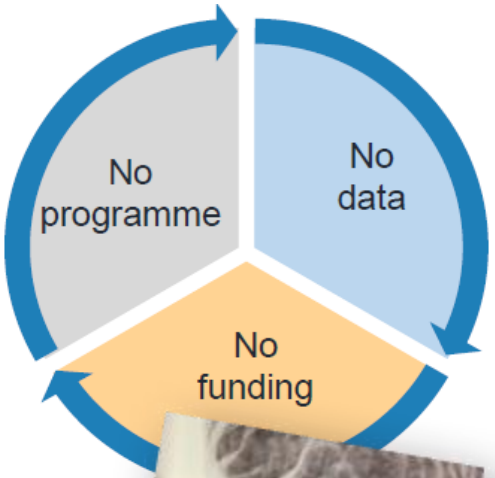
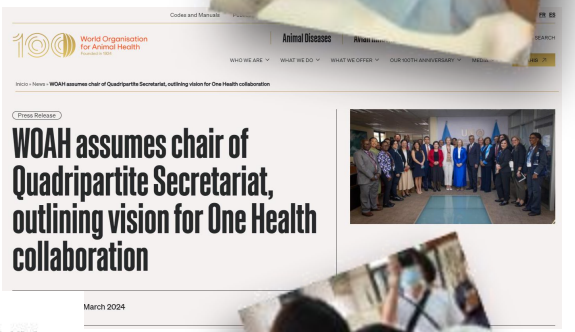


One Health approach to dog-mediated public health risks



Dr. Vlad Vuta
Dr. Florence Cliquet

WOAH Reference Laboratory for Rabies

Reference Centre World Organisation for Animal Health
Founded as OIE

for Rabies

5th WOAH Regional Workshop on Dog Population Management for the Caucasus and Central Asia, 2-4 December 2025 - Almaty, Kazakhstan

PET-ASSOCIATED DISEASE RISKS

- More than 70 pathogens of pets transmissible to humans and pets often subclinical shedding.
- Dog structure and dog population dynamics variable depending upon many factors.
- Heath risks depend on many factors, and increase at extreme ages, pregnancy and immunocompromised people.
- Emerging and re-emerging diseases: Over 30 new human pathogens have been detected in the last three decades, 75% of which have originated in animals.

Sources: *https://ipac-canada.org/photos/custom/Members/pdf/OneHealth_Stull.pdf; Jones et al., 2008; Hiby et al., 2023,*

HUMAN-PET BOND

Increased levels of outdoor physical activity that often accompany pet ownership (e.g. regular dog walking).

The sustained mental health benefits brought on by pet companionship.

Greater exposure to germs that can 'favourably alter the gut microbiome of an owner'.

- Reduction in cardiovascular disease risk.
- Reduction in stress, anxiety, loneliness, depression.
- Shorter hospital stays.
- Positive health and welfare effects in patients affected by cancers or autism.
- For children, better social skills, self-esteem, empathy.

Sources: https://healthforanimals.org/reports/pet-care-report/global-trends-in-the-pet-population/#health; *Takashima et al., 2022; Patronek and Glickman, 1993; Friedmann and Son, 2009; Melson et al., 2009*

HUMAN-PET BOND

Increased levels of outdoor physical activity that often accompany pet ownership (e.g. regular dog walking).

The sustained mental health benefits brought on by pet companionship.

Greater exposure to germs that can 'favourably alter the gut microbiome of an owner'.

Therefore, dogs and humans have to continue to live together for a long time and everything must be done to ensure that it goes well!

Sources: https://healthforanimals.org/reports/pet-care-report/global-trends-in-the-pet-population/#health; *Takashima et al., 2022; Patronek and Glickman, 1993; Friedmann and Son, 2009; Melson et al., 2009*

Most common Diseases of dogs

Viruses

Rabies
Canine parvovirus
Canine coronavirus
Canine distemper
Canine influenza
Infectious canine hepatitis
Canine herpesvirus
Pseudorabies

Parasites

Intestinal parasites (Echinococcosis, cryptosporidiosis, etc)
External parasites (fleas, ticks, mange)
Heartworms

Bacteria

Brucellosis
Leptospirosis
Tick-borne diseases (Rickettsiosis, Lyme disease, ehrlichiosis, etc)
Kennel cough

Protozoa

Leishmaniosis
Babesiosis
Neosporosis
Giardiasis

Others

Fungal infections (blastomycosis, histoplasmosis, cryptococcosis, ringworm, etc)

Diabete
Cancer
Allergies
Tooth pathology
Fertilizers and pesticides

In blue: zoonotic diseases

Underlined: vaccine(s) available

DOG, MAN'S BEST FRIEND

In a context of an overall increase in owned and free roaming dog populations

- Very close physical association with the population.
- Number of zoonotic diseases that may be transmitted from dogs to people and other animals (owned or roaming dogs, dogs in shelters).
- Transmission dependent upon many factors:
  - Animal side: lifestyle of the dog, vaccination and parasite control, exposure to other domestic or wild animals, exposure to particular environments.
  - Human side: knowledge of the population, education of children, dog ownership, hygiene conditions and health care, waste management, disposal of animal carcasses, movements of the people, level of surveillance of major zoonosis.

***Sources**: Day, 2011; https://healthforanimals.org/reports/pet-care-report/global-trends-in-the-pet-population/#ownership;*

TRANSMISSION OF INFECTIOUS AGENTS BETWEEN ANIMALS AND PEOPLE

Direct contact: Coming into contact with the saliva, blood, urine, mucous, feces, or other body fluids of an infected animal. Examples include petting or touching animals, and bites or scratches.

Indirect contact: Coming into contact with areas where animals live and roam, or objects or surfaces that have been contaminated with germs (pet habitats as well as pet food and water dishes).

Vector-borne: Being bitten by a tick, or an insect like a mosquito or a flea.

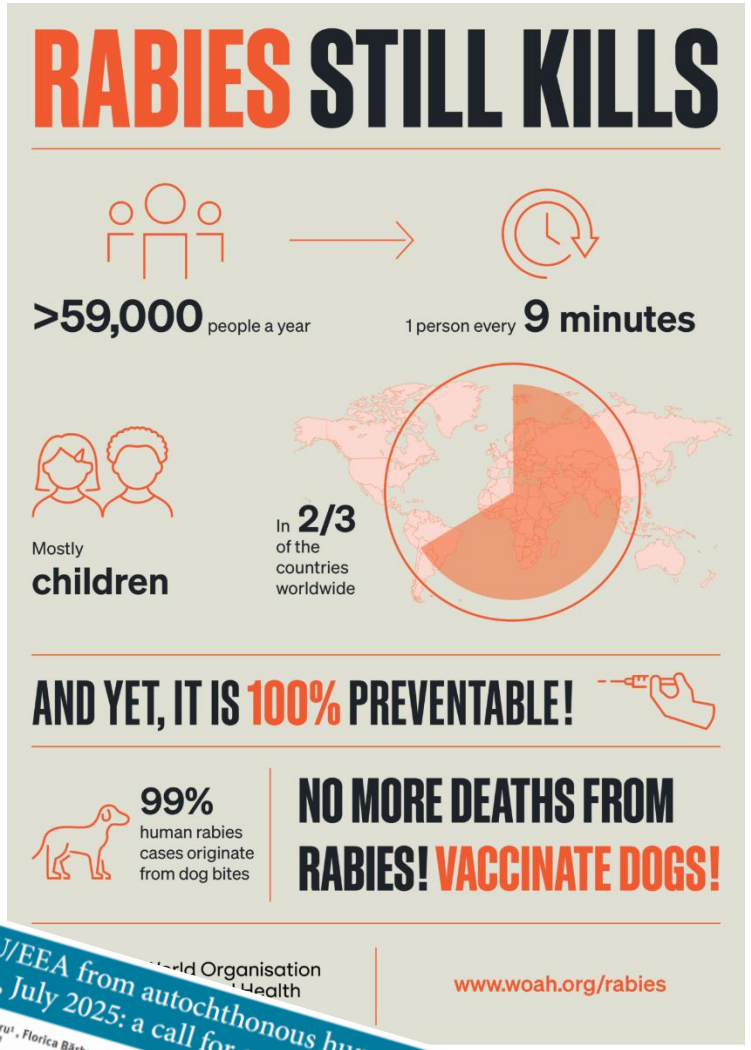
Foodborne: Eating contaminated food. Eating or drinking something unsafe, such as unpasteurized (raw) milk, undercooked meat or eggs, or raw fruits and vegetables that are contaminated with feces from an infected animal. Contaminated food can cause illness in people and animals, including pets.

Waterborne: Drinking or coming in contact with water that has been contaminated with feces from an infected animal.

***Sources**: https://www.cdc.gov/one-health/about/index.html*

DOG BITES

- Worldwide estimations at tens of millions of injuries per year annually (≈ 76-94 % of animal bite injuries).
- Saliva from these animals can be contaminated with pathogens transmitted to humans, such as Pasteurella, Staphylococcus, and also rabies.
- Children are the largest percentage of people bitten by dogs.



Sources: Ghasemzadeh et al., 2015; https://www.who.int/news-room/fact-sheets/detail/animal-bites;

OTHER RISKS CAUSED BY DOGS (BUT BECAUSE OF PEOPLE!)

