The Importance of the One Health Approach in Tackling Emerging and Re-emerging Zoonotic Epidemics and Pandemics

The animal health perspective

Executive Summary

Emerging and re-emerging zoonotic diseases are infections caused by pathogens that can be transmitted between animals and humans and whose occurrence or distribution has increased in a population or that have reappeared after a decline. It is estimated that over 75% of emerging infectious human diseases are zoonotic, giving animals a major role as reservoirs in the dynamics of these diseases [1]. Wildlife represents the most significant reservoir of emerging zoonotic diseases (e.g. yellow fever and severe acute respiratory syndrome [SARS]). Livestock can also transmit emerging zoonotic diseases (e.g. bovine spongiform encephalopathy and avian influenza) and act as amplifiers for pathogen spillover from wildlife [2].

The appearance of emerging and re-emerging zoonotic diseases is associated with multiple drivers, some of which can be related to anthropogenic activities such as land use change and climate change [3]. Understanding drivers and processes associated with emerging and re-emerging zoonotic diseases is essential to prevent future disease outbreaks and anticipate related risks.

Given the multitude of variables involved in the dynamics of emerging zoonotic diseases, the One Health approach is essential for managing and preventing disease outbreaks. The World Organisation for Animal Health (WOAH) advocates for the implementation of One Health policies and strategies in the animal health sector, increased investments in Veterinary Services and multisectoral partnerships to prevent and control emerging and re-emerging zoonotic diseases.

The Quadripartite consisting of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO) and WOAH developed the One Health Joint Plan of Action (2022–2026) (OH JPA) to better tackle health threats collectively, with Action Track 2 focusing on reducing risks from emerging and re-emerging zoonotic epidemics and pandemics. WOAH advocates for policy alignment of Action Track 2 of the OH JPA in the animal health sector.

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Insights from Scientific Evidence

Zoonotic diseases are estimated to be responsible for **2.5 billion** cases of human illness globally per year [4].

Over **60%** of existing and **75%** of emerging and re-emerging human diseases are zoonotic [1,5].

The majority of animals involved in zoonotic disease events are domestic animals, while wild animals represent the predominant reservoirs of emerging infectious diseases [1,2].

Over **36%** of emerging and re-emerging zoonotic diseases are associated with food-producing animals [6].

About **US$ 22–31 billion** yearly would be needed globally for prevention measures that reduce the risks of zoonosis spillover [7].

Vaccination of animals and humans is a key tool in combating infectious diseases. In humans, vaccines prevent about **2.5 million** deaths each year [8].

Definition of Concepts

Emerging disease
New occurrence of a disease, infection or infestation causing a significant impact on animal or public health (e.g. SARS, avian influenza) [9].

Re-emerging disease
Disease that was once a major health problem, then declined but has recently reoccurred, leading to major health complications (e.g. plague, yellow fever) [10].

Zoonotic disease
Infectious disease that spreads between animals and humans. The diseases can be foodborne, waterborne, vector-borne, transmitted through direct contact or indirectly by environmental contamination [11].

Epidemic
A disease outbreak that spreads quickly and affects one or more populations at the same time in a small geographical area [12].

Pandemic
A disease outbreak that occurs over a wide geographical area (such as multiple countries or continents) and typically affects a significant proportion of the population [12].

Drivers
The causes or risks associated with the presence of emerging and re-emerging diseases, such as anthropogenic, environmental, behavioural, demographic and biological factors [3].

One Health surveillance
Integrated surveillance for pathogens and traditional disease-based surveillance, including surveillance of drivers of disease emergence, to improve prevention and mitigation of spillover events [13].

Prevention of zoonotic spillover to humans
Proactive (primary) prevention can be achieved by addressing drivers of disease emergence and activities that increase spillover risk, in order to reduce the risk of human infection [14].

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The Importance of Reducing Risks associated with Emerging and Re-emerging Zoonotic Diseases

Emerging and re-emerging zoonotic diseases in humans can occur owing to drivers that increase the contact between humans and wildlife (see Figure 1 for examples). Pathogens can spill over from domestic and wild animals to humans or through vectors such as mosquitoes or ticks. Human-to-animal spillback events are also a concern, for instance humans infecting companion and zoo animals with COVID-19 [15].

