

**Forum:** World Health Organization (WHO)

**Issue:** Strengthening Global Cooperation to Prevent Zoonotic Disease Transmission



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**Position:** Deputy President

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## Personal Introduction

Dear delegates,

My name is Alexandra Theodora Santaintidi and I am an 11th grader at Leonteios School of Athens. This year I have the utmost honor of serving as the Deputy President of the World Health Organization at the 9<sup>th</sup> ACGMUN conference. By participating in numerous conferences, I have come to appreciate the importance of diplomacy in today's world. MUN not only helps people improve themselves but also allows us to educate ourselves in topics that determine our future lives. For this reason, I believe that it is very important for the youth to participate in such conferences.

As the Deputy President of this committee, my goal is to ensure that every single one of you has a meaningful and enjoyable experience during the conference. I hope that this conference not only makes you familiar with some of the health issues that our world is currently facing but also helps you grow into confident speakers. I will do my best to create a respectful environment where everyone feels like they can contribute. I am going to support you throughout this journey, whether this is your first conference or one of many.

This study guide will provide you with information on the topic of Strengthening Global Cooperation to Prevent Zoonotic Disease Transmission. However, I encourage you to do your own research on the topic as well.

For any further questions, don't hesitate to contact me at [alexkoralia@gmail.com](mailto:alexkoralia@gmail.com) since I am here to help you through any challenge you may face during your research on the topic or during the debate. I can't wait to meet and work with all of you.

Best wishes,

Alexandra

## Topic Introduction

Zoonotic diseases are diseases like COVID 19, which is believed to have originated from animals and rabies which is spread to humans through bites<sup>1</sup>. These diseases occur when pathogens that normally live in animals find ways to infect humans, leading sometimes to serious public health crises. This demonstrates how closely linked human health, animal health, and the environment really are. Scientists believe that around 60% of infectious diseases in humans originally came from animals, and about 75% of infectious diseases have been transmitted from animals to people<sup>2</sup>. This fact is proof that diseases that transfer between different species are very common and play a central role in current global health risks<sup>3</sup>. This also highlights how vulnerable modern societies have become from direct interaction and contact with animals that pose the risk of transmission of infections known as zoonoses.

Human activities such as wildlife trading, deforestation, urban expansion and intensive farming have all played a role in the increased frequency and intensity of contact between humans, livestock and wildlife. This contact has been creating ecological and socioeconomic conditions that facilitate the easier spread of zoonotic diseases<sup>4</sup>. Moreover, habitat loss from deforestation, fire outbreaks or floods forces animals to move closer to urban areas and agricultural lands<sup>5</sup>. In addition, illegal and legal wildlife global trade also exposes humans to an increased number of different pathogens<sup>6</sup>. At the same time, many countries, especially underdeveloped and developing countries with limited surveillance systems, weak veterinary infrastructure and underfunded public healthcare, struggle to detect outbreaks early. This fact often leads to delayed responses and thus greater problems for people and health systems. Weaknesses in the healthcare systems in one region can rapidly turn into a global threat. This is due

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<sup>1</sup> World Health Organization. (2020). Zoonoses, <https://www.who.int/news-room/fact-sheets/detail/zoonoses>

<sup>2</sup> Cui M, Shen B, Fu ZF, Chen H. Animal diseases and human future - animal diseases. Springer Link 2022. <https://link.springer.com/article/10.1186/s44149-022-00041-z>

<sup>3</sup> Shaheen, Mohamed N F. "The concept of one health applied to the problem of zoonotic diseases." *Reviews in medical virology* vol. 32,4 (2022): e2326. doi:10.1002/rmv.2326

<sup>4</sup> Ortiz-Millán, Gustavo. "One Health in a globalized world: challenges and responses to zoonotic threats." *Global bioethics = Problemi di bioetica* vol. 36,1 2550805. 2 Sep. 2025, doi:10.1080/11287462.2025.2550805

<sup>5</sup> "Disease and Deforestation." *World Wildlife Fund*, 2016, [www.worldwildlife.org/our-work/forests/disease-and-deforestation/](http://www.worldwildlife.org/our-work/forests/disease-and-deforestation/).

<sup>6</sup> "Preventing Zoonotic Disease Transmission." *World Wildlife Fund*, 2020, [www.worldwildlife.org/our-work/wildlife/reducing-zoonotic-disease-risk-from-wildlife-trade/](http://www.worldwildlife.org/our-work/wildlife/reducing-zoonotic-disease-risk-from-wildlife-trade/)

to global travel, trade and migration, which compromise global health security and economy as recently seen with the COVID 19 pandemic<sup>7</sup>.

These interconnected biological, environmental and socioeconomic factors demonstrate that zoonotic diseases cannot be effectively addressed through isolated national policies alone. Because these diseases cross borders and travel worldwide, integrated and preventive strategies that operate across countries and sectors are strongly needed. This clearly highlights the need for a “One Health” Approach, a collaborative framework that brings together human, animal and environmental health perspectives to prevent and respond to shared threats, especially zoonotic diseases<sup>8</sup>. Therefore, studying and preventing zoonotic diseases is essential not only for controlling current outbreaks but also for protecting future generations. This can be achieved by addressing the underlying conditions that shape tomorrow’s global health risks and by ensuring a more resilient and sustainable global health system.

## Definition of Key Terms

### Disease

Any harmful deviation from the healthy structural or functional state of an organism, generally associated with certain signs and symptoms and differing in nature from physical injury. A diseased organism commonly exhibits signs or symptoms indicative of its state of health.<sup>9</sup>

### Pathogen

A pathogen is a microorganism that can cause disease in a host, with common examples including viruses, bacteria, fungi, and parasites. These disease-causing agents, often called "germs," can spread through various means such as coughing, sneezing, contaminated food, or direct contact.<sup>10</sup>

### Zoonotic Disease/ Zoonosis

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<sup>7</sup> Worsley-Tonks, Katherine E L, et al. “Strengthening Global Health Security by Improving Disease Surveillance in Remote Rural Areas of Low-Income and Middle-Income Countries.” *The Lancet Global Health*, vol. 10, no. 4, Apr. 2022, pp. e579–e584, [https://doi.org/10.1016/s2214-109x\(22\)00031-6](https://doi.org/10.1016/s2214-109x(22)00031-6).

<sup>8</sup> World Health Organization, Food and Agriculture Organization of the United Nations, & World Organisation for Animal Health. (2019). Taking a multisectoral, One Health approach: A tripartite guide to addressing zoonotic diseases in countries. World Health Organization. <https://iris.who.int/handle/10665/325620>

<sup>9</sup> Burrows, William, Dante G. Scarpelli. “Disease.” *Encyclopedia Britannica*, 13 Oct. 2024  
[www.britannica.com/science/disease](http://www.britannica.com/science/disease)

<sup>10</sup> “Pathogen: Types, Causes, Effects on Body & Control.” *Cleveland Clinic*, 17 June 2025, <https://my.clevelandclinic.org/health/articles/pathogen>

A zoonosis/zoonotic disease is an infectious disease that has jumped from a non-human animal to humans. Zoonotic pathogens may be bacterial, viral or parasitic, or may involve unconventional agents and can spread to humans through direct contact or through food, water or the environment.<sup>11</sup>

### “One Health” approach

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.<sup>12</sup>

### Post Exposure Prophylaxis (PEP)

Post-exposure prophylaxis, also known as post-exposure prevention (PEP), is any preventive medical treatment started after exposure to a new pathogen in order to prevent the infection from occurring.<sup>13</sup>

## Background Information

### Historical Background

#### Early Recognition of Animal to Human Diseases

Early recognition of diseases that can spread from animals to humans goes back thousands of years, long before modern medicine or microbiology existed. At that time, understanding was based on observation and not on scientific explanation. Ancient civilizations in Mesopotamia, Egypt, China, Greece and Rome recorded illnesses that we now recognize as zoonotic, even though the idea of pathogens was unknown<sup>14</sup>. One of the earliest documented examples is rabies. From 2000 BC there are Mesopotamian texts describing animal bites that led to fatal neurological symptoms. Moreover, ancient Greek physicians, such as Hippocrates, linked dog bites to severe illness and death in humans. Similarly, diseases resembling anthrax were observed in livestock, where sudden animal deaths were

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<sup>11</sup> “Zoonoses.” *World Health Organization*, 29 July 2020, [www.who.int/news-room/fact-sheets/detail/zoonoses](http://www.who.int/news-room/fact-sheets/detail/zoonoses)

<sup>12</sup> World Health Organization. “One Health Global.” *World Health Organization*, 2023, [www.who.int/health-topics/one-health#tab=tab\\_1](http://www.who.int/health-topics/one-health#tab=tab_1)

<sup>13</sup> “Post-Exposure Prophylaxis.” *Wikipedia*, 28 July 2022, [en.wikipedia.org/wiki/Post-exposure\\_prophylaxis](https://en.wikipedia.org/wiki/Post-exposure_prophylaxis).

<sup>14</sup> Hubálek, Zdenek, and Ivo Rudolf. “A History of Zoonoses and Saprónoses and Research into Them.” *Microbial Zoonoses and Saprónoses* 9–24, 10 Nov. 2010, doi:10.1007/978-90-481-9657-9\_3, <https://pmc.ncbi.nlm.nih.gov/articles/PMC7120709/>

often followed by infections in humans, such as farmers and butchers who handled the dead animals<sup>15</sup>. Such evidence was also seen in other regions like Africa, demonstrating that zoonotic threats have been recognized across multiple continents<sup>16</sup>

Early agricultural societies also noticed that being close to domesticated animals could increase the risk of illnesses. During the Neolithic period, the rise of farming and animal domestication meant that people were exposed to animals more often. This repeated contact resulted in outbreaks of diseases transmitted through milk, meat and direct contact with animals<sup>17</sup>. Although these societies did not have modern scientific knowledge or tools, they developed practical responses based on observation and intuition. These observations were often encouraged and reinforced by religious and cultural texts. For example, ancient rules about food and handling animals may have served as early forms of public health measures, helping to prevent people from getting sick<sup>18</sup>.