- Lack of responsible dog ownership
- Free roaming dogs, dog rehoming and overcrowded shelters.
- Dog trafficking: illegally farmed for importation in EU countries.
- Limited access to veterinarian services: particularly in rural areas

Sources: *https://www.dogstrustworldwide.com/our-priorities/balkans/*

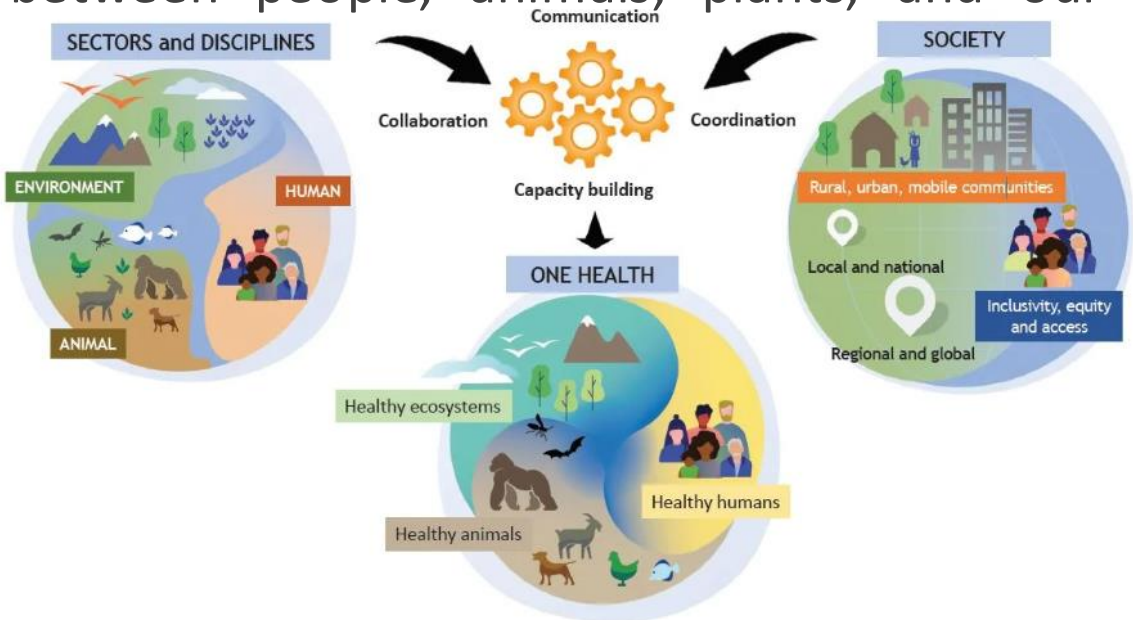
ONE HEALTH, NEW TERM FOR AN OLD CONCEPT

- Health of people closely connected to the health of animals and our shared environment.

- One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems.

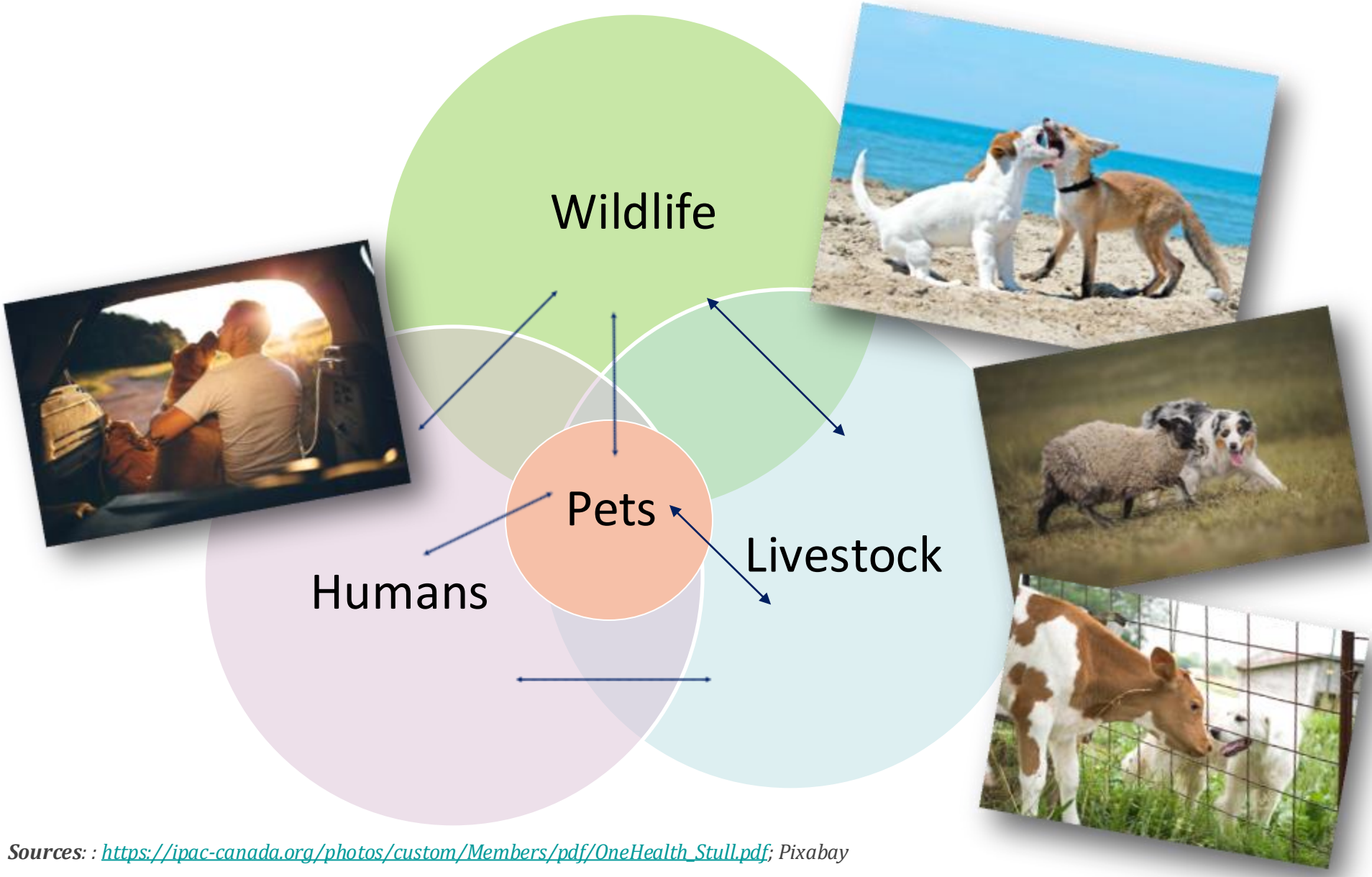
- One Health has become more important in recent years as many factors have changed interactions between people, animals, plants, and our environment.

- Multiple sectors, disciplines and communities involved at varying levels of society to work together.



Sources: *https://www.cdc.gov/one-health/about/index.html; https://www.who.int/news/item/01-12-2021-tripartite-and-unep-support-ohhlep-s-definition-of-one-health; https://www.woah.org/en/what-we-do/global-initiatives/one-health/*

PET-ASSOCIATED DISEASE TRANSMISSION



Sources: : *https://ipac-canada.org/photos/custom/Members/pdf/OneHealth_Stull.pdf; Pixabay*

DOGS AS SENTINELS FOR DISEASE

Animals, including dogs, may serve as sentinels for identification and pathogen testing, as well as for environmental contaminants posing health risks to the exposed human population.

Tropical Medicine and Infectious Disease

MDPI

Brief Report

One Health Approach to Leptospirosis: Dogs as Environmental Sentinels for Identification and Monitoring of Human Risk Areas in Southern Brazil

Natacha Sohn-Hausner [1], Louise Bach Kmetiuk [1], Evelyn Cristine da Silva [2], Helio Langoni [2] and Alexander Welker Biondo [1,*]

Use of tick surveys and serosurveys to evaluate pet dogs as a sentinel species for emerging Lyme disease

Sarah A. Hamer, MS; Jean I. Tsao, PhD; Edward D. Walker, PhD; Linda S. Mansfield, VMD, PhD; Erik S. Foster, MS; Graham J. Hickling, PhD

Dogs can play useful role as sentinel hosts for disease

SIR — News that Thai dogs have tested positive for antibodies to the influenza A H5N1 virus ("Thai dogs carry bird-flu virus, but will they spread it?" *Nature* 439, 773; 2006) reinforces our notion that carnivore and scavenger species have the potential to act as important sentinel hosts for emerging human and livestock diseases, providing a valuable tool for surveillance and for determining spatial and temporal patterns of infection.

Domestic dogs may prove particularly

Science

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PERSPECTIVE | TOXICOLOGY

Canine sentinels and our shared exposome

Dogs are distinctly positioned to be indicators of human health and well-being

COURTNEY SEXTON AND AUDREY RUPLE Authors Info & Affiliations

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the Science of the Total Environment

An International Journal for Scientific Research into the Environment and its Relationship with Man

The Science of the Total Environment 274 (2001) 161–169

www.elsevier.com/locate/scitotenv

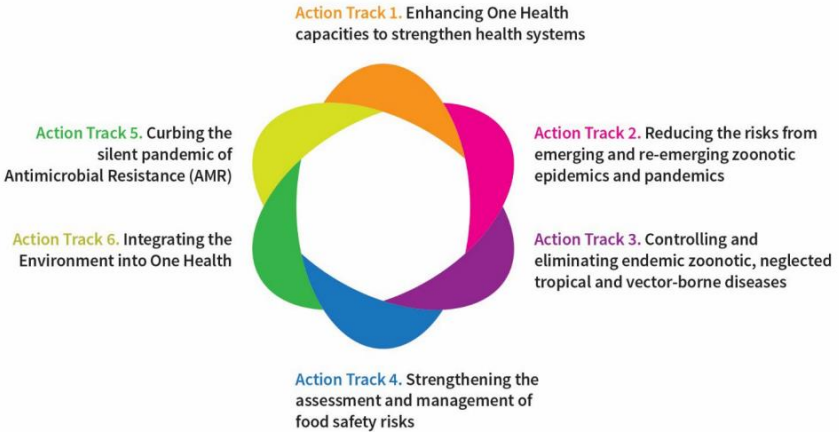
Pet dogs as sentinels for environmental contamination

