



International Journal of Veterinary Sciences and Animal Husbandry



ISSN: 2456-2912

NAAS Rating (2026): 4.61

VET 2026; 11(6): 15-22

© 2026 VET

www.veterinarypaper.com

Received: 10-03-2026

Accepted: 13-04-2026

Dhinesh R

MVSc Scholar, Dept. of
Veterinary Public Health and
Epidemiology, RIVER,
Puducherry, India

Bhanu Rekha V

Professor and Head, Dept. of
Veterinary Public Health and
Epidemiology, RIVER,
Puducherry, India

Nithya Quintoil M

Assistant Professor, Dept. of
Veterinary Public Health and
Epidemiology, RIVER,
Puducherry, India

Deepan G

Project Research Scientist I,
ICMR- National Institute of
Epidemiology, Chennai, Tamil
Nadu, India

Corresponding Author:

Dhinesh R

MVSc Scholar, Dept. of
Veterinary Public Health and
Epidemiology, RIVER,
Puducherry, India

One health approach to monkey pox virus: Interaction between wildlife, human and environment

Dhinesh R, Bhanu Rekha V, Nithya Quintoil M and Deepan G

DOI: <https://www.doi.org/10.22271/veterinary.2026.v11.i6a.3306>

Abstract

Mpox (monkeypox) is a re-emerging zoonotic viral disease caused by the monkeypox virus (MPXV), a member of the genus Orthopoxvirus in the family Poxviridae. Historically confined to Central and West Africa, mpox has gained global significance following widespread outbreaks beyond endemic regions, particularly since 2022. The virus affects both humans and animals, with rodents likely serving as natural reservoirs, and transmission occurs through direct contact with infected animals, humans, or contaminated materials. Clinically, mpox presents with fever, lymphadenopathy, and a characteristic vesiculo-pustular rash. Declining smallpox immunity, increased human-animal interactions, environmental changes, and global travel have contributed to its resurgence. Diagnosis relies primarily on PCR-based detection, while management is largely supportive, with antivirals reserved for severe cases. Prevention includes vaccination, isolation, and infection control measures. Given its zoonotic nature, effective control of mpox requires a comprehensive One Health approach integrating human, animal, and environmental health to enhance surveillance, preparedness, and outbreak response globally.

Keywords: Mpox, One Health, Zoonosis, Public Health, PCR Diagnosis

1. Introduction

The origin of the monkeypox virus (MPV), a type of orthopoxvirus in the Poxviridae family. It belongs to the same genus as cowpox, variola, and vaccinia viruses. Initially documented in 1958 in monkeys imported to Southeast Asia from Africa. Monkey Pox Virus has produced intermittent infections and outbreaks since the first human case was discovered in the Democratic Republic of the Congo in 1970. The majority of the outbreaks were limited to countries in west and central Africa, particularly among youngsters living in tropical and rainforest areas. Immunity against the disease was granted by the smallpox vaccination. The WHO designated monkeypox as a Public Health Emergency of International Concern in July 2022 because of the disease's extraordinary global spread outside of Africa's endemic countries and the necessity of international cooperation to combat this neglected illness (Mitjà, O., Ogoina *et al.*, 2023).

Ten cases of human monkey pox were reported from Western African nations between 1970 and 1986, while 394 cases were reported from the Central African Republic, Cameroon, and Zaire (now the Democratic Republic of the Congo), which are all part of the American Journal of Infectious Diseases and Microbiology. Prior to 2003, when the first cases were documented in the Western Hemisphere, monkeypox was only found in the rain forests of central and western Africa. Several people in the Midwestern United States were found to have contracted fever, rash, respiratory symptoms, and lymphadenopathy in late spring 2003 after coming into contact with sick pet prairie dogs (a rodent of the *Cynomys* species) that were infected with the monkeypox virus. (Pal, M., *et al.*, 2013).

The World Health Organization designated mpox a public health emergency of international concern due to the circumstances and potential additional channels of transmission beyond intimate contact, such as sex [9-12]. As of February 4, 2024, 117 nations had recorded 92,546 cases, and 25 countries had confirmed 170 deaths (Aldana, J. R *et al.*, 2014) [2].

Direct contact with skin wounds, scabs, rashes, saliva, respiratory secretions, and bodily secretions through ingestion of contaminated tissues and animal bites is the primary way that MPX is spread from infected animals to people. Close contact with infected individuals who have skin lesions or other places, including the mouth or genitals, is linked to transmission in humans. The virus enters through the respiratory system, the wounded skin, and mucous membranes, including the oral, pharyngeal, ophthalmic, genital, and anorectal. (Martínez-Fernández *et al.*, 2023) ^[29]

Addressing zoonotic illnesses requires a One Health approach. One Health acknowledges that many diseases are common to both humans and animals, and that knowledge of how these diseases spread and how to prevent them is essential. There are substantial knowledge gaps and a wide range of public awareness and comprehension regarding Mpox, especially in non-endemic areas. Healthcare professionals around the world frequently lack basic understanding of Mpox transmission, clinical manifestations, and preventative strategies. Delays in interventions and a higher risk of transmission can result from this ignorance, which can also impede early identification and proper management of Mpox patients. In order to prevent and eradicate Mpox worldwide, One Health initiatives must be implemented in all health sectors (Islam S. M. & Rahman M. T., 2024) ^[21]

Etiology of Monkey Pox Virus

MPV is a large, enveloped virus with double-stranded linear DNA encased in a lipoprotein membrane. The virus is characteristically large measuring between 200 and 250 nanometers and exhibits an ovoid to brick-shaped morphology. The mpox virus is genetically and antigenically related to the variola virus, the causative agent of smallpox. Due to this close relationship, mpox infection in humans can produce clinical manifestations similar to smallpox, though typically with lower mortality and severity. The virus demonstrates a notable ability to adapt to diverse hosts and environmental conditions, contributing to its zoonotic potential.

