

## 2015 – issue 68, Abstracts

### AEEMA Meeting, march 19<sup>th</sup>, 2015

#### **Uncertainty in epidemiology and its impact on decision making for animal health**

##### **Areas and sources of uncertainty in animal epidemiology**

Toma Bernard & Dufour Barbara

This paper reviews some basic notions regarding the concept of uncertainty routinely encountered in every day's life and in the scientific field, and proceeds to characterize four major types of uncertainty and their origin: Epistemic uncertainty, associated with a gap in knowledge; Methodological uncertainty, resulting from the method used; Stochastic uncertainty, related to chance, to population heterogeneity and/or to variability among individuals; Linguistic uncertainty, related to the vocabulary used to communicate. The overall uncertainty encountered in a given situation results from one type of uncertainty or, more frequently, from a combination of several types of uncertainty. Only a part of the overall uncertainty can be mastered.

#### **Health decisions and uncertainty**

Brucker Gilles

Ensuring the safety of populations is a sovereign responsibility of the State, in charge of public health and risk management. The uncertainty regarding the extent and the seriousness of emerging risks in public health rests with the scientific field of epidemiology and risk evaluation. But, decision making on the management of risks in the health field is the responsibility of the political authorities. The role assigned to the health administration is to provide a link between the health monitoring sphere under authority of experts (scientific experts and epidemiologists), and the political sphere, that are expected to take appropriate steps to protect the populations. A decision by the State in the field of risk management creates obligations that go beyond the management of eventual consequences; it also creates sanitary liabilities under a variety of potential scenarios, and carries social, judicial and economic consequences. Decision making must encompass those various factors and particularly risk/benefit and cost/benefit considerations. One of the main lessons learned from last years' various public health crises is that threats must be identified and crises must be anticipated in order to be prepared to face health crises as they occur.

#### **Uncertainty about the epidemiological situation of an animal disease: brucellosis in the Bargy massif (Haute-Savoie)**

Hars Jean & Garin-Bastuji Bruno

Multiple cases of human and bovine cases of brucellosis due to *Brucella melitensis* biovar were recorded in 2012 in the Bargy' mountain area (Haute-Savoie, France). In 2013 a high seroprevalence was identified in the local Alpine ibex population (38%; IC95% [28.2-47.8]; 56% in animals over 5 years of age) were found contaminated. This finding was confirmed by the isolation of the same bacterial strain in culled animals. In the absence of any external risk factor, it was assumed that the Ibex population had provided a silent link between the last domestic local outbreak, in 1999, and the 2012 bovine outbreak in the area. The question arose then of the risk to domestic livestock and public health of associated with his probable *B. melitensis* wild reservoir, which had never before reported anywhere in the world. Surprisingly, the partial culling of the oldest animals in October 2013 resulted in a significant

increase in the prevalence of the infection in younger animals in 2014. These unexpected results raise a number of epistemological and methodological questions regarding descriptive and analytical epidemiology, and regarding control strategies. The aspects requiring further investigations include: 1. A better knowledge of the Ibex population itself (size, movements, feeding, sexual and maternal behaviours, contacts with domestic herds, etc.); 2. The physiopathology and epidemiology of the Brucella infection in a wild species that was very little studied in this regard; 3. The potential extension of the epidemics to neighbouring areas; 4. The persistence of Brucella in the mountain environment; 5. The reliability for Ibex of the serological tests validated in domestic ruminants; 6. The risk management, in which uncertainty takes precedence. Measures applied to livestock may not apply to wildlife while the risk-manager will be confronted with the consequences of sanitary measures taken in the wild population.