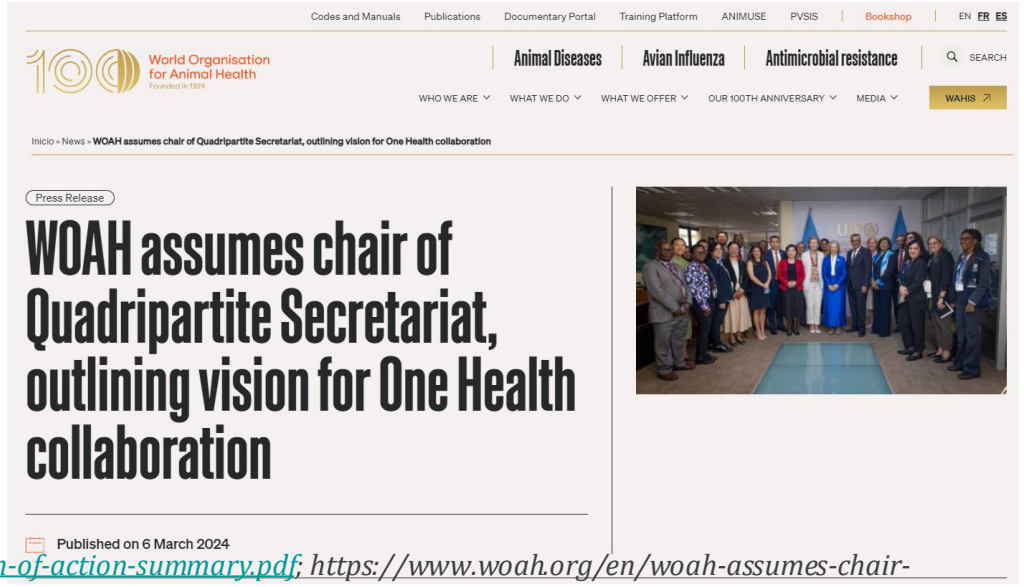
Lorraine C. Backer [a,*], Carol B. Grindem [b], Wayne T. Corbett [b], Laura Cullins [b], J. Lee Hunter [c]

QUADRIPARTITE COMMITMENT FOR ONE HEALTH

- Commitment between World Organization for Animal Health (WOAH), World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), and UNEP (United Nations Environment Programme).

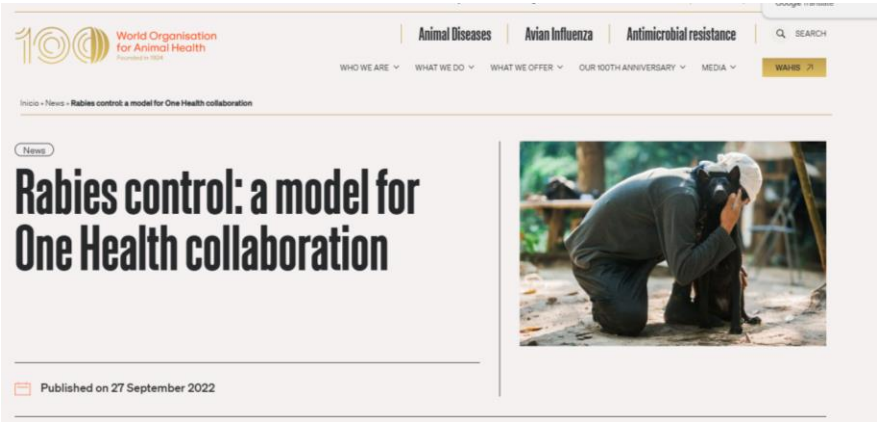
- During the Second Quadripartite Executive Annual Meeting at the United Nations Office in Nairobi in 2024, WOAH formally assumed its role as forthcoming chair of the Quadripartite Secretariat, reinforcing its dedication to combating zoonotic animal diseases such as rabies or vector-borne diseases through a holistic approach.

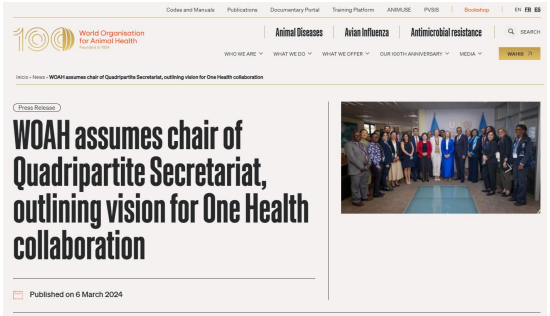




Sources: *https://www.woah.org/app/uploads/2022/04/oh-joint-plan-of-action-summary.pdf; https://www.woah.org/en/woah-assumes-chair-of-quadripartite-secretariat-outlining-vision-for-one-health-collaboration/*

ONE HEALTH ACTION AGAINST RABIES





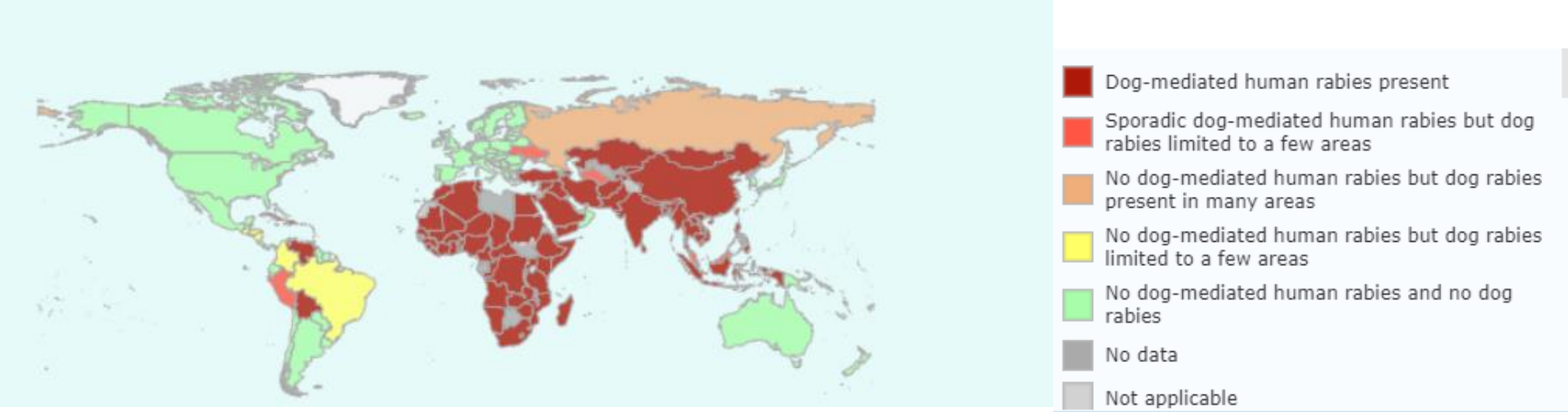
- "*At the forefront of WOAH's leadership lies our robust commitment to combating rabies, a preventable yet deadly disease that still affects vulnerable communities".*
- *"WOAH will promote efforts to control and eliminate endemic zoonoses, neglected tropical diseases, and vector-borne diseases, with a particular focus on ending human deaths from dog-mediated rabies. Leveraging on the strategic plan Zero by 30 developed by FAO, WHO, and WOAH, OH JPA activities on rabies will operationalise the One Health approach in countries with the highest rabies burden. This includes promoting the development of national control plans while considering surveillance in wildlife, facilitating access to the WOAH vaccine bank for the vaccination of dogs (both sheepdogs in contact with wildlife and free-roaming dogs), and fostering stakeholder and communities communication".*

***Source** : https://www.woah.org/en/woah-assumes-chair-of-quadripartite-secretariat-outlining-vision-for-one-health-collaboration/; https://www.woah.org/en/rabies-control-a-model-for-one-health-collaboration/*

RABIES GLOBAL IMPACT

- Rabies still a neglected, vaccine-preventable disease, 100% fatal
- ~60,000 deaths per year (one person/ 9 minutes, ~100 children/ day)
- Dog bites cause ~ 95-99% of human cases
- Weak data and under-reported
- Impacts human and animal health and welfare
- Economic losses : economic impact of US$8,6 billion annually

Inadequate investment in dog vaccination and accessibility to PEP



Presence of dog-mediated human rabies, 2022 (WHO)

Source *: Hampson et al., 205; https://www.who.int/data/gho/data/themes/topics/rabies*

STRATEGIC PLAN « ZERO BY 2030 » IN A ONE HEALTH APPROACH

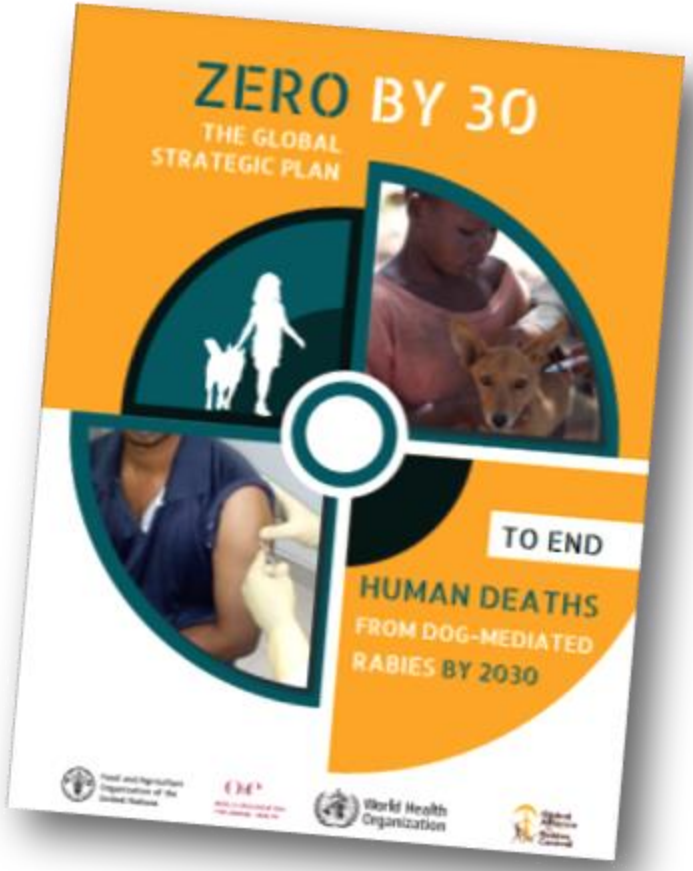
World Health Organization | Food and Agriculture Organization of the United Nations | OIE World Organisation for Animal Health | Global Alliance for Rabies Control

Zero by 30: The Global Strategic Plan to Prevent Human Deaths from Dog-Transmitted Rabies by 2030

Objective 1: To efficiently prevent and respond through effective use of vaccines, medicines, tools and technologies.