Unlike most DNA viruses, the mpox virus carries a complete set of enzymes required for viral replication, transcription, and assembly, allowing these processes to occur entirely within the cytoplasm of infected host cells. However, despite this high level of replication autonomy, the virus remains dependent on host cellular ribosomes for the translation of viral mRNA into proteins.

The virus is divided into two separate clades: Clade I (formerly Congo basin clade) which includes subclades Ia and Ib and is associated with higher virulence and transmissibility. Clade II (formerly the West African clade), comprising subclades IIa and IIb, which generally cause milder disease). (Hirani R. *et al.*, 2023) ^[15]

Epidemiology

The first case of monkeypox in the WHO's South-East Asia Region was recorded in India, when a 35-year-old male from the UAE visited Kerala. The person experienced a fever and rashes, which finally cleared up, and he or she fully recovered. Following this, 25 cases were reported across India, including New Delhi, Uttar Pradesh, Bihar, Telangana, and Rajasthan. The majority of those infected had travelled international (Kumar *et al.*, 2023) ^[25]

In Humans

Since its discovery in the 1970s, the majority of cases have occurred in Central and West Africa, with only intermittent outbreaks recorded. However, the 2022 outbreak saw over 94, 297 mpox cases reported worldwide in 118 countries, marking a record epidemic. Prior to 1970, endemic mpox caused rare human infections in African rainforests, with the first case described in the Democratic Republic of the Congo. Subsequent outbreaks were infrequent, with roughly 500 illnesses documented during a 1996-1997 epidemic in the Democratic Republic of Congo. Nigerian instances also increased 20-fold between 2006 and 2007, indicating rising regional occurrences. The 2022 rise is unknown, but decreases in smallpox immunization may allow orthopoxvirus re-emergence alongside new viral mutations, climate conditions, population movement, and declining herd immunity against mpox. ^[10] 2024. Several parts of the world are currently experiencing a new monkeypox virus (MPV) outbreak. The World Health Organization (WHO) has received reports of 3, 040 cases worldwide since the start of May 2022. The virus has so far been found in 47 countries, including those in Europe, America, Oceania, and Asia, where monkeypox is rare or has not yet been documented, in addition to its typical "endemic" basis in Africa. The WHO Emergency Committee unanimously recognized the emergency nature of the outbreak and agreed that a strong response would be necessary to stop its further spread, but on June 25, 2022, the committee concluded that the outbreak did not now qualify as a Public Health Emergency of International Concern. ^[2] 2022. In 2024, a severe Mpox outbreak occurred in the DRC and other African countries. The WHO has declared a Public Health Emergency of International Concern (PHEIC) for the viral outbreak, which is largely caused by the clade I strain and has a high death rate of 3% to 4%. The global response to the Mpox outbreak was coordinated by international health institutions, notably WHO and Africa Centres for Disease Control and Prevention (Krishna *et al.*, 2024) ^[24]

In Animals

Mpox (monkeypox) was originally discovered in Denmark in 1958 in captive cynomolgus macaques brought from Malaysia. The first wild animal case occurred in 1985 with a rope squirrel in the Democratic Republic of the Congo (DRC), followed by a sooty mangabey in Côte d'Ivoire in 2012. Field research in the Democratic Republic of the Congo indicated a 24.7% seropositivity rate in rope squirrels, implying that they, like sun squirrels and non-human primates, may serve as virus reservoirs. While mpox has been detected in animals imported from Malaysia, India, and Singapore, no local animal infections have been recorded in these countries. In August 2022, human-to-dog transmission instances were reported in France and Brazil. The majority of animal cases have been documented in the United States and Central African countries such as the Democratic Republic of the Congo and Cameroon. (Aldana *et al.*, 2024) ^[2]

Pathogenesis

Monkey Pox Virus attacks mucosal surfaces in the oral and respiratory tracts, predominantly affecting airway epithelium and skin cells (keratinocytes, fibroblasts, and endothelial cells), and spreads through the bloodstream. The virus comes in two forms: mature virions (MV/IMV) and encapsulated virions (EV/EEV/CEV). Infection begins with EEV binding to host cell glycosaminoglycans, which is followed by viral

entry and uncoating. Early gene expression weakens host defense and allows DNA replication. This results in the synthesis of intermediate and late mRNA, which generate structural proteins. Microtubules convey new virions to the cell membrane, where they combine and induce actin polymerization to release the virus. (Islam M. M. *et al.*, 2023)^[21]

