

How to recognize and respond to monkeypox 2022 outbreak in non-endemic countries: a narrative review

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Abstract. – In May 2022, cases of monkeypox were reported in non-monkeypox endemic countries such as Europe and the United States. As of 26 May, a cumulative total of 257 laboratory-confirmed cases and approximately 120 suspected cases had been reported to WHO from non-monkeypox endemic countries. This event immediately caused great concern and alarm to the WHO and national virologists. This paper aims to summarize the epidemiological and clinical features of previous monkeypox virus infections and the current local outbreaks in non-monkeypox endemic countries and propose countermeasures to control the current localized infections in non-monkeypox endemic areas as soon as possible.

We reviewed the literature and websites related to monkeypox. We searched Google Scholar, PubMed, Web of Science, Embase, and African Journals Online using the medical subject terms “monkeypox”, “monkeypox virus”, “monkeypox outbreak”, “non-monkeypox endemic areas”, “clinical features”, “epidemiology”, “transmission”, and “infection”.

We found that monkeypox is a zoonotic disease of forest animals that has occurred mainly in West and Central Africa since the first case was reported in the Congo in 1970, with occasional cases spreading to countries such as the United States and Europe. It is common among students, housekeepers, hunters, farmers and housewives. It is more common in males than females, occurs below middle age, and is more common in children under 10. The incubation period is 5 to 21 days, and the rash usually appears within 1 to 3 days after the onset of fever. Clinical manifestations include fever, rash, swollen lymph nodes, headache, muscle pain and unusual weakness. Most patients have mild symp-

toms that last from 2 to 4 weeks. The source of the sudden outbreak in Europe and the United States is currently unknown and occurs mostly in homosexuals who have sex with men (MSM).

Outbreaks of monkeypox virus infection in non-monkeypox endemic areas have received widespread attention and focus. We believe that a scientific response to the transmission route of monkeypox virus and, where necessary, vaccination of high-risk groups against the monkeypox smallpox will control infection in non-monkeypox endemic areas.

Key Words:

Monkeypox, Clinical features, Epidemiology, Transmission, Non-monkeypox endemic areas.

Introduction

Following the 1970 monkeypox outbreak, repeated outbreaks of this zoonotic disease with epidemic potential have occurred in Central and West Africa, posing a threat to health security in the African region and beyond¹. The number of reported human cases has increased dramatically in the last 20 years, exceeding the total number of patients in the 45 years since monkeypox was first identified²⁻⁴. Even this disturbing situation has not received sufficient attention from people in non-monkeypox endemic areas.

The first confirmed case of monkeypox this year was reported in the UK on 7 May 2022, when the patient returned to the UK by air from Nigeria⁵. Unexpectedly, many confirmed and sus-

pected monkeypox cases were soon identified in the UK, Spain, Portugal, Sweden, Italy, and other countries, with no relevant history of monkeypox endemic areas⁶. Within three weeks, 257 laboratory-confirmed and approximately 120 suspected cases were reported to the WHO from non-endemic countries in Europe and the USA⁷. This event immediately attracted widespread international attention and raised many concerns.

We searched the relevant literature and websites of the World Health Organization (WHO) and other organizations to summarize the epidemiological and clinical features of previous monkeypox virus infections and current reports of conditions in non-monkeypox endemic local areas. We analyzed the monkeypox virus's transmission routes and epidemiological data and proposed proactive measures to respond to the outbreak to guide infection control in non-monkeypox endemic regions.

Origin and Development of Monkeypox

Both monkeypox and smallpox viruses belong to the genus Orthopoxvirus of the family Poxviridae⁸. Variola viruses have been eradicated through extensive vaccination^{9,10}. Other orthopox viruses that are pathogenic to humans circulate in nature. The origin of the West African subtype of monkeypox virus was inferred from the isolation of some genetic variants of orthopox viruses about 600 years ago¹¹. Monkeypox virus was not found until 1958 in an outbreak of blistering disease in captive monkeys brought from Africa for research in Copenhagen, Denmark¹². In August 1970, in the equatorial region of Zaire (now the Democratic Republic of Congo, DRC), a child who had contact with monkeys in the village of Bukenda developed a fever and pox-like rashes, initially suspected to be smallpox. A sample was sent to the WHO Smallpox Reference Centre (Moscow) where the virus was isolated and eventually diagnosed as monkeypox¹³. This was the first confirmed case of human monkeypox in the world.

