Disease surveillance systems: types of surveillance, data integration, evaluation of reliability and sensitivity

Risk analysis of spillover events in wildlife workshop

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World Organisation for Animal Health
Founded as OIE

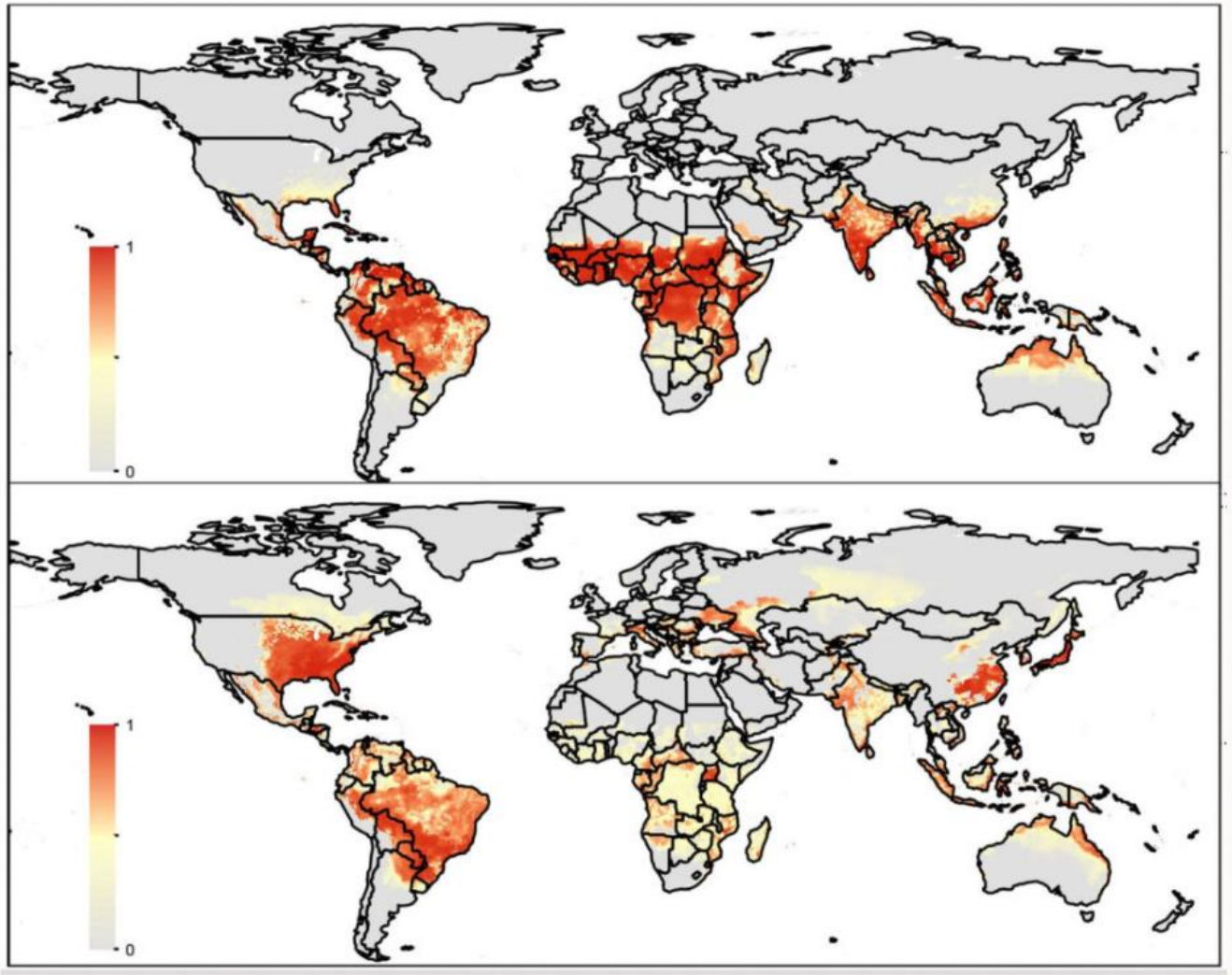
Funded by the European Union

Background and consideration points

- **Summary**

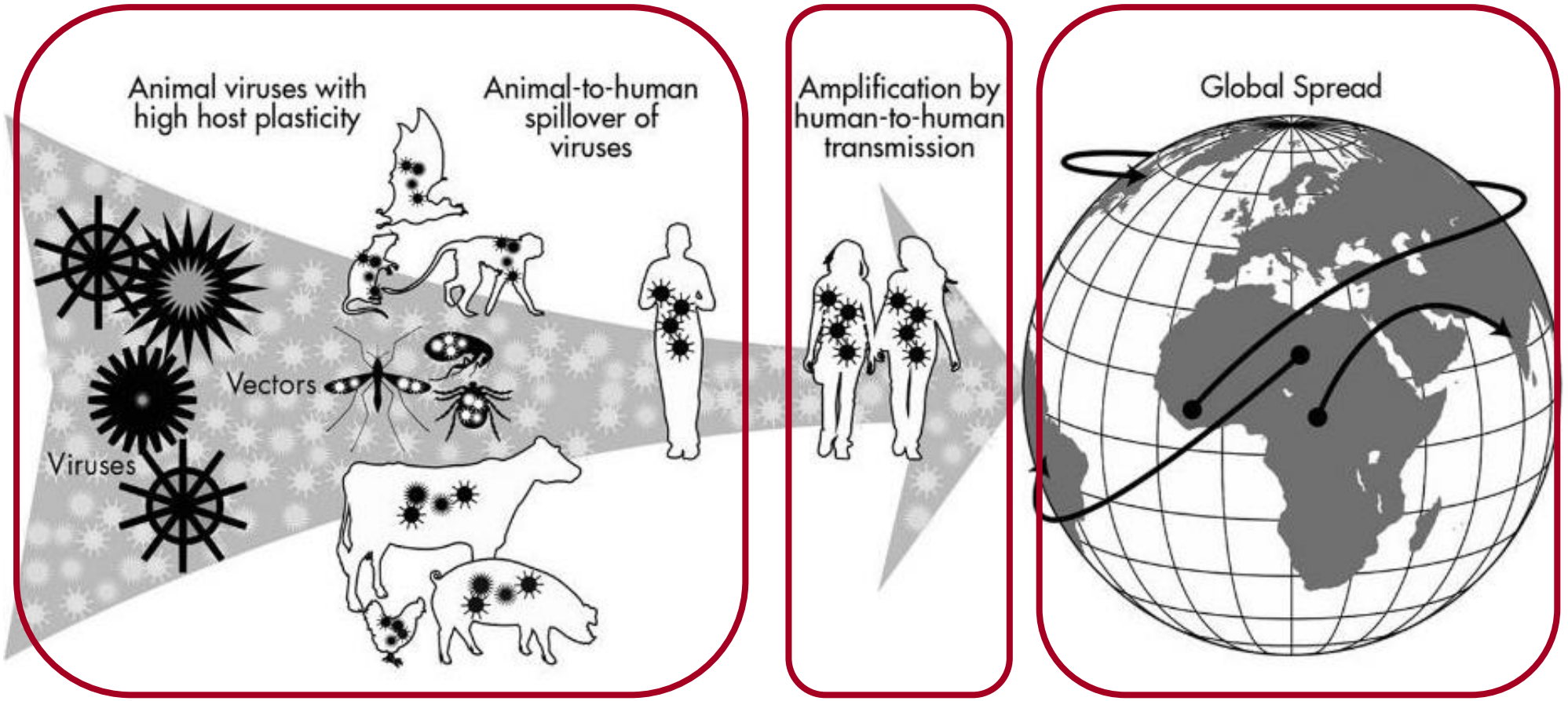
  - Introduction and objectives
  - Surveillance systems / methods
  - Data integration
  - Evaluation of reliability and sensitivity
  - Closing remarks and key messages
  - Assessing and improving the quality of disease notification to WOAH: Asia-Pacific experience in supporting early threat warning
  -

Disease surveillance



These maps show the predicted global ranges of *Aedes aegypti* (above) and Aedes albopictus (below) in 2050 assuming a 'medium' climate scenario in which greenhouse gas emissions peak in 2080 and then begin to decline. The darker areas have the highest predicted prevalence of mosquitos. MORITZ KRAEMER FOR *NATURE MICROBIOLOGY*

