



Mpox in the United States: Current implications for public health nursing

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Abstract

In 2022, mpox, an orthopoxvirus first isolated in 1958 in cynomolgus monkeys, became a global public health threat. While the virus can be communicated through skin-to-skin contact from any infected person to non-infected person, most cases in the United States have been in gay and bisexual men. Consequently, early public health and community-based efforts concentrated on reducing infections in this population. This article explores current mpox case count epidemiologic data and trends. In addition, vaccination indications, contraindications, adverse events, and national administration data are provided along with directions for nurses and other clinicians moving forward in the outbreak.

KEYWORDS

epidemiology, infectious diseases, vaccination

1 | INTRODUCTION

1.1 | A primer on mpox

Mpox is a member of the genus *Orthopoxvirus* which also includes the historic variola virus responsible of smallpox and the vaccinia and cowpox viruses (Table 1) (Centers for Disease Control & Prevention [CDC], 2015; National Institutes of Allergy & Infectious Diseases, 2022). In 1958, mpox was first identified in cynomolgus monkeys (von Magnus et al., 1959). Initially, researchers and clinicians concluded humans were not susceptible to mpox infection. This, however, was

disproven in 1970, with the death of a 9-month-old boy believed to have been the first fatality from mpox in the Democratic Republic of the Congo (World Health Organization [WHO], 2022b). During the following 30 years, nearly all mpox cases were essentially limited to the confines of Africa.

Mpox are zoonotic viruses that can be communicated from animal to human and vice versa (CDC, 2015). Since the first human case in 1970, very infrequent and periodic outbreaks were noted in the United States (US), the United Kingdom (UK), Israel, and Singapore; thus, prevailing thought considered mpox as endemic to the African continent (Gessain et al., 2022; WHO, 2022a). However, in May 2022, a spike

TABLE 1 Viruses members of the genus *Orthopoxvirus* (CDC, 2015; Lanave et al., 2018).

- Abatino macacapox virus
- Akhmeta virus
- Camelpox virus
- Cowpox virus
- Ectromelia virus
- Mpox virus
- Raccoonpox virus
- Skunkpox virus
- Taterapox virus
- Vaccinia virus
- Variola (Smallpox) virus
- Volepox virus

in cases not associated to travel to Africa were reported in Europe and followed by reports in other continents. This shifted the epidemiologic consideration of mpox from endemic to Africa, but with a potential of world-wide distribution. This prompted the WHO to declare mpox a global public health emergency on July 23, 2022.

Two mpox clades are currently recognized: Clade I, previously identified as the Congo Basin or Central African clade, and Clade II, also known as the West African clade (National Institute of Allergy & Infectious Diseases [NIAID], 2022). Clade II is further divided into subclades, IIa and IIb, with Subclade IIb being largely responsible of the widespread cases around the world. Clade I remains largely responsible for infections in the Democratic Republic of Congo and is estimated to cause more severe disease and higher mortality than Clades IIa and IIb (NIAID, 2022).

1.2 | Nomenclature

As mentioned, mpox was named “human monkeypox” in 1970, years before WHO’s best practices in naming diseases were published in 2015 (CDC, 2022a; WHO, 2022a). Per the International Classification of Diseases (ICD), the WHO is the entity responsible for assigning names to diseases (WHO, 2022a). In November 2022, the WHO revised the nomenclature for monkeypox and suggested mpox as the new, preferred nomenclature as monkeypox phases out during the following year. The term monkeypox will only remain as an ICD historic term for reference (WHO, 2022c).

This nomenclature change was a result from a request by several individuals, professional organizations, and countries to reduce racial and stigmatizing language associated with the term monkeypox (WHO, 2022c). The designation of mpox as a synonym for monkeypox became official in 2023 and is the current standard language for clinical and statistical health data (WHO, 2022c). Moreover, as noted above, the mpox clades were also renamed to avoid discriminatory language (WHO, 2022c).

1.3 | Epidemiology of mpox infection

As of March 15, 2023, the US has documented slightly over 30 thousand cases of mpox (CDC, 2023a). Case count data are updated biweekly by the CDC (2023a). There have been 38 recorded mpox-related fatalities in the US (CDC, 2023a). Thirteen states and the District of Columbia reported incident cases at rates higher than 500 per 100,000 residents (i.e., Arizona, California, Florida, Georgia, Illinois, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Texas, Virginia, and Washington) (CDC, 2023a). Conversely, the lowest incident rates under 10 per 100,000 residents were reported in Alaska, Montana, North Dakota, South Dakota, Vermont, and Wyoming (CDC, 2023a).