In the ten years since 1970, 47 human cases of monkeypox have occurred in five Central and West African countries; Zaire, where cases were first identified, reported the highest number of cases, with 38 confirmed cases. All cases occurred in tropical rainforest areas, with clusters of cases observed in households and at the edges of forests in tropical areas around countries¹⁴.

Between 1970 and 1986, 10 human cases were reported in West African countries (Sierra Le-

one, Nigeria, Liberia, and Côte d'Ivoire) and 394 were reported in the Congo Basin countries of Cameroon, Central African Republic and DRC. Between 1996 and 1997, the DRC erupted large-scale ongoing epidemics¹⁵. The outbreak began in mid-February 1996 when the first case was reported in the village of Akungula but did not become apparent until late July when more people were infected. Five hundred eleven suspected cases occurred in 54 towns in the Katoko Kombe health district and 24 villages in the Lodja health district between February 1996 and October 1997^{16,17}. The disease was relatively mild, with a mortality rate of about 1-5%, while the proportion of secondary cases was much higher than previously reported (about 78%). A large proportion of the reported cases were smallpox cases in acquired immunodeficiency syndrome (AIDS) patients, which were later confirmed by the laboratory¹⁸. For reasons such as poverty, AIDS patients here do not go on anti-AIDS medication, which puts some patients at risk of co-infection with monkeypox and smallpox, as five monkeypox-positive patients in one family had serological evidence of recent smallpox infection (two of them had smallpox DNA detected in skin lesion samples)¹⁹.

Ten African countries have reported human cases of monkeypox - the Democratic Republic of Congo, Republic of Congo, Cameroon, Central African Republic, Nigeria, Côte d'Ivoire, Liberia, Sierra Leone, Gabon, and South Sudan. Active in the occurrence and development of monkeypox, WHO issued a bulletin in 1986 and now considers monkeypox to be "a rare viral zoonotic disease occurring mainly in remote areas of central and Africa, near tropical rainforests". As the disease has been reported, several viral genes have been sequenced and traced in different countries^{20,21}.

Based on the clinical and epidemiological characteristics of monkeypox virus isolates, combined with genotypic studies, two distinct branches of the virus have been identified: Central African Congo Basin (CB) and West African (WA)^{1,22}. The CB branch has a higher mortality rate (~10%) and appears to be more frequently transmitted in humans, with multiple cycles of human-to-human transmission. By report, the CB branch caused a light human-to-human infection in the DRC, while the WA branch has a lower mortality rate²³⁻²⁵.

From January 2001 to December 2004, the surveillance project of the Congolese Ministry of Health reported 2734 suspected cases of human monkeypox in 11 provinces, with an increasing trend annually, including 380 cases in 2001, 545

in 2002, 783 in 2003, and 1026 in 2004. The majority (94%) occurred in young people who had not been vaccinated against smallpox. These years the ongoing civil war may have accelerated the flow of the monkeypox epidemic, but it also led to interruptions in reporting and uncontrolled surveillance of monkeypox²⁶. Besides, DRC has the highest number of reported cases of monkeypox in the world each year^{27,28}.

In 2003, cases of monkeypox outside the endemic area (Africa) were reported in the United States. Some people in the Midwest of the USA developed fevers, rashes, respiratory symptoms and swollen lymph nodes, and outbreak investigations revealed cases of monkeypox following contact with pet prairie dogs (*Cynomys ludovicianus*)²⁹. During this outbreak, the importation of contaminative rodents from Ghana led to cases in several US states, and subsequent animal-to-animal transmission led to animal-human messages, culminating in an outbreak of 47 confirmed or suspected cases, fortunately with no deaths³⁰.

From 2018 to 2021, adults in Nigeria with the dubious onset of monkeypox in Israel, the UK, Singapore, and the USA were diagnosed with monkeypox³¹⁻³⁴. These cases are suspected to be the result of animal-to-animal transmission. Three other cases occurred in the UK, one caused by hospital infection and two through transmission by family members³⁵.

Clinical Features of Monkeypox

The clinical presentation of monkeypox is similar to that of smallpox, including symptoms of skin and mucosal lesions³⁶⁻³⁸. As with smallpox, the precursors of monkeypox infection begins with fever, headache, backache, myalgia and malaise and is followed 2-3 days later by skin and mucosal lesions, starting on the face, distributed over the trunk and extremities, but also around the vulva and anus, with a centrifugal distribution in 96.5% of individuals³⁹. The lesions evolve from macules to clear fluid-filled blisters, then to pustules, and then to crusts within 10 minutes until they disappear completely⁴⁰. The rash has been reported to be widespread throughout the body, but the most affected areas are the face (96%), legs (91%), trunk (80%), arms (79%), palms (69%), genitals (68%) and soles of the feet (64%)⁴⁰.

