



Editorial

Mass Gatherings and the Emerging Viral Infections

Shakiba Seifi¹ , Ahmed S. Abdel-Moneim² , Mohammad Yousef Alikhani³ , Manish Pratap Singh⁴ , Amir Sasan Mozaffari Nejad^{5,6*} 

¹Nosocomial Infection Research Center, Isfahan University of Medical Sciences, Isfahan, Iran

²Department of Microbiology and Immunology, College of Medicine and Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman

³Infectious Disease Research Center, Hamadan University of Medical Sciences, Hamadan, Iran

⁴Department of Zoology, DDU Gorakhpur University, City Gorakhpur, India

⁵Infectious Disease and Tropical Medicine Research Center, Isfahan University of Medical Sciences, Isfahan, Iran

⁶Universal Scientific Education and Research Network (USERN) JMU Office, Jiroft University of Medical Sciences, Jiroft, Iran

*Corresponding author: Amir Sasan Mozaffari Nejad, Email: asmnejad@res.mui.ac.ir



Please cite this article as follows: Seifi S, Abdel-Moneim AS, Alikhani MY, Singh MP, Mozaffari Nejad AS. Mass gatherings and the emerging viral infections. Avicenna J Clin Microbiol Infect 2026;13(3): 199-200. doi:10.34172/ajcmi.3988

Received: June 13, 2026, Accepted: July 7, 2026, ePublished: September 29, 2026

A pandemic emerges when an infectious agent acquires efficient and sustained human-to-human transmission, enabling global spread within susceptible populations, as observed during coronavirus disease 2019 (COVID-19) (1). However, pandemic emergence is a multistep ecological and evolutionary process that is influenced by viral adaptation, host susceptibility, environmental pressures, and human behavior, rather than a discrete triggering event (2). To explain pathogen emergence at the human-animal-environment interface, the One Health framework integrates ecological, climatic, and human behavioral determinants (2). Within this framework, human mobility and interaction patterns represents a critical driver of transmission amplification.

Mass gatherings, defined as planned or spontaneous events that assemble large populations in spatially constrained settings, can increase opportunities for the transmission of respiratory and other infectious agents through high contact rates and population mixing (3). Likewise, major international events scheduled for 2026, including the FIFA World Cup in North America and the Hajj in Saudi Arabia, are characterized by extreme population density and global mobility flows that may facilitate pathogen dissemination across borders (4). Nonetheless, such events should primarily be understood as amplification environments rather than sources of novel pathogens.

Climate and environmental variability represent an additional determinant shaping infectious disease dynamics. Similarly, temperature shifts, precipitation changes, and

ecological disruption can influence vector distribution, viral seasonality, and host-pathogen interactions, thereby modifying transmission potential for both respiratory and zoonotic diseases (1). Therefore, climate change acts as a modulator of epidemic intensity and spatial distribution rather than a direct causal agent of pandemics (5). Recent concurrent public health events, including the outbreaks of Bundibugyo virus disease (*Orthoebolavirus bundibugyoense*) in the Democratic Republic of the Congo and Uganda and the reported Andes virus (*Orthohantavirus andesense*) infection linked to a cruise ship in May 2026, have raised public health concerns regarding outbreak preparedness rather than immediate pandemic potential (6). In response, the World Health Organization has issued alerts in order to enhance surveillance and containment capacity (7).

Hantaviruses are zoonotic pathogens maintained in rodent reservoirs and transmitted primarily via the inhalation of aerosolized excreta. While most hantaviruses do not transmit between humans, sustained human-to-human transmission has been conclusively demonstrated only for Andes virus and closely related lineages under specific outbreak conditions in South America (7). By contrast, Bundibugyo virus outbreaks require direct contact with infected bodily fluids, and no sustained airborne or indirect transmission has been documented in this regard. Consequently, these pathogens do not currently meet criteria for efficient pandemic transmission (8). From a risk perspective, there is no evidence indicating that mass gatherings enhance viral evolution toward sustained human-to-human transmission. However, such settings



can facilitate outbreak amplification, particularly when infected individuals are introduced into dense, highly connected populations with delayed detection and limited containment capacity (1). This principle broadly applies to respiratory and zoonotic pathogens with existing human transmissibility, rather than to specific agents such as Andes virus or Bundibugyo virus disease (9). Therefore, the principal pandemic risk associated with mass gatherings is not pathogen emergence itself, but delayed recognition and rapid international dissemination of already transmissible infections.