Objective 2: To generate, innovate and measure impact through policies, guidance and governance; reliable data to enable effective decision-making.

Objective 3: To sustain commitment and resources to drive progress. By providing a coherent foundation for rabies control, confidence in the feasibility of global elimination, and engages countries, research institutions and development partners in the fight to end rabies.



***Sources**: http://www.oie.int/eng/RABIES2015/publication.html - http://www.who.int/rabies/Executive_summary_draft_V3_wlogo.pdf*

DETAILED ACTIVITY FRAMEWORK

Objective 2.1: Policies, guidance and governance provide support

Outcomes	Outputs	Major activities
2.1 Policies and guidelines, and governance to prevent human deaths from rabies exposure are created and adopted at regional and national levels	2.1.1 Clear guidance, strategies, priorities and legal frameworks at global, regional and national levels provided to prevent human deaths	Complete WHO and OIE recommendations and FAO guidelines Define guidelines for regulatory framework Update and embed stepwise approach to national rabies elimination policies and plans in line with the global framework Implementation of One Health approach embedded within strong human and animal health services
	2.1.2 Efficient and effective governance of regional and national rabies elimination programmes established	Establish cross-sectoral working group Establish roles, responsibilities and accountability
2.2 Appropriate technology and information are made available	2.1.3 Technology and health innovations to eliminate human deaths from rabies fostered	Incorporate existing tools and leverage existing programmes Promote ICT-based enablers including surveillance tools Promote supply chain innovations Promote innovation into new vaccines and vaccine strategies Promote innovative rapid and sensitive diagnostics Promote dog population management tools (e.g. movement control, contraceptive technology, identification)

Objective 2.2: Reliable data enables effective decision-making

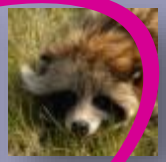
Outcomes	Outputs	Major activities
2.3 Progress towards the goal is constantly and	2.3.1 Robust disease surveillance in human and animals	Initiate capacity-building for laboratory diagnostics Train staff in surveillance and diagnostic methods

...

RABIES RESERVOIRS IN EUROPE

Cycle on non-flying mammals (classical rabies)

Red fox

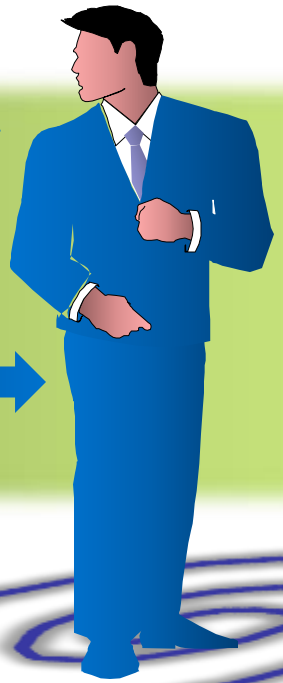


Raccoon dog

Lyssavirus
RABV virus species

Cycle on flying mammals

Lyssavirus
Virus species
EBLV-1, EBLV-2,
BBLV, LLBV, WCBV
and KBLV

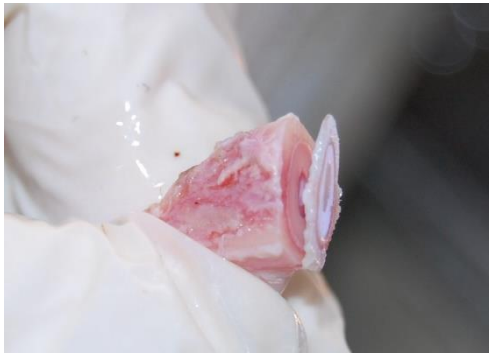


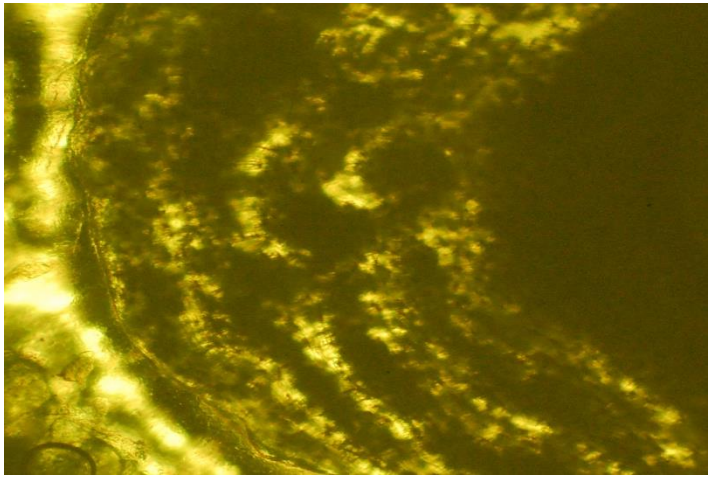
ORAL VACCINATION METHOD: A UNIQUE CONCEPT FOR BEST COST-BENEFIT RATIO

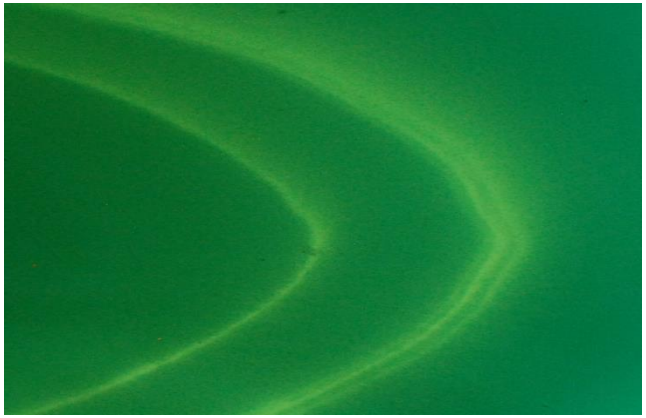
- Bait: rabies vaccine + biological marker (tetracycline)
- Distribution of baits in spring (April - May) and in Autumn (September – November)
- Regular distribution of 20 baits/km²
- Distribution by helicopter or by fixed-wing aircraft
- Choice of the area to be vaccinated : whenever feasible, it is preferable to vaccinate as a whole the totality of the infected area.

Monitoring of the efficacy of ORV program

- Age determination
- Biomarker detection
- Immunization:
  - ELISA (Biorad/BioPro)







VACCINATION OF ANIMALS AGAINST RABIES IN EUROPE

Rabies vaccination (with inactivated vaccines) in domestic carnivores is intended:

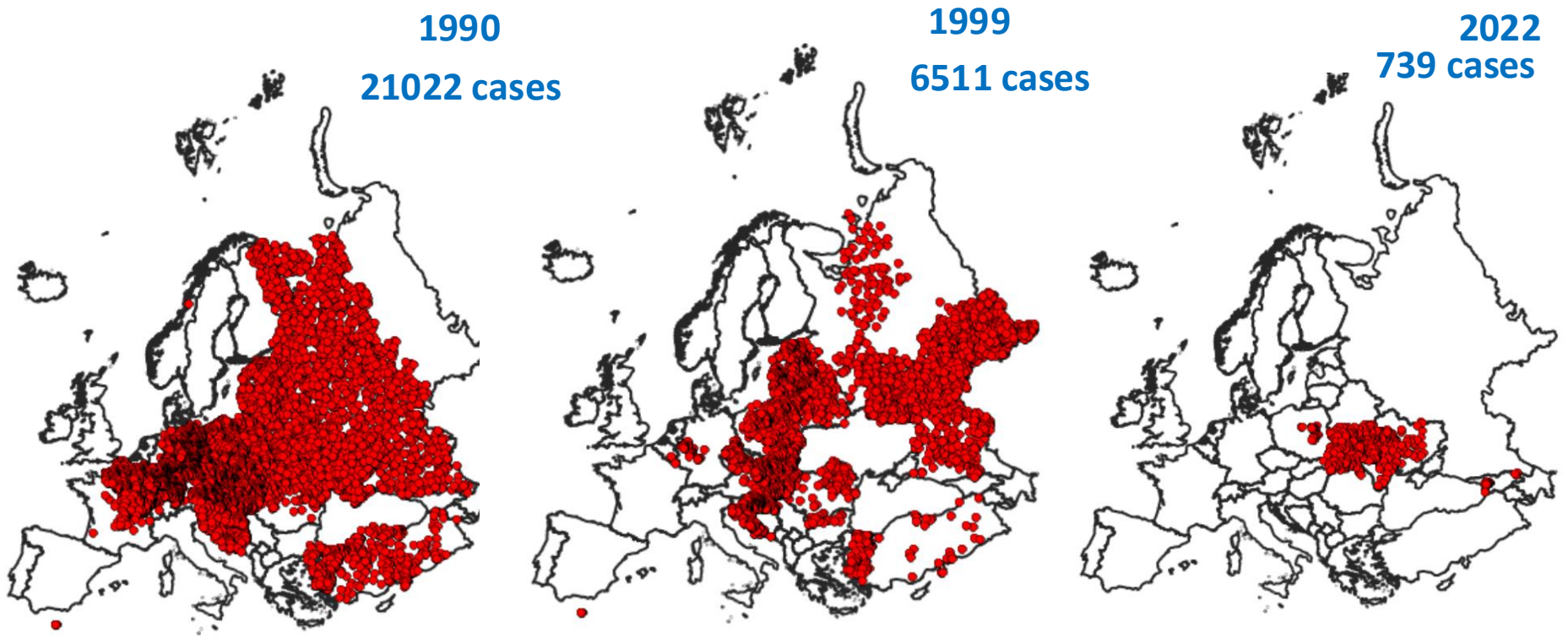
- to protect individual animals if exposed to rabies virus,
- to prevent them from transferring rabies virus to other domestic animals or to humans.

Rabies vaccination (with live vaccines) in wildlife is intended:

- to interrupt the transmission from one animal to another one,
- to eliminate the virus from those reservoirs.