The incubation period for monkey is usually 6 to 13 days, or maybe 5 to 21 days. The febrile period usually lasts from 1 to 3 days. The main clinical signs of monkeypox are systemic symp-

toms (fever, headache, muscle pain, malaise) and some local rashes. Some patients present with respiratory symptoms such as sore throat and chunter, a few show gastrointestinal symptoms such as nausea and vomiting, and a few have damage to the conjunctiva or oral mucosa. Compared to smallpox, most patients have milder symptoms, usually lasting 2 to 4 weeks. Some patients present with only rashes and mild discomfort. Case reports from Nigeria show the incidence of these symptoms: 100% in rash, 88% in fever, 79% in headache, 73% in itching, 69% in lymphadenopathy, 68% in chills or sweats, 63% in myalgia, 58% in sore throat, 54% in fatigue, 36% in mouth ulcers, 28% in cough, 24% in conjunctivitis, 22% in photoallergic, 22% in vomiting or nausea, 57% had a fever prior to the rash⁴⁰.

Unlike smallpox, most cases present with swollen lymph nodes, which prompted us to confirm laboratory tests and viral cell cultures to diagnose monkeypox⁴¹. Individuals with complex exposures were more likely to have significant systemic symptoms (49.1% vs. 16.7%) and to be hospitalized for the duration of their illness (68.8% vs. 10.3%) compared to those with non-invasive exposures. There was a difference in the prevalence of gastrointestinal symptoms among all MPXV-infected individuals presenting with gastrointestinal symptoms (47.1% vs. 20%)⁴². Patients who were bitten or scratched also exhibited more systemic symptoms (fever, chills, and back pain) and were more likely to have nausea or vomiting, especially in the early stage of disease⁴³.

Monkeypox began to be reported in the DRC in 1970 and rapidly led to 47 human cases of monkeypox in five Central and West African countries. Over the decades, it has occurred in ten African countries. All early cases of monkeypox occurred in tropical rainforest areas of Africa, with clusters of cases observed in some areas within countries and households⁴⁴.

The reported incidence of monkeypox varies widely, with a population-based surveillance study in nine health districts in the DRC identifying 760 laboratory-confirmed human cases of monkeypox with a cumulative annual incidence of 5.53/10,000 (2.18%-14.42%)⁴⁵. Based on previous data, the overall morbidity and mortality rate was 8.7%, with 10.6% (95% CI:8.4%-13.3%) vs. 3.6% (95% CI:1.7%-6.8%) in the Central and West African groups, respectively⁴⁶. Currently, the CFR of suspected cases reported in the DRC is approximately 3%. In the past, within Africa, the West African branch has been associated with an overall

lower morbidity and mortality rate of approximately 1% in a generally younger population⁴⁷. The vast majority of data show that more males than females develop the disease, with 53.7% of males vs. 46.0% of females reported. Students, housekeepers, hunters, farmers, and housewives were the most affected groups. The groups reported were students (31.7%), housekeepers (21.5%), hunters (14.8%), farmers (14.1%), housewives (10.8%), gamekeepers (3.5%), traders (2.4%), health care workers (1.3%) and others (7.4%). Males were more likely to report being a student, trophy trader, farmer, hunter or health worker or working in another occupation, while females were more likely to report being a housekeeper or housewife⁴⁸.

The median age of onset of disease increased from 4 years (1970s) to 21 years (2010-2019). In the early years (1970-1989), monkeypox occurred mainly in children, with a median age of onset of 4 to 5 years; this figure increased to 10 years between 2000 and 2009 and to 21 years between 2010 and 2019. Some of the information reported is incomplete due to poor medical care and occasional warfare. Regarding the age of death in monkeypox cases, in the early years, 100% of deaths were in children under 10 years of age, while in the period of 2000-2019 children under 10 years of age accounted for only 37.5% of deaths. Interestingly, over the next decade, the average age of monkeypox cases increased from 10 to 21 years. In fact, most cases were either too young to be vaccinated or were born after routine smallpox vaccination had ceased⁴⁹. Factors associated with an increased risk of infection included living in a forested area, being male, being younger than 15 years, and not having been vaccinated against smallpox. Since 2017, a small number of monkeypox deaths in West Africa have been associated with young or untreated HIV infection.