### **Uncertainty related to the risk of introduction of an animal disease in France: comparing the approach for porcine epidemic diarrhoea and African swine fever**

Rose Nicolas, Ruvoen Nathalie, Leforban Yves & Guillotin Jean

Risk analysis of a first outbreak of an animal disease in France includes an estimation of the probability of introducing the disease related to various potential sources and the assessment of the risk of exposure of the local animal population to this hazard. At each step in the analysis, experts are faced with various degrees of uncertainty related to the methodology used, to the availability of data, to the quality of available data, and/or to the occurrence of random events. The risk analysis of a first outbreak in France of African swine fever and that of porcine epidemic diarrhoea are used to illustrate this point. These examples illustrate how the type of uncertainty differs between an old exotic disease and an emerging or even re-emerging, poorly known, disease. The way the uncertainty is managed in the risk analysis and the various wordings in which the results are presented are also discussed.

### **Modelling contribution to the reduction of uncertainty in an animal disease spread: example of foot-and-mouth disease in France**

Marsot Maud, Rautureau Séverine, Dufour Barbara & Durand Benoît

How does modelling contribute to the reduction of uncertainty in the evaluation of the spread of an infectious animal disease? To illustrate this, foot-and-mouth disease (FMD) in France was taken as an example. The objective was to analyse the contribution afforded by the construction of a model in the evaluation of uncertainty on FMD dynamics in France, in the identification of sources of uncertainty and in the actions designed to reduce it. The first source of uncertainty is the epistemological uncertainty associated with a lack of knowledge during the construction of the model, particularly in the estimation or the choice of values for the parameters. To evaluate it, we performed a sensitivity analysis. The second source of uncertainty is the stochastic uncertainty. To understand it, we measured the variability in simulated epizootic diseases depending on the starting point (place and date) of the epizootic, before analysing how this stochastic variability could be modified by using of various strategies for control of the disease. Following a presentation of the model, a sensitivity analysis is presented, which considers two parameters of the model: the speed of disease spread (slow or fast) and the level of resources assigned to the control of the disease (normal or degraded level). The results of the stochastic uncertainty analysis are then presented, for a fast spread and a normal level of resources. We show how this variability evolves when the starting point of the epizootic, is known by distinguishing 3 levels of location: national, regional and herd

level. Finally, we illustrate how this variability is modified by the implementation of control measures: pre-emptive slaughter or vaccination. The modelling of FMD spread increased the understanding of the sources of uncertainty concerning the potential spread of FMD in case of reintroduction in France. The consideration of this uncertainty underlined the importance of the choice of the control strategy used in case of FMD epizootics in France.

### **The contribution of behavioural sciences to the consideration of uncertainty by a decision maker**

Auvigne Vincent

The variety of uncertainties that an animal health decision maker may encounter includes the stochastic uncertainty and the terminological uncertainty. This article focuses on both types. We seek to understand why it seems that decisions are not always consistent with rational conclusions of studies that are supposed to inform decision-makers. Stochastic uncertainty is about understanding how we consider the irreducible uncertainty linked to the occurrence of the event itself, even if the probability of occurrence is well known. Under which conditions and by what mechanisms do we accept the probable as certain when taking decisions? Regarding terminological uncertainty, we will see how the formulation of a result can have an important impact on the decision. The risk assessor can partially control this bias by standardising the presentation of the results, but should also realise that whatever precautions he takes, he will have to make choices that will influence the decision-maker. These issues were studied by using the concepts and tools of behavioural economics, a scientific approach on the border between economics and psychology.

