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Risk Assessment of Animal Infectious Diseases and Decision Making Process

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Abstract

With the aim to present advances in risk assessment of animal diseases, recent methods have been considered in a brief review. Various initiatives relating to the risk assessment of animal diseases for categorization and prioritization have been undertaken with the objective to provide decision-makers with elements of priority for the application of optimal prevention and control measures. Theoretically, a technical approach should be harmonized and internationally recognized. However, methodologies remain complex, and different fields of applications (for example animal species, production systems) multiply variants. Local dimension play an essential role for the definition of a final result, often not necessarily comparable with results obtained when considering different geographical realities. Furthermore, other elements, as political or cultural aspects, may influence final decisions taken by competent authorities. Nevertheless, further efforts will be needed to harmonize procedural tools. In conclusion, despite methodological limits, the application of categorization and prioritization protocols represents a precious support for the competent authorities in relation to the various aspects of animal health management, from legislation, surveillance, or control measures.

Keywords: Animal infectious diseases; Decision making process; Prioritization; Risk assessment

Introduction

In response to major zoonotic and economic problematics rose in the zootechnics systems and subsequent serious concern by civil society, the national and international organizations competent for animal health developed accordingly, and in parallel to environmental, global agro food system and consumers demand modifications. This induced changes of strategy to combat infectious diseases in animals, passing from therapeutically based control to preventive approach and reasoned control.

A new animal health strategy has been developed for the European Union [1]. Under the guidance of the Directorate-General for Health and Consumers (DG SANCO) of the European Commission, and after an extensive evaluation and a large stakeholders consultation, Member States competent authorities implemented a 4 pillars action plan based on prioritization of EU intervention, legislative framework, prevention, surveillance and preparedness, and science, innovation and research. The ambition of the new strategy could be resumed in a tailored slogan: "Prevention is better than cure". The initiative identified long term goals and recognized the strong relations among animal health and welfare and public health, aiming to put greater focus on precautionary measures, disease surveillance, controls and research, in order to reduce the incidence of animal disease and minimize the impact of outbreaks when they do occur. The first pillar focuses on prioritization of EU interventions, to address new and emerging challenges to face such as diseases that have become more prevalent thanks to global warming. Priorities will be based on careful risk assessment and solid scientific advice, and funds will be primarily made available for diseases with high public relevance in terms of health, society and/or the economy.

Even well before the delineation of the new EU animal health strategy, various efforts have been made to define methods of evaluation in order to identify priorities of interventions. The World Organization for Animal Health (Office International des Épizooties: OIE) list of diseases was developed as international reference, and relevant for international trade of animals and animal products [2]. The method to include a disease in the list (previously two lists, A and B, with the latter classifying diseases with lower priority) relies on few and clear determinants, including epidemic potential and/or recognized zoonotic character. Therefore, the occurrence of listed diseases may causes, in addition to the objective health threat, and depending on prescribed norms, a relevant economic burden on the zootechnics and agro food sectors.

For the competent authorities, the main point is to identify targets on which human and economic resources should be focused. To categorize and prioritize selected diseases of recognized importance to be prevented/controlled, and thus determine priorities to allocate public funds, define obligations or promote voluntary application of preventive measures is certainly of high importance. The first main target is therefore the definition of adequate categorization of diseases into different groups depending on particular criteria, primarily with the objective to clarify general control approaches, by establishing a link between some characteristics of the disease (as geographical spread, transmission and clinical consequences) to types of actions liable to be implemented to control such a disease in a given country or region. For example, in order to improve the control of transboundary animal and plant pests and diseases the Food and Agriculture Organization (FAO) created in 1994 the Emergency Prevention System for Animal Health (EMPRES) [3]. The FAO EMPRES distinguishes: (1) epidemic diseases of strategic importance: rinderpest, foot and mouth

disease (FMD) and contagious bovine pleuropneumonia; (2) diseases requiring tactical attention at the international/regional level: Rift Valley fever, peste des petits ruminants, lumpy skin disease, Newcastle disease, African and classical swine fever; and (3) emerging or re-emerging diseases: such as bovine spongiform encephalopathy and porcine reproductive and respiratory syndrome.

