**PREZODE**
**European Workshop – July 6th 2021**
**Break out room 3: Surveillance**

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## *Context of the break-out group about Surveillance*

The workshop on "Surveillance and early detection" involved **30 persons**, knowing that some people had problems joining the seminar due to technical issues. The session was organized with the **brainstorming technique** to share ideas on **three topics**:

1. **Ongoing research and applications on the surveillance of zoonotic agents / diseases, with a focus on European specificities**
2. **Knowledge gaps, cutting edge science**
3. **How answering scientific gaps would contribute to changes in the society to reach a low level of zoonotic emergence**

The propositions of participants were then classified and summarized in two main sections:

- The present and future of research and innovation to improve the surveillance of zoonotic emergence
- How to improve the societal impact of these research and innovations by limiting the number and burden of zoonotic emergence

## *Present and future topics of research and innovation for the surveillance of zoonotic emergence*

The participants work at gaining the attention and the support of governments to intensify research and translate them into field based applications in the domain of "Surveillance" that are necessary to anticipate and prevent future pandemics. One major remaining challenge is yet to get to a **concrete and efficient One Health framework**. We should make research a motor to reach this aim, starting from One-Science to One-Health.

Currently, we are working to **build some of the bricks, tools and procedures** needed to ensure the continuous monitoring of pathogens in potential sources: humans, animals, and the environment. While we concentrate on human and animal health, we still do not sufficiently cover environmental health. Stronger threat identification and characterization, based on surveillance and pathogen discovery across these different sectors, would help reduce societal risks. The surveillance of the dynamic of hazards in different epidemiological situations should allow a continuous improvement of

risk mitigation relying on:

-relevant capacity building, using international/intersectorial cooperation and training

-methodological progress in the analysis of zoonoses emergence, across various hazard types, relying on hypotheses elaborated from various materials, from past events to potential game changing scenarios.

*Data collection*

To run "Surveillance" efficiently, general questions about what (which populations should be monitored), where (at which place, location, step in the chain) and how (type of sample, method) it should be organized, need to be answered. Different types of diseases and health problems require new tools, procedures, the willingness to share data and legal mechanisms to break down current boundaries. The community which participated in the workshop is interested in quite a range of topics:

**- Syndromic approach**

**- The detection of pathogens**

**- The characterization of Antimicrobial Resistance (AMR)**

**- The creation of a data registration system for antimicrobial use in animals to follow the impact of policies and practices**

**- The identification of arthropod vectors**

To ensure the most efficient surveillance, we have to target high-risk situations, e.g. species or environments:

-humans (e.g. farmers), livestock, but also wildlife, including vectors. Regarding animals, surveillance systems are indeed in place for the main livestock populations but not for minor species, wildlife and vectors.

-environments that could be used as proxies of contamination level or ecosystem disequilibrium.

In the future, there is a need to refine further priorities for surveillance systems. The interface among human - livestock - wildlife interfaces require a specific attention. This strengthens the need to **convince the authorities to invest in cross-sector, multidisciplinary work**. Citizen science could help to obtain the information required. Surveillance activities should focus on **specific key aspects of the production systems, natural ecosystems, overall biodiversity and species properties** (e.g. host and vector competence), **depending on the result of epidemiological modeling**. Beside the variety of well-known zoonotic pathogens, we have to take into account neglected zoonoses and the environmental resistome that could lead to new emergencies or illustrate general patterns of hazard circulation.

The opportunities to analyse circulating pathogens and hazards (including at fine genotypic level) and further the spread of pathogens/diseases should be identified. There are already examples of pan-viral detection tools and tools for characterizing the background microbiome (including the virome) in different ecological niches. Encouraging preliminary results on on-site high-throughput sequencing and metagenomic methods used to analyse viromes & microbiota using non-invasive biological samples are reported. There is yet a need to improve the cost-effectiveness of pan-pathogen detection methods and develop prompt and easy to use automated analysis systems for broad range detection of emerging pathogens. This could **allow using routine environmental DNA (eDNA) to identify shifts that signal emergence of (novel) pathogens**, or pathogenic traits or other DNA

sequencing techniques supporting real-time use of pathogen genomic data in epidemiology.

The expected improvements will yield **more cost effective and SMART** surveillance systems implemented at a multi-country level. In this context, an **international emerging disease surveillance network** should aim at rationalizing initiatives, harmonising methods and promoting training of participants.

