



## ***Guidance for the Prevention and Treatment of Monkeypox (Mpox)***

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*This document was approved by the ACOEM Board of Directors on November 5, 2022.*

The American College of Occupational and Environmental Medicine (ACOEM) provides this guidance on monkeypox for occupational and environmental medicine (OEM) physicians and other health professionals responsible for preventing and treating monkeypox among health care workers and those workers who may have skin-to-skin contact with others (e.g., schools, correctional facilities, laboratories, veterinary settings, sex workers, etc.). This document is also intended to address some of the associated work-related issues.

### **What Is Monkeypox?**

Monkeypox was first discovered in 1958 with outbreaks occurring in colonies of monkeys kept for research (resulting in its name). Monkeypox belongs to the same family as smallpox. However, in contrast to smallpox, which can only be transmitted from human to human, the monkeypox virus can spread from animals (i.e., rodents) to people, typically yielding limited outbreaks. As of October 27, 2022, there are a total of 28,244 cases of monkeypox nationally.<sup>1</sup> This is the largest-ever outbreak of monkeypox in the U.S.; monkeypox has typically been confined to other continents. Early diagnosis is the key to controlling these isolated outbreaks,<sup>2</sup> but most physicians have never seen a case in their lifetime. It is known to spread through close personal contact, often involving skin-to-skin touch but also through bodily fluids, respiratory droplets, and contaminated materials.

U.S. officials are raising awareness about monkeypox and encouraging precautions especially to populations most at risk. Vaccines for smallpox and monkeypox exist, and experts are already familiar with the disease and how to prevent and treat it. The U.S. Centers for Disease Control and Prevention (CDC) is urging health care providers to be on alert for patients who have rashes consistent with monkeypox, regardless of whether they have traveled or have specific risk factors for monkeypox. While the risk to the general public remains low, individuals are urged to avoid close contact with those who are sick, including those with skin or genital lesions, as well as sick or dead animals. Anyone displaying symptoms, such as unexplained skin rash or lesions, should reach out to their health care providers for guidance.

### **Clinical Presentation**

Signs and symptoms of monkeypox can include fever and chills, along with aches and fatigue early on and vesicular rash developing on the face and genitals in more advanced cases.<sup>3</sup> Symptoms typically occur within 1 or 2 weeks after exposure, and a person can remain contagious for several additional weeks. The incubation period is usually 7–14 days but can range from 5–21 days.

Monkeypox does not typically require hospitalization. Fatality rates are low, but can be higher in children, pregnant women, and those who are immunocompromised. With a disease that has a low mortality (1%), it is appropriate to rely on symptom monitoring of contacts for 21 days. Individuals should look for fever, rash and any other symptoms that would prompt evaluation. Individuals who have been infected with monkeypox appear to develop prolonged immunity (for up to 3 years or longer) which makes reinfection less likely.

### **Epidemiology and Risk**

The virus is mainly spread by direct skin-to-skin contact with someone who has vesicles or pustules, but it can also be spread by fomites (e.g., clothes, bedding). Unlike COVID-19, it is unlikely that monkeypox is routinely transmitted via aerosol.

Monkeypox is not a sexually transmitted infection, but sexual activity is a mode of transmission. Data suggest that gay, bisexual, and other men who have sex with men make up the majority of cases in the current monkeypox outbreak. It is also known that people living with HIV make up a substantial portion of monkeypox cases, but they do not appear to have worse outcomes if their HIV disease is well-controlled. However, those with HIV may not respond as well to the new monkeypox vaccine which may pose another challenge in controlling this outbreak. Controlling the outbreak in high-risk populations is important so the virus does not spread to children, pregnant women, and immunosuppressed individuals who may be more at risk for a severe case.

The monkeypox virus is not very efficient at transmitting from human to human. It requires close, continuous contact, as is characteristic of congregate setting such as childcare centers, correctional facilities, hospitals, or refugee populations. Risk to the public is low. The act of having sex creates ideal conditions for transmitting this virus through prolonged physical proximity allowing the opportunity for direct contact.

