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Demographic, transmission, and clinical characteristics associated with human monkeypox infection, October 2022: a systematic analysis for World Health Organization database and brief review

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Abstract

The monkeypox (MPX) is an unusual viral disease which, until recently, has rarely been detected outside of Africa. A total of 71,237 confirmed cases of MPX, as of October 6th, 2022, had been discovered in 109 countries in the matter of months. The risk factors of MPX are men who have sex with the same gender (prevalence 90.0%, 95% CI, 89.5 to 90.4), sexual exposure to sex partners with MPX (prevalence 87.3%, 95% CI 6.7 to 87.8), human immunodeficiency virus-positive individuals (prevalence 49.1%, 95% CI, 48.4 to 49.8), people who have travel history to Africa (prevalence 16.9%, 95% CI, 16.2 to 17.7), hospitalization (prevalence 7.3%, 95% CI 7.0 to 7.6), health workers (prevalence 3.2%, 95% CI 2.9 to 3.5), admission to intensive care unit (prevalence 0.18%, 95% CI 0.11 to 0.28), and death (prevalence 0.03%, 95% CI 0.02 to 0.06).

According to an international cohort of 60,510 individuals, the MPX can result in rash (all types; 83.6%, n=21,472), fever (57.8%, n=14,842), rash on the whole body (49.6%, n=12,730), genital rash (45.5%, n=11,696), headache (29.4%, n=7,556), fatigue (29.3%, n=7,523), lymphadenopathy(all types) (29.0%, n=7,453), muscle ache (26.9%, n=6,919), general lymphadenopathy (24.3%, n=6,235), local lymphadenopathy (18.6%, n=4,779), rash of unknown location (12.7%, n=3,271), sore throat, oral rash, chills, cough, vomiting, and other signs and/or symptoms in the order of frequency, with a subtle difference between men and women. The median delay between the date of onset and reporting was 6 days (interquartile range, 3 to 9). Results that an African endemic virus has been identified more in worldwide populations than in Africa has shocked scientists which led to the question of why an African disease is becoming a global illness and why the world is currently encountering this problem.

Keywords: monkeypox; symptom; sexual transmission

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1. Epidemiology and transmission of monkeypox

The general public has been occupied with severe apprehension that the development of one viral pandemic after another (i.e., severe acute respiratory syndrome [SARS], new influenza virus, and COVID-19) is causing many global negative effects. Various studies have suggested the possibility of COVID-19 entering a controllable endemic stage across the world.[1] On the other hand, many scientists warn the public that the world is encountering a second new viral pandemic, the monkeypox virus (MPXV).[2] The name of the virus, monkeypox (MPX), was given as researchers first detected it in laboratory monkeys in 1958.[3] Although the first case of animal-to-human zoonotic MPXV transmission was reported in the Democratic Republic of Congo in 1970,[4] MPX outbreaks have dominantly developed in the African continent. However, since January 1st, 2022 to October 6th, 2022, the World Health Organization has reported 72,237 confirmed cases including 26 deaths across 109 countries.

According to the World Health Organization report on an international cohort since the beginning of the 2022 global outbreak of MPX to October 6th, 2022, the risk factors for developing MPX were found to be men who have sex with other men (prevalence 90.0%, 95% CI, 89.5 to 90.4), sexual exposure to sex partners with MPX (prevalence 87.3%, 95% CI 6.7 to 87.8), human immunodeficiency virus-positive individuals (prevalence 49.1%, 95% CI, 48.4 to 49.8), travel history to Africa (prevalence 16.9%, 95% CI, 16.2 to 17.7), hospitalization (prevalence 7.3%, 95% CI 7.0 to 7.6), health workers (prevalence 3.2%, 95% CI 2.9 to 3.5), admission to intensive care unit (prevalence 0.18%, 95% CI 0.11 to 0.28), and death (prevalence 0.03%, 95% CI 0.02 to 0.06; Table 1). It was also found that the virus has a possibility to transmit during pregnancy to the fetus, during or after birth through skin-to-skin contact, or from a parent with MPX to an infant or child during close contact. Person-to-person transmission normally occurs through close contact, which is usually face-to-face, skin-to-skin, mouth-to-mouth, or mouth-to-skin contact.[5] Laboratory evidence suggest that the MPXV is preserved by separate species in endemic regions,[6] with recurrent transmission into human populations, where short chains (≤7) of human-to-human infections may ensue.[7, 8] Much to the scientific society's surprise, approximately 72,237 confirmed cases of MPX, including 26 deaths, had been discovered in 109 countries in the matter of a few months.

