

Microbes and Infectious Diseases

Journal homepage: <https://mid.journals.ekb.eg/>

Review article

Monkeypox infection: Epidemiology update with analysis on community transmission risk

*Naushaba Akhtar*¹, *Shakti Rath*^{*2}, *Sourav Palai*², *Sangram Panda*³

1- School of Public Health, Asian Institute of Public Health, Bhubaneswar, Odisha, India.

2- Microbiology & Research, Central Research Laboratory, Institute of Dental Sciences, Siksha 'O' Anusandhan University, Bhubaneswar, Odisha, India.

3- Department of Prosthodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan University, Bhubaneswar, Odisha, India

ARTICLE INFO

Article history:

Received 25 February 2023

Accepted 24 March 2023

Keywords:

Monkeypox
World wide status
Pathophysiology
Transmission
Global outbreak
Prevention

ABSTRACT

Background: Human Monkeypox is a zoonotic disease. The Monkeypox virus belongs to the orthopoxvirus family, and it is a double-stranded DNA virus which is mainly found among rodents and other animals and is expected to have been transmitted incidentally to humans and is further spread through human-to-human transmission. **Aim:** To give a clear picture of the extent of the monkeypox virus and thereby depict the future risk of community transmission of the virus. **Methods:** A descriptive study has been conducted by analyzing secondary data from the Centre of Disease Control, UK and the cumulative cases and deaths are calculated. This is an evidence basis analysis which describes a clear picture of the arising risk due to the monkeypox virus. **Result:** It was identified that data collected from reliable sources give a clearer picture of the prevalence of the monkeypox virus among men. **Conclusion:** With the current knowledge of the devastation caused by the COVID-19 pandemic, it is crucial to examine pathophysiology and transmission to prevent its effect on public health and its propensity to spread like a pandemic. All the governments, health agencies and organizations along with related stakeholders must work on prevention policies to control monkeypox.

Introduction

The emergence of another outbreak has raised concern for another health emergency. The outbreak of the orthopox virus is a rare event and not so frequently reported among humans. This

monkeypox infection is likely to spread across the globe irrespective of any boundaries, and history of infection as reported so far [1]. There have been numerous studies conducted that confirm it as a sexually transmitted infection. Though the mode of transmission has not yet been confirmed [2].

The monkeypox virus belongs to the orthopoxvirus family, and it is a double-stranded DNA virus which is mainly found among rodents and other animals and is expected to have been transmitted incidentally to humans and is further spread through human-to-human transmission [3]. The human monkeypox outbreak started with an imported case from Nigeria, which was confirmed on 7th May 2022. Currently, the cases have raised to 68,428 cases and 28 deaths as of 30th September 2022 as reported by the Center for Disease Control and Prevention, USA [4]. Since the eradication of smallpox in 1977, the maintenance of live viruses was assigned to the important authorities of the world, which also raises a question about it being used as a bioterrorism weapon. Due to their high infectivity rate among humans, the pox virus spreads from human to human mainly through droplet infections [5, 6]. This virus spreads among human beings irrespective of demographic, age, race, and sex, though some studies have proven that it is widely seen among bisexual individuals but it is yet to be confirmed. Researchers have identified a high-risk group of the population who are prone to getting individuals, include. infants, immune-compromised individuals, sex workers, transgender males, and transgender females [5, 6]. This outbreak now took the face of various incidents which resulted in multiple regions of the world, which increases the chances of community infection. This study

identifies and foresees the risk of community transmission of the monkeypox virus. This study gives a clear picture of the extent and spread of the virus, its mechanism and assessment of the risk of community transmission which would be essential for designing a standardized guideline for treatment and prevention [5, 6].

