Popular Article

New Emerging Diseases: A Global Challenge

Rahul G Kadam; Amit Raj Gupta, Saurabh Zingare, Kruti Debanath Mandal, Vinod Kumar; and Dayanidhi Jena*
Assistant professor, Unit of TVCC, Faculty of Veterinary and Animal sciences, RGSC, BHU, Varanasi
*Professor and In-Charge unit of TVCC, FVAS, RGSC, BHU

Corresponding author: Rahul G Kadam, Email: *samerahul@rediffmail.com

Introduction

Emerging and re-emerging infectious diseases are now among the greatest threats to global health, food security, and socio-economic stability. An "emerging disease" is one that has newly appeared in a population or has existed but is rapidly increasing in incidence or geographic range. They may arise from microbes jumping from animals to humans (zoonoses), or from existing pathogens that acquire new virulence through mutation or resistance. The 21st century has witnessed several high-profile outbreaks—SARS (2002–2003), H1N1 Influenza (2009), Ebola (2014–16), Zika (2015–16), COVID-19 (2019 onwards), and monkeypox (2022) each reminding us of the unpredictability of infectious agents. Alongside these, the silent pandemic of antimicrobial resistance (AMR) is growing unchecked. Understanding the epidemiology, risk factors, clinical manifestations, diagnosis, prevention, and management of such diseases is essential. The One Health concept, which integrates human, animal, and environmental health, is the cornerstone of tackling these modern health threats.

Emergence and Global Spread

The sudden appearance of new diseases is rarely random; instead, it reflects a complex interplay of ecological and social factors that shape the interactions between pathogens, hosts, and the environment. Climate change is one of the most critical drivers. Rising global temperatures, altered rainfall patterns, and extreme weather events expand the habitats of arthropod vectors such as Aedes and Culex mosquitoes and ticks, facilitating the northward spread of diseases like malaria, dengue, chikungunya, Lyme disease, and West Nile fever into regions previously considered non-endemic These changes also extend the seasonal windows for transmission, thereby increasing the risk of outbreaks. Global travel and trade further amplify these risks. In today's

interconnected world, an infected person can board an airplane and carry a pathogen across continents within a day. This phenomenon was starkly demonstrated during the COVID-19 pandemic, where a local outbreak in Wuhan, China, rapidly escalated into a global health emergency due to unrestricted international travel. Historical precedents exist as well; the rapid spread of the 2009 H1N1 influenza pandemic was closely linked to air travel networks, highlighting how modern mobility reshapes epidemiological patterns. Another major driver is urbanization and high population density. The growth of megacities, particularly in low- and middle-income countries, has created environments ripe for the transmission of infectious diseases. Informal settlements often lack basic infrastructure such as clean water, sanitation, and waste management, leading to outbreaks of enteric pathogens including cholera, typhoid, and hepatitis E. Crowded living conditions, coupled with inadequate health services, increase the potential for both endemic and emerging pathogens to spread swiftly.

Deforestation and wildlife contact have also been repeatedly implicated in zoonotic spillover events. Large scale land use changes and encroachment into forest ecosystems force wildlife reservoirs such as bats, rodents, and primates into closer contact with humans. This ecological disruption creates opportunities for cross-species transmission. For example, Pteropus fruit bats have been identified as reservoirs for the Nipah virus in South Asia, with spillover occurring through contaminated fruit or livestock intermediaries. Similarly, Ebola virus outbreaks in Central and West Africa have been linked to increased human exposure to fruit bats and other wildlife following deforestation and hunting activities.

Finally, intensive animal farming systems present unique risks. The industrial production of poultry and swine under crowded and stressful conditions provides ideal environments for rapid viral replication, recombination, and mutation. This has been particularly evident in the emergence of avian influenza strains such as H5N1 and H7N9, which not only devastate poultry industries but also spill over into humans with high fatality rates. Pigs, in particular, are considered “mixing vessels” for influenza viruses, allowing for reassortment between avian, swine, and human influenza strains—creating the potential for novel pandemic strains. Together, these ecological and anthropogenic factors underscore the One Health perspective, which recognizes the interdependence of human, animal, and environmental health. By understanding how human activities alter disease ecology, we can better anticipate, monitor, and

prevent future outbreaks.

Prominent Examples of Emerging Diseases

The different species of warm blooded animals live in cold environments and have adapted in many ways to survive the harsh climate and conditions. They can survive in the harsh cold climate because of their thick fur, short extremities, adipose tissue and many other adaptive features.

1. COVID-19 (Coronavirus Disease 2019)

• Caused by SARS-CoV-2, first identified in Wuhan, China in December 2019.

