



The Past, Present, and Future of Monkeypox: A Rapid Review Regarding Prevalence and Prevention

INQUIRY: The Journal of Health Care
Organization, Provision, and Financing
Volume 59: 1–6
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DOI: 10.1177/00469580221139366
journals.sagepub.com/home/inq


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Abstract

While monkeypox virus (MPXV) remained endemic in central and western African countries, a sudden unusual spike of global cases among non-endemic countries is an enigma for scientists. With 257 cases reported as of 26th May 2021, a multi-country outbreak of monkeypox has been declared in countries including the UK, EU/EEA states, and North America. Even though the likelihood of transmissibility of MPXV is limited compared to COVID-19, yet a coordinated multidisciplinary effort is required to prevent any further global expansion. Few appropriate responsive approaches to contain the infection could be; limiting the contact with potential animal reservoirs, isolation of confirmed cases, using PPEs to prevent human-human transmission, awareness activities, and administration of pre and post prophylactic vaccination. In this review, we have discussed the previous and current outbreaks of MPXV along with the abrupt actions that are needed to address the situation.

Keywords

Monkeypox, prevalence, prevention

What do we already know about this topic?

Monkeypox, a zoonotic disease belonging to the orthopoxvirus family, has recently shown a sudden upheaval of cases in non-endemic countries. Although studies have shown an unlikelihood of its being lethal, few severe cases and deaths have been reported. Starting with flu-like symptoms and a fever, it progresses to smallpox-like painful blisters that cover the entire body. Even though the smallpox vaccine has been shown to be effective with the symptoms, an appropriate approach is required to prevent it from becoming a widespread pandemic.

How does your research contribute to the field?

With monkeypox cases increasing globally, studies are required to entail relevant and current information regarding it. In this review, we have summarized all authentic facts regarding previous outbreaks and current statistics of monkeypox virus, along with the previous and future preventative strategies that could help contain monkeypox outbreaks. The findings of this study will help uncover all critical areas toward a preventative approach.

What are your research's implications toward theory, practice, or policy?

Given the recent statistics regarding the monkeypox virus, it is expected to spread rapidly across the globe. Our research has identified a few practical implications for containing the outbreak, including: limiting contact with potential animal reservoirs; isolating confirmed cases; using PPEs to prevent human-to-human transmission; raising awareness; and administering pre and post prophylactic vaccination.

Introduction

Monkeypox (MPX) is a zoonotic disease that is endemic to western and central Africa, especially in the Democratic Republic of Congo.¹ It belongs to the orthopoxvirus genus

of the family Poxviridae.² The disease is so-called because it was first identified in captive monkeys back in 1958.³ It has since been found in other rodents such as squirrels, mice, rats, and prairie dogs.^{1,4} There are 2 distinct Clades of MP: The Congo basin clade which is more transmissible with a



higher case fatality ratio and the West African Clade.¹ In newer proposed classifications, the Congo Basin clade is named Clade I, and West African clades are named Clade IIa and IIb. The newer classification is proposed as a nondiscriminatory and non-stigmatizing alternative to the old geographical classification.⁵

The virus is transmitted from human to human by droplet infection contact with lesions, fomites and via the placenta too. The first human case of MPX was identified in 1970 in the Democratic Republic of Congo.⁶ In 2003 the first outbreak of MPX outside of Africa was reported in the United States of America.⁷ Currently, the incidence of MPX has increased drastically from what it was in 1986.⁸ There is an ongoing outbreak of MPX outside of its endemic areas and as of 26 May, global number of 257 laboratory-confirmed cases and 120 suspected cases have been reported as stated by World Health Organization (WHO).⁹ Plenty of reasons have been proposed for the rise in MPX cases in recent times including overcrowding, an increase in rodent population owing to food storage in villages, an increase in immune naive population as the number of people who are vaccinated against smallpox decreases, and the fact that the definite reservoir of MPX is still not known.¹⁰ There are several vaccines against smallpox that provide some immunity against MPX and a newer vaccine (MUA-BN) that was also approved for MPX in 2019 but it is not yet widely available.⁹

MPX has mostly stayed limited to the Southern hemisphere and therefore, there has been some hesitancy among scientists to further study the topic; this is reflected in the limited biomedical literature that is available on MPX. Considering the current number of rising cases of MPX outside of Africa our article will help understand different outbreaks of MPX over time and develop measures to stop further spread and outbreaks.