Transmission

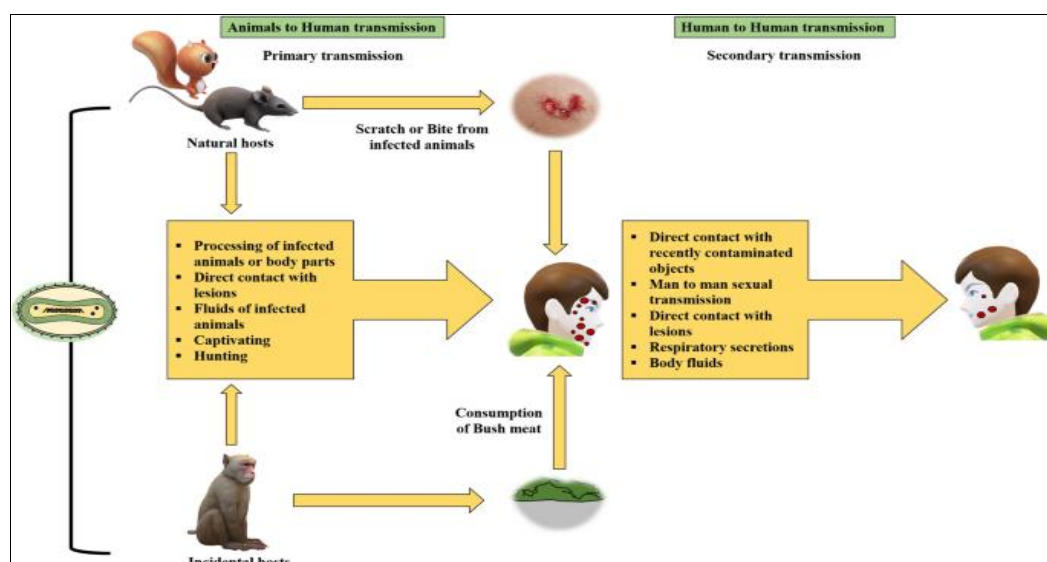
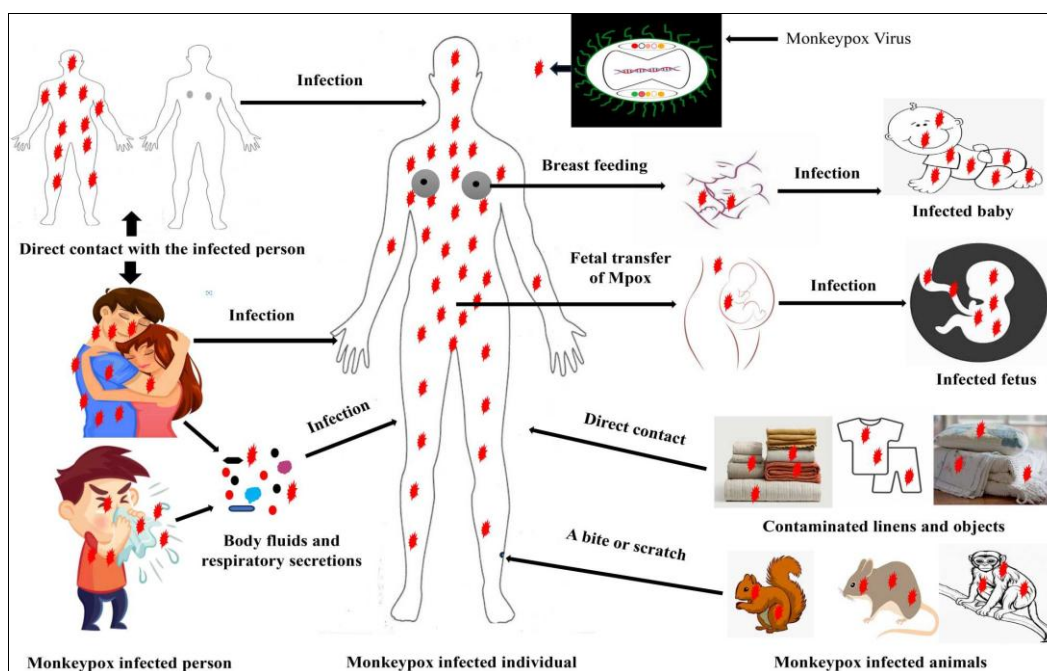
Animal to human transmission

Monkey pox virus transmission from animal to human occurs when infected animals' blood, body fluids, or lesion material come into direct touch with humans. The native animal reservoir is unknown, however African rodents and nonhuman primates may harbour and transmit the virus to humans. Hunting these animals or handling their raw meat

can cause human infection. Bites and scrapes from infected animals can potentially spread the infection. Evidence suggests that the virus occasionally spreads from its animal reservoir to humans.

Human to human transmission

Direct contact with infected individuals' skin lesions and respiratory secretions, as well as contaminated objects, such as clothing, provide major risks for monkeypox transmission. Monkey pox is an infectious disease that can be contracted by exposing the host's oropharynx, respiratory mucosa, damaged skin, or mucous membranes. Furthermore, monkey pox can be transmitted vertically during pregnancy via the placenta, a condition known as congenital monkeypox. Infectious disease transmission rates vary based on economic, social, and environmental factors (Martínez-Fernández *et al.*, 2023)^[29]



Monkey pox virus in wild animals

Mpox is a zoonotic disease, however its ecology is still poorly understood. MPXV can infect a wide range of mammalian species, with rodents being the most likely reservoir of the virus, however primates have also been regarded as potential reservoirs. Despite years of epidemiological observation for

MPV, the virus's unique reservoir species have yet to be reliably identified. This is a significant hurdle to understanding the ecology of this virus, and it requires immediate attention. Furthermore, the geographic isolation of clade I and clade II viruses suggest that the reservoir(s) may be separate for each clade. (Martínez-Fernández *et al.*, 2023)^[29]

Wildlife human interaction

Two putative wild reservoir species captured in the DRC, Emin's pouched rats (*Cricetomys emini*) and thicket rats (*Grammomys surdaster*) are being under study for understanding the transmission. Further animal research could highlight the most likely pathways of transmission, allowing us to better understand how long these animals can keep and shed the virus, as well as simulate MPXV maintenance and transmission in different species. This research could also be used in conjunction with other field studies to better understand the ecology and social behaviour of these host species, as well as human interactions with them. The practical use of this information about native host species could include educational campaigns for African bush meat consumers. (Hutson C. L. *et al.*, 2015)^[18]

Clinical manifestation

In Humans

Monkey Pox Virus symptoms typically appear during 1-14 days of incubation, but can last up to 21 days. The sickness begins with fever, headaches, muscle pain, and a rash. Rash typically arises one to three days after fever and affects the face, mouth, eyes, legs, hands, chest, anus, and genitalia. This rash begins as a flat macula, progresses to a papule, and eventually becomes a transparent liquid-filled vesicle. After that, the clear liquid becomes yellow and forms pustules. Once sores, pustules, and crusts are removed, the patient is no longer considered contagious (Yusuf-Isleged *et al.*, 2024)^[52]

In Animals

In pets, monkey pox virus symptoms may include rash, lethargy, loss of appetite, coughing, bloating, nasal and/or ocular secretions or crust, fever, and/or pox-like skin lesions (which may initially resemble a pimple or blister). If your pet had intimate contact with a person with probable or proven mpox and they have a new rash or two other symptoms, your pet should be tested for monkey pox virus. (CDC, 2023) MPXV can induce fever, lymphadenopathy, enanthem, and exanthem in many mammalian species, yet some are asymptomatic. MPXV is an amphixenosis, which is a sort of zoonosis that can be transmitted from animal to human. The research is unclear, although squirrels are the most likely reservoir hosts. Rope squirrels infected with MPXV shed high quantities of the virus for 5-22 days, resulting in constitutional symptoms, lymphadenopathy, and rash. Intranasal infections resulted in moderate to severe morbidity and a 75% death rate.

