Journal: Texila Advanced Journal of Multidisciplinary Health Research
Publisher: Texila International Journal
ISSN: 3105-3564
Volume 5 Issue 2, 2025
DOI: 10.21522/TAJMHR.2016.05.02.Art034

# Tackling the Problem of Mpox: A Global Phenomenon

Muekara Friday Dugbor
*Department of Public Health, Texila American University, Guyana*

***Abstract***

*This article, Tackling the Problem of Mpox: A Global Phenomenon, examines the resurgence and global impact of Mpox. Mpox, previously known as Monkeypox, has rapidly evolved from a localized health issue in Central and West Africa into a global public health challenge. The 2022 outbreak, which spread across several continents, revealed just how easily infectious diseases can cross borders in our interconnected world and how vital global cooperation has become. This conceptual article explores the patterns of Mpox transmission, its social and economic impacts, and how different countries have responded to the outbreak. It also sheds light on key challenges such as weak disease surveillance and unequal access to vaccines. Using global health frameworks and the One Health approach, this paper recommends practical strategies such as stronger surveillance systems, fair vaccine distribution, cross-border collaboration, and continuous health education. In the end, it emphasizes that tackling Mpox is not just a medical or policy issue; it's a shared responsibility that calls for global solidarity, compassion, and commitment to building a healthier, more prepared world.*

***Keywords****: Epidemic Preparedness, Monkeypox, Mpox Virus (MPXV), One Health, Ortho Poxvirus, Outbreak, Public Health Surveillance, Vaccination, Viral Zoonoses, Zoonotic Diseases*

## Introduction

The monkeypox virus was discovered in Denmark (1958) in monkeys kept for research. It has been a public health concern for 65 years [10, 39]. The first reported human case of mpox was a nine-month-old boy in the Democratic Republic of the Congo (1970). Following the eradication of smallpox in 1980 and the end of smallpox vaccination worldwide, mpox steadily emerged in central, east, and west Africa. Since then, mpox has been reported sporadically in central and east Africa (clade I) and west Africa (clade II). In 2003, an outbreak in the United States of America was linked to imported wild animals (clade II). Since 2005, thousands of cases have been reported in the Democratic Republic of the Congo every year. In 2017, mpox re-emerged in Nigeria and continues to spread between people across the country and in travelers to other destinations [34]

Mpox is an infectious disease that can cause a painful rash, enlarged lymph nodes, fever, headache, muscle ache, back pain, and low energy. Most people fully recover, but some experience severe illness. Mpox is caused by the monkeypox virus (MPXV). It is an enveloped double-stranded DNA virus of the *Orthopoxvirus* genus in the *Poxviridae* family, which includes variola, cowpox, vaccinia, and other viruses. There are two distinct clades of the virus: clade I (with subclades Ia and Ib) and clade II (with subclades IIa and IIb). A global outbreak of clade IIb began in 2022 and continues to this day, including in some African countries. There are also growing outbreaks of clades Ia and Ib affecting the Democratic Republic of the Congo and other countries in Africa. As of August

***Received: 24.11.2024*** ***Accepted: 20.11.2025*** ***Published on: 28.11.2025***
***Corresponding Author: muekara@yahoo.com***

2024, clade Ib has also been detected beyond Africa. The natural reservoir of the virus is unknown, but various small mammals such as squirrels and monkeys are susceptible [37].

In 2022, outbreaks of mpox due to clade I occurred in refugee camps in the Republic of the Sudan.

Since 2022, there has also been an upsurge in mpox cases and deaths in the Democratic Republic of the Congo. In some areas of the country, a new offshoot of clade I, called clade Ib, has been spreading person-to-person. As of 23 December 2023, the disease has spread globally, with 92,976 confirmed cases and 172 deaths reported across 113 countries [9]. As of mid-2024, the clade has also been reported in other countries. Over 120 countries have reported mpox between Jan 2022 – Aug 2024, with over 100,000 laboratory-confirmed cases reported and over 220 deaths among confirmed cases.