### **Point of view of a decision maker in animal health**

Briand Pascale

Uncertainty is the decision maker's vital space, his reason for being. It nurtures his daily existence, partially devoted to reducing its dimension, partially obliged to accept its presence, since "Taking uncertainty for certain is the worst possible error". Epistemological, methodological, stochastic or terminological uncertainty open the way to the possibilities to be taken into account, casting lack of focus and fog over the complex landscape offered to the decision maker from which to forge a path towards containing, eradicating, or limiting the sanitary and economic impact of an event. Clarification, to the extent possible, reducing the sources of uncertainty, mobilizes scientists: producers of new biological, environmental, behavioural, technological, eco systematic and economical knowledge, refiners of techniques, methods, modelling; scientific teams which integrate these findings in order to estimate risk, qualify uncertainty, describe possible management options: professionals, witnesses in actual practice; participants. Such a line of thought which, via reductionist approaches, integrates complexity, merits questioning as to what can be improved. But clarification to the extent possible occasionally confronts difficulties of a non-conceptual nature. Are the pressure and methods applied to eliminate one uncertainty with respect to another perhaps heterogeneous? Is there another explanation as to why no attempt has been made on a European level to analyse the localization of two recent vector-borne diseases (BTV, Schmallenberg virus) and to establish adequate surveillance? Furthermore, are management difficulties related to other causes falsely attributed at times to uncertainty? Is, for example, uncertainty the source of the difficulty in handling brucellosis in the Bargy massif rather than a difficulty in decision making irrelevant to animal health? Remains the « fog », the irreducible uncertainty, which imposes adaptation of action, modulation of decision, questioning. « The

certainty of uncertainty leads to strategy », according to Edgar Morin; strategy requiring adaptability and comprehension. Uncertainty infers the necessity in decisional planning to include, from conception onward potential corrective measures. This should be part of the effort in communication: convincing political authorities, as well as the population concerned, that a sufficient number of elements justifies the proposed action, while, simultaneously, developing the indicators for possible change in orientation is a necessity to be grasped. Preparation, programming, anticipating, observing are trump cards, but is managing risk and uncertainty pertinent to the same logic? The more uncertainty that exists, the more inventiveness, construction should override planned application. Does vigilance occupy enough space next to surveillance? Creative initiative, a new approach towards action, a new conception of decision making undoubtedly still needs to be thought through at a moment when Precaution pervades, a source of action implying ignorance of consequences.

## **AEEMA Meeting, march 20<sup>th</sup>, 2015 – Communications**

### **Is present bovine tuberculosis different from the one who raged formerly?**

Bernard Marianne & Bénet Jean-Jacques

For most veterinary practitioners, present bovine tuberculosis (TB) is quite different from the one which could be observed formerly, about twenty years ago or more: both number of infected bovines and skin reactions to skin test are lower. Our objective was to compare present and past situations, to verify those assertions. Source of data: We used the data from a survey undergone in 1988 in different local veterinary services, concerning the herds infected the previous year (1987), their history (1981-1987), the possible observations in 1988, their previous histories, and dates (month and year) for recorded events. We compared them to a national survey conducted in 2008 on the outbreaks of TB appeared between 2005 and 2007. We compared also the sizes of the skin reactions in TB infected herds selected among files subjected to our expertise at the beginning of the 80s to those of TB infected herds recorded since 2009 in the database of the department of Côte-d'Or. Results: The comparison of the situation between two different periods requires a standardization of the observation conditions: at present, as soon as TB is detected, the herd is submitted to whole depopulation. Formerly, the rule was the progressive eradication by detection and elimination of the reactors to bovine tuberculin. Actually, the comparison of tuberculosis status between those two periods shows statistically significant differences. But, if we limit this comparison to the first tuberculin test performed in a herd, in order to standardize the conditions, this difference disappears: TB situations are comparable between the two periods (low number of concerned animals). Consequently, veterinary practitioners' perception should come from their reminding of the accumulation of the cattle detected in the course of the successive tuberculin tests. From an epidemiological point of view, we cannot say that there is a substantial difference in the expression of tuberculosis in a herd, under comparable conditions of observation. The sizes of the reactions show a significant decrease (median changing from 9.6 mm to 3.0 mm). Various hypotheses are proposed to try to explain this point. Due to the weakness of skin tests reactions, it is strongly recommended to measure the fold of skin with a calliper, according to European and French regulations.

