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Communications: AEEMA-AESA MEETING, 2009 JUNE 4th - Sentinel animals

The sentinel function in epidemiology

B. Toma

Four themes have been reviewed, as briefly indicated: a discussion of potential definitions of sanitary sentinel animals; the relationship between sentinel animals and epidemiological monitoring; the history of the sentinel function; and the diversity of situations encountered in the field. This whole review leads us to submit a *stricto sensu* definition of sanitary sentinel animals and a *lato sensu* definition to be time tested and discussed with colleagues.

Quality requirements of the sentinel function in epidemiology

P. Hendrikx & Barbara Dufour

The quality of a sentinel surveillance system is, first of all, contingent on its adequacy with the objectives of the surveillance. These objectives must be precisely defined and relevant. The evaluation of a surveillance system should be based on the following criteria: Representativeness of the system allowing extrapolation of the results to the target population; Timeliness of the system i.e. its capacity to assure an early detection of the disease under surveillance; Simplicity of the system, guaranteeing an easy implementation; Acceptability of the system by the actors of the surveillance; Flexibility of the system, making it possible to respond to changes in the situation; Stability of the system in time. The objectives and quality criteria listed above must be evaluated and analysed in a synthetic way to determine three aspects of the proposed system: its relevance, its practicality and its cost / benefit ratio.

Sensitivity and specificity of the system, conditioned by the choice and location of the sentinel species, the size of the proposed sample and the characteristics of the diagnostic tools; Sentinel animals in tropical environments. Toward an integrated surveillance system

R. Lancelot

In Kenya, the sero-monitoring of sentinel wild ruminants has been used to assess the progress of rinderpest control in the Somali and Tsavo ecosystems. In West Africa, low-level Rift Valley fever (RVF) virus activity has been identified using sero-monitoring of sentinel small-ruminant herds. However, results could not be used for RVF early warning. An integrative, multidisciplinary approach is needed for a better detection of future disease emergencies. A close collaboration between research and development, and a regional strategy relying on the animal health regional centres promoted by OIE, FAO, and UA-IBAR, should facilitate this process.

Animals as sentinels in toxicology: animals as sentinels of sanitary risk from environmental origin for humans: from saturnism to cancers

Brigitte Anna Enriquez, G. Hakou, Marie-Danielle Payn, Aude Tabaries, P. Devauchelle, Brigitte Revol & J-J. Benet

Pets can be useful sentinels for humans, for sanitary risks of environmental origin. Indeed, family dogs are at least as susceptible to lead as children and an elevated blood lead level in

dog points to the same condition in children. In addition, dogs, because of their shorter lifespan, may develop environment induced cancers such as lymphomas. Based on a presentation of a few articles dealing with saturnism and with cancers common to the two species, the authors propose the development of epidemiological studies in dogs designed to investigate the potential association of certain disease conditions with specific factors in the environment.

Rodents as potential sentinels for Hantavirus infections

P. Heyman & C. Saegerman

Rodents as sentinels for hantavirus infections. The bank vole (*Myodes glareolus*) is the reservoir and vector of Puumala hantavirus (PUUV) infections. This vector was selected as a model of animal sentinel. This study in Belgium showed that serum monitoring of the carrier species for hantavirus infections, provides a six-month period (November-April) in which Public Health authorities can address at-risk groups and health care workers and inform them of the like-hood of an impending epidemic.

The sentinel function in aquatic environments

C. Michel

Surveillance of aquatic environment may apply to a variety of habitats and is frequently based on the use of animal species to detect water quality degradation. Three kinds of biological systems have been proposed. Indicators, sentinel animals and biological sensors. Indicator species encompass a large range of organisms and are selected to obtain a global evaluation of the quality of an ecosystem. Sentinel animals are selected for monitoring of specific pollutions or aquatic animal diseases; they may apply to wild water environments as well as to restricted space environments. Sensors include living species in bio-monitoring systems specially designed for water quality surveillance. A fully automated station combines an early warning system and real time assessment of animal behaviour. Examples of sentinel animal systems will be presented in order to illustrate the advantages and limits of their use in aquatic environment surveillance.

