



MPOX (Monkeypox): Current Epidemiology, Clinical Manifestations, and Advances in Treatment and Prevention Strategies

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ABSTRACT: MPOX (formerly known as monkeypox) has emerged as a significant public health concern in recent years, necessitating a comprehensive understanding of its epidemiology, clinical manifestations, treatment options, prevention strategies, and global health impact. This literature review synthesizes the latest data on the spread and incidence of MPOX, with a focus on geographic distribution, affected populations, and emerging trends in transmission. The clinical presentation of MPOX, including symptoms, disease progression, and complications, is explored, with particular attention to variations across different demographics. Recent advances in the treatment of MPOX are analyzed, covering current antiviral therapies, the role of supportive care, and the potential of new treatments under investigation. Prevention strategies are also examined, highlighting the effectiveness of vaccination efforts, public health measures, and containment and control strategies. The review further considers the broader impact of MPOX on global health, discussing its implications for public health policy and pandemic preparedness. Through this comprehensive analysis, the review aims to provide a robust foundation for understanding MPOX and inform future research, clinical practice, and public health initiatives.

KEYWORDS: Clinical Manifestations, Epidemiology, MPOX (Monkeypox), Orthopoxvirus, Prevention Strategies, Treatment Advances.

INTRODUCTION

Monkeypox, also known as Mpox is a infectious disease from the Orthopoxvirus genus in the Poxviridae family first discovered in 1958 and first reported in humans in 1970 with it originally occurring in the continent of Africa via transmissions to humans via animals [1]. Primarily, Mpox is a disease native to central and western regions of Africa although recently however, cases have started appearing in numerous countries throughout different continents via contact with infected lesions or bodily fluids. Moreover, transmissions of Mpox have been identified to occur via sexual contact, primarily in men who have sex with other men (MSM) [2]. Common symptoms of the Mpox include rashes and fever with potential complications for those below the age of 5, over the age of 65, or those who are immunocompromised [3].

Currently, Mpox has been declared a public health emergency of international concern by WHO Director-General as more cases of Mpox are identified in different parts of the world emphasizing the severity of this outbreak. While primarily the Mpox disease is not often deadly, complications or situations may arise which could prove to be fatal in specific scenarios hence why the continuous study of infectious diseases and Mpox is critical in the making of prevention strategies and treatment to reduce fatalities [4]. Recently, numerous studies have been conducted on the matter with interventive measures and surveillance programs being devised such as wastewater monitoring of the MPVX. [5] The purpose of this review is to create a strong foundation of understanding on the Mpox disease through comprehensive review and analysis of numerous researches conducted on the disease.

EPIDEMIOLOGY OF MPOX

Geographic Distribution of MPOX: Recent Changes in Prevalence and Emerging Trends Prior to the 2022 outbreak, MPOX primarily circulated within Central and Western Africa, where zoonotic transmission accounted for most cases [6]. However, the 2022 global outbreak marked a notable geographical expansion of the virus, with cases rising most prominently in the Americas and Europe [7]. This shift reflects not only increased international spread but also new trends in MPOX distribution, with the majority of cases now reported outside Africa. Recent data highlight that the virus remains most prevalent in North America and parts of Europe, where large cities with dense populations have seen higher rates of infection [8]. The unprecedented rise in cases



in these non-endemic regions underscores changes in human movement, behavior, and potential vulnerabilities within populations that were previously unaffected.

Transmission Pathways: Human-to-Human and Zoonotic Factors MPOX is transmitted through both zoonotic and human-to-human pathways, and each transmission mode contributes to its recent spread [6]. Traditionally, zoonotic transmission has occurred via close contact with infected tissues or fluids from African animals like rodents and primates. The virus enters the human population through exposure to infected tissues or excreta of native African animals, often during hunting or handling [9].

With the global spread in 2022, human-to-human transmission has taken on a more prominent role, especially through contact with infected lesions or bodily fluids [7]. Evidence suggests that close, prolonged contact—particularly in intimate settings—facilitates transmission, with a significant number of cases linked to men who have sex with men (MSM) and close sexual contact [9]. This transmission shift underscores the importance of recognising MPOX not solely as a zoonotic disease but one that now has prominent human-to-human transmission potential in certain social contexts.