Mpox re-emerged as a global public-health concern when an unprecedented multicounty outbreak began in 2022. Although mpox has long been endemic in parts of central and west Africa, the 2022–2024 waves exposed gaps in global surveillance, risk communication, equity in access to vaccines, and the ability of health systems to protect vulnerable populations.

In June 2022, the WHO declared Mpox a global public health emergency, knowing the suppressed zoonotic viral transmissible nature of the dreaded disease. At the onset, Mpox comes with an innocent beginning, showing a self-limiting illness. Mpox is a result of the monkeypox virus, which is a member of the Orthopox virus genus in the family of Poxviridae [37]. Mpox continues to be a threat today, and an upsurge of cases in the Democratic Republic of the Congo and other countries caused by clades Ia and Ib has raised concern [37]. There are vaccines for mpox. Vaccination should be considered along with other public health interventions. Common symptoms of mpox are a skin rash or mucosal lesions, which can last 2– 4 weeks, accompanied by fever, headache, muscle aches, back pain, low energy, and swollen lymph nodes. Mpox can be transmitted through close contact with someone who has mpox, with contaminated materials, or with infected animals. During pregnancy, the virus may be passed to the fetus or to the newborn during or after birth. Mpox is treated with supportive care for symptoms such as pain and fever, with close attention to nutrition, hydration, skin care, prevention of secondary infections, and treatment of co-infections, including HIV where present [37].

Mpox spreads from person to person mainly through close contact with someone who has mpox, including members of a household. Close contact includes skin-to-skin (such as touching or sex) and mouth-to-mouth or mouth-to-skin contact (such as kissing), and it can also include being face-to-face with someone who has mpox (such as talking or breathing close to one another, which can generate infectious respiratory particles). People with multiple sexual partners are at higher risk of acquiring mpox. People can also contract mpox from contaminated objects such as clothing or linen, through needle injuries in health care, or in community settings such as tattoo parlors. During pregnancy or birth, the virus may be passed to the baby. Contracting mpox during pregnancy can be dangerous for the fetus or newborn infant and can lead to loss of the pregnancy, stillbirth, death of the newborn, or complications for the parent. Animal-to-human transmission of mpox occurs from infected animals to humans from bites or scratches, or during activities such as hunting, skinning, trapping, cooking, playing with carcasses, or eating animals. The animal reservoir of the monkeypox virus remains unknown, and further studies are underway. More research is needed on how mpox spreads during outbreaks in different settings and under different conditions [34].

## Objectives

1. To examine the global spread of Mpox, including its origins, transmission patterns, and recent outbreak trends.
2. Evaluate preventive and control measures in global Mpox Management.
3. To evaluate the effectiveness of existing prevention and control measures, including vaccination, surveillance, and isolation strategies.

## Literature Review

### Recent Spread of Mpox and Its Association with Sexual Behaviour

Historically, human mpox infections were rare and primarily reported in African countries. Since the first human case was reported in DRC, subsequent cases have been reported across Africa [39].

In the recent discourse surrounding infectious diseases, the rise of mpox has become a critical subject. Particularly noteworthy is its significant association with homosexual practices, which has drawn both public and scientific attention. The mpox outbreak was declared a public health emergency in the United States, with 20,733 reported cases by 6th September 2022, representing a significant portion of the global caseload [10]. The disease quickly spread to over 100 countries across all six WHO regions, with 57,995 laboratory-confirmed cases reported by 13th September 2022 [10]. As of November 2023, 91,417 cases of mpox were reported, with 34 % of the cases being from the United States [10]. On 30th April 2024, a total of 97,208 laboratory-confirmed cases of mpox, including 186 deaths, were reported to WHO from 117 countries in all six WHO Regions (Fig. 1) [35]. With some cases being retrospectively recorded for earlier months, the number of new cases reported in April was 528, a 21.2 % decrease from the number of new cases reported in March. The Region of the Americas (43.8 %), the African Region (29.9 %), and the European Region (20.6 %) reported the most cases in April 2024. The Eastern Mediterranean Region did not report any cases (Fig. 1).