Categorization of Animal Diseases

Among existing initiatives relating to the categorization of animal diseases, for example, in France the management of animal health has been redefined since 2011, and animal diseases have been clustered according to 3 new categories [4]. The dangers for animal health of first category correspond to diseases that represent serious threat to public health or animal health, to wild fauna or domestic animals or represent serious direct or indirect threat to the production capacity of a sector. For a general interest, such dangers require compulsory prevention, surveillance or control measures. The dangers of second category are defined as dangers other than those classified in the first category, requiring for a collective interest eventual necessary prevention, surveillance or control measures defined by the administrative authority or approved by regional health associations. Any other dangers (diseases or contaminants) are included in the third category. In Italy, with reference to surveillance measures on zoonoses and zoonotic agents, two main categories have been established [5]. In the first category (A) are listed diseases for the application of compulsory surveillance measures: brucellosis, campylobacteriosis, echinococcosi, listeriosis, salmonellosis, trichinellosis, tuberculosis caused by *Mycobacterium bovis*, and vero cytotoxin-producing *Escherichia coli*. In a second group (B) are included zoonoses to be monitored in function of the epidemiological situation. Another more articulated example is given by the Emergency Animal Disease Response Agreement [6], in which the Australian Animal Health Council defines 4 different categories for animal diseases with regard to their potential impact and the relevant patterns of public intervention and funding: (1) diseases that seriously affect human health and/or the environment, but with low economic impact for the livestock sector (as rabies); (2) diseases causing major socio-economic consequences as serious international trade losses, national market disruptions and very severe production losses in the involved livestock sector; the same category includes diseases with lower socio-economic consequences but a significant public health or environmental impact (as foot and mouth disease or brucellosis); (3) diseases of moderate public impact, with the potential to cause significant national socio-economic consequences but with minimal effect on human health or the environment (as anthrax or highly pathogenic avian influenza); and (4) diseases causing mainly production losses, liable to cause international and local market disruptions, but without significantly affecting the national economy (as Aujeszky's disease).

A further fundamental step is the prioritization, through the organization of listed diseases into a hierarchy considering their respective impacts, aiming to support decision making process for the selection of the disease related threats that are worth being addressed by public policies. Prioritization may be performed within the different categories, as well as for diseases belonging to different categories. Decisions could be taken on obtained lists of prioritized diseases to implement sanitary actions focused on particular diseases, based on corresponding control measures determined according to the specific characteristics of each selected disease through the profiling performed for the categorization.

OIE multiple species diseases list	National Committee Category list
Anthrax	3
Aujeszky's disease	2
Bluetongue	3
Brucellosis (*Brucella abortus*)	3
Brucellosis (*Brucella melitensis*)	3
Brucellosis (*Brucella suis*)	3
Crimean Congo haemorrhagic fever	4
Echinococcosis/hydatidosis	2
Foot and mouth disease	4
Heartwater	2
Japanese encephalitis	3
Leptospirosis	2
New world screwworm (*Cochliomyia hominivorax*)	-
Old world screwworm (*Chrysomya bezziana*)	-
Paratuberculosis	2
Q fever	-
Rabies	3
Rift Valley fever	4
Rinderpest	4
Trichinellosis	2
Tularemia	3
Vesicular stomatitis	3
West Nile fever	3

Table 1: Comparison of some pathogens included in the OIE list [2] with their classification according to the Italian National Committee for biosafety and biotechnology and life sciences [7].

At national level, various methods have been applied to categorize and prioritize pathogens affecting animals. For example, in 2004, the Italian Ministry of Health, with the scope to determine for each microorganism the necessary containment level to protect health and environment, committed to the National Committee for biosafety and biotechnology and life sciences a classification of pathogenic agents of animals and plants [7]. The microorganisms included in the list have been classified in 4 distinct categories on the base of the risk that the diseases that they induce affect animal health. In order to evaluate the risk related to each pathogen, the following parameters have been used: (1) pathogenic potential, (2) dissemination capacity, (3) transmissibility, (4) diagnostic potential, and (5) availability of therapeutic or prophylactic protection. All helminthes, pathogenic fungi and almost all bacteria have been classified with an index of danger equivalent to 2, exception made of few bacteria as *Bacillus anthracis* and *Brucella abortus* or *B. melitensis* scoring 3. The majority

of viruses have been classified with an index of danger equivalent to 2. Some as Avian influenza virus scored 3, and few as *Ebola* virus, Crimean congo hemorrhagic fever virus or African swine fever virus scored 4. However, discrepancies appear when comparing the list provided by the National Committee for biosafety, biotechnology and life sciences with the OIE listed diseases (Table 1). This indicates difficulties in interpretation of significance and application possibilities of categorized lists of diseases.