Men between 30-39 years old have been disproportionately affected by this outbreak as they account for approximately 80% of the cases, followed by those between 18 to 29 years old, those between 40 to 49 years old, those between 50 to 59 years old, those between 60 to 69 years old, those between 10 to 17 years old, those between 0 to 9 years old, those between 70 to 79 years old, and those ≥80 years old (Fig. 1). Women have shown similar patterns with men regarding age.

2. What are the signs and/or symptoms of human monkeypox virus infection?

According to the international cohort of 60,510 individuals, the MPXV can cause rash (all

Table 1. Clinical findings in international cohort (n=60,510)

	No	Yes	Unknown	Prevalence (95% CI)
Men who have sex with men	15,706 (90.0%)	1,753 (10.0%)	46,051	90.0 (89.5 to 90.4)
HIV-positive	9,516 (49.1%)	9,852 (50.9%)	44,142	49.1 (48.4 to 49.8)
Health worker	425 (3.2%)	12,947 (96.8%)	50,138	3.2 (2.9 to 3.5)
Travel history	1,632 (16.9%)	8,018 (83.1%)	53,860	16.9 (16.2 to 17.7)
Sexual transmission	10,585 (87.3%)	1,545 (12.7%)	51,380	87.3 (86.7 to 87.8)
Hospitalization	2,145 (7.3%)	27,400 (92.7%)	33,965	7.3 (7.0 to 7.6)
Intensive care unit	19 (0.2%)	10,732 (99.8%)	52,759	0.18 (0.11 to 0.28)
Deaths	8 (0.0%)	25,979 (100.0%)	37,523	0.03 (0.02 to 0.06)

CI, confidence interval; HIV, human immunodeficiency virus

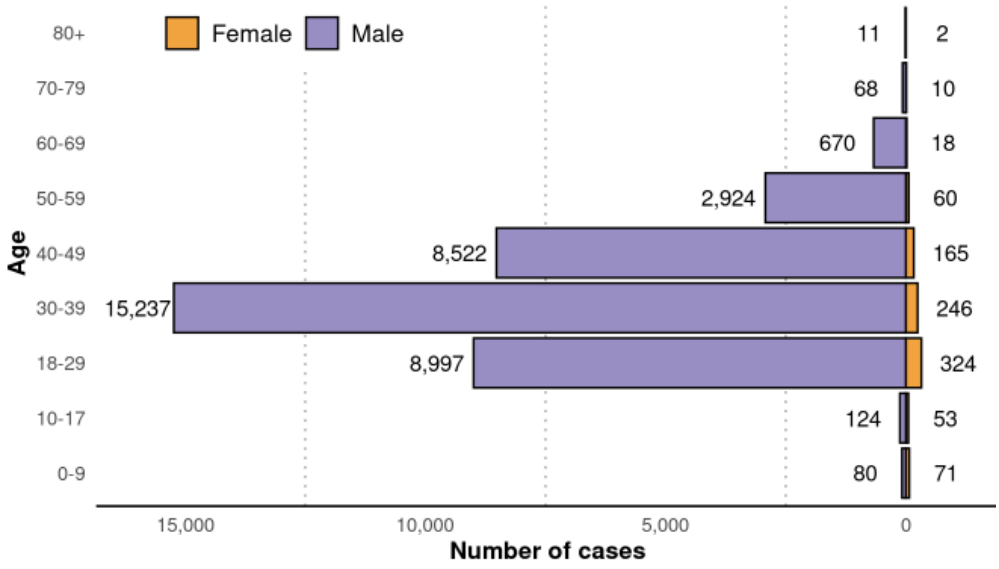

Fig. 1. Age-sex pyramid for laboratory-confirmed monkeypox cases (total n=37,582)