One of the most famous historical examples demonstrating disease spread from animals to humans is the Black Death in 1347 in Europe. Although medieval people did not understand bacteria and vectors, they observed clear patterns linking rats, and fleas with outbreaks in humans<sup>19</sup>. The plague spread quickly along trade routes used for transporting goods and animals. This was later evidence showing that human movement and animal populations played a role in the spread of epidemics. Earlier outbreaks of plague, such as the Plague of Justinian in the 6<sup>th</sup> century Byzantine Empire, had already shown similar patterns of disease. These historical facts point out that observation alone, even without scientific knowledge, highlighted the links between environment, animals, humans and diseases<sup>20</sup>.

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<sup>15</sup> Esposito, Michelle Marie et al. "The Impact of Human Activities on Zoonotic Infection Transmissions." *Animals : an open access journal from MDPI* vol. 13,10 1646. 15 May. 2023, [doi:10.3390/ani13101646](https://doi.org/10.3390/ani13101646)

<sup>16</sup> "Animal Disease Challenges" Fifteen Years Later: The Hypothesis in Light of New Data." *Quaternary International*, vol. 436, Apr. 2017, pp. 283–293, <https://doi.org/10.1016/j.quaint.2015.10.054>

<sup>17</sup> Mori, Masami, and Hans-Joachim Roest. "Farming, Q Fever and Public Health: Agricultural Practices and Beyond." *Archives of Public Health*, vol. 76, 2018, Article 2, <https://doi.org/10.1186/s13690-017-0248-y>

<sup>18</sup> Zeder, Melinda A., and Rebecca Bendrey. "Zoonotic Brucellosis from the Long View: Can the Past Contribute to the Present?" *Infection Control & Hospital Epidemiology*, 2020, <https://doi.org/10.1017/ice.2020.101>

<sup>19</sup> Damen, Mark. "The Black Death." *History and Civilization*, Utah State University, <https://www.usu.edu/markdamen/1320hist%26civ/chapters/06plague.htm>.

<sup>20</sup> Haensch, Stephanie, et al. "Distinct Clones of *Yersinia pestis* Caused the Black Death." *PLoS Pathogens*, vol. 6, no. 10, 2010, e1001134, <https://doi.org/10.1371/journal.ppat.1001134>.

Early recognition of diseases that can be transmitted from animal to humans laid the foundation for later scientific inquiry<sup>21</sup>. Although ancient societies could not identify germs or explain how diseases spread, their careful observations helped establish patterns that link animals, environmental conditions, and human illnesses. By documenting the associations between animals and certain diseases, ancient civilizations contributed to what we now know as the "One Health" perspective.

## Scientific Breakthroughs and the Rise of Germ Theory

The 19<sup>th</sup> century was a turning point in the understanding of disease. For many decades, people believed in the "miasma theory", which was the idea that diseases were caused by "bad air". Many years had to pass in order to scientifically understand microorganisms and that knowledge is based on evidence. Scientists like the French Scientist Louis Pasteur and the German physician Robert Koch challenged the miasma theory by providing evidence-based proof that germs and not air caused illnesses.<sup>22</sup>

Between the 1850s and the 1860s, Louis Pasteur conducted a series of experiments that disproved the idea of spontaneous generation and showed that microorganisms were responsible for fermentation and spoilage<sup>23</sup>. On April 7, 1861, he presented his findings to the public showing that microbes in the environment could cause biological changes. That was a key milestone in the development of germ theory. He later extended these ideas to what caused diseases, arguing that specific microorganisms were responsible for specific illnesses. Pasteur's work also played an important role in understanding diseases that can spread from animals to humans, especially rabies<sup>24</sup>. On July 6, 1885, he successfully administered the first rabies vaccine to a human patient. In that way, he showed that vaccination could prevent this disease that is transmitted from animals to humans. This

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<sup>21</sup> Hubálek, Zdenek, and Ivo Rudolf. "A History of Zoonoses and Sapronoses and Research into Them." *Microbial Zoonoses and Sapronoses*, 10 Nov. 2010, pp. 9–24, [www.ncbi.nlm.nih.gov/pmc/articles/PMC7120709/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC7120709/) , [https://doi.org/10.1007/978-90-481-9657-9\\_3](https://doi.org/10.1007/978-90-481-9657-9_3).

<sup>22</sup> Karamanou, Marianna et al. "From miasmas to germs: a historical approach to theories of infectious disease transmission." *Le infezioni in medicina* vol. 20,1 (2012): 58-62, <https://pubmed.ncbi.nlm.nih.gov/22475662/>.

<sup>23</sup> Jambholkar, Pankaj C, et al. "Louis Pasteur: A Legacy Unmasked." *Cureus*, 29 Aug. 2024, <https://doi.org/10.7759/cureus.68080>.

<sup>24</sup> Corless, Victoria. "Louis Pasteur, Germ Theory and the First Life-Saving Vaccines - Advanced Science News." *Advanced Science News*, 27 Dec. 2022, [www.advancedsciencenews.com/louis-pasteur-germ-theory-and-the-first-life-saving-vaccines](http://www.advancedsciencenews.com/louis-pasteur-germ-theory-and-the-first-life-saving-vaccines).

achievement did not prove that all zoonotic diseases could be prevented but laid the foundation to develop interventions against diseases<sup>25</sup>.

At the same time, Robert Koch made important advances in identifying the microorganisms that could cause diseases. He managed to prove that *Bacillus anthracis* was the cause of anthrax. He proved that by tracing its full life cycle and demonstrating transmission between animals and humans. This was one of the first times a zoonotic pathogen was scientifically isolated and linked to a specific disease. Between 1882 and 1883, Koch identified the bacteria responsible for tuberculosis and cholera. This strengthened the scientific support for germ theory. In 1890, Koch summarized his work into what became known as Koch's Postulates, which were a set of criteria used to establish a causal relationship between a microorganism and a disease. These principles became a cornerstone of infectious disease research, including studies of zoonotic diseases.<sup>26</sup>

The acceptance of the germ theory in the late 19<sup>th</sup> century transformed public health, veterinary medicine and epidemiology. Scientists could now explain that diseases were transmitted between animals and humans through pathogens rather than vague environmental factors like "bad air". This understanding helped in the development of targeted control measures. These measures include vaccination, improved sanitation, quarantine, and better animal health practices.<sup>27</sup>

The concept of zoonosis emerged alongside advances in pathology and microbiology during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Scientists such as Rudolf Virchow highlighted the relationship between human and animal health. He argued that there should be no strict line between human and veterinary medicine. The term "zoonosis" began to appear in scientific literature to describe diseases that could be transmitted between animals and humans<sup>28</sup>. In later years, researchers refined this concept by categorizing different types of zoonotic diseases. This helped clarify their transmission pathways and distinguish them from strictly human or animal diseases. This period marked a shift from

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<sup>25</sup> "A Milestone in Medical History Was Reached 140 Years Ago." *WHO Rabies Bulletin Europe*, <https://www.who-rabies-bulletin.org/news/milestone-medical-history-was-reached-140-years-ago>

<sup>26</sup> Blevins, Steve M, and Michael S Bronze. "Robert Koch and the 'golden age' of bacteriology." *International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases* vol. 14,9 (2010): e744-51. doi:10.1016/j.ijid.2009.12.003, <https://pubmed.ncbi.nlm.nih.gov/20413340/>

<sup>27</sup> Ma, Lie, and Joshua B Sheetz. "Infectious Diseases." *The Yale Journal of Biology and Medicine*, vol. 90, no. 2, 23 June 2017, p. 163, [pmc.ncbi.nlm.nih.gov/articles/PMC5482295](https://pubmed.ncbi.nlm.nih.gov/articles/PMC5482295)

<sup>28</sup> Gwenaël Vourc'h, et al. "DEFINING ZOONOSES." *Nih.gov*, Éditions Quae, Feb. 2022, [www.ncbi.nlm.nih.gov/books/NBK596957](https://pubmed.ncbi.nlm.nih.gov/books/NBK596957).

isolated case observations to systematic classification, forming the foundation for modern epidemiology, veterinary public health, and integrated approaches to disease prevention.<sup>29</sup>

### Modern Era (The One Health Framework)

In the modern era, the One Health framework has become a key approach to addressing zoonotic diseases. This was achieved by recognizing the strong connections between human health, animal health and the environment. The concept dates back in the 80s and 90s, when health experts first highlighted the need for coordinated action across medical, veterinary and environmental fields. Scientists believed that these actions are needed to prevent, detect and respond to health threats before they spread. From the early 2000s governments, international organizations and research institutions began adopting the One Health Approach to improve monitoring of diseases, strengthen early warning systems and enhance communications across all sectors<sup>30</sup><sup>31</sup>. This change reflected the growing understanding that fragmented health systems are not sufficient to handle complex, cross-border zoonotic diseases. Recent health crises, such as pandemics caused by zoonotic pathogens, have strengthened the fact that prevention cannot depend on individual countries or isolated sector responses. In order to manage these diseases ongoing collaboration between public health authorities, veterinary services, environmental agencies and policymakers is needed. Today, One Health framework has become the guide that helps countries work together to prevent, detect, and reduce future zoonotic disease outbreaks.<sup>32</sup>

### Other Key Examples of Zoonotic Diseases

#### Rabies

Rabies is a serious and almost always fatal zoonotic viral disease that affects the central nervous system of mammals, including humans. The rabies virus is usually transmitted through the bite or

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<sup>29</sup>Zinsstag, J., Schelling, E., Waltner-Toews, D., & Tanner, M. "From 'One Medicine' to 'One Health' and Systemic Approaches to Health and Well-Being." *Preventive Veterinary Medicine*, vol. 101, no. 3-4, 2011, pp. 148–156. <https://doi.org/10.1016/j.prevetmed.2010.07.003>

<sup>30</sup> CDC. "One Health History." *One Health*, 24 Apr. 2024, <https://www.cdc.gov/one-health/about/one-health-history.html>.