*Data management*

**Better integration of data management between sectors** for surveillance is a major issue. This implies to establish and maintain cooperations and linkages between the different surveillance systems: human, domestic animals, wildlife, and vectors (e.g. insects) of medical and veterinary interest. Some examples of web-based applications for sharing information on cases, diseases or characterisation data are developed and are encouraging. Further progress requires:

-**Harmonising the collection of data and metadata**, including information regarding sampling or characterization, and the language for One Health surveillance for the sake of proper analysis and interpretation.

-**Linking general/regional/thematic databases** through a data management ecosystem to obtain interoperable data collection systems and platforms that will allow the continuous and efficient monitoring of potential pathogens.

-**Coordinating this ecosystem** at the EU level, to facilitate the FAIR management of data, and to ensure compliance with data **privacy regulations**.

To achieve this, training and graduation on the One Health approach is essential.

Integrated data management is important from a European and global perspective, and closely connected to regional and national scale. Currently, there is still a lack of connection between human and animal health policies among countries and regions.

*Data analysis*

Based on surveillance data and using different approaches including modeling, we are investigating how to improve surveillance by:

-**Identifying and promoting best practice**, templates, favoring capacity building in laboratory diagnostics, or implementing mobile laboratories and mobilising citizen science. These improvements should allow the analysis of data from different sources and facilitate comparison among different sampling schemes (eg, areas, sources, data).

-**Succeeding in the integration of new data and interpretation of massive information** (e.g. metagenomic data), which is a challenge. In the future, agreement is needed on the approach from early signals to action, on how to determine whether the finding is significant. Interpretation of data depends on the context. For example, how do we overcome the fact that a pathogen load or associated symptoms can vary drastically from one to another?

-**Analysing data** from environment, animal health and human health surveillance **to design the most relevant sampling/surveillance procedure**, e.g. by developing risk-driven surveillance. **Cases and sequence data can both be used to refine risk assessment, identify emergence hotspots, quantify the most frequent reservoirs and sources of pathogens, in order to improve surveillance making it more cost-effective and inclusive.** This has to rely on tests of hypotheses on the emergence and spread of hazards and their properties. More precisely, modeling is still needed to understand

drivers of emergence for specific pathogen groups to predict when zoonotic events occur in a One Health context. **Research should cover reservoir hosts** to characterize host ranges, infection dynamics, ecology & epidemiology of emerging pathogens.

Future research is needed to improve **risk assessment and indicators for early warning** across sectors with a One Health perspective. It will be critical **to inform stakeholders**, and to explain new initiatives and their potential return on investment. To facilitate translation, adequate and output-proven predictive modeling tools should be made more accessible for public and veterinary public health officials by working closer together with researchers. Successful translation of research to policy and illustrations of surveillance/prevention efficiency would **create the necessary trust to enter a virtuous circle**.

***How surveillance could induce changes in society to reach low levels of zoonotic emergence?***

We believe that the modeling of information provided by "Surveillance", allowing among others integrated preparedness and early warning systems at international level, are required to build more resilient societies to pandemic threats. Creating integrated models that underpin decision-making, including the planning and implementation of surveillance in socio-agro-systems, will require a high level of understanding of pathogen transmission and distribution **but also take into account economics, social & societal impacts** e.g.:

-**balancing the costs** of interventions, such as surveillance, with not yet materialised costs, such as outbreak, epidemic, or pandemic management costs.

-**anticipate acceptability** (political, social, economic) of false alarms and consequences in individual behaviors...

In this context, the demonstration and recognition of the value created by One Health surveillance is essential.

On the one hand, we have to **position science at the center of the decision-making process**. Current directives and regulations on animal production should integrate more broadly risk based analysis and surveillance. The effort to evaluate risks (logistic and financial) should consider inputs from and be paid by different sectors: e.g. public/private, Public-Health/Animal-Health/Environmental-Health.

On the other hand, future **investment should focus on transdisciplinar/co-created/co-designed methods for assessing needs and deciding on interventions** between researchers and stakeholders: policy making, industry, and the public/community/citizens. Especially, **taking into account the yield of investment in surveillance, evaluating economic and sociological impacts is needed** to identify shared priorities. This would lead to help to change governance and more generally decision making from a reactive perspective to a more pro-active-mode.

There is in parallel **a need to inform and mobilize local populations** about risk exposure. Acceptance of new procedures of surveillance, or more generally of health management (e.g. sensibilisation to common goods, vaccination, protection, prevention of the population), by the population is key for implementation. This implies closer interactions with partners in the fields of h**uman and social sciences and dissemination and communication.** This will help to achieve a better diffusion of scientific information, discussion of relevant controversies, limit the impact of misconceptions, and mobilization of the population through constructive behavior or further in citizen science. These

actions would target a transformative change of behaviours related to disease emergence, helping people to become actors of the surveillance system (reporting, etc).