Case count trends have dropped dramatically since August 1st, 2022, when cases of mpox peaked; 624 new cases were reported over that 7-day reporting period (CDC, 2023d). Case counts steadily declined nationwide over the next 5 months, with just three new cases recorded on the reporting period ending on January 18, 2023 (CDC, 2023d). The decline in cases of mpox in the US was mirrored by administration of vaccinations to those at most risk (CDC, 2023c, 2023d).

1.4 | Mpox communication and clinical characteristics

Mpox has multiple routes of transmission rooted in interpersonal contact (CDC, 2022c). This direct contact comes from communication with an infected person with active rash or scabs; but other infectious contact sources include saliva, upper respiratory secretions (mucus), and perianal, rectal, and vaginal areas (CDC, 2022c). The CDC identified intimate behaviors in which infection can be communicated to include, “oral, anal, or vaginal sex, or touching of genitals (penis, testicles, labia, and vagina) or anus of a person with mpox; (...) hugging, massaging, and kissing; and prolonged face-to-face contact” (2022c, para. 2). Because sexual contact is the leading mode of transmission, some infectious disease scientists and clinicians have begun to classify mpox as a sexually transmitted infection (Allan-Blitz et al., 2022; Handsfield, 2022).

Nonsexual contact has also caused infection (CDC, 2022c). Vertical transplacental transmission from mother to fetus is possible, as it is communicated from mother to newborn due to close skin-to-skin contact during intra- and postpartum periods (American College of Obstetricians & Gynecologists [ACOG], n.d.). Direct zoonotic infection can occur from contact with an infected animal’s rash, open lesions, or fluids, such as, saliva, urine, and feces (CDC, 2022c).

The incubation period from exposure to when symptoms occur ranges from 3 to 17 days (CDC, 2022d). mpox symptoms often include fever, headache, myalgias, lymphadenopathies, respiratory symptoms (e.g.,odynophagia, nasal congestion, cough), and a rubbery, circumscribed, umbilicated, vesicular rash that may occur on the face, hands, feet, thorax, genitals, anus, and/or intraorally ([ACOG], n.d.; CDC, 2022d). Asymptomatic cases of infection have also been identified (CDC, 2022d). An infected individual is capable of transmitting

TABLE 2 Risk factors warranting recommendation of mpox vaccination (CDC, 2023b).

- Known or suspected exposure to someone with mpox
- Sex with a partner diagnosed with mpox in the past 2 weeks
- Gay, bisexual, or other man who has sex with other men, transgender, nonbinary, or gender-diverse person who reports the following within the past 2 weeks:
 - > 1 sex partner
 - Sex at a commercial venue (sex club or bathhouse)
 - Sex at an event, venue, or area where mpox transmission is occurring*
- Gay, bisexual, or other man who has sex with other men, transgender, nonbinary, or gender-diverse person who reports the following within the past 6-months:
 - New diagnosis of any sexually-transmitted disease
 - > 1 sex partner
- Reports the following in the past 6 months:
 - Sex at a commercial venue (sex club or bathhouse)
 - Sex at an event, venue, or area where mpox transmission is occurring*
- Reports having a sex partner reporting any of the above risk factors
- Reports anticipation of experiencing any of the above risk factors
- Reports work with orthopoxviruses in a lab or is an orthopoxvirus responder

*From CDC, 2023b.

mpox from time of symptom onset until their rash has completely healed and replaced by a new integumental layer (CDC, 2022d).

1.5 | Vaccination against mpox

1.5.1 | Administration

The main vaccine currently in use in the US is a smallpox and mpox live, nonreplicating injection (Jynneos®; Bavarian Nordic), administered in two doses, 4 weeks apart (CDC, 2023b; Missouri Department of Health & Senior Services, 2022). The standard dose is 0.5 ml administered subcutaneously (SQ) (CDC, 2022b). However, under Emergency Use Authorization for adults 18 years and older (Administration for Strategic Preparedness & Response, n.d.; CDC, 2022b), 0.1 ml administered intradermally could be used in lieu of 0.5 ml SQ. This strategy increased five-fold the number of available doses and has been proven noninferior to the standard SQ dose in terms of immunogenicity, reactogenicity, and safety (Brooks et al., 2022; Frey et al., 2015).

1.5.2 | Indications and contraindications

Recommendations of receiving of the vaccine should be based on data collected from a focused social history. Specific patient risk factors (CDC, 2023b) that should prompt the nurse or other clinician to recommend vaccination are presented in Table 2.