<sup>32</sup> Destoumieux-Garzón, Delphine et al. "The One Health Concept: 10 Years Old and a Long Road Ahead." *Frontiers in veterinary science* vol. 5 14. 12 Feb. 2018, doi:10.3389/fvets.2018.00014, <https://pubmed.ncbi.nlm.nih.gov/29484301>

scratch of an infected animal or when saliva enters an open wound or mucous membrane. Domestic dogs are the main source of human rabies worldwide, causing 99% of cases<sup>33</sup>, although wild animals such as bats, foxes, raccoons and jackals can also transmit the virus in certain regions. After entering the body, the virus travels along peripheral nerves to the brain, where it causes progressive inflammation leading to symptoms such as fever, agitation, hydrophobia, paralysis and ultimately death. Once clinical symptoms appear, rabies is almost 100 %fatal. This makes it one of the deadliest infectious diseases known<sup>34</sup>.

Despite its severity, rabies is entirely preventable when proper public health measures are applied. Immediate wound washing, followed by timely administration of post exposure prophylaxis (PEP), including rabies vaccines and immunoglobulin, can successfully prevent infection if given before symptoms develop<sup>35</sup>. However, access to these life-saving interventions is not equal worldwide. Globally, rabies causes an estimated 59,000 human deaths every year, with approximately 95% of cases occurring in Asia and Africa, particularly in rural and underserved communities<sup>36</sup>. Children are disproportionately affected due to higher exposure to dog bites. The continued presence of rabies in these regions is closely linked to limited access to vaccines, inadequate dog vaccination programs, weak surveillance systems and insufficient public awareness. While many high income countries have successfully controlled or eliminated rabies through mass vaccination and strict animal control, rabies remains a significant public health and socioeconomic burden in low- and middle-income countries, highlighting the need for sustained international cooperation and One Health based strategies.

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<sup>33</sup> “Rabies.” *World Health Organization*, 5 June 2024, [www.who.int/news-room/fact-sheets/detail/rabies](http://www.who.int/news-room/fact-sheets/detail/rabies).

<sup>34</sup> *ibid*

<sup>35</sup> Hemachudha, Thiravat et al. “Human rabies: a disease of complex neuropathogenetic mechanisms and diagnostic challenges.” *The Lancet. Neurology* vol. 1,2 (2002): 101-9. doi:10.1016/s1474-4422(02)00041-8, <https://pubmed.ncbi.nlm.nih.gov/12849514/>

<sup>36</sup> “PEP Recommendations.” *Who.int*, 2018, [www.who.int/teams/control-of-neglected-tropical-diseases/rabies](http://www.who.int/teams/control-of-neglected-tropical-diseases/rabies)

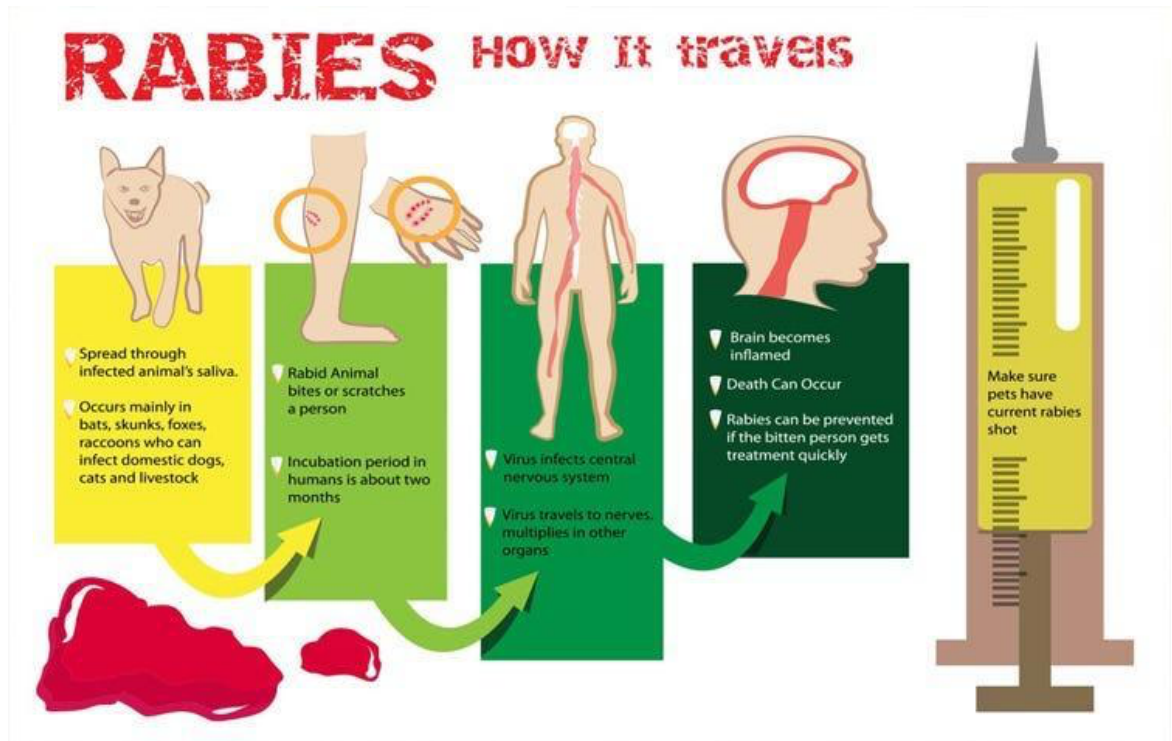


Figure 1: The Transmission and travel of rabies<sup>37</sup>

## Toxoplasmosis

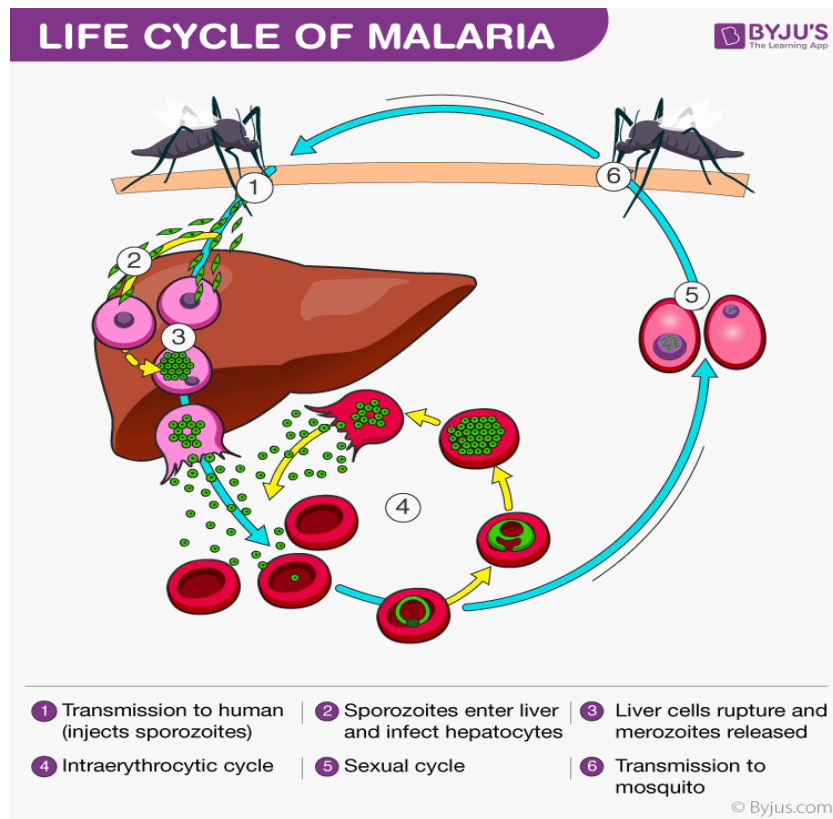
Toxoplasmosis is a zoonotic parasitic disease caused by *Toxoplasma gondii*, a parasite that can infect most warm-blooded animals, including humans. Cats play a central role in the transmission cycle as they are the definitive hosts in which the parasite reproduces. Humans most commonly become infected through the ingestion of food or water contaminated with cat feces, consumption of undercooked or raw meat containing tissue cysts or contact with contaminated soil. This is possible during activities such as gardening without using proper hygiene. In healthy individuals, toxoplasmosis causes mild or no symptoms at all. However, the infection can be dangerous for pregnant women and individuals with low immune systems (i.e. immunocompromised individuals), including people living with HIV/AIDS or those receiving chemotherapy.<sup>38</sup>

## Malaria

<sup>37</sup> Shutterstock.com, 2026, [www.shutterstock.com/el/image-vector/how-rabies-travel-concept-infographics-editable-1418836010?dd\\_referrer=https%3A%2F%2Fwww.google.com%2F](https://www.shutterstock.com/el/image-vector/how-rabies-travel-concept-infographics-editable-1418836010?dd_referrer=https%3A%2F%2Fwww.google.com%2F).