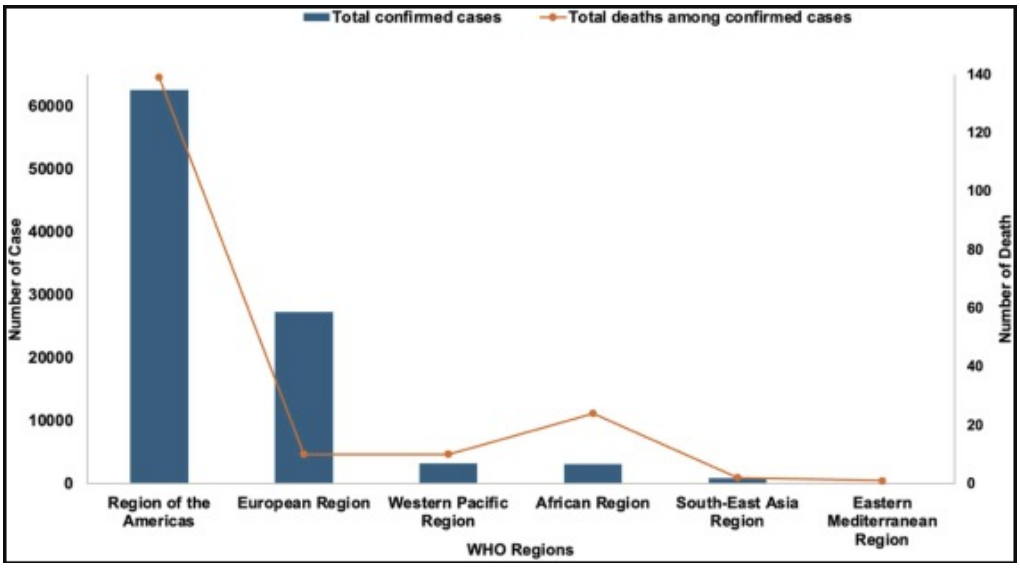


**Fig. 1.** Number of laboratory-confirmed mpox cases and deaths reported WHO Region, from 1 January 2022 through 30 April 2024.

To effectively understand the spread of mpox and the role of sexual behaviour, particularly among gays and bisexuals, it is crucial to examine the comprehensive epidemiological data and research findings. The global outbreak of mpox in 2022 highlighted that the transmission was notably prevalent within the men who have sex with men (MSM)

community, shedding light on specific patterns and interventions that could mitigate the spread.

Evidence suggests that the dynamics of mpox outbreaks can be heavily influenced by levels of community immunity and behavioural changes [17]. Another study indicated that higher immunity levels within a community, alongside modifications in behaviour, could significantly curtail the spread of the more virulent mpox clade IIb among MSM compared to the less intense clade I outbreak (CDC, 2024). In France, reports have noted that a reduction in the number of sexual partners among MSM was effective in decreasing the number of new mpox cases [23]. Similarly, the relationship between vaccination and sexual behaviours offers insightful revelations. Data shows that vaccinated individuals tend to continue employing protective practices without necessarily reducing their sexual activity [26]. This observation supports the argument for sex-positive communications and harm reduction strategies. Such approaches are considered more beneficial than abstinence-only messages, which can inadvertently stigmatize and alienate MSM, a group already facing considerable marginalization.

## Methodology

### Epidemiological Transition Framework

This conceptual paper adopts a multidisciplinary framework combining the Public Health Systems and Global Health Governance Perspective and the One Health Approach to analyze Mpox as a global phenomenon. It explains why Mpox, once a regional disease in Central and West Africa, re-emerged as a global phenomenon due to international travel, population mobility, and changing ecological conditions. The framework provides a lens through which the interconnected dimensions of health systems preparedness, zoonotic transmission, and global policy coordination can be understood. It also incorporates the Social Determinants of Health perspective to highlight how socio-economic conditions shape disease vulnerability and response capacity.