The Previous Monkeypox Outbreaks

Monkeypox virus (MPXV) discovered as pox-like skin eruptions amongst cynomolgus monkeys in 1958, gained discernment when the first human case was identified in 1970 in the Democratic Republic of the Congo (DRC).¹ Human strain of MPXV was obtained from a 9-month-old boy when he developed a rash that was hemorrhagic with centrifugal

distribution and associated with cervical lymphadenopathy.⁶ Considering the case-based similarity, it was initially suspected as smallpox until soon identified as another variant of the orthopoxvirus family.¹¹ Since then, 57 cases were reported in other central and western African countries between 1970 and 1980, with the majority of them that is, 45 reported from DRC.¹² All other cases were reported from tropical regions that include: Liberia, Nigeria, Ivory Coast, and Sierra Leona.¹³ The prevalence of diseases during this period was mostly observed during dry seasons, accounting for over 84% of all cases among children aged below 10 years that have not been vaccinated against smallpox.¹² While most cases were found to be directly linked to animal-human transmission, 7.5% of cases showed susceptibility to human-human transmission.¹³

As the case count subsequently rose after the first incidence, a major outbreak of MPXV was observed between the years 2003 to 2005 when a total of 760 cases were identified in Sankuru District, DRC.¹⁴ The infection was primarily caused by exposure to disease through infected rodents and other zoonotic reservoir species. During this outbreak, the ages of the recipients ranged (from 5 days to 70 years) with 92.1% amongst the unvaccinated population while only 3.8% of cases were previously vaccinated against smallpox.¹⁴ Consecutively, an outbreak of the disease was also confirmed in Sudan when more than 40 cases were suspected.¹⁵ Even though the origin of the disease remained unidentified, a few hypotheses attributed to the sudden outbreak included; (i) exponential increase of human to animal reservoir transmission after flooding in the year 2005, and (ii) importation of infection from other endemic regions.¹⁵

Besides the major spike of cases in Africa, MPX was first documented in the USA in 2003 when a 3-year-old girl from Central Wisconsin got infected. Soon an outbreak of the disease was proclaimed when a total of 72 cases were confirmed in 6 Midwestern states. States that were potentially exposed to MPXV included, Indiana, Illinois, Kansas, Missouri, and, Ohio, with a majority of cases³⁹ reported from Wisconsin.^{16,17} The trace-back investigation of the outbreak was linked to the trade of exotic animals from Ghana to Texas, animals infected with MPXV were accommodated with native prairie dogs. All cases were reported to be transmitted via contact with infected prairie dogs.^{16,17} Although the manifestation of

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Received 9 June 2022; revised 30 October 2022; revised manuscript accepted 31 October 2022

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the disease was found to be similar to the previous outbreak in Africa, a few contrasting features included; transmission solely due to contact with infected animals, milder course of infection, and lower mortality rates.¹⁷ According to a few reports, younger individuals were shown to have more severe clinical presentations than adults.¹⁸ The outbreak was responded by Public health authorities in the USA through the initiation of smallpox vaccination programs for pre and post-exposure individuals.¹⁸

Although few cases of monkeypox had been reported previously in Nigeria between 1971 and 1978. In the year 2017, Nigeria Center for Disease Control (NCDC) declared an outbreak of the disease after they identified 276 suspected cases with 118 (43%) confirmed for MPXV stain followed by around 7 (3%) deaths.¹⁹ Cases that were reported had the highest prevalence amongst adults aged (21-40 years) with the most significant sign and symptoms including; vesiculopustular rash, pruritis, and lymphadenopathies associated with fever and myalgias.^{19,20} Besides this, sore throat was also observed in a few individuals.¹⁹ Although the exact etiology of substantial re-emergence of monkeypox in Nigeria was unknown, it was suspected due to discontinued vaccination programs against the smallpox virus, poor surveillance system, and increased animal-human and, human-human transmissions.²⁰ To determine the origin and rapid detection of the suspected cases, NCDC introduced the Surveillance, Outbreak Response Management and Analysis System (SORMAS) which proved to optimize the monitoring of the situation.²¹

Furthermore, in September 2018 a few monkeypox cases were documented in the United Kingdom and Israel.²² All reported cases were found to be ultimately linked to Nigeria outbreak. While few individuals caught the infection after traveling to Nigeria, others were reported to have contact with infected patients.²² Albeit the limited number of cases imported, health authorities have been on a high alert regarding the global trends of the disease for the past few years.

