

2023, issue 82 – ABSTRACTS

AEEMA MEETING - JUNE 1st, 2023: ADAPTATION OF THE EPIDEMIOLOGICAL APPROACH TO ANIMAL DISEASES FACING GLOBAL CHANGES

Introduction to the meeting of June, 1st

Hendrikx Pascal

The risk of animal and human infectious diseases has been continuously rising over the last sixty years. The appearance of most of these infectious events comes as a surprise to health authorities and the general population. This surprise is combined with a feeling of failure of our epidemiological methods and tools. It is now obvious that this evolution of risk is related to global changes affecting climate, environment, and human behaviours. The AEEMA thematic day thus provided an opportunity to illustrate, through examples of infectious diseases, the need to adapt epidemiological approaches in the face of these global changes. To this end, the presentations were based on the different compartments of the infectious disease system.

Global changes and consequences on animal and human infectious disease risk. Implications for veterinary sciences

Guégan Jean-François

Global changes today influence natural ecosystems and their biological diversity. These changes modify the dynamic balances of species and, in particular, disrupt the transmission cycles of parasitic and microbial agents. From climate change that favours the installation of vector species or reservoir hosts of pathogenic agents to international trade in goods, animals and people that carry a multitude of "micro-illegal passengers", this article discusses the importance of better consideration of these externalities in the understanding and management of current and future human and animal health risks.

I provide a critical look at the considerable lack in the international animal health bibliography of synthetic and comparative work, making it possible to lay the foundations of a global research strategy. I comment on the research time required to obtain solid results in a current context of high volatility of research products and a current science that has become event-driven and short-term. I conclude on the importance for research, slave of an ambient reductionist vision, and, in particular, for that dealing with the consequences of global changes, of having to regain control of its schedule, by positioning surveillance in animal health, acquisition of adequate and serial data and their analysis at the heart of the national and international health security system.

Globalisation of food systems and human global changes - MOND'Alim 2030

Hugonnet Mickaël

This paper aims to characterise the current phase in the globalisation of food systems, understood as "the way in which people organise themselves in space and time to obtain and consume their food" [Malassis, 1976]. It documents the dynamics at work, envisages how they will continue between now and 2030, and identifies some disruptions that are already in their making. It explores six themes: changes in eating habits and patterns; the dynamics of international trade; the internationalisation of research, databases, and innovations; the globalisation of risks and public problems; public and private players in globalisation; governance issues and trends.

Global changes and vector-borne diseases

Balenghien Thomas

For several decades now, there have been numerous examples of the emergence or recrudescence of vector-borne diseases. The stability of the epidemiological situations of vector-borne diseases is the result of complex interactions between populations of infectious agents, vertebrate hosts, and vectors. As very sensitive to the environment, these interactions are changing significantly under the impact of global changes. Socio-demographic factors (population movements, armed conflicts, 'globalisation' of trade, increase in the world's population, changes in human practices), and environmental modifications due to human activity, have a direct, obvious, and major impact on the transmission of vector-borne diseases.

On the other hand, as the link between temperatures and vector-borne transmission is not linear, the current global rise in temperatures could have contradictory effects, difficult to predict, depending on the region and the disease. In this context, health authorities face the question of whether to include an entomological component in vector-borne disease surveillance plans. The relevance of such a component depends on the disease and the epidemiological context.

Highly pathogenic avian influenza (HPAI): a changing face and the need for pragmatic adaptation

Scoizec Axelle, Niqueux Éric, Schmitz Audrey, Grasland Béatrice, Palumbo Loïc, Huneau-Salaün Adeline & Le Bouquin Sophie

In recent years, Europe and France have faced important changes in their situation about highly pathogenic avian influenza (HPAI). Since the emergence of panzootic with viruses of clade 2.3.4.4b, seasonal waves of HPAI occurred and have become annual. Furthermore, the idea of an endemic extension of these viruses in wild birds in Europe and France is supported by the detection of infected wild birds in all seasons during the last years. A wide variety of wild bird species have been detected infected and several of these populations have been affected by episodes of massive over-mortality never encountered in the past.

On the field, adaptations have had to be made for the management of these over-mortality events in wild birds, for monitoring them and more broadly for surveillance of HPAI circulation in this compartment. The impact of these changes and of these new viral strains on poultry farms has been major: multiplication of epizootics, overflow of management and control capacities in areas with very high poultry densities, reaching new geographical areas and new poultry sectors, etc.

In response, new prevention and control methods have been implemented or are under construction: drastic reduction in the density of poultry that are highly susceptible to these viruses, improved early detection in poultry farms, consideration of vaccination, etc. These viral strains also represent an increasing zoonotic risk: numerous crossings of the species barrier to mammals have been detected in the world and these viral strains present a high capacity for reassortment. In response, surveillance of wild mammals, both terrestrial and marine, has been set up in France and a protocol has been drawn up. For the human component, prevention messages have been sent to the most exposed populations, vaccination against human seasonal influenza has been recommended to them and surveillance of these populations is being reinforced and deployed.