<sup>38</sup> Tenter, A M et al. "Toxoplasma gondii: from animals to humans." *International journal for parasitology* vol. 30, 12-13 (2000): 1217-58. doi:10.1016/s0020-7519(00)00124-7, <https://pubmed.ncbi.nlm.nih.gov/11113252/>

Malaria is a serious infection caused by *Plasmodium* parasites, and is most commonly spread to humans through the bites of infected female *Anopheles* mosquitoes. When it enters the human body, the parasite multiplies in the liver. It then passes to circulation and destroys red blood cells. As a result, infected people experience symptoms such as high fever, chills, headache, muscle pain, fatigue, nausea and anemia. Without treatment, malaria can become severe and cause serious complications. These, among others, include organ failure, severe anemia, cerebral malaria and death.<sup>39</sup> These risks are higher for vulnerable groups such as young children, pregnant women and individuals with weakened immune systems. Although malaria is mainly transmitted between humans through mosquitoes, some forms of the disease originate in animals and can infect humans. This demonstrates its connection to broader discussions and concerns about zoonotic diseases and vector borne health risks.<sup>40</sup>



<sup>39</sup> World Health Organization. "Malaria." *World Health Organization*, 11 Dec. 2024, [www.who.int/news-room/fact-sheets/detail/malaria](http://www.who.int/news-room/fact-sheets/detail/malaria).

<sup>40</sup> Ashley, Elizabeth A et al. "Malaria." *Lancet (London, England)* vol. 391,10130 (2018): 1608-1621. doi:10.1016/S0140-6736(18)30324-6 - <https://pubmed.ncbi.nlm.nih.gov/29631781/>

Figure 2: The life Cycle of Malaria<sup>41</sup>

## Ebola

Ebola is a very dangerous zoonotic viral disease. It is often fatal and is caused by the Ebola virus. Scientists believe that the virus originated in wild animals, with fruit bats considered the most likely natural reservoir. It can be transmitted to humans through direct contact with infected animals such as bats, monkeys or apes. Ebola spreads through direct contact with the blood, bodily fluids, organs or contaminated surfaces of infected individuals. This mode of transmission placed healthcare workers and caregivers at very high-risk during outbreaks. The disease is characterized by a sudden onset of symptoms including high fever, severe weakness, muscle pain, headache, vomiting, diarrhoea, and internal and external bleeding. The progression of Ebola can be very rapid, and without appropriate and timely medical treatment, it can lead to multi organ failure and death.<sup>42</sup>

Ebola has caused several major outbreaks, mostly in sub-Saharan Africa. The most severe outbreak occurred between 2014 and 2016 in West Africa, mainly affecting Guinea, Liberia, and Sierra Leone. According to the World Health Organization, this outbreak resulted in more than 28,000 cases and over 11,000 deaths<sup>43</sup>. These numbers highlight the virus's high case fatality rate, which can range from 25-90% depending on the outbreak and availability to healthcare<sup>44</sup>. Although vaccines and improved treatment options have been developed in recent years, Ebola remains a serious threat due to fragile healthcare systems, limited disease surveillance and mistrust in some affected communities. The disease highlights the need for and importance of early and rapid detection, infection prevention and control measures and coordinated international response. The disease also emphasizes the need to address animal to human transmission pathways through a One Health approach to prevent future outbreaks.

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<sup>41</sup> "Malaria - Causes, Symptoms, Prevention and Life Cycle of Parasite." *BYJUS*, [byjus.com/biology/common-diseases-in-humans-malaria/](https://byjus.com/biology/common-diseases-in-humans-malaria/).

<sup>42</sup> Feldmann, Heinz, and Thomas W Geisbert. "Ebola haemorrhagic fever." *Lancet (London, England)* vol. 377,9768 (2011): 849-62. doi:10.1016/S0140-6736(10)60667-8, <https://pubmed.ncbi.nlm.nih.gov/21084112/>

<sup>43</sup> World Health Organization. "Ebola Outbreak 2014-2016 - West Africa." *Www.who.int*, 2025, [www.who.int/emergencies/situations/ebola-outbreak-2014-2016-West-Africa](http://www.who.int/emergencies/situations/ebola-outbreak-2014-2016-West-Africa).

<sup>44</sup> Centers for Disease Control and Prevention. "Ebola Disease Basics." *Ebola*, CDC, 23 Apr. 2024, [www.cdc.gov/ebola/about/index.html](http://www.cdc.gov/ebola/about/index.html).

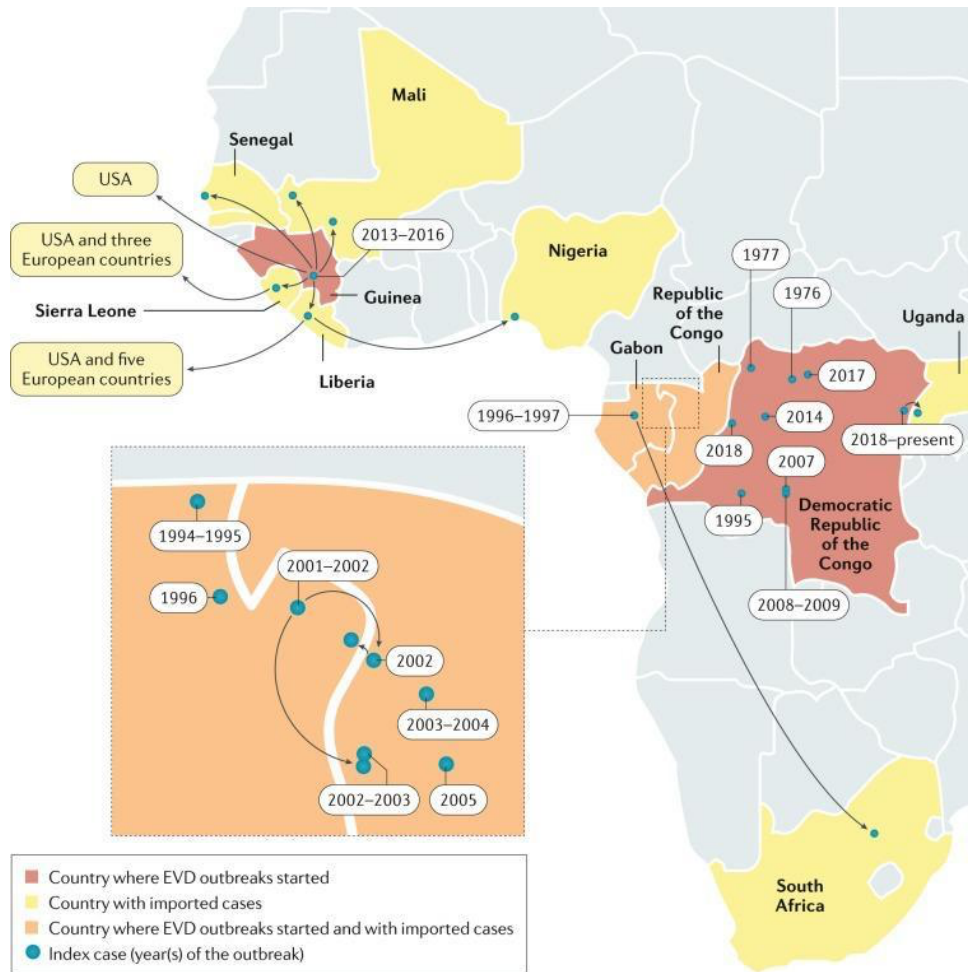


Figure 3: The map shows the location and years of all reported Ebola virus disease (EVD) outbreaks.<sup>45</sup>

## Modes of Transmission

### Direct Transmission

As already mentioned above, Ebola is transmitted to humans primarily through direct contact with infected animals or people. Direct transmission refers to the spread of zoonotic diseases through close and immediate physical contact between an infected animal and a human, without the involvement of vectors such as mosquitoes. This mode of transmission commonly occurs through bites or scratches

<sup>45</sup> Jacob, Shevin T et al. "Ebola virus disease." *Nature reviews. Disease primers* vol. 6,1 13. 20 Feb. 2020, doi:10.1038/s41572-020-0147-3, <https://pubmed.ncbi.nlm.nih.gov/32080199/>

which allow pathogens to enter the body through broken skin, as well as through contact with bodily fluids like saliva, blood or urine. Certain people are at extremely high risk to get infected. This group of people include farmers, veterinarians, hunters and people who handle wildlife, sick animals, animal carcasses or tissues without protective measures. Diseases such as rabies are classic examples of direct transmission since the virus is passed almost exclusively through the saliva of infected animals during bites. Direct transmission often occurs during human and animal interactions especially in settings with limited animal health controls. It highlights the importance of vaccination, protective equipment and safe animal handling practices in preventing zoonotic infections.<sup>46</sup>

### **Indirect Transmission**

On the other hand, indirect transmission occurs when zoonotic diseases are spread to humans not through direct contact with an infected animal, but through contaminated environment or objects. These pathogens are able to survive on surfaces, such as animal bedding, tools, soil, food or water for varying periods of time. Their strong survival poses a high risk to humans that can get infected when they come in contact with these materials.<sup>47</sup> This transmission is very common in places like farms, slaughterhouses, wet markets, and areas with poor sanitation and inadequate waste management, because in these places pathogens can survive and spread more easily. This pathway of transmission highlights the importance of maintaining good hygiene, clean environment, safe waste disposal and regular disinfection of surfaces and materials in order to reduce the risk of zoonotic disease spread.

