulation of animals, which may be a significant source of stress, the “Control measures require animal handling” criterion should be set to **1**.
- If the control measures imply confining animals that are normally free-range (for example, to avoid possible contact with wildlife), the “Confinement of animals” criterion should be set to **1**.
- If the control measures may cause pain, injury or even death (in the event of culling) in animals, the “Control measures cause pain, injury or death” criterion should be set to **1**.

42. SOCIETAL CONCERNS	42.2. Societal acceptance	Control measures with restriction of movement	Yes=1 / No=0	
		Control measures cause loss of property (seizure, etc.)	Yes=1 / No=0	
		Perception of the method	Good=0 / Bad=1	

The second group of criteria relates to the expected societal acceptance of the method in itself, and its impact on individual humans:

- If control strategies imply significant movement restrictions (for animals and/or humans), it will be perceived as a major hindrance to human activities. In this case, the “Control measures with restriction of movement” criterion should be set to **1**.
- If the control of the disease may cause a loss of individual property (for example through seizures or emergency culling), it may worsen its perception by professionals. In this case, the “Control measures cause loss of property” criterion should be set to **1**.
- Depending on the particularities of local society and culture, certain control measures may be poorly accepted. Note that this point must be handled carefully because there can be very wide variations as a result of different socio-cultural contexts. For example, in some countries culling is very poorly accepted as it is regarded as cruel,



whereas other cultures may see it as the most effective means of preventing animal suffering. Thus, if the disease control measures are liable to cause local specific acceptance issues, the “Perception of the method” criterion should be set to **1**.

<p>42. SOCIETAL CONCERNS</p>	<p>42.3. Policy directions</p>		<p>No public policy => 0 Official disease control action with a system of appropriate compensation (for livestock) => 1 Official disease control action without proper compensation => 2</p>	
-------------------------------------	---------------------------------------	--	--	--

The control measures may imply culling of animals, with or without appropriate financial compensation systems for farmers. In all cases, we assume that a coercive public policy is liable to raise acceptance issues among professionals. Moreover, if there is no compensation or if compensation is insufficient, these policies will not be financially acceptable. For this reason, the “Policy directions” criterion should be set to:

- **0** if no official policy is in place for the disease;
- **1** if there is an official disease control action with proper compensation for the subsequent loss to farmers;
Remark: Only livestock species are considered here, in the case of mass culling. Some diseases, such as rabies, may lead to individual culling of animals (notably pets), but there will be no need for compensation in this case as it is part of the owners’ individual responsibility.
- **2** if there is an official disease control action with coercive measures but no proper financial compensation for farmers.

<p>42. SOCIETAL CONCERNS</p>	<p>42.4. Local cultural identity concerns</p>	<p>Control policies interfere with particular cultural or religious contingencies (rites, sacred species, etc.)</p>	<p>Yes=1 / No=0</p>	
-------------------------------------	--	---	---------------------	--

The last point concerning the societal acceptance of control measures regards potential local cultural or even religious contingencies. For instance, certain animal species may have a particular status in some countries (sacred animals, role in rites, religious ban, etc.). This may strongly interfere with the orientations of control policies; for example, it will not be possible to cull animals that are considered locally to be sacred. If such potential interferences exist, then the corresponding criterion should be set to **1**.



5.5.2.2 - Environmental impact

The potential impact of control measures on the environment consists mainly of pollution issues resulting from:

- Culling and disposal of large numbers of animals, causing effluent management problems;
- Cleaning and disinfection and use of veterinary pharmaceuticals, which can generate residues in the environment;
- Pesticides, which may raise concerns in terms of:
 - Residues (particularly in water)
 - Biodiversity, through side-effects on local animal species.

In all cases, the existence of local regulations and appropriate protocols will count as an attenuating factor (and, correlatively, their absence as an aggravating factor).

43. ENVIRONMENTAL ISSUES	43.1. Disposal of culled animals	Importance of culling in the local control strategy	No culling or seizure=> 0 Organised and controlled culling (proper protocols, facilities and regulation) => 1 Uncontrolled culling => 2	
		Quantitative requirements for disposal of biological materials	No culling or seizure => 0 Limited or progressive culling and seizures => 1 Mass emergency culling or large amount of seizures (animals or products) => 2	

As in the case of the environmental impact of the disease, the first kind of environmental issues that control measures may raise concern the risk of pollution by biological materials in the event of culling or seizures, associated with the disposal of large numbers of animals or products. Two aspects are considered:

- The place of culling (or seizures) and disposal in the local control strategy for the disease. The corresponding criterion should be set to:
 - **0** if no mass culling or seizure is recommended;
 - **1** if there is significant culling or seizure, with appropriate protocols, facilities and regulations;
 - **2** if there is only uncontrolled culling with no guarantee of proper disposal.
- The scale of required culling or seizures, related to the required means of disposal. This “Quantitative requirements for disposal of biological materials” criterion should be set to:
 - **0** if there is no culling or seizure;
 - **1** if there is only limited (or progressive) culling or seizure;
 - **2** if mass emergency culling or seizure of large quantities of products is required (thus requiring considerable means of disposal).



43. ENVIRONMENTAL ISSUES	43.2. Cleaning and disinfection (C&D)	Importance of C&D in the local control strategy	No particular C&D measures => 0 Recommended C&D measures, with authorisation and control of products => 1 Uncontrolled use of C&D products => 2	

The “Cleaning and disinfection” criterion ranges from 0 to 2 according to both the local relevance of C&D to control the disease, and the regulation and control applicable to C&D in the country:

- **0** if no particular C&D is recommended to control the disease;
- **1** if control strategies imply particular C&D measures, with appropriate authorisation and control of products;
- **2** if the control strategies imply C&D, but with no or insufficient control of products to ensure proper authorisation and use.

43. ENVIRONMENTAL ISSUES	43.3. Veterinary pharmaceuticals	Importance of medical treatment in the local control strategy	No treatment, or treatment useless or unauthorised => 0 Medical treatment with proper authorisation and prescription of products => 1 Uncontrolled use of pharmaceuticals => 2	

The “Veterinary pharmaceuticals” criterion ranges from 0 to 2 according to both the local relevance of treatment (in animals) to control the disease, and the regulation and control of medicines in the country:

- **0** if no specific treatment exists (or is authorised) to control the disease;
- **1** if control strategies may imply specific treatment in animals, with appropriate authorisation and control for the prescription and sale of veterinary medical products;
- **2** if the control strategies imply medical treatment in animals, but with no or insufficient control of drugs to ensure proper authorisation and use (increasing the risk of residues).



<p>43.ENVIRONMENTAL ISSUES</p>	<p>43.4.Pesticides</p>	<p>Importance of pesticide treatment in the local control strategy</p>	<p>No anti-vectoral measures => 0 Organised and controlled pesticide treatment (authorised products, appropriate use, etc.) => 1 Uncontrolled use of pesticides => 2</p>	
---------------------------------------	-------------------------------	--	---	--

The “Pesticides” criterion ranges from 0 to 2 according to both the local relevance of pesticide treatment to control the disease (by limiting vector populations), and regulation and control applicable to pesticides in the country:

- **0** if no particular pesticide treatment are used to control the disease;
- **1** if control strategies imply particular antivectoral treatments, with appropriate authorisation and control of products;
- **2** if the control strategies imply the use of pesticides, but with no or insufficient control of products to ensure proper authorisation and use (increasing the risk of pollution and side-effects on other animal species).

5.5.2.3 - Result

The societal and environmental consequences of control measures are rather difficult to estimate. Moreover, assessing the impact of control strategies may only be a secondary step, once a first prioritisation based on the impact of the diseases has been performed.

For these reasons, and in order to limit the impact of these aspects in the final weighting, societal and environmental criteria are compiled into a single score for each disease:

- The sum of all the societal criteria is divided by 9 (sum of maximal values);
- The sum of all the environmental criteria is divided by 10 (sum of maximal values);
- The average value of the two previous results is calculated and multiplied by 10 to get a **score for the local societal and environmental impact of control measures** (ranging from 0 to 10).