Epidemiology of the disease

The change in the epidemiological scenario of monkeypox infection is an emerging infection with great challenges which the world has to face. The Monkeypox virus was first identified among captive monkeys in Denmark in the year 1958. The human Monkeypox virus was reported on 13th May 2022 across four regions categorized according to the WHO as Europe, America, Eastern Mediterranean and Western Pacific regions. Thereafter multiple cases were identified in the African region and later spread across the World through cross-country travel and migration. The rise of monkeypox virus cases in different regions of the World also suggests the need for rapid case detection [7]. There are several countries without a history of monkeypox infection that have also reported some recent cases and deaths due to the monkeypox virus (**Table 1**). Contains the country enlisted according to the CDC which has reported monkeypox infections and deaths occurring due to it till the 30th of September 2022 [4].

Table 1. List of countries with cases and deaths occurred due to the monkeypox virus as of 30th September 2022; Source: Centre of Disease Control [4]

Country	Cases	Death
Andorra	4	0
Argentina	396	0
Aruba	3	0
Australia	136	0
Austria	310	0
Bahamas	2	0
Bahrain	1	0
Barbados	1	0
Belgium	770	1
Benin	3	0
Bermuda	1	0
Bolivia	185	0
Bosnia and Herzegovina	5	0
Brazil	7687	2
Bulgaria	6	0
Cameroon	8	2
Canada	1396	0
Chile	880	0
China	1	0
Colombia	2042	0
Costa Rica	4	0
Croatia	29	0
Cuba	3	1
CuraAçao	3	0
Cyprus	5	0
Czechia	66	1
Denmark	185	0

Dominican Republic	31	0
Ecuador	120	1
Egypt	1	0
El Salvador	5	0
Estonia	11	0
Finland	40	0
France	3999	0
Georgia	2	0
Germany	3625	0
Ghana	91	4
Gibraltar	6	0
Greece	80	0
Greenland	2	0
Guadeloupe	1	0
Guatemala	24	0
Guyana	2	0
Honduras	6	0
Hong Kong	1	0
Hungary	77	0
Iceland	14	0
India	12	1
Indonesia	1	0
Iran	1	0
Ireland	183	0
Israel	252	0
Italy	850	0
Jamaica	14	0
Japan	4	0
Jordan	1	0
Latvia	5	0
Lebanon	11	0
Liberia	3	0
Lithuania	5	0
Luxembourg	55	0
Malta	33	0
Martinique	1	0
Mexico	1627	0
Moldova	2	0
Monaco	3	0
Montenegro	2	0
Morocco	3	0
Netherlands	1223	0
New Caledonia	1	0
New Zealand	9	0
Nigeria	400	7
Norway	92	0
Panama	14	0
Paraguay	2	0
Peru	2480	0
Philippines	4	0
Poland	188	0
Portugal	917	0
Qatar	5	0
Republic of the Congo	5	0
Romania	40	0
Russia	2	0
Saint Martin	1	0
Saudi Arabia	8	0
Serbia	40	0
Singapore	19	0
Slovakia	14	0
Slovenia	47	0
South Africa	5	0
South Korea	2	0
Spain	7149	3
Sudan	7	1
Sweden	192	0
Switzerland	513	0
Taiwan	3	0
Thailand	8	0
The Central African Republic	8	2
The Democratic Republic of the Congo	174	0
Turkey	1	0
Ukraine	3	0
United Arab Emirates	16	0
United Kingdom	3635	0
United States	25850	2
Uruguay	8	0
Venezuela	5	0

Though case detection and surveillance continue there is a specific non-endemic region which has increased the number of cases. Some studies also show the emergence of evolving transmission pattern which facilitates the spread of infection. Some studies reveal the role of gender and ethnicity in the spread of monkeypox infection, various research has also revealed that pox infection is most prevalent among bisexual males, MSM and gays. This unprecedented spread of infection is likely to increase the chances of community infection.

Figures 1 and 2 also reveals the difference in the number of cases among different sex, race and ethnic groups. Several unusual incidents have been recorded throughout the occurrence and spread of infection so far. Some researchers found there have not been many cases in the outbreak that appropriately showed monkeypox-like symptoms [8].