• Spread rapidly to all continents, infecting hundreds of millions.

• Symptoms range from mild flu-like illness to severe pneumonia, ARDS, and multi-organ failure.

•Introduced widespread vaccination campaigns with novel mRNA vaccines.

• Socio-economic impact: unprecedented global lockdowns, disruption of education, mental health crises.

2. Nipah Virus (NiV)

• First identified in Malaysia in 1998; bats are the natural reservoirs.

• Human cases frequently reported in Kerala, India, with high fatality rates (40–75%).

• Transmission through bat-contaminated fruit, direct contact with infected pigs, or human-to-human spread.

• Symptoms: fever, headache, neurological involvement, encephalitis.

• No specific treatment; only supportive care available.

3. Monkeypox (Mpox)

• Orthopoxvirus closely related to smallpox virus.

• Previously confined to Central and West Africa but spread globally in 2022.

• Transmission: close contact with infected individuals or animals.

• Symptoms: fever, rash, lymphadenopathy.

• Although less severe than smallpox, global outbreaks raised alarm about zoonotic poxviruses.

4. Avian Influenza (Bird Flu)

• Caused by highly pathogenic avian influenza viruses like H5N1, H7N9.

• Sporadic human cases with very high fatality rates.

• Poultry farming and migratory birds are major risk factors.

• Pandemic potential due to chances of viral reassortment.

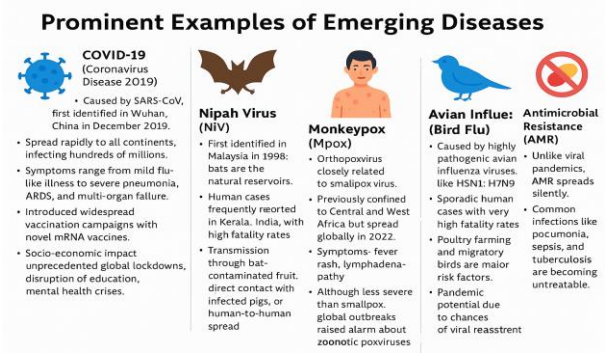
5. Antimicrobial Resistance (AMR)

• Unlike viral pandemics, AMR spreads silently.

• Common infections like pneumonia, sepsis, and tuberculosis are becoming untreatable.

• Overuse of antibiotics in humans and livestock fuels resistance.

• WHO warns of a “post-antibiotic era” where minor infections could once again become deadly.



Risk Groups

While emerging diseases have the potential to affect individuals across all age groups and communities, certain populations remain at a significantly higher risk of developing severe illness. Elderly individuals, particularly those above 60 years of age, often experience worse outcomes due to age-related decline in immunity. Similarly, young children, especially those under five years, are highly vulnerable because their immune systems are still developing. People living with chronic health conditions such as diabetes, cancer, kidney disorders, or hypertension are more susceptible to complications once infected. The situation is even more critical for immunocompromised individuals, including organ transplant recipients and patients with HIV/AIDS, who may lack the ability to mount effective immune responses. In addition, healthcare workers and frontline responders face increased risk owing to repeated occupational exposure. Finally, rural communities with frequent contact with animals, limited healthcare infrastructure, and inadequate disease surveillance are disproportionately affected, making them an important focus group for prevention and control strategies.

Symptoms and Clinical Signs

Although the clinical manifestations of emerging diseases vary depending on the causative agent, many share overlapping features that complicate early diagnosis. General symptoms such as fever, fatigue, headache, and muscle pain are frequently observed across viral and bacterial infections. Several diseases, including COVID-19 and influenza, present with prominent respiratory involvement, often characterized by cough and breathlessness, which may progress to pneumonia in severe cases. Others, like Nipah virus, rabies, and West Nile virus, show significant neurological signs, ranging from confusion and seizures to paralysis and encephalitis. Infections such as Zika virus and cholera are more likely to produce gastrointestinal disturbances, including nausea, vomiting, and diarrhea. Certain pathogens, notably mpox and Zika, are associated with distinct dermatological features like rashes and skin lesions. Importantly, in severe cases, these diseases can progress to multi-organ failure, coma, or even death, underscoring the need for vigilant clinical monitoring and rapid intervention.