Spillover and spillback events can cause and fuel disease outbreaks and have devastating societal and economic consequences for humans and their livelihoods, disproportionately affecting the most vulnerable. This includes effects on mental health; for example, livestock culling has been associated with depression in farmers [8]. Antimicrobial resistance is also a source of emerging zoonotic diseases and highlights the importance of One Health surveillance [1].
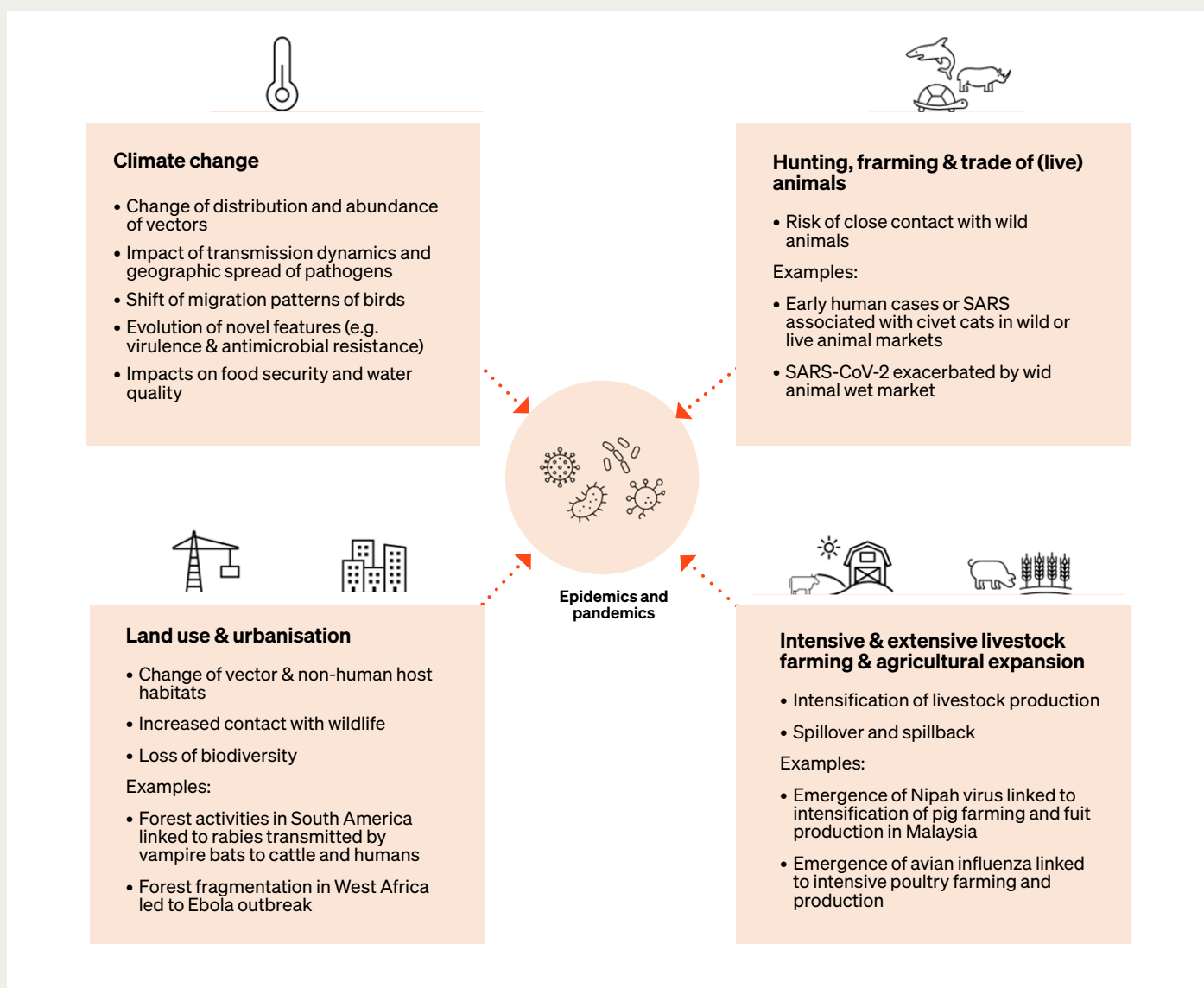

Climate change

- Change of distribution and abundance of vectors
- Impact of transmission dynamics and geographic spread of pathogens
- Shift of migration patterns of birds
- Evolution of novel features (e.g. virulence & antimicrobial resistance)
- Impacts on food security and water quality