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## **Establishment of a method of assessing body condition of crossed breed pigs (Large White and local) in Senegal**

Manishimwe Rosine & Koné Philippe

The continuous evaluation of body condition of pigs is a very important practice to optimize production and animal health. This study was designed to develop a method of body condition assessment suitable for crossbred pigs (Large White and local breed). The proposed method makes it possible to assess both body weight and back fat (main indicators of body condition in pigs), using major components deduced from the correlation matrix between these two variables. Regression equations, based on visual notations or linear measures of the morphology individual animals, were developed to predict these major components. The study also assessed the repeatability and reproducibility of the method developed in comparison with the visual scoring method described by Patience and Thacker [1989]. It turns out that the new method has a repeatability of 0.84 and a reproducibility of 0.64 for the first major component. Our study demonstrated that the major components were better correlated with body condition indicators (body weight and back fat) and that the method can predict body condition of crossbred pigs (Large White x local breed) under field conditions.

## **Epidemiology Papers**

### **Evaluation of the surveillance system for bovine tuberculosis in wild animals in France and recommendations**

Lhubert Marie, Réveillaud Édouard, Cavalerie Lisa, Hendrikx Pascal & Rivière Julie

Bovine tuberculosis (*Mycobacterium bovis*) is a disease with significant economic and sanitary impact. An increasing number of outbreaks in cattle in some French districts since 2004 and the discovery of infected wild animals in the vicinity of cattle outbreaks suggest the existence of reservoirs in wildlife in France, as reported in other countries. In 2011, the French Ministry of Agriculture launched a national surveillance program for bovine tuberculosis in wildlife, named Sylvatub. The main goals of this surveillance system were to detect early cases in wild animals, to monitor the progress of bovine tuberculosis infection in wildlife and to harmonize the surveillance system within the country. The aim of this study was to assess the Sylvatub system using a semi quantitative method, the OASIS method (« flash » variant), to identify its strengths and weaknesses and to suggest improvements. The main strengths of the system were its organization at the central and intermediate levels, the quality of the surveillance and of laboratory protocols, the communication system, the coordination and the training of participants. The recommendations suggested here to improve the acceptance and the coverage of the surveillance system, rigorous data management, a better harmonization of surveillance activities between districts and higher awareness (especially in districts of low-risk levels). Performance markers developed for the surveillance network could be useful for regular monitoring.

### **Evolution of the distribution of equine and human West Nile infections during the last fifteen years in Europe and Mediterranean Basin**

Hosy Fanny & Dufour Barbara

West Nile virus is an arthropod borne virus which infects birds. It is primarily transmitted by mosquitoes of the genus *Culex*. The virus can infect humans and horses. The infection may remain unapparent or cause signs of severe encephalomyelitis. This virus originating from Africa has been found in Europe since the sixties. In the last ten years, an increase of the

number of cases was recorded in the Mediterranean Basin and in the South East Europe. Currently, the West Nile virus is endemic in a zone which extends from the North of Italy to the south-west of Russia, as well as in Andalusia and in Israel. In the future, the global warming may contribute to the extension of the endemic area, in particular to the North and West of Europe, areas with rather similar ecological characteristics. In France, especially in the South East, which has already been sporadically affected, the risks of introduction are significant, and events monitoring should be consolidated.

### **Evaluation of an alternative protocol for skin thickness measurement in testing cattle for tuberculosis**

Lambert Oriane & Bénet Jean-Jacques

In the screening of cattle for tuberculosis, some veterinarians, instead of applying systematically the compulsory measurement of skinfold thickness, perform it only if they notice a reaction on the day of the reading. In that case, they use as reference value a measurement made either slightly ahead of the injection site (« control site »), or on a symmetric point, Skinfold thickness. Skinfold thickness was measured on 500 suckling cattle, and 500 dairy cattle in three sites, injection, control and symmetric sites, on the day of injection and on the day the results were read. The use of a site other than that of injection is a source of variability. Differences were found to be greater with the control site, most commonly used in this alternative protocol. The simulation of this protocol with real data from the Côte-d'Or area showed errors by excess or default totally incompatible with the requirements of the tuberculosis eradication program.