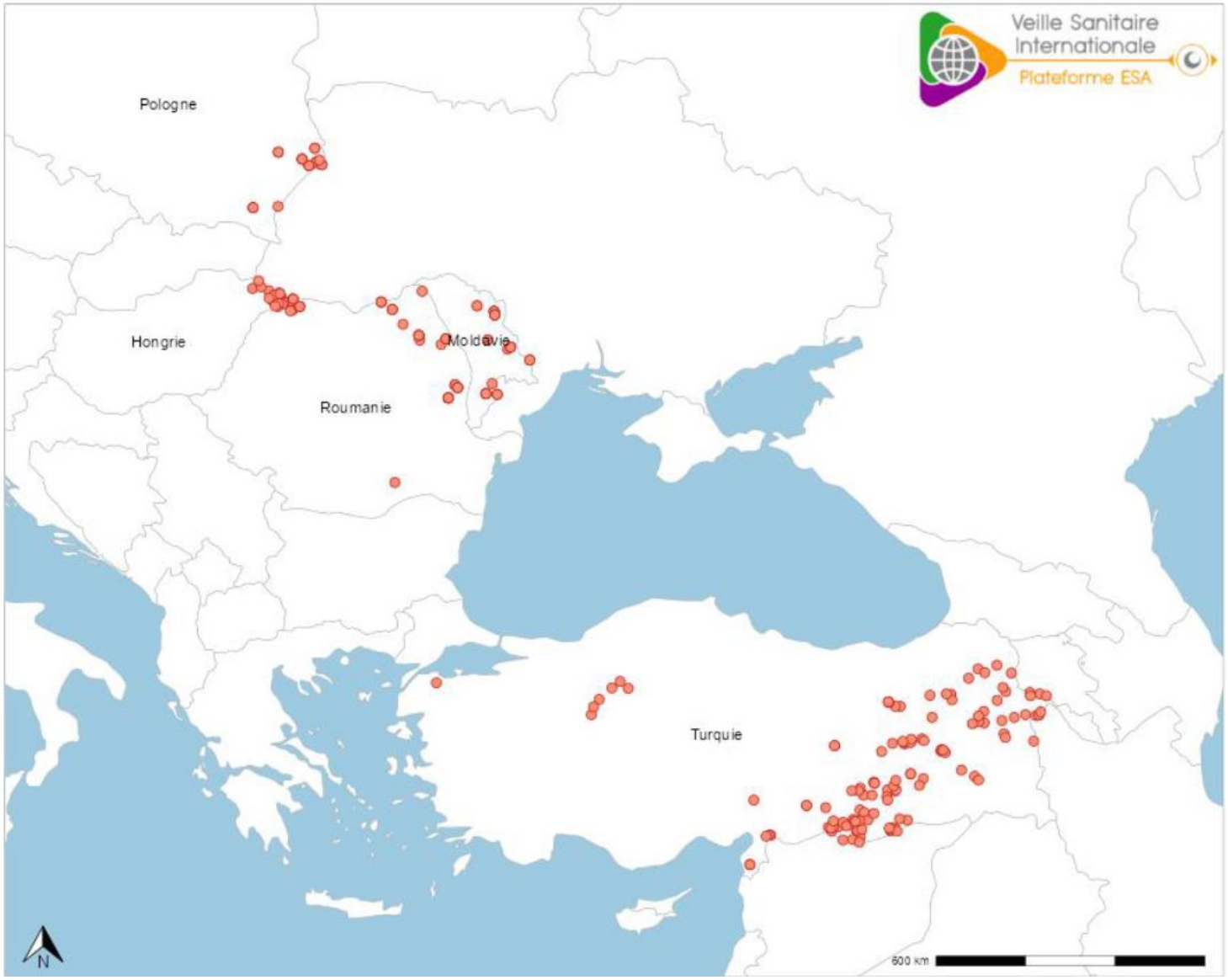
EVOLUTION OF RABIES IN EUROPE IN WILD AND DOMESTIC ANIMALS*

* Are excluded : bat rabies cases



***Source** : Rabies Bulletin Europe (compilation)*

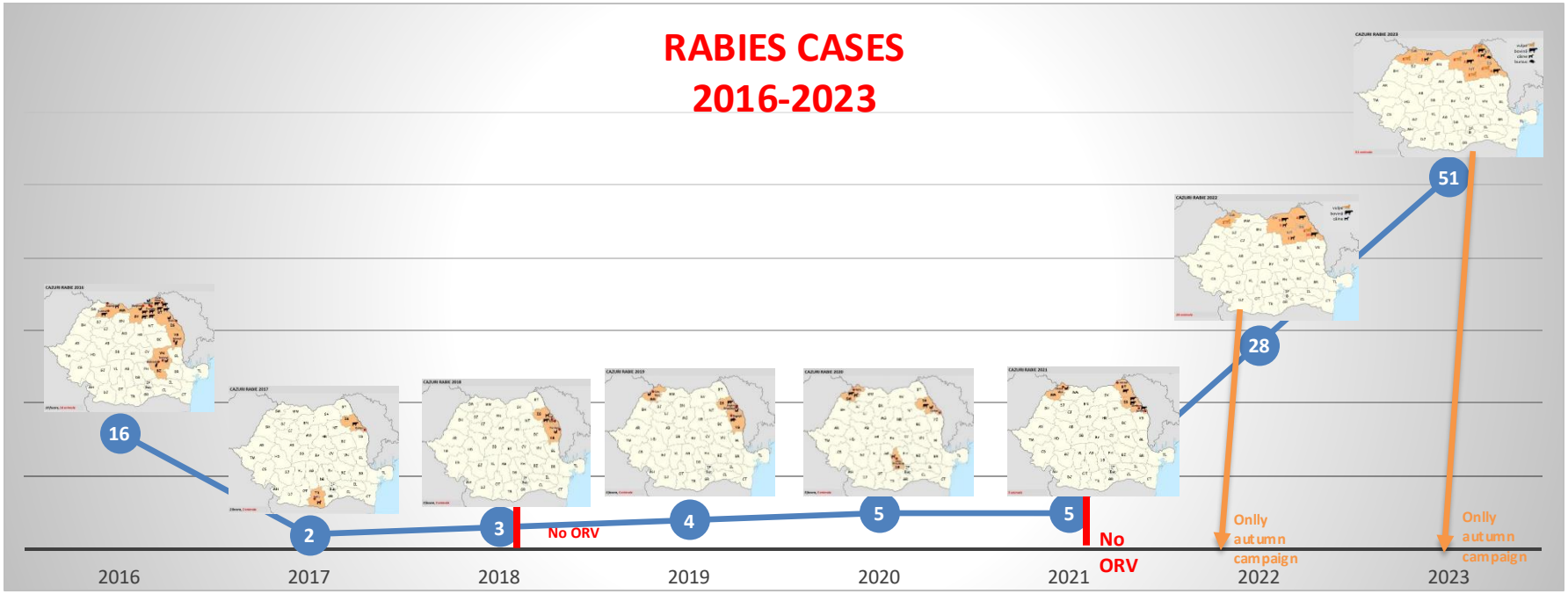
RABIES EPIDEMIOLOGICAL SITUATION IN EUROPE IN 2024 (UNTIL 27 OCTOBER)



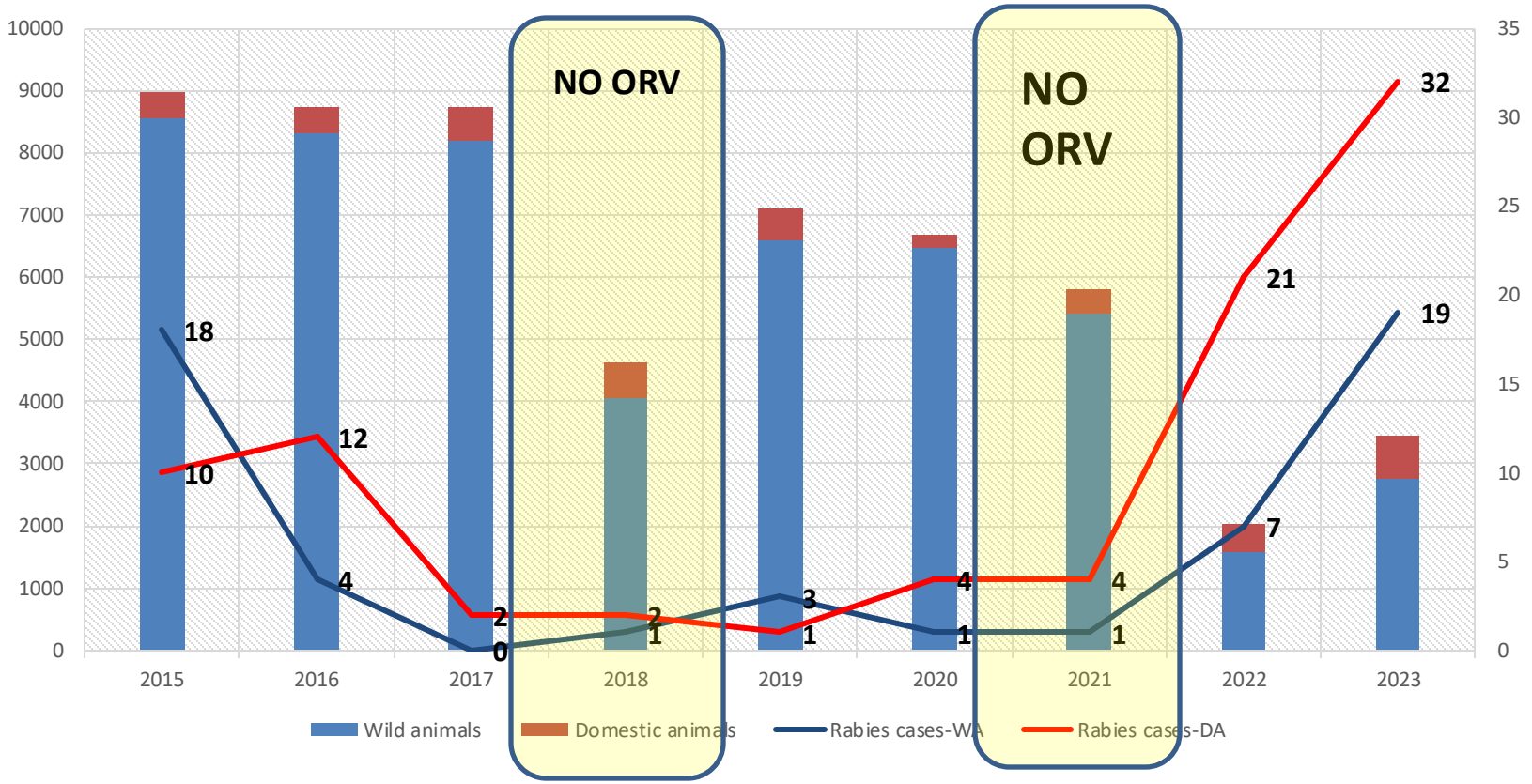
Sources *: Compilation of ADIS data*

RABIES SURVEILLANCE 2016 -2023

- rabies cases



Rabies evolution in Romania 2015-2023



PREVENTION OF RABIES RE-INTRODUCTION IN EU

Animal health requirements for the non-commercial movement of pet animals into a Member State from another Member State or from a territory or a third country into EU