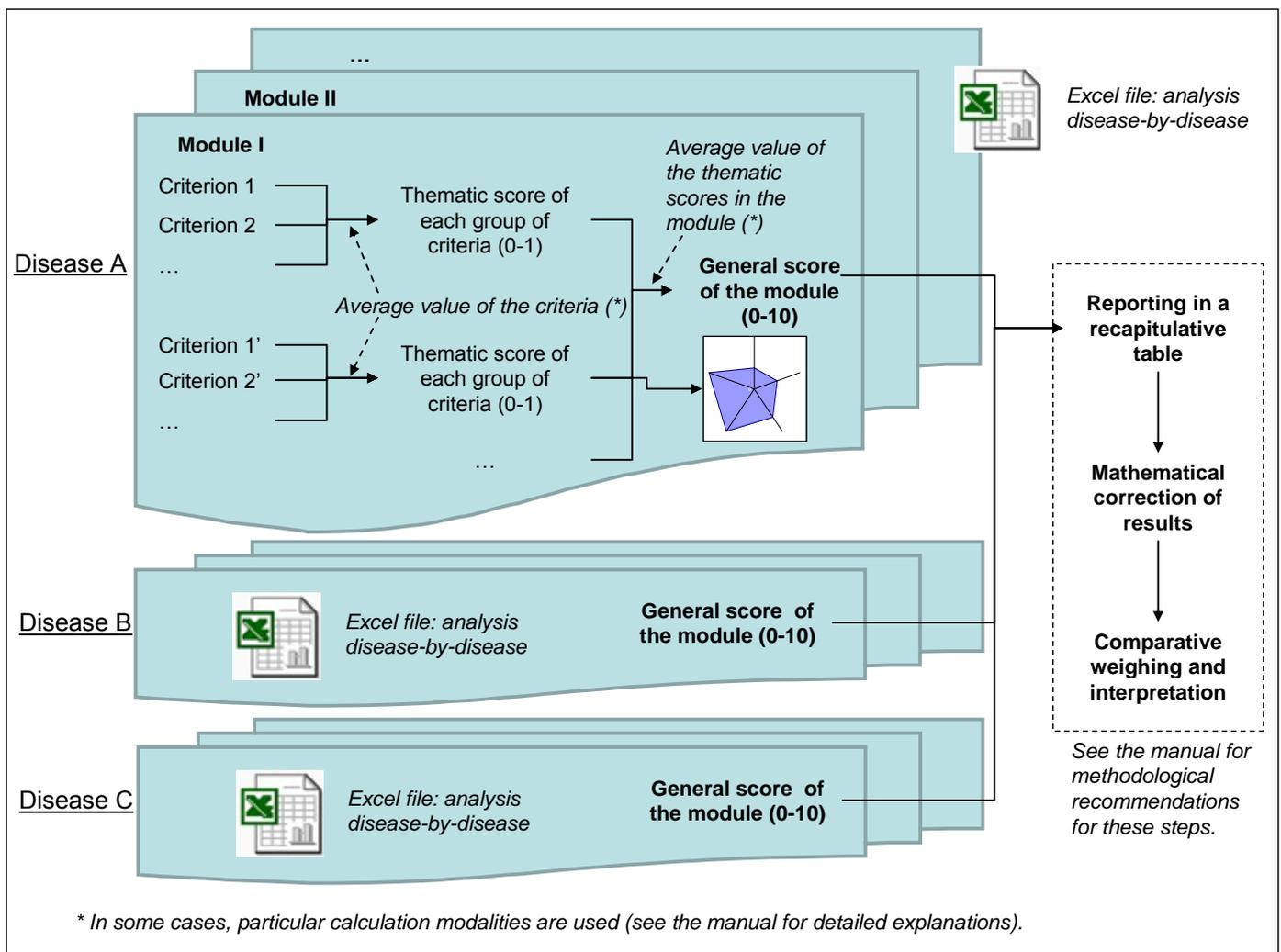
More information about the scores provided in each module and their general interpretation are provided in the following section.

5.6 - General results and elements of interpretation

This section deals with the presentation of the summary table of results, which provides elements to adapt the weighting of each type of criteria and to obtain general interpretation clues for the disease prioritisation.

The organisation of the different indicators provided by the tool and the principles of their synthesis and interpretation are described in the following figure. One simply has to copy the results of the local approach for each disease on the “recapitulative table” spreadsheet to the corresponding sheet.

Figure 5 - Analysis of the results, synthesis and interpretation





5.6.1 - Reminder of the different numerical results

As a result of the whole analysis, the tool proposes a series of numerical indicators for each of the main types of impacts of the disease and of the corresponding control measures in the studied country or region:

- A general indicator of the **economic impact of the disease**, which is calculated on the basis of the average of each “thematic” indicator:
 - Epidemiological importance of the disease in the country (incidence and prevalence);
 - Impact on animal productions;
 - Impact on international trade;
 - Impact on local trade;
 - Ripple and spill-over effects.
- A general indicator of the **impact of the disease on human health**, which is calculated on the basis of the average of each “thematic” indicator:
 - Severity in humans;
 - Contagiousness;
 - Prevention and treatment in humans;
 - Food security issue;
 - Zoonotic impact indicator in the country.
- A general indicator of the **societal impact of the disease**, which is calculated on the basis of the average of each “thematic” indicator:
 - Animal welfare concerns;
 - Crisis potential;
 - Bioterrorism issue.
- A general indicator of the **environmental impact of the disease**.
- A general indicator of the **feasibility of control measures**, which is calculated on the basis of the average of each “thematic” indicator:
 - Diagnosis and surveillance;
 - Territorial protection;
 - Vaccination in animals;
 - Medical treatment in animals;
 - Biosecurity;
 - Culling.
- A general indicator of the **economic impact of control measures**.
- A general indicator of the **societal and environmental impact of control measures**.

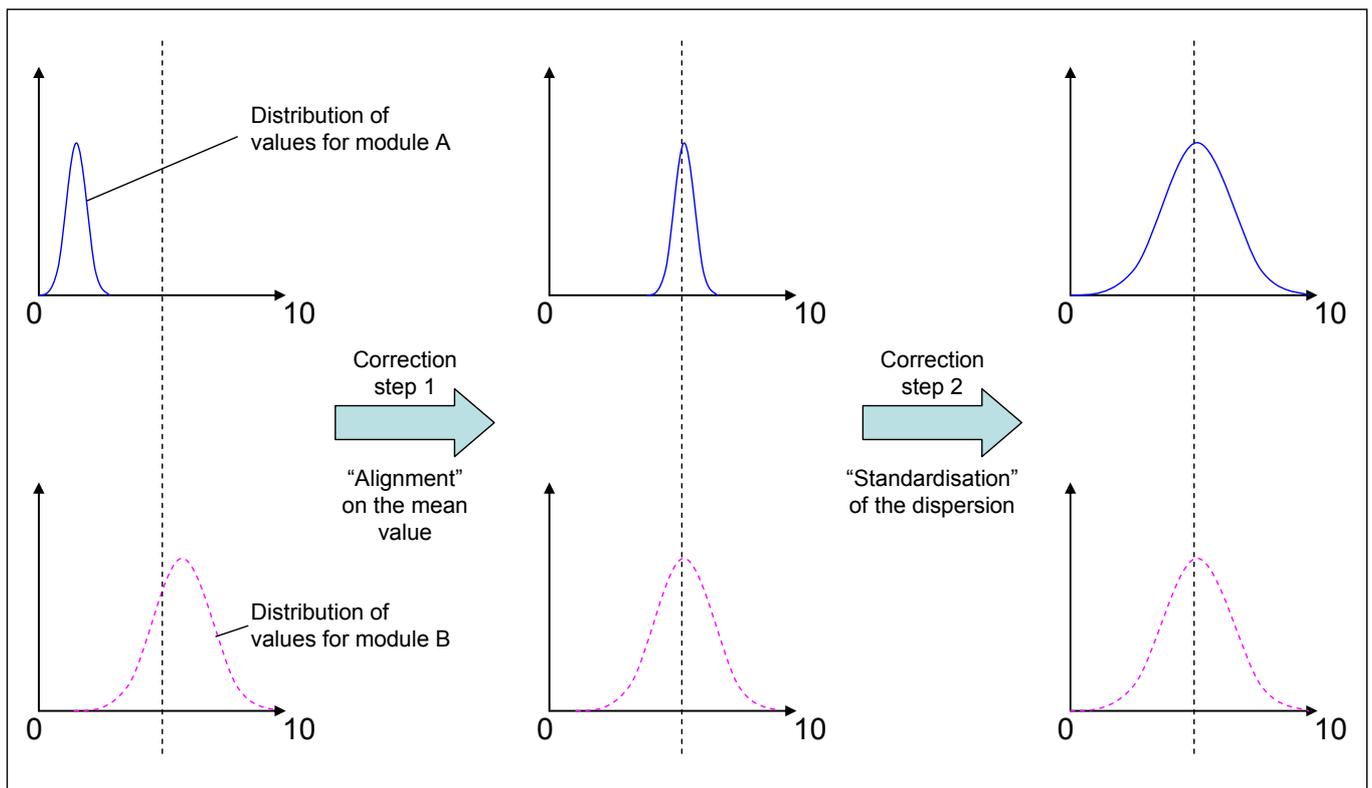
5.6.2 - Mathematical correction

Depending on the selected criteria, the characteristics of the studied diseases and local contingencies, the aforementioned scores may not be homogenous between the different modules. Thus, in order to propose relevant elements of interpretation, a mathematical correction is necessary to standardise these results. Indeed, without this correction, the

respective weight of a module would depend on the distribution of its values (a module with relatively high scores would artificially be accorded more importance in the interpretation than another one with relatively low scores).