Sentinel animals and bluetongue in Europe

C. Saegerman, Cécile Herr, D. Crochet, P. Sarradin, R. Lancelot, F. Vandenbussche, Verheyden Bart, L. Martinelle, J. Hooyberghs, K. De Clercq & Estelle Méroc

The recourse to sentinel animals or sentinel units is a type of specific surveillance based on a prospective protocol. This is the strategy usually applied to the surveillance of bluetongue disease around the world. This article presents the initial results of a sentinel network in cattle implemented in Belgium in 2007 and of a system of sheep sentinel system set up in 2008 at the INRA Experimental Infectious Platform I – Research Centre in Tours-Nouzilly (France). These systems made possible the detection of bluetongue reoccurrence. However, improvements in standardisation, assessment and management are required to meet all the quality criteria of a surveillance system similar to that enacted by the centres of disease prevention and control in the United States.

Indications and limits of animal sentinels: lessons learnt from French episodes of West Nile virus infection

Sylvie Lecollinet, J. Hars, T. Lefrançois, B. Durand & S. Zientara

West Nile fever is a zoonotic infection, caused by the West Nile virus (WNV), a virus of the Flaviviridae family. Its transmission takes place mostly through mosquito bites. It can lead to neurological disorders in humans and horses, with clinical symptoms of meningo-encephalitis (1-10% of cases). Numerous outbreaks observed recently have highlighted the importance of organizing a permanent and efficient surveillance system for WNV infection by appropriate information and intervention, in order to limit the number of neuro-invasive cases in humans and horses. Among surveillance tools, serological surveys (active surveillance) of sentinel animals (avian or equine) were carried out to strengthen basic passive surveillance (clinical surveillance). Active surveillance was implemented in avian species (call ducks and domestic poultry) from 2001 to 2007 in some of the departments on the French Mediterranean coastline. Horse sentinels were maintained in Guadelupe since 2002. Starting from these two examples, we attempt to specify the sentinel function for WNV surveillance and to characterize the main benefits to be expected and the limitations of active surveillance.

Oral communications, June 5th, 2009

Wildlife, as an epidemiological sentinel of infectious and toxic diseases

J. Hars, P. Gibert & O. Mastain

In this paper, we discuss the concept of passive and active wild sentinels. A good example of passive sentinels is offered by brucellosis infected chamois (*Rupicapra rupicapra*) in the Alps which revealed the unsuspected presence of the infection in cattle and sheep herds. Another example, is provided by the wild boar (*Sus scrofa*), which, being highly susceptible to mycobacteria, can disclose the presence of *Mycobacterium bovis* excreted by cattle or other wild species such as the red deer. In the same way, during outbreaks of avian influenza throughout Europe in 2006 and 2007, the mute swan (*Cygnus olor*) was found to be an excellent epidemiological sentinel able to reveal the presence of the H5N1HP virus in the natural habitat. Among active sentinels, captive mallards are used in France for surveillance of the Influenza and West Nile viruses. Wild animals are also considered as good disclosers or ecological indicators of environment contamination by toxic substances. The role of wildlife as epidemiological sentinels is being discussed.

Historical review (1992-2006) of bovine tuberculosis resurgence in France

J-J. Bénet & Barbara Dufour

An estimation of relative risk of resurgence of bovine tuberculosis (BTb) in previously infected herds and free of disease strengthened the decision of total depopulation according to 1999 French regulation (OR » 80). However, this value did not give information of the risk for such herds to become infected twice. Data from French Ministry of Agriculture has been used for an estimation of incidence rate cumulated for several years. Numerator was number of re-infected herds previously infected and free of BTb, for which resurgence was supposed to be responsible. Denominator was estimations of herds at risk. According to different calculation ways, values of cumulative incidence rates and cumulative incidence risks were about 2 per

cent (range 1.5%; 2.5%). Validity of estimations is discussed, as the interest of these estimations for the decision for some herds and in some conditions to stop total depopulation.

Bulk tank milk, reliable tool for diagnosing Q-Fever in dairy herds?

G. Czaplicki, J.-Y. Houtain, C. Mullender, C. Manteca & C. Saegerman

Two transversal sero-epidemiologic surveys, led in 2006 (n=206) and 2008 (n=1137), made it possible to evaluate the apparent sero-prevalence (Pa) of Q fever on bulk tank milk in the dairy bovine herds of Wallonia (Pa₂₀₀₆ = 57.8%, Pa₂₀₀₈ = 71.2%). Among these two samples of herds, respectively 50 and 150 herds were randomly selected and subjected, on the same tank milk samples, to a *Coxiella burnetii* PCR analysis. The apparent prevalence of excretion was of 30.0% in both cases, with an estimation of generally low bacterial titres. Fortunately, the results show that many Walloon dairy herds were exposed to *Coxiella burnetii*. The effective circulation of the pathogen within these herds appears more limited. Finally, there is a close relationship between the level of sero-positivity of the tank milk and the frequency of a positive PCR test.