Figure 1. Number of cases among different gender groups. Source: Centre of Disease Control Author's representation [4].

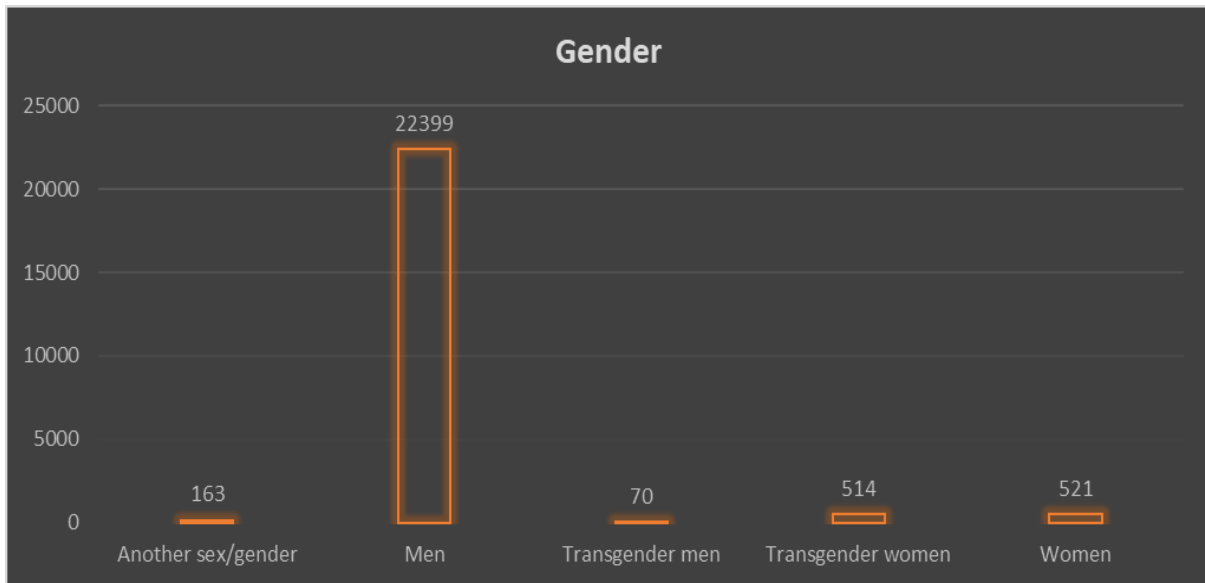
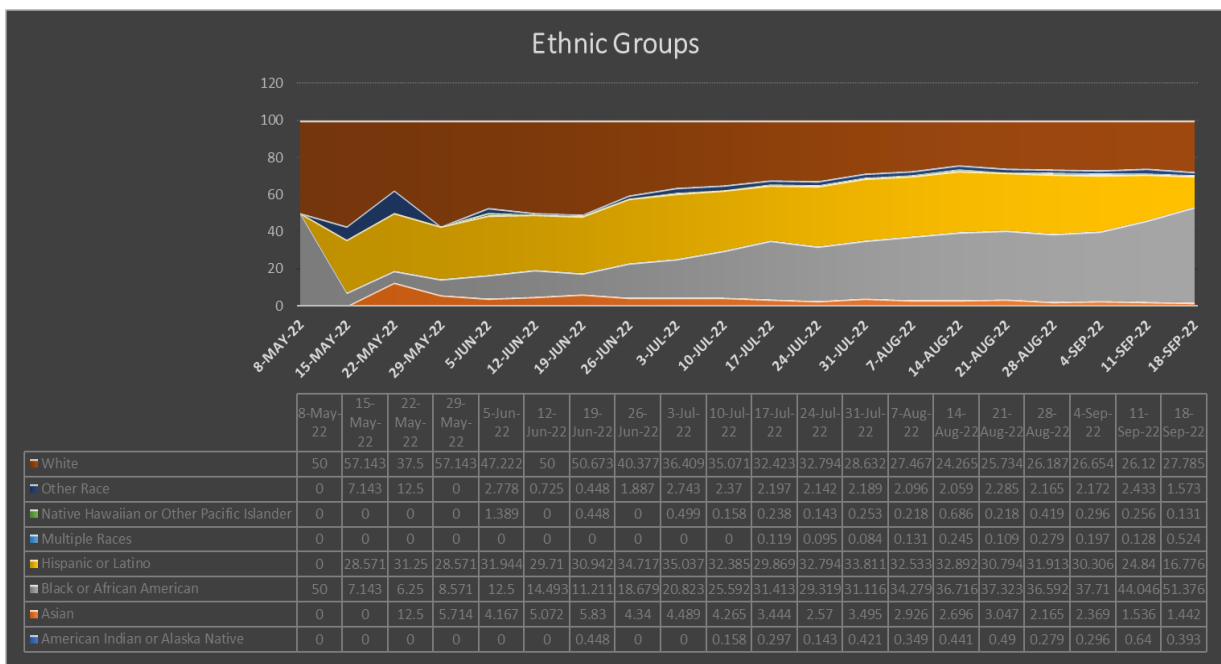