The principles of the mathematical correction of the results are presented in the following figure.

Figure 6 - Principles of the mathematical correction of the results



- Results are processed by series, that is to say considering for each indicator the different values provided by the tool for all the studied diseases.

Remark: In this step, all results for diseases that are absent and those that are present must be processed in the same series, for their respective value to be relevant (otherwise, the respective importance of diseases present and diseases absent may be severely biased). The specific interpretation distinguishing between diseases present and diseases absent will be done in the next step.

- The different values for all studied diseases are analysed in order to determine for each series:



- The minimum value in the series (MIN);
- The maximum value in the series (MAX);
- The average value of the indicator in the series (AVE).

- Each individual value for each disease (called X) is then converted into the corresponding difference to the average value:

$$(X - AVE)$$

- As the previous value may be negative for the lower scores, the absolute value of the greatest difference to the average value in the series, corresponding to (AVE-MIN), is added:

$$(X - AVE) + (AVE - MIN) = (X - MIN)$$

This first operation corresponds to the “alignment” of the series of results on the average value (step 1 of the correction on the figure).

- This value is then divided by the difference between maximal and minimal values in the series, in order to homogenize the differences between the scores:

$$\frac{(X - MIN)}{(MAX - MIN)}$$

- Last, a multiplication factor of 10 is applied in order to obtain for each series a panel of scores ranging from 0 to 10:

$$SCORE = 10 \times \frac{(X - MIN)}{(MAX - MIN)}$$

This last operation corresponds to the “standardisation” of the dispersion of the series of values, to obtain homogeneous ranges between 0 and 10 (step 2 of the correction on the figure).

Once the results of all modules have been corrected, a cross interpretation is possible between the different diseases studied. Indeed, as the different scores in each different module now have homogeneous weights, the difference between the diseases will be the only source of variability in the results. Therefore, a relevant comparison between the different diseases is possible.



Note: The consequence of this is that this approach **cannot in any case be used** to compare diseases between two different territories. Only a qualitative discussion about the respective priorities in each territory is possible.

5.6.3 - Example of table of results

As a result of all the previous steps, the results (corrected as above) for the different studied diseases regarding the different modules can be synthesised in a summary table. The distinction should then be made between diseases that are present in the territory and diseases that are absent (for the latter, the tool displays a reminder of the risk of introduction). For interpretation purposes, a choice should be made on whether to include diseases of unknown status with those that are present or with those that are absent (a distinct group for diseases of unknown status may not be very relevant).

An example of a table of results is shown below.

Disease D	Disease E	Disease I	Disease A	Disease C	Disease G	Disease J	Disease B	Disease H	Disease F
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

Epidemiological status of the disease in the country	Absent => A Present => P Uncertain => U	P	P	P	P	P	A	A	A	A	A
---	---	---	---	---	---	---	---	---	---	---	---

		Coefficient	MIN	MAX	AVERAGE
DISEASES	Economic impact	1	1.06	3.09	1.84
	Impact on human health	1	0.00	3.68	1.26
	Societal impact	1	2.24	5.67	3.80
	Environmental impact	1	3.00	8.00	5.20
CONTROL MEASURES	Feasibility	1	2.92	6.13	4.44
	Economic impact	1	2.00	10.00	5.40
	Societal & environmental impact	1	3.67	6.78	4.98

		Corrected and weighed values										
DISEASES	CONTROL MEASURES		0.00	5.69	4.71	0.51	2.15	3.82	1.82	8.69	10.00	1.22
Economic impact			10.00	0.00	0.00	0.00	0.00	0.00	7.52	8.18	0.00	8.44
Impact on human health			10.00	3.01	3.98	1.94	0.00	3.98	1.57	6.06	6.90	8.06
Societal impact			6.00	6.00	4.00	6.00	6.00	10.00	0.00	0.00	0.00	6.00
Environmental impact			3.75	10.00	3.65	1.06	0.00	5.67	3.41	6.88	7.16	6.01
Feasibility			2.50	8.75	7.50	0.00	0.00	2.50	1.25	7.50	10.00	2.50
Economic impact			2.32	1.96	3.57	4.82	0.00	5.18	10.00	5.36	3.75	5.18
Societal & environmental impact												

Indicative prioritisation score	Absent diseases						4.45	3.65	6.09	5.40	5.34
	Risk of introduction						LOW	HIGH	ERMEDIA	ERMEDIA	HIGH
	Present diseases	4.94	5.06	3.92	2.05	1.16					
	Diseases with uncertain status										



In this example, ten diseases are considered in a given territory (5 present and 5 absent). The corrected results for all the modules are reported and a total score is calculated for each one (average value of all the modules for the disease).

A ranking is then possible, regarding this final score, between the different diseases. Of course, this has to be done separately for diseases that are present and those that are absent. Indeed, as their respective analysis is a little different, a global ranking including both diseases present and diseases absent would be meaningless.

Note that it is possible in this table to modify the importance given to each module thanks to the corresponding box in the “Coefficient” column. For example, in order to compare only the impact of the diseases (regardless of their control measures), the coefficients for the “DISEASES” criteria should be set to 1 and the coefficients for the “CONTROL MEASURES” set to 0.

Similarly, if economic contingencies are believed to have a particular importance in the country, the corresponding coefficient should be set to 2 or even more.

We further emphasise that this presentation of results must in no case be taken as a “turnkey” automatic prioritisation. These elements are only clues to help decision-makers to make rapid and easy comparisons on several aspects of the studied disease.



5.7 - Elements of interpretation of the results

5.7.1 - Results of the profiling

The interpretation of the profiling provides two types of conclusions:

- What is the profile of the disease as regards epidemiological, economic and human health aspects? The work of the experts' team should allow a consensus to be reached between all participants concerning the profile of the disease and the points that may be subject to discussion as regards their respective importance.
- What is the current state of knowledge and what are the available control measures? This will highlight the fields in which additional work and research are needed in order to increase the global knowledge of the disease.

Therefore, at the scale of a region, this tool is a way to exchange on the analyses made by different countries, before moving from a local approach based on the particularities of each territory to a regional approach.

The profiling allows also identifying the fields in which there is a lack of knowledge and for which additional research work is required.

5.7.2 - Local approach

5.7.2.1 - Diseases that are absent

1- The analysis of the results is made with regard to two aspects:

- The risk of introduction of the disease in the territory: our study determines three classes, but a more precise hierarchy may be achieved to differentiate diseases within the same class.
- The prioritisation of the disease, based on criteria concerning:
 - The disease-related impacts: economic impact, impact on human health, societal impact and environmental impact;
 - The impact of the control measures.

It is preferable to give priority to the indicators of impact of the disease, rather than to those concerning control measures. The weighting of the different classes of indicators can be modified in order to test the corresponding variability in the ranking of diseases (see 5.6.3).

In the case of diseases that are absent, the indicators of impact of control measures must always be considered in addition to those regarding the impact of the disease. Indeed, the more difficult it is to control a disease, the more important it is to implement effective territorial protection to prevent its introduction in the country.

Remark: It is necessary to keep in mind that the discrimination may not be relevant for very close values: differentiating diseases for which corresponding indicators differ by only 0.5 points requires an additional, precise, cost-benefit analysis.



2- The decision regarding the prioritisation of diseases is therefore made on the basis of the following table:

- Diseases with a high risk of introduction are normally of greater priority. Yet it is necessary to determine whether or not the last diseases in the first column may have negligible impacts in the country.
- Diseases with an intermediate risk of introduction should come after, but a choice should be made here depending on the predicted impact of these diseases, in addition to their risk of introduction.
- Diseases with a negligible risk of introduction are generally of secondary priority, unless the importance of their predicted consequences means that the case of an exceptional introduction should be considered. For example, this could be the case of some imported hemorrhagic fevers.

Priority ranking for diseases that are absent	High risk of introduction	Unknown or uncertain risk of introduction	Low risk of introduction
1-	Disease A	Disease B	Disease D
2-	Disease C	Disease H	Disease E
3-	Disease F		Disease G

5.7.2.2 - Diseases that are present

1- **The analysis of the results** will be performed:

- First on the indicators of impact of the disease (see for example the following table). The weighting can be modified according to political objectives, in order to analyse subsequent changes in the hierarchy of diseases. It is essential to adopt a cautious approach when there are only slight differences between the values for two diseases (for a given indicator); such differences may not always be significant.

This allows a first ranking to be performed:

- Ranking of zoonoses;
- Ranking of animal diseases;
- Global ranking.