MPXV in prairie dogs is similar to clade I MPXV in people; the animals exhibit constitutional symptoms (fever, tiredness) throughout the prodromal period before developing skin lesions. (Falendysz *et al.*, 2023)^[12]

One Health Surveillance Systems for Mpox

As mpox spreads among animals, people, and the environment, One Health surveillance systems are becoming more and more crucial to the disease's containment. By connecting veterinary, medical, and environmental monitoring systems, a robust surveillance system aids in the early detection of outbreaks and stops their wider spread.

Surveillance is still disjointed in many endemic areas, particularly in Central and West Africa. Early epidemic detection is delayed because the human and animal health sectors sometimes operate independently. In the Democratic Republic of the Congo, poor sectoral coordination has led to underreporting and a delayed response to mpox epidemics

(Durski *et al.*, 2018)^[10]. This demonstrates the significance of integration for prompt action.

By implementing One Health-based surveillance techniques, nations like Nigeria have demonstrated progress more recently. According to (Ogunleye *et al.*, 2024)^[33], integrating veterinary records with human case detection facilitated the early detection of outbreaks and enhanced response times. Health officials can better understand how the virus is spreading among other species thanks to this type of cooperation.

Global organizations that prioritize data exchange and coordinated surveillance systems include the WHO, 2022, and the WHO-FAO-WOAH Tripartite framework (2019). These days, epidemic tracking is improved by the use of real-time data systems, mobile health apps, and digital reporting technologies. According to (Husein *et al.*, 2023), these instruments greatly shorten the time it takes to detect zoonotic outbreaks. All things considered,

One Health surveillance serves as the "early warning system" for mpox, making sure that outbreaks are identified before they develop into significant public health crises.

Socioeconomic and Behavioral Drivers of Mpox Transmission

The transmission of mpox is largely influenced by social factors and human activity. Due to cultural customs, dietary preferences, and financial necessities, people in many areas coexist closely with wildlife. Consuming bushmeat, which comes from hunting and eating wild animals, is one of the most significant risk factors.

Because bushmeat hunting puts people in close proximity to possible animal reservoirs, it greatly raises the danger of zoonotic illnesses, including mpox. Furthermore, human populations are being pushed closer to forest areas due to increased urbanization, which raises the possibility of spillover incidents.

Another significant factor is deforestation. Animals lose their native habitat and frequently relocate closer to human settlements when forests are removed for development or agriculture. (Olivero *et al.*, 2022)^[35] discovered that the probability of mpox transmission was higher in Central African regions with higher rates of deforestation.

The rate at which the illness spreads among people is also influenced by behavioral factors. Many people postponed seeking medical attention during the 2022 global pandemic due to stigma and false information. According to (Focosi *et al.*, 2022)^[13], underreporting and concealed transmission chains occurred in a number of nations due to fear and misinformation about the illness.

Another issue is exposure at work. Due to their frequent contact with animals or diseased patients, people including hunters, animal traffickers, veterinarians, and healthcare professionals are more vulnerable. The significance of awareness campaigns and preventative interventions for these high-risk groups was emphasized by (Yadav *et al.*, 2022)^[51].

To put it briefly, mpox is not just a biological problem; human behavior, culture, and socioeconomic circumstances also have a significant impact.

Environmental and Climate Change Drivers of Mpox Emergence

The resurgence of mpox is closely linked to environmental factors. Deforestation, mining, and agricultural growth are examples of human activities that disrupt natural ecosystems and increase human contact with wildlife reservoirs.

According to Hemati *et al.*, (2024)^[14], one of the main causes of mpox epidemics is environmental upheaval, which pushes wildlife species particularly rodents closer to people. Spillover infections are more likely as a result.

Deforestation is very significant. Rodent populations suspected of transmitting the virus frequently relocate toward human settlements when forest areas are destroyed. (Olivero *et al.*, 2022)^[35] showed a direct connection between Central African mpox risk and forest destruction.

Another factor is climate change. Rodent and other wildlife population numbers and travel habits can be affected by variations in temperature and precipitation. Changes in mpox case patterns are linked to specific environmental variables, such as increased humidity and temperature variability (Islam *et al.*, 2022)^[22].

Contamination of the environment is another issue. Contaminated materials like soil, garbage, or animal remains can harbor virus particles. Indirect transmission concerns result from this. According to (Tiwari *et al.*, 2023)^[35], environmental surveillance including wastewater monitoring is starting to play a significant role in monitoring the spread of illness within communities.

Environmental and climatic conditions are a fundamental component of the One Health strategy since they influence the location and mode of mpox outbreak.

Wastewater and Environmental Surveillance for Mpox

A contemporary and promising method for monitoring the spread of mpox in populations is wastewater surveillance. It functions by identifying viral genetic material in sewage systems, which can offer early indicators of infection even prior to the reporting of clinical cases.

According to (Tiwari *et al.*, 2023)^[35], wastewater contains monkeypox virus DNA, indicating that afflicted people release the virus into the environment. This approach is particularly helpful in cities where it is possible to effectively monitor huge populations.

The fact that wastewater surveillance does not rely on individual testing is one of its key benefits. It can provide early warning indicators and identify outbreaks at the community level. Interpretation is not always easy, though. Viral DNA does not necessarily indicate active infection or transmission.