types; 83.6%, n=21,472), fever (57.8%, n=14,842), rash on the whole body (49.6%, n=12,730), genital rash (45.5%, n=11,696), headache (29.4%, n=7,556), fatigue (29.3%, n=7,523), lymphadenopathy (all types) (29.0%, n=7,453), muscle ache (26.9%, n=6,919), general lymphadenopathy (24.3%, n=6,235), local lymphadenopathy (18.6%, n=4,779), rash of unknown location (12.7%, n=3,271), sore throat, oral rash, chills, cough, vomiting, and other signs and/or symptoms in the order of frequency, with a subtle difference between men and women (Table 2). The median delay between the date of onset and reporting was 6 days (interquartile range, 3 to 9). Symptoms may persist for two to three weeks. The number of lesions can range from one to several thousands. The lesions on the skin commence flat, then fill with fluid before they crust over, and finally dry up and detach with a fresh layer of skin forming underneath.[9] Most people recover from MPX within a few weeks, without the need of treatment.[10] Infection persists until a new layer of skin has been formed underneath. Those at higher risk of being infected with the virus or death may include pregnant women, children, and individuals who are immunocompromised.[11] The emergence of the rash can be seen as the first indication of infection. Further, MPX signs and/or symptoms frequently start in regions of the head and advance to the patient's arms, legs, palms, and soles.[12] In contrast, according to previous studies, cases that the rash having started in the genital or perianal region prior spreading to the person's extremities (Fig. 2 and Fig. 3) instead of head regions have been found.[12] Complications from MPX consist of secondary skin infections, pneumonia, disorientation, eye problems, proctitis, and pain or difficulty when urinating. Identification of viral DNA in swabs taken from crusts of vesicles or ulcers represent the preferred strategy for diagnosing active MPX cases.[13]

Table 2. Summary of clinical symptoms in international cohort (n=60,510)

	Total	Male	Female
Rash (all types)	21,472 (83.6%)	20,436 (83.7%)	399 (66.1%)
Fever	14,842 (57.8%)	14,184 (58.1%)	306 (50.7%)
Systemic rash	12,730 (49.6%)	11,769 (48.2%)	327 (54.1%)
Genital rash	11,696 (45.5%)	11,125 (45.6%)	141 (23.3%)
Headache	7,556 (29.4%)	7,069 (29.0%)	244 (40.4%)
Fatigue	7,523 (29.3%)	7,008 (28.7%)	186 (30.8%)
Lymphadenopathy (all types)	7,453 (29.0%)	7,327 (30.0%)	115 (19.0%)
Muscle ache	6,919 (26.9%)	6,475 (26.5%)	211 (34.9%)
General lymphadenopathy	6,235 (24.3%)	6,134 (25.1%)	96 (16.1%)
Local lymphadenopathy	4,779 (18.6%)	4,711 (19.3%)	59 (9.9%)
Rash, unknown location	3,271 (12.7%)	3,250 (13.3%)	19 (3.1%)
Sore throat	3,162 (12.3%)	2,902 (11.9%)	92 (15.2%)
Oral rash	2,502 (9.7%)	2,049 (8.4%)	37 (6.1%)
Chills	1,635 (6.4%)	1,307 (5.4%)	38 (6.3%)
Cough	486 (1.9%)	396 (1.6%)	14 (2.5%)
Vomiting	467 (1.8%)	439 (1.8%)	25 (4.1%)
Asymptomatic	20 (0.1%)	20 (0.1%)	0
Other	3 (0.0%)	2 (0.0%)	1 (0.2%)
Conjunctivitis	0	0	0
Diarrhea	0	0	0
Genital edema	0	0	0
Lymphadenopathy, location unknown	0	0	0
Anogenital pain and/or bleeding	0	0	0

3. Mechanism of human monkeypox viral infection

MPXV-2022 strains contained 46 novel consensus mutations, compared with the 2018 strains.[14] Many scientists and physicians expected that the higher transmission rate and lower severity and outcomes of 2022 strains may associated to these 46 novel consensus mutations, compared with the 2018 strains.[15] To find the novel insight on the potential association between viral infectivity and mutation, additional research is warranted.

