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Review article

Mpox in Egypt: Status, preparedness and looming challenges

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ABSTRACT

Background: Monkeypox (Mpox) is a zoonotic disease endemic in many countries of West and Central Africa with a trend of global spread due to its high contiguity. The emerging new clade of Monkeypox virus (MXPV), its swift spread in eastern the Democratic Republic of the Congo (DRC), and the reports of cases in several neighboring countries are alarming and worrisome. The World Health Organization (WHO) has recently declared Mpox as a public health emergency of international concern. In this narrative review, we present the microbiological features of MXPV, the status of Mpox, as well as the preparedness and the challenges that face the Egyptian health authorities. we concluded that while there are no current indications that the virus is headed towards Egypt, the interconnectedness of today's world presents ongoing risks. To prevent the spread of the virus into Egypt, the Health Ministry has raised the alert level to the highest. However, with limited resources and competing healthcare demands, they face significant challenges. To address these vulnerabilities, it is recommended that Egyptian health authorities enhance early detection systems at key entry points, such as airports and border crossings, increase public awareness campaigns on Mpox, and establish emergency stockpiles of vaccines and antiviral treatments. Collaborative efforts with neighboring countries and international donors can also strengthen regional surveillance networks and improve Egypt's overall readiness to manage potential outbreaks.

Introduction

Human mpox (formerly known as monkeypox) is a zoonotic disease caused by the monkeypox virus (MPXV). Infected animals or humans are the main transmission mode of MXPV [1].

WHO has declared Mpox a Public Health Emergency of International Concern twice, the first in May 2022 and the second in August 2024 [2]. During the period from January 2022 to September 2024, a total of 43,232 suspected cases; 8,264 confirmed, and 1,597 Mpox deaths have been reported in 20 African countries [3].

Two separate clades of MXPV exist; Clade I, which includes subclades Ia and Ib, and clade II, which includes subclades IIa and IIb. Clade IIb is still widespread today, having started in 2022 and spreading to several African nations. The Democratic Republic of the Congo and other African nations are also experiencing an increase in clades Ia and Ib epidemics. Beyond Africa, clade Ib has also been found as of August 2024. Therefore, proper and timely preparedness of nations against

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Mpox from the root level is advisable [4]. While Egypt is not typically regarded as an ideal location for Mpox, with no cases have being reported in the 2024 PHEIC until the 26th of August 2024 [5], its strategic location as a hub connecting Africa, the Middle East, and Europe increases its vulnerability to the importation and transmission of this illness [6]. In this narrative review, we present the microbiological features of MXPV, the status of Mpox, as well as the preparedness and the challenges that face the Egyptian health authorities in particular.

Microbiological features of MXPV:

Structure. MXPV 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, formerly called the Congo Basin (Central African) clade, with subclades Ia and Ib and clade II (with subclades IIa and IIb), formerly called the West African clade, with sub-clades IIa and IIb [2]. In Egypt, clade II is the existed existing one in the 2022 outbreak [3].

Replication and pathogenicity. MXPV attaches to host cells through precise interactions between viral proteins and receptors located on the outer cell surface. Though the precise receptors remain incompletely understood, experts speculate that they encompass glycosaminoglycans and other cell surface chemicals. The steps of life cycle is illustrated in figure 1 [7,8]. Variations in viral clearance and pathogenicity may be explained by genetic differences between the two clades' viral genomes. Higher mortality and more severe disease have been linked to Clade I. Compared to other enveloped viruses, poxviruses have exceptional resilience to drying as well as a better tolerance to temperature and pH. Their environmental persistence is significantly impacted by these traits. The Orthopoxvirus genus is recognized for its enduring stability in the environment, as evidenced by the detectability of viable MPXV on domestic surfaces up to 15 days following surface contamination. Regardless of these qualities, poxviruses are susceptible to standard disinfectants. However, they may be less sensitive to organic disinfectants than other enclosed viruses [1].

Transmission and spread.

From animal to human. MPXV is a zoonotic disease that can spread between animals and people with high endemicity. The virus has been found in small rodents, monkeys, and other mammals that live in these areas. From human to human. Close contact with rashes, blisters, or sores on the skin; bodily fluids, particularly respiratory droplets from coughing or sneezing; and contaminated items, like linen and towels, can all result in the spread of MPOX between people. Respiratory droplet transmission (such as coughing or sneezing) is less prevalent and typically only occurs during extended face-to-face contact. During sex, close physical touch can spread diseases. In this instance, blisters, lesions, or infectious skin rashes are probably the means of transmission. During pregnancy, the virus can potentially be transferred to the fetus through the placenta. people with mpox are considered infectious until all their lesions have crusted over, the scabs have fallen off and a new layer of skin has formed underneath, and all the lesions on the eyes and in the body (in the mouth, throat, eyes, vagina and anus) have healed too, which usually takes from 2 to 4 weeks. It is also possible for the virus to persist for some time on clothing, bedding, towels, etc. From humans to animals. There have been a few reports of the virus being identified in pet dogs. However, it has not been confirmed whether these were true infections or whether the detection of virus was related to surface contamination [2,9].