The Current Monkeypox Outbreak

While MPX remains endemic in countries of central and west Africa such as Democratic Republic of Congo, Benin, Cameroon, Nigeria and other such countries,⁹ the current surge in cases in non-endemic countries spread across various continents is a concern. As of 8 October 2022, there are 73 288 confirmed cases worldwide, with 72 428 cases distributed across non-endemic countries and 860 cases in endemic countries.²³

On 7 May 2022, the index case of MPXV, specifically its West African clade variant, was confirmed in the United Kingdom, with history of travel from Nigeria.²⁴ Following this, cases have appeared rapidly in England and Scotland. However, Wales and Northern Ireland have also reported their first cases on 26 May 2022,^{25,26} taking the tally up to 90 cases.²⁷

Up until 23 May 2022, 67 MPX cases have been confirmed across 9 European countries: Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain, and Sweden, while another 42 cases were under investigation.²⁸ Spain and Portugal are worst affected with case counts of 52 and 49 respectively on 25 May 2022.²⁹ Genome testing of a case in Portugal revealed a similar strain to that associated with Nigeria-imported MPX outbreaks in the UK, Israel, and Singapore in 2018 and 2019.⁹

After reporting their first case in a patient who returned from Canada on 18 May 2022, the United States of America is also expecting more cases.³⁰ Meanwhile, Canada has reported 16 confirmed cases as of 26 May 2022, all in Quebec.³¹

The MPX outbreak has also resulted in suspected or confirmed cases in the UAE, Czech Republic, Slovakia, Australia, Argentina, Morocco, Switzerland, and Israel.^{32,33}

Despite such outbreaks, the chances of a MPX pandemic of the likes of COVID-19 is highly unlikely due to the difference in mode of transmission (physical contact versus airborne droplet transmission), the presence of effective vaccines and management strategies. However, the main concerns are the unusually large distribution of cases and rapid transmission of the virus during these outbreaks. A vast majority of the cases have been reported in men who identify as men who have sex with men (MSM) who came to health-care facilities with telltale symptoms,⁹ proving that transmission via mucus membranes and bodily fluids during sexual contact may be an effective mode of transmission. However, the virus has the potential of being transmitted via contact with skin lesions of patients, clothes, bedding, and air droplets as well.³⁴

At the outset of these outbreaks, conspiracy theories regarding the involvement of the COVID-19 vaccine in the spread of monkeypox began circulating. However, it has been debunked that MPX is not a side effect of COVID-19 vaccination.³⁵ However, the resurgence of MPX outbreaks may be associated with the long-term cessation of smallpox vaccination among populations as the disease became negligible, resulting in the loss of cross-protection against MPX achieved through these vaccines.³⁶

With cases on the rise, affected countries are aiming to control transmission via effective surveillance and improving disease management with the help of the World Health Organization (WHO). On 20 May, the WHO held the Strategic & Technical Advisory Group on Infectious Hazards and Pandemic and Epidemic Potentials (STAG-IH) meeting for this purpose.³⁷ A 21-day quarantine has been recommended for symptomatic individuals in Belgium, and UK.³⁸ The use of smallpox vaccines has been recommended by WHO for close contacts owing to its 85% effectiveness against MPX.³⁴ However, mass vaccination is not needed yet. This might afford a significant advantage to countries, such as the USA,³⁹ who already have adequate stocks of the vaccine available for use.

In countries such as India and Pakistan where there have been no confirmed cases of MPXV so far, Health Departments are still on high alert.^{40,41} Such places, owing to their high population densities, poor sanitation and hygiene, poor standards of living, various endemic diseases, and low vaccination rates are at significant risk of problematic outbreaks that have the potential to cause complications in affected individuals. It has also been studied that the monkeypox virus causes more severe disease in children than in adults.³⁴ A combination of the known susceptibility of children to significant disease and malnutrition related immunosuppression in many Third World countries can also result in a bleak scenario in the case of imported infections.

Prevention of Future Outbreaks

For containing and preventing any future outbreaks of monkeypox, coordinated, multidisciplinary global efforts are required. In endemic areas, curbing the spread of the virus from primates and rodents is important but highly challenging. Efforts should be made to conduct large-scale health awareness campaigns to educate people on limiting contact with potential animal reservoir species and avoiding the consumption of improperly cooked meat.²² While it would not be culturally and economically feasible to entirely stop the bushmeat trade, proper handling of animals using surgical masks, gloves, and protective clothing will decrease animal-to-human transmission.²² Additionally, in endemic as well as non-endemic areas, any animal that is infected or suspected to be infected should be isolated or euthanized as a last resort to prevent further spread.