Prevalence survey by immunological detection of bovine fasciolosis (*Fasciola gigantica*) in cattle raised by transhumant Peul herders, milk producers in the Region of the river Senegal in the north of the country

YOU WILL FIND AN ERRATUM IN THE ISSUE N°57

J-B. Hanon, O. Tala Diaw, M. Mbacke Seye, J. Guillotin & C. Saegerman

Fasciolosis (*Fasciola gigantica*) is a common disease in cattle in the region of the river Senegal in the north of the country. A survey was carried out to estimate its prevalence in the livestock of Peul herders supplying milk to a dairy plant located in that zone. Bulk milk samples from 131 herds were analysed with a commercial Elisa test, 53% of them was found positive. On bulk milk, the level of positivity in the test provides an estimate of the degree of infestation in the herd. The geographical distribution of positive herds was uneven and varied with the distance to the river Senegal or to the Guiers Lake. Some of the herds were tested at a later date on individual milk and serum samples; for 2/3 of them, the results confirmed the within-herd prevalence's estimated from the bulk milk results. No significant difference was found between the results of individual tests made on milk or serum. The Elisa test on bulk milk samples is therefore suitable for the screening of herds infested with *Fasciola gigantica* but negative results should be double-checked due to their lower sensitivity compared with that of tests on individual samples. This study confirms the high prevalence of fasciolosis in the region and shows how important it may be to take adequate measures against the disease.

First emergence of bovine parafilariosis in Belgium

B. Losson & C. Saegerman

This study describes the first two outbreaks of bovine parafilariosis found in Belgium and provides a few preliminary observations on the epidemiology of the disease gathered from a phone survey with veterinarians in a limited area close to these outbreaks. Typical clinical signs consisting of bleeding spots and areas of oedema were recorded. Furthermore, the aetiology was confirmed through the observation of typical embryonated eggs of *Parafilaria bovicola* in the exudate. The localisation of the lesions (withers, neck, back and, to a lesser extent, the rump) and their first appearance in early spring were additional epidemiological features of

interest. The prevalence of clinical signs among herds in the area close to the first two outbreaks was 14.1% (95 CI: 11.3 - 17.2%). This suggests that bovine parafilariosis is now established in the referred area.

Creating an epidemiological surveillance network in Mayotte

Stéphanie Maeder, Fabienne Biteau-Coroller, Tamine Madi & E. Cardinale

In Mayotte the livestock farming system is poorly structured and mainly made up of farms with social vocation. Cattle identification started in 2007. So far, two thirds of the cattle have been identified and followed through a centralized database. While major epizootic diseases (OIE list) are not present currently (except for Rift Valley Fever which is enzootic), the epidemiologic situation of several tropical diseases remains largely unknown. Studies designed to evaluate the situation are lacking. Then, whereas cases of tick-borne diseases have been occasionally diagnosed and reported, no studies have been conducted to evaluate the prevalence of such diseases. Moreover, the vectors of these diseases have not been studied in Mayotte. The network was designed to provide surveillance of tick-borne diseases, FVR primarily, and to participate in the regional surveillance network. The network will organize and manage the partnership between the various actors in animal health (veterinary services, veterinarians in sanitary services, public health services, laboratories and agricultural associations). Gathering information through *ad hoc* studies on tick-borne diseases and Rift Valley Fever is our first priority. This should enable us to strengthen the diagnostic capabilities of the veterinary laboratory and to estimate the seroprevalence of these diseases. Samples will be collected on the four islands in the Comoros archipelago in order to make an inventory of livestock ticks present and to look for pathogens transmitted. Analysis of the ticks will permit to know which pathogens are present. Eventually, the biology and ecology of the ticks identified as potential carriers of pathogens will enable us to take appropriate measures to control these diseases. Another priority is to choose the diseases to be considered in our epidemiological-surveillance network. Initially, the surveillance will focus on two conditions: the abortive syndrome (Rift Valley Fever, brucellosis, leptospirosis...) and massive mortality within a single herd (symptomatic anthrax...). In order to better detect diseases, we will educate farmers to the importance of sanitary surveillance and train veterinarians to better detect symptoms. Training will also be provided to actors in the field (vets, lab assistants...) in order to improve results. Mayotte's epidemiological surveillance network is designed to join the Indian Ocean regional network. Indeed, a national approach is not sufficient, because Mayotte Island belongs to a larger epidemiological entity. Diseases do spread easily across borders. Real-time and continuous information exchange across the whole region requires harmonization of the different networks for early-warning and intervention.