Individuals who have had an allergic reaction to the first mpox vaccine dose should not receive a second dose (CDC, 2023b; Missouri

Department of Health & Senior Services [MDHSH], 2022). In addition, it should be avoided in those with allergies to gentamicin, ciprofloxacin, or egg protein (MDHSH, 2022). While the vaccine is safe for use during pregnancy and in people living with the human immunodeficiency virus (HIV), those who are immunocompromised may have a decreased immunologic response (MDHSH, 2022). Individuals are considered fully-vaccine protected 2-weeks following the second dose (MDHSH, 2022); and it should be administered 4-weeks before or after receiving COVID-19 vaccination due to unknown potential risk for myocarditis (MDHSH, 2022). The most common adverse event reported for both intradermal and SQ injection was erythema at the injection site (Duffy et al., 2022). Table 3 lists the most frequently reported adverse events reported with both administration methods.

1.5.3 | Vaccination trends

As of January 17, 2023, 1,171,826 doses of the mpox vaccine have been provided in the 57 US jurisdictions, a stark increment from only 49 doses administered during the May 22 to 28, 2022 reporting period (CDC, 2023c). In contrast, 104,070 first dose and 4649 second-dose administrations were given during the reporting period of August 07 to 13, 2022 (CDC, 2023c). After this peak, administration declined gradually, with 1259 first-dose and 1282 second-dose administrations given during the reporting period of January 22 to 28, 2023 (CDC, 2023c).

Most vaccines (91%), including first and second doses, have been administered in men and in those between the ages of 25 and 39 years (45%) (CDC, 2023c). Non-Hispanic White adults received the most vaccine administrations (48%) while those reporting their race as Native Hawaiian or other, received the least (0.02%) (CDC, 2023c). Within the continental US, California has received the most vaccine vials (15.7%) while Wyoming has received the least (0.04%) (Administration for Strategic Preparedness & Response, 2023). This distribution of vials reflects the case count of the outbreak, with California reporting the most cases ($n = 5,719$; 19%) and receiving the most vials and Wyoming reporting the least cases ($n = 4$; .01%) and receiving the least vials (CDC, 2023a).

1.6 | Public health outreach

Because the mpox outbreak is recent, large, representative studies of public health strategies shown to be efficacious in prompting those at risk to get vaccinated or alter riskier behaviors to avoid infection are scarce. However, there are some suggestions the *For us, by us* public health response, which swiftly followed revelation the outbreak was being seen primarily in gay and bisexual men, may have played a major role in curtailing new infections (Landman, 2022). *For us, by us* defines a public health approach in which “people working with community-led groups provide health outreach to members of their own, often marginalized communities” (Landman, 2022, para. 5).

TABLE 3 Most common adverse events¹ from intradermal and subcutaneous routes² of mpox vaccine administration³ (Duffy et al., 2022).

Intradermal (n = 325)	Number of Reports	Reporting Rate (95% CI)
Injection site erythema	75	150 (118-188)
Dizziness	66	132 (102-168)
Urticaria	60	120 (91-154)
Injection site edema	51	102 (76-134)
Syncope	43	86 (62-116)
Erythema	42	84 (60-113)
Loss of Consciousness	41	82 (59-111)
Injection site pruritus	40	80 (57-109)
Hyperhidrosis	38	76 (54-104)
Pruritus	33	66 (45-92)
Subcutaneous (n = 212)		
Injection site erythema	36	107 (75-148)
Injection site edema	36	107 (75-148)
Injection site pain	34	101 (870-141)
Pain	29	86 (57-123)
Erythema	28	83 (55-120)
Dizziness	27	80 (53-116)
Headache	26	77 (50-113)
Fatigue	25	74 (48-109)
Injection site pruritus	23	68 (43-102)
Pyrexia	23	68 (43-102)

1 = Excluding vaccination errors and deviations from recommendations.

2 = Licensed and authorized routes of administration only.

3 = Reports per million dose administered; total number of intradermal doses administered = 501,228 and subcutaneous doses administered = 337,950.

Early in the mpox outbreak, government-based health institutions failed to deliver quick communication about risks associated with sexual behaviors; and vaccine supplies were inadequate to meet demand (Landman, 2022). Complicating the public health response was a seemingly uneven system of access to treatment and prevention (Landman, 2022; Patel & Kounang, 2022). To combat these inadequacies, community-based queer health groups partnered with health departments to distribute vaccines (Landman, 2022).