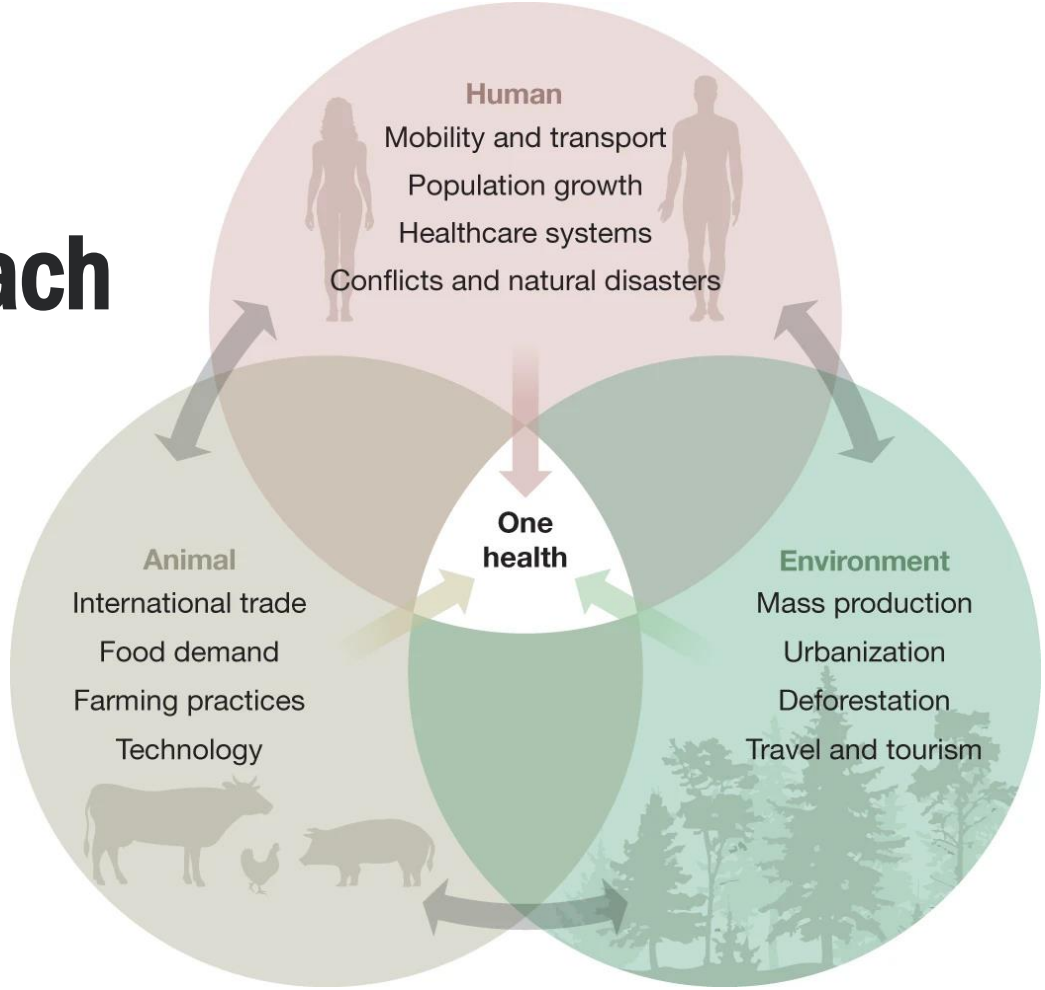
Pathogen dynamics in a changing world



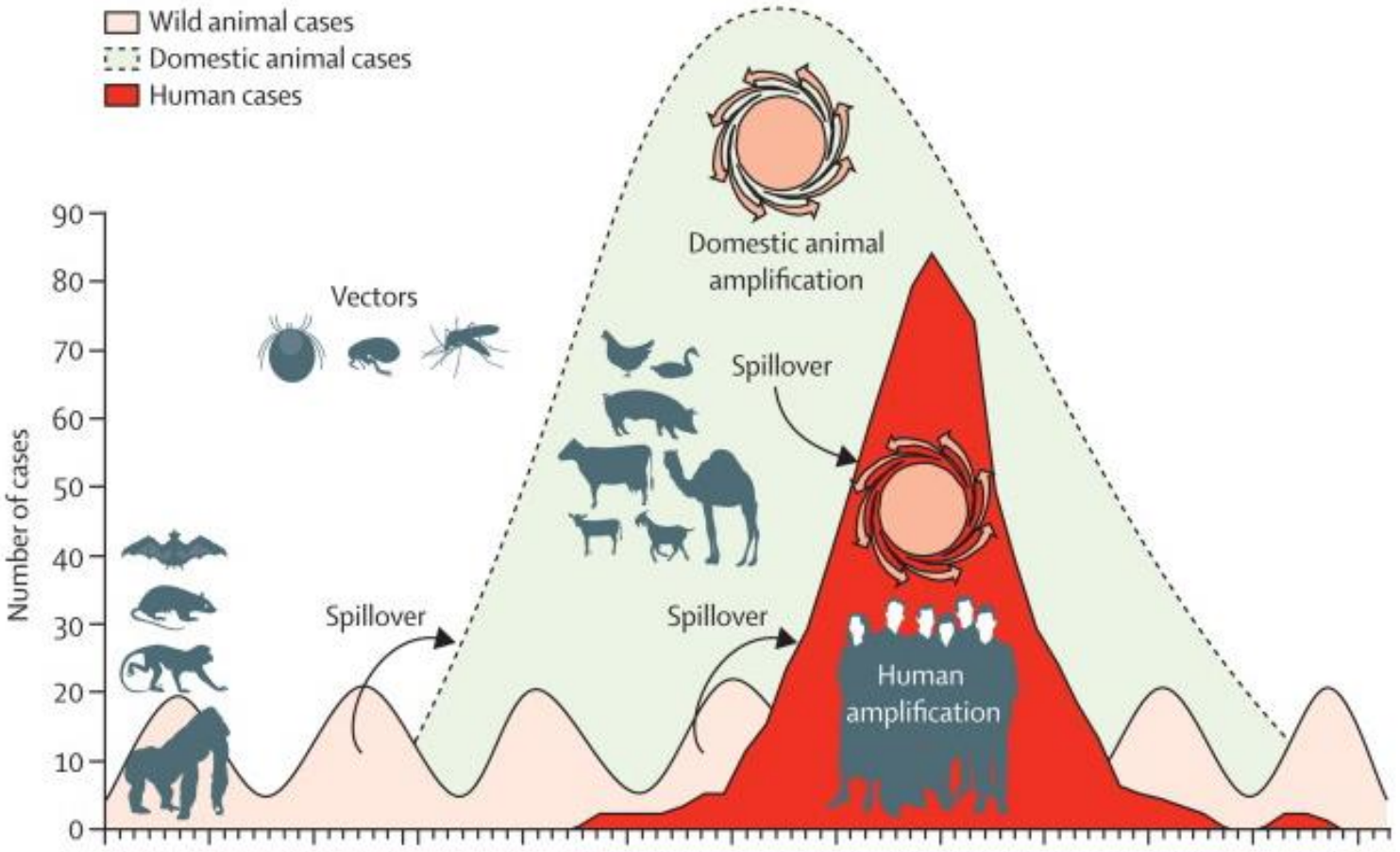
https://www.nature.com/articles/srep14830

Adopting a One Health approach

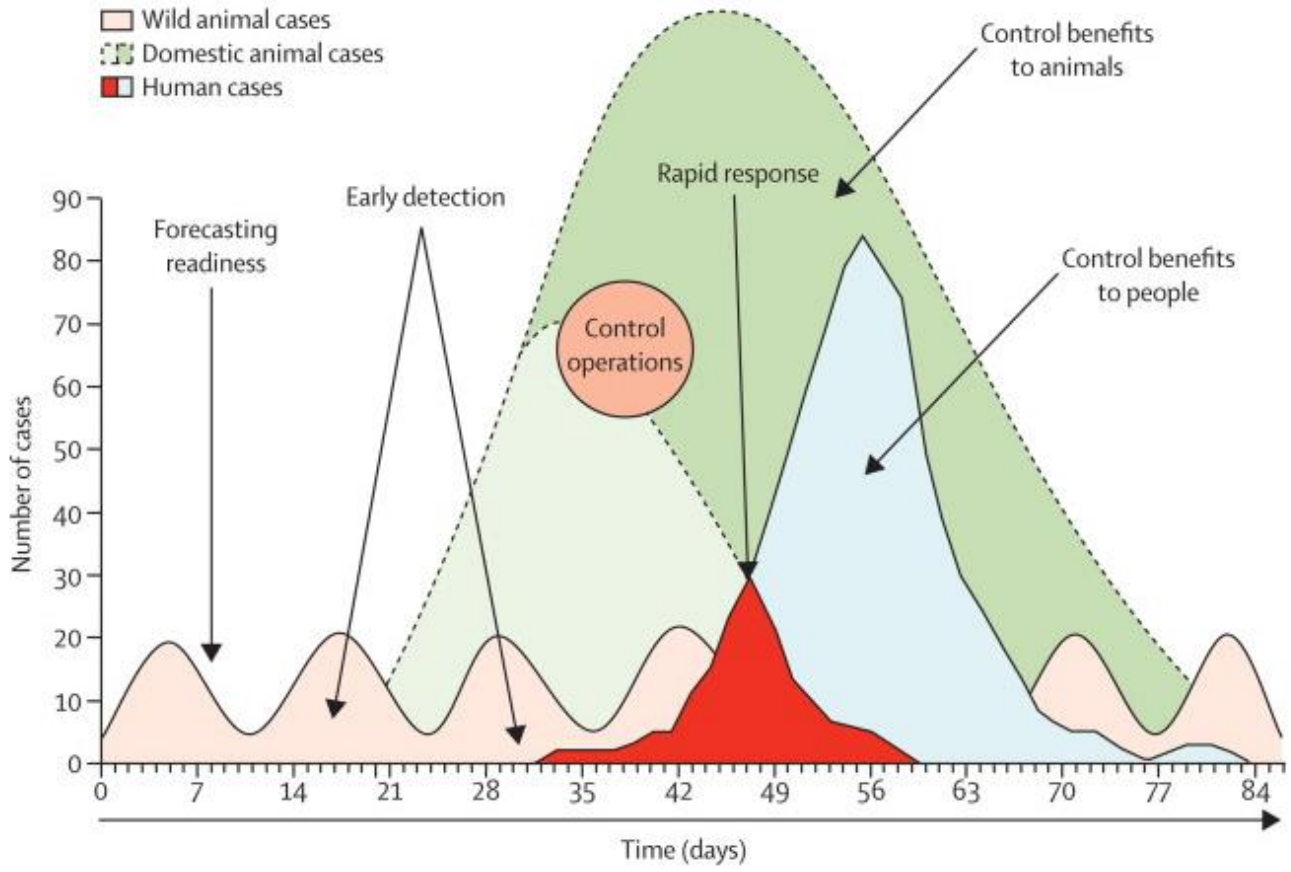
"Human health and animal health are interdependent and bound to the health of the ecosystems in which they exist."