Mpox prevention and control

The primary objective of Mpox control is to restrict human interaction with possible animal transporters, adhere to proper hygiene practices, and wear personal protective equipment in hospital environments [10]. In addition to standard precautions, the patient should be placed in a single room, PPE include gloves, gown, eye protection, and NIOSH approved respirator equipped with N95 filters or higher

Those with suspected MPXV infection should have recommended isolation precautions for mpox maintained until MPXV infection is ruled out. Those with confirmed MPXV infection should have recommended isolation precautions for mpox maintained until all lesions have crusted, those crusts have separated, and a fresh layer of healthy skin has formed underneath [11].

The implementation of public health strategies, such as monitoring, prompt detection of cases, and segregation of affected persons, are crucial in averting epidemics and managing the transmission of the virus [12]. It is crucial to

increase the level of vaccination coverage and enhance diagnostic skills [13]. At present, WHO recommends the use of MVA-BN or LC16 vaccines for people at risk during an outbreak of mpox. ACAM2000 may also be used for certain people based on an individual assessment when other vaccines are not available. Vaccination is recommended by WHO for individuals at high risk of exposure to Mpox during an outbreak, including health professionals and others who have had contact with someone infected. During epidemics, WHO recommends vaccination for children with a high risk of exposure. Travelers who may be at risk, based on an individual risk assessment with their healthcare provider, may wish to consider vaccination [2].

Status of MPOX cases in Egypt:

Using the latest data on Mpox cases in Africa from WHO and the Centers for Disease Control and Prevention (CDC), a detailed and up-to-date map of the African spread of Mpox is created using geographic data and visualizing it in a way that highlights the distribution of cases across different regions in Africa. This map illustrates the geographic spread of monkeypox across Africa, highlighting regions with prevalence in red and dark blue,and areas with lower incidence in light pink an d green across different African countries, figure 2.

Starting from September 2022, Egyptian authorities documented occasional cases of Mpox, most likely transmitted by international travel or cross-border animal commerce, highlighting the interdependence of the entire region [14]. In the 2024 Mpox outbreak, Egypt had documented no Mpox cases, and health authorities are closely monitoring possible transmission through contact tracing and implementing restrictions [15].

Risks of Mpox infection and Preparedness in Egypt. The African Union Member States are divided into four categories according to their mpox status and risk level. This risk category is only for planning and resource optimization in response to active and sustained transmission epicenters. Egypt is one of category 2 countries; Countries not experiencing sustained human-to-human transmission but experiencing sporadic human cases since 01 January 2022; and / or, countries that are assessed as having endemic zoonotic reservoirs for MPOX [16].

Various risk factors, such as a dense population, frequent foreign travel, and the existence of biological repositories, affect the transmission of Mpox in Africa [17]. Moreover, participation in social traditions and business activities related to animal trading can increase the spread of zoonotic disease [18]. Individuals with impaired immune systems, such as those with HIV, are more vulnerable, adding complexity to the field of public health [19]. Facilitating prompt immunization and providing comprehensive public education are crucial for reducing these hazards [20].

The Egyptian healthcare authorities have implemented monitoring and diagnostic procedures to oversee and control possible epidemics [21]. Based on the given data, the possibility that Mpox will become an epidemic is very low. However,
The Health Ministry has upgraded the alert level to the highest to prevent the viral disease from reaching Egypt. On the patient level, suspicious cases are directed to the nearest fever hospital, the medical staff is trained to handle the monkeypox virus [8].

Health authorities in Egypt face challenges. Egypt's position as a transit point requires increased precautionary measures to avoid the transmission of Mpox to other regions of the Middle East and Europe [22]. Egyptian authorities have used their knowledge from past epidemics, such as COVID-19, to improve monitoring, raise public awareness, and establish quarantine and medical sites [23]. Nevertheless, general readiness in the surrounding area is characterized by different degrees of healthcare infrastructure, monitoring of illness capacities, and public health strategies among various nations [24]. Researchers suggest the necessity of implementing a synchronized global approach that includes the sharing of resources, the application of standardized response procedures, and augmented funding for healthcare facilities [25, 26].