According to a study by Vaughan et al,⁴² changing contaminated bedding was a probable source of transmission in the instance of the MPX cases that led to the infection of a healthcare worker. Contact with skin lesions on an infected person, exposure to fomites, or inhalation of large respiratory droplets and contact with contaminated objects are all possible ways for the disease to spread.⁴² Even though the use of personal protective equipment (PPE) by healthcare professionals dealing with a known or suspected case is considered as optimal preventative method,⁴³ it is noted that using regular PPE could not have provided enough protection from MPX, especially if skin lesion material carrying viruses had been disturbed and inhaled during bedsheet changes.⁴²

A potential method to lessen the spread of disease from person to person is to avoid contact with any individual who has a rash or with any object that has come into contact with a sick person.⁴⁰ Mandatory quarantine for confirmed cases must be implemented. The smallpox vaccine is known to be effective against monkeypox virus and can be administered for post-exposure prophylaxis of close contacts of infected people using a “ring strategy.”^{44,45} Additionally, it can be considered for some groups at a higher risk of infection.⁴⁶ Pre-exposure prophylactic vaccination in endemic areas can be considered where the prevalence of the disease is

especially high; however, this would require careful assessment of the risk/benefit ratio in each country. National Immunization Technical Advisory Groups (NITAG) should formulate specific guidelines regarding the vaccination of close contacts and high-risk groups.⁴³

The COVID-19 pandemic has highlighted the weaknesses in the world’s public health systems and the lack of preparedness to deal with any future large-scale disease outbreaks. There is a dire need to decolonize global health and adopt a universal approach with the global cooperation of researchers to disseminate the necessary technology and expertise and create capacity at the source for uniform collection and analyzes of health data for effective surveillance, evaluation and response.⁴⁷ There is much about monkeypox virus that remains unknown regarding its epidemiology, the extent of animal host reservoir, the natural history and transmission of disease, pathogenesis and prevention.¹⁰ Well-designed regional collaborative studies are needed to fill these knowledge gaps. Additionally, there is a need to develop an effective surveillance and response system across Africa to monitor and control any future outbreaks.^{48,49}

A further obstacle to MPX prevention is ignorance, particularly among healthcare professionals.⁵⁰ According to a WHO assessment, one of the difficulties in preventing the resurgence of MPX was a lack of understanding about the disease, especially among healthcare professionals.⁵¹ Among health professionals, conspiracy theories about newly developing virus, a substantial knowledge gap, and an ineffective patient-care strategy were all very common.⁵² A cross-sectional online study of Indonesian general practitioners (GPs) revealed knowledge deficiencies in every area of disease.⁵¹ Additionally, a pilot study on knowledge, attitudes, and practices (KAP) in a sample of Italian medical professionals found that just 26.2% of the respondents were aware that vaccination can prevent MPX, showing that lower levels of MPX knowledge were linked to higher levels of conspiracy views.⁵³ Advancing public health preparedness through regional training and integrated, locally-led efforts aligned with priority research and surveillance could be an important step toward putting an end to the threat of MPX as a potential global outbreak.^{54,55} This emphasizes that a combined “One-Human-Environmental-Animal Health” approach is required across Africa to implement the necessary measures and strategies.⁵⁶

Conclusion

A rare disease similar to smallpox caused by the MPXV, monkeypox, has re-emerged as a menace to public health. Even though, the illness has had a historically low case fatality rate, serious cases are more prevalent in children and depend on the extent of virus exposure, the patient’s health state, and the type of complications. With countries recovering from economic shutdown after COVID-19 is contained, MPX outbreak could inflict an extensive global economic and

health damage. The main preventive strategy for MPX could be raising awareness and educating people about risk factors and how to limit exposure to the virus. Rapid identification and surveillance of new cases is also an essential component of limiting transmission. Furthermore, with numerous studies demonstrating an 85% prophylactic response of smallpox vaccination against monkeypox, an immediate global pre and post-exposure vaccination could aid in eradication. While, new vaccines, diagnostics, and antiviral agents precisely for MPXV are imperative to prevent any future re-emergence.

Acknowledgments

None

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical approval

Not applicable

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