Hunting, frarming & trade of (live) animals

- Risk of close contact with wild animals

Examples:

- Early human cases or SARS associated with civet cats in wild or live animal markets
- SARS-CoV-2 exacerbated by wid animal wet market

Land use & urbanisation

- Change of vector & non-human host habitats
- Increased contact with wildlife
- Loss of biodiversity

Examples:

- Forest activities in South America linked to rabies transmitted by vampire bats to cattle and humans
- Forest fragmentation in West Africa led to Ebola outbreak

Intensive & extensive livestock farming & agricultural expansion

- Intensification of livestock production
- Spillover and spillback

Examples:

- Emergence of Nipah virus linked to intensification of pig farming and fuit production in Malaysia
- Emergence of avian influenza linked to intensive poultry farming and production

Epidemics and pandemics

Figure 1: Some of the key drivers of emerging and re-emerging zoonotic diseases, adapted from Tazerji *et al.* (2022) [3].

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Preventing epidemics and pandemics requires a One Health risk reduction approach, the understanding of characteristics and behaviour of wildlife, domestic animals, pathogens and disease drivers, and One Health surveillance and control measures. Secondary prevention includes measures such as early detection, the development and administration of vaccines, and the development of laboratory diagnostics (see Figure 2) [14]. For example, animal diseases can provide an early warning of a potential outbreak, as shown by non-human primates who are highly susceptible to the yellow fever virus. As sickness in animals often precedes human cases, the detection of infected non-human primates represents an early warning that should be used by public health authorities to initiate prevention and control activities, including vaccination campaigns [16]. Timely diagnosis of zoonotic diseases in humans and animals decreases antimicrobial use and the risk of secondary infections and epidemics.
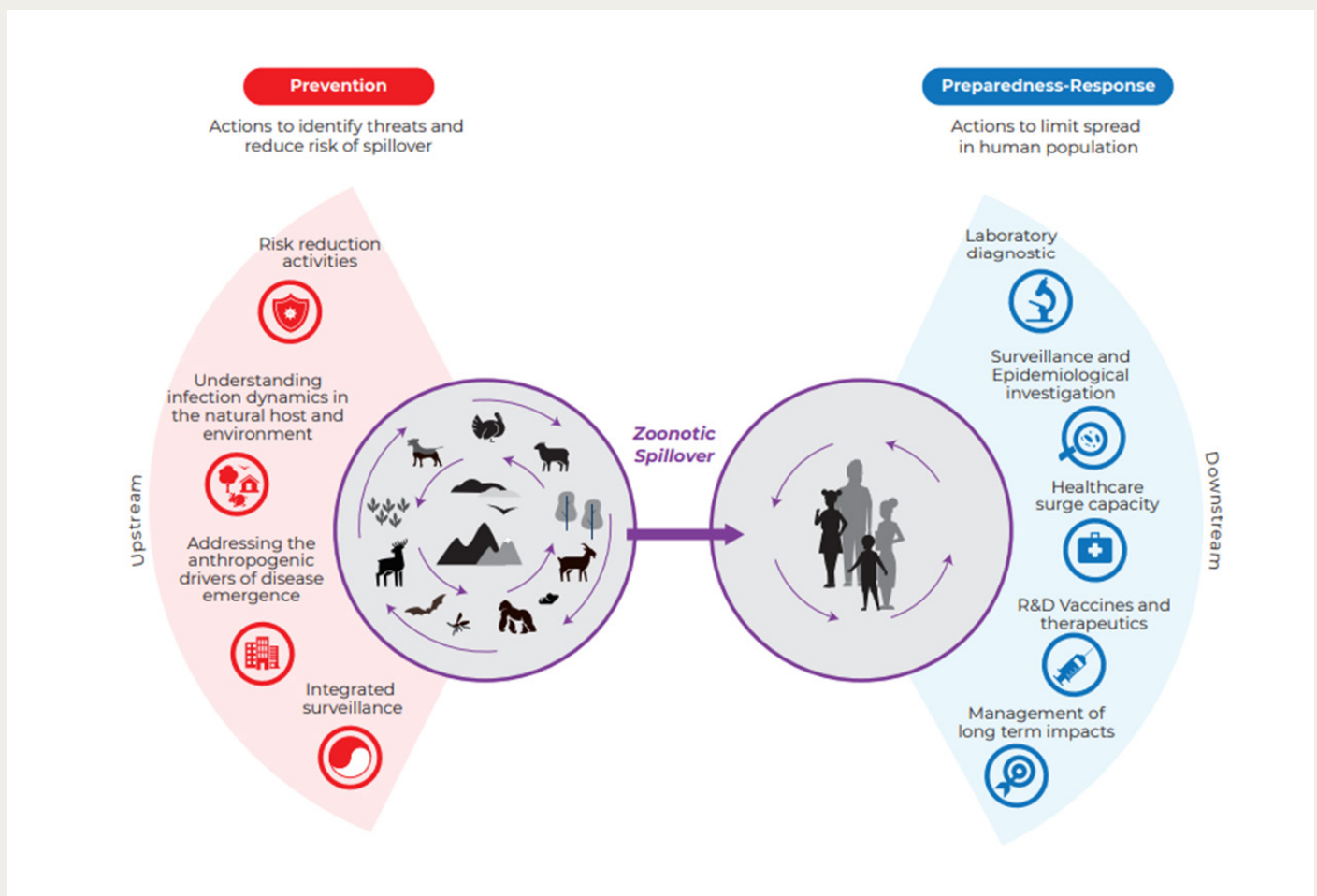