Figure 2. Number of cases in different ethnic groups Source: Centre of Disease Control Author's representation [4].



Community transmission

The first outbreak case was isolated from Nigeria and the virus was identified as non-infectious through direct contact. Though the origin of the monkeypox virus has been from Central Africa and West Africa in two different clades it gradually spread across the forest of Central Africa and the transmission pattern was the result of a decrease in *orthopox* immunity. The monkeypox virus was mostly identified among adult men (aged 18 < years). **Figure 1** shows 22399 cases have been reported among men and some studies have also revealed that certain ethnic group shows comparatively more cases. **Figure.2** shows the increased number of cases among the Black or African American group (termed according to CDC) a higher number of cases, followed by the white group. Monkeypox transmission has been reported through multiple sexual and non-sexual contacts. The United Kingdom has also reported a case which

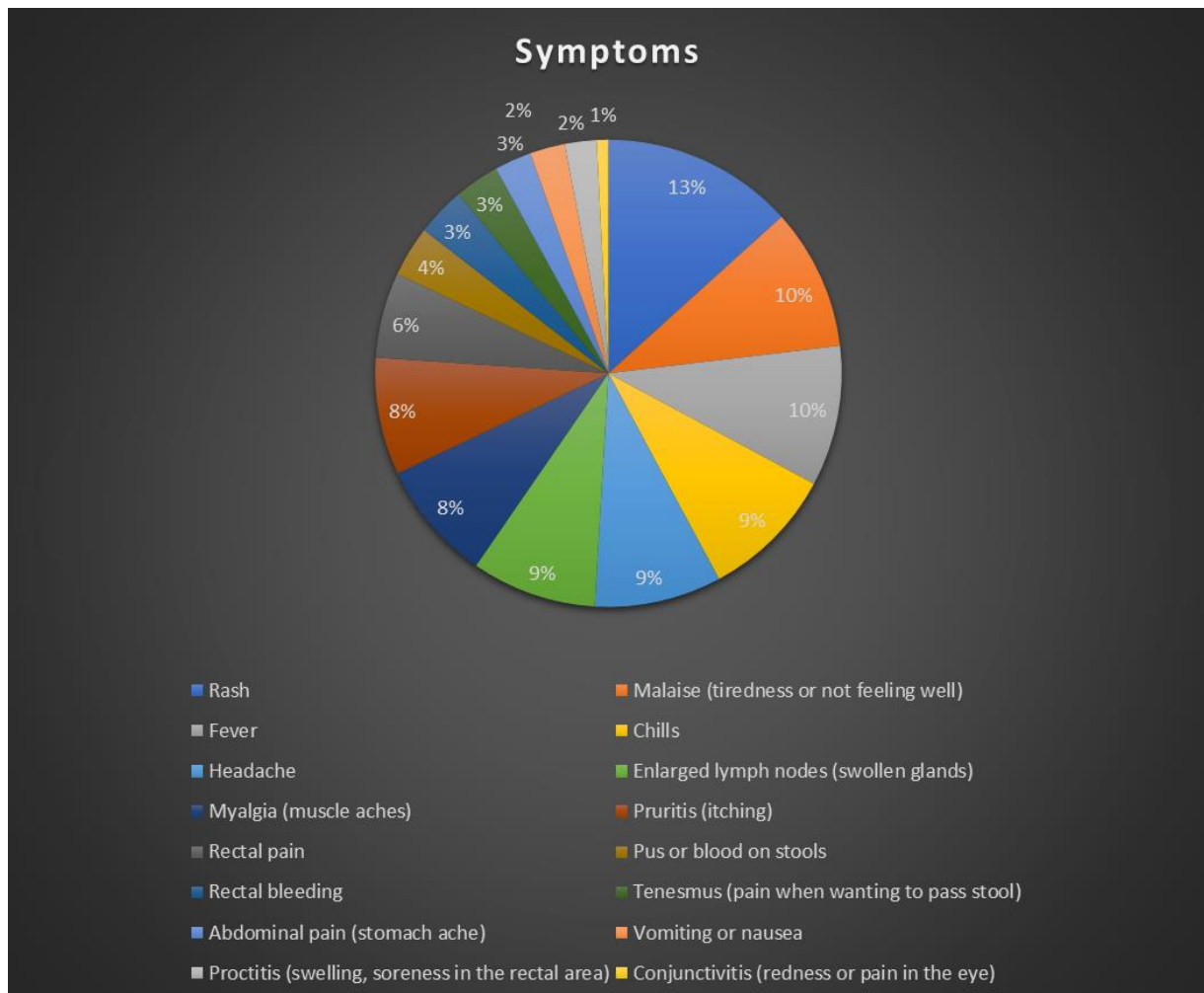
had a history of travel to Nigeria. Some cases have also shown animal transmission. Several cases of droplet transmission in the hospital setting have also been reported.