4. Conclusion

Most patients with MPX have a mild, self-limiting disease course with no medical

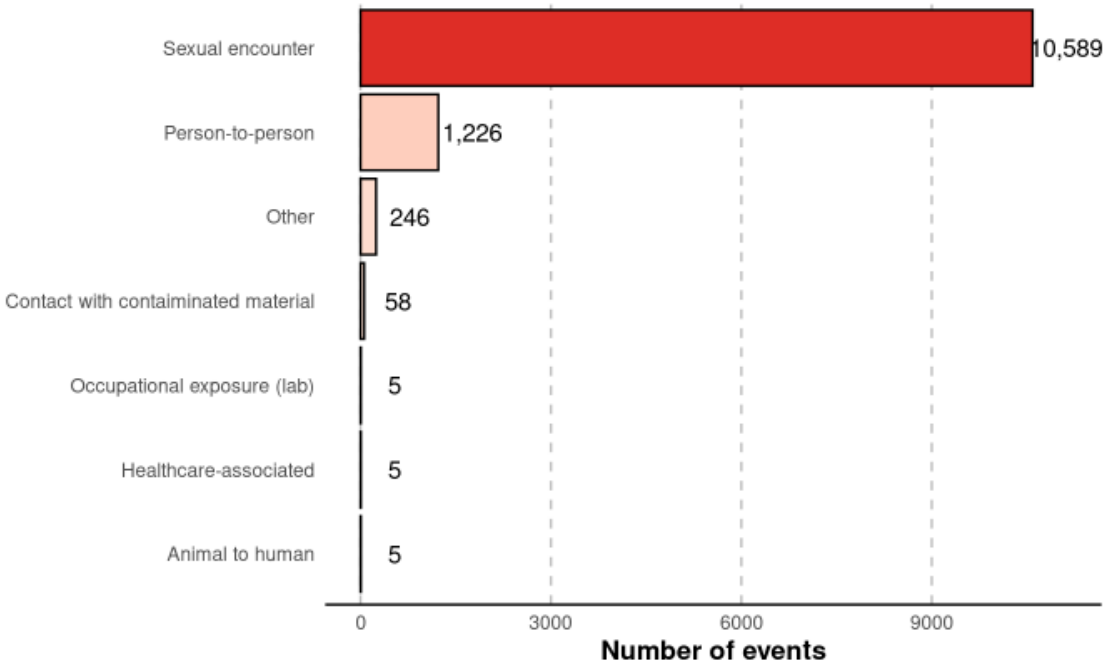

Fig. 2. Laboratory-confirmed monkeypox cases, by transmission type (total n=12,134)

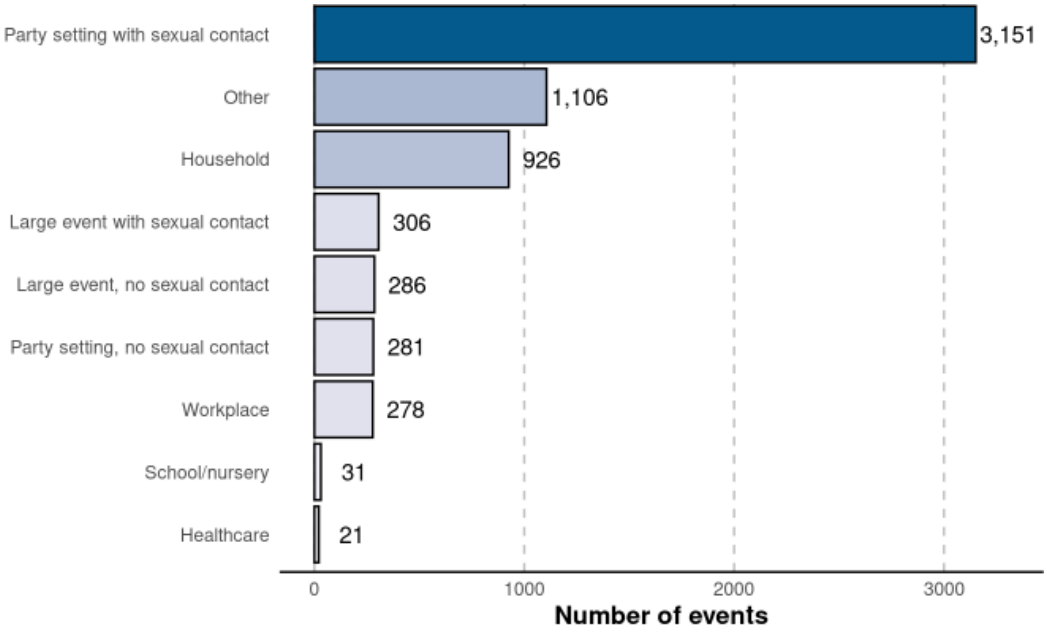

Fig. 3. Laboratory-confirmed monkeypox cases, by exposure type (total n=6386)

treatment or supportive care. However, the prognosis for MPX may be differ according to initial health status (i.e., immunocompromized patients), previous vaccination status, and comorbidities. Taken together, a case-by-case strategy considering the health status of individuals is seemingly the most reasonable therapeutic option in controlling the MPX.

Capsule Summary

This comprehensive review aims to provide that a case-by-case strategy considering the health status of individuals may be seemingly the most reasonable therapeutic option in controlling the monkeypox.

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Author Contribution

Dr HY contributed to the preparation of this review.

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Conflicts of Interest

The author has no conflicts of interest to declare for this study.

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