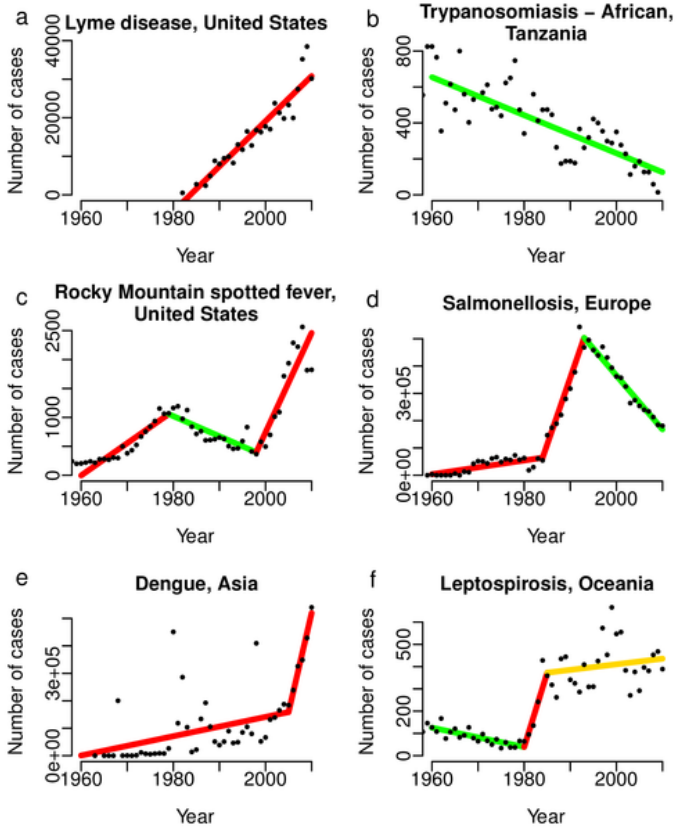
Phases of pathogen emergence & surveillance



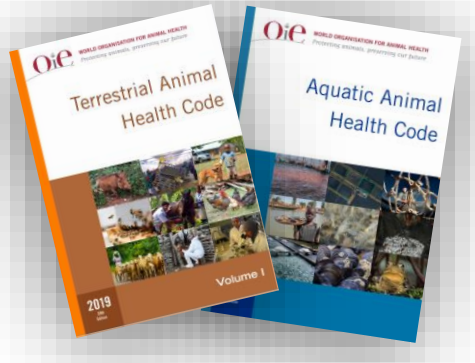
Phases of pathogen emergence & surveillance



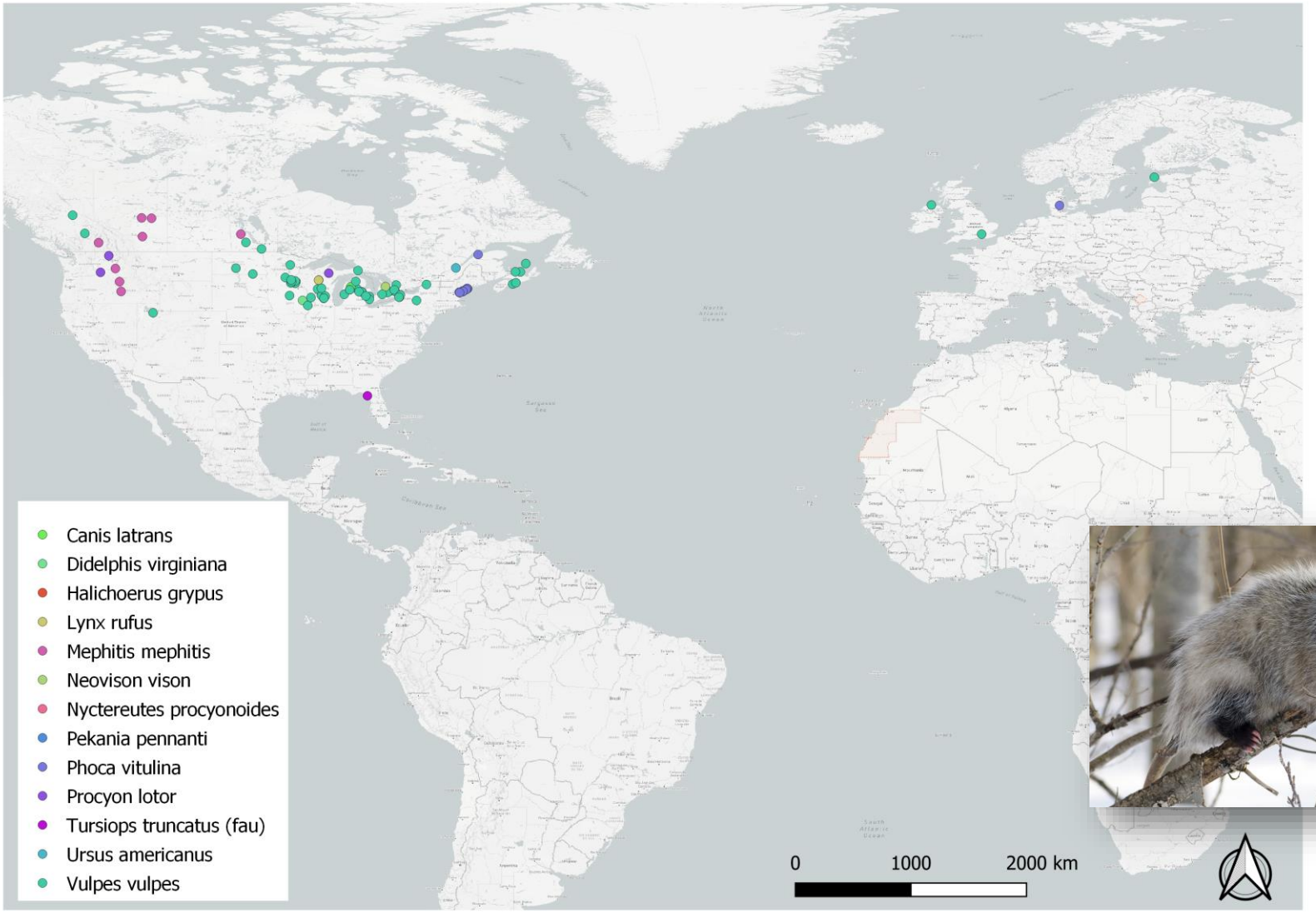
Surveillance introduction and objectives

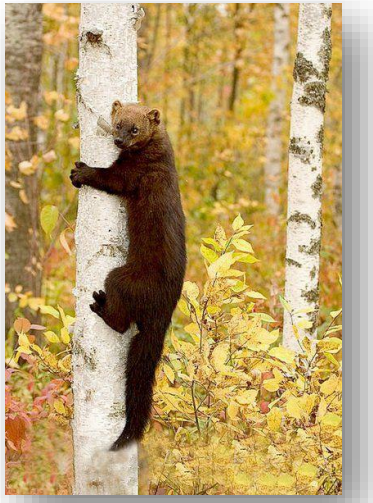


- Disease surveillance is aimed at demonstrating **the absence** of infection or infestation, determining **the presence** or distribution of infection or infestation or **detecting as early as possible** exotic diseases or emerging diseases
- Tool to monitor **disease trends**, to facilitate the control of infection or infestation, to **provide data for use in risk analysis**, for animal or public health purposes, to **substantiate the rationale for sanitary measures**
- The type of surveillance applied depends on the **objectives** of the surveillance, the **available data sources** and the **outputs needed** to support decision-making.