Since 2003, disease transmission associated with importation and travel outside of Africa has occasionally led to outbreaks. Interacting or contacting with infected animals or individuals is a risky behavior associated with the acquisition of monkeypox.

Transmission of Monkeypox

Monkeypox is a zoonotic disease of forest animals, with the primary mode of transmission being contact with infected animals. Although the host remains elusive, small mammals, including prairie dogs and rodents, are thought to be associated with the natural history of the virus⁵⁰.

Monkeypox virus is transmitted when humans come into contact with the virus from an infected animal, an infected person or material contaminated. In addition to the transmission of monkeypox virus to humans through bites or direct contact with blood, meat, body fluids or skin/mucosal lesions of infected animals, human consumption of undercooked meat and other animal products from infected animals may also be a risk factor^{51,52}. The virus can also be transmitted to the foetus through the mother's placenta. Monkeypox virus can be transmitted from animals to humans by being bitten or scratched by an infected animal, handling wildlife, or using products made from infected animals. The virus can also be transmitted through direct contact with body fluids or ulcers of an infected person or through contact with materials that have been exposed to body fluids or ulcers.

Molecular and epidemiological investigations of infections in pet rodents in Ghana, USA, revealed that the West African monkeypox gene cluster (clade) entered Texas, USA, on 9 April 2003 *via* transport of nine different small mammals, including six African rodent genera⁵³. Researchers have cultured evidence of the provable monkeypox virus from 22 animals, and the virus DNA has been found in at least 33 animals⁵⁴. Genomic studies of monkeypox viruses isolated from one human and many pet rodents showed that these viral isolates were identical.

Although transmission of monkeypox from person to person is less common. Monkeypox virus is transmitted from one person to another through close contact with foci, body fluids, respiratory droplets, and contaminated materials (e.g., bedding). A health care worker in the UK was infected after caring for an imported monkeypox patient. This fact also shows that infection can occur even when special infection control precautions are taken. Second- and third-generation interpersonal transmission of monkeypox is well documented⁵⁵⁻⁵⁷.

Status of Monkeypox Virus Outbreaks in Non-Endemic Areas

The current outbreak of monkeypox virus infection in a non-monkeypox endemic area is an isolated regional outbreak. Eight cases of monkeypox, including two familial clusters of monkeypox, were reported in the UK from 13-18 May. These eight patients had no history of travel to monkeypox-endemic areas and were not related to the travel-related case from Nigeria reported in the UK on 7 May.

In the following days, several other EU countries and other countries also reported cases of monkeypox unrelated to travel in monkeypox-endemic countries⁵⁸. As of 13:00 on 21 May, 92 laboratory confirmed cases of monkeypox have been reported to WHO by 12 non-monkeypox-endemic Member States in the three WHO-acceding regions⁵⁹.

In the time since, there has been a rapid increase in monkeypox virus cases in non-monkeypox endemic areas and with an expansion of the incidence area, cases have started to emerge in Asia and Oceania. As of 26 May, a cumulative total of 257 laboratory-confirmed cases and approximately 120 suspected cases had been reported to WHO (Table I). Anyway, no deaths have been reported. The sudden and large simultaneous occurrence of monkeypox in several non-endem-

ic countries suggests that there may have been a period of community transmission that just went undetected⁶⁰.

WHO continues to receive updates on ongoing outbreaks through the Integrated Disease Surveillance and Response (IDSR) established for endemic countries in the African Region. In addition to the cases reported in non-endemic countries, there has been a more pronounced increase in the incidence of monkeypox in endemic countries in Africa during the same period⁶¹, as shown in Table II. The cross-border outbreaks and large-scale human-to-human transmission that characterize the current epidemic are of great global concern.

Most current cases of monkeypox are self-reported in young men who have sex primarily with men, and most patients first present with genital

Table I. Monkeypox cases in non-endemic countries submitted to WHO between 13 May and 26 May 2022, 5 pm CST.

Region	Country	Confirmed	Suspected under Investigation
PAHO	Argentina		1
	Canada	26	25-35
	French Guiana		2
	United States of America	10	
EMRO	United Arab Emirates	1	
	Sudan		1
EURO	Austria	1	
	Belgium	3	3
	Czechia	2	1
	Denmark	2	
	Finland	1	
	France	7	
	Germany	5	
	Israel	1	
	Italy	4	
	Netherlands	12	>20
	Portugal	49	
	Slovenia	2	
	Spain	20	64
	Sweden	2	
	Switzerland	1	
		United Kingdom of Great Britain and Northern Ireland	106
WPRO	Australia	2	
TOTAL	23 countries	257	117-127

Source: World Health Organization website⁷.