Mpox, though endemic in certain parts of Africa, became a global health emergency due to cross-border transmission and weak coordination mechanisms. This framework helps conceptualize Mpox as a global public health governance challenge.

## Discussion and Findings

### Tackling, Prevention, and Control in mpox Management: The Surveillance Systems

The current framework of mpox surveillance systems is a sophisticated amalgamation of case reporting, laboratory diagnostics, and epidemiological tracking, varying from one country to another [8]. Thus, these systems have exhibited variable effectiveness across different regions, contingent mainly on the historical presence of mpox and the consequent establishment of robust public health infrastructures [20]. In areas with a history of mpox, these systems are more comprehensive, benefiting from established awareness and resources [20]. The global outbreak of mpox, commencing in May 2022, necessitated a significant recalibration of these surveillance strategies. For example, in the United States, the Centers for Disease Control and Prevention (CDC) rapidly adapted their smallpox preparedness mechanisms to meet the specific challenges posed by the mpox outbreak [27]. This adaptation proved pivotal in managing the outbreak, as evidenced by the report of over 30,000 cases in the U.S. within the first year [27].

In the context of the global mpox outbreak, classical public health measures like isolation, contact tracing, quarantine, and vaccination have been instrumental in curtailing its spread [2]. As of March 2023, the persistence of mpox cases in various countries accentuated the critical necessity for continued vigilance and the systematic application of these measures. The effectiveness of these strategies is

apparent, yet their implementation faces distinct challenges, particularly in regions where mpox is not endemic. These non-endemic regions often need more specific knowledge and resources, which can hinder the effective execution of these strategies. Consequently, there is a pressing need for up-to-date, comprehensive information about mpox to enhance global understanding and facilitate the acceptance and implementation of these public health measures.

This commitment is imperative in managing the immediate challenges posed by mpox and preparing for potential future outbreaks. The disparity in the effectiveness of surveillance systems across different geographical regions, the risk of the virus becoming endemic in new areas, and the varied success of public health measures collectively aggravate the dynamic and complex nature of this public health challenge. To address these multifaceted issues effectively, a comprehensive approach is essential, one that synergizes scientific research, public health policies, and international cooperation. This integrated approach would facilitate the development of tailored strategies responsive to the unique challenges MPXV presents in different global contexts. Enhancing diagnostic capabilities, improving resource allocation, and fostering collaborative efforts among nations are critical components of this approach. Such concerted efforts are crucial in ensuring a robust and coordinated global response to the ongoing mpox outbreak, ultimately aiming to minimize its impact on public health worldwide.

## Vaccination Against mpox as an Effective Preventive Measure

The evolution of orthopoxvirus vaccines, particularly in mpox, is a narrative of scientific advancement and public health adaptation. The historical eradication of smallpox, a significant triumph in medicine, marked a pivotal turning point in vaccine development [29]. This achievement was predominantly driven by the widespread application of the smallpox vaccine, a cornerstone in the annals of vaccinology. Post-smallpox era, attention gradually shifted towards addressing the threat posed by mpox, a related but less understood orthopoxvirus. The transition from smallpox to mpox vaccines was not merely a redirection of focus but a critical evolution in vaccine technology and application. The cessation of routine smallpox vaccination post-eradication led to a growing population without immunity to orthopoxviruses, inadvertently setting the stage for the re-emergence of mpox as a public health concern [24]. This scenario necessitated the development of new vaccination strategies tailored explicitly to mpox.