Figure 2: Importance of prevention measures in identifying threats and reducing risks of zoonotic spillover [14].

Emerging and re-emerging zoonotic diseases can have devastating economic consequences, threaten global health security and contribute to food insecurity. It is estimated that about US$ 22–31 billion per year are needed globally for prevention measures. The COVID-19 pandemic highlights the socio-economic burden, as it is estimated that the outbreak will cause about US$ 14 trillion in economic losses until 2024 [14].

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Importantly, costs associated with preventing disease outbreaks are much lower than those associated with controlling them. Benefits of disease prevention include reduced morbidity and mortality of animals and humans, reduced likelihood of a pandemic, and other economic and social co-benefits [17]. For instance, lowering greenhouse gas emissions through scaling down deforestation (a disease driver) is likely to result in US$ 4 billion in social benefits annually [14].

The Contribution of WOAH to Reducing Risks of Emerging and Re-emerging Zoonotic Diseases using the One Health Approach

Facilitating One Health governance

WOAH works with Members to ensure participation in global, regional and national One Health meetings, and advocates for equal representation of the animal health sector in One Health governance. With the development of **standards, guidelines and recommendations** for animal health, WOAH contributes to minimising risks associated with emerging and re-emerging zoonotic diseases [9]. The **Working Group on Wildlife** reviews developments relating to wildlife health, emerging zoonotic diseases and biodiversity [18]. Further, WOAH has a global network of **Reference Centres** consisting of Reference Laboratories and Collaborating Centres, which promote international collaboration and develop diagnostics to prevent and respond to animal disease outbreaks [19].