Organizations under the leadership of lesbian, gay, bisexual, transgender, and queer (LGBTQ) community members spearheaded efforts to educate their own membership on engaging in safer sex activities; and their coordinated efforts helped augment the supply of the mpox vaccine and increase access to mpox treatment (Landman, 2022). Bathroom operators and gay-male focused sexual-networking apps promoted messages regarding prevention and vaccination. The work of these concerted, LGBTQ community-based, and grassroots interventions resulted in a quick flattening of the mpox curve (Landman, 2022).

However, vaccine equity remains a major concern (CDC, 2022f; CDC Foundation, 2022; Landman, 2022). Socioeconomic, political, psychosocial, and environmental variances affect health acuity and thus, access to vaccines (CDC, 2022f; CDC Foundation, 2022; Land-

man, 2022). Specific groups most frequently impacted by vaccine inequity include ethnic and sexual male minorities (CDC, 2022f; CDC Foundation, 2022; Landman, 2022). Nurses and other public and primary health clinicians can impact care outcomes by directly focusing their efforts on the social determinants influencing vaccine equity.

2 | DISCUSSION

2.1 | Increasing vaccine equity

Vaccination could be the most significant intervention to reduce new mpox infections globally. While the mpox curve has flattened and case counts dramatically decreased nationally since its recognition as a global health threat (CDC, 2023c, 2023d), vaccine access remains problematic (CDC, 2022f; CDC Foundation, 2022). Some determinants surrounding vaccine equity are systemic. For example, lack of access to well-paying jobs and good working conditions, discrimination (particularly biases rooted in racism and homophobia), and gaps in education and earnings, are major contributors (CDC, 2022f; CDC Foundation, 2022). However, some variables can be targeted by public health



initiatives, such as the *For us, by us* framework implemented for the mpox outbreak or adapting effective strategies proposed in the containment of non-communicable diseases, such as social determinants of health driving hypertension disparities in sexual and gender minorities (López Castillo & Martínez, 2022).

Inadequate transportation can challenge individuals' access to vaccine administration sites (CDC, 2022f). Public health nurses and other public health advocates can be elected to transportation boards and serve as a link between community stakeholders and decision-makers to enhance transportation access in low-income neighborhoods. Another major input that threatens vaccine equity is lack of trust of the healthcare system by some minorities due to past medical racism and even documented cases of experimentation on certain minorities (CDC, 2022f).

Establishing a credulous relationship with minority persons is important for nurses and healthcare clinicians. Many minorities, including sexual minorities, traditionally distrust the healthcare system due to anxiety of preconceived biases and stigma associated with having non-heterosexual identities (Martos et al., 2017). This can compound issues surrounding access among these persons and increase unwillingness to utilize care services (Blackwell, 2020; Martos et al., 2017).

While dialogue of these topics exceeds this exposition, readers should appraise resources provided by Streed et al. (2019), the Gay & Lesbian Medical Association (GLMA, 2023) and Fenway Institute's National Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual Health Education Center (Blackwell, 2020; Fenway Institute, 2023). mpox is a global health threat affecting persons beyond US borders and those of all sexual orientations. However, its disparate effects on the gay and bisexual male community are undeniable and intensified by the overall health inequalities endemic in gay and bisexual men before mpox evolved into a foremost concern.

Nurses must integrate comprehension of these notable public health distresses and the cultural considerations associated with providing care to gay and bisexual men when providing sexual counseling (Blackwell & López Castillo, 2021) and to other affected minorities. Nurses must recognize their roles as LGBTQ supporters with their contemporaries exclusive, and non-exclusive, of nursing (Blackwell & López Castillo, 2021).

Vaccine hesitancy remains a major impedance to reducing vaccine-preventable infections. While hesitancy to receive vaccines among the US population has weakened over the COVID-19 pandemic (Dreisbach, 2021), engrained societal racism has contributed to community distrust of the healthcare system by many African American adults, which might impact their willingness to accept vaccinations (Bogart et al., 2021).

In an assessment of mistrust of the COVID-19 vaccine among African American men living with HIV ($n = 101$), Bogart et al. (2021) found every participant held at least one COVID-19 mistrust belief. Half also indicated at least one COVID-19 vaccine misbelief (Blackwell & López Castillo, 2021; Bogart et al., 2021). As COVID-19 mistrust beliefs increased, so did the vaccine and treatment hesitancy among

this sample (Blackwell & López Castillo, 2021). Because men indicated social and healthcare resources as most trusted, nurses, social service professionals, and other clinicians could make significant inroads when working with this susceptible population (Blackwell & López Castillo, 2021).

As trusted healthcare collaborators, it is vital for nurses and other clinicians to be aware of the resources that exist to help combat mpox in vulnerable populations. Through utilization of these resources, outreach efforts can be improved, and the disease further eradicated. Thus, implementing projects that focus on reducing vaccine inequity is vital.