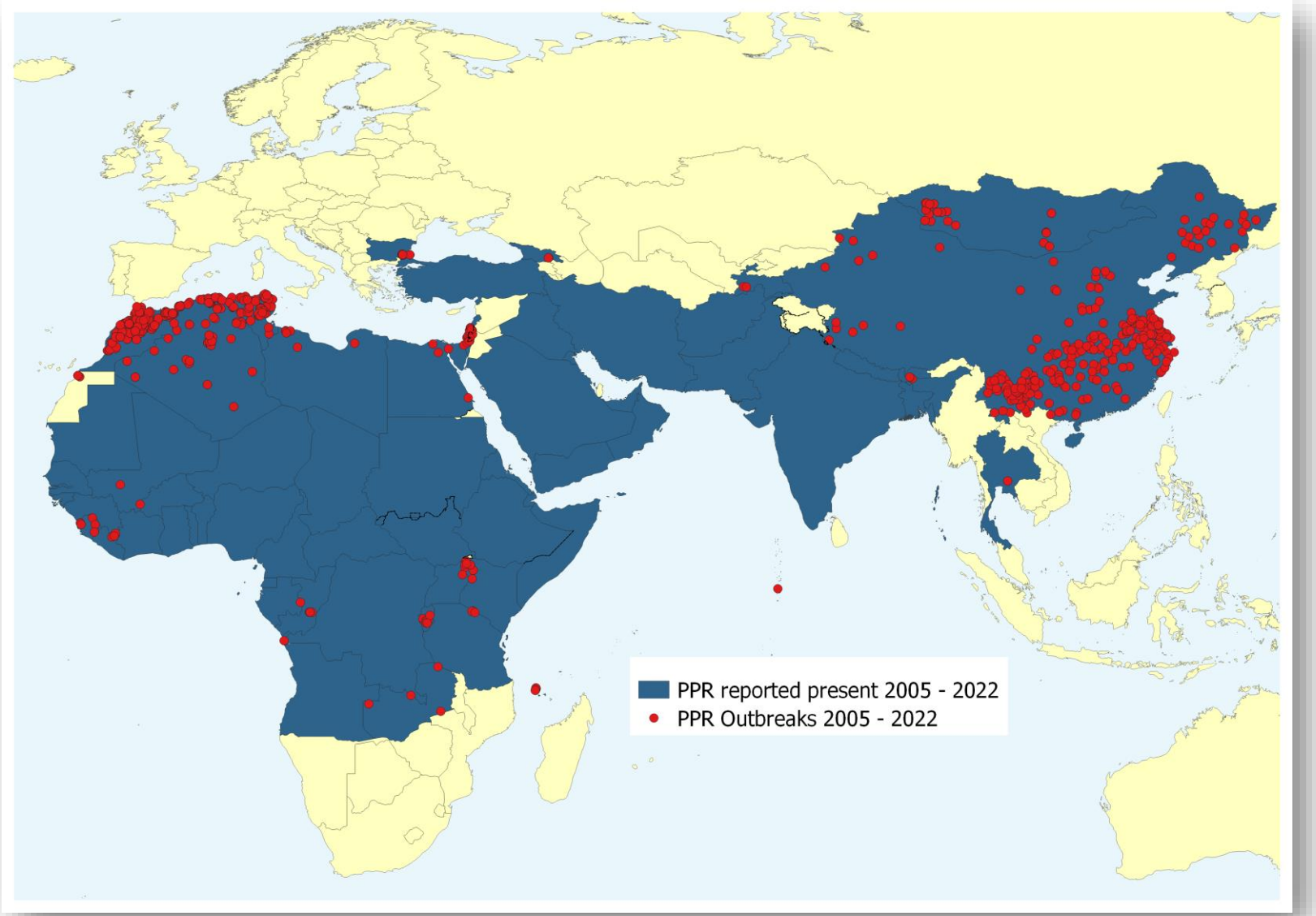


Disease surveillance output: Unusual host species avian influenza





Disease surveillance output: distribution of peste des petits ruminants



Surveillance systems

- Design of the surveillance system
  - Definitions of appropriate populations
  - Timing and temporal validity of surveillance data
  - Case definition
  - Epidemiological unit
  - Diagnostic tests
  - Analytical methodologies
  - Scope of the surveillance system
  - Follow up actions

Surveillance methods

Surveillance systems routinely use data collected by ***probability-based or non-probability-based methods****, either alone or in combination. A* ***wide variety of surveillance sources may be available****. These vary in their* ***primary purpose*** *and the* ***type of surveillance information*** *they are able to provide.*

Surveillance methods

Early warning for Early detection

An early warning system is essential for the timely detection, reporting and communication of occurrence, incursion or emergence of diseases, infections or infestations and is an integral component of emergency preparedness.

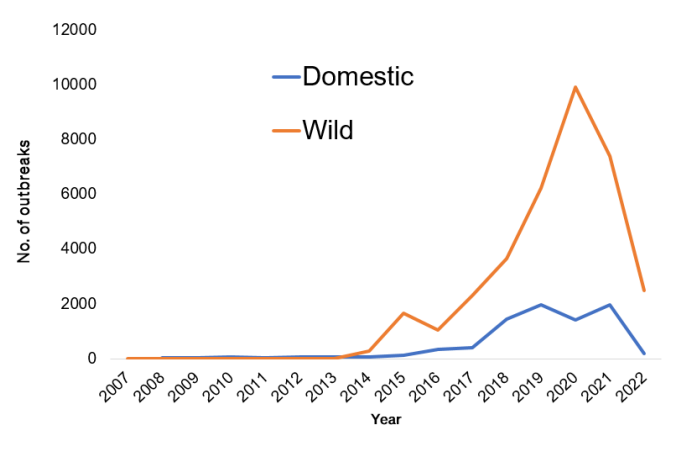
Use of official and non-official data data: data integration and improved sensitivity

Use of official data – Global and Regional meetings

ASF : spread in Europe between 2005 and 14 July 2022

- First occurrence of the disease in 10 new countries
- Spread to 94 new administrative divisions in affected countries
- 233 events of ASF recurrences in countries or zones

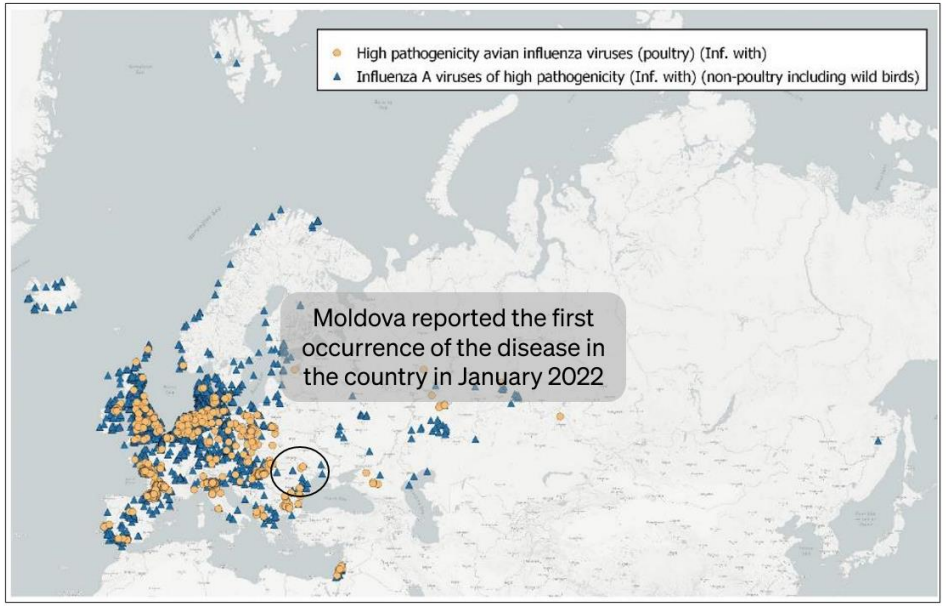
Dynamics of ASF outbreaks reported to WOAH by Members in the Europe Region through the early warning system, in domestic swine and wild boar
(between 1 January 2005 and 14 July 2022)



HPAI : distribution of outbreaks reported between 1 October 2021 and 14 July 2022