Table II. Monkeypox cases in endemic countries.

Country	Time period	Cumulative cases	Cumulative deaths
Cameroon	15 December 2021 to 1 May 2022	25	9
Central African Republic	4 March to 17 May 2022	8	2
Democratic Republic of the Congo	1 January to 8 May 2022	1284	58
Nigeria	1 January 2022 to 30 April 2022	46	0
Republic of the Congo	21 May 2022 to 23 May 2022	2	0

Source: World Health Organization website⁷.

(peri) and perianal rashes, suggesting that monkeypox may occur through close physical contact during sexual activity. The sexual route of transmission has not been established as a mode of transmission of monkeypox. However, prolonged close contact during sexual activity and contact with secretions may contribute to interpersonal transmission. Transmission may be by close contact with contaminated infectious material through mucous membranes or non-intact skin, or by large droplets of respiratory fluid during prolonged face-to-face contact. This group is largely unvaccinated against smallpox and has not reported the possibility of HIV co-infection, but one should still be alerted to the possibility of HIV co-infection, which would increase the risk and severity of monkeypox infection, particularly in HIV-infected individuals not receiving antiretroviral therapy⁶²⁻⁶⁴. Overall, these individuals lack monkeypox immunity and are all susceptible to monkeypox, hence monkeypox virus shows a high rate of interpersonal transmission in this population. Cases reported in some countries appear to be associated with events in Spain (Madrid and Canary Islands) and Belgium (Antwerp). However, many countries have also reported cases with no known epidemiological link to travel abroad, exposure to other cases, animals, or participation in specific activities.

The current aggregation of monkeypox cases is inconsistent with the previous low risk of human-to-human transmission, so factors such as altered host adaptation or increased infectivity due to virus mutation cannot be excluded. Current outbreaks of monkeypox virus infections in non-monkeypox endemic areas are associated with outbreaks in Africa during the same period. The events associated with Spain and Belgium will be further investigated and some epidemiological investigations regarding travel abroad, exposure to other cases, animals or participation in specific activities will be further developed. Besides, sequencing has now been completed and shows that the virus in infected cases

matches the 2018-2019 export cases from Nigeria⁶⁵, so the likelihood of virus mutation is in a pig's eye; however, vigilant, and frequent surveillance is still required. We believe that a combination of monkeypox virus gene sequencing may be useful for outbreak tracking and case surveillance.

Current Responses to Outbreaks of Monkeypox Virus Infection in Non-Monkeypox Endemic Areas

Outbreaks of monkeypox virus infections in non-monkeypox endemic areas pose a challenge to humans. At a time when a major once-in-a-century epidemic like COVID-19 is not yet under control, it is imperative that people must take a high priority and respond proactively to monkeypox virus infections before they become a further overwhelming public health problem for countries.

In the current situation, there are very important precautions to take: for example, do not to travel to monkeypox endemic areas in Africa and take care to avoid close contact with people from these areas whenever possible. Restrict or ban the importation of wild animals such as pet rodents from monkeypox endemic areas. Avoid contact with wild animals in areas where monkeypox is endemic, especially unprotected contact with the meat, blood or other parts of sick or dead animals, and only consume meat if it is thoroughly cooked. Infected animals should be isolated from other animals and quarantined immediately. Animals that may have come into contact with infected animals should be isolated for 30 days and observed for signs of monkeypox.

We should identify monkeypox cases as early as possible, trace close contacts, isolate and treat cases to prevent further transmission. People in close contact with monkeypox cases should self-monitor the development of symptoms for 21 days after the last contact and avoid close physical contact with

young children, pregnant women and immunocompromised individuals until monkeypox is ruled out. Monkeypox surveillance and case investigation are important, and the key objective is to rapidly identify cases and clusters to provide optimal clinical care. Patients with or suspected of having monkeypox must be hospitalized or treated in isolation at home until their lesions crust over, the scabs fall off and a new layer of skin forms underneath. In the current situation, contact identification and contact tracing should be initiated as soon as a suspected case is identified. This requires early identification of monkeypox by medical staff, and once a rash is detected, the contact should be daily monitored for any signs/symptoms for at least 21 days, starting with the last contact with the patient or their contaminated material during the period of infection. Isolation or exclusion efforts are not required during contact tracing as long as there are no symptoms. Clinicians should immediately report suspected cases to public health authorities. In non-endemic countries, a single case is considered an outbreak. Because of the public health risk associated with a single case of monkeypox, clinicians should immediately report suspected cases to local or national public health authorities according to national reporting protocols⁶⁶.