2.2 | Vaccine equity programs

The CDC Foundation (2022) has an active program designed to fund projects reducing disparities in mpox vaccination. These programs provide up to \$25,000 to state, territorial, or tribal health departments, or community-based organizations with specific projects that “demonstrate ways to reach populations who are most affected by mpox yet experiencing a disparity in vaccination as defined by the applicant and supported by local context and data” (CDC Foundation, 2022, sec. 6). Complete program data and application can be obtained through the CDC Foundation (2022). In addition to implementing funded projects at enhancing vaccine access, other strategies can also assist healthcare professionals in this endeavor. One toolkit that public health providers may find to be of great benefit is the *MPX Outreach Tool* from the City and County of San Francisco (n.d.). This online resource comprises mpox consumer prevention outreach materials including informational posters, videos, and vaccine information sheets in addition to resources useful for clinicians, including a care sheet which can be provided to infected individuals regarding care (City and County of San Francisco, n.d.).

2.3 | Implications for nursing and healthcare education

Nurses, nurse practitioners (NPs), and other healthcare providers must have a thorough understanding of the processes involved in the patient interview to correctly determine an individual's risks for acquiring and transmitting mpox. However, because most clinicians may be unfamiliar with mpox, its mode of transmission, and symptoms, they may need education to equip them with proper assessment and prevention skills. Since the virus is transmitted through skin-to-skin contact (CDC, 2022c), patients should be assessed regarding contacts with potentially infected individuals.

The healthcare provider should consider other infectious contact sources beyond the integument, including saliva, upper respiratory secretions (mucus), and exposure to perianal, rectal, and vaginal areas (CDC, 2022c). During the social history, focus should be directed towards activities such as those previously described (CDC, 2022c). When obtaining the review of systems, it is important for the

provider to be cognizant of mpox symptoms, which often include fever, headache, myalgias, lymphadenopathies, and different respiratory symptoms, and a vesicular rash that occurs on the face and elsewhere (ACOG, n.d.; CDC, 2022d). Temporal considerations are also applicable since the incubation period before symptoms develop ranges from 3 to 17 days (CDC, 2022d).

In addition to increasing knowledge of practicing nurses through continuing education, prelicensure nurse learners and graduate advanced practice nurse learners, such as NPs, should be exposed to concepts that will augment their clinical skills related to the assessment, evaluation, and prevention of mpox as well as other vaccine preventable diseases. Exposure can be done through simulation-based learning, or SBL. According to Koukourikos et al. (2021), SBL gives learners a way to practice skills, such as decision-making, without retribution, and learning can be fostered.

Opportunities for SBL in prelicensure and graduate NP learners should be aimed at enhancing their abilities to assess, evaluate, and prevent mpox might include simulated health history-taking, designing an mpox vaccine clinic, use of mannequins, and embedded or simulated participants (Lewis et al., 2017) to identify vaccine injection site anatomy, and use of simulated injection pads and other equipment to practice both intradermal and SQ injection techniques. Enhancing the capacity to evaluate and diagnose lesions can be accomplished by using simulated wounds and simulated dermal surfaces that mimic those lesions common to the presentation of mpox, as well as other vaccine preventable diseases and disorders. It may be particularly important to simulate diseases common to one's area of practice.


3 | CONCLUSION


This article discussed current mpox case count epidemiologic data and trends. In addition, vaccination indications, contraindications, adverse events, and national administration data were provided along with directions for nurses and other clinicians moving forward in the outbreak. While the public health threat of mpox is waning in the US, it remains a concern. Nurses and other healthcare providers must be equipped with the knowledge and skill necessary to assess patients for risk, identify vulnerable patients who may be less likely to be vaccinated, and advocate for public health and nursing education interventions that can reduce the incidence of mpox. Through a concerted effort aimed at public health education and vaccination, the trend of diminishing new infections can continue. Nurses and NPs will continue to play vital roles as care providers, educators, and public health advocates in the fight against mpox and other infectious diseases as they emerge and become regional, state, national, and global threats.

DATA AVAILABILITY STATEMENT

The information presented in this manuscript are derived from data available in the resources listed within the manuscript's references.

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How to cite this article: Blackwell, C. W., Hicks, R. W., López Castillo, H. L., Guido-Sanz, F., & Anderson, M. (2023). Mpox in the United States: Current Implications for Public Health Nursing. *Public Health Nursing*, 1–7. <https://doi.org/10.1111/phn.13194>