### **Vector Borne Transmission**

Zoonotic diseases can also be transmitted from animals to humans indirectly through vectors instead of direct contact with the infected animal. Common vectors include mosquitoes, ticks, fleas and sandflies, which carry the pathogens and infect humans while feeding on blood or interacting with both animal and human hosts.<sup>48</sup> This type of transmission causes several zoonotic diseases with high public health impact. For example, Lyme disease is transmitted by infected ticks, while plague is spread by

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<sup>46</sup> Karesh, William B et al. "Ecology of zoonoses: natural and unnatural histories." *Lancet (London, England)* vol. 380,9857 (2012): 1936-45. doi:10.1016/S0140-6736(12)61678-X., <https://pubmed.ncbi.nlm.nih.gov/23200502/>

<sup>47</sup> Mason, Meghan R et al. "Protective practices against zoonotic infections among rural and slum communities from South Central Chile." *BMC public health* vol. 15 713. 28 Jul. 2015, doi:10.1186/s12889-015-1964-2, <https://pubmed.ncbi.nlm.nih.gov/26215091/>

<sup>48</sup> Gubler, Duane J. "The Global Emergence/Resurgence of Arboviral Diseases as Public Health Problems." *Archives of Medical Research*, vol. 33, no. 4, 2002, pp. 330–342. doi:10.1016/S0188-4409(02)00378-8, <https://www.sciencedirect.com/science/article/abs/pii/S0188440902003788>

fleas that have fed on infected rodents.<sup>49</sup> Environmental factors such as temperature, humidity and availability of suitable habitats strongly influence vector-borne transmission. Prevention and control strategies focus mainly on vector control, personal protection measures, habitat modification and public health surveillance. Since many species and environmental factors are involved in vector-borne transmission, this makes this pathway a key target for integrated One Health strategies, which aim to reduce the incidence of zoonotic infections.

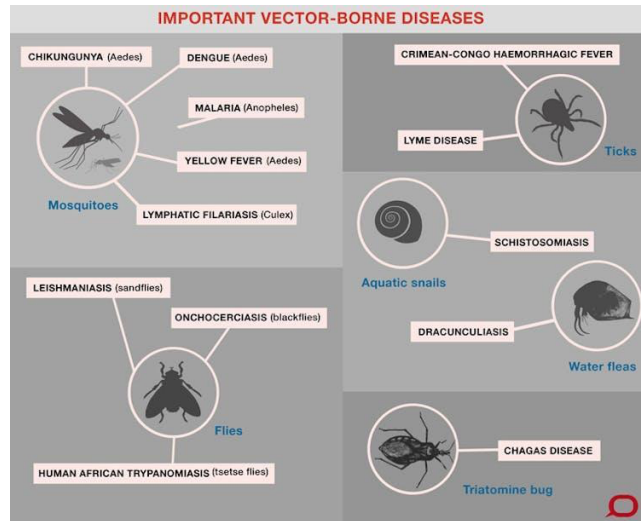


Figure 4: Important vector borne diseases<sup>50</sup>

<sup>49</sup> Steere, Allen C., et al. "Lyme Borreliosis." *Nature Reviews Disease Primers*, vol. 2, 2016, p. 16090. doi:10.1038/nrdp.2016.90, <https://pubmed.ncbi.nlm.nih.gov/27976670/> AND. Perry, R D

<sup>50</sup> Freyend, Simona John von. "Bites and Parasites: Vector-Borne Diseases and the Bugs Spreading Them." *The Conversation*, [theconversation.com/bites-and-parasites-vector-borne-diseases-and-the-bugs-spreading-them-24072](https://theconversation.com/bites-and-parasites-vector-borne-diseases-and-the-bugs-spreading-them-24072).

## Foodborne and Waterborne Transmission

Humans are exposed to zoonotic pathogens through contaminated food or water, such as undercooked or raw meat, milk, eggs or unsafe drinking water. This transmission pathway is called foodborne and waterborne and is associated to poor food handling, inadequate cooking or cross contamination which allows pathogens to survive and infect consumers<sup>51</sup>. Water can also be a source of contamination through runoff from livestock farms, illegal or improper sewage disposal or untreated drinking water. Common diseases that are known to be transmitted via this pathway include salmonellosis and E. coli infections causing gastrointestinal symptoms, fever and in severe cases systemic complications<sup>52</sup>. Effective prevention requires safe food handling, proper cooking and storage, clean and safe water supplies and education on hygiene. This highlights the need for coordination between public health authorities, veterinary services and environmental management to minimize human exposure.

## Environmental and Ecological Transmission

Zoonotic pathogens can survive for extended periods in natural habitats such as soil, water or vegetation, infecting humans without direct contact. These reservoirs pose a risk during routine outdoor activities, farming or even contact with contaminated land or water. For example, anthrax spores can survive in soil for decades<sup>53</sup>. Prevention of this transmission requires environmental monitoring, proper waste disposal, soil management and protective practices. It also highlights the connection between ecosystems, animal and human health, emphasizing the need for One Health approaches in preventing zoonotic disease transmission.

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<sup>51</sup> Scallan, Elaine, et al. "Foodborne Illness Acquired in the United States—Major Pathogens." *Emerging Infectious Diseases*, vol. 17, no. 1, 2011, pp. 7–15. doi:10.3201/eid1701.P11101, <https://pmc.ncbi.nlm.nih.gov/articles/PMC3375761/>

<sup>52</sup> Havelaar, Arie H et al. "Disease burden of foodborne pathogens in the Netherlands, 2009." *International journal of food microbiology* vol. 156,3 (2012): 231-8. doi:10.1016/j.ijfoodmicro.2012.03.029, <https://pubmed.ncbi.nlm.nih.gov/22541392/>

<sup>53</sup> Wilcox, Bruce A., and Richard A. Colwell. "Emerging and Reemerging Infectious Diseases: Biocomplexity as an Interdisciplinary Paradigm." *EcoHealth*, vol. 1, no. 1, 2004, pp. 6–17. doi:10.1007/s10393-003-0020-0, [https://www.researchgate.net/publication/226912431\\_Emerging\\_and\\_Reemerging\\_Infectious\\_Diseases\\_Bio-Complexity\\_as\\_an\\_Interdisciplinary\\_Paradigm](https://www.researchgate.net/publication/226912431_Emerging_and_Reemerging_Infectious_Diseases_Bio-Complexity_as_an_Interdisciplinary_Paradigm)

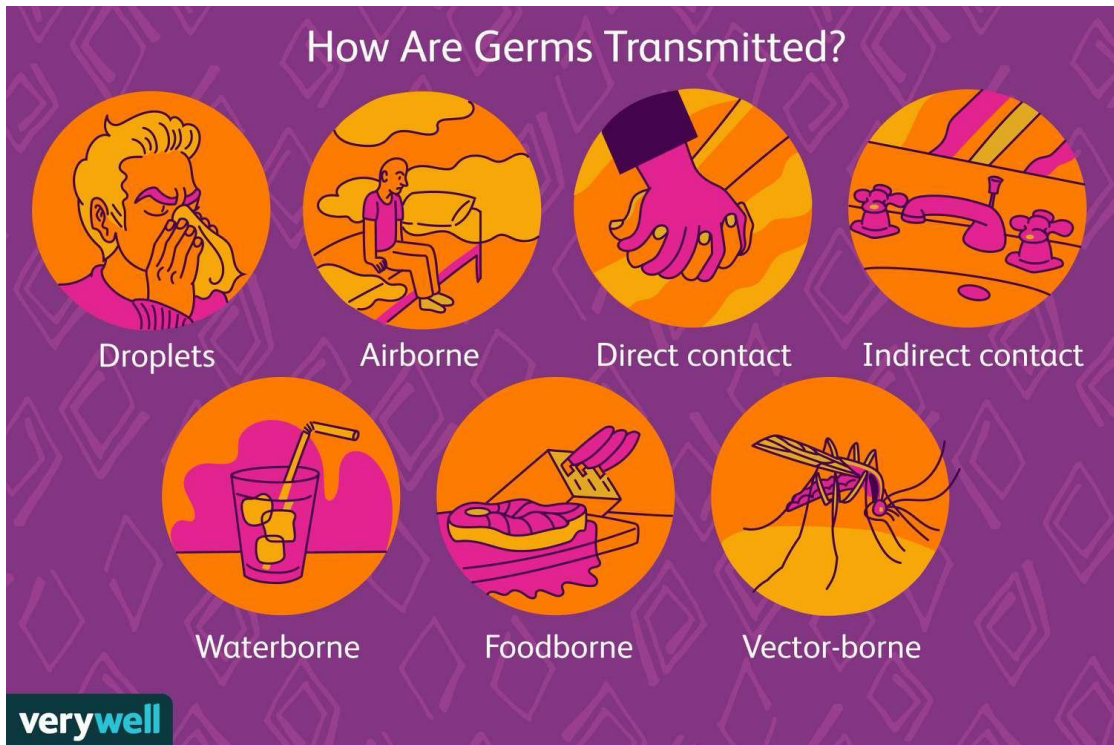


Figure 5: Germs' transmission methods<sup>54</sup>

## Global Impact

## Public Health Impact

Zoonotic diseases represent a major global health issue, causing millions of human infections contributing to significant mortality worldwide. Severe zoonotic diseases such as Ebola, rabies and plague have high fatality rates, while emerging pathogens like COVID 19 demonstrate the potential for rapid global spread and pandemics placing immense pressure on healthcare systems<sup>55</sup>. In developing countries with limited healthcare infrastructure, outbreaks can overwhelm hospitals, causing delayed treatment and thus, higher mortality rates. This highlights the importance for increased surveillance, rapid response and the One Health approach in order to minimize the impact of zoonoses.

## Economic Impact

<sup>54</sup> "How Germs Spread through Droplet Transmission." *Verywell Health*, 2019, [www.verywellhealth.com/droplet-transmission-3956438](https://www.verywellhealth.com/droplet-transmission-3956438).