Clinical manifestations of the disease

Symptoms

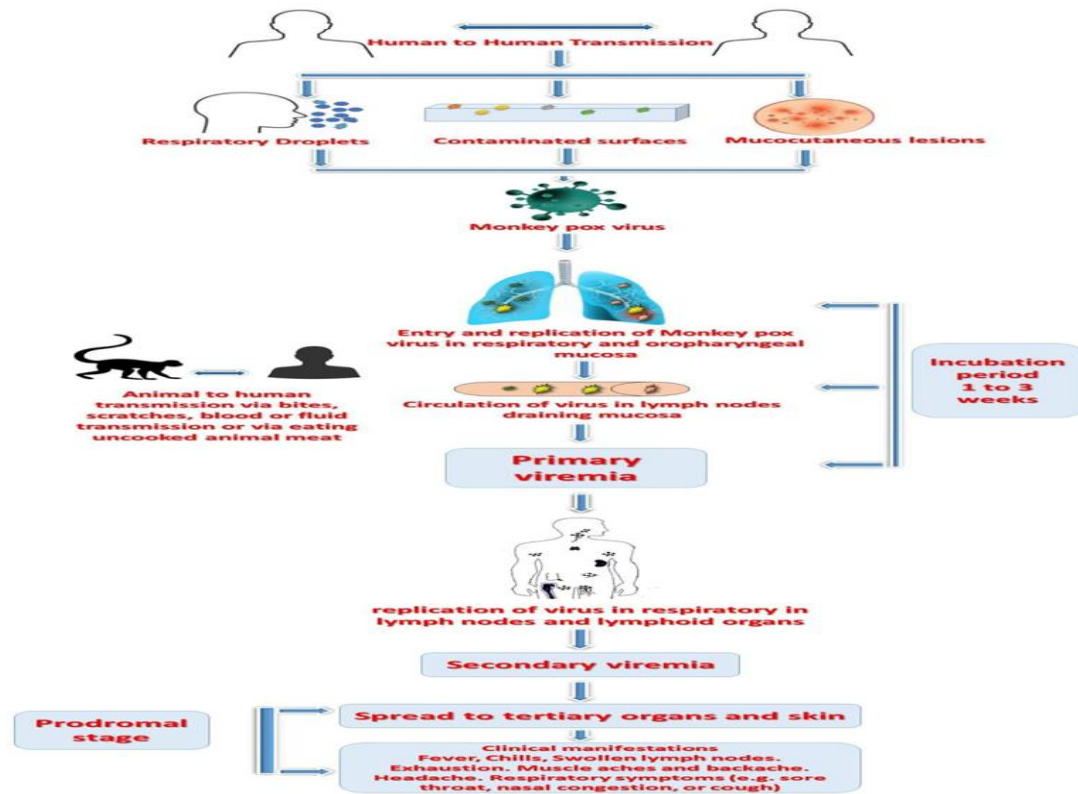
Humans can contract the monkeypox virus from sick animals by biting them or by coming into close contact with their bodily fluids. Additionally, it can be spread from person to person via prolonged close contact, typically amongst family members; exposure to respiratory droplets may also be a means of transmission (**Figures 3 & 4**). Humans have a fever, headache, general malaise and weariness, swollen lymph nodes, and other symptoms two weeks after infection. A rash of raised pimples develops on the face and torso a few days later. The sickness gradually takes its course in two to four weeks, and eventually crusts and peels off [9, 10],

Figure 3. Symptoms of monkeypox



Pathophysiology

Figure 4. Pathophysiology of monkeypox [3]



Treatment

To prevent smallpox, the CDC advises vaccination within two weeks of monkeypox exposure. The Jynneos vaccine has FDA approval for use in people who are at high risk of contracting smallpox or monkeypox. Antiviral medication cidofovir (Vistide) is recommended for patients who are experiencing severe, life-threatening symptoms. The effectiveness of using vaccine immune globulin has not been established. Supportive methods like mechanical ventilation may occasionally be required for patients with severe symptoms. The CDC and an infectious diseases specialist should be consulted [9,10].

Discussion

The Human monkeypox virus is a rare zoonotic infection, which has incidentally got transmitted from animals to humans and it is spreading from human to human. The overall geographical pattern of the disease hardly reveals any information which needs to be investigated and traced. The emergence of this zoonotic disease right after the world had faced a deadly COVID-19 pandemic increased attention is required for the

high-risk groups. The rising prevalence of monkeypox infection is an increasing potential threat to the world [11, 12].

The situation can be brought under control by taking the right action at right time, by increasing laboratory testing, screening & diagnosis, developing vaccines and guidelines for treatment for efficient management of the disease and laboratory testing can help in distinguishing monkeypox virus from other pox viruses [13]. There is a need for more effective research and monitoring in this area as sufficient information and root cause analysis will enable better management of the disease. Clinicians and healthcare workers need to be educated and trained for effective care and treatment. This study identifies and foresees the risk of transmission of the monkeypox virus in the community irrespective of exposure to the virus [14]. This study gives a clear picture of the extent and spread of the virus, and its mechanism and identifies the risk of community transmission which would be essential for policymakers for developing effective policies that would promote healthcare equity, this study will help in providing valuable information that will enable in designing a standardized medical

guideline for treatment and care, this paper also promotes effective research, drug and vaccine development for the treatment of monkeypox virus, further studies on foundation if aetiology is essential for understanding the origin of monkeypox virus other than relating it with smallpox or other pox viruses. Through this paper one can get a clearer picture of the approaching risk due to monkeypox infection which also needs further in-depth research in this area [15,16].