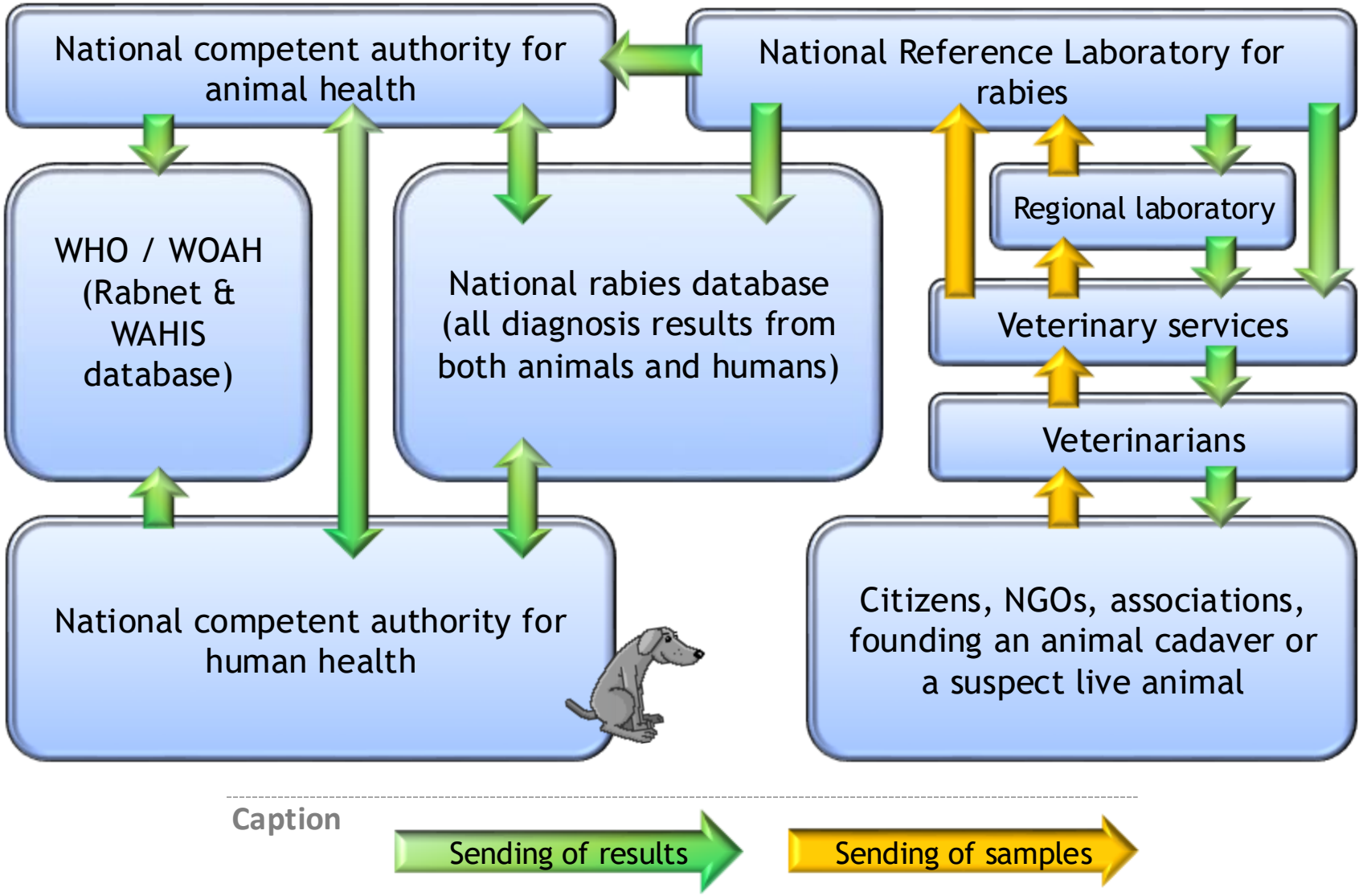
- Microchip (traceability of pets).
- Anti-rabies vaccination.
- Serological test, depending on the country of origin.
- Waiting period before animal movement, depending on the country of origin.
- Border checks.

To limit illegal movements of pets to EU (introduction of exotic pathogens to EU via pets)

Source *: Regulation (EU) No 576/2013 of the European parliament and of the council of 12 June 2013; Commission Implementing Regulation (EU) No 577/2013 of 28 June 2013*

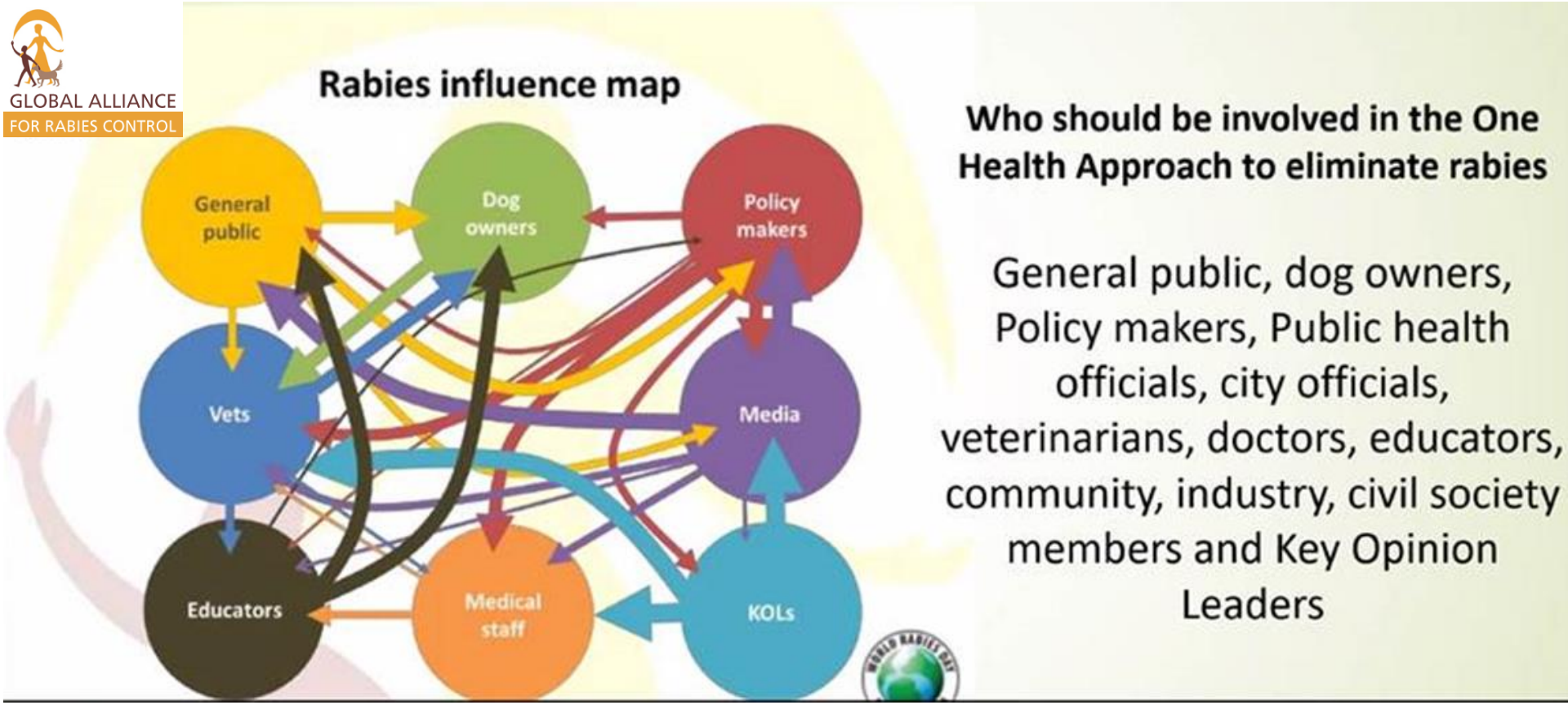
EXAMPLE OF ONE HEALTH RABIES SURVEILLANCE NETWORK

Such network should have a legal basis (legislation article)