<sup>55</sup> Karesh, William B et al. "Ecology of zoonoses: natural and unnatural histories." *Lancet (London, England)* vol. 380,9857 (2012): 1936-45. doi:10.1016/S0140-6736(12)61678-X, <https://pubmed.ncbi.nlm.nih.gov/23200502/>

Zoonotic disease outbreaks can have massive economic impacts at local, national and global level. For example, the West Africa Ebola outbreak caused significant GDP losses across Guinea, Liberia and Sierra Leone due to decreased productivity, trade restrictions and disrupted healthcare and social services. Livestock diseases directly impact the income of farmers through animal deaths, lower productivity and trade restrictions, and outbreaks cause losses in tourism, increased healthcare spending and affect supply chains. This shows that zoonotic diseases not only threaten human health but also economic stability, especially in countries with limited resources that rely on farming and livestock.<sup>56</sup>

### **Social and Development Impact**

Zoonotic diseases mostly affect vulnerable populations, especially those in rural, low income and marginalized communities with limited access to healthcare, clean water and reliable information. These populations often depend on livestock, wildlife or informal markets, a fact that increases their exposure to zoonotic pathogens. At the same time, their ability to cope with outbreaks is reduced. Outbreaks also affect education, employment and social services through lockdowns, thus, slowing human development and enlarging existing inequalities. Lastly, fear of infection disrupts social interactions, limits mobility, declines trade and tourism, further reducing income opportunities and slowing economic and social development particularly in countries that rely heavily on these sectors.<sup>57</sup>

### **Environmental and Ecological Impact**

Environmental degradation significantly increases the risk of zoonotic disease emergence and transmission. Deforestation, climate change and rapid urbanization disrupt natural habitats forcing wildlife, human populations and livestock closer. These changes create ideal conditions that allow pathogens to cross species barriers. Changes in land use, such as agricultural and mining, reduce biodiversity and disrupt natural disease regulation mechanisms. At the same time, altered ecosystems

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<sup>56</sup> Zinsstag, Jakob, et al. "Drivers and Consequences of Viral Zoonoses: Public Health and Economic Perspectives." *Viruses*, vol. 5, no. 4, 2025, <https://www.mdpi.com/2813-0227/5/4/32>

<sup>57</sup> Di Bari, Carlotta et al. "The global burden of neglected zoonotic diseases: Current state of evidence." *One health (Amsterdam, Netherlands)* vol. 17 100595. 29 Jun. 2023, doi:10.1016/j.onehlt.2023.100595, <https://pubmed.ncbi.nlm.nih.gov/37545541/>

may introduce new transmission pathways that allow pathogens to persist in soil, water or vectors such as mosquitoes and ticks. These ecological shifts demonstrate that zoonotic diseases are not only a public health issue but also a consequence of unsustainable environmental practices, highlighting the need for integrated environmental management in prevention strategies<sup>58</sup>.

## Current Challenges on Combatting the Issue

Combating zoonotic diseases is challenging due to environmental, scientific and socioeconomic factors. Habitat destruction caused by deforestation, climate change and urban expansion increases contact between humans, livestock and wildlife. This creates favorable conditions for pathogen spillover. At the same time early detection and rapid response is hindered by the lack of effective surveillance systems, especially in less economically developed countries leading to the rapid spread of zoonotic diseases before detection<sup>59</sup>. The implementation of the One Health approach is complex and challenging, as it requires sustained coordination efforts across human health, veterinary and environmental sectors, which often operate under separate governance and funding mechanisms. Furthermore, scientific challenges such as the unpredictable nature of outbreaks and rapid pathogen mutation, make prevention and control difficult even in developed countries with resource availability. These challenges are further magnified by socioeconomic gaps since limited funding, infrastructure and technical expertise weaken global preparedness. This demonstrates how vulnerabilities in one region can escalate into international health threats<sup>60</sup>.

## Major Countries and Organizations Involved

### United States of America (USA)

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<sup>58</sup> Patz, J A et al. "Global climate change and emerging infectious diseases." *JAMA* vol. 275,3 (1996): 217-23., <https://pubmed.ncbi.nlm.nih.gov/8604175/>

<sup>59</sup> Morse, Stephen S et al. "Prediction and prevention of the next pandemic zoonosis." *Lancet (London, England)* vol. 380,9857 (2012): 1956-65. doi:10.1016/S0140-6736(12)61684-5, <https://pubmed.ncbi.nlm.nih.gov/23200504/>

<sup>60</sup> Kelly, Terra R et al. "Implementing One Health approaches to confront emerging and re-emerging zoonotic disease threats: lessons from PREDICT." *One health outlook* vol. 2 1. 10 Jan. 2020, doi:10.1186/s42522-019-0007-9, <https://pmc.ncbi.nlm.nih.gov/articles/PMC7149069/>

The United States of America plays a significant role in addressing zoonotic diseases through national and international cooperation. The Centers for Disease Control and Prevention (CDC) operates the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) which is responsible for the detections, prevention and control of zoonotic diseases within the United States while also supporting global efforts to combat the issue. Through research, surveillance and technical assistance the CDC contributes to early outbreak detection and the development of effective response strategies. The U.S. also takes part in the Global Health Security Agenda (GHSA), helping other countries improve their systems of prevention, detection and response to infectious diseases, including zoonotic outbreaks, strengthen public health systems, emphasizing in international collaboration<sup>61</sup>.

### **The European Union (Member States)**

The European Union Member States are working together to address and prevent zoonotic diseases by promoting the One Health approach through which Member states coordinate human health, veterinary and environmental authorities. This coordinated framework recognizes that systems are interconnected and allows countries to share surveillance data and respond quickly to emerging threats. Through health programs and coordinated surveillance and prevention efforts, the EU Member States aim to protect their population and serve as a regional model for coordinated zoonotic disease management<sup>62</sup>.

### **Australia**

Australia supports the One Health Approach by combining efforts across human, environmental and animal health sectors to extensively research, survey and respond to zoonotic diseases. Australia shares data and scientific expertise with neighboring countries in Southeast Asia and the Pacific and contributes technical assistance and training. This is done for Australia to aid in the early identification of potential threats and strengthen response capacities in partner countries with fewer resources.

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<sup>61</sup> Belay, Ermias D., et al. "Zoonotic Disease Programs for Enhancing Global Health Security." *Emerging Infectious Diseases*, vol. 23, no. 13, Dec. 2017, [https://www.researchgate.net/publication/321434079\\_Zoonotic\\_Disease\\_Programs\\_for\\_Enhancing\\_Global\\_Health\\_Security](https://www.researchgate.net/publication/321434079_Zoonotic_Disease_Programs_for_Enhancing_Global_Health_Security)

<sup>62</sup> European Food Safety Authority (EFSA) | European Centre for Disease Prevention and Control (ECDC). "The European Union One Health 2024 Zoonoses Report." *EFSA journal. European Food Safety Authority* vol. 23,12 e9759. 9 Dec. 2025, doi:10.2903/j.efsa.2025.9759, <https://pubmed.ncbi.nlm.nih.gov/41377167/>

Australia also collaborates with international organizations such as the WHO and FAO (Food and Agriculture Organization), to support coordinated global efforts to prevent zoonotic outbreaks and limit their potential to escalate into wider health crises<sup>63</sup>.

## Bangladesh

Bangladesh plays an important role in addressing zoonotic diseases by implementing the One Health approach to conduct joint surveillance programs across human and animal populations. This helps health authorities to identify potential zoonotic threats early and understand their transmission patterns. Bangladesh also works closely with international organizations such as WHO and FAO to strengthen early detection systems and improve rapid outbreak response, which is particularly important given its high population density and close interactions between humans and animals. Lastly, Bangladesh also focuses on providing education to the community to reduce risks associated with wildlife and livestock. Bangladesh recognizes that prevention requires coordinated action at local, national, and international levels, despite the challenges that arise from limited resources<sup>64</sup>.

## Food and Agriculture Organization of the United Nations (FAO)

The UN Food and Agriculture Organization (FAO) plays a central role in preventing and controlling zoonotic diseases by focusing on animal and environmental levels. FAO works with countries to monitor and reduce zoonotic risks. It recognizes that animal health is a critical component of human health security. It supports countries in lowering the risk of disease transmission through food supply chains and across borders by developing technical guidelines on animal health, food safety and trade regulations. Furthermore, FAO supports national governments by strengthening laboratory capacity and early detection systems, and collaborates closely with WHO, and other partners under the One

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<sup>63</sup> Food and Agriculture Organization of the United Nations and Australian Government. "FAO and Australia Partner to Strengthen Animal Health Systems in Southeast Asia and the Pacific." FAO, 14 Mar. 2025, <https://www.fao.org/ectad/asiapacific/news-and-events/news/news-detail/fao-and-australia-partner-to-strengthen-animal-health-systems-in-southeast-asia-and-the-pacific/en>.

<sup>64</sup> Ahmed, Md Jisan, et al. "One Health Assessment of Farmers' Knowledge, Attitudes, and Practices (KAPs) on Zoonoses in Bangladesh." *Scientific Reports*, vol. 15, article 1258, 8 Jan. 2025, <https://doi.org/10.1038/s41598-025-85462-9>, <https://www.nature.com/articles/s41598-025-85462-9#citeas>

Health approach, to coordinate collaborative efforts that aim to prevent zoonotic outbreaks and to reduce their global impact<sup>65</sup>.

### **World Organization for Animal Health (WOAH)**

The World Organization for Animal Health (WOAH) plays a key role in preventing and controlling zoonotic diseases by establishing international animal health standards. These actions reduce the risk of disease transmission from animals to humans. WOAH asks member countries to report outbreaks in animals. This strengthens global early warning systems and improves transparency. It also provides training, technical guidelines, and capacity-building support for veterinary services worldwide. Through close collaboration with the FAO and WHO, WOAH contributes to the coordination of global One Health initiatives, ensuring that animal health considerations are fully integrated into international efforts to prevent and control zoonotic diseases<sup>66</sup>.

### **Blocs Expected**

#### **More Economically Developed Countries (MEDCs)**

More Economically Developed Countries (MEDCs) include nations like the United States, most Member States of the European Union, Australia, Japan and Canada. These countries will be forming the first bloc. They can spend more money on research, training, and programs to prevent diseases that move from animals to humans. They have strong health systems, advanced animal health services and a lot of scientific and financial resources. As a bloc, MEDCs are expected to focus on preventing diseases to jump from animals to humans by using advanced tools. These tools include early warning systems, surveillance technologies, and genomic research in order to study pathogens. MEDCs are also expected to have strict biosecurity rules in order to make it harder for pathogens to spread. Moreover, they encourage countries to share their data and collaborate under the example of the One Health Approach. Finally, they also help train workers in other countries in order to lower the risk of diseases spreading from animals to humans<sup>67</sup>.