Key milestones in this journey include the development of JYNNEOS (Imvamune/Imvanex) and ACAM2000 vaccines [29]. These vaccines represent the culmination of decades of research and development in orthopoxvirus vaccination. JYNNEOS, a non-replicating vaccine, was a significant advancement over traditional vaccines, designed to mitigate the risks associated with live, replicating vaccines (Samolej et al., 2024) [28]. On the other hand, ACAM2000, although a live, attenuated vaccine like its smallpox predecessors, was adapted to offer protection against mpox, demonstrating the adaptability of existing vaccine platforms to new challenges [28]. These vaccines represent scientific progress and the responsiveness of public health systems to emerging infectious diseases. The historical context of orthopoxvirus vaccine development reflects the dynamic nature of vaccine science and the ongoing effort to improve public health safety in response to evolving viral threats.

Recent data reveal nuanced insights into the efficacy and safety profiles of the JYNNEOS and ACAM2000 vaccines against mpox. For example, in a recent study by [25], the incidence of mpox per 100 person-years was observed to be markedly higher among unvaccinated individuals (8.83) compared to

those vaccinated with one dose (3.32) or two doses (0.78) of the JYNNEOS vaccine. Factors significantly associated with mpox diagnosis included age categories 30–39 and 40–51 years, HIV positivity, recent syphilis diagnosis, having over ten sexual partners in the past year, and clinic visits in the last year. After adjusting for these factors, the effectiveness of the JYNNEOS vaccine was determined to be 81 % for one dose and 83 % for two doses. This data supplements earlier findings, which showed the vaccine's efficacy against mpox in humans to range from 36 % to 86 % for a single dose and 66–89 % for two doses, underscoring its critical role in mpox prevention [8].

Regarding vaccination strategies, ring vaccination and targeted vaccination of high-risk groups are pivotal. Ring vaccination, an approach successfully employed during the smallpox eradication campaign, involves vaccinating contacts and potential contacts of an infected individual [30]. This strategy has shown effectiveness in controlling mpox outbreaks, though its success hinges on the rapid and accurate identification of cases and contacts. Targeted vaccination, particularly relevant in regions where mpox is endemic or among specific populations such as healthcare workers and communities with higher exposure risks, poses its challenges [6]. In the context of mpox outbreaks, these strategies must be evaluated for their effectiveness and practical and ethical implications in diverse global settings.

## Treatment

At the moment, there is no specific approved treatment for Mpox. Usually, the primary reason for taking care of a patient with Mpox disease is to prevent complications. When mpox is handled on time, it prevents a lot of problems. Vaccines could be administered to someone who shows signs of mpox within 4 days or within two weeks, if no symptoms show. Tecovirimat (TPOXX) treatments in small numbers are made available by the WHO for compassionate use, particularly for those who have severe symptoms. See figure. Note that Cidofovir and Tecovirimat are drugs for smallpox ailment; they are being tried on mpox to see their effectiveness. Most people get well within 2-4 weeks without treatment. What such people to do, according to [36], is:

1. Stay home and in your own room if possible
2. Wash hands often with soap and water or hand sanitizer, especially before or after touching sores
3. Wear a mask and cover lesions when around other people until your rash heals
4. keep skin dry and uncovered (unless in a room with someone else)
5. Avoid touching items in shared spaces and disinfect shared spaces frequently
6. Use saltwater rinses for sores in the mouth
7. Take sitz baths or warm baths with baking soda or Epsom salts for body sores
8. Take over-the-counter medications for pain like paracetamol (acetaminophen) or ibuprofen.

Another medication that could be administered to an mpox patient is Brincidofovir (Tembexa).

NIAID also supported the early development of Brincidofovir (Tembexa) as a treatment for smallpox. Similar to its support of tecovirimat, NIAID supported the discovery, preclinical development, and early clinical testing of the drug; BARDA funded its advanced clinical.