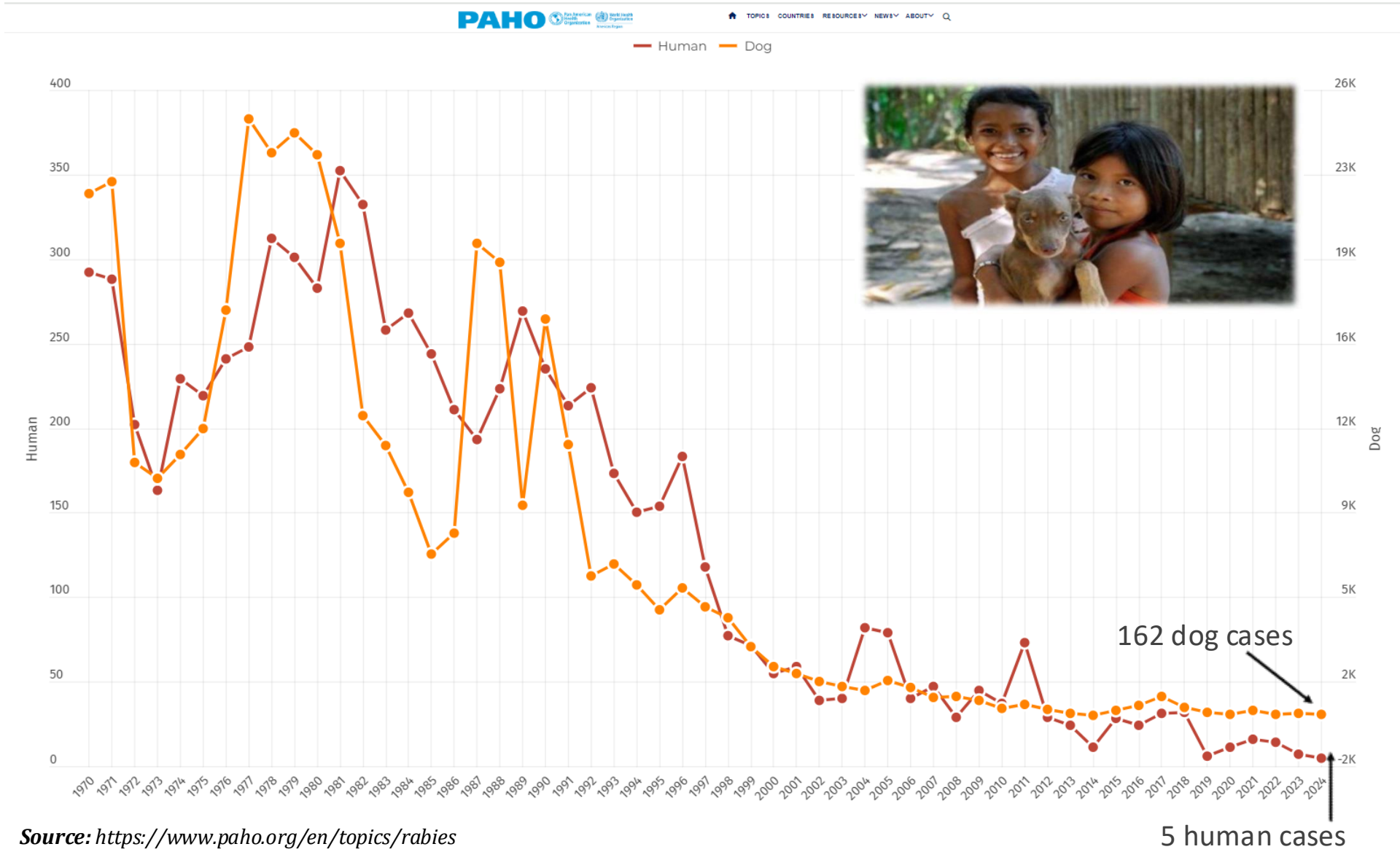
ONE HEALTH AND CANINE RABIES CONTROL AND PREVENTION IN THE FIELD

GLOBAL ALLIANCE FOR RABIES CONTROL



Source *: Tidman, United Against Rabies Stakeholder Meeting, 23-25 September 2024*

EPIDEMIOLOGICAL SITUATION OF RABIES IN LATIN AMERICAN AND CARIBBEAN COUNTRIES, 1970 – AUG. 2024



Source: *https://www.paho.org/en/topics/rabies*

RABIES IN LATIN AMERICAN AND CARIBBEAN COUNTRIES

How we got here? By prioritising rabies

	Endemic	First	Second	Third	Total
1	Rabies	22	2	6	30
2	Leptospirosis		11	10	25
3	Brucellosis				19
4	Tuberculosis				
5	*Salmonella*				
6	Hydatidosis				
7	*Campylobacteria*				
8	*Escherichia coli*				
9	Influenza				

PLOS ONE

RESEARCH ARTICLE

Building the road to a regional zoonoses strategy: A survey of zoonoses programmes in the Americas

Melody J. Maxwell[1]*, Mary H. Freire de Carvalho[1], Armando E. Hoet[2], Marco A. N. Vigilato[1], Julio C. Pompei[1], Ottorino Cosivi[1], Victor J. del Rio Vilas[1,3]*

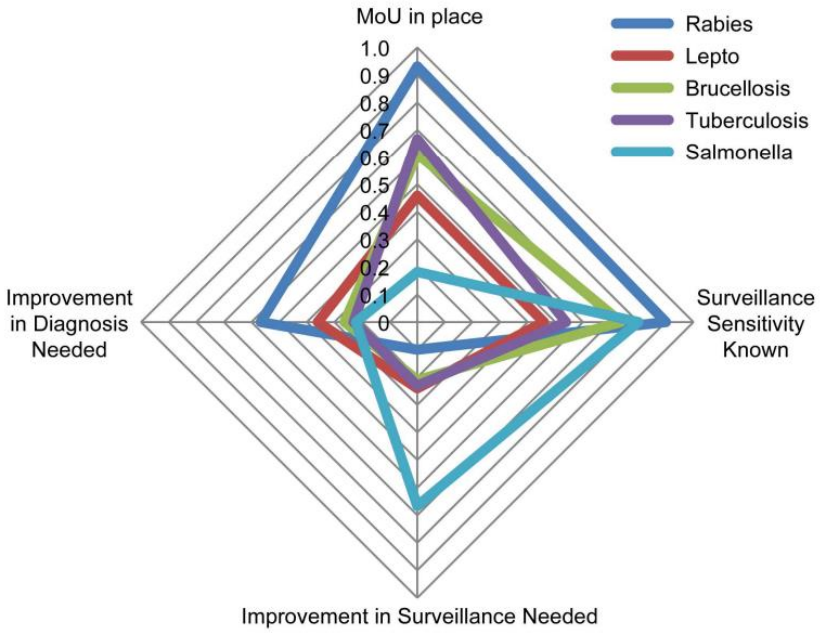


Fig 5. Comparison of the top five priority endemic zoonoses for Latin American and Caribbean countries.

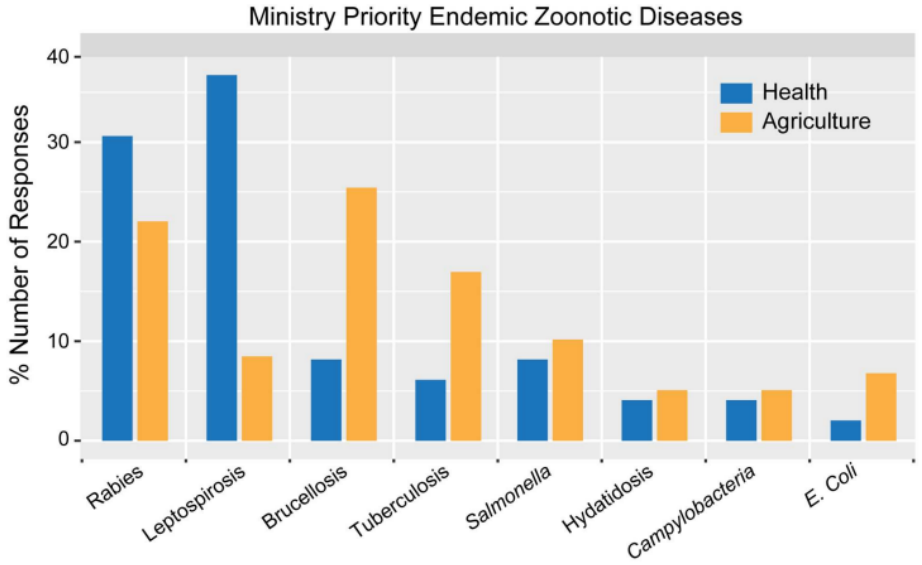


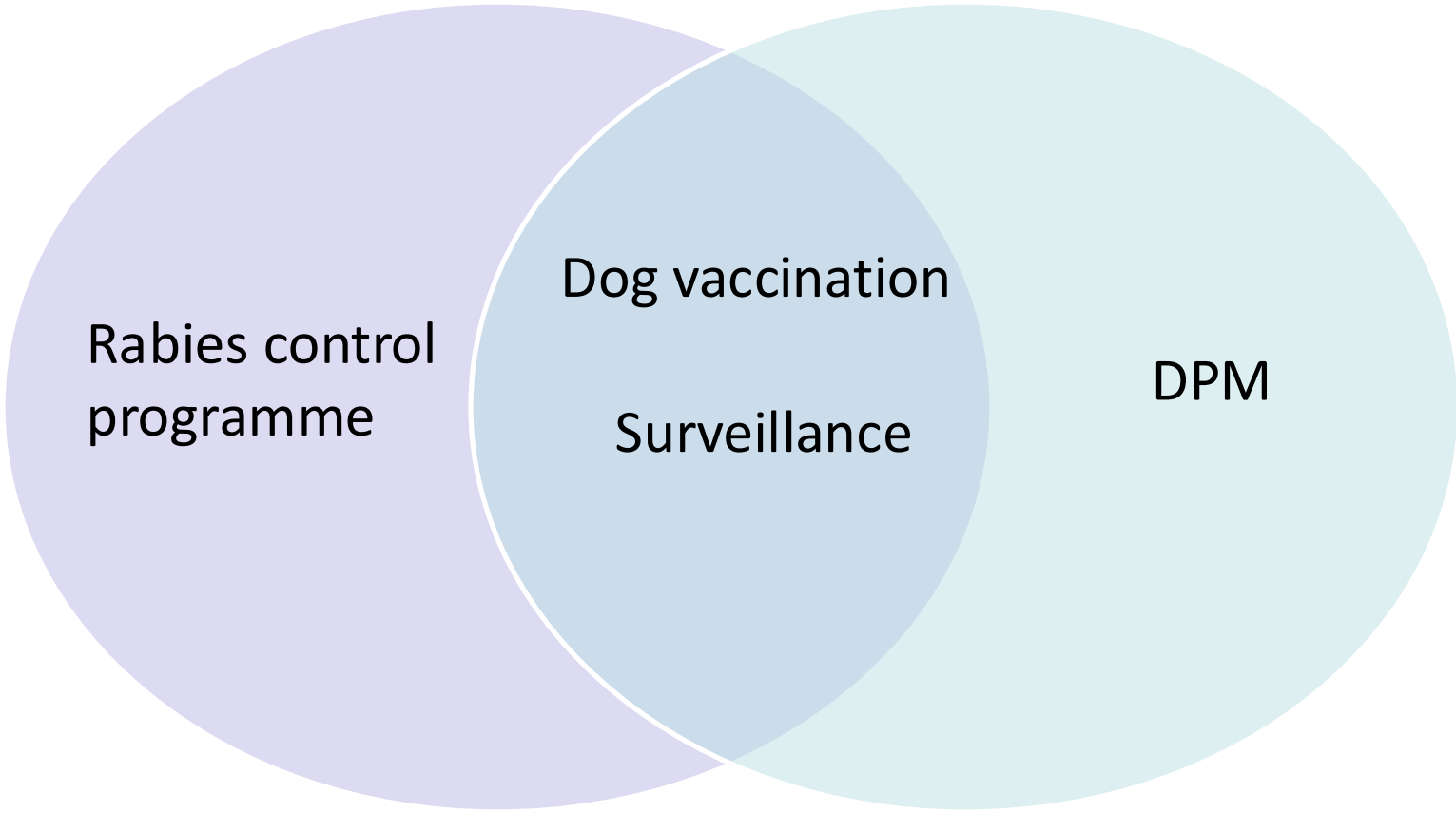
Fig 1. Comparison between the Ministries regarding their top endemic zoonotic disease priorities.