Climatic conditions and chances of finding disease vector mosquitoes

A. Eyraud-Griffet, Jennifer Pradel, Karine Chalvet-Monfray & D. Bicout

It is now generally agreed that our planet is experiencing a global climate change mainly due to recently increasing human activities. It is highly likely that the 21st century will suffer from many climatic upheavals that may have a serious impact on the spatial distribution of living beings, especially insects, vectors of diseases. As a consequence, some territories still free of vector-borne diseases may get exposed in the future. In this study, we focus on two French wetland areas, the Camargue and the Dombes, and we attempt to determine whether these

areas may become sites for the reproduction and development of *Culex modestus*, a mosquito vector of the West Nile virus in Camargue. To this end, data on climate from the Arpege-Climate model downscaled to 15 km were used for characterization of climate changes in the areas under study. Entomo-climatic indices were calculated for analysis of the relationship between climate and population dynamics of *Cx. modestus*. It appears that, for three time periods, past (1951–1980), present (1991–2020) and future (2031–2060), a significant rise in mean temperature can be expected, as well as a change in the distribution of rainfall over the year which may result in a significant increase in the number of periods favourable to *Cx.modestus*.

Modelling the spread of Avian Influenza viruses among wild birds in the Ebro Delta (Spain)

Ana Alba, D. Bicot, F. Vidal, A. Curco, A. Allepuz, S. Napp, I. Garcia & J. Casal

This study presents a stochastic model to simulate the possible spread of Avian Influenza viruses (AIV) in wild birds under different scenarios. This work based on ornithological and ecological information provides a tool for identification of the species and zones in a specific area that should be targeted in a risk-based avian influenza (AI) surveillance system. The model illustrates the spatial-temporal dynamics of AIV among wild birds based on an individual susceptible-infectious-susceptible approach. It was focused on the Natural Park of Ebro Delta, which is one of the most important reserves of waterfowl in the Western Mediterranean Basin in terms of abundance and variety of species. A series of inputs related to the hosts, viruses and to the environment were included into the model as follows: the onset date of introduction, the number and type of infected bird species and their location, the different polygons according to ecological and ornithological criteria that made up the Natural Park of Ebro Delta, a list of frequent bird species divided into high risk species and intermediate species, the census of each one of these bird species by polygon and period and their patterns of dispersion, the degree of affinity among bird species, the duration of infectiousness and different rates of transmission probability. This type of model can provide the decision makers with useful information for the design and the implementation of future surveillance activities for AIV in wild birds in specific areas.

Quantitative estimation of economic losses linked with the Bluetongue (BTV-8) in Walloon Region during the 2006-2007 period

J-B. Hanon, Aude Uyttenhoef, Fabienne Fecher-Bourgeois, Nathalie Kirschvink, E. Haubruge, Brigitte Duquesne & C. Saegerman

Since 2006, bluetongue (BT) emerged in the central and northern parts of Europe and affected domestic ruminants. The dissemination of BT was rapid. Clinical signs of BT, particularly reproductive disorders in cattle were reported since the fall of 2007. The economic consequences of BT were estimated quantitatively in the South of Belgium by using transversal epidemiological inquiries performed among cattle and sheep farmers and among veterinarians and by identifying and interconnecting various databases providing technical and economic information. The results of this study illustrate the extent of the infection in the bovine and ovine sectors of the Walloon Region. A deterministic approach was used to evaluate the economic losses. The mean technical and economic losses in the Walloon Region reached 32.3 million € (low estimate based on officially declared BT farms), 92.9 millions € (mean estimate based on the enquiry among veterinarians) and 104.8 million € (high estimate

based on inquiries among cattle and sheep farmers). Many elements of the consulted technical and economic databases provide a good validity to the study. The main economic losses are related to reproductive disorders. Earlier estimates of socio-economic losses should be revised because they were computed soon after the emergence of BT.