Disease D	Disease E	Disease I	Disease A	Disease C	Disease G	Disease J	Disease B	Disease H	Disease F
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

Epidemiological status of the disease in the country	Absent => A									
	Present => P	P	P	P	P	P	A	A	A	A
	Uncertain => U									

		Coefficient	MIN	MAX	AVERAGE
DISEASES	Economic impact	1	1.06	3.09	1.84
	Impact on human health	1	0.00	3.68	1.26
	Societal impact	1	2.24	5.67	3.80
	Environmental impact	1	3.00	8.00	5.20
CONTROL MEASURES	Feasibility	0	2.92	6.13	4.44
	Economic impact	0	2.00	10.00	5.40
	Societal & environmental impact	0	3.67	6.78	4.98

		Corrected and weighed values	Disease D	Disease E	Disease I	Disease A	Disease C	Disease G	Disease J	Disease B	Disease H	Disease F
DISEASES	Economic impact			0.00	5.69	4.71	0.51	2.15	3.82	1.82	8.69	10.00
	Impact on human health		10.00	0.00	0.00	0.00	0.00	0.00	7.52	8.18	0.00	8.44
	Societal impact		10.00	3.01	3.98	1.94	0.00	3.98	1.57	6.06	6.90	8.06
	Environmental impact		6.00	6.00	4.00	6.00	6.00	10.00	0.00	0.00	0.00	6.00
CONTROL MEASURES	Feasibility		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Economic impact		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Societal & environmental impact		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Indicative prioritisation score	Absent diseases						4.45	2.73	5.73	4.22	5.93
	Risk of introduction						LOW	HIGH	ERMEDIA	ERMEDIA	HIGH
	Present diseases	6.50	3.67	3.17	2.11	2.04					
	Diseases with uncertain status										

- In a second step, the indicators of the impact of control measures should be considered, in order to assess possible difficulties in implementing control policies.
- It is important to list the fields for which there is a lack of knowledge, because they may complicate the decision-making process; in this case preliminary research may be justified. If the lack of data is prevents any decisions from being made, this research should be considered a priority.

2- **The iteration concerning control measures.** If the control measures are complicated to implement or may have a severe impact, it might be relevant to assess other control strategies. Nevertheless, this iteration must be performed very carefully because the tool is not always precise enough to allow an effective comparison to be made between different control strategies. In this case, it is necessary to analyse in detail the elements that may be needed in the country:

- Regulation;
- Procedures;



- Human and technical means;
- Training;
- Reporting;
- Other

3- Decision-making

- First, one must verify that a decision is possible and that there are not too many missing data. If necessary, the prioritisation of research can be based on the impact of the diseases (theoretical).
- In order to optimise the available means, prioritisation should be performed by distinguishing classes according to the impact of the disease. The thresholds for these classes are not defined here because they are not fixed and may be very different from one country to another.

In a second step, within these classes, the diseases are ranked according to the impact of the corresponding control measures. In order to optimise public sector means, priority should be given to diseases with a severe impact and for which control measures have limited costs and consequences.

Impact of the disease	Impact of the control measures
Severe impact	Disease 1 Disease 2 Disease 3
Intermediate impact	Disease 1 Disease 2 Disease 3

However, in addition to this prioritisation, the Veterinary Services must take into consideration other aspects when making the decision:

- A disease may become a priority because the control plan may be an opportunity to meet other objectives, such as favouring a production sector by imposing traceability requirements which will also be useful for export markets. Another example may be the implementation and maintaining of an epidemio-surveillance network.
- Prioritisation using this approach does not presume the organisation of control plans and the respective involvement of public sector veterinarians and private sector professionals in the sector concerned.

5.7.2.3 - Diseases with an unknown status

Before defining any control plan, it is necessary to know the status of the disease. Thus, in this case, additional studies will be essential in order to collect sufficient epidemiological



data: analysis of surveillance information, active surveillance campaign, participatory epidemiological surveys, etc.

However, in order to prioritise these tasks, the theoretical impact of the diseases concerned can be used; priority will then be given to diseases with a predictably severe impact.



5.7.3 - Categorisation of the diseases

The categorisation step is the second aspect of our analysis. It aims at dividing the studied diseases into groups, in terms of their respective control strategies.

5.7.3.1 - Objectives in relation to the previous step

In the previous sections, a first categorisation of diseases was proposed, based on the following criteria:

- Disease present or disease absent;
- Vector-borne or non vector-borne;
- Zoonosis or non-zoonosis.

These three aspects provide some elements of information concerning the relevant control strategies for the diseases, particularly as regards the complexity of the control policies. Indeed, according to these characteristics, different dimensions will have to be considered: contingency plan for diseases that are absent, eradication or control for diseases that are present, antivectoral efforts, involvement of human health systems and services, etc.

In addition to these first clues, decision-makers may wish to have further input about points that are of particular interest to them, linked to the local context. For example, it could be useful to have an idea of the type of control policy likely to be applied to the diseases in question:

- Diseases causing major problems and difficult to control (severe impact of the disease and of the control measures), requiring public-sector sanitary management for short-term eradication or control (standstill, culling, etc.);
- Diseases that are problematic but more effectively controllable by medical means (significant impact of the disease, intermediate impact and relative feasibility of control measures), requiring medical and sanitary management (vaccination, treatment, test and cull, test and move, etc.);
- Production diseases (limited impact of the diseases and control measures), requiring management by the professionals of the sectors concerned, using “best practices” (breeding, slaughtering, sanitary control, consumer awareness, etc.).

In this case, the tool can provide elements to perform a comparative analysis of the diseases concerned, in order to distinguish groups of diseases corresponding to the aforementioned classes.

5.7.3.2 - Descriptive approach

Categorisation differs from the prioritisation in that it is not based on a quantitative approach. Indeed, it is impossible to describe a control policy with a simple score. For this

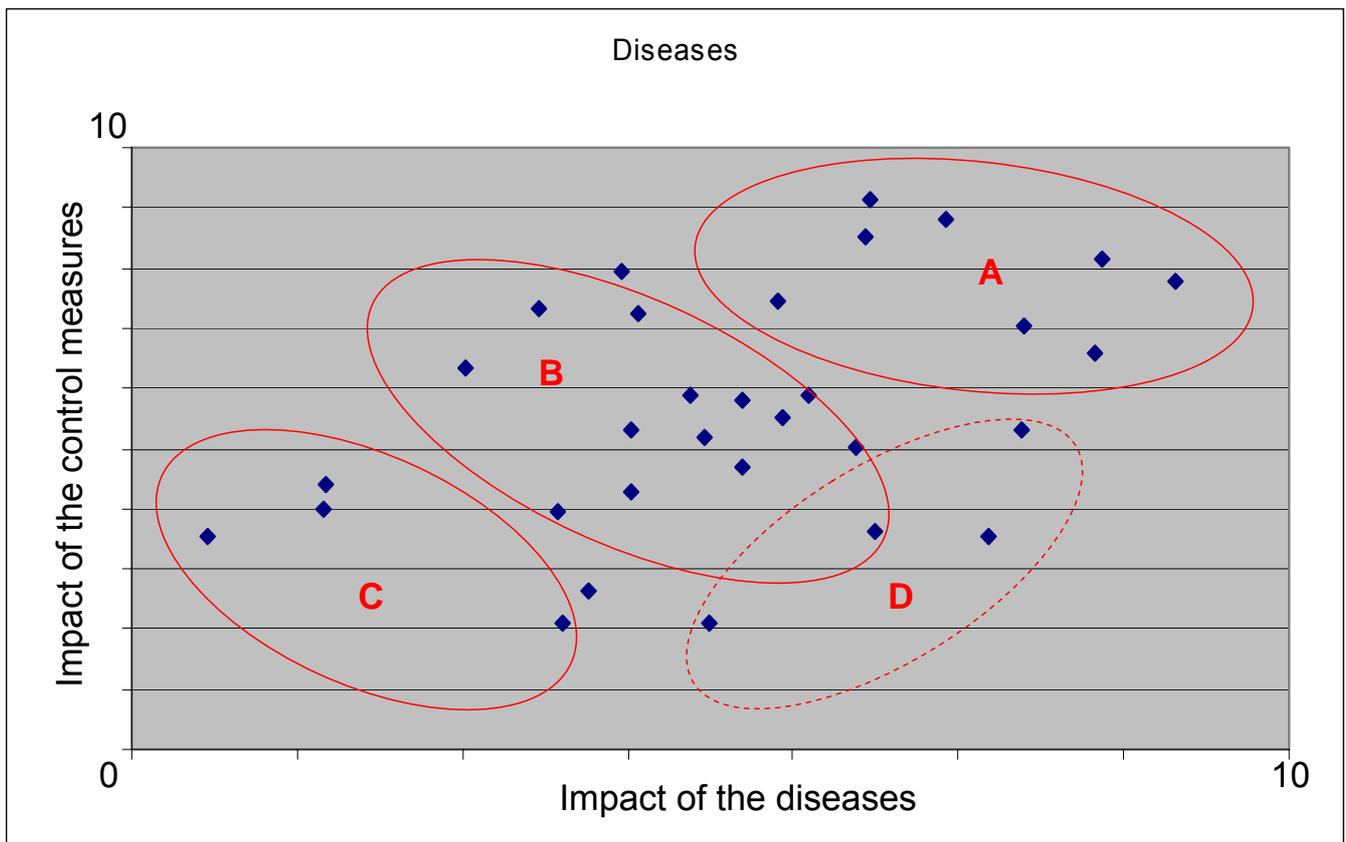
reason, we will only mention here some methodological points to perform a qualitative graphical analysis, as well as some elements of interpretation and recommendations.