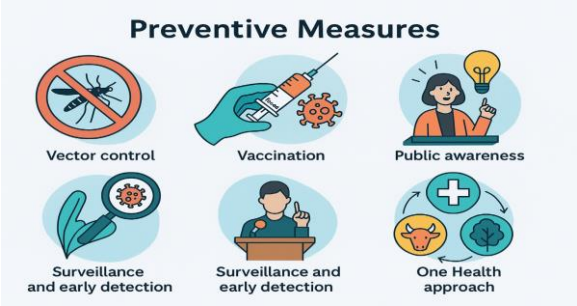
Diagnosis

The diagnosis of emerging infectious diseases requires a combination of clinical evaluation, laboratory investigations, and advanced molecular techniques. A detailed clinical history often provides the first clue, with emphasis on recent exposure to animals, travel to endemic regions, or contact with vectors such as mosquitoes and ticks. This is followed by laboratory testing, where methods like RT-PCR are widely used for the detection of pathogens such as COVID-19, Nipah virus, and influenza, while serological assays including ELISA remain important for infections like Zika and m.pox. In specialized settings, virus isolation may be

performed in reference laboratories to confirm the diagnosis. Accurate results also depend on proper sample collection, with blood, throat or nasal swabs, cerebrospinal fluid in cases of neurological involvement, and urine being the most commonly tested materials. In recent years, genome sequencing has emerged as a critical tool, not only in confirming infections but also in tracking viral evolution and the emergence of new variants, as demonstrated extensively during the SARS-CoV-2 pandemic.

Preventive Measures

The prevention and control of emerging diseases demand a comprehensive, multi-pronged strategy. Vector control remains fundamental, involving the elimination of mosquito breeding sites, targeted insecticide spraying in high-risk zones, and personal protective measures such as insecticide-treated nets and repellents. Vaccination has proven highly effective against certain infections, including COVID-19, influenza, and human papillomavirus (HPV), while ongoing research continues to focus on developing vaccines for diseases such as Nipah and Zika. Equally important is surveillance and early detection, which require continuous monitoring of animal reservoirs and human populations, coupled with genomic surveillance to identify novel variants and track their spread. Public awareness also plays a critical role; community education on hygiene, sanitation, and safe practices helps reduce transmission, while efforts to counter misinformation about vaccines and treatments build public trust in health interventions. Finally, the One Health approach, which integrates veterinary, medical, and environmental sciences, is essential for managing zoonotic spillovers like Nipah, Avian influenza, and rabies, ensuring that human, animal, and ecosystem health are addressed in a coordinated manner.



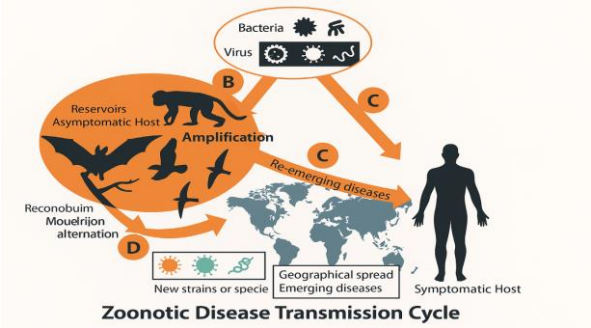
Treatment and Supportive Therapy

For most emerging diseases, the absence of specific antiviral drugs or licensed vaccines apart from a few exceptions such as COVID-19 and influenza means that management primarily relies on supportive care. Treatment usually begins with symptomatic relief, including the use of antipyretics to reduce fever and analgesics to manage pain. In patients with severe respiratory involvement, oxygen therapy or mechanical ventilation may be necessary to combat pneumonia and acute respiratory distress. Neurological complications are addressed with anticonvulsants to control seizures, while hydration therapy, both oral and intravenous, is critical to correct fluid and electrolyte imbalances. Preventing secondary bacterial infections through appropriate antibiotic use is another important aspect of care. Finally, long-term cases often benefit from rehabilitation programs, including physiotherapy to restore muscle strength and improve recovery in patients affected by paralysis or prolonged weakness.

Transmission Cycle (Generalized for Emerging Zoonoses)

Wildlife reservoirs (bats, birds, rodents) → Intermediate hosts (pigs, poultry, cattle) → Vectors (mosquitoes, ticks) → Humans → Human-to-human transmission (respiratory droplets, body fluids, contact).

This interconnected cycle demonstrates why zoonotic diseases are the majority of emerging infections and why breaking the chain at multiple points is vital.



Conclusion

Emerging diseases are no longer rare events they are becoming a defining feature of the modern world. Their roots lie in human activity, environmental change, and microbial adaptability. Strengthening research, surveillance, vaccination programs, and public health preparedness is critical to future resilience. Above all, the One Health approach acknowledging that the health of people is closely connected to the health of animals and our shared environment offers the most promising path forward. The next pandemic is not a question of "if," but "when." Being prepared is our only shield.