Hemati *et al.*, (2024)^[14] noted that in order to prevent drawing incorrect inferences, wastewater data must be examined in conjunction with clinical and epidemiological studies. Since mpox is a zoonotic illness, determining whether the virus in wastewater originates from humans or animals is another difficulty.

Notwithstanding these drawbacks, environmental surveillance complements conventional public health monitoring methods and is a good fit for the One Health paradigm.

Vaccine Equity and Public Health Preparedness

One of the best ways to avoid mpox is by vaccination, but not everyone has equal access to them. High-income nations have better access, but many low- and middle-income nations where mpox is more prevalent face shortages.

The (WHO, 2024) has highlighted that vaccine distribution remains uneven, limiting global outbreak control efforts. Despite the fact that smallpox vaccinations protect against mpox, it is still difficult to get enough doses in many endemic areas.

According to (Rahi *et al.*, 2023)^[39], this imbalance makes it possible for outbreaks to persist in certain areas while being

contained in others. This reveals a glaring problem of global health disparities.

Early diagnosis, the availability of antivirals, and the preparedness of the healthcare system all play a role in preparedness. (Martínez-Fernández *et al.*, 2023)^[29] stressed that the best methods to stop the spread are still quick case detection and isolation, especially when paired with immunization tactics.

Improving global preparedness requires cooperation between countries, better funding for public health systems, and equitable distribution of medical resources.

Diagnosis

Monkeypox virus is diagnosed using both clinical and laboratory tests. Healthcare providers check for specific symptoms, such as fever, lymphadenopathy, and a unique rash that advances from macules to vesicles and pustules. Laboratory techniques like polymerase chain reaction (PCR) can discover viral DNA in lesion samples, blood, and other physiological fluids, confirming the diagnosis. Serological assays can reveal particular antibodies against the monkeypox virus (Yusuf-Isleged *et al.*, 2024)^[52].

Real-time PCR is the most effective method for detecting MPXV in both people and animals. PCR assays may employ generic primers to target the E9L gene in orthopoxviruses. Commercial laboratories offer general (not clade-specific) MPXV testing. MPXV-specific primers can target distinct genes to identify it from other orthopoxviruses. However, clades I and II have 99% sequence identical, making it tough to distinguish between them. Clades I and II differ in their tumor necrosis factor receptor (TNFR) gene, which is placed at the end of the ITR's linear DNA. The TNFR gene has several SNPs and insertion/deletions (indels) that distinguish clades I and II (Li *et al.*, 2010)^[28].

Treatment

MPX treatment includes symptomatic and supportive, including maintaining hydration and electrolyte balance, nutrition, symptomatic therapy with antipyretics and analgesics, early detection of secondary infections, and timely treatment with suitable antimicrobial drugs (Choudhary *et al.*, 2022)^[8].

Given that most instances of monkeypox are self-limiting, no special antiviral medication is recommended. Antiviral therapy should be explored for patients with severe and progressing illness, the critically immunocompromised, and pregnant women. Antivirals have been used anecdotally to manage MPX in nonendemic regions. In a recent trial, only 5% of patients got antiviral medication (2% intravenous/topical cidofovir, 2% tecovirimat, and less than 1% vaccinia immunoglobulin). The patient's severe epiglottitis improved quickly after receiving tecovirimat (Thornhill *et al.*, 2022)^[44].

Prevention

Prevention of mpox relies on a combination of vaccination, infection control measures, surveillance, and One Health-based public health interventions. Several observational studies have demonstrated that the smallpox vaccine provides approximately 85% protection against mpox, owing to the close genetic and antigenic relationship between variola and monkeypox viruses. Evidence from endemic African regions shows that prior smallpox vaccination significantly reduces the incidence of mpox. Accordingly, the Centers for Disease Control and Prevention (CDC) recommends smallpox

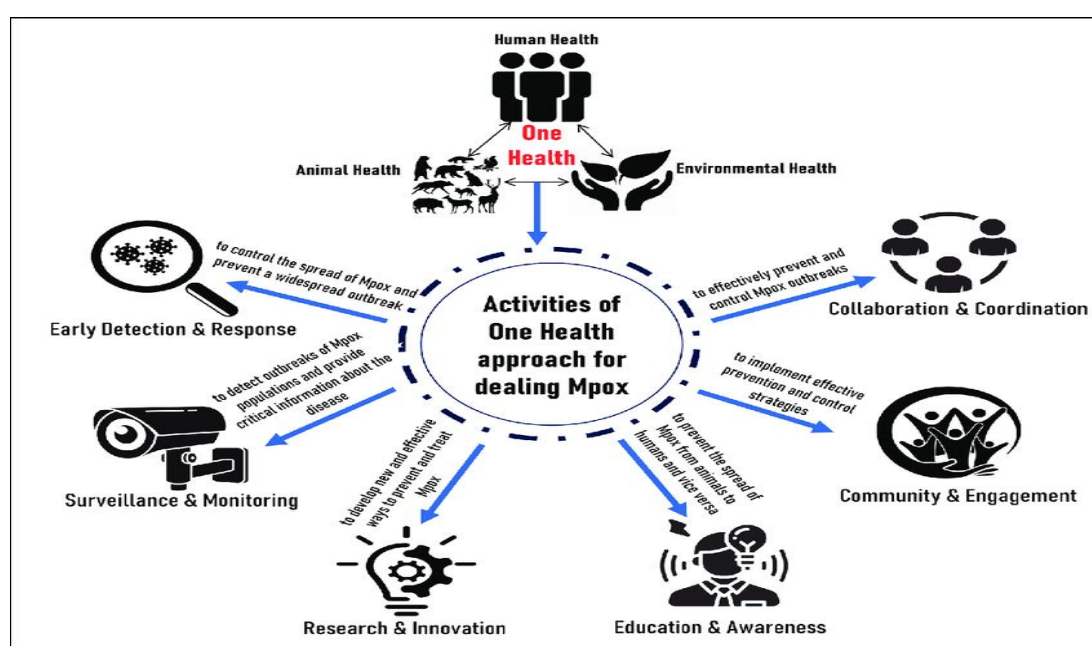
vaccination for individuals involved in outbreak investigations, healthcare workers caring for infected patients, and persons with close or direct exposure to infected humans or animals.