5.7.3.2.1 - Graphical representation of the results

The basis for this descriptive analysis is a graph showing the studied diseases in terms of two axes. The example provided here displays the global impact of the diseases on the x-axis (average value of the four types of disease-related impacts), and the global impact of the control measures on the y-axis (average value of the three types of impact of control measures).

Depending on the different diseases or countries and on the particular questions to be answered, other types of representation can be used (the local economic impact of the disease, the feasibility of control measures, etc.). However, not all types of representation will provide relevant information in all cases, as the results will differ from one case to another.

Figure 7 - Graphical analysis of the impacts of the diseases and control measures





5.7.3.2.2 - *Interpretation: categories of diseases*

The figure above enables several groups of diseases to be distinguished (see the ellipses in red):

- Group A: severe impact of the diseases and of the control measures, requiring public sanitary management.
- Group B: noticeable impact of the disease, with more feasible control means (even if their impact is significant), requiring and integrated medical and sanitary management, requiring public or professional sanitary management.
- Group C: limited impact and relatively easy to control, allowing management by professionals (“best practices”) with a possible adapted regulatory framework.

It is sometimes possible to define additional categories, depending on the different contexts and diseases. In this example, a group D is apparent, bringing together diseases with consequences for public health and food safety, requiring particular measures (e.g. echinococcosis, fasciolosis and trichinellosis).

5.7.3.3 - **Deductive approach**

This first approach provides elements for a three-level categorisation according to the types of control strategies. Depending on the geographical areas and particular contexts, some additional points may be raised:

- Which geographical scale is relevant to implement control strategies (local, national, regional, etc.)? This will depend on possible local measures (if some are in place). In certain cases, particularly for emerging diseases, it may be relevant to mobilise a whole country or region in order to prevent the spread of the disease, even from a very limited introduction point (as a spread would threaten the whole territory).
- How should the costs of control measures be shared between the different stakeholders and public and private operators concerned? What actions should the public sector be responsible for (regulation, control, financial backing, etc.)?

Even if these points seem to follow on naturally from the previous prioritisation and categorisation elements, they are beyond the scope of our study. In countries or groups of countries willing to follow through this approach, it will be necessary to define precisely the different questions of particular interest, in order to orientate the additional work of socioeconomic analysis and the study of different scenarios.

Eventually, it should be possible to define categories of diseases, with a possibility to prioritise the different categories as well as the diseases within those categories.



5.7.4 - Final decision

All the previous elements have their place in the prioritisation and categorisation process; their balanced interpretation will provide a relevant level of priority for each disease and for the corresponding control measures, as well as clues regarding the possible type of management for the disease.

However, it is not a tool to define the control strategy for the prioritised disease. To determine the relevant control strategy and the required means, further investigations will be necessary:

- Active or passive surveillance (possibly with identification of the pathogen);
- National laboratories (number, capacity), or contracts with foreign laboratories;
- Vaccination (what strategy, and for what types of animals?);
- Compensation systems if culling is operated;
- Monitoring;
- Other



6 - Conclusion

At the end of this manual, it is important to remember the following points:

- This protocol is a tool to assist in decision-making ***and not*** a tool to take decisions:
 - The criteria have been selected to be as simple to fill in as possible. However, other relevant criteria could also be included in this approach.
 - The country must balance the weighting accorded to the different indicators to suit their own political objectives.
 - It is not a quantitative approach. To differentiate two diseases with a similar profile, a quantitative socioeconomic approach could be necessary.
 - Some additional elements may sometimes have to be considered when making the final decision. This might be the case for diseases that are already the subject of control plans, or if other strategic objectives are involved (e.g. epidemiological surveillance networks).
- The quality of the outcome will depend on the quality of the experts. It is therefore necessary to develop a participatory process that includes all the relevant expertise. This will allow a consensus to be reached on the appraisal of the disease.
- The process must be regularly updated to take into account changes in the epidemiological and scientific knowledge of the disease, and the evolution of the local context (epidemiological or economic context).

Lastly, even if we have tried to keep the approach as simple as possible, the process requires sufficient time to gather the data, fill in the criteria and reach a consensus on the prioritisation.

				
--	---	--	--	--

**Appendix 1 - Glossary of terms used
in the study “Listing and
Categorization of Priority Animal
Diseases, including those
Transmissible to Humans”**



Categorisation – Organisation of listed diseases into different groups depending on particular criteria. Each group is associated with a specific pattern of herd-scaled, collective or State measures in relation to the corresponding critical competencies of the Veterinary Services.

Compensation – Financial mechanism set up by the State or public institutions to promote early declaration of animal diseases and effective disease control, and to reimburse losses suffered by private citizens who have complied with a disease control process for the public good.

Control measures – All kinds of actions that can be performed in response to a disease outbreak or threat, including surveillance, diagnosis, notification systems, medical prevention (vaccines), treatment, culling, compartmentalisation, zoning, sanitary status, etc. These measures can be either public or private (even individual) initiatives.

Criterion – Data that can be assessed through qualitative or quantitative (scoring) means. The synthesis of values for various criteria should enable decision tools to generate a result. Each criterion must be relevant for the tools to work properly.

DALY – Disability Adjusted Life Years. Unit developed by the World Health Organization to assess the impact on human health of a disease (or a control measure). It represents the loss of healthy life years due either to premature mortality or to long-term disability or injury caused by the disease.

Epizootic diseases – Animal diseases that may spread rapidly over a territory, affecting a large number of animals within a short period.

Food safety – Discipline that defines good practices for the elaboration and handling of food products, in order to avoid and prevent food-borne diseases and threats.

Food security – Refers to food availability and quality, for people to be able to have a sufficient and well-balanced alimentation, compatible with preservation of health.

Impact – All the consequences a disease may have regarding the main sectors of importance. The global impact of a disease is subdivided as follows:

- **Economic** impact: the consequences a disease may have in terms of animal health with subsequent losses in production systems and trade (direct loss) as well the costs represented by response and prevention measures implemented to control the disease (indirect loss).
- Impact on **public health**: this relates to the zoonotic potential of the disease and its ability to affect human health, but also the potential disease-related threats to food safety and food security.
- **Societal and environmental** impact: the potential of the disease to generate a social crisis, relating to the way it may affect issues of major popular concern such as animal welfare or environment, the acceptability of the disease and of the corresponding control measures, the potential religious or cultural contingencies that may influence animal health policies, and the bioterrorism potential of the disease.



Listing – Selection and synthesis of available data for characterisation of animal diseases.

Prioritisation – Organisation of listed diseases into a hierarchy considering their respective impacts. Prioritisation may be performed within the different categories, as well as for diseases belonging to different categories.

This process is aimed at providing decision-makers with a tool to help them select the disease-related threats that are worth being addressed by public policies (the corresponding control measures should then be determined thanks to the categorisation tool).

Production disease – Animal diseases whose major consequences are economic, mainly affecting production capacity, the quality of products, or trade status and flows.

Region – Refers to a geographical area encompassing several countries with similar situations in terms of a disease, or with common animal and public health policies or agreements.

Sanitary status – means the situation of a country or a zone with respect to a particular animal disease, according to criteria which possibly leading to a certified and controlled designation of relevance to access to specific trade channels and relations with trading partners (e.g. “disease free” status).

Scoring – Quantitative or semi-quantitative assessment of criteria, resulting in a numerical assessment. The final decision is made by compiling the scores for each criterion. This process is heavily dependent on the views of the experts and may be the source of considerable variations in the final result from one country/region to another.

Zoonosis – (OIE *Terrestrial Code* definition) Means any disease or infection which is naturally transmissible from animals to humans.