CLINICAL MANIFESTATIONS OF MPOX

SYMPTOMS AND PROGRESSION

Monkeypox (MPOX) is a viral zoonotic disease caused by the monkeypox virus, a member of the Orthopoxvirus genus. The clinical presentation of MPOX typically includes a prodromal phase characterized by fever, headache, myalgia, and lymphadenopathy, followed by the development of a distinctive rash [10]. The rash progresses through several stages, starting with macules, then papules, vesicles, pustules, and finally scabs, which eventually fall off [11]. The illness usually lasts 2-4 weeks [12].

Recent studies have provided further insights into the clinical manifestations of MPOX. A prospective observational study in the UK found that the most common symptoms were fever (62%), lymphadenopathy (58%), and skin lesions (95%) [19]. The skin lesions often presented as pustules (64%), vesicles (52%), and ulcers (24%). Notably, 36% of patients had lesions in the genital area, and 10% had lesions in the oropharyngeal area [19]. These findings suggest that the current MPOX outbreak may have a different clinical presentation compared to previous outbreaks, with more frequent involvement of genital and oropharyngeal areas.

COMPLICATIONS

While MPOX is usually self-limiting, complications can occur, particularly in immunocompromised individuals, children, and pregnant women. Potential complications include secondary bacterial infections, bronchopneumonia, sepsis, encephalitis, and corneal infection with ensuing loss of vision [13]. Severe cases may lead to death, with case fatality rates ranging from 1% to 10% in endemic countries [14]. In the UK study, 13% of patients required hospitalization for pain management, mostly due to severe anorectal pain [19].

VARIATIONS IN CLINICAL PRESENTATION

The clinical presentation of MPOX can vary depending on the population and region. In Africa, where MPOX is endemic, the disease tends to be more severe, with higher case fatality rates [15]. This may be due to factors such as malnutrition, co-infections, and limited access to healthcare. In contrast, cases reported in non-endemic countries, such as the United States and United Kingdom, have generally been milder, with lower mortality rates [16, 17].

The current MPOX outbreak has predominantly affected men who have sex with men (MSM) [19, 20]. This population may have different risk factors and clinical presentations compared to previous outbreaks. For example, the UK study found that 54% of patients had a sexually transmitted infection in the past year, and 31% were living with HIV [19]. The high prevalence of genital and oropharyngeal lesions in this outbreak suggests that sexual transmission may play a significant role in the spread of MPOX among MSM [20].

Additionally, some studies suggest that the clinical presentation may differ between the two distinct genetic clades of the monkeypox virus, the Congo Basin and West African clades [18]. However, more research is needed to understand the clinical implications of these genetic differences in the context of the current outbreak.



ADVANCES IN TREATMENT

Antiviral therapies play a crucial role in managing MPOX. The viruses belonging to the Orthopoxvirus genus, including MPOX, are genetically similar, allowing for the potential use of antiviral drugs developed for smallpox. Tecovirimat, Cidofovir, and Brincidofovir are among the antivirals that have been used to treat MPOX infections, with Tecovirimat showing promise as an effective therapeutic agent against severe cases [21]. However, the efficacy of Cidofovir in MPOX infections is still under investigation, and the emergence of drug-resistant strains poses a significant challenge [22, 23]. While the development of MPOX-specific antivirals is ongoing, supportive care remains an essential component in managing the disease [24]. In addition to antiviral therapies, supportive care plays a crucial role in managing MPOX. Recognizing the importance of comprehensive patient care, supportive measures for MPOX patients can include symptom management, such as providing pain relief and addressing skin lesions, as well as preventing secondary infections [25, 26]. Alongside the current treatment approaches, researchers are actively exploring innovative strategies to combat the MPOX outbreak. Novel treatments under investigation include the development of MPOX-specific vaccines and the exploration of the potential use of monoclonal antibodies, which have shown efficacy against other Orthopoxviruses [27, 28]. Despite the progress in antiviral therapies, supportive care, and emerging innovations, several challenges remain in the treatment of MPOX. While the recent advancements in antiviral therapies and supportive care have provided some relief, the treatment of MPOX still faces significant challenges. Drug resistance, limited access to treatment, and the effectiveness of current therapies are among the primary concerns [29, 30]. The genetic mutation of the virus, as observed in the current outbreak, further increases the risk of developing resistance to existing treatments [31, 32].