## Vaccination

Mpox vaccines are actually free of charge; whichever vaccine is applied is cost-free. According to WHO[3,] there are three vaccines against mpox. These vaccines are MVA-BN, LC16, and OrthopoxVac. This assertion is not very clear to the author. MVA-BN®) It is a trademark for Imvanex and Imvamune. While Imvanex vaccine is for the European Union, Imvamune is for Canadians. However, NYSDOH asserted that anyone who identifies as at risk for mpox is eligible for the JYNNEOS

vaccine. Both Imvanex and Imvamune are brands of the JYNNEOS vaccine. While Imvanex is squarely for smallpox and Imvamune is for both smallpox and mpox. On the other hand, OrthopoxVac is a kind of dose that is taken, based on the severity of the mpox disease in the patient. Should the illness persist, ACAM2000 is taken as an alternative dose. Both vaccines are under JYNNEOS, the supposed approved vaccine for mpox. The LC16, sometimes written as LC16-18m, is also for smallpox treatment.

According to the CDC, getting the vaccine for mpox must mean that you are:

1. Are a gay, bisexual, or other same-gender loving man who has sex with men or are transgender, gender non-binary, or gender-diverse.
2. Have had sexual or intimate contact with someone who may have mpox. Get vaccinated as soon as possible after exposure, regardless of your sexual or gender identity.

And they added that if the patient, in the last 6 months, has had or expects to have

1. One or more sexually transmitted infections
2. A weakened immune system because of another illness, like HIV
3. Sexual or intimate contact with a person who is at risk of mpox
4. Anonymous sexual or intimate contact, or more than one sexual partner

## JYNNEOS Vaccine

Mpox vaccines are free and highly effective in protecting against the virus. Receiving two doses provides optimal protection. The recommended schedule involves taking the first dose, waiting four weeks, and then receiving the second dose. Maximum immunity is achieved two weeks after the second dose. According to the National Library of Medicine (NLM), the JYNNEOS vaccine, also known as Imvamune or Imvanex, is approved for use as a smallpox and monkeypox vaccine in individuals aged 18 years and older who are at high risk of infection. The NLM specifies that two 0.5 ml doses of JYNNEOS should be administered within a four-week interval.

However, the World Health Organization (WHO) highlights concern about regional disparities. WHO data show that Nigeria currently has the highest number of confirmed mpox cases and deaths in Africa. Globally, the virus has spread to over 75 countries.

## One Health Intervention

According to the World Health Organization, 97,208 human cases of mpox were confirmed as of 30 April 2024 in 117 countries worldwide [37]. Many human cases of mpox have occurred in the tropical rainforest areas of Central and West Africa since 1970. The endemicity of the disease has been established basically due to the non-determination of the primary source of infection, which is essential in breaking its transmission dynamics [40]. The recent increase in the rate of emergence of mpox and the multi-country spread [22], has been related to anthropogenic activities of humans, which include, but are not limited to, global travel and trade, climate change, increased population, urbanization, deforestation, and intensification of livestock farming. Mpox has shown the need for a close collaboration between various specializations (meteorology, sociology, ecology, environmental health, veterinary medicine, human medicine, etc.). Therefore, holistic attention must be given to the interconnectedness of the environment, animals, and humans to provide optimal intervention strategies [3].

The need for One Health (OH) in combating epidemics or pandemics of infectious diseases has been previously demonstrated for Ebola and COVID-19 [36]. The One Health approach facilitates interdisciplinary collaboration between human, animal, and environmental health sectors. Being a cross-sectoral and multidisciplinary strategy, the application of

One Health promises several benefits in effectively controlling and eliminating future mpox outbreaks [30]. The approach operates at local, regional, national, and global levels, based on communication, collaboration, and coordination across all sectors [15]. The One Health approach provides a framework for integrating efforts and expertise from different sectors to address the eradication of mpox and other health challenges. By promoting collaboration across all industries, the One Health approach can achieve the best health outcomes for all stakeholders by strengthening the disease surveillance system and data sharing mechanism between stakeholders, supporting healthcare and public health efficiency, improving diagnostic capacity, medical education, and clinical care, and thus, protecting millions of lives [16]. It will also promote faster resolution of complicated health threats posed by mpox and the management and operations of medical supply chains for treatment [35].