In Japan, the Ministry of Agriculture, Forestry and Fisheries promulgated the Act on Domestic Animal Infectious Diseases Control in 1957 [8]. The purpose of this Act was to promote the livestock industry by preventing the outbreak or spread of domestic animal infectious diseases. In this Act, the diseases for which measures must be taken particularly comprehensively to prevent the outbreak or spread are listed in the Category 1 (Table 2). Other notifiable infectious diseases are classified in the Category 2 (Table 3). In 1998, Ministry of Health, Labour and Welfare also made a law, Act on Prevention of Infectious Diseases and Medical Care for Patients Suffering Infectious Diseases [9], aiming to prevent occurrence and spread of infectious diseases, and to promote public health by taking necessary measures in preventing infectious diseases and medical care of infected patients.

S.No	Infectious disease	Domestic animal species
1	Rinderpest	cattle, sheep, goat, pig
2	Contagious bovine pleuropneumonia	cattle
3	Foot-and-mouth disease	cattle, sheep, goat, pig
4	Infectious encephalitis	cattle, horse, sheep, goat, pig
5	Rabies	cattle, horse, sheep, goat, pig
6	Vesicular stomatitis	cattle, horse, pig
7	Rift Valley fever	cattle, sheep, goat
8	Anthrax	cattle, horse, sheep, goat, pig
9	Hemorrhagic septicemia	cattle, sheep, goat, pig
10	Brucellosis	cattle, sheep, goat, pig
11	Tuberculosis	cattle, goat
12	Johne's disease	cattle, sheep, goat
13	Theileriosis	cattle, horse
14	Anaplasmosis	cattle
15	Transmissible spongiform encephalopathies	cattle, sheep, goat
16	Glanders	horse
17	Equine infectious anemia	horse
18	African horse sickness	horse
19	Classical swine fever	pig
20	African swine fever	pig
21	Swine vesicular disease	pig
22	Fowl cholera	chicken, duck, quail
23	Highly pathogenic avian influenza	chicken, duck, quail
24	Newcastle disease	chicken, duck, quail
25	Salmonella infections in poultry	chicken, duck, quail
26	Foulbrood	bee

Table 2: Category 1 domestic animal infectious diseases according to the Japanese Act on Domestic Animal Infectious Diseases Control, Ministry of Agriculture, Forestry and Fisheries [8].

Prioritization Methods

In the decision making process that competent authorities have to undertake, risk assessment become a must to define priorities among identified hazards in the framework of the risk analysis approach, preliminary to the risk management and risk communication components. With concern to animal diseases, different methods have been developed in relation to national or international needs. In 2004, in Spain, Garcia Nieto et al. elaborated a method of prioritization focused on pet animal diseases with zoonotic interest occurring in Madrid, based on 16 discrimination criteria of public health relevance [10]. In UK, the Department for Environment, Food and Rural Affairs (DEFRA) developed in 2006 the Prioritization Decision Support Tool (DST) an Excel® file method of prioritization of animal diseases to be considered for governmental interventions in the framework of the national strategy for animal health and welfare [11]. Forty criteria have been used in relation to public health, animal welfare, societal impact, international trade, risk and epidemiology, including control measures. In 2008, a collegial work made by the chief veterinary officers of the European Union Member States issued a 34 criteria based guideline for the allocation of funds for animal diseases prevention, control and eradication [12]. The European Technical Platform for Global Animal Health released in 2009 the Disease Control Tools (DISCONTOOLS) [13]. This tool aims at assessing the priority level of animal diseases through the application of 29 different criteria to perform a gap analysis in terms of prevention and control means (diagnostic methods, vaccination, treatments).