Healthcare professionals in Egypt and the Middle East face significant challenges in effectively managing the Mpox epidemic: Scarce or limited healthcare facilities, persistent political instability in specific regions, and the lingering effects of the COVID-19 epidemic have placed significant pressure on healthcare institutions [27]. Another significant obstacle is the distribution of precise knowledge despite false information and widespread apprehension [28]. Providing fair and equal access to vaccinations and treatments is of paramount importance, as is establishing public confidence in healthcare organizations [29]. In addition, the issue of collaboration across borders

persists because of the heterogeneous degree of preparedness for responses and disparate medical systems throughout the region. Public awareness of Mpox is often inadequate, especially in areas that have not seen previous epidemics [30]. This lack of understanding is responsible for the delays in seeking medical care and the resulting increase in incidence. Furthermore, false information can intensify panic and obscure public health initiatives. A recent study among Egyptian HCWs showed that high-income level and having information about MPOX were significant predictors of confidence in the MPOX vaccines [31]. Limited resources pose challenges in adequately prioritizing and efficiently addressing novel public health concerns such as Mpox. Despite the availability of vaccines cross-protection against Mpox, their accessibility remains restricted, particularly in areas with occasional reported cases. Challenges in the global supply chain, regulatory barriers, and fair distribution also pose significant obstacles [32].

Figure 1. MXPV replication cycle

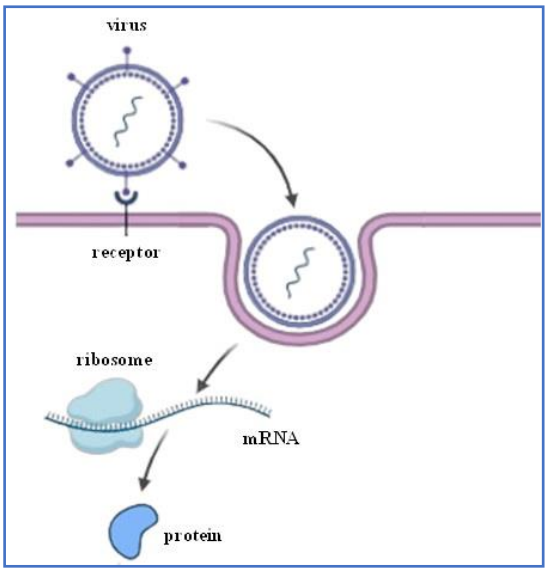
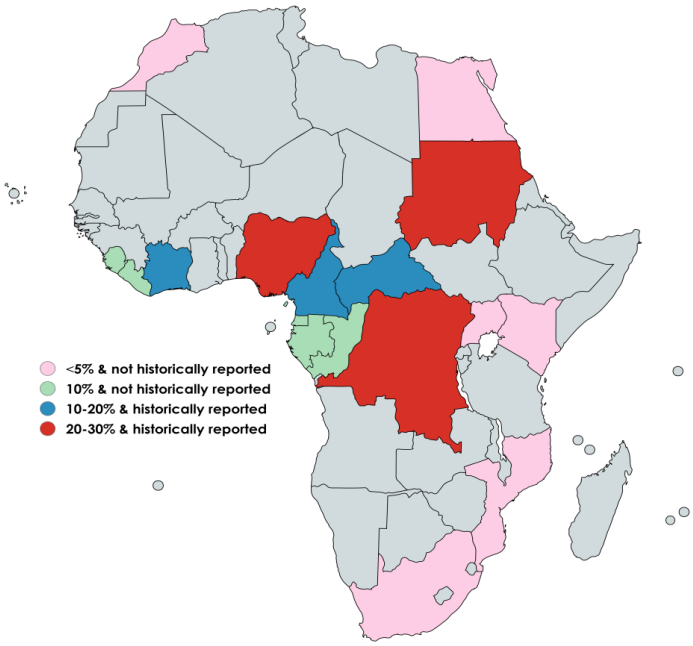


Figure 2. Map of the monkeypox outbreak in Africa.



Conclusion

The transmission of MPXV is influenced by factors such as dense population, frequent travel, and animal trading activities. While there are no current indications that the virus is headed towards Egypt, the interconnectedness of today's world presents ongoing risks. To prevent the spread of the virus into Egypt, the Health Ministry has raised the alert level to the highest. However, with limited resources and competing healthcare demands, they face significant challenges. To address these vulnerabilities, it is recommended that Egyptian health authorities enhance early detection systems at key entry points, such as airports and border crossings, increase public awareness campaigns on Mpox, and establish emergency stockpiles of vaccines and antiviral treatments. Collaborative efforts with neighboring countries and international donors can also strengthen regional surveillance networks and improve Egypt's overall readiness to manage potential outbreaks.

Author contributions

ZK and MD wrote the original draft of the article. RE, MK and HM contributed to the conception and design of the study. All authors (ZK, MD, MK, HM, YM, and RE) critically revised the manuscript for important intellectual content and provided comments on previous versions. All authors have seen and approved the final version of the article. They warrant that the article is their original work.

Declaration of interest:

The authors report no conflicts of interest.

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