

**Cutaneous eruptions associated with monkeypox virus infection: A systematic review**

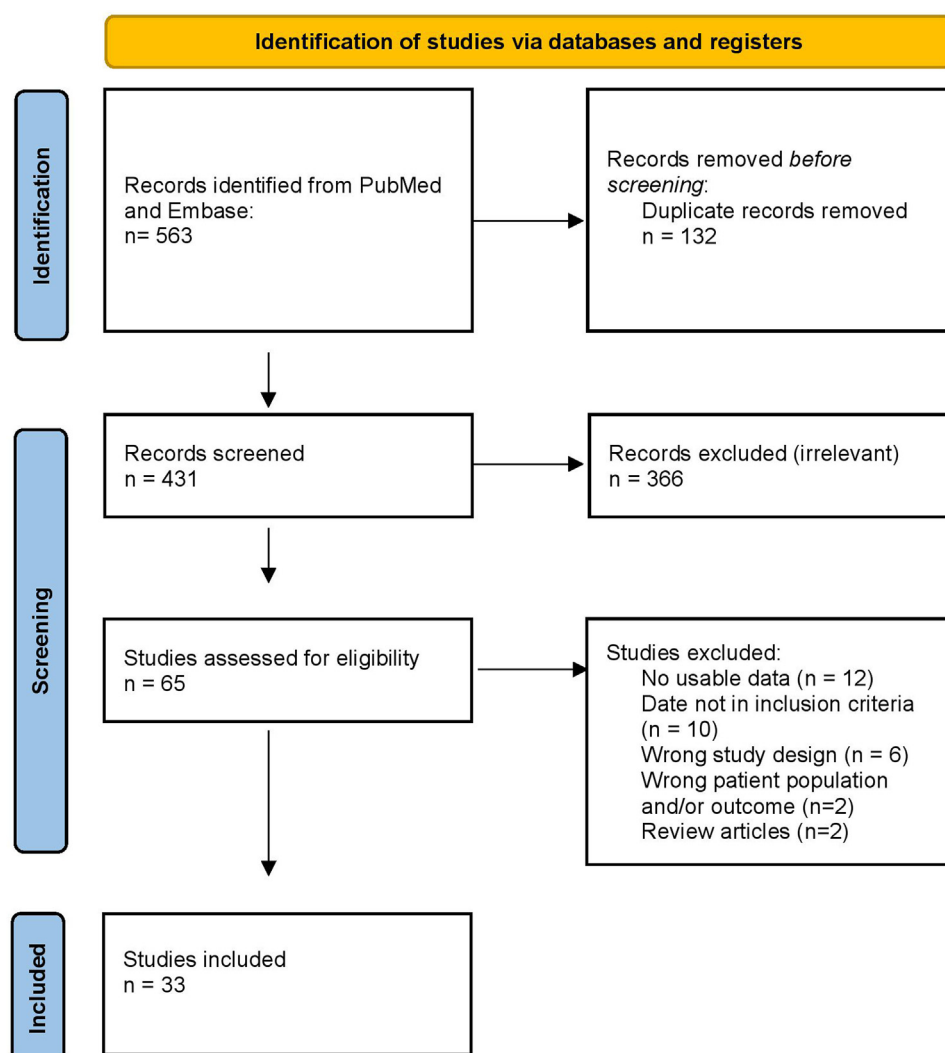


*To the Editor:* With the July 23, 2022 World Health Organization declaration of monkeypox virus (MPV) infection as a public health emergency of international concern,<sup>1</sup> we aimed to characterize the cutaneous morphologies of the MPV-associated rash.

A Preferred Reporting Items for Systematic Reviews and Meta-Analyses–compliant systematic review was conducted with the goal of identifying

published articles describing the skin rash in confirmed cases of MPV infection. The database search included PubMed and EMBASE databases from inception to September 2022. Studies were included if the contained descriptions of rash morphology. We critically evaluated the identified cases.