Expansion of tick-borne diseases, involvement of civil society in surveillance (citizen science) and development of innovative detection tools

Moutailler Sara, Bournez Laure & Durand Jonas

Ticks are the primary vectors of pathogens in Europe, transmitting more pathogens than any other arthropods (around 60 bacteria, 30 parasites and 100 viruses identified; a third of these are responsible for zoonoses). Due to increased travels and transported freights, climate and environmental changes, the incidence of tick-borne diseases in humans and animals is rising worldwide. Extensive surveillance tools are therefore desirable to better control ticks and tick-borne pathogens. To this end, various citizen science projects are being carried out around the world. In addition, new high-throughput molecular biology tools (real-time microfluidic PCR) have been implemented to detect 65 bacteria, 6 bacterial genera, 28 parasite species, 53 viruses and 8 tick species, to better identify tick-related risk.

Landscapes modifications and emerging diseases: the case of bats

Moutou François

With more than 1 400 known species, chiropteran order is ranking second after rodents in the number of species diversity within mammals but ahead of all others orders. Bats entered the field of public health research only recently. Their great moving facilities give them the possibility to fly away rapidly from disturbed natural areas, whatever the reasons, and also to find easily safer places, including those close to human settlements, like urban parks and orchards, attractive for fruits-bats.

This is how human contaminations by Hendra virus in Australia and by Nipah virus in Malaysia and Singapore in the 1990s are explained. The study of these small and nocturnal flying mammals goes through the development of specific methodologies and tools, different from those used for non-flying mammals. Only this approach may lead to a real control of the sanitary hazards linked to bats. A few examples are given, as well as their limitations.

To include multiple stressors, new tools are used in field surveys to assess pollinator health

Chauzat Marie-Pierre, Sanson Caroline, Druesne Christine & Laurent Marion

Because of the pollination service they provide, declining populations of pollinators are key actors for biodiversity conservation. Global changes, and particularly environmental modifications, cause the observed pollinator decline. A bibliographic study was undergone to better assess the methods used and the results stemming from field surveys to monitor the causes of pollinator losses. Field surveys are currently mostly conducted with honeybee colonies, although other pollinator species are also used. Over time, the study scopes extend with the increasing number of active ingredients screened in the different matrices, the growing number of matrices collected in the field and the study of stressor interactions. The panel of tools used to measure colony end points also increases with the use of ColEval method which quantify the honeybee populations and storages, the in and out counters, and the pesticide sensors.

These long-term and wide-range field studies need a lot of material and human resources, particularly for field recordings and subsequent analyses. However, they produce essential information on the pollinator health from a field perspective, to better understand the global changes.

Summary of changes and adaptation needs to fight against animal diseases

Angot Jean-Luc

In a rapidly changing global context, it is essential to adapt the fight against animal diseases. The profound global changes that we are seeing make it necessary to develop new approaches and new tools, in a multidisciplinary and intersectoral framework.

In particular, this involves concretely implementing the One Health concept.

AEEMA MEETING - JUNE 2, 2023 - COMMUNICATION

The intra-vector viral dynamics challenges a common assumption in vector-borne disease modelling

Loisel Léa, Viginier Barbara, Raquin Vincent, Ratinier Maxime, Ezanno Pauline & Beaunée Gaël

Arbovirus transmission is a complex process, ranging from the intra-vector viral dynamics (IVD) to the spread of the virus in host populations. The IVD in the mosquito has been little studied in modelling research. Vector transmission models generally do not explicitly represent the IVD but consider an average extrinsic incubation period, assuming an exponential distribution of this duration in the population.

To study the validity of this major and extremely common assumption, we developed a stochastic compartmental model representing two of the stages of the IVD: mosquito infection and virus' dissemination within the mosquito. We calibrated this model with data from experimental infections of Aedes albopictus and Aedes aegypti by three major arboviruses: dengue, chikungunya and Zika viruses.

We found marked differences in the IVD of the three viruses, with, in particular, a non-exponential distribution of the duration of the infected state for Zika and dengue viruses. The exponential hypothesis is therefore not always relevant, which could penalize the predictions of epidemiological models used to assess control measures for zoonotic arboviruses.

POINT OF VIEW

What governance and what priorities to ensure that biodiversity-health issues are appropriately considered in public policies

Durand Thierry

Biodiversity and health are linked, and the statement that "Our health depends on biodiversity" is an obvious one, confirmed by scientific literature. Alterations to ecosystem functions can result in a significant loss of ecosystem services, and a deterioration in human, animal, and ecosystem healths. The challenge facing us in the face of climate change, the collapse of biodiversity and the deterioration of health parameters is to position health-biodiversity at the core of public policies.

To achieve this, we need to focus on a few key objectives: The main short-term recommendations include adjusting the position and governance of the National Environmental Health Program, making significant progress on knowledge policies concerning ecosystem health and ecosystem services, rethinking the organization of research to ensure greater interdisciplinarity, strengthening the evaluation strategy for plans, programs and projects, and making the national strategy more territorial, while encouraging the creation of one health territories.

This unavoidable change of course must be accompanied by strong commitments, public resources in line with the challenges, and new paradigms, placing the three health's care, ecological solidarity, interdisciplinarity and collective intelligence at the core of our value systems.