Appendix 2 - OIE/CFSPH list of Bioterrorism Agents/Diseases



Human Disease From Potential Bioterrorist Agents



Iowa State University • College of Veterinary Medicine
Ames, IA 50011 • Phone: 515-294-7189

E-mail: cfsph@iastate.edu • <http://www.cfsph.iastate.edu>

CDC Category	Disease or Agent	Route of Transmission	● = Potential System Affected						Incubation Period (days)	Person to Person	Prominent Clinical Signs
			Septicemia	Respiratory	Intestinal	Cutaneous	Ocular	Neurological			
A	Anthrax <i>Bacillus anthracis</i>	infected animal; inhalation; contaminated food	●	●	●	●			1-7	NO	Flu-like signs; pustules; scabs; respiratory distress; wide mediastinum on x-ray; bloody vomit and diarrhea; abdominal distress; sepsis; shock; death
A	Botulism <i>Clostridium botulinum</i> toxin	contaminated food; inhalation	●	●	●	●			1-5	NO	Weakness; dizziness; dry mouth; nausea; vomiting; cranial nerve deficits: double vision, drooping eyes, slurred speech; symmetrical paralysis; respiratory paralysis; death
A	Plague <i>Yersinia pestis</i>	fleas; infected animal; inhalation	●	●					1-6	YES	Flu-like signs; enlarged tender lymph nodes ('buboes'); rapid pneumonia; respiratory failure; toxemia; shock; death
A	Smallpox <i>Variola major</i>	infected human; inhalation					●		7-17	YES	Flu-like signs; vomiting; rash to pustules (skin, throat, mouth); death
A	Tularemia <i>Francisella tularensis</i>	arthropods: ticks, deer fly, mosquito; inhalation; infected animal tissue; contaminated food; contaminated water	●	●	●	●	●		1-14	NO	Flu-like signs; exhaustion; ulcerative lesions; enlarged painful lymph nodes; painful purulent conjunctivitis; abdominal pain; diarrhea; vomiting; chest pain; respiratory distress; pneumonia; sepsis; death
A	Viral Hemorrhagic Fevers <i>Ebola, Marburg, Lassa, Machupo</i>	varies with virus; mosquitoes, ticks; infected human; rodents	●			●			2-21	YES	Flu-like signs; fever; headache; vomiting; diarrhea; petechiae; maculopapular to hemorrhagic rash; hepatic damage; renal failure; seizures; shock; coma; death
B	Brucellosis <i>Brucella species</i>	contact with infected animal tissue; inhalation; contaminated food	●						1-21	Rare	Flu-like signs; cyclic fever; arthritis; orchitis; epididymitis; hepatomegaly; Chronic: neurological; endocarditis
B	Glanders <i>Burkholderia mallei</i>	infected animal; inhalation; wound contamination	●	●	●	●	●		1-14	YES	Flu-like signs; diarrhea; chest pain; pulmonary signs; pustules; ulcerations; swollen lymph nodes; photophobia
B	Melioidosis <i>Burkholderia pseudomallei</i>	inhalation; infected body fluids; wound contamination	●	●		●			2 days to years	Rare	Flu-like signs; pustules; chronic and prostatic abscesses; chest pain; pneumonia; bronchitis; acute sepsis; death
B	Psittacosis <i>Chlamydophila psittaci</i>	inhalation of dust from infected bird dander, droppings or secretions		●		●			7-28	NO	Flu-like signs; rash; extensive pneumonia; endocarditis, myocarditis; encephalitis

Note: Bioterrorism pathogens may have atypical routes of transmission and clinical manifestations. The information provided in this chart is intended to alert the public and medical professionals to the presence of possible bioterrorism agents. The information should not be used to rule out a diagnosis, and should not take the place of advice provided by a physician or veterinarian.

Created by Glenda Dvorak, DVM, MPH on 3/6/03, revised 4/26/05

wall chart human apr 2005.doc



Human Disease From Potential Bioterrorist Agents



Iowa State University • College of Veterinary Medicine
 Ames, IA 50011 • Phone: 515-294-7189
 E-mail: cfsph@iastate.edu • <http://www.cfsph.iastate.edu>

CDC Category	Disease or Agent	Route of Transmission	● = Potential System Affected						Incubation Period (days)	Person to Person	Prominent Clinical Signs	
			Septicemia	Respiratory	Intestinal	Cutaneous	Ocular	Neurological				
B	Q Fever <i>Coxiella burnetii</i>	arthropods: ticks; inhalation; infected animal body fluids (urine, milk, blood, birthing)		●					10-40	NO	Flu-like signs; severe sweats; weakness; retrobulbar headache; pneumonitis but no cough or chest pain; granulomatous hepatitis; osteomyelitis; arteritis; endocarditis; neurologic signs	
B	Typhus Fever <i>Rickettsia prowazekii</i>	human body louse; fleas from flying squirrels	●	●	●	●			7-14	YES	Flu-like signs; macular eruptions on upper trunk then body, not face, palms or soles of feet; cough; chest pain; pneumonia; abdominal pain; toxemia	
B	Viral encephalitis <i>VEE, EEE, WEE</i>	arthropods: mosquitoes			●			●	●	2-6	NO	Flu-like signs; nausea; vomiting; conjunctival congestion; encephalitis; disorientation; seizures; coma; death
B	Toxins <i>Clostridium perfringens</i> <i>Ricinus communis</i> <i>Staph. aureus</i>	contaminated food; inhalation		●	●	●	●	●	< 1	NO	Flu-like signs; vomiting; bloody diarrhea; abdominal cramps; kidney failure; shock; death	
C	Nipah <i>Nipah virus</i>	infected animal; inhalation		●					●	3-18	YES	Flu-like signs; drowsy; disoriented; neurological signs; seizures; respiratory distress; death
C	Hantavirus <i>Hantavirus</i>	inhalation of aerosolized rodent urine, feces or saliva	●	●	●	●	●	●	4-42	Rare	HPS: Flu-like signs; back pain; myalgia; cough; shortness of breath; dyspnea; tachypnea; tachycardia; death; HFRS: Fever; hypotension; petechiae; conjunctival injection; oliguria followed by polyuria; shock; convalescence	
	West Nile Fever <i>West Nile virus</i>	arthropod: mosquitoes			●	●	●	●	3-12	YES	Flu-like signs; vomiting; lymphadenopathy; periocular pain; conjunctivitis; encephalitis; death	
	Hendra <i>Hendra virus</i>	infected animal; inhalation		●					●	3-14	NO	Flu-like signs; severe acute respiratory signs; neurological signs; death
	Rift Valley Fever <i>Rift Valley fever virus</i>	arthropod: mosquitoes; infected animal tissue				●	●	●	3-12	NO	Flu-like signs; petechiae; hemorrhage; fever; retinopathy; encephalitis; death	
	Transmissible Spongiform Encephalopathy <i>vCJD</i>	consumption of infected animal tissue						●	Many years	NO	Depression; schizophrenia; other neurological signs; ataxia; dementia; involuntary muscle spasms; death	

Note: Bioterrorism pathogens may have atypical routes of transmission and clinical manifestations. The information provided in this chart is intended to alert the public and medical professionals to the presence of possible bioterrorism agents. The information should not be used to rule out a diagnosis, and should not take the place of advice provided by a physician or veterinarian.

Created by Glenda Dvorak, DVM, MPH on 3/6/03, revised 4/26/05

wall chart human apr 2005.doc



Animal Disease From Potential Bioterrorist Agents



Iowa State University • College of Veterinary Medicine
Ames, IA 50011 • Phone: 515-294-7189
E-mail: cfsph@iastate.edu • <http://www.cfsph.iastate.edu>

CDC Category	Disease or Agent	Severity of disease in potentially affected species									Incubation Period	Source: The Merck Veterinary Manual, 8 th ed. Prominent Clinical Signs
		Cattle	Sheep	Goats	Pigs	Horses	Dog	Cat	Birds	Other		
A	Anthrax <i>Bacillus anthracis</i>	●	●	●	▲	●	▲	▲		wild herbivores and carnivores, guinea pig	3-7 days	Sudden death from septicemia with lack of rigor mortis; blood fails to clot; excitement followed by depression or stupor; blood from mouth, nose, anus; edema, especially throat and shoulders
A	Botulism <i>Clostridium botulinum</i> toxin	●	●	●	■	●	■	■	●	foxes, mink	24-72 hours	Muscle paralysis; progressive symmetrical to flaccid; disturbed vision; unable to swallow or chew; death from respiratory or cardiac paralysis
A	Plague <i>Yersinia pestis</i>						■	●		rodents, rock and ground squirrel, prairie dog	Variable, several days	High fever; extremely swollen lymph nodes ("buboes"); severe pneumonia; septicemia
A	Tularemia <i>Francisella tularensis</i>		●		■	▲	■	■		rabbits, rodents, aquatic animals	1-10 days	Sudden high fever with lethargy and anorexia; stiffness; reduced mobility; tachycardia; tachypnea; prostration and death; miliary white necrotic foci of liver, spleen or lymph node
A	Viral Hemorrhagic Fevers <i>Ebola; Marburg; Lassa; Machupo</i>									non-human primates	2-16	Fever; petechiae; bleeding from orifices and internal organs; skin rash; splenomegaly
B	Brucellosis <i>B. melitensis</i>	■	●	●						wild ruminants	Variable	Abortions, stillborn or weak newborns; retained placentas; placentitis; orchitis; epididymitis; arthritis; lameness; Goats: May also have mastitis
B	Brucellosis <i>B. abortus, B. ovis, B. suis, B. canis</i>	●	●	●	●	■	▲			wild ruminants, buffalo, bison, elk	Variable	Abortions, stillborn or weak newborns; placentitis; orchitis; epididymitis; arthritis; lameness; Horses: suppurative bursitis ("fistulous withers")
B	Glanders <i>Burkholderia mallei</i>			■		●	■	▲		donkeys, mules, guinea pigs, hamsters	2 weeks	Ulcerated nodules on skin, upper respiratory tract, lungs; septicemia; high fever; thick mucopurulent nasal discharge; respiratory signs
B	Melioidosis <i>Burkholderia pseudomallei</i>	■	●	●	●	▲	■	■		rodents, rabbits, kangaroos, other zoo animals, fish	Variable; Latency	Signs vary with site of lesion; suppurative or caseous lesions in lymph nodes, lungs, and viscera; pneumonia; possibly nasal discharge; possibly arthritis and lameness; Horses: neurological; colic; Goats: mastitis
B	Psittacosis <i>Chlamydophila psittaci</i>							■		parakeets, parrots, love birds	3-10 days	Nasal and ocular discharges; conjunctivitis; yellow-green droppings; inactivity and ruffled feathers; inappetence; weight loss