Overall, lessons from the COVID-19 pandemic highlight the importance of integrated surveillance, rapid diagnostic deployment, real-time genomic monitoring, and coordinated international response mechanisms to mitigate the risk of outbreak amplification associated with mass gatherings and global mobility (1, 7, 10).

Authors' Contribution

Conceptualization: Shakiba Seifi, Amir Sasan Mozaffari Nejad, Ahmed S. Abdel-Moneim

Formal Analysis: Amir Sasan Mozaffari Nejad
Ahmed S. Abdel-Moneim

Investigation: Shakiba Seifi, Amir Sasan Mozaffari Nejad

Project Administration: Amir Sasan Mozaffari Nejad

Supervision: Amir Sasan Mozaffari Nejad, Ahmed S. Abdel-Moneim

Validation: Amir Sasan Mozaffari Nejad, Ahmed S. Abdel-Moneim,

Mohammad Yousef Alikhani, Manish Pratap Singh

Writing–Original Draft: Shakiba Seifi, Amir Sasan Mozaffari Nejad

Writing–Review & Editing: Ahmed S. Abdel-Moneim

Mohammad Yousef Alikhani, Manish Pratap Singh

Competing Interests

The authors declare that they have no conflict of interests.

Ethical Approval

Not applicable.

Funding

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Memish ZA, Alshamrani MM, Kattan RF, Azhar EI, Farahat FM,

Albarrak AM, et al. Reducing risks from respiratory pathogens at the 2024 Hajj. *Lancet Infect Dis* 2024;24(6):573-5. doi:10.1016/s1473-3099(24)00260-3

2. Guo J, Semenza JC, Ecker F, Rizzoli A, Dagostin F, Ulrich RG, et al. A Pan-European assessment of multi-sector drivers of human hantavirus risk: climate, biodiversity, and socio-economic factors as key determinants. *Environ Res* 2026;298:124282. doi:10.1016/j.envres.2026.124282

3. Zeyad L, Alothaimeen H, Alsaab H, Al Ghimlas F, Aljarbou L, Almohsen LA, et al. Regional collaboration for public health preparedness in mass gatherings: lessons from the GCC region and recommendations. *Mass Gather Med* 2025;4:100044. doi:10.1016/j.mgmed.2025.100044

4. Mehrotra P, Mathew T, Trulic KG, Kaye KS, Nori P, Bearman G, et al. Sports fever! Getting the ball rolling to prevent infections at the World Cup™ and beyond. *Antimicrob Steward Healthc Epidemiol* 2026;6(1): e61. doi:10.1017/ash.2026.10319

5. Kulkarni PS, Flores-Pérez NY, Jian AH, Bird BH, Johnson CK, Uhart M, et al. Climate-driven changes in zoonotic risk of arenaviral hemorrhagic fevers in South America. *Npj Viruses* 2026;4(1):23. doi:10.1038/s44298-026-00189-2

6. European Centre for Disease Prevention and Control (ECDC). Threat Assessment Brief. Hantavirus-Associated Cluster of Illness on a Cruise Ship: ECDC Assessment and Recommendations. Stockholm: ECDC; 2026. p. 1-11. doi:10.2900/6502463

7. World Health Organization (WHO). Hantavirus Cluster Linked to Cruise Ship Travel, Multi-Country. WHO; 2026. Available from: <https://www.who.int/emergencies/disease-outbreak-news/item/2026-DON600>.

8. World Health Organization (WHO). Epidemic of Ebola Disease Caused by Bundibugyo Virus in the Democratic Republic of the Congo and Uganda Determined a Public Health Emergency of International Concern. Geneva: WHO; 2026. Available from: <https://www.who.int/news/item/17-05-2026-epidemic-of-ebola-disease-in-the-democratic-republic-of-the-congo-and-uganda-determined-a-public-health-emergency-of-international-concern>.

9. Shaky M, Ma KC, Hughes LJ, Smith C, Atherton LJ, Boehm AB, et al. Early detection and surveillance of the SARS-CoV-2 variant BA.3.2 - worldwide, November 2024-February 2026. *MMWR Morb Mortal Wkly Rep* 2026;75(10):130-7. doi:10.15585/mmwr.mm7510a1

10. Jafari AS, Mozaffari Nejad AS, Faraji H, Abdel-Moneim AS, Asgari S, Karami H, et al. Diagnostic challenges in fungal coinfections associated with global COVID-19. *Scientifica (Cairo)* 2025;2025:6840605. doi:10.1155/sci5/6840605