

Emergence or re-emergence of zoonoses

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- Emerging zoonoses are defined as “diseases that are caused either by an **apparently new agents** or by a **previously known organisms that appears in places or in species** in which it was previously unknown”.

Factors responsible for the emergence of a zoonotic disease

- Factors responsible for the emergence of a zoonotic disease are usually complex and in general relate to
 - (i) The causative agent itself undergoing changes**
 - (ii) Change in immunological status of population**
 - (iii) Environmental and social changes**

- **Ecological changes** caused by human activities like agriculture and modification of agricultural practices, migration, urbanization, deforestation, dam building, human demographic and behavioral changes, travel and trade, technology and industry as well as natural disasters like floods and earthquakes, and breakdown of public health measures are among the most frequently identified factors in the emergence of zoonoses.
- The factors that modify the natural equilibrium or natural ‘echo-niche’ are often at the origin of outbreaks of unknown diseases with high case-fatality rates.
- E.g., Deforestation in state of Karnataka and emergence of Kyasanoor forest disease.
- Leptospirosis appears to be on the increase in Kerala, Tamil Nadu and the Andamans during the last two decades, probably due to increased farming activity and inadequate rodent control.
- The incidence of leptospirosis and Japanese encephalitis in Asia, is closely associated with rice field irrigation.

- **Human population movements** caused by migration or war are often important factors in the emergence of a new disease.
 - Urbanization has led to **mass movements** of workers from rural areas to cities.
 - E.g., outbreaks of brucellosis in urban communities

- **The continuous spread of human populations to new areas** is also a factor to consider in the emergence of new zoonoses.

E.g., Outbreaks of vampire bat rabies occurred in Peru and Brazil following settlement of new agricultural communities in the remote jungle.

- **Farming of new animal species** may also lead to outbreaks of new diseases.
 - E.g., An outbreak of Congo-Crimean haemorrhagic fever occurred in a slaughterhouse that specialized in slaughtering ostriches in South Africa.

- **Continuing industrialization of food processing** has helped to create ecological niches for previously suppressed pathogens.
 - E.g., emergence of new food-borne pathogens like *Listeria monocytogenes*, *E. coli* 0157:H7 and *Campylobacter* spp. New pathogenic strains continue to emerge, such as *Salmonella enteritidis* and *S. typhimurium* DT104.

➤ **Rapid globalization of infectious agents**

- Large amount of human flux associated with the dramatic reduction in the time to travel over long distances, has increased the possibility of the rapid globalization of infectious agents.
- E.g., SARS, Ebola

➤ **Increasing international trade** in live animals and foodstuff has favoured the spread of enteric zoonotic infections especially salmonellosis, campylobacteriosis etc.

➤ **The changing pre and post harvest technology** and manufacturing practices have drastically changed the disease patterns.

➤ **Advance technology of investigation and identification:** Recognition of zoonotic diseases may also be related to a better technology of investigation and identification of the pathogens. Many new infectious agents have been identified following carefully conducted epidemiological investigations. e.g. cat scratch disease and hantavirus pulmonary syndrome.

- **The breakdown of public health measures** and deficiencies in public health infrastructure are also associated with disease emergence and re-emergence.
- In the Indian context, plague re-appeared in two outbreaks in Maharashtra and Gujarat in 1994 indicating a breakdown of the public health measures.
- **Changes in food chain** will continue to create opportunities for the emergence of new diseases and the re-emergence of old diseases.
- Forecasts of likely future pathogen threats include bacteria (*Citrobacter freundii*, *Arcobacter butzleri*, *Salmonella*), some viruses, parasites and prions

- **Microbial adaptation** at molecular level such as genetic drift and shift and enhancing the virulence or acquisition of multidrug resistance are some of the most important factors associated with the emergence of new zoonoses.
- E.g., New variants and recombinant strains of Influenza viruses after genetic shifts and drifts causing worldwide pandemics.
- Microorganisms are also adapting to the traditional methods of prevention and control of food borne pathogens including refrigeration, heat, pH and disinfection techniques.