Note: Bioterrorism pathogens may have atypical routes of transmission and clinical manifestations. The information provided in this chart is intended to alert the public and medical professionals to the presence of possible bioterrorism agents. The information should not be used to rule out a diagnosis, and should not take the place of advice provided by a physician or veterinarian.

Chart created by Glenda Dvorak DVM, MPH on 3/6/03, revised 4/26/05

wall chart animal apr 2005.doc

Phylum	Listing and Categorisation of Priority Animal Diseases, including those Transmissible to Humans	February 2010
--------	---	---------------



Animal Disease From Potential Bioterrorist Agents



Iowa State University • College of Veterinary Medicine
 Ames, IA 50011 • Phone: 515-294-7189
 E-mail: cfsph@iastate.edu • <http://www.cfsph.iastate.edu>

CDC Category	Disease or Agent	Severity of disease in potentially affected species									Incubation Period	Source: The Merck Veterinary Manual, 8 th ed. Prominent Clinical Signs
		Cattle	Sheep	Goats	Pigs	Horses	Dog	Cat	Birds	Other		
B	Q Fever <i>Coxiella burnetii</i>	▲	▲	▲			■	■		rodents, rabbits	1-3 weeks	Typically asymptomatic. Sheep, Goats: abortion; anorexia; Cattle: infertility; sporadic abortion; Dog, Cat: subclinical; abortions
B	Typhus fever <i>Rickettsia prowazekii</i>									flying squirrels	12 days	Asymptomatic
B	Viral encephalitis <i>VEE, EEE, WEE</i>					●			■	rodents	1-14 days	CNS dysfunction: altered mentation, impaired vision, wandering, head pressing, circling, unable to swallow; ataxia; paresis; paralysis; convulsions; death
B	Toxins <i>Clostridium perfringens, Ricinus communis, Staph. aureus</i>	▲	▲	▲	■	▲	■	■	■		12-72 hours	Ricin: violent vomiting; bloody diarrhea; salivation; trembling; incoordination; Clostridium: necrotic enteritis; bloody diarrhea; septicemia; acute death, esp in young; Staph: diarrhea; vomiting; pulmonary edema
C	Nipah <i>Nipah virus</i>				●	■	▲	▲			7-14 days	Severe respiratory distress; harsh "barking" cough; open mouth breathing; possibly neurological signs; head pressing
C	Hantavirus <i>Hantavirus</i>									rodents		Asymptomatic carriers
	West Nile Fever <i>West Nile virus</i>	■	■	■		●	■	■	●	many mammals and reptiles	3-14 days	Fever; encephalitis; altered mentation; impaired vision; circling; head pressing; ataxia; weakness of limbs; partial paralysis; death
	Hendra <i>Hendra virus</i>					●		▲		guinea pigs	6-18 days	Acute respiratory syndrome; nasal discharge; head pressing; ataxia
	Rift Valley Fever <i>Rift Valley fever virus</i>	●	●	●			▲	▲		monkeys, camels	12-36 hours in young	Abortion storms; hepatic necrosis; high mortality in young; fever
	Transmissible Spongiform Encephalopathy (TSE) <i>BSE, CWD, Scrapie, FSE, TME</i>	●	●	●				▲		deer, elk, mink	unknown > 2 years	Neurological and behavioral changes: increased nose licking, sneezing, snorting, teeth grinding, exaggerated menace and corneal reflex, increased startle response; ataxia; hypermetria; paresis

Note: Bioterrorism pathogens may have atypical routes of transmission and clinical manifestations. The information provided in this chart is intended to alert the public and medical professionals to the presence of possible bioterrorism agents. The information should not be used to rule out a diagnosis, and should not take the place of advice provided by a physician or veterinarian.

Chart created by Glenda Dvorak DVM, MPH on 3/6/03, revised 4/26/05

wall chart animal apr 2005.doc

Phylum	Listing and Categorisation of Priority Animal Diseases, including those Transmissible to Humans	February 2010
--------	---	---------------



Appendix 3 - HHS and USDA Lists of Select Agents and Toxins



HHS AND USDA SELECT AGENTS AND TOXINS 7 CFR Part 331, 9 CFR Part 121, and 42 CFR Part 73

HHS SELECT AGENTS AND TOXINS

Abrin
Botulinum neurotoxins
Botulinum neurotoxin producing species of *Clostridium*
Cercopithecine herpesvirus 1 (Herpes B virus)
Clostridium perfringens epsilon toxin
Coccidioides posadasii/Coccidioides immitis
Conotoxins
Coxiella burnetii
Crimean-Congo haemorrhagic fever virus
Diacetoxyscirpenol
Eastern Equine Encephalitis virus
Ebola virus
Francisella tularensis
Lassa fever virus
Marburg virus
Monkeypox virus
Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus)
Ricin
Rickettsia prowazekii
Rickettsia rickettsii
Saxitoxin
Shiga-like ribosome inactivating proteins
Shigatoxin
South American Haemorrhagic Fever viruses
Flexal
Guanarito
Junin
Machupo
Sabia
Staphylococcal enterotoxins
T-2 toxin
Tetrodotoxin
Tick-borne encephalitis complex (flavi) viruses
Central European Tick-borne encephalitis
Far Eastern Tick-borne encephalitis
Kyasanur Forest disease
Omsk Hemorrhagic Fever
Russian Spring and Summer encephalitis
Variola major virus (Smallpox virus)
Variola minor virus (Alastrim)
Yersinia pestis

OVERLAP SELECT AGENTS AND TOXINS

Bacillus anthracis
Brucella abortus
Brucella melitensis
Brucella suis
Burkholderia mallei (formerly *Pseudomonas mallei*)
Burkholderia pseudomallei (formerly *Pseudomonas pseudomallei*)
Hendra virus
Nipah virus
Rift Valley fever virus
Venezuelan Equine Encephalitis virus

USDA SELECT AGENTS AND TOXINS

African horse sickness virus
African swine fever virus
Akabane virus
Avian influenza virus (highly pathogenic)
Bluetongue virus (exotic)
Bovine spongiform encephalopathy agent
Camel pox virus
Classical swine fever virus
Ehrlichia ruminantium (Heartwater)
Foot-and-mouth disease virus
Goat pox virus
Japanese encephalitis virus
Lumpy skin disease virus
Malignant catarrhal fever virus
(Alcelaphine herpesvirus type 1)
Menangle virus
Mycoplasma capricolum subspecies *capripneumoniae*
(contagious caprine pleuropneumonia)
Mycoplasma mycoides subspecies *mycoides* small colony (*MmmSC*) (contagious bovine pleuropneumonia)
Peste des petits ruminants virus
Rinderpest virus
Sheep pox virus
Swine vesicular disease virus
Vesicular stomatitis virus (exotic): Indiana subtypes
VSV-IN2, VSV-IN3
Virulent Newcastle disease virus¹