A total of 33 studies Supplementary References S1-S33, available via Mendeley at <https://data.mendeley.com/datasets/k9mdym29r6/1> were included (Fig 1); all were observational; 23 case report/



**Fig 1.** Study flowchart as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses criteria.

**Table I.** Patient demographics and monkeypox associated rash characteristics

Variables	Monkeypox rash	
	Frequency (n)	Percentage %
Gender		
Male	1843	73
Female	682	27
The median (range) time of rash onset from viral symptoms	5.5 d (1-33)	
The median (range) time of rash resolution	19 d (7-60)	
Rash morphology		
Polymorphic	118	10.20
Maculopapular	149	12.87
Pustular/pseudopustular	271	23.42
Vesicular	204	17.63
Central umbilication	7	0.6
Erosion	6	0.5
Affected sites		
Trunk	1652	65.42
Palms	1200	47.52
Plantar	1056	41.82
Genital	732	29
Perianal	157	6.2
Conjunctiva	213	8.4
Oral	50	2
Scalp	16	0.6
Rash associated symptoms		
Fever	1747	69.18
Lymphadenopathy	1594	63.12
Myalgia	955	37.82
Fatigue	924	36.59
Dysphagia	738	29.22
Cough	569	22.53
Conjunctivitis	294	11.64
Headache	225	9
Proctitis	124	5
Sore throat	101	4
Facial swelling	3	0.1

case series and 10 retrospective studies reporting 2525 participants, 2261 (previous outbreaks) and 264 (2022 outbreak) and among the latter group 233 were MSM. The majority were males ( $n = 1843$ ; 73%) vs females ( $n = 682$ ; 27%). The median (range) time of rash onset from viral symptoms (ie, fever, sore throat, headache, malaise) was 5.5 days (1-33). Rash resolution was 7 to 60 days (Table I).

All but 3 studies described morphologies, Supplementary References S8,S14,S33, available via Mendeley at <https://data.mendeley.com/datasets/k9mdym29r6/1> with a total of 1368 patients. Multiple morphologies were reported in ( $n$ : 118; 10.20%); maculopapular ( $n$ : 149; 12.87%); pustular

or pseudopustular ( $n$ : 271; 23.42%); vesicular ( $n$ : 204; 17.63%); central umbilication ( $n$ : 7; 0.6%); erosions ( $n$ : 6; 0.5%); and in 1 case, bullous. Rash ( $n$ :657; 56.78%) was itchy. Oral ulceration was observed in 10 (0.4%).

The trunk was the most affected site of rash location when diagnosed ( $n = 1652$ ; 65.42%) followed by extremities ( $n = 1279$ ; 50.65%); palms ( $n = 1200$ ; 47.52%); plantar ( $n = 1056$ ; 41.82%); genital ( $n = 732$ ; 29%); perianal ( $n = 157$ ; 6.2%), conjunctiva ( $n = 213$ ; 8.4%); oral ( $n = 50$ ; 2%); and the scalp ( $n = 16$ ; 0.6%).

Symptoms and signs associated with the rash were fever ( $n = 1747$ ; 69.18%), lymphadenopathy (1594; 63.12%), myalgia (955; 37.82%), fatigue ( $n = 924$ ; 36.59%), dysphagia ( $n = 738$ ; 29.22%), cough (569; 22.53%), conjunctivitis ( $n = 294$ ; 11.64%), headache ( $n = 225$ ; 9%), proctitis presenting with anal pain (124; 5%), sore throat (101; 4%), and facial swelling ( $n = 3$ ; 0.1%) and other symptoms.

The 3 main symptoms of MPV infection are fever, rash, and lymphadenopathy. One to 3 days after the prodromal symptoms, a vesiculopustular eruption appears, beginning on the face and spreading centrifugally.<sup>2</sup> An international collaborative study that included 528 infected persons, 98% of whom were identified as gay or bisexual men, showed a median incubation period of 7 days (range, 3-20). This is close to our finding of 5.5 days (1-33). In that study, 73% of those infected had anogenital lesions, 41% had mucosal lesions, and fever was the most common associated symptom.

The MPV-associated rash can have several morphologies, with pustules being the most typical. Any suspected MPV infection should be evaluated with an anogenital and mucosal examination in addition to the palpation of lymph nodes, as more than half the patients had concomitant lymphadenopathy.<sup>3</sup> Recognizing the MPV infection and associated eruption is essential to stopping the spread of disease within the community.

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**Conflicts of interest**

None disclosed.

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