The Quadripartite addresses emerging and re-emerging zoonotic diseases of zoonotic origin in the **One Health Joint Plan of Action** (2022–2026) (OH JPA) via Action Track 2 that focuses on reducing the risks from emerging and re-emerging zoonotic epidemics and pandemics. Also important for addressing emerging and re-emerging zoonotic epidemics and pandemics are Action Tracks 1 and 6 (see Figure 3) [12].
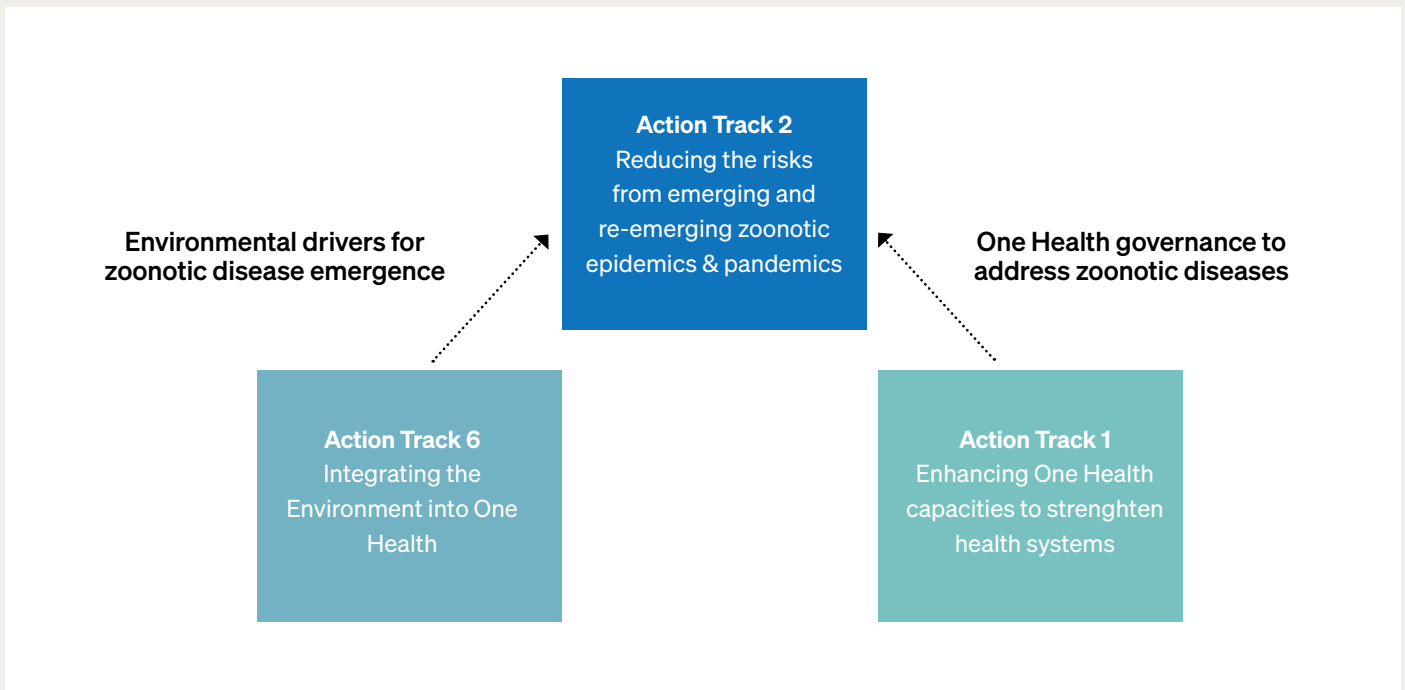

Figure 3: Interrelation of Action Track 2 with Action Tracks 1 and 6 of the OH JPA.

Surveillance measures

Data, knowledge creation and sharing are essential for effective disease prevention and control. One Health surveillance facilitates joint coordination, as was highlighted during the COVID-19 pandemic when Veterinary Services provided expertise, support and laboratory capacity to test human samples for public health authorities [20]. Reporting animal health and wildlife data enables competent authorities to assess emerging threats and take appropriate actions [21].

Examples of WOAH's work in this area include:

- **World Animal Health Information System (WAHIS) and WAHIS-Wild:** Early warning and monitoring systems where Members can report data on animal disease outbreaks, including zoonotic diseases.
- **PROVNA project:** Enhances risk-based surveillance for vector-borne diseases and planning for appropriate allocation of resources in the case of an outbreak event in North Africa.
- **EBO-SURSY project:** Improves local, national and international early detection systems for zoonotic diseases in ten West and Central African countries, with plans to expand to other countries.

- **Wildlife Health Framework:** Facilitates the implementation of regional, national and local surveillance for the early detection of diseases in wildlife.
- **Ad hoc group Wildlife:** Next generation wildlife health information system which enhances wildlife disease reporting.
- **ANIMUSE database:** Allows users to report, access, analyse and communicate data on antimicrobial use in animals.
- **Global Burden of Animal Diseases (GBADs):** WOAH contributes to GBADs, a programme that gathers and uses existing data to provide knowledge and improve animal health at local, national and global levels.
- **Global Early Warning System (GLEWS+):** WOAH, FAO and WHO inform prevention and control measures for health threats at the human–animal–ecosystems interface.
- **Epidemic Intelligence from Open Sources (EIOS):** WOAH is involved in governing EIOS, which uses a One Health approach for early detection, assessment and communication of public health threats.

Capacity building and guidance

The **Performance of Veterinary Services (PVS) Pathway** for the improvement of Veterinary Services and the Training Platform for Veterinary Services are the WOAH flagship capacity building programmes. PVS identifies strengths and weaknesses and recommends solutions for improvement and investment. The Training Platform is a tool to strengthen Veterinary Service capacities, reflecting WOAH standards. The **PVS Information System** is a new tool enabling an understanding of Veterinary Service strengths and weaknesses related to One Health competencies and providing recommendations to improve capacities.