Health workers caring for monkeypox patients are recommended to use personal protection equipment (PPE) such as eye protection, N95 masks, gowns, gloves, and to put the patient in an airborne isolation room due to possible respiratory transmission (though not the dominant mode of transmission historically). **Table 1 presents guidance from CDC on assessing health care worker risk from monkeypox exposure** (see also <https://www.cdc.gov/poxvirus/monkeypox/clinicians/infection-control-healthcare.html>).

## **Stigma and Discrimination**

Public health professionals must openly address the role sex plays in the transmission of monkeypox. No one wants to stigmatize a group of people; however, it should not prevent acknowledging and addressing the risk of infection in the community. It is important to know who might be at risk so cases can be better identified earlier. Public health will continue to do its best to avoid stigmatizing populations, but it is important for individuals in high-risk populations know that they are at greater risk if they fit this profile.

## **Diagnostic Tests**

The diagnosis of monkeypox is made by polymerase chain reaction (PCR) evaluation of fluid from an unroofed pustule.<sup>4</sup> However, as with most emerging diseases, monkeypox is not in the standard diagnostic PCR panel and health care facilities and labs need to build up their diagnostic capability.

## **Treatment**

### *Antivirals*

Until recently, there has been no U.S. Food and Drug Administration (FDA)-approved antiviral specifically for monkeypox. However, there are two antiviral drugs that have been used for smallpox and vaccinia virus that can be used “off label”: Cidofovir (a CMV drug) and Chimerix’s brincidofovir (Tembexa), a lipid conjugate of Cidofovir.

In Europe, there is an effective antiviral approved against monkeypox and vaccinia called Tecovirimat (TPOXX). TPOXX and Tembexa (brincidofovir) can be used alone or in combination and are effective antiviral therapies for cases of severe monkeypox in immunocompromised victims. These drugs are not used for prophylaxis. TPOXX is FDA approved for variola, and under an EA-IND protocol by CDC to treat other non-variola orthopoxviruses infections (i.e., monkeypox, rabbitpox, and vaccinia): dose 3 (200 mg) capsules BID during meals with 25 grams of fat (25 X 9 = 225 calories or half a class of whole milk) for 14 days.

The U.S. government has stockpiled 1.7 million courses of TPOXX in the Strategic National Stockpile. Due to the low supply of TPOXX, it is currently being administered to patients with severe disease and cases need to be reviewed before it can be administered.

**TABLE 1.\* Assessing Risk of Health Care Professional (HCP) with Monkeypox Virus Exposures to Guide Monitoring and Recommendations for Postexposure Prophylaxis (PEP)**

Risk Level of Exposure	Exposure Characteristics	Recommendations	
		Monitoring	PEP
Higher	<p>Unprotected contact between an exposed individual’s broken skin or mucous membranes and the skin lesions or bodily fluids from a patient with monkeypox (e.g., inadvertent splashes of patient saliva to the eyes or mouth of a person), or from soiled materials (e.g., linens, clothing) – OR –</p> <p>Being inside the patient’s room or within 6 feet of a patient with monkeypox during any medical procedure that may create aerosols from oral secretions (e.g., cardiopulmonary resuscitation, intubation), or activities that may resuspend dried exudates (e.g., shaking of soiled linens), without wearing a National Institute for Occupational Safety and Health (NIOSH)-approved particulate respirator with N95 filters or higher and eye protection</p>	Yes	Recommended
Intermediate	<p>Being within 6 feet for a total of 3 hours or more (cumulative) of an unmasked patient with monkeypox without wearing a facemask or respirator – OR –</p> <p>Unprotected contact between an exposed individual’s intact skin and the skin lesions or bodily fluids from a patient with monkeypox, or soiled materials (e.g., linens, clothing) – OR –</p> <p>Activities resulting in contact between an exposed individual’s clothing and the patient with monkeypox’s skin lesions or bodily fluids, or their soiled materials (e.g., during turning, bathing, or assisting with transfer) while not wearing a gown</p>	Yes	Informed clinical decision making recommended on an individual basis to determine whether benefits of PEP outweigh risks of transmission or severe disease
Lower	Entry into the contaminated room or patient care area of a patient with monkeypox without wearing all recommended PPE, and in the absence of any exposures above	Yes	None
Lower	Entry into the contaminated room or patient care area of a patient with monkeypox wearing all recommended PPE, and in the absence of any exposures above – <i>this is ACOEM’s recommendation for this exposure characteristic</i>	Yes	None
No Risk	No contact with the patient with monkeypox, their contaminated materials, nor entry into the contaminated patient room or care area	No	None

\*Table adapted from Centers for Disease Control and Prevention (CDC). *Infection Prevention and Control of Monkeypox in Healthcare Settings*. October 24, 2022.