COMMUNICATION

Epidemiological veterinary survey regarding three vector diseases in North-Kivu province (Democratic Republic of Congo)

M. Kasereka Kalume, B. Losson, C. Guido Vyambwera, Lusenge Mbegumbaya, A. M'Pondi Makumyaviri & C Saegerman

An epidemiological survey carried out among veterinary surgeons in North-Kivu ($n = 1,021$) showed that bovine theileriosis is more commonly encountered (49.35%) than anaplasmosis (35.5%) and babesiosis (15.15%). Clinical diseases were reported over the year in thirty agropastoral locations distributed over the territories of Lubero ($n = 10$), Masisi ($n = 9$), Beni ($n = 8$), Nyiragongo ($n = 2$) and Rutshuru ($n = 1$). The most critical situation was reported in herds located in the vicinity of the equatorial forest, in the savannah woodlands of the Graben and in the national parks of Virunga and Maïko. The mean rate of tick infestation was not significantly different between these three vector diseases ($\text{Chi}^2 = 0.579$; $\text{ddl} = 4$; $p < 0.9$), with 10 to 50 ticks per sick animal. This study indicated also that the availability of efficacious drugs against those diseases must be improved. *Tephrosia vogelli* was cited as a medicinal plant used against ticks but its effect on ticks and the proper concentration to be used remain to be determined.

EPIDEMIOLOGICAL PAPERS

Qualitative risk assessment of the introduction of “peste des petits ruminants” in France

Manuelle Miller, E. Etter, Barbara Dufour, Geneviève Libeau & R. Lancelot

The risk of introduction and spread of “Peste des petits ruminants” (PPR) in France was the subject of a qualitative risk assessment. This viral infectious disease is widespread in Africa, the Middle East and Asia. An epizootic occurred in Morocco in 2008. The probability of each event possibly leading to PPR introduction in France and the consequences of a possible outbreak of PPR were estimated. Three risk scenarios were identified. A few vigilance points for risk management are reviewed and discussed.

Prevalence of hydatidosis in sheep in Sardinia

Marion Ripoche, A. Varcasia & A. Scala

A survey on hydatidosis in sheep in Sardinia was carried out in 2008. Out of 399 carcasses of Sardinian breed sheep examined at the slaughterhouse, 332 (83%) were found infected with hydatid cysts. This prevalence demonstrates the high contamination level of the environment, which represents a major risk for humans. Most cysts were found in the liver but the chances of finding liquid, highly fertile, cysts was higher in the lungs than in the liver. The general public is not aware of this so that dogs may be fed with the raw lungs of infected sheep, especially when sheep are slaughtered on the farm. The parasite cycle may thus be closed. The proper

information of farmers and slaughterhouse personnel appears crucial to limit the spread of hydatidosis caused by *Echinococcus granulosus*.

Dogs, a sentinel of human risk from environmental origin: interest for saturnism prevention; first study conducted in the Alfort French veterinary School

Brigitte Enriquez, G. Hakou, Aude Tabaries, Brigitte Révol, Joëlle le Moaf, Annie Sasco & J-J. Bénét

A study was carried out at the Alfort Veterinary School to apply the concept of sentinel animals to environmental toxicology, associated with pet epidemiology. The recruitment, with owners' consent, of adequate dogs (over 10 kg) in sufficient number, at the School's attending clinics has made it possible to quantify the lead blood level in 125 dogs coming for consultation. Mono-variate and multivariate linear regressions were used to investigate a potential relationship between lead blood levels and intrinsic parameters relating to the animals themselves as well as to extrinsic factors related to the lifestyle and environment of these dogs, as described by the owners in their answers to our environmental questionnaire. The age of animals, the place where they lived (countryside, city or suburbs), year of building of their housing were related to variations in lead blood levels, although not significantly because of the limited number of samples. Younger dogs because of similarities in their behaviour and higher values of lead blood levels may be worth considering as sentinels for lead poisoning in children, as demonstrated in U S medical literature. This kind of study ought to be repeated on larger samples to obtain more significant results.

INFORMATION

Situation of the “*peste des petits ruminants*” in Morocco during year 2008

Laurie Dufour, Barbara Dufour, Geneviève Libeau & Adama Diallo

Evaluation of the methodological workshop on June 3rd, 2009 about the use of the software « R » for risk analysis of living animals' importation

C. Saegerman, J-J. Benet, Fatah Bendali & D. Berkvens

***Erratum* - Use of Bayesian methods to compare the characteristics of two diagnostic tests for detection of infection with Map (Epidémiol. et santé anim, 2007, 51, 57-64)**