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<sup>65</sup> Food and Agriculture Organization of the United Nations. "One Health." FAO, [www.fao.org/geneva/our-activities/one-health/en](http://www.fao.org/geneva/our-activities/one-health/en) , <https://www.fao.org/geneva/our-activities/one-health/en>

<sup>66</sup> World Organization for Animal Health (WOAH). "One Health." WOAH, <https://www.woah.org/en/what-we-do/global-initiatives/one-health/>

<sup>67</sup> Raja Danasekaran. "One Health: A Holistic Approach to Tackling Global Health Issues." *Indian Journal of Community Medicine*, vol. 49(2)

## Less Economically Developed Countries (LEDCs)

Less Economically Developed Countries (LEDCs) include places like Bangladesh, Kenya, India and other countries in Asia, Sub Saharan Africa and some parts of Latin America. These countries will be forming the second bloc. The people in LEDCs often have more contact with pathogens and are at greater risk to get infected by zoonotic diseases. LEDCs have weaker healthcare systems and limited disease surveillance. Because of the above, these countries are more at risk of outbreaks from diseases that move from animals to people. As a bloc, LEDCs are likely to ask more developed countries for financial assistance, support with technology, information sharing, and training for people working in the health and veterinary fields. They ask for rules that fit their country, fairness and help to strengthen their national systems and fight animal diseases. Lastly, with all the help mentioned above they would be able to join global efforts to stop zoonotic diseases<sup>68</sup>.

## Timeline of Events

| Date                          | Description of Event   |
|-------------------------------|--|
| 2000 BC                       | Mesopotamians write about animal bites that lead to fatal neurological symptoms in texts.                          |
| 1347                          | The outbreak of Black Death occurs in Europe   |
| 1850s-1860s                   | Louis Pasteur Conducted experiments that proved that microorganisms were responsible for fermentation and spoilage |
| 7 <sup>th</sup> of April 1861 | Pasteur publicly presented his findings showing that microbes in the environment could cause biological changes.   |

[https://www.researchgate.net/publication/378836213\\_One\\_Health\\_A\\_Holistic\\_Approach\\_to\\_Tackling\\_Global\\_Health\\_Issues](https://www.researchgate.net/publication/378836213_One_Health_A_Holistic_Approach_to_Tackling_Global_Health_Issues)

<sup>68</sup> Pantha, Saurav, et al. "Zoonotic Diseases in Low and Middle-Income Countries (LMICs): Economic Burden, Challenges, Strategies, and Future Directions." *Animals and Zoonoses*, vol. 1, 2025,

[https://www.researchgate.net/publication/397186189\\_Zoonotic\\_Diseases\\_in\\_Low\\_and\\_Middle-Income\\_Countries\\_LMICs\\_Economic\\_Burden\\_Challenges\\_Strategies\\_and\\_Future\\_Directions](https://www.researchgate.net/publication/397186189_Zoonotic_Diseases_in_Low_and_Middle-Income_Countries_LMICs_Economic_Burden_Challenges_Strategies_and_Future_Directions)

|                               |  |
|-------------------------------|--|
| 1882-1883                     | Koch identified the bacteria responsible for tuberculosis and cholera.                                     |
| 6 <sup>th</sup> of July 1885  | Louis Pasteur successfully administered the first rabies vaccine to a human patient.                       |
| 1890                          | Koch formalized his findings in the Koch's Postulates.   |
| Late 19 <sup>th</sup> century | Germ theory was accepted and the term "zoonosis" started appearing in medical scientific literature.       |
| Early 2000s                   | Governments, international organizations and research institutions began adopting the One Health Approach. |
| 2014-2016                     | The largest Ebola outbreak occurred.   |

## Relevant UN Resolutions, Treaties & Events

### [The International Health Regulations \(IHR, 2005\)](#)

The International Health Regulations (IHR) are a set of rules, a framework, managed by the World Health Organization (WHO). It helps countries to work together when serious disease outbreaks occur all over the world. All 196 countries that are part of WHO agree to report and respond to public health emergencies that globally affect the entire world. These emergencies also include infectious diseases that can pass from animals to people. The IHR improves the way countries monitor for these emergencies and tries to facilitate trade and travel. This framework is legally binding, and it has been used for global cooperation during outbreaks like the COVID-19 pandemic<sup>69</sup>.

### [The World Assembly Resolution wha68.7\(2015\)](#)

The World Health Assembly Resolution WHA68.7 of 2015 is titled "Global Action Plan on Antimicrobial Resistance". This plan asks all Member States to work together to stop the growing

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<sup>69</sup> (World Health Organization. "International Health Regulations (2005)." WHO, 2025, <https://www.who.int/health-topics/international-health-regulations>)

problem of microbes being resistant to medicines. It also encourages countries to strengthen their surveillance systems in order to be able to detect resistant infections and to control how antibiotics are used in both humans and animals<sup>70</sup>. This resolution is very important because many germs circulate between animals and humans. And because many antibiotics are misused or overused in farming and animal care, these germs can become resistant. This resolution supports the One Health approach and recognizes that antimicrobial resistance cannot be effectively solved by the healthcare system alone. It requires action in human and animal health, food production and the environment<sup>71</sup>.

### The Convention on Biological Diversity (CBD, 1992)

The Convention on Biological Diversity (CBD) is an international treaty that focuses on protecting nature, biological diversity, and using natural resources in a sustainable way. Although CBD does not directly focus on zoonotic diseases, it is highly relevant to their prevention. This is because damage to ecosystems, loss of biodiversity, and unsafe use of wildlife increase the risk of diseases to jump from animals to humans<sup>72</sup>. The CBD helps lower the risk of zoonotic disease spread by reducing contact between animals and humans. The Convention does this by encouraging the protection of natural habitats, regulating wildlife use and trade and managing ecosystems. Through these actions the CDC supports global health security, and aligns with the One Health approach, which connects human and animal health with the environment<sup>73</sup>.

## Previous Attempts to Solve the Issue

### One Health Action Plan Against Antimicrobial Resistance (European Union)

The One Health Action Plan Against Antimicrobial Resistance aims to reduce antimicrobial resistance. In order to do this, it acts in human and animal health, agriculture and the environment. It promotes better monitoring of infections that are found to be resistant, and responsible use of antibiotics

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<sup>70</sup> *Who.int*, 2020, [wkc.who.int/resources/publications/i/item/global-action-plan-on-antimicrobial-resistance](https://www.who.int/resources/publications/i/item/global-action-plan-on-antimicrobial-resistance).

<sup>71</sup> World Health Assembly. "Global Action Plan on Antimicrobial Resistance (WHA68.7)." World Health Organization, 1 January 2016, <https://www.who.int/publications/i/item/9789241509763>

<sup>72</sup> "Biodiversity and Infectious Diseases: Questions and Answers." *Convention on Biological Diversity*, [www.cbd.int/health/infectiousdiseases](http://www.cbd.int/health/infectiousdiseases).

<sup>73</sup> Secretariat of the Convention on Biological Diversity. "Biodiversity and Health." United Nations, 2020, <https://www.cbd.int/health> and <https://sdgs.un.org/un-system-sdg-implementation/secretariat-convention-biological-diversity-cbd-34573>

in humans and animals. Moreover, it supports the conduction of more research and calls for strong collaboration between countries. The Plan helps and supports Member States of the European Union to work together using the One Health approach. By following this approach, the plan contributes to reducing the spread of resistant infections, as well as of infections that are associated with zoonotic diseases<sup>74</sup>. However, the implementation of the Plan differs in each country. Finally, the rules in agriculture are not always strongly enforced in each country. Thus, one can understand that although the plan is important, a stronger action is needed for better collaboration and rule enforcement to fully reduce the risks of zoonotic diseases.

### **Biological Threat Reduction Program (BTRP NATO)**

The Biological Threat Reduction Program is supported by NATO and aims to improve biosafety and disease monitoring in partner countries. Its goal is the rapid response to dangerous pathogens, including those that are responsible for zoonotic diseases. The program also helps countries to have better and more equipped laboratories. These laboratories must be staffed by experts who will be able to rapidly detect harmful pathogens, especially in high-risk regions. The Program also focuses on preventing unsafe handling and accidental or deliberate release of harmful pathogens. The Program helps lower the risk of outbreaks since it emphasizes international cooperation, sharing of information and building skills. This is more pronounced in countries with limited health and laboratory infrastructure. However, because the Program focuses mainly on NATO partner countries, it may not cover all high risk Less Economically Developed Countries. This constitutes a serious problem, since these are the countries that pose a greater risk regarding zoonotic disease transmission<sup>75</sup>.

### **European Centre for Disease Prevention and Control (ECDC)**

The European Centre for Disease Prevention and Control (ECDC) is an agency of the European Union. ECDC helps protect countries in the European Union from infectious diseases, including zoonotic diseases. This is mainly done through the collection and analysis of epidemiological data and the coordination of disease monitoring. ECDC also provides early warning systems about zoonotic outbreaks across Europe. In addition, it also works with national health and veterinary authorities to

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<sup>74</sup> European Commission. "A European One Health Action Plan against Antimicrobial Resistance (AMR)." European Union, 2017, [https://health.ec.europa.eu/antimicrobial-resistance/eu-action-antimicrobial-resistance\\_en](https://health.ec.europa.eu/antimicrobial-resistance/eu-action-antimicrobial-resistance_en)

<sup>75</sup> U.S. Department of Defense, Defense Threat Reduction Agency. "Biological Threat Reduction Program: Strengthening Partner Capabilities to Prevent and Detect Biological Threats." DTRA, Aug. 2023, <https://www.dtra.mil/Portals/125/Documents/CTR-Factsheets/DTRA-Fact-Sheet-BTRP-Aug-2023.pdf>

track diseases that jump from animals to humans and improve early monitoring systems. However, ECDC mainly focuses on Europe and may not directly help countries at high risk of zoonotic diseases located outside the EU<sup>76</sup>.

