

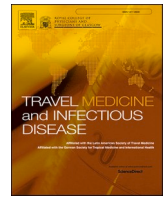


Elsevier has created a [Monkeypox Information Center](#) in response to the declared public health emergency of international concern, with free information in English on the monkeypox virus. The Monkeypox Information Center is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its monkeypox related research that is available on the Monkeypox Information Center - including this research content - immediately available in publicly funded repositories, with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the Monkeypox Information Center remains active.

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Travel Medicine and Infectious Disease

journal homepage: www.elsevier.com/locate/tmaid

Emergence of monkeypox: Risk assessment and containment measures

ARTICLE INFO

Keywords

COVID-19
 Pandemic
 Monkeypox
 Zoonotic
 Epidemiology
 Prevention
 Control

Dear Editor,

The monkeypox virus has emerged as a novel threat to the human race amid the worldwide efforts to overcome the ongoing coronavirus disease 2019 (COVID-19) pandemic. This correspondence aims to highlight the possible impacts of the monkeypox virus, assess the existent risk, and delineate the possible containment measures to mitigate the same. Monkeypox is a viral zoonotic disease that occurs primarily in the tropical rainforest areas of Central and West Africa and is occasionally exported to other regions. Monkeypox virus belongs to the Orthopoxvirus genus in the family Poxviridae [1]. The Orthopoxvirus genus also includes variola virus (which causes smallpox), vaccinia virus (used in the smallpox vaccine), and cowpox virus (World Health Organization, <https://www.who.int/news-room/fact-sheets/detail/monkeypox>).

Monkeypox was first discovered in 1958 when two outbreaks of a pox-like disease occurred in the colonies of monkeys kept for research, hence the name 'monkeypox'. The first human case of monkeypox was recorded in 1970 in the Democratic Republic of the Congo (DRC) during a period of intensified efforts to eliminate smallpox. Since then, the monkeypox has been reported in people in several other central and western African countries, including Cameroon, Central African Republic, Cote d'Ivoire, the Democratic Republic of the Congo, Gabon, Liberia, Nigeria, Republic of the Congo, and Sierra Leone. The majority of infections are in the Democratic Republic of the Congo (World Health Organization, <https://www.who.int/news-room/fact-sheets/detail/monkeypox>). Additionally, etiological and genomic sequencing studies in Nigeria have shown several human-to-human transmission episodes, including illnesses in a health care provider and family members of one patient whose illness was discovered in the United Kingdom (UK). The risk of human-to-human transmission is a concern for family members and caregivers of sick persons [2]. Although monkeypox has never been recognized as a sexually transmitted virus, the UK Health Security Agency (UKHSA) claims that it can be spread through intimate contact during sex. Coming into close contact with someone who has monkeypox or coming into contact with their clothing or linens can also

spread it [3] (Fig. 1A).

According to a recent World Health Organization (WHO) statement issued on May 20, there are approximately 80 confirmed monkeypox cases and 50 investigations underway. More than fifty instances of monkeypox infection have recently been confirmed and published in the UK, posing a serious public health issue amid the current COVID-19 pandemic. Furthermore, numerous European nations, including Germany and Belgium, have reported a sharp increase in monkeypox illnesses (Fig. 1B). Monkeypox has also been recorded in various other parts of the world. As of June 16, 2022, 2093 cases of monkeypox have been reported globally (Our World in Data, <https://ourworldindata.org/monkeypox>).

Monkeypox cases are often mild, and patients recover within weeks. Monkeypox typically presents clinically with fever, rash, and swollen lymph nodes and may lead to a range of medical complications (Fig. 1C). However, dependent on the kind, the fatality rate varies. According to the European Centre for Disease Prevention and Control (ECDC), the West African clade, which has been detected in Europe so far, has a mortality rate of roughly 3.6% (estimated from studies conducted in African countries). Children, young adults, and immunocompromised people have a greater death rate risk. The dangers to the general UK public are minimal, and UK healthcare institutions are capable and specialized in treating these tropical illnesses as mentioned by a senior research fellow in global health at the University of Southampton. However, the situation can be different for 'developing countries. In tropical medicine, these imported cases can imply a more significant disease burden elsewhere in the world. It's possible that in the aftermath of a pandemic, we should pay greater attention to the local and global ramifications of Lassa, monkeypox, Ebola, and other unusual but dangerous viruses (UK Health Security Agency, <https://www.gov.uk/guidance/monkeypox#treatment>).