Infected or suspected cases should be isolated in hospital settings or at home, following medical guidance, to prevent further transmission. Home-isolated individuals should remain in well-ventilated separate rooms, avoid close contact, use dedicated utensils, perform personal laundry separately, and disinfect shared facilities after use. Caregivers and close contacts are advised to wear well-fitted medical masks and disposable gloves, ensure that skin lesions are covered, and monitor symptoms for 21 days following the last exposure. The World Health Organization (WHO) recommends post-exposure prophylaxis (PEP) vaccination within four days of exposure to reduce disease severity and transmission.

At the population level, effective mpox prevention requires a One Health approach integrating human, animal, and environmental health sectors. Public health strategies focus on

strengthening diagnostic capacity, early case detection, surveillance systems, immunization coverage, and risk communication, alongside isolation, quarantine, and community engagement to address sociocultural practices that increase transmission risk. Data sharing and interdisciplinary collaboration are essential for timely outbreak response and health system strengthening.

Although mpox is generally self-limiting and often requires only supportive care, antiviral therapies, vaccinia immune globulin, and newer therapeutic options may be considered for high-risk individuals, including the immunocompromised. Currently available vaccinia-based vaccines include live replication-competent and live replication-incompetent formulations, which should be administered cautiously in individuals with immune deficiencies. Continued research and pharmaceutical innovation targeting multiple stages of the viral life cycle remain critical for improving prevention and preparedness against future mpox outbreaks.



Environmental factor and monkey pox spread

Environmental and ecological variables play a crucial role in the ongoing Monkey pox virus epidemics in Africa (S. Hemati, *et al.*, 2024)^[14]. Human activities like deforestation, agriculture, and urbanization have impacted wildlife habitats, changing ecosystems and bringing humans into touch with animals that can carry the monkey pox virus. Deforestation has significantly impacted the transmission of monkey pox virus. Deforestation for agriculture and logging brings MPXV-carrying animal species, such as rats and primates, closer to humans. This increases the risk of virus transmission by contact with infected animals or contaminated environments. Climate change may affect the transmission of the monkey pox virus (Olawade, D. B *et al.*, 2024)^[34]. Climate change can impact wildlife species' distribution and behavior, perhaps expanding the Monkey pox virus range (M. Islam *et al.*, 2022)^[22]. Hunting and bushmeat consumption are cultural and economic practices in these groups, which increase the risk of zoonotic transmission due to regular contact with possible viral reservoirs (D. Focosi, *et al.*, 2022)^[13]. Monkeypox is a zoonotic virus that can spread from animal reservoirs to sewage systems, making it difficult to interpret WBS data for human cases. However, zoonotic infections are typically controlled using a One Health

strategy. If zoonotic diseases are found in any compartment (human, animal, or environment), they can spread to other compartments, posing a risk. As a result, the incidence of zoonotic pathogens such as MPXV must be examined simultaneously throughout all potential compartments. Clinical or wastewater surveillance alone cannot accurately determine the prevalence of zoonotic carriers in communities.

Future Challenges

Surveillance of mpox has faced persistent challenges, including undetected cases, insufficient trained personnel, limited laboratory capacity, misreporting due to weak healthcare systems in developing countries, and inadequate global coordination (Simpson K *et al.*, 2024)^[42]. A critical limitation is the unknown primary source of infection, which hinders effective interruption of transmission chains. Additionally, the true extent of local and asymptomatic transmission remains uncertain, increasing the risk of underdetection. In non-endemic regions such as the United Kingdom, herd immunity is minimal, further amplifying outbreak potential (Idris I *et al.*, 2023)^[19].

Viral evolution poses an ongoing threat, as emerging variants may exhibit increased virulence, immune evasion, diagnostic escape, or resistance to existing vaccines. To enhance

preparedness for future outbreaks, investments are needed in population surveillance, diagnostic infrastructure, laboratory capacity, and viral genomic sequencing, alongside the establishment of standardized systems for rapid diagnostic testing and scalable vaccine production (WHO).

Genomic analyses reveal that Clade IIb MPXV genomes harbor mutations linked to apolipoprotein B editing complex (APOBEC3) activity, an innate antiviral mechanism that targets single-stranded DNA during replication. Although these mutations may restrict viral replication, they also reflect ongoing viral adaptation and increased human-to-human transmission (Duarte PM *et al.*, 2024)^[9].

Orthopoxvirus genomes are highly conserved, resulting in significant antibody cross-reactivity and cross-protection. Among shared antigens, A29 and M1 induce stronger cross-neutralizing immune responses against MPXV, making them promising targets for next-generation orthopoxvirus vaccines. Despite genetic similarities, MPXV contains unique, truncated, or mutated genes absent in vaccinia virus, which can serve as molecular markers for improved differential diagnostics and assay development (Hirani R *et al.*, 2023)^[15].

Conclusion

Mpox (monkeypox) is a re-emerging zoonotic disease that highlights the intricate interdependence of human, animal, and environmental health. The disease typically presents with fever, lymphadenopathy, and a characteristic rash, and its resurgence has been driven by factors such as bushmeat consumption, deforestation, climate change-induced human-animal interactions, and gaps in healthcare and research infrastructure. Formerly confined to endemic regions, mpox has now spread globally, underscoring its significance as an emerging public health threat.