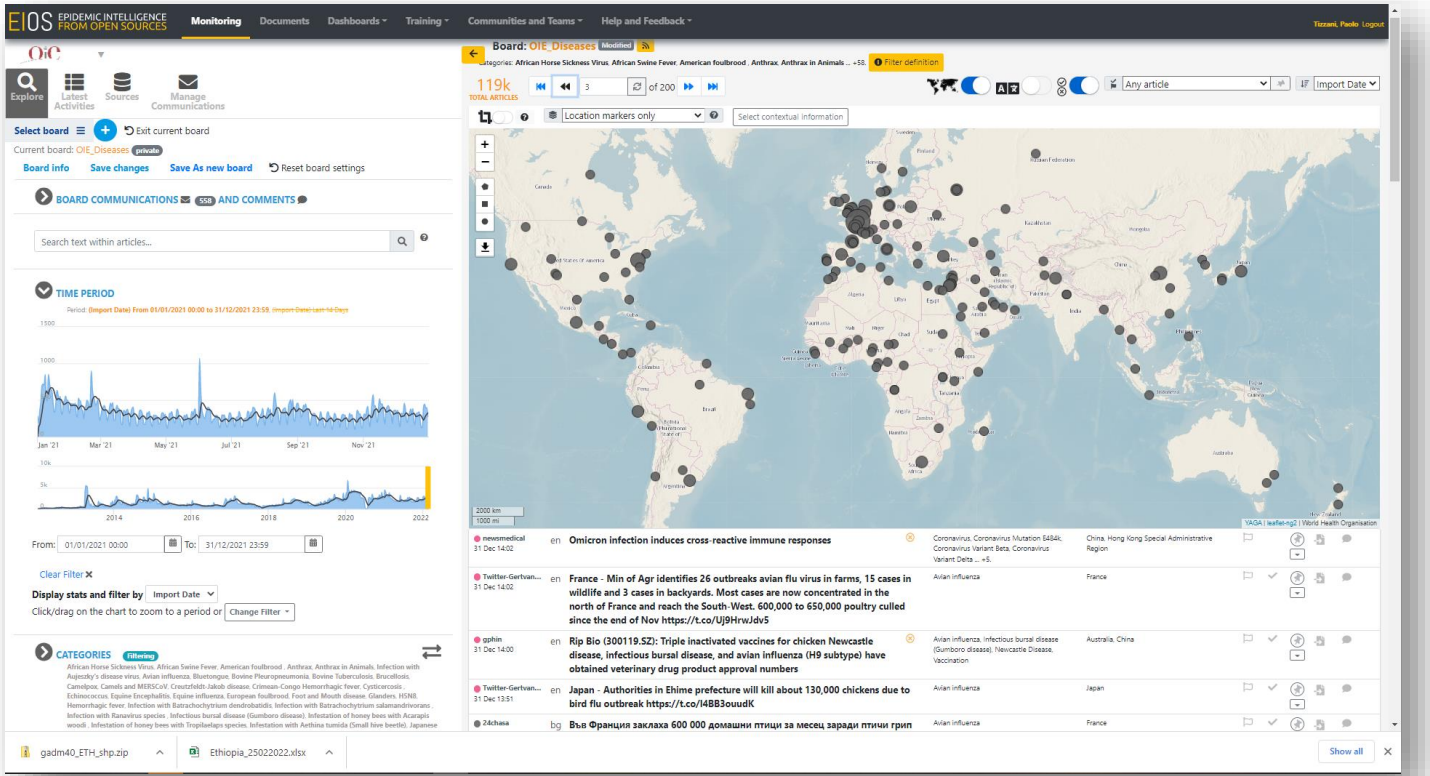
POULTRY : 26 countries and territories

- Moldova : 1st occurrence
- Bulgaria, Russia & Spain : new areas of the country
- Norway & Poland : new subtypes (H5N1 & H5N2 respectively)
- Recurrences



Epidemic intelligence (EI) activity – source of data

- **EIOS** system for epidemic intelligence
- **Daily screening** of the web for all listed diseases
  - 100,000 news screened in 2020
  - 120,000 news screened in 2021
- Constant communication between WOAH and Members
- The tripartite **GLEWS** use independently the system
- Information shared with key partners including INTERPOL



EIOS EPIDEMIC INTELLIGENCE FROM OPEN SOURCES

Unverified information

Unknown cattle disease strikes Leishi

Source: **The Sangai Express / Mungchan Zimik**

Ukhrul, June 11 2022: At least nine cows were found dead in suspicious manner at Leishi village, Kam

Reportedly, all the cattle which died 'mysteriously' had swollen bellies and constipated fecal discharge.

These 'unnatural deaths' have worried th
they feared a cattle epidemic may have h

According to one cattle owner, L Samuel
learnt about the death when he visited h
constructed about 2 Kms away from Leisl

Saying that he has been rearing 26 c
calves in his shed and let the cattle gr
(northern and southern sides of Leishi), he added all the dead
cows grazed at the southern side.

Continuing that he immediately released the remaining cows and were all active with no symptoms of any infection whatsoever, Samuel maintained that the villagers had informed the Veterinary Department and the latter had collected samples to establish the exact cause of the death.

Mysterious disease kills buffaloes in Ukl

24-Mar-2022

Mungchan Zimik

Ukhrul, Mar 24 : At least eight water buffaloes of Asiatic breed reportedly died due to an unknown disease at New Tusom village in Ukhrul district.

Speaking to this correspondent, a cattle owner Agarso Horam of New Tusom confirmed that eight buffaloes were found dead in Laitram forest in the south west region of New Tusom village.

Virus appears in the United Kingdom that adds up to 150 infected dogs; researchers still do not discover origin

In addition to the high number of COVID-19 infections in the world, now the United Kingdom is experiencing a new problem. Yorkshire county authorities announced the emergence of another virus, which affected more than 150 dogs, with cases also reported in the Leeds and Sheffield areas.

The origin of the virus is still unknown. One of the first theories suggested that the disease was related to toxins present in the water of scarborough and Saltburn beaches on the east coast of the country.

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However, the Department for Environment, Food and Rural Affairs (DEFRA), concluded, after conducting several tests, that this fact, "has no link to the problem of dead crabs and lobsters washed ashore off the coast of Yorkshire at the end of last year", as some voices mentioned.

Given this, the veterinarian who discovered the disease and who has been warning for weeks about the presence of this virus in the world and the alarming way in which it spreads, Brogan-Alexandra Proud, explained that the symptoms of sick dogs are vomiting and diarrhea, in addition to dehydration and weakness.

Proud warned that neither veterinarians nor the government have deciphered what the real root of the problem is, meanwhile, the virus continues to infect more dogs.

At the moment, the recommendations that are made to avoid more infections are: be extremely careful with the hygiene of your canines during walks, avoid approaching the beaches, restrict the interaction of your pets with other dogs and bathe them after each outing.

Despite the alarm, the good news is that at the moment no deceased dog has been reported. In addition, the period of discomfort lasts approximately seven days to disappear.

Assessing the sensitivity of WAHIS

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ORIGINAL ARTICLE

WILEY

Sensitivity of an international notification system for wildlife diseases: A case study using the OIE-WAHIS data on tularemia

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Abstract

The World Organization for Animal Health (OIE) has recently developed a Wildlife Health Framework to respond to the need of members to manage the risk from emerging diseases at the animal–human–ecosystem interface. One of its objectives is to improve surveillance systems, early detection and notification of wildlife diseases. Members share information on disease occurrence by reporting through the OIE World Animal Health Information System (OIE-WAHIS—formerly known as 'WAHIS'). To evaluate the capacity of a surveillance system to detect disease events, it is important to quantify the gap between all known events and those officially notified to the OIE. This study used capture–recapture analysis to estimate the sensitivity of the OIE-WAHIS system for a OIE-listed wildlife disease by comparing information from publicly available sources to identify undetected events. This article presents a case study of the occurrence of tularemia in lagomorphs among selected North American and European countries during the period 2014–2019. First, an analysis using three data sources (OIE-WAHIS, ProMED, WHO-EIOS [Epidemic Intelligence from Open Sources]) was conducted. Subsequent analysis then explored the model integrating information from a fourth source (scientific literature collected in PubMed). Two mod-

WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future
OIE-WAHIS

ProMED
INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES

EIOS
EPIDEMIC INTELLIGENCE FROM OPEN SOURCES

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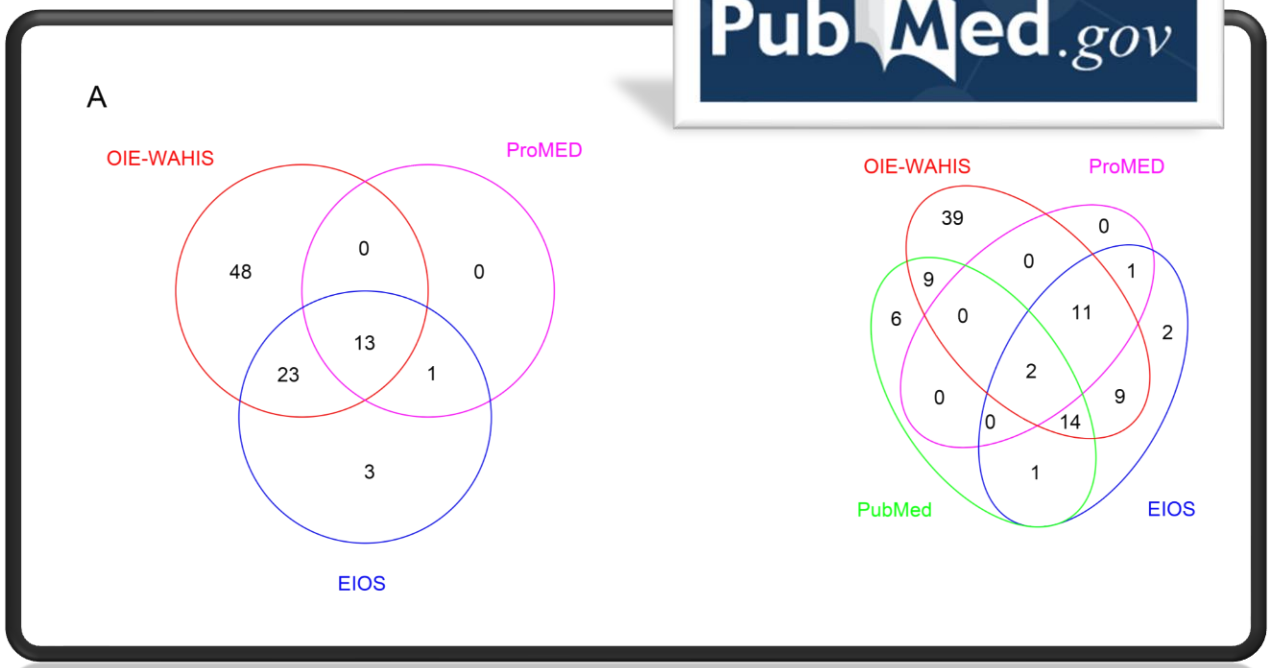


