

# Zoonotic Diseases

Zoonoses or Zoonotic diseases are infectious diseases that can naturally be transmitted/spread between animals (usually vertebrates) and humans. These diseases can be caused by viruses, fungi, parasites, and bacteria. This topic finds relevance under the GS-II paper of the [UPSC](#) exam.

## What are Zoonotic Diseases?

Zoonosis refers to the transmission of diseases between animals and humans. Such diseases are termed as Zoonotic Diseases. Zoonotic diseases range from mild to severe, while in extreme cases can even be fatal.

- Zoonoses may be bacterial, viral, or parasitic, or may even involve unconventional agents for the transmission of the disease.
- WHO in 1959 defined Zoonoses as “those diseases and infections which are naturally transmitted between vertebrate animals and man.”
- The **World Zoonoses Day** is observed every year on July 6 to create awareness on zoonotic diseases, how to prevent them and what actions to take when exposed.

## Classification of Zoonotic diseases

The classification of diseases is usually done on the basis of the pathogen causing the disease. With the advancement in science, scientists and medical professionals have been able to identify and study in detail the etiological agents causing the diseases. **Etiological agents usually refer to the causative agent of a diseased condition.** The zoonoses are classified on the basis of three factors:

1. According to the etiological agents
  2. According to the mode of transmission
  3. According to the reservoir host
- **According to the etiological agents-** there is a further classification under this as:
    - Bacterial zoonoses: e.g. anthrax
    - Viral zoonoses: e.g. rabies
    - Rickettsial zoonoses: e.g. Q-fever
    - Protozoal zoonoses: e.g. toxoplasmosis
    - Helminthic zoonoses: e.g. echinococcosis
    - Fungal zoonoses: e.g. cryptococcosis
    - Ectoparasites: e.g. scabies
  - **According to the reservoir host:** A reservoir is usually a living host of a certain species, such as an animal or a plant, inside of which a pathogen survives, often (though not always) without causing disease for the reservoir itself. A cascading effect is caused by the extinction of a species, leading to an increase in the population of the reservoir species.
    - **Anthropozoonoses**– Infections transmitted to men from lower vertebrate animals e.g. rabies.
    - **Zooanthroponoses-** Infections transmitted from man to lower vertebrate animals e.g. diphtheria
    - **Amphixenoses-** Infections maintained in both man and lower vertebrate animals and transmitted in either direction e.g. salmonellosis

## Transmission of Zoonotic Diseases

Zoonotic diseases are transmitted through various means. The chances of diseases getting transmitted increase due to the expansion of transition zones between adjacent ecosystems when forests are cleared off for agricultural purposes. This is because the environment is overlapped for wild and domesticated animals. Some of the most common ways of transmission of the diseases are:

- **Direct zoonoses**-These are transmitted from an infected vertebrate host to a susceptible host (man) by direct contact, by contact with a fomite or by a mechanical vector. E.g. Rabies
- **Cyclozoonoses**- These require more than one vertebrate host species, but no invertebrate host for the completion of the life cycle of the agent. E.g. echinococcosis.
- **Metazoonosis**- These are transmitted biologically by invertebrate vectors, in which the agent multiplies and/or develops and there is always an extrinsic incubation (prepatent) period before transmission to another vertebrate host. E.g. plague
- **Saprozoonosis**- These require a vertebrate host and a non-animal developmental site like soil, and plant for the development of the infectious agent e.g. cryptococcosis

**Note:**

- **Pathogens** are the organisms responsible for causing the disease. These are of five main types: viruses, bacteria, fungi, protozoa, and worms.
- **Vectors** are organisms that do not cause the disease in itself but spread infection by conveying pathogens from one host to another. E.g. bats in the case of NIPAH virus and mosquitoes in the case of Malaria.

## Causes of Zoonotic Diseases

The zoonotic diseases can be transmitted from animals to humans in multiple ways, most often, people with a weakened immune system are at risk. A few of the factors responsible for causing zoonotic diseases are:

- Deforestation could be the primary reason as it increases the contact between humans and wild animals.
- Through direct contact with bodily fluids such as blood, saliva, etc. of an infected animal or human.
- The disease can also be transmitted through the intake of infected or contaminated food.
- Global climate change, the overuse of antimicrobials in medicine, and more intensified farm settings can also contribute to the spread of Zoonotic diseases.