The world's Quadripartite Organizations [Food and Agriculture Organization (FAO), United Nations Environment Program (UNEP), World Organization for Animal Health (WOAH), and World Health Organization (WHO)] jointly published a One Health Joint Plan of Action which contains the guidelines for the implementation of One Health actions [20]. This One Health Plan will improve regional, local, and national surveillance, preparedness, and response efforts, and the international health regulations and global security efforts against the mpox outbreak will be strengthened [31]. As part of this plan, WOAH/OIE collaborates with other partners to gather the most recent scientific information and reports and develop risk guidance for pet owners and livestock farmers. Similarly, WHO collaborates with different international communities and supports member states with surveillance, preparedness, and outbreak response activities for mpox in affected countries. In addition, through the WHO Information Network for Epidemics, they educate stakeholders and the general public and also provide real-time information on best practices in mpox prevention, testing, diagnosis through genomic sequencing, and treatment. Furthermore, the FAO offered technical assistance and advice regarding epidemiological knowledge of the disease and established a global early warning system for transboundary animal diseases by building capacities in different nations, thereby strengthening cross-sectoral cooperation [5].

Global health security is hinged on the assurance of public health safety at local, regional, and national levels. The OH strategy aims to enhance surveillance, data and information sharing, multilevel collaborations, and effective coordination of professionals to attain optimal health outcomes. Successful implementation of this approach will support global health security in the prevention and control of mpox. One Health (OH) also impacts global health security by providing government and non-governmental organizations with evidence-based information from diverse fields of expertise to guide decision-making, policy formulation, and resource distribution before or during mpox outbreaks [33].

In conclusion, since its introduction in the 1800s, the One Health approach has met its mandate to address the rising effect of the health crisis at the interface between humans, animals, and their environments. The role of One Health in mitigating future epidemics can be summarized as follows: the implementation of global mpox surveillance systems to provide real-time monitoring and evaluation of mpox transmission and spread; multidisciplinary research to demystify the specific reservoir host and hence, transmission dynamics of mpox; increased capacity building especially in the area diagnostics and healthcare provisions in the endemic African countries to facilitate early detection and interventions; control of anthropogenic activities of humans, especially those activities of encroachment into the wild to

prevent continuous mpox spillover events; and community-focused awareness and education in the hotspot regions of mpox outbreak should be intensified to nib the disease from the grassroots.

## Recommendations

1. **Strengthen Surveillance and Early Detection Systems:** Governments and health organizations should establish or reinforce real-time surveillance systems to monitor outbreaks and detect mpox cases early. This can include integrating Mpox surveillance into existing infectious disease monitoring programs, such as those used for smallpox or Ebola. Rapid identification enables faster responses, which will reduce transmission [38]
2. **Enhance Public Awareness and Community Education:** There is a need for health education campaigns to reduce stigmatization and encourage early reporting of symptoms. Media platforms, community health workers, and local influencers should be engaged to spread accurate information about Mpox transmission, prevention, and treatment [10]
3. **Improve Access to Vaccines and Treatments:** Equitable distribution of vaccines, especially the smallpox-based JYNNEOS vaccine, and antiviral treatments such as Tecovirimat, should be prioritized. International collaboration through the WHO, UNICEF, and GAVI can help ensure that low- and middle-income countries are not left behind during [12].

## Conclusion

Mpox has grown from a little-known disease found mostly in parts of Africa into a global health challenge that affects people across continents. Its spread reminds us how closely connected our world is today; what happens in one region can quickly impact others. To truly tackle Mpox, we need a combined effort that goes beyond borders. This means improving early detection and surveillance, educating communities, ensuring fair access to vaccines and treatments, supporting more research, and working together across nations.

If these actions are taken, health systems around the world will not only be better prepared to handle Mpox but also stronger against future outbreaks. In the end, the global response to Mpox is a reflection of how committed we are to protecting one another with fairness, knowledge, and compassion at the heart of every step.

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