S.No	Infectious Diseases	Domestic animal species	S.No	Infectious Diseases	Domestic animal species
1	Bluetongue	cattle, buffalo, deer, sheep, goat	37	Maedi-visna	sheep
2	Akabane disease	cattle, buffalo, sheep, goat	38	Contagious agalactia	sheep, goat
3	Malignant catarrhal fever	cattle, buffalo, deer, sheep	39	Enzootic ovine abortion	sheep
4	Chuzan disease	cattle, buffalo, goat	40	Toxoplasmosis	sheep, goat, pig, wild boar
5	Lumpy skin disease	cattle, buffalo	41	Psoroptic mange of sheep	sheep
6	Bovine viral diarrhea-mucosal disease	cattle, buffalo	42	Goat pox	goat
7	Infectious bovine rhinotracheitis	cattle, buffalo	43	Caprine arthritis-encephalomyelitis	goat
8	Bovine leukemia	cattle, buffalo	44	Contagious caprine pleuropneumonia	goat
9	Aino virus infection	cattle, buffalo	45	Aujeszky's disease	pig, wild boar
10	Ibaraki disease	cattle, buffalo	46	Transmissible gastroenteritis	pig, wild boar
11	Bovine papular stomatitis	cattle, buffalo	47	Porcine enterovirus encephalomyelitis	pig, wild boar
12	Bovine ephemeral fever	cattle, buffalo	48	Porcine reproductive and respiratory syndrome	pig, wild boar
13	Melioidosis	cattle, buffalo, deer, horse, sheep, goat, pig, wild boar	49	Vesicular exanthema of swine	pig, wild boar
14	Tetanus	cattle, buffalo, deer, horse	50	Porcine epidemic diarrhea	pig, wild boar
15	Blackleg	cattle, buffalo, deer, sheep, goat, pig, wild boar	51	Atrophic rhinitis	pig, wild boar
16	Leptospirosis (*Pomona*, *Canicola*, *Icterohaemorrhagiae*, *Grippotyphosa*, *Hardjo*, *Autumnalis*, *Australis*)	cattle, buffalo, deer, pig, wild boar, dog	52	Swine erysipelas	pig, wild boar
17	Salmonellosis (*Dublin*, *Enteritidis*, *Typhimurium*, *Choleraesuis*)	cattle, buffalo, deer, pig, wild boar, chicken, duck, turkey, quail	53	Swine dysentery	pig, wild boar
18	Campylobacteriosis in cattle	cattle, buffalo	54	Avian influenza	chicken, duck, turkey, quail
19	Trypanosomiasis	cattle, buffalo, horse	55	Avian pox	chicken, quail
20	Trichomoniasis	cattle, buffalo	56	Marek's disease	chicken, quail
21	Neosporosis	cattle, buffalo	57	Infectious bronchitis	chicken

22	Hypodermosis	cattle, buffalo	58	Infectious laryngotracheitis	chicken
23	Nipahvirus infection	horse, pig, wild boar	59	Infectious bursal disease	chicken
24	Equine influenza	horse	60	Avian leukosis	chicken
25	Equine viral arteritis	horse	61	Avian tuberculosis	chicken, duck, turkey, quail
26	Equine rhinopneumonitis	horse	62	Avian mycoplasmosis	chicken, turkey
27	Equine morbillivirus pneumonia	horse	63	Leucocytozoonosis in chickens	chicken
28	Horse pox	horse	64	Duck hepatitis	duck
29	Tularemia	horse, sheep, pig, wild boar, rabbit	65	Duck virus enteritis	duck
30	Contagious equine metritis	horse	66	Rabbit viral hemorrhagic disease	rabbit
31	Equine paratyphoid	horse	67	Rabbit myxomatosis	rabbit
32	Pseudofarcy in horses	horse	68	Varroa disease	bee
33	Peste des petits ruminant	deer, sheep, goat	69	Chalk disease	bee
34	Contagious pustular dermatitis	deer, sheep, goat	70	*Acarapis woodi* disease	bee
35	Nairobi sheep disease	sheep, goat	71	Nosema disease	bee
36	Sheep pox	sheep			

Table 3: Category 2 domestic animal infectious diseases according to the Japanese Act on Domestic Animal Infectious Diseases Control, Ministry of Agriculture, Forestry and Fisheries [8].