- Importance of disease surveillance at the **animal – human – environmental interface**
- Disease surveillance to **prevent disease spread and reduce the risk of disease emergence**
- Importance of disease surveillance at **national**, **regional** and **international level**
- Significant importance of early warning surveillance systems
- Importance of data integration to improve system sensitivity

Assessing and improving the quality of disease notification to WOAH: Asia-Pacific experience in supporting early threat warning

Paolo Tizzani, Data Integration Department (DID), WOAH headquarters, Paris

Jacqueline Lusat, WOAH Regional Representation for Asia and the Pacific (RRAP), Tokyo

World Organisation for Animal Health
Founded as OIE

Organisation mondiale de la santé animale
Fondée en tant qu'OIE

Organización Mundial de Sanidad Animal
Fundada como OIE

WOAH Epidemic intelligence (EI) activity – official and unofficial sources

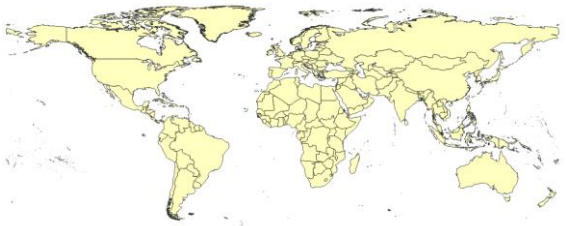
GLEWS platform — Global Early Warning and Response System for Major Animal Diseases, including Zoonoses

EIOS EPIDEMIC INTELLIGENCE FROM OPEN SOURCES

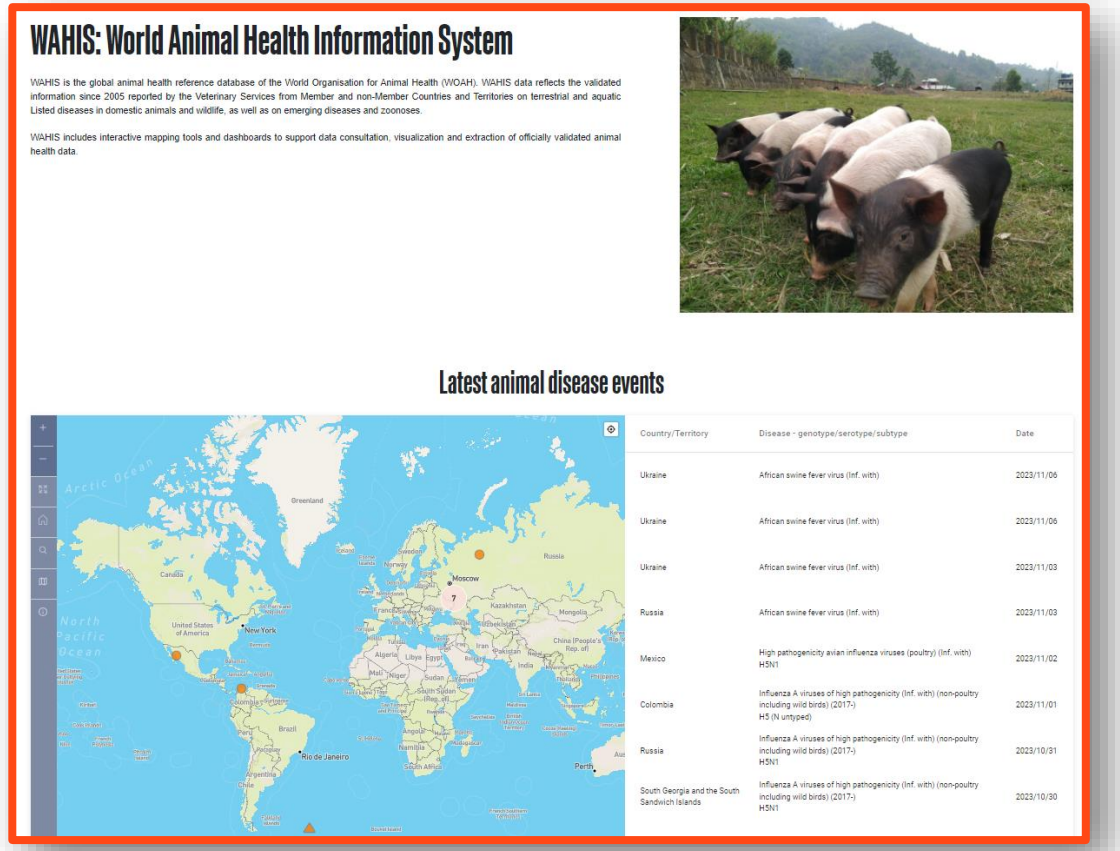
Reference laboratories (WOAH network)

Source Intelliriver Source

IBIS (Australia)

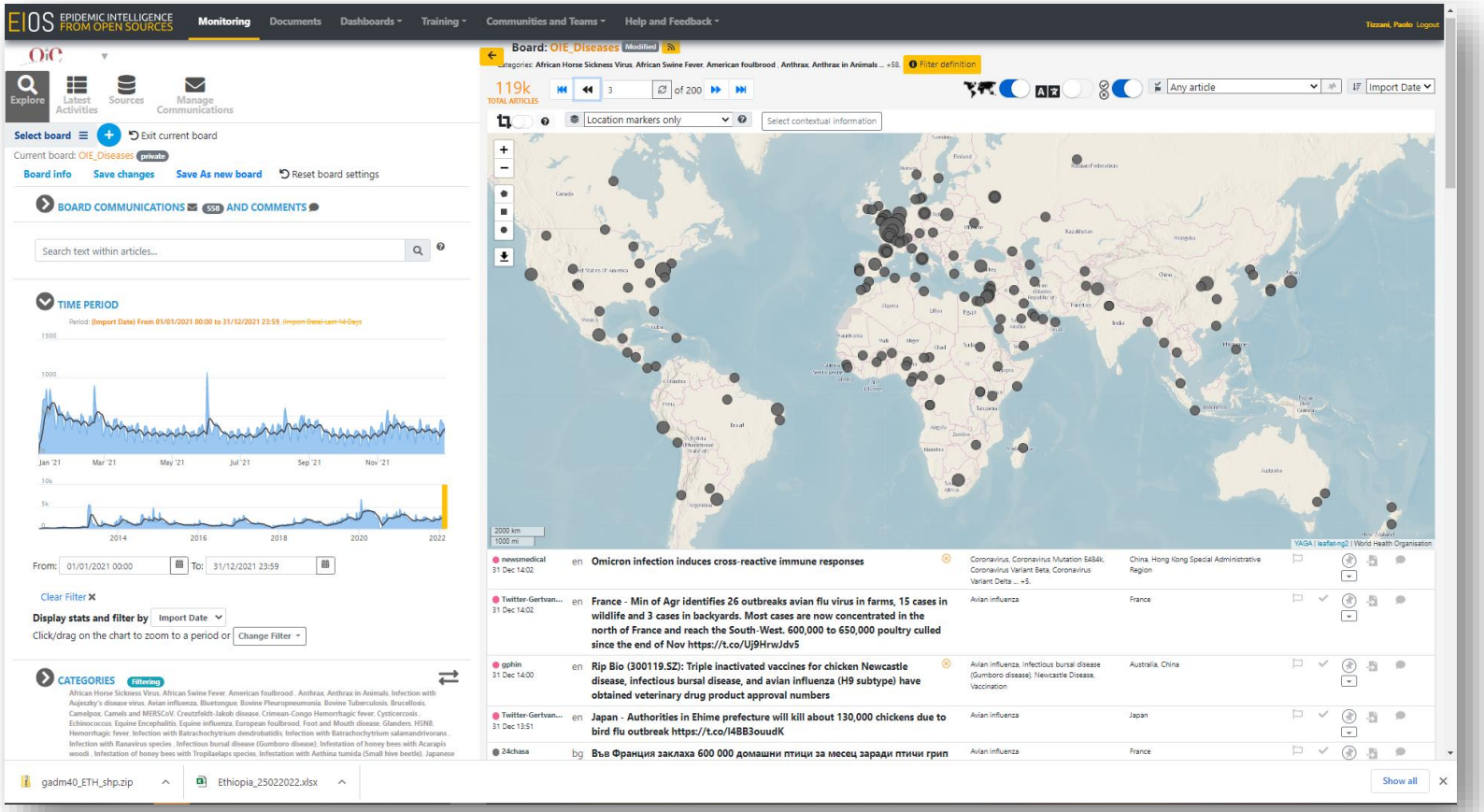


WOAH verifies with Members



EIOS system – key figures

- Used since end **2017**
- **Daily screening** of the web for all **listed and emerging diseases**
- **15,000** sources
- **500** disease categories
- **15** languages
- **100,000 – 150,000** news / year
- Communication between WOAH and Members



EIOS EPIDEMIC INTELLIGENCE FROM OPEN SOURCES

Background

One of WOAH 's missions: to ensure transparency of the animal disease situation worldwide.