## The health risk posed by Zoonotic diseases

Historically, zoonotic diseases had a tremendous impact on the evolution of man, especially in the societies that domesticated and bred animals for food and clothing. Over the last seven decades, more than three hundred Zoonotic Diseases have been reported. They account for 75% of the Emerging Infectious Diseases (EIDs) among human beings. The dramatic increase in the population, mobility, associated environmental and social changes in the past few decades can be attributed to the recent increase in the spread of Zoonotic diseases worldwide. The mobility of the diseases has drastically increased due to globalization.

- Zoonotic diseases such as bovine tuberculosis, bubonic plague, and glanders caused millions of deaths. They are still **a major problem in developing countries**.
- Apart from the obvious risk of the loss of significant lives, there is a risk of such dangerous microorganisms being **used as biological weapons**.
  - Since World War I, a number of nations have conducted programs to develop biological agents as weapons of war.
  - A majority of the biological agents that have been considered as weapons are zoonotic.
  - Most of the zoonotic agents are not highly contagious, which would make them relatively easy to control when incorporated into a weapons system and deployed in a tactical situation. However, these can be manipulated to be highly contagious once deployed in a population without the necessity for weaponization and can be presented as a respirable aerosol.
  - Terrorists have an even broader spectrum of zoonotic agents from which to choose than military weaponeers. The zoonotic pathogens are usually deployed in the form of aerosols.
- Disease epidemics caused by the outbreak of zoonotic diseases also result in **economic losses**.
  - Endemic zoonotic diseases have the dual impact of causing illness and death in humans and animals as well as substantial economic loss in resource-poor societies where livestock farming is a major engine of economic growth at the household and national levels.

## Zoonotic Disease prevalent in India

Some of the zoonotic diseases which are prevalent in India are Nipah virus, Avian Influenza, Rabies, Japanese encephalitis, Leptospirosis, Hantavirus, **SARS (Severe Acute Respiratory Syndrome)**, Cysticercosis, Anthrax, Plague, Echinococcosis and Schistosomiasis, Kyasanur forest disease (KFD), etc.

## Prevention Measures against Zoonotic Diseases

More than 220 million people in India depend on forestry and are vulnerable due to contact with wild animals but have no economic capacity to fight disease outbreaks like Kyasanur forest disease (KFD). For millennia, humans have feared the inevitable and unpredictable devastation wrought by infectious diseases emerging from forests and transmitted through wild animals. But there has been a stark increase in the incidence of **Emerging Infectious Diseases (EIDs)** among both humans and domesticated animals in the recent past.

- The **SARS pandemic** in 2003, was a milestone in disease management because it moved disease response beyond national sovereignty. It took close coordination between several state and non-state actors under the guidance of the WHO to get the disease under control.

**One important measure to combat the spread of zoonotic diseases is:**

- The **One Health Zoonotic Disease Prioritization tool** is a semiquantitative tool for prioritization with equal input from represented sectors. It has been developed at the Centers for Disease Control and Prevention (CDC) of the USA.
  - The tool is designed to bring together a multidisciplinary team of professionals from the human, animal, and environmental health agencies and other relevant sectors with a common goal of developing country-specific criteria for ranking zoonotic diseases of greatest national concern.

## Measures to control or regulate the spread of zoonotic diseases:

- A rapid and effective response to endemic and emerging zoonotic diseases relies heavily on timely and efficient surveillance and reporting systems.
- Training of the epidemiologists and the laboratory staff should be undertaken to handle an emergency situation.
- The establishment of effective laboratory systems is critical for a successful zoonotic disease surveillance program.
- Well-functioning and separate national public health and animal health laboratory systems are essential to identify etiologic agents so that appropriate prevention, detection, and response strategies can be implemented.
  - Laboratories should be an integral part of the public health infrastructure with a system for rapid testing of prioritized samples and timely sharing of results.
- An outbreak and emergency management system should be in place to coordinate multi-sectoral response activities at the national to sub-national levels.