PREVENTION AND CONTROL STRATEGIES

The emergence of the MPOX virus has posed a significant global health challenge, necessitating a multifaceted approach to prevention and control. This research paper aims to provide a comprehensive review of the available MPOX vaccines, the effectiveness of non-vaccine prevention strategies, and the global and local responses to MPOX outbreaks, as well as a comparison [33]. Vaccination is a key tool in preventing the spread of MPOX. As of 2023, two vaccines are available and approved for use against MPOX: the JYNNEOS vaccine (also known as Imvamune or Imvanex) and the ACAM2000 vaccine [34]. The JYNNEOS vaccine is a live, non-replicating vaccine administered in two doses 28 days apart. Clinical trials have shown it to be safe and effective in preventing MPOX infection [35]. The ACAM2000 vaccine, originally developed for smallpox, can also provide protection against MPOX. However, it carries a higher risk of adverse effects and is not recommended for individuals with certain health conditions [34]. Ensuring adequate vaccine coverage, particularly among high-risk populations, is crucial in controlling MPOX outbreaks.

In addition to vaccination, non-pharmaceutical public health measures play a vital role in preventing MPOX transmission. Quarantine and isolation of infected individuals and their close contacts can help break the chain of transmission [36]. Contact tracing involves identifying, assessing, and managing people who have been exposed to an infected individual. It enables early detection and prevents further spread of the virus [37]. Public education campaigns are essential in raising awareness about MPOX, its symptoms, and prevention methods. These campaigns should target both healthcare professionals and the general public to ensure early recognition and appropriate response to potential cases [38].

The global response to MPOX outbreaks requires coordination among countries and international health organizations. The World Health Organization (WHO) plays a central role in monitoring MPOX cases worldwide, providing guidance, and supporting affected countries [39]. Regional collaborations, such as the African MPOX Response Alliance, have been established to improve surveillance, information sharing, and outbreak response capacity across countries [40]. In endemic countries, such as Nigeria and the Democratic Republic of the Congo, local health authorities work closely with international partners to strengthen disease surveillance, conduct case investigations, and implement control measures [41].

Lessons learned from other infectious diseases can inform MPOX prevention and control strategies. The COVID-19 pandemic has highlighted the importance of early detection, rapid response, and global cooperation in managing emerging infectious diseases [42]. The successful eradication of smallpox through widespread vaccination and public health measures serves as a model for combating other poxvirus diseases like MPOX [43]. Additionally, strategies used to control outbreaks of viral hemorrhagic fevers, such as Ebola, can be adapted for MPOX response. These include strengthening healthcare systems, engaging local communities, and providing adequate resources and training to frontline health workers [44].



A comprehensive approach combining vaccination, public health measures, global coordination, and lessons learned from other infectious diseases is necessary to effectively prevent and control MPOX outbreaks. Continued research, surveillance, and preparedness efforts are crucial in mitigating the impact of this emerging viral disease.

GLOBAL HEALTH IMPACT

The emergence of the monkeypox (MPOX) virus as a global health threat has significant implications for public health policies, economic and social well-being, and pandemic preparedness. The MPOX outbreak has prompted national and international public health authorities to reassess their strategies for preventing and controlling the spread of infectious diseases [45]. In response to the outbreak, the World Health Organization (WHO) has issued guidance on surveillance, case management, and infection prevention and control measures [46]. Countries have implemented various public health measures, such as quarantine, contact tracing, and targeted vaccination campaigns, to contain the spread of MPOX [47].

The economic and social impact of MPOX outbreaks can be substantial. The direct costs associated with the disease, such as healthcare expenses and productivity losses, can burden healthcare systems and individuals [48]. Additionally, MPOX outbreaks can lead to social stigma and discrimination, particularly among marginalized communities, which can further exacerbate health disparities [49]. The fear and uncertainty surrounding the disease can also have psychological effects on affected individuals and communities [50].

