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Correspondence



Immediate countermeasures against the monkeypox outbreak

Dear Editor,

In early May 2022, the UK Health Security Agency reported a cluster of cases infected with the monkeypox virus (MPXV); the positive cases shared a recent history of past travel to Nigeria, Africa [1]. A week later, a second group of infected patients were confirmed, but they had not travelled to any of the MPXV-endemic African countries [1]. This evidence suggests that the monkeypox outbreak has emerged by asymptomatic or symptomatic human–human transmission in nonendemic countries.

MPXV is an enveloped, double-stranded-DNA virus that is less lethal than other members of the family *Poxviridae*. *Poxviridae* had previously caused thousands of fatalities [2,3]. The first MPXV infection in humans was recorded in 1972, two years after the smallpox eradication, in the Democratic Republic of Congo (previously Zaire) [3]. MPXV has remained mainly endemic among an extensive range of animal hosts, including rodents and non-human primates mainly in the west and central Africa [4,5]. It thus has two major genetic clades: west African and central African [6]. Because this is a zoonotic virus, determining whether it could cause an aggressive illness (or new characteristics) in humans is pivotal [7]. While extensive surveillance systems are yet to be developed, the rising trend of MPXV cases indicates emergence of another concerning disease outbreak (Fig. 1). Thus, assessing and establishing efficient protective countermeasures are warranted to help healthcare policymakers control and contain the outbreak as the World Health Organization (WHO) advised [8].

We would like to highlight some important countermeasures to efficiently battle this outbreak which is propagating into different continents.

First, because MPXV cases have not been linked epidemiologically, extensive genomic sequencing should be used to discover how the virus has evolved and whether it relates to the two recognized MPXV clades. Some uninvestigated mutations may facilitate the human–human MPXV transmission because viral mutations are known to increase the viral propagation and survival chances among humans or other hosts. If MPXV transmits by asymptomatic carriers or even super-spreaders, stringent contact-tracing programs at cross-border entries should be rapidly implemented to identify and isolate potential cases, similar to travel restrictions following the surge of the Omicron variant of SARS-CoV-2 [9]. Travel restrictions and biosecurity of imported goods are particularly important to control the spread of MPXV into nonendemic countries.

Second, historically, WHO called for a cessation of mass vaccination against smallpox in the 1980s. Thus, approximately more than 5.6 billion or 70% of the world population (in 2022) have remained unimmunized against this deadly virus because they never received the smallpox vaccine [10]. Most of the MPXV cases in the present outbreak are less than 50 years old [11], supporting the above claim. Smallpox

and monkeypox vaccines are developed based on a vaccinia virus and they offer cross-protection due to immune responses to *orthopoxviruses*. Because of the vulnerability of the naïve individuals to MPXV infection, this large proportion of the population may suffer severe illness considering a previously published 1–10% case-fatality ratio [12]. Weakened or lack of immunity predisposes to MPXV infections; therefore, even a single dose of vaccination becomes pertinent for individuals at high risk [13]. Accordingly, Canada and some other countries have already begun implementing “ring vaccination” [13–16] for controlling the spread of the virus among those who have had close contact with monkeypox patients. However, ring vaccination or previous vaccine formulations may not be sufficient for broader immunization campaigns if MPXV becomes widespread [13]. Presently, the healthcare policy-makers have not considered a mass-vaccination campaign against MPXV; however, being prepared for a potentially extensive outbreak as the worst scenario is sensible. Millions of doses of smallpox vaccines, which have been stockpiled in different countries as a potential protection against bioterrorism, could potentially be deployed. Some alternative second-generation vaccines could also be considered, but their severe side-effects already reduce their chance of success.

Third, MPXV is a respiratory zoonotic virus, but not the same as SARS-CoV-2. Therefore, MPXV can be controlled effectively by complying with similar hygiene and distancing protocols implemented against SARS-CoV-2, because close physical contact facilitates successful MPXV transmission.

Fourth, antiviral agents including tecovirimat and brincidofovir are supported by WHO and available to treat the patients, while a third generation of vaccines is another promising countermeasure against this outbreak [17].

In 2002, no one would have expected the casualties that resulted from the unbelievable global spread of SARS. Since then, the world has already suffered many coronavirus outbreaks, including MERS, SARS, influenza, and SARS-CoV-2. The most recent, but not last, dreadful virus could be MPXV. Nevertheless, rare zoonotic outbreaks can be contained if quick and practicable countermeasures are implemented opportunistically.

Ethical approval

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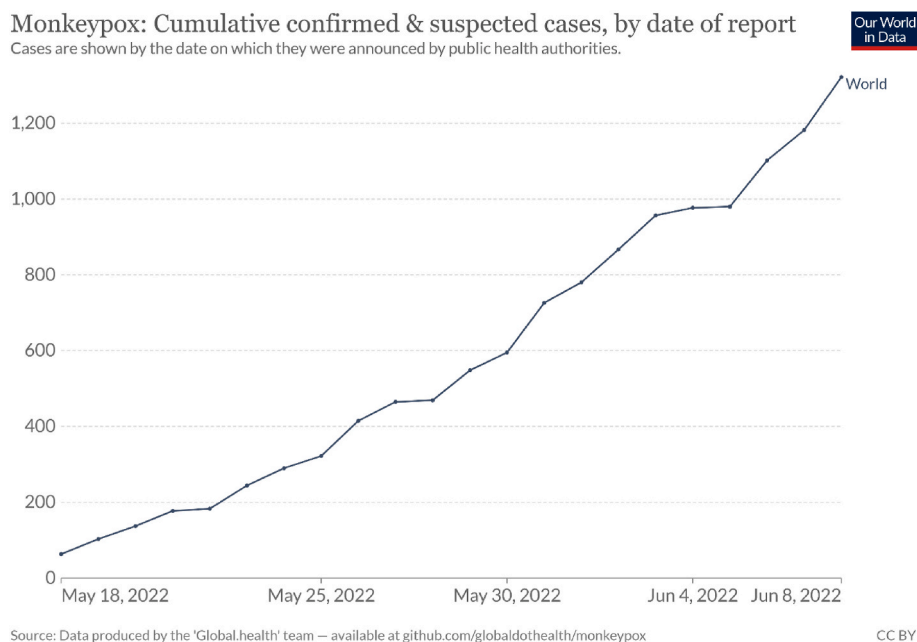


Fig. 1. The rising trend of new and suspected MPXV cases worldwide (source: <https://ourworldindata.org/monkeypox>).

Author contribution

Farid Rahimi: Conceptualization, Data Curation, Writing – Original Draft, Writing – review & editing., Amin Talebi Bezmin Abadi: Conceptualization, Data Curation, Writing – Original Draft, Writing – review & editing, Negin Kamali: Data Curation, Writing – Original Draft, All authors critically reviewed and approved the final version of the manuscript before submitting.

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