***Mpox: A Public Health Threat***

**Introduction:**

Mpox, previously known as monkeypox, is a zoonotic viral disease caused by the monkeypox virus (MPXV) a member of the Ortho poxvirus genus within the Poxviridae family. (Diana Emilia Martínez‐Fernández et al., 2023) Discovered in 1958 after outbreaks of a pox like illness in captive monkeys, mpox was first identified in humans in 1970 in the Democratic Republic of the Congo (DRC) during the global smallpox eradication campaign. (Mitjà et al., 2022) Mpox was thought to be a rare and geographically confined viral infection with sporadic cases in Central and West Africa, mainly due to animal contact. In recent times mpox has got a lot of attention due to its spread outside of its endemic areas. The 2022 outbreaks in non-endemic regions such as Europe, the Americas, and Asia marked the first human-to-human transmission of the virus outside Africa. In response, the World Health Organization (WHO) declared a Public Health Emergency of International Concern (PHEIC) .(Mitjà et al., 2022) Mpox was initially designated as a PHEIC by the WHO on 23 July 2022. By the end of May 2023, over 87,545 cases and 141 deaths had been reported, with the majority of cases occurring in non-endemic countries, primarily due to human-to-human transmission. (Diana Emilia Martínez‐Fernández et al., 2023) More recently, on 14 August 2024, the WHO once again declared mpox a public health emergency of international concern. (Health, 2024)The discontinuation of routine smallpox vaccination which provided cross protection against MPXV left the global population exposed. In this essay we will look at the role of the mpox virus, host and environmental factors that contributed to its spread and the policies and treatments that have been implemented.

**Role of the Agent (Monkeypox Virus):**

The disease Mpox is brought about by the monkeypox virus, which is an enveloped, double-stranded DNA virus, its classification falling under the genus Ortho poxvirus. The latter group includes variola virus or smallpox and vaccinia virus. (Diana Emilia Martínez‐Fernández et al., 2023) Similar to other Ortho poxviruses, MPXV can infect a wide range of hosts, both animals and humans, making it a zoonotic pathogen with complex transmission dynamics. Two genetic clades of MPXV have been identified: clade I (Congo Basin), including subclades Ia and Ib; and clade II (West African Basin), including subclades IIa and IIb. In 2022, a global outbreak was initiated among members of clade IIb and continues to this day, including across some African countries. Clades Ia and Ib also continue to cause growing outbreaks affecting the Democratic Republic of the Congo and other African countries. (Crouch et al., 2023) As of August 2024, clade Ib has also been detected beyond Africa. The Congo Basin clade is more virulent with a case fatality rate above 10%, while the West African clade has a case fatality rate below 1%.(Crouch et al., 2023) As of January 2022, more than 80,000 cases of mpox in nonendemic countries have occurred, and more than 25,000 cases in the United States alone. (Jafari & Woodward, 2023)

**Structure and Transmission**

MPXV has a core that contains the viral DNA surrounded by a lipid envelope that helps it enter the host cell. MPXV is transmitted through several routes including zoonotic transmission (animal to human) and human to human transmission. Zoonotic transmission is through direct contact with infected animals mainly rodents which are believed to be the natural reservoir of the virus. Human to human transmission is through contact with infected bodily fluids, lesions, respiratory droplets or contaminated materials like bedding.  (Lu et al., 2023)

**Entry and Replication**:

Once MPXV enters the body through broken skin, respiratory tract or mucous membranes it initiates infection by replicating in local tissues and lymph nodes. The virus goes through both cytoplasmic and nuclear stages of replication typical of Ortho poxviruses and then spreads to the bloodstream (viremia) and throughout the body. This dissemination leads to the characteristic symptoms of mpox including fever, rash and lymphadenopathy (swollen lymph nodes).  (Lu et al., 2023)

**Symptoms and Complications**

The incubation period of Mpox is ~7–14 days, with symptoms lasting for 14–21 days.  (Lu et al., 2023)Early symptoms are similar to other viral infections and include fever, headache, muscle aches, back pain and fatigue. Lymphadenopathy which is a distinguishing feature of mpox occurs before the appearance of the rash. The rash goes through several stages from macules to papules, vesicles, pustules and eventually scabs. While most mpox cases resolve without complications severe cases can lead to secondary bacterial infections, sepsis, pneumonia or encephalitis especially in individuals with compromised immune system. The Congo Basin clade is associated with more severe disease and higher mortality. (World Health Organization, 2024)

**Host and Environmental Factors:**

Several host and environmental factors contribute to the acquisition and spread of MPXV. Host factors like immune status play a big role in determining disease severity while environmental factors affect the transmission dynamics of the virus.

**Immune Status**

Individuals with compromised immune system including those with HIV or other immune deficiencies are at higher risk for severe outcomes of mpox. Research shows that individuals with HIV who have high CD4+ T-cell count (>350 cells/mm³) can mount immune response similar to healthy individuals. But individuals with low CD4+ T-cell count (<350 cells/mm³) are more likely to have severe disease due to reduced viral control. In such individuals the immune response especially memory B-cell response may be insufficient to prevent re-infection or severe complications even if they had prior immunity through smallpox vaccination. (Mitjà et al., 2022)

The discontinuation of smallpox vaccination after the eradication of smallpox in 1980 has left most of the global population without cross-protective immunity against MPXV. Older generations vaccinated against smallpox have some immunity while younger generations are largely unprotected and this is the reason for large scale outbreaks. (Mitjà et al., 2022)

**Environmental Factors**

Environmental factors play a big role in the transmission of MPXV especially in endemic regions of West and Central Africa. Direct contact with infected animals like rodents (Gambian pouched rats, rope squirrels) and non-human primates is the primary source of zoonotic transmission. Human activities like hunting, handling bushmeat and encroaching on wildlife habitats increase the risk of exposure to the virus. Poor sanitation, inadequate healthcare infrastructure and limited access to clean water further spread mpox in endemic regions. (Mitjà et al., 2022).