The MPOX outbreak has highlighted the need for robust pandemic preparedness and response strategies. The global community must prioritize investments in public health infrastructure, disease surveillance systems, and research and development of medical countermeasures [51]. Strengthening international collaboration and coordination is crucial for effectively responding to emerging infectious diseases like MPOX [52]. Lessons learned from the COVID-19 pandemic, such as the importance of early detection, transparent communication, and equitable access to vaccines and treatments, should inform future pandemic preparedness efforts [53].

Addressing the global health impact of MPOX requires a multidisciplinary approach that involves public health professionals, healthcare providers, researchers, policymakers, and community stakeholders [54]. Engaging with affected communities and building trust is essential for effective outbreak response and mitigating the social and economic consequences of the disease [55]. Continued research on MPOX epidemiology, transmission dynamics, and clinical management is necessary to inform evidence-based public health policies and interventions [56].

In conclusion, the global health impact of MPOX extends beyond the immediate public health concerns and encompasses economic, social, and pandemic preparedness implications. A coordinated and comprehensive approach that addresses the multifaceted challenges posed by MPOX is essential for effectively controlling the outbreak and mitigating its consequences.

FUTURE DIRECTIONS FOR MPOX: ADDRESSING RESEARCH GAPS, EMERGING TRENDS, AND THE LONG-TERM OUTLOOK

The recent global outbreak of MPOX has revealed several critical research gaps, future development opportunities, and considerations for the long-term management of the virus as a public health issue [57]. Understanding these areas is essential for advancing MPOX prevention, treatment, and control strategies worldwide.

While significant progress has been made in understanding MPOX's transmission and epidemiology, several areas require further investigation to guide effective control measures [58]. Key research gaps include understanding the specific mechanisms behind human-to-human transmission, particularly in social settings with close physical contact, as these dynamics differ markedly from traditional zoonotic transmission pathways [59]. Additionally, research on the virus's potential for persistence within non-human reservoirs outside of Africa is limited, creating uncertainties about whether MPOX could establish endemic reservoirs in other regions. Another area of need is comprehensive longitudinal studies on the clinical and immunological responses in different populations, which would provide insights into long-term immunity and potential reinfection risks [60]. Further research into social and demographic vulnerabilities—particularly among populations showing high susceptibility to severe outcomes—will also be vital for refining intervention strategies and preventive measures.

Recent trends indicate that MPOX is evolving from a zoonotic infection with sporadic human cases to a virus with notable potential for sustained human-to-human transmission in certain contexts [61, 62]. As such, new approaches to treatment and



prevention are essential. While the smallpox vaccine provides partial cross-protection, future developments may include MPOX-specific vaccines and post-exposure prophylactic treatments to limit transmission following exposure [63].

CONCLUSION

This review highlights the evolving epidemiology, transmission dynamics, and public health implications of MPOX following the 2022 global outbreak. Key findings indicate that MPOX, once primarily confined to Central and Western Africa through zoonotic transmission, has now spread to multiple continents with significant prevalence in the Americas and Europe, largely due to human-to-human transmission. High-risk groups include males, particularly within the MSM community, and individuals with underlying health vulnerabilities, such as the immunocompromised or those at extreme ages. The recent trends in MPOX cases point to new challenges in understanding transmission dynamics, adapting surveillance, and developing targeted interventions.

The shift in MPOX epidemiology calls for a comprehensive update to healthcare practice and public health policy. Enhanced surveillance across regions, especially in non-endemic areas, is crucial to detect and control potential outbreaks early. There is a pressing need for education and outreach initiatives tailored to high-risk groups, coupled with the integration of MPOX management into sexual health services where appropriate. Furthermore, policy adjustments should prioritize the development of MPOX-specific vaccines and treatment options, while recognising the potential necessity for MPOX to become part of routine vaccination and outbreak preparedness protocols. The research gaps identified, particularly regarding immunity, social determinants, and potential animal reservoirs, underline the need for a multidisciplinary approach to address both current and future challenges posed by MPOX.

The global spread of MPOX in recent years underscores the importance of robust, adaptable public health systems capable of responding to zoonotic viruses with human-to-human transmission potential. As MPOX continues to be studied, future research should focus on developing more effective prevention and treatment strategies, understanding viral adaptations in diverse settings, and preparing for possible endemicity outside traditional regions. The insights gained from MPOX will not only improve response strategies for this virus but will also strengthen preparedness for other emerging zoonotic threats in an increasingly interconnected world.

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