Monkeypox is spread from person to person mainly through direct contact with infected ulcers, scabs or body fluids. It can also be transmitted through respiratory secretions during prolonged face-to-face contact. Monkeypox can be transmitted through intimate human-to-human contact, including during sexual intercourse, and activities such as kissing, hugging, or touching body parts with monkeypox sores⁶⁷. The sexual route of transmission has not been established as the mode of transmission of monkeypox and it is unclear whether monkeypox can be transmitted through semen or vaginal secretions. Prolonged close contact during sexual activity and contact with secretions may contribute to interpersonal transmission of monkeypox. Condoms do not prevent this interpersonal transmission. During such outbreaks, many people develop a localized rash - oral, peri-genital and/or perianal distribution with painful localized lymphadenopathy - sometimes with secondary infection. These individuals may be seen in a variety of community and health care settings, including but not limited to primary care, fever clinics, sexual health services, travel health clinics, infectious disease units, emergency departments, dermatology clinics, obstetrics and gynaecology and dentist-

ry. Raising awareness of monkeypox among potentially affected communities as well as health care providers is essential to identify and prevent further secondary cases and to effectively manage the current outbreak⁶⁸. Because monkeypox lesions usually occur on multiple or all parts of the skin, even in the mouth, there is a high risk of further transmission of the virus through close physical contact, including face-to-face, skin-to-skin, or mouth-to-mouth contact, or contact with contaminated materials (e.g., bed sheets, bedding, clothing or utensils) within the home or with sexual partners. It is particularly important to improve the management of the MSM and train them in the prevention of monkeypox. The difficulty lies in the fact that it is difficult for us to identify and target these populations. We can promote monkeypox prevention messages in places where these populations are active. At present, the infection risk to the public appears to be low and MSM populations may be concerned about this knowledge. Once they seek help, it is important that those involved understand how to provide support and try to offer a multifaceted service. Nevertheless, countries must take immediate action to control further transmission between high-risk groups, guard transmission against the general population, and prevent monkeypox from becoming a clinical disease and a public health problem in countries where it is not currently endemic.

Protecting frontline health workers, developing effective control and prevention measures are indispensable. Health workers need to use personal protective equipment, including gloves, disposable gowns, surgical or N95 masks, goggles or face shields, anti-particulate respirators for aerosol generating operations and hand hygiene is also considered. Furthermore, safeguarding authorities should promptly dispose of contaminated clothing and bedding, and clean and disinfect environmental surfaces.

Vaccination of contacts and/or health personnel against smallpox can be used as post-exposure prophylaxis. Countries may consider the timely vaccination of close contacts as post-exposure prophylaxis⁶⁹. Some countries may consider locally available vaccination against monkeypox or smallpox for high-risk contacts (preferably within 4 days of exposure), such as family members living together, close personal or sexual contacts, or health workers exposed without wearing appropriate personal protective equipment. Decisions about vaccination and which vaccine to use should be

based on national guidelines. Individual decisions about exposure to patients with monkeypox should be based on public health guidance, risk-benefit assessments and shared clinical decision-making between health care providers and patients. Pre-exposure vaccination may also be considered for certain health workers, including laboratory personnel or other high-risk individuals.

Conclusions

An outbreak of monkeypox virus infection in a non-monkeypox endemic area has generated widespread interest and concern. However, this outbreak of monkeypox virus in non-monkeypox endemic areas is mainly a West African branch, with sequencing of the viral genes which showing no mutations. In our view, this outbreak appears to have enhanced the spread of monkeypox virus, but it remains limited. We believe that infection in non-monkeypox endemic areas is likely to be controlled soon through aggressive tracing, isolation of patients and their close contacts, scientific response to the transmission route of monkeypox virus, and vaccination of high-risk groups against monkeypox if necessary.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Ethics Approval

This article does not contain any studies with human participants or animals performed by any of the author.

Authors' Contribution

All authors contributed to the study conception and design. Dr. Zongyu Qiu and Dr. Shiliang Zheng conceived the idea and designed the study. The manuscript was prepared by Zongyu Qiu and Dr. Jinrong Wang. The revision of the manuscript was mainly completed by Yuhao Tao, Zongyu Qiu and Jinrong Wang. All authors have read and approved the final manuscript.

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