Human-to-human transmission became a key feature of the 2022 outbreaks in non-endemic regions, primarily linked to close intimate contact, including sexual activity. Most cases were recorded among men who have sex with men, many of whom exhibited new epidemiological and clinical features. (Storer et al., 2024)The incubation period typically ranged from 7 to 10 days, with most patients experiencing fever, muscle aches, and a distinctive rash that progressed from papules to vesicles, pustules, and crusts, commonly affecting the genital, anal, or oral regions, and often involving mucous membranes. (World Health Organization, 2022) Close physical contact, particularly sexual contact, was the primary transmission route, suggesting that mpox could spread beyond its traditional boundaries due to global travel and migration. (Masoud Keikha et al., 2023)

**Policy Responses:**

Governments and international organizations have implemented various policies to prevent the spread of mpox drawing from lessons learned from previous infectious disease outbreaks including smallpox and COVID-19.

**Vaccination**

Vaccination is a vital component of mpox prevention, especially among high-risk groups. There are two vaccines: ACAM2000 and JYNNEOS(also sold under the brand name IMVANEX in Europe). Both have been rolled out across endemic and non-endemic countries. These vaccines provide cross-protection for MPXV since the vaccines are proven to be effective against smallpox. In countries like the DRC and Nigeria, targeted vaccination campaigns target individuals at a very high risk of encountering the virus, such as health workers, laboratory technicians, and those in close contact with cases. (Mitjà et al., 2022).

Other measures used in non-endemic countries to curtail outbreak include vaccination before and after the exposure. Vaccination has been proved to decrease not only its transmission but also the severity of the disease. However, this is still a challenge, especially concerning vaccine distribution and access to low-income countries. (*Mpox (Previously Known as Monkeypox)*, 2024)

**Quarantine and Isolation**

Important in Mpox control has been quarantine and isolation. For example, the United States and the United Kingdom have set protocols regarding the isolation of confirmed cases and observation of close contacts. Added to public health advisories on hygiene practices and safe contact behaviours, these activities have been very important in containing the virus. (World Health Organization, 2024)

**Public Health Communication and Surveillance**

Public health advisories by national health departments and international organizations, such as the WHO, have been at the forefront in raising awareness about mpox and advocating for preventive behaviours. These campaigns are directed toward the education of the public with regard to risks related to close physical contact, especially in relation to sexual modes of transmission, and to encourage early reporting of symptoms. (World Health Organization, 2022)

Strengthening global surveillance systems has helped monitor and track mpox outbreaks and to respond appropriately. Declaration of PHEIC by WHO in 2022 facilitated international coordination for great facilitation: technical support, mobilization of resources, data sharing among the affected countries. But surveillance gaps exist, especially in low-resource settings, where poor detection and response to mpox cases are constrained by a lack of diagnostic instruments and public health infrastructure (*Mpox (Previously Known as Monkeypox)*, 2024)

**Treatments for Mpox**

Supportive care and antiviral medication are cornerstones of the treatment of mpox. There are only a few available anti-viral agents in practice. Of all, the most common is known as TPOXX. By inhibiting the Ortho poxvirus protein required for viral spread, tecovirimat is given both intravenously and orally. It works best if taken early in infection, with symptoms starting within five days. While studies in humans have been few, animal models show improved survival, and anecdotal evidence suggests that symptoms are alleviated in mpox patients by tecovirimat. (Diana Emilia Martínez‐Fernández et al., 2023)

Other antiviral options like Cidofovir and Brin cidofovir inhibit viral DNA replication. However, these drugs have their adverse drug effects, such as nephrotoxicity and liver enzyme elevation, making them not as favourable for large-scale use. Basically, supportive care remains pivotal in the management of mpox, especially in serious infections. This includes pain management, hydration, and treatment of secondary infections.  (Lu et al., 2023)

**Discussion and Conclusion**

The reviewed literature on mpox underlines several key challenges regarding the virus' global response. Large vaccination campaigns and quarantine measures have been very effective in containing outbreaks, but there are striking gaps in vaccine distribution and access, especially in low-income parts of the world. The cessation of vaccination against smallpox has left a large segment of the world population susceptible to MPXV infection, while although cross-protection against MPXV is provided by existing vaccines, its deployment has been very uneven across the different regions which we have also observed during COVID-19 vaccination distribution as well . (World Health Organization, 2024)

While antiviral treatments like Tecovirimat have had promising results, the very few and generally small-scale trials raise concerns on the generalizability of these findings from animal models and case reports. Further, safety concerns, as were seen with Cidofovir and Brin cidofovir, raise the need for caution in their use, especially in patients already suffering from pre-existing conditions(Immunocompromised patients). (Crouch et al., 2023)

These host and environmental factors contribute significantly to mpox spread, especially in areas known to be endemic for such viruses, since zoonotic transmission still constitutes a significant risk. The response thus needs to target humans who cause transmission among themselves and the environmental drivers of spillover: deforestation and urbanization. (World Health Organization, 2022)

**Conclusion**

Mpox is an emerging public health priority that necessitates international collaboration for the prevention of future outbreaks. Vaccination, public health communication, and enhanced surveillance systems are some of the cornerstones in the response, but significant gaps in access and distribution need to be urgently closed to ensure that all populations receive protection equitably. (Guagliardo, 2024) As long as Mpox virus continues to burden the global community, further research into antiviral therapies and development of new vaccines will be crucial in mitigating the impact of this emerging zoonotic disease.

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