Looking at prevention strategies for monkeypox, raising awareness of risk factors, and educating people about the measures they can take to reduce exposure to the virus is the main prevention strategy for monkeypox. Scientific studies are now underway to assess the feasibility and appropriateness of vaccination for the prevention and control of

<https://doi.org/10.1016/j.tmaid.2022.102392>

Received 25 May 2022; Received in revised form 17 June 2022; Accepted 20 June 2022

Available online 22 June 2022

1477-8939/© 2022 Elsevier Ltd. All rights reserved.

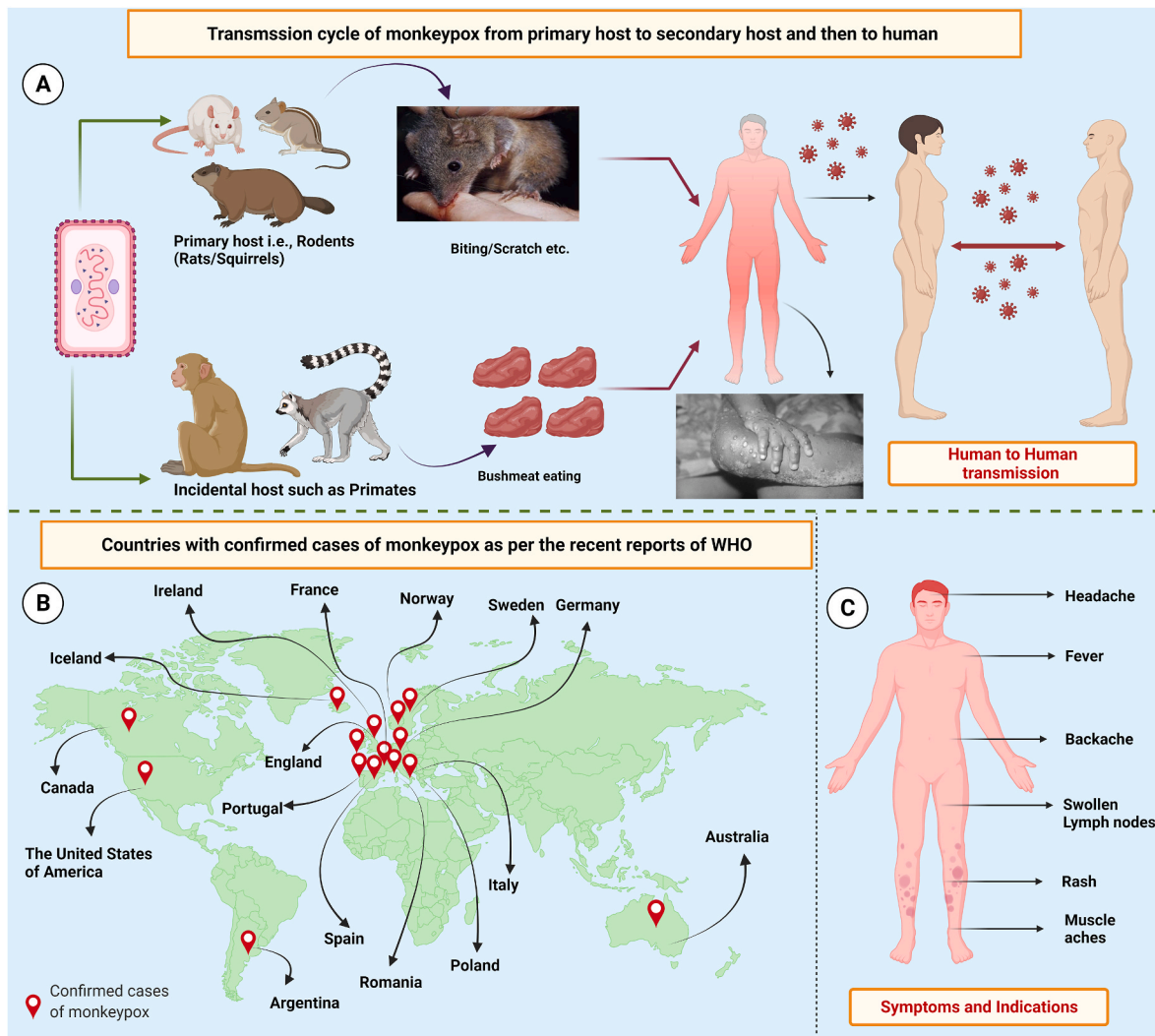


Fig. 1. The figure represents the various mechanisms of monkeypox virus transmission. Especially the human to human transmission such as during sexual contact has been considered crucial in the significant increase in the number of cases worldwide (A); the worldwide reported and confirmed cases of monkeypox disease (B); symptoms of monkeypox disease (C).

monkeypox. Some countries have or are developing the policies to offer the vaccine to persons who may be at risks such as the laboratory personnel, rapid response teams, and health workers [2–5].