Recent outbreaks emphasize the necessity of a One Health approach to effectively prevent and control mpox. Integrated surveillance, interdisciplinary collaboration, and proactive public health interventions including animal health monitoring, environmental management, and community engagement are essential for early detection and rapid response. Strengthening One Health-based strategies through sustained investment in research, education, and health system capacity will enhance preparedness, reduce transmission, and support a coordinated and sustainable framework for global health security against mpox and other emerging zoonotic diseases.

When viewed through a One Health lens, mpox is not just a viral disease it is a reflection of how humans, animals, and the environment interact. Factors such as deforestation, cultural practices, weak surveillance systems, and unequal healthcare access all contribute to its emergence and spread.

What becomes clear is that controlling mpox requires more than medical treatment alone. It needs early surveillance, responsible environmental management, community awareness, and global cooperation. A truly effective response must integrate human health, animal health, and environmental health into one coordinated system.

Acknowledgement

Not available

Author's Contribution

Not available

Conflict of Interest

Not available

Financial Support

Not available

References

1. Abafi DSO, Adewunmi MO, Michael OO, Kia GSN, Adeyemo OK, Alarape SA, *et al.* Molecular detection of monkeypox virus in wild rodents and humans in Ibadan, Nigeria: A cross-sectional study. *PAMJ One Health*. 2024;13:16.
2. Aldana JR, Ali Al-kassab-Córdova EA, Hernandez-Bustamante EA, Benites-Zapata VA, Copaja-Corzo C, Silva-Cajaleon K, Rodriguez-Morales AJ. Monkeypox in animals: Systematic review. *J Infect Public Health*. 2024.
3. Anil S, Joseph B, Thomas M, Sweetey VK, Suresh N, Walimo T. Monkeypox: A viral zoonotic disease of rising global concern. *Infect Dis Immun*. 2024;4(3):121-131.
4. Bonilla-Aldana DK, Bonilla-Aldana JL, Ulloque-Badaracco JR, Al-kassab-Córdova A, Hernandez-Bustamante EA, Alarcon-Braga EA, *et al.* Mpox infection in animals: A systematic review and meta-analysis. *J Infect Public Health*. 2024.
5. Centers for Disease Control and Prevention. Notes from the field: Responding to an outbreak of monkeypox Nigeria. *MMWR Morb Mortal Wkly Rep*. 2018;67(37).
6. Centers for Disease Control and Prevention. One Health investigation into mpox and pets, United States. *Emerg Infect Dis*. 2023.
7. Centers for Disease Control and Prevention. Interim clinical guidance for treatment of monkeypox.
8. Choudhary G, Prabha PK, Gupta S, Prakash A, Medhi B. Monkeypox infection: A quick glance. *Indian J Pharmacol*. 2022;54(3):161-164.
9. Duarte PM, Adesola RO, Priyadarsini S, Singh R, Shaheen MN, Ogundijo OA, *et al.* Unveiling the global surge of mpox (Monkeypox): A comprehensive review of current evidence. *Microbe*. 2024;4:100141.
10. Durski KN, McCollum AM, Nakoune E, *et al.* Epidemiological and ecological risk factors for human monkeypox in the Democratic Republic of Congo. *Emerg Infect Dis*. 2018;24(8):1458-1463.
11. Eva MA, Ovi MAR, Akhter MS, Tanjin R, Akter R, Samapti MMS, *et al.* Prevention, treatment and management strategies for monkeypox virus infection in pregnant and breastfeeding women: A systematic review. *Adv Infect Dis*. 2025;15(1):110-127.
12. Falendysz EA, Lopera JG, Rocke TE, Osorio JE. Monkeypox virus in animals: Current knowledge of viral transmission and pathogenesis in wild animal reservoirs and captive animal models. *Viruses*. 2023;15(4):905.
13. Focosi D, Novazzi F, Baj A, Maggi F. Monkeypox: An international epidemic. *Rev Med Virol*. 2022;32(6):e2392.
14. Hemati S, Mohammadi-Moghadam F. A systematic review on environmental perspectives of monkeypox virus. *Rev Environ Health*. 2024;39(2):363-370.
15. Hirani R, Noruzi K, Iqbal A, Hussaini AS, Khan RA, Harutyunyan A, *et al.* A review of the past, present, and future of the monkeypox virus: Challenges, opportunities, and lessons from COVID-19 for global health security. *Microorganisms*. 2023;11(11):2713.
16. Husein SA, Alleyo TG, Jilo SA, *et al.* A review on monkeypox: Role of One Health approach against monkeypox. *J Public Health Int*. 2023;6(4):18-29.
17. Hutson CL, Lee KN, Carroll DS, *et al.* Emerging zoonotic infection with rodent reservoirs: Rodent ecology and MPXV. *PLoS Negl Trop Dis*. 2017;11(5):e0005575.