In 2010, another method resulted from a study commissioned by the OIE and co-funded by the World Bank and the European Union DG SANCO, named Phylum method [14,15]. Through the development of an ambitious methodological tool applicable on different geographical scales and in a great variety of contexts, the study was undertaken to fulfill the specific objective, defined according to the terms of reference, to facilitate regional/national veterinary authority management decision making on priorities and categorization of all animal diseases and animal-related threats. The proposed protocol is organised into a sequence of thematic analyses to avoid lack of discrimination into a global prioritization, thus providing a differential assessment of every main aspect within each theme, and proposing graphical representation of the profile of the disease as regards each group of criteria. The protocol is based on the analysis of 5 different groups of criteria according to the impact caused by a disease in terms of (1) epidemiology, (2) economy,(3) human health, (4) societal impact, and (5) environment. Precise and organised methodological steps have been structured within a two-dimensional decision process for categorization and prioritization of animal diseases, taking into account specific aspects such as availability of data, presence or absence of the disease, local level, exotic diseases and the risk of introduction in free countries, and possible use of pathogenic agents in bioterrorism, as well as prioritization criteria specific to developing countries as risks of disease impact on food security or availability of animal traction for agricultural work. A "vertical" and chronological sequence is established, starting with a first step for the determination of the potential negative impact of each disease under evaluation, considering related general knowledge, including possible control measures, in order to assess the impact on animal and/or human health, societal sphere, and environment. Subsequently, the evaluation continues taking into account the local dimension to refine the results. For this purpose, data concerning the characteristic of a country or region (territory, population, production systems, trade activities, society, etc.) and the specific epidemiological situation of the disease in the selected geographic area (presence or absence in the territory, affected native species, etc.) are considered, in order to assess the specific impact of a given disease, as well as corresponding control measures, at the local scale. In parallel, a "horizontal" and logical sequence is respected at each level: information from the categorization of the disease is crossed with the processing of available data in order to assess a priority level for the disease at the current level (general or local). As stressed by the OIE in the terms of reference, underlining the links between animal health and public health, large space has been attributed to zoonoses. However, it is necessary to specify that this is restricted to generally internationally recognized zoonotic agents. While characterizing a disease and determining its zoonotic profile (zoonotic character of the disease, including its ability to affect humans, to determine inter-human transmission, and to pass from humans back to animals) only human forms and cases where transmission modalities exist and may be relatively common in normal conditions will be considered. 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, it will be assumed that there is no human disease, and such modalities will not be taken into account in the general analysis, but it should be specified in the corresponding "Comments" field, so that every operator will be working with the same reference. For example, this is the case of FMD and bovine viral

diarrhea (BVD). FMD has been demonstrated to be effectively capable to infect humans and to induce infection with clinical symptoms. However, this event has been reported only in very rare circumstances, accounting no more than about 40 cases worldwide, according to reports in several countries in Europe, Africa, and South America since 1921, and those few infections that have been reported have resulted in mild self-limiting illness [16-19]. Similarly, serological and antigenic evidence of BVDV in humans has been reported [20]. The virus has been demonstrated in viraemic patients [21], and supposed to be related with gastro enteric or neurological neonatal pathologies [22-24] or post-infective nevritis [25], but these observations have been reported in experimental or exceptional conditions and does not correspond to common evidence in normal conditions, and for this reason diseases not listed as zoonoses in the framework of disease categorization and prioritization.

The methodology represents advancement for the criteria retained for prioritization, and there is a recognized interest to apply the method Phylum to ensure coherence among community and national approaches on animal diseases. However, the method showed application limits. The quantitative tool for prioritizing all animal-related threats and biosecurity was expected to be able to categorize all diseases of the OIE lists for all animals (terrestrial and aquatic animals, production animal, companion animal or wildlife). Considering the extreme variability existing among these topics, diseases affecting aquatic animals have been excluded, and it appeared difficult to differentiate diseases with similar profiles and a comparable local situations. The obtained ranking depends on the available data quality, and it is not possible to do a global ranking for all diseases, in particular to prioritize diseases that are absent and diseases that are present in a studied country, thus only providing elements of comparison for these two subcategories that should therefore be addressed separately. In addition, criteria related to disease impact on public health appear particularly complex due to the consideration of the disability-adjusted life year (DALY) indicator with a subsequent need of often unavailable data for computing.