KEY COMPONENTS

- Political decision
- Community desire, perception of risk and strong support/participation
- Intersectoral participation/collaboration, including private sector, if feasible
- Control/elimination plan, at national, state or provincial and local levels
- Clear definition of the responsibility of each government level (ex: the quality of rabies vaccines either for dog or human should be controlled by the national level)
- Technical capacity development – staff trained and permanently updated
- Results based follow-up

Source: *Courtesy of Dr Marco Vigilato, PANAFTOSA/VPH-PAHO/WHO, Rabies EURL Workshop, Bucarest, June 2019; https://www.who.int/news/item/21-12-2019-mexico-is-free-from-human-rabies-transmitted-by-dogs*

INTERSECTION BETWEEN DPM AND RABIES CONTROL

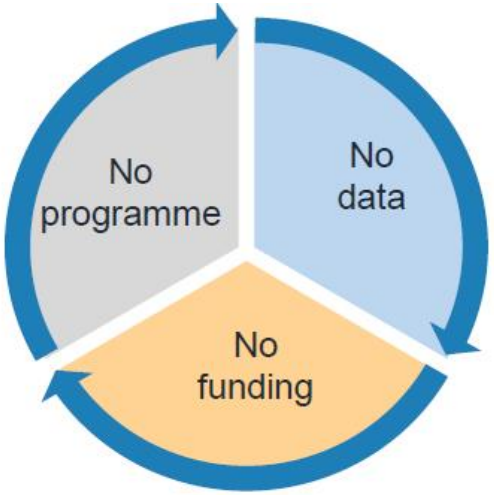


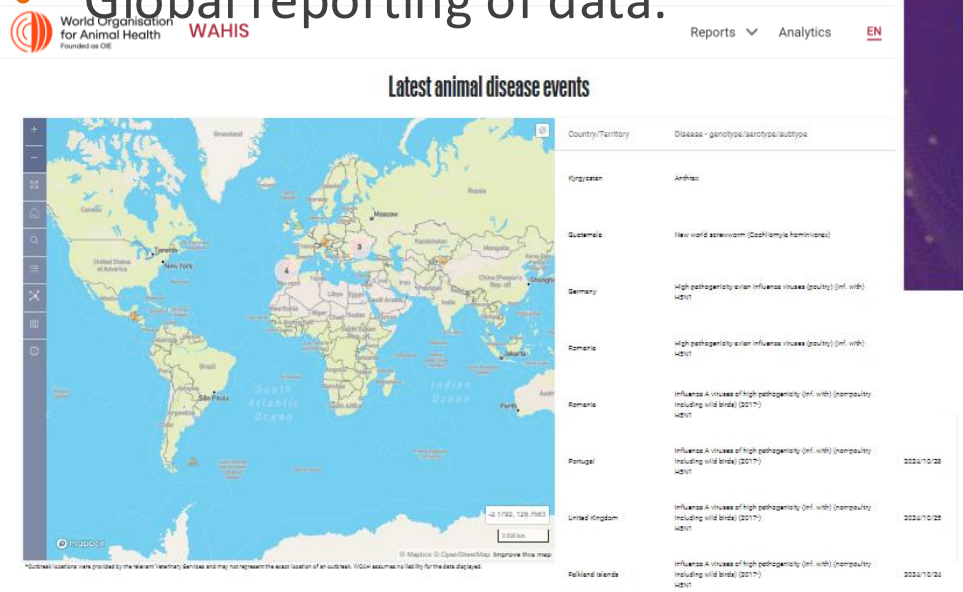
« Humane DPM is effective for minimizing the risk of rabies outbreak and reducing dog population turnover and creating a healthy, sustainable population, allowing to maintain vaccination coverage and effective surveillance. Dog culling does not stop rabies ».

***Sources**: Hiby et al, 2023; WHO Expert Consultation on Rabies, Third report, 2018*

REINFORCING SURVEILLANCE SYSTEMS

- Animal and health systems strengthening, through governance, advocacy for continued political and financial support, agile chains of command.
- Disease indicators (surveillance data) collection.
- Data analysis (epidemiology, mapping, risk analysis).
- Global reporting of data.





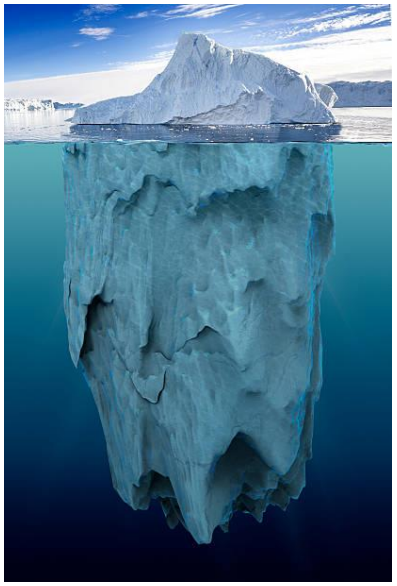
World Health Organization

ADEQUATE PASSIVE SURVEILLANCE ?

Surveillance indicators:

- Do we have sufficient surveillance data to assess the real situation?
- Are data on negative cases sufficient?
- Is surveillance pressure enough regarding the size of the reservoir population?
- Are awareness campaigns enough?

Achieving a sufficient level of surveillance to assess the *true* disease situation is the priority : is the disease still in the country, even in small areas, or is it eliminated?



Source *: Lojkic et al, 2021*

CHALLENGES - CONCLUSIONS

In a context of globalization, increase in international traveling, political instability, increase in dog populations (owned and stray dogs)

- Political prioritization: Identifying diseases for which dogs are reservoir of human infection (e.g. rabies, leishmaniosis, etc) and establishing public health strategies that effectively prevent and control the diseases in reservoirs.
- Improving and facilitating inter-sectoral collaborations.
- Promoting awareness to recognize these diseases by the public and by the human and veterinary sectors.
- Developing surveillance networks for mapping these infectious agents and their vectors.
- Using WOAH recommended methods (or developing robust ones) in National Reference Laboratories well trained and equipped.
- Possibly investigating the contacts between dogs and wildlife species and developing strategies to minimize these contacts.
- Importance of research.

***Sources**: Day, 2011*

RAPID COMMUNICATION

Death in the EU/EEA from autochthonous human rabies, Romania, July 2025: a call for action

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We report a confirmed autochthonous human case of classical rabies in Romania involving an individual in their mid-40s from Iași county, who was bitten by a free-roaming dog in February 2025. The case did not receive post-exposure prophylaxis (PEP) and died from rabies in July 2025. This event highlights critical gaps in rabies prevention, the importance of timely PEP, and the need for continued vigilance in rabies surveillance and public health communication.

Rabies is a zoonotic viral disease with 100% case fatality once clinical symptoms appear [1]. Globally, terrestrial rabies caused by rabies virus (RABV) has been mostly eliminated in domestic dog populations of high-income countries, but sporadic cases still occur due to insufficient prophylaxis following exposure from wildlife reservoirs or spillover hosts [1]. Here we describe a confirmed autochthonous human rabies case in Romania in 2025, which acquired RABV through an infected dog.

Case presentation

a cerebrospinal fluid cell count of 19 cells/mm³ (normal range: 0–5 cells/mm³). Encephalitis was suspected, and the patient was transferred to the intensive care unit (ICU) of the Hospital of Infectious Diseases in Iași. After further clinical evaluation, rabies was only suspected when the family reported the prior dog bite. The patient remained in the ICU of the infectious disease clinic until succumbing to the infection 34 days post symptom onset after more than 3 weeks of intensive

At the Institute for Diagnosis and Animal Health Bucharest, the clinical diagnosis, which was consistent with classical rabies encephalitis, was confirmed by intra-vitam laboratory tests, i.e. reverse-transcription (RT)-PCR of cerebrospinal fluid (CFS) and saliva samples.

In February 2025, a free-roaming dog entered the property of a resident in their mid-40s of Iași county, Romania, and bit this individual on the hand. The bite was managed with local wound care and a short course of antibiotics. Rabies post-exposure prophylaxis (PEP) was suggested by the local physician but declined by the patient

miological context

pe, dog-mediated rabies was eliminated during
-20th century and in most European Union (EU)
es fox-mediated rabies has been successfully
led through extensive oral rabies vaccination
campaigns [2,3]. Between 1977 and 2025, 285
rabies cases were reported in Europe, primarily
e Russian Federation (n = 189), Ukraine (n = 13),
orgia (n = 12). In the last decade (2014–2025),
of 15 human cases were detected in the EU/
an Economic Area (EEA). Of these, 13 were travel
ated, and one was caused by a bat lyssavirus

THANK YOU FOR YOUR ATTENTION!