To meet this objective, WOAH collects official notifications of animal diseases from its Members and disseminates the information to the international community.

Title: Supporting early threat warning project for WOAH 7th Strategic Plan funded by the Australian Department of Agriculture, Fisheries and Forestry (DAFF).

Australian Government
Department of Agriculture, Fisheries and Forestry

Aim: to promote transparency in disease reporting and sharing.

Objective: to strengthen WOAH's early warning systems in Asia and the Pacific region through intelligence-gathering, active search activity (rumour tracking), and information sharing.

Target countries: WOAH Members in Asia and the Pacific region.

Components:

1. Intelligence gathering - gap analysis, consultancy
2. Asia-Pacific rumour tracking
3. Development & implementation of a strategy – information sharing

Gap analysis of disease reporting and detection in Asia-Pacific region

Gap analysis

Objective

Evaluate current animal disease detection capacity in Asia-Pacific region and identify areas for improvement

Data sources

- ✓ **WAHIS**: statistics on disease reporting
- ✓ **WOAH active search** : statistics on country transparency
- ✓ **EIOS**: statistics on rumour detection capacity

Gap analysis

Indicators

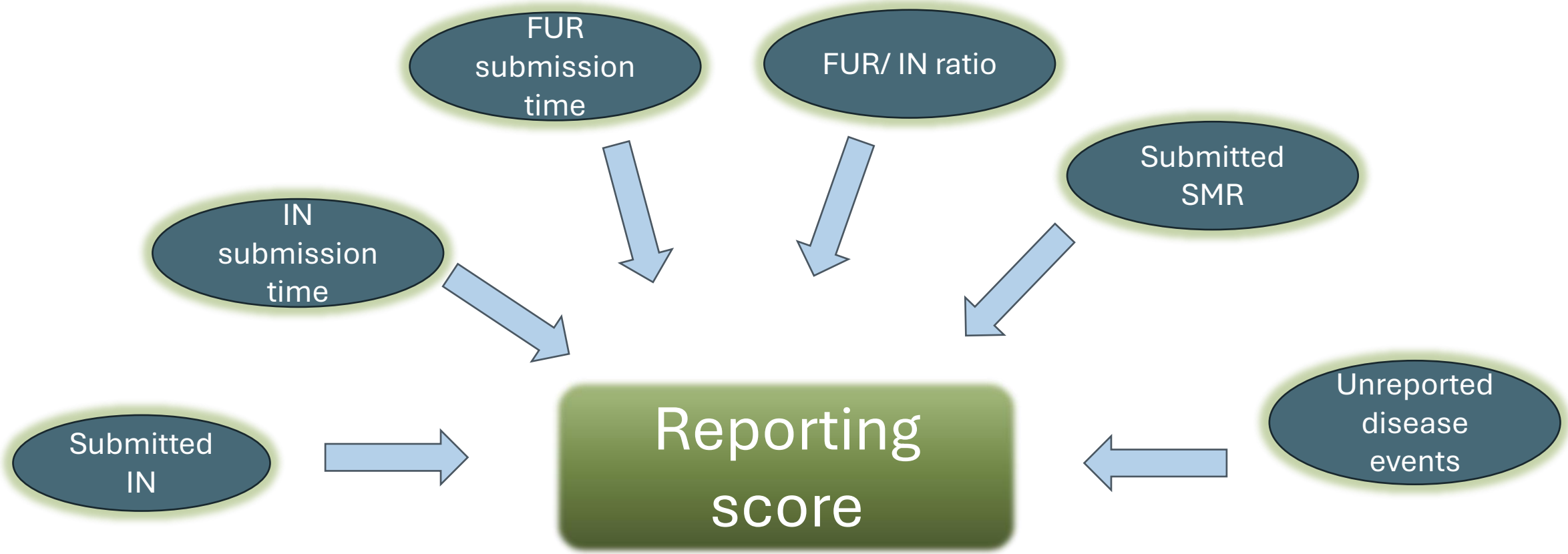
- Countries reporting performances through the Early Warning System (immediate notifications)
- Countries reporting performances through the Monitoring System (six-monthly reports)
- Country response to WOAH request for unreported events
- EIOS ability to detect unreported disease events