USDA PLANT PROTECTION AND QUARANTINE (PPQ) SELECT AGENTS AND TOXINS

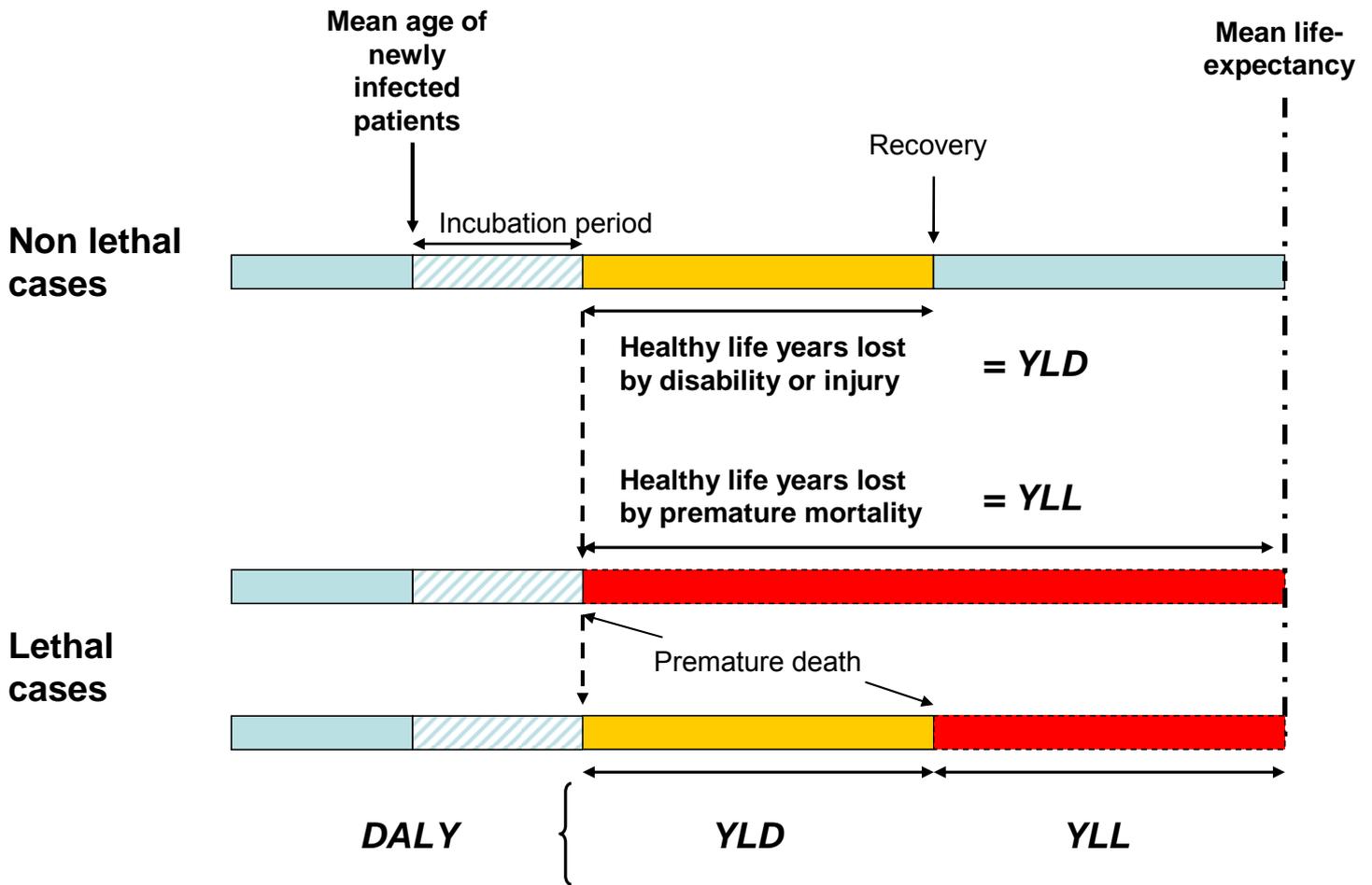
Peronosclerospora philippinensis (*Peronosclerospora sacchari*)
Phoma glycinicola (formerly *Pyrenochaeta glycinis*)
Ralstonia solanacearum race 3, biovar 2
Rathayibacter toxicus
Sclerophthora rayssiae var *zea*
Synchytrium endobioticum
Xanthomonas oryzae
Xylella fastidiosa (citrus variegated chlorosis strain)

11/17/2008

¹ A virulent Newcastle disease virus (avian paramyxovirus serotype 1) has an intracerebral pathogenicity index in day-old chicks (*Gallus gallus*) of 0.7 or greater or has an amino acid sequence at the fusion (F) protein cleavage site that is consistent with virulent strains of Newcastle disease virus. A failure to detect a cleavage site that is consistent with virulent strains does not confirm the absence of a virulent virus.



Appendix 4 - Principles of calculation of simplified DALYs for zoonoses



DALYs in human cases = YLD + YLL



Appendix 5 - Calculation of the local zoonotic impact indicator (for diseases that are present)



Definition and objectives

- To objectivise the impact of a zoonosis in a given territory (in terms of human health), the need has arisen for an indicator providing both:
 - a relevant ranking scale, representative of the actual importance of the human form of the disease in the country (depending on the characteristics of the local population),
 - good discrimination, even for diseases with a rather discrete impact.
- In order to obtain the most objective indication of the zoonotic impact of a disease in a country, we decided to calculate its total impact in terms of simplified DALYs (see I.3.3.2 for the method), and then relate it to the “instantaneous total life years in the country” corresponding to the mean national life expectancy multiplied by the total national population.

Of course, in many cases this value will be very low. It will have to go through additional conversion steps in order to provide sufficient discrimination.

- Moreover, the respective impact of the different zoonoses is highly variable, depending on each disease and country. Thus, in some countries where the global level of human health is good, even the worst zoonosis present has only a relative impact in its own right, in terms of cumulated DALYs. In contrast, in countries with a lower level of human health, a zoonosis which is not the worst locally may cause the loss of several thousand DALYs.

To take into consideration this major variability, while keeping a sufficient level of discrimination among the diseases with a low impact, we have chosen a calculation method integrating a logarithmic factor.

Calculation protocol

- First, the actual local impact of the disease on human health is calculated in “simplified DALYs” as follows:

* *Simplified DALYs (non fatal cases):*

$$\text{NonFatalDALYs} = (\text{Number of reported cases} - \text{Number of reported deaths}) \times \text{Mean duration of symptoms}$$

* *Simplified DALYs (fatal cases):*

$$\text{FatalDALYs} = \text{Number of deaths} \times (\text{Mean life expectancy} - \text{Mean age of infection} - \text{Mean incubation period})$$



=> *Total simplified DALYs:*

$$TotDALYs = NonFatalDALYs + FatalDALYs$$

* “Instantaneous total life-years”(ITLY) in the country:

$$ITLY = Total\ population \times Mean\ national\ life\ expectancy$$

=> *Zoonotic impact of the disease in terms of national population:*

$$Zoonotic\ Impact = \frac{TotalDALYs}{ITLY}$$

* As the aforementioned value is comprised between 0 and 1, Log_{10} (Zoonotic Impact) will be negative. For this reason, we add 10 to this log to obtain the final **Zoonotic Impact Indicator (ZII)**:

$$ZII = 10 + \text{Log}_{10} \left(\frac{TotalDALYs}{ITLY} \right)$$

Theoretical cases – Examples

- Case 1: The corresponding hypothesis is a disease that would cause 200 cases a year in the national population (100 million inhabitants, with a mean life expectancy of 80 years), and with clinical expression lasting one week (7 days), without mortality:

$$Total\ DALYS = 200 \times \frac{7}{365} = 3.84$$

$$ITLY = 10^8 \times 80 = 8.10^9$$

$$\Rightarrow ZII = 10 + \text{Log}_{10} \frac{3.84}{8.10^9} = 0.7$$

- Case 2: The corresponding hypothesis is a disease that would annually affect 10% of the same national population, with clinical expression lasting one week (7 days), without mortality:



$$\text{Total DALYS} = 10^8 \times 0.1 \times \frac{7}{365} = 19.18 \cdot 10^4$$

$$\text{ITLY} = 10^8 \times 80 = 8 \cdot 10^9$$

$$\Rightarrow \text{ZII} = 10 + \text{Log}_{10} \frac{19.8 \cdot 10^6}{8 \cdot 10^9} = 5.3$$

- Case 3: The corresponding hypothesis is a disease that would annually affect 10% of the same national population, infecting people at a mean age of 20 years, and invariably fatal:

$$\text{Total DALYS} = 10^8 \times 0.1 \times (80 - 20) = 6 \cdot 10^8$$

$$\text{ITLY} = 10^8 \times 80 = 8 \cdot 10^9$$

$$\Rightarrow \text{ZII} = 10 + \text{Log}_{10} \frac{6 \cdot 10^8}{8 \cdot 10^9} = 8.9$$

Note

As this calculation method provides a better discrimination for low impact diseases, attention must be paid to the relevance of the available data. Indeed, when the impact is discrete, the logarithmic operator increases the distinction between relatively close values. Thus, the lower the impact of the disease the greater the need for data accuracy and reliability is needed, so as to avoid biasing the final results.

When there is uncertainty about the corresponding data, expert appraisals can provide useful information to confirm or correct them. For this reason, local human health system experts should be involved in the project team when this analysis is performed.