The worldwide health repercussions of monkeypox infection should not be underestimated, especially given the present pandemic risk scenario. To understand the ever-changing epidemiology of this resurgent illness, increased worldwide surveillance and case identification are crucial tools [2,3].

Smallpox vaccines and an antiviral medication that is regarded to be particularly effective against the virus are available in countries like the United States as a preventive safeguard against bioterrorism. To prevent the spread of monkeypox, healthcare workers would most likely use a “ring vaccination strategy”, in which the close relatives of people who have been diagnosed with the disease are vaccinated [2–5].

CRedit authorship contribution statement

Manish Dhawan: Conceptualization, Data Curation, Writing - Original Draft, Writing - review & editing. **Priyanka:** Conceptualization, Data Curation, Supervision, Writing - Original Draft, Writing - review & editing. **Om Prakash Choudhary:** Conceptualization, Data Curation, Supervision, Writing - Original Draft, Writing - review & editing. All authors critically reviewed and approved the final version of the

manuscript.

Ethical approval

This article does not require any human/animal subjects to acquire such approval.

Funding

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

All authors report no conflicts of interest relevant to this article.

Acknowledgements

Fig. 1 has been created with BioRender (<https://biorender.com/>). All the authors acknowledge and thank their respective Universities and Institutes.

References

- [1] Rao AK, Schulte J, Chen TH, Hughes CM, Davidson W, Neff JM, Markarian M, Delea KC, Wada S, Liddell A, Alexander S, Sunshine B, Huang P, Honza HT, Rey A, Monroe B, Doty J, Christensen B, Delaney L, Massey J, Waltenburg M, Schrodtt CA, Kuhar D, Satheshkumar PS, Kondas A, Li Y, Wilkins K, Sage KM, Yu Y, Yu P, Feldpausch A, McQuiston J, Damon IK, McCollum AM, July. Monkeypox response team. Monkeypox in a traveler returning from Nigeria-Dallas, Texas, July 2021. *MMWR Morb Mortal Wkly Rep* 2021;71(14):509–16. <https://doi.org/10.15585/mmwr.mm7114a1>. 2022.
- [2] Bunge EM, Hoet B, Chen L, Lienert F, Weidenthaler H, Baer LR, Steffen R. The changing epidemiology of human monkeypox-A potential threat? A systematic review. *PLoS Neglected Trop Dis* 2022;16(2):e0010141. <https://doi.org/10.1371/journal.pntd.0010141>.
- [3] Mahase E. Monkeypox: what do we know about the outbreaks in Europe and North America? *BMJ* 2022;377:o1274. <https://doi.org/10.1136/bmj.o1274>.
- [4] Kozlov M. Monkeypox goes global: why scientists are on alert. *Nature*; <https://doi.org/10.1038/d41586-022-01421-8>.
- [5] León-Figueroa DA, Bonilla-Aldana DK, Pachar M, Romaní L, Saldaña-Cumpa HM, Anchay-Zuloeta C, Diaz-Torres M, Franco-Paredes C, Suárez JA, Ramirez JD, Paniz-Mondolfi A, Rodríguez-Morales AJ. The never ending global emergence of viral zoonoses after COVID-19? The rising concern of monkeypox in Europe, North America and beyond. *Travel Med. Inf Disp* 2022;102362. <https://doi.org/10.1016/j.tmaid.2022.102362>.

Manish Dhawan

Department of Microbiology, Punjab Agricultural University, Ludhiana,
141004, Punjab, India

Trafford College, Altrincham, Manchester, WA14 5PQ, UK

Priyanka **

Department of Veterinary Microbiology, College of Veterinary Science, Guru
Angad Dev Veterinary and Animal Sciences University (GADVASU),
Rampura Phul, Bathinda, 151103, Punjab, India

Om Prakash Choudhary*

Department of Veterinary Anatomy and Histology, College of Veterinary
Sciences and Animal Husbandry, Central Agricultural University (I), Selesih,
Aizawl, 796015, Mizoram, India

** Corresponding author. Department of Veterinary Microbiology,
College of Veterinary Science, Guru Angad Dev Veterinary and Animal
Sciences University (GADVASU), Rampura Phul, Bathinda, 151103,
Punjab, India.

* Corresponding author. Department of Veterinary Anatomy and
Histology, College of Veterinary Sciences and Animal Husbandry,
Central Agricultural University (I), Selesih, Aizawl, 796015, Mizoram,
India.

E-mail address: priyanka7malik@gmail.com (Priyanka).

E-mail address: dr.om.choudhary@gmail.com (O.P. Choudhary).