Reporting score

Detection score

Indicators

Reporting score



Percentage countries by group

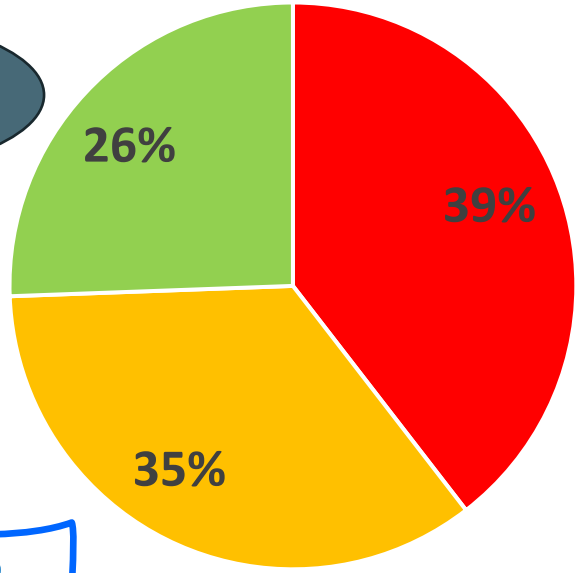
Reporting score

FUR submission time

FUR/ IN ratio

Submitted SMR

IN submission time



Poor reporting

Unreported disease events

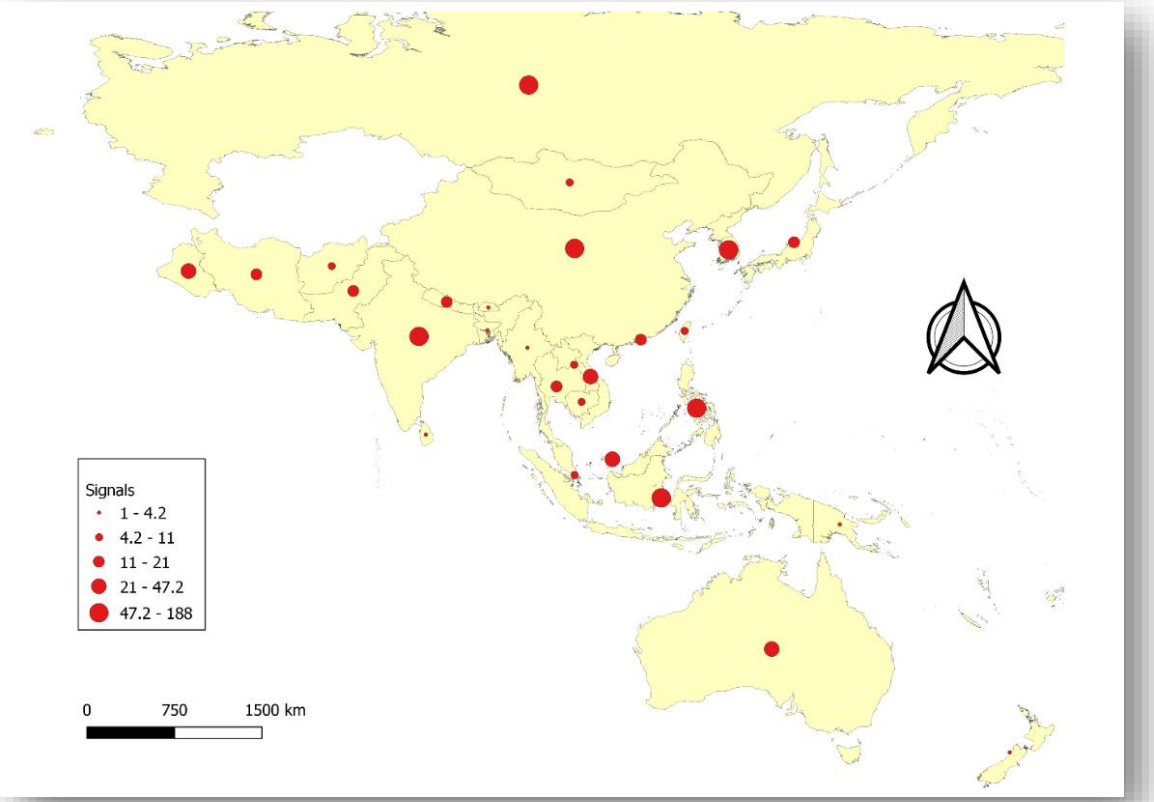
Submitted IN

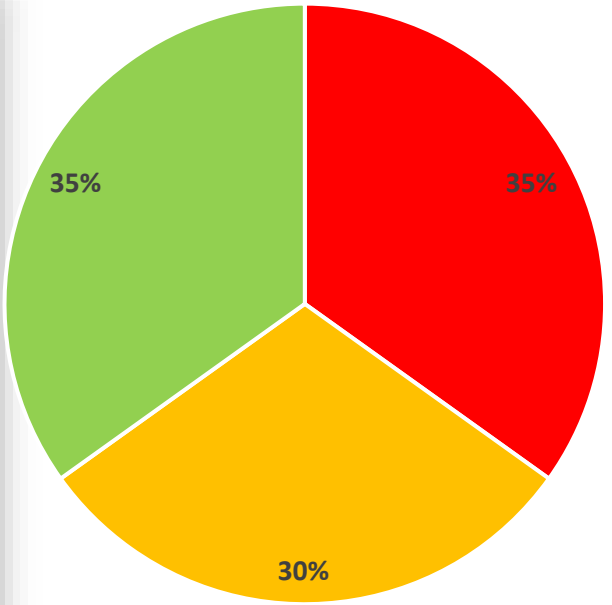
Good reporting

N = 43

Indicators and groups

Detection score





- Low
- Medium
- High

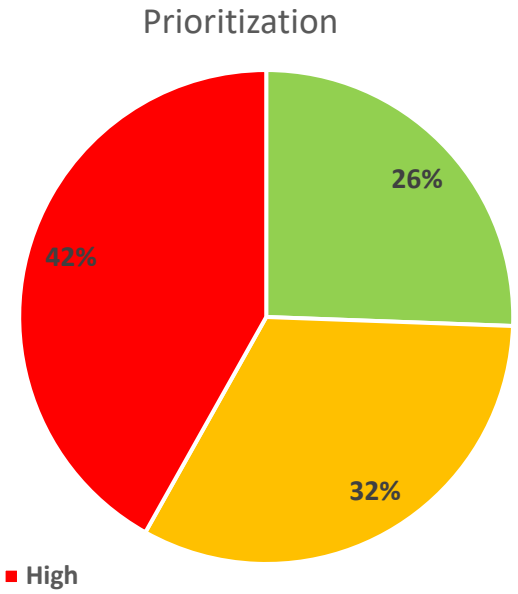
Poor detection

Good detection

N = 43

Combining reporting and detection scores

		Detection capacity score		
		Low	Medium	High
Reporting country score	Low	High priority	High priority	Medium priority
	Medium	High priority	Medium priority	Medium priority
	High	Low priority	Low priority	Low priority



Transparency : high --> low priority
Transparency : medium --> medium priority except when detection is low and then priority high...

N = 43

11 “low priority”,
14 “medium priority”
18 “high priority”.

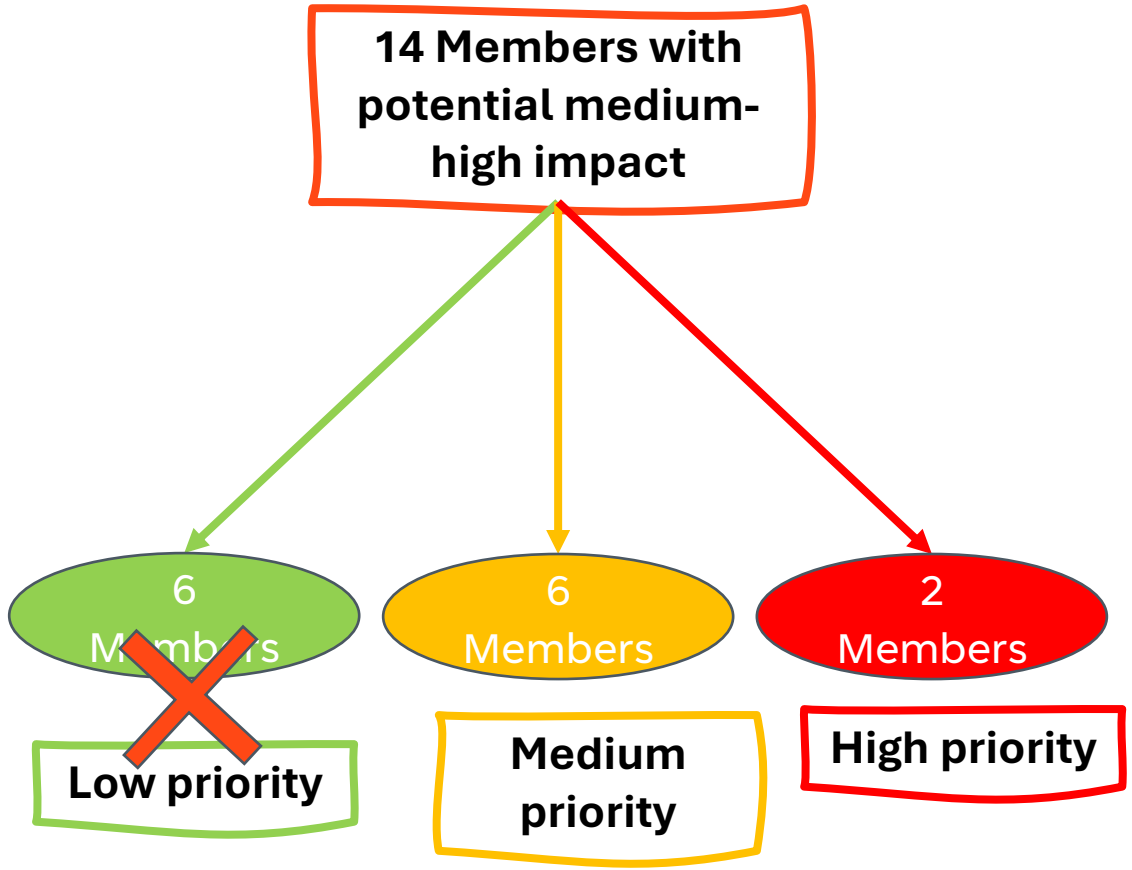
Further refining of the prioritisation

Including impact assessment

Data sources

- ✓ Animal population
- ✓ Country size
- ✓ Animal population density
- ✓ Geographic isolation
- ✓ Number of trading partners

N = 8



Gap analysis – main findings

Reporting highlights

- **80%** of IN since 2005 submitted by **10** Members and non-Members
- IN submission time = **15 days** (median)
- FUR submission time = **67 days** (median)
- **Only 28%** of the Members and non-Members submitted all the SMR required
- Most of the IN (70.4%) related to three diseases only: ASF, AI, FMD

Dedicated efforts to improve reporting

Detection highlights

- EIOS detected news for only **65%** of the Members and non-Members
- **60% of the news** detected in **five** Members
- Globally EIOS detected relevant signals for 29 diseases
- **78%** of signal detected for only **6 diseases**

Needs to improve ability to detect rumours

Results from gap analysis refined through dedicated workshop with subject matter experts

Proposed actions based on identified gaps in the analysis report

Proposed actions

For WOAH (at the regional)

1) To improve detection/reporting
   a. using gap analysis with a **country-specific** approach
   b. identify factors related to detected gaps and propose actions to reduce the impact
   c. constantly monitor efficacy of the rumour tracking activity.
2) To support countries/territories
   a. tailored to **individual (identified) needs**
   b. encourage disease reporting and **quality data sharing**
   c. develop materials to be used to raise awareness on the importance of transparency and support limiting identified gaps
   d. facilitate, and encourage creation of event-base surveillance system at country level.
3) To improve communication
   a. promote **regional networking**
   b. establish **a secure and efficient channel** to communicate on rumour tracking findings with countries/territories

For countries/territories

1) To improve detection/reporting
   a. tackle and **prioritise main gaps** identified from the project to improve disease detection and reporting
   b. support WOAH in sharing local sources to be integrated in the EIOS system
   c. ask guidance from WOAH to facilitate national event base surveillance systems

2) To improve communication
   a) networking with other countries/territories and **be a champion in promoting** the benefit of transparent in disease reporting
   b) disseminate and share with countries/territories **examples of impact and consequence** of - early detection, sharing and reporting of disease events (both positive and negative effects)
   c) improve the timeliness and efficiency in communication with WOAH on any request of clarifications from rumour tracking activity

Proposed actions

For EIOS system

1) To improve detection/reporting
   a. improve detection capacity for priority countries & diseases
   b. increase detection algorithm scope including local languages to cover priority areas
   c. increase local sources that feed information in EIOS from priority areas

Expected impacts

1) Improve WOAH capacity to monitor undetected events at regional level *(i.e., improve sensitivity and specificity of the EIOS system)*.
2) Improve sensitivity of WAHIS system.
3) Improve the trust in WAHIS data.
4) Promote country responsiveness & awareness of the importance of reporting.
5) Reduce delays in disease sharing and reporting.

A pilot project to detect early warnings in Asia-Pacific - could be extended to other regions if successful (a model).

Thank you

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