Among examples of further recent national new developed methods, in 2012, the French National Agency for Health and Food Safety, Environment and Work (ANSES) realized a prioritization of diseases affecting domestic animals occurring in France [26]. In a preliminary phase, 104 diseases (related to 5 zootechnics sectors: 41 for ruminants, 12 for equids, 19 for suids, 23 for avian species and 9 for lagomorphs) have been selected for the application of the prioritization procedure, mainly on the base of their inclusion in the OIE list, EU, national or regional laws, zoonotic character, economic impact, and epidemiology. The method Phylum was taken into account as starting base, and developed and adapted according to the specific national objectives. Therefore, giving relevance of contextualization, criteria related to general profiling of each disease and local context have been partially integrated. Exotic diseases, being object in a separate analytical approach [27], and bioterrorism were not considered. Similarly, criteria referring to emerging countries as for example impact on food security or animal traction have been excluded. Despite, such criteria may not deviate results, they may cause a general reduction of scores (resulting zero for all considered diseases) and thus presenting more homogeneous and less differentiable the considered diseases, opposite to the expected from categorization process. Due to heterogeneity among different zootechnics sectors, the inter-sectorial evaluation was not retained, preferring a method adapted to clusters of diseases related to sectors with specific production concepts and objectives. With concern to public health/zoonosis, criteria developed by DEFRA have been preferred instead of those foreseen in the method Phylum. The method was further modified for its application for the prioritization of the selected diseases in terms of definition of domains of criteria (adjustments of number and nomenclature of criteria or sub criteria), scoring for each criteria, attribution of coefficients for each domain of criteria and aggregation modalities. Two main types of domains of criteria have been identified in relation to impacts caused by the disease and those due to the application of control measures. Eight domains of criteria have been considered: (1) epidemiological characteristics (potential persistence and evolution in animals); (2) economic and commercial impact; (3) impact on human health; (4) societal impact; (5) impact on biodiversity (wild fauna); (6) limits of prophylactic and control measures; (7) global economic impact of control measures at national level; and (8) impact of control measures on society and environment. Each domain of criteria has been subdivided in specific criteria, sub-criteria, and evaluation elements according to the complexity of the topic, for a total of about hundred single scores attributed to each considered disease. The method provides two Microsoft Excel® format files, a summary of scores for each evaluated disease, and a synthesis of prioritized diseases per each considered zootechnics sector. The analysis of obtained results is than performed through various utilization modalities as classification, comparison or aggregation of domains of criteria or statistical analyses.

Despite several animal health crises, in reference to animal diseases subject to legal norms, the epidemiological situation in the agro zootechnics systems evolved favorably with sensible reduction or up to eradication of various diseases in different countries. Therefore, for competent authorities remains important to continue in their search for priorities to address and focus efforts. Thus, development of methodologies and gathering of updated scientific data are necessary to sustain this purpose. Apart method like Phylum designed for a variety of contexts and intended to be applicable in any country, and able to provide, at any scale, a relevant prioritization and categorization for the selected diseases, the majority of the protocols have a relatively well-defined field of action designed for a given country with precise objectives. Often, only diseases recognized for their potential to severely affecting the livestock industry causing massive epizootics or disrupting trade channels, or zoonoses capable to cause major social crises are retained as priorities by the authorities in various countries. Nevertheless, the relevance of a general evaluation approach may be significantly different according to local context, as considered aspects reflect the economic, social, cultural and political traits specific to each different geographical area. Therefore, in order to support effective decision process to identify the relevant priority level, it is essential to assess the impact of a disease and related necessary control measures through approaches fully adaptable to the particular considered territory. However, even the realization of a global national evaluation considering all the agro zootechnics sectors remains a complex exercise.

Conclusions

In principle, the protocols should be simple, but in reality and in contrast they must be precise enough to effectively discriminate between the diseases and provide a useful assessment. Therefore, complex weighting values applicable to each criterion are necessary to obtain good discrimination for each aspect of each disease. Thus, categorization and prioritization methods are necessarily constantly improved and become more articulated and complex. Socio-economic elements are also useful to avoid evaluation difficulties of the economic

impacts due to diseases, to refine qualitative prioritization, and in order to assess risk management strategies. The integration of cost/benefit studies on prophylactic and control measures may also offer interesting additional information. In addition, methods designed for a specific field or sector will require modifications if intended to be applied to other types of diseases such as multifactorial diseases, or other zootechnis sectors. As for any science based procedure, results may be affected by a certain level of incertitude for example due to biological variability and insufficient knowledge or epidemiological data for certain diseases. However, regular updating is necessary since many factors may change possibly even rapidly and in unpredictable ways. Apart consideration of sudden and relevant novelties, at least the prioritization methodology should undergo periodically after a reasonable laps of time to a full revision of parameters to avoid obsolescence and lack of significance.

At the end, despite all these limits, the interest for the application of comparative evaluations (obtained through categorization and prioritization protocols) relies on the support offered to competent authority decision-makers to facilitate decisions with concern to various aspects related to animal health, from legislation, surveillance, control measures, biosecurity, border inspection, animal movements, trade, funding, and also awareness campaigns or new research programs.

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