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The *ad hoc* group on Emerging Diseases and Drivers of Disease Emergence in Animals supports the response to major emerging disease events as part of WOAH's Incident Management System.

The Tripartite (WOAH, FAO, WHO) developed **A Tripartite Guide to Addressing Zoonotic Diseases** in Countries. The tool allows countries to improve their zoonotic disease frameworks, strategies and policies. The guide is accompanied by operational tools: The **Multisectoral Coordination Mechanism Operational Tool**, the **Operational Tool on Joint Risk Assessment**, and the **Operational Tool on Surveillance and Information Sharing** [22]. More operational tools such as the **Workforce Development Operational Tool** are under development. WOAH and FAO jointly created the **Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs)**, offering capacity training and helping to establish regional partnerships for transboundary animal disease management. Additionally, the Tripartite **Framework for Competencies for One Health Field Epidemiology** provides training for epidemiologists using the One Health approach. The Tripartite, in collaboration with the Centers for Disease Prevention and Control, the European Centre for Disease Prevention and Control, and the Association of Public Health Laboratories, created the **Laboratory Leadership Competency Framework**, outlining competencies needed by laboratory leaders to build and direct sustainable national laboratory systems [23]. The Quadripartite developed the **One Health Competency Framework** to build capacity for the One Health approach among the veterinary, public health and environment workforce.

Policy Recommendations

WOAH recommends the following policy-based solutions to strengthen the prevention of emerging and re-emerging zoonotic diseases under the One Health approach:

At policy and institutional level:

- Develop or align national One Health action plans and policies with the OH JPA, adopting a multisectoral and whole-of-society approach, including public–private partnerships and ensuring gender equity.
- Enhance global governance of emerging and re-emerging zoonotic diseases with a focus on prevention and addressing drivers, including strengthening legal frameworks and legislation with adequate human and financial resources.
- Develop or strengthen community engagement policy and strategy and joint risk communication on zoonotic diseases.
- Strengthen One Health surveillance at national level to prevent and control the spillover of pathogens at the human–livestock–wildlife interface. Increase investments to strengthen veterinary laboratory capacity to achieve timely and effective detection of emerging and re-emerging zoonotic diseases.
- Promote monitoring and mitigation of drivers of zoonotic disease emergence, spillover and spread, such as land use change due to unsustainable livestock intensification and deforestation.

At programmatic level:

- Establish or strengthen a technical working group on emerging zoonotic diseases under the national One Health Multisectoral Coordination Mechanism to facilitate the implementation of the OH JPA.
- Develop standard operating procedures for joint outbreak investigations and conduct regular joint risk assessments of possible emerging zoonotic diseases at national level.

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- Share data on drivers associated with zoonotic spillovers between sectors and countries to strengthen prevention, surveillance and control of emerging and re-emerging zoonotic diseases.
- Develop and update guidelines for responsible and prudent use of antimicrobials at national and sub-regional levels, aligned with WOAH international standards.
- Advance the creation of reliable and easily accessible vaccination protocols for domestic animals to achieve high coverage and herd immunity, reduce the risk of mutations and limit the need for antimicrobials.
- Promote biosecurity measures along the food chain, aligned with WOAH international standards.
- Share guidelines and best practices to reduce interaction between wild and domestic animals to prevent the spread of diseases and protect animal health.

At technical level:
- Promote and establish One Health joint training for the veterinary workforce, building joint risk assessment and risk communication capacities to prevent, detect and control the emergence and re-emergence of zoonotic diseases.
- Involve sub-national technical staff, local authorities, Indigenous Peoples and local communities in the decision-making process to adapt prevention, surveillance and control activities to the local context.
- Promote research of the characteristics of pathogens, spillovers, drivers and the global burden of animal diseases associated with emerging and re-emerging zoonotic diseases, to develop targeted prevention and control measures.

Recommended WOAH sources for further information

International Standards
WAHIS and WAHIS Wild
PVS Pathway
Veterinary and veterinary paraprofessional education
Training Portal
Working Group on Wildlife
Reference Centres
Wildlife Health Framework
PROVNA project
EBO-SURSY Project
Quadripartite One Health Joint Plan of Action (2022–2026)
Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs)
Global Burden of Animal Diseases (GBADs)
A Tripartite Guide to Addressing Zoonotic Diseases in Countries
GLEWS+
Tripartite Operational Tools
Laboratory Leadership Competency Framework

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