### **Africa One Health Coordination Platform (Africa Union)**

The Africa One Health Coordination Platform was set up by the African Union to help the collaboration between human health, animal health and environmental sectors. This collaboration is needed to prevent and control zoonotic diseases. This platform helps countries coordinate surveillance, lab testing and outbreak responses. This is achieved by enhancing the collaboration between institutions like the Africa Centres for Disease Control and Prevention, the Interafrican Bureau for Animal Resources and environmental agencies. The platform also works to solve problems such as weaknesses in health and veterinary systems that are responsible for the delayed detection and response to zoonotic threats. It promotes integrated policies, training and regional cooperation<sup>77</sup>. However, some countries may take longer to put everything into action because of their limited resources.

## **Possible Solutions**

### **The development of a new global pathogen database**

Creating a new global pathogen database could greatly improve how we prevent and control zoonotic diseases. Creating a centralized, open access database that contains genetic, epidemiological and ecological information on pathogens that affect animals and humans would help researchers and health authorities to track how diseases emerge and evolve. Another important aspect of this database is that the early detection of genetic mutations that enable pathogens to become more resistant and jump from animals to humans would allow governments and organizations to act before outbreaks

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<sup>76</sup> European Centre for Disease Prevention and Control. "About ECDC." ECDC, 2025, <https://www.ecdc.europa.eu/en/about-ecdc>

<sup>77</sup> Africa Centres for Disease Control and Prevention (Africa CDC). "African Union Establishes One Health Coordination Group on Zoonotic Diseases." Africa CDC, 4 July 2022, <https://africacdc.org/news-item/african-union-establishes-one-health-coordination-group-on-zoonotic-diseases/>

spread on a global scale. Moreover, this database would also promote scientific transparency, speed up research and minimize the duplication of efforts between countries<sup>78</sup>.

For this database to be successful, it has to rely on strong cooperation between countries. However, some countries may hesitate to participate and provide information. This hesitation is due to differences in the ability to share data, various political tensions and concerns about intellectual property and biosecurity issues between countries. Addressing those issues would require clear international rules and guidelines, trust binding measures, and equal access to the benefits that shared data generate.

### Research and development of new vaccines and treatments

To minimize the impact of zoonotic diseases on a global level, scientists must focus on the research and development of new vaccines and treatments. These novel agents will be able to detect and prevent infections and will limit the increased rate of deaths during outbreaks. The support of governments for the healthcare systems in developing new vaccines for pathogens that are considered high risk can reduce the likelihood of widespread transmission<sup>79</sup>. The reason for this is that vaccines provide immunity to people before or during outbreaks<sup>80</sup>. Moreover, governments should promote collaboration between countries regarding research and development of new treatments. This collaboration will include the sharing of scientific knowledge, data and expertise between researchers and doctors. However, this solution can be difficult to put into practice. The research and development of vaccines and treatments is expensive and time consuming. These treatments are oftentimes scientifically uncertain, especially for diseases like COVID-19, where the germ responsible for the disease mutates quickly. Moreover, developing countries or regions in conflict cannot have the same access to vaccines and treatments as developed ones. This unequal access can limit the effectiveness of the stockpile strategy. The people who are most vulnerable to outbreaks will not have access to treatment if there is not enough political support, funding and equal distribution all over the world<sup>81</sup>.

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<sup>78</sup> Zhang, Boyuan et al. "Zoonosis: a comprehensive database of zoonotic pathogens." *Database : the journal of biological databases and curation* vol. 2025 (2025): baaf062. doi:10.1093/database/baaf062, <https://pmc.ncbi.nlm.nih.gov/articles/PMC12527251/>

<sup>79</sup> Lerch, Anita, et al. "Projecting Vaccine Demand and Impact for Emerging Zoonotic Pathogens." *BMC Medicine*, vol. 20, no. 1, 16 June 2022, <https://doi.org/10.1186/s12916-022-02405-1>. Accessed 8 Feb. 2026.

<sup>80</sup> Gingles, Jacob G, and Michael Q Doyle. "Immunization." *Nih.gov*, StatPearls Publishing, 2023, [www.ncbi.nlm.nih.gov/books/NBK459331/](http://www.ncbi.nlm.nih.gov/books/NBK459331/).

<sup>81</sup> "Why Global Vaccine Equity Is the Prescription for a Full Recovery." *Brookings*, [www.brookings.edu/articles/why-global-vaccine-equity-is-the-prescription-for-a-full-recovery/](http://www.brookings.edu/articles/why-global-vaccine-equity-is-the-prescription-for-a-full-recovery/).

Even when vaccines are available, another barrier is vaccine distrust. For example, during the COVID-19 pandemic, misinformation, conspiracy theories and organized anti-vaccination campaigns influenced the public. Many people delayed or completely refused vaccination because of concerns about safety and side effects. This distrust caused challenges of equitable distribution, which meant that the most vulnerable populations were sometimes left unprotected, prolonging outbreaks and increasing the burden on healthcare systems<sup>82</sup>. This indicated that without strong political support, public health campaigns and community engagement to address the misinformation, even well funded campaigns cannot achieve their goal fully<sup>83</sup>.

### International Standardization of Animal Trade Regulations

International standardization of animal trade regulations would be a good start to reduce the spread and transmission of zoonotic disease across countries. This can be achieved by focusing on the main pathways that the pathogens use to spread. One pathway is to focus on the livestock and wildlife trade by establishing global rules. Shared rules among different countries can include quarantine procedures, health certificates and monitoring of high-risk species. Applying these rules means that governments will properly check animals for infectious diseases. Thus, animals will be "clean" before entering domestic or international markets. These measures make animal trade safer and lower the chances of future outbreaks. Finally, standardized regulations also improve traceability. This allows authorities to quickly identify and control sources of infection during outbreaks<sup>84</sup>.

The implementation of these regulations, however, can be challenging. This is because countries have different abilities to enforce rules, and many depend on animal trade to boost their economy. Some nations may resist the implementation of stricter standards because they worry about factors like trade restrictions, higher costs, or impacts on people's livelihoods. Without the effective and strong enforcement of these rules, sufficient financial support and collaboration between countries, all these

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<sup>82</sup> Lee, Sun Kyong, et al. "Misinformation of COVID-19 Vaccines and Vaccine Hesitancy." *Scientific Reports*, vol. 12, no. 1, 11 Aug. 2022, pp. 1–11, [www.nature.com/articles/s41598-022-17430-6](http://www.nature.com/articles/s41598-022-17430-6), <https://doi.org/10.1038/s41598-022-17430-6>.

<sup>83</sup>World Health Organization (WHO). "Ten Threats to Global Health in 2019." *World Health Organization*, 2019 [www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019](http://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019).

<sup>84</sup> World Trade Organization. *New WTO Paper Explores Linkages Between Trade and the Spread of Diseases of Animal Origin*. WTO, 5 Nov. 2020, [https://www.wto.org/english/news\\_e/news20\\_e/sps\\_05nov20\\_e.htm](https://www.wto.org/english/news_e/news20_e/sps_05nov20_e.htm)

attempts may fail. And the reason for this is that the regulations may not be applied unevenly and thus fail to significantly reduce the risk of zoonotic diseases<sup>85</sup>.

### Capacity Building Scholarships and Training Programs

Stopping diseases that move from animals to humans requires skilled workers from all fields that involve animal care, as well as health workers. This can be achieved through training and educational programs in health, veterinary and environmental fields. These programs are most important for poorer countries that do not have the funding and trained experts are limited. International scholarships and training programs can be the key solution to the problem. These educational programs include monitoring of diseases, investigation of outbreaks, and lab tests, as well as the practical implementation of the One Health approach. This helps all countries to detect and respond to threats more effectively and independently. Moreover, trained professionals can also help make health policies. They can work together with local communities and collaborate with other countries to make the prevention of future outbreaks more sustainable in the long term<sup>86</sup>.

However, this solution has some challenges that make it difficult to implement it. Many countries may not have enough money to fund these training programs. This mostly applies to underdeveloped or developing countries. Many students and healthcare workers may not have equal access to these training opportunities. Moreover, economic crises lead trained professionals to leave their country and move to richer ones with better jobs and salaries<sup>87</sup>. Without strong local health systems, good salaries, scholarships and support from institutes and governments, long-term improvement in the prevention of these diseases will not be achieved.

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<sup>85</sup> Aguiar, Raphael et al. “Preventing zoonotic spillover through regulatory frameworks governing wildlife trade: A scoping review.” *PloS one* vol. 20,1 e0312012. 6 Jan. 2025, doi:10.1371/journal.pone.0312012 e0312012–e0312012, pmc.ncbi.nlm.nih.gov/articles/PMC11703008/, <https://doi.org/10.1371/journal.pone.0312012>.

<sup>86</sup> Seffren, Victoria et al. “Strengthening the global one health workforce: Veterinarians in CDC-supported field epidemiology training programs.” *One health (Amsterdam, Netherlands)* vol. 14 100382. 28 Mar. 2022, doi:10.1016/j.onehlt.2022.100382, <https://pubmed.ncbi.nlm.nih.gov/35686141/>

<sup>87</sup> Yopa, Daniele Sandra et al. “Barriers and enablers to the implementation of one health strategies in developing countries: a systematic review.” *Frontiers in public health* vol. 11 1252428. 23 Nov. 2023, doi:10.3389/fpubh.2023.1252428, <https://pubmed.ncbi.nlm.nih.gov/38074697/>

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