18. Hutson CL, Nakazawa YJ, Self J, Olson VA, Regnery RL, Braden Z, *et al.* Laboratory investigations of African pouched rats (*Cricetomys gambianus*) as a potential reservoir host species for monkeypox virus. *PLoS Negl Trop Dis.* 2015;9:e0004013.
19. Idris I, Adesola RO. Current efforts and challenges facing responses to monkeypox in United Kingdom. *Biomed J.* 2023;46(3):100553.
20. Islam MM, Dutta P, Rashid R, Jaffery SS, Islam A, Farag E, *et al.* Pathogenicity and virulence of monkeypox at the human-animal-ecology interface. *Virulence.* 2023;14(1):2186357.
21. Islam MS, Rahman MT. One Health: A must-needed approach for dealing with monkeypox. *J Res Vet Sci.* 2024;3(2):52.
22. Islam M, Sangkham S, Tiwari A, Vadiati M, Hasan M, Noor S, *et al.* Association between global monkeypox cases and meteorological factors. *Int J Environ Res Public Health.* 2022;19(23):15638.
23. Ismael SS, Sadiq AJ, Barwary NJS. Why did the monkeypox virus raise its head again in 2024? 2024.
24. Krishna S, Kurrey C, Yadav M, Mahilkar S, Sonkar SC, Vishvakarma NK, *et al.* Insights into the emergence and evolution of monkeypox virus: Historical perspective, epidemiology, genetic diversity, transmission, and preventative measures. *Infect Med.* 2024;100105.
25. Kumar A, Borkar SK, Choudhari SG, Mendhe HG, Bankar NJ, Mendhe H. Recent outbreak of monkeypox: Implications for public health recommendations and crisis management in India. *Cureus.* 2023;15(9).
26. Lãm S, Masudi SP, Nguyen HTT, *et al.* Preventing mpox at its source: Using food safety and One Health strategies to address bushmeat practices. *BMC Glob Public Health.* 2024;2:69.
27. The resurgence of monkeypox virus: A critical global health review. *Front Public Health.* 2025.
28. Li Y, Zhao H, Wilkins K, Hughes C, Damon IK. Real-time PCR assays for the specific detection of monkeypox virus West African and Congo Basin strain DNA. *J Virol Methods.* 2010;169(1):223-227.
29. Martínez-Fernández DE, Fernández-Quezada D, Casillas-Muñoz FAG, Carrillo-Ballesteros FJ, Ortega-Prieto AM, Jimenez-Guardeño JM, Regla-Nava JA. Human monkeypox: A comprehensive overview of epidemiology, pathogenesis, diagnosis, treatment, and prevention strategies. *Pathogens.* 2023;12(7):947.
30. McCollum AM, Damon IK. Human monkeypox. *Clin Infect Dis.* 2014;58(2):260-267.
31. Mitjà O, Ogoina D, Titanji BK, Galvan C, Muyembe JJ, Marks M, Orkin CM. Monkeypox. *Lancet.* 2023;401(10370):60-74.
32. Morse SS, Mazet JA, Woolhouse M, *et al.* Prediction and prevention of the next pandemic zoonosis. *Lancet.* 2012;380(9857):1956-1965.
33. Ogunleye SC, Akinsulie OC, Aborode AT, Olorunshola MM, Gbore D, Oladoye M, *et al.* The re-emergence and transmission of monkeypox virus in Nigeria: The role of One Health. *Front Public Health.* 2024;11:1334238.
34. Olawade DB, Wada OZ, Fidelis SC, Oluwale OS, Alisi CS, Orimabuyaku NF, David-Olawade AC. Science in One Health. 2024.
35. Olivero J, Fa JE, Real R, *et al.* Deforestation and monkeypox risk in Central Africa. *Conserv Lett.* 2022;15(4):e12825.
36. Pal M, Mengstie F, Kandi V. Epidemiology, diagnosis, and control of monkeypox disease: A comprehensive review. *Am J Infect Dis Microbiol.* 2017;5(2):94-99.
37. Pal M, Singh R, Gutama KP, Savalia CV, Thakur R. Human monkeypox: An emerging and re-emerging infectious viral disease. *Acta Sci Microbiol.* 2022;5(4):146-150.
38. Petersen E, Kantele A, Koopmans M, Asogun D, Yinka-Ogunleye A, Ihekweazu C, Zumla A. Human monkeypox: Epidemiologic and clinical characteristics, diagnosis, and prevention. *Infect Dis Clin North Am.* 2019;33(4):1027-1043.
39. Rahi M, Joy S, Sharma A. Public health challenges in the context of the global spread of mpox infections. *Am J Trop Med Hyg.* 2023;108(4):641.
40. Reddy SSP, Francis DL. Monkeypox: A resurfacing threat and global public health challenge in India. *J Glob Health Econ Policy.* 2025;5:e2025001.
41. Seang S, Burrell S, Todesco E, *et al.* Evidence of human-to-dog transmission of monkeypox virus. *Lancet.* 2022;400(10353):658-659.
42. Simpson K, Heymann D, Brown CS, *et al.* Human monkeypox After 40 years, an unintended consequence of smallpox eradication. *Vaccine.* 2020.
43. Song TZ, Zheng YT. Monkeypox, wild animals, and potential big problem. *Zool Res.* 2022;43(4):612.
44. Thornhill JP, Barkati S, Walmsley S, *et al.*; SHARE-net Clinical Group. Monkeypox virus infection in humans across 16 countries, April-June 2022. *N Engl J Med.* 2022.
45. Tiwari A, Adhikari S, Kaya D, Islam MA, Malla B, Sherchan SP, *et al.* Monkeypox outbreak: Wastewater and environmental surveillance perspective. *Sci Total Environ.* 2023;856:159166.
46. World Health Organization, Food and Agriculture Organization, World Organisation for Animal Health. Taking a multisectoral, One Health approach: A tripartite guide to addressing zoonotic diseases in countries. Geneva: World Health Organization; 2019.
47. World Health Organization. Mpox fact sheet. 2022.
48. World Health Organization. Mpox vaccine prequalification report. 2024.
49. World Health Organization. WHO prequalifies the first vaccine against mpox. 2024.
50. World Organisation for Animal Health. WOA statement on novel MPOX. 2024.
51. Yadav AK, Srivastava A, Verma P, Srivastava P, Gupta D, Nooreen Z. A comprehensive review on monkeypox virus transmission, pathogenesis, treatments and its preventive measures. *NeuroQuantology.* 2022;20(10):7320.
52. Yusuf-Isleged MA, Salah OM, Mohamed MOS, Jama AM. A review of monkeypox (Mpox) disease: Clinical manifestations, diagnosis, treatments and preventions. 2024.

How to Cite This Article

Dhinesh R, Rekha VB, Quintoil MN, Deepan G. One health approach to monkey pox virus: Interaction between wildlife, human and environment. *International Journal of Veterinary Sciences and Animal Husbandry.* 2026; 11(6): 15-22.

Creative Commons (CC) License

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.