Conclusion

The monkeypox virus, which was only found in Africa, is now a global challenge. Healthcare personnel who treat sick patients are also concerned about the possibility of human-to-human transfer. Given the present-day atmosphere of pandemic dangers, the significance of the monkeypox epidemic for public health should not be overstated.

The moment has come to establish a truly global approach that ends this problem once and for all in both developed and, most importantly, endemic countries that have been battling monkeypox for decade. International funding is needed for heightened surveillance and case detection to better understand the epidemiology of this resurgent sickness, which is constantly changing.

Funding: None.

Ethical Concern: None.

Conflicts of interests: No conflicts of interests.

References

- 1-Simões P, Bhagani S. A viewpoint: The 2022 monkeypox outbreak. *J Virus Erad* 2022; 8(2):100078.
- 2-Velavan TP, Meyer CG. Monkeypox 2022 outbreak: An update. *Trop Med Int Health* 2022; 27(7):604-605.
- 3-Petersen E, Kantele A, Koopmans M, Asogun D, Yinka-Ogunleye A, Ihekweazu C, et al. Human Monkeypox: epidemiologic and clinical characteristics, diagnosis, and prevention. *Infect Dis Clin North Am* 2019; 33(4):1027-1043.
- 4-<https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html> (Last accessed on 2nd October 2022)
- 5-Vaughan AM, Cenciarelli O, Colombe S, Alves de Sousa L, et al. A large multi-country outbreak of monkeypox across 41 countries in the WHO European Region, 7 March to 23 August 2022. *Euro Surveill* 2022; 27(36):2200620.
- 6-Riopelle JC, Munster VJ, Port JR. Atypical and unique transmission of monkeypox virus during the 2022 outbreak: An overview of the current state of knowledge. *Viruses* 2022; 14(9):2012.
- 7-Kaler J, Hussain A, Flores G, Kheiri S, Desrosiers D. Monkeypox: A comprehensive review of transmission, pathogenesis, and manifestation. *Cureus* 2022; 14(7):e26531.
- 8-Philpott D, Hughes CM, Alroy KA, et al. epidemiologic and clinical characteristics of monkeypox cases — United States, May 17–July 22, 2022. *Morb Mortal Wkly Rep* 2022; 71:1018-1022.
- 9-Goyal L, Ajmera K, Pandit R, Pandit T. Prevention and treatment of monkeypox: a step-by-step guide for healthcare professionals and the general population. *Cureus* 2022; 14(8):e28230.
- 10-Rizk JG, Lippi G, Henry BM, Forthal DN, Rizk Y. Prevention and treatment of monkeypox. *Drugs* 2022; 82(9):957-963.
- 11-Altindis M, Puca E, Shapo L. Diagnosis of monkeypox virus - An overview. *Travel Med Infect Dis* 2022 Nov-Dec;50:102459.
- 12-Moore MJ, Rathish B, Zahra F. Monkeypox. 2022 Jul 16. In: *Stat Pearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2022
- 13-Titanji BK, Tegomoh B, Nematollahi S, Konomos M, Kulkarni PA. Monkeypox: A

contemporary review for healthcare professionals. *Open Forum Infect Dis* 2022 Jun 23; 9(7):ofac310.

14-**Fahrni ML, Priyanka, Sharma A, Choudhary OP.** Monkeypox: Prioritizing public health through early intervention and treatment. *Int J Surg* 2022 Aug; 104:106774.

15-**Luo Q, Han J.** Preparedness for a monkeypox outbreak. *Infectious Med* 2022;1(2):124–34

16-**Dhawan M, Priyanka, Choudhary OP.** The emergence of monkeypox: Risk assessment and containment measures. *Travel Med Infect Dis* 2022; 49:102392.

Akhtar N, Rath S, Palai S, Panda S. Monkeypox infection: Epidemiology update with analysis on community transmission risk. *Microbes Infect Dis* 2023; 4(3): 754-761.