## **Managing Symptoms<sup>5</sup>**

### *Pain*

Medications like Ibuprofen (Advil, Motrin) and Acetaminophen (Tylenol) can help patients feel better. Health care providers may prescribe stronger pain relievers as well. For rash in the mouth, patients can rinse with salt water at least 4 times a day. Prescription mouthwash sometimes called miracle or magic mouthwash, or local anesthetics like viscous lidocaine can be used to manage pain. Oral antiseptics like chlorhexidine mouthwash can be used to help keep the mouth clean.

### *Rash*

The most effective way to manage the rash is for individuals to try not to touch or scratch the rash. Touching or scratching the rash can spread the rash to other parts of the body, increasing the chance of spreading the virus to others, and possibly cause open lesions to become infected by bacteria. (If you accidentally touch the rash, wash your hands with soap and water and avoid touching sensitive areas like your eyes, nose, mouth, genitals, and anal region.) Topical benzocaine/lidocaine gels can be used for temporary relief of the rash. Oral antihistamines such as Benadryl and topical creams such as calamine lotion or petroleum jelly may help with itching. Soaking in a warm bath (using oatmeal or other over-the-counter bath products for itchy skin) may offer some relief to the dry, itchy sensations that can come with the rash.

Individuals who have the rash in or around their anus, genitals (penis, testicles, labia, vagina), or perineum may also benefit from a sitz-baths. Their health care provider may prescribe medication like povidone-iodine or other products to be added to the water in a sitz bath.

## **Vaccines**

There are two vaccines available for monkeypox. ACAM2000 (previously produced by Sanofi and now made by Emergent Biosolutions) is a cell culture derived version of the original 1949 NYDH smallpox (DRYVAX) Vaccinia strain. ACAM2000 has been the main vaccine used to protect researchers working with poxviruses for the past two decades. Due to its side effects, ACAM2000 is not recommended for all individuals, especially those who are immunosuppressed, pregnant, or have cardiac or chronic skin conditions.

The second is JYNNEOS, manufactured by Bavarian Nordic, a live, replicant-deficient vaccinia vaccine produced from the Modified Vaccinia Ankara (MVA) and approved in 2018 to protect against smallpox in the U.S. and monkeypox and cowpox in the EU. It has been in government stockpiles as part of the U.S. pandemic preparedness. It does not cause disease in humans and cannot reproduce in human cells like the currently licensed smallpox vaccine. Consequently, JYNNEOS allows previously excluded researchers to work with orthopoxviruses.

The vaccine is called JYNNEOS in the U.S., Imvanex in Europe, and Imvamune in Canada. JYNNEOS is supplied as frozen single dose vials that can be stored refrigerated but must be used within 8 weeks of receipt. The vaccine was FDA approved to be administered by subcutaneous injection as 2 doses (0.5 ml each) 4 weeks apart. As of August 26, 2022, the CDC Drug Service changed their guidance on vaccination administration from subcutaneous to intradermal (0.1 ml) 4 weeks apart to conserve vaccine supplies.<sup>6</sup>

Side effects related to the JYNNEOS vaccine include local reaction at the site of injection, muscle pain, redness, headache, fatigue, nausea, and chills.<sup>7</sup> Since JYNNEOS has not been used outside of clinical trials, it is critical for health care providers to monitor for and immediately report any adverse events (AEs) or serious adverse events (SAEs) to the Vaccine Adverse Event Reporting System (VAERS).

As of June 30, 2022, the U.S. Department of Health and Human Services (HHS) expanded access to JYNNEOS for adults 18 years of age and older determined to be at elevated risk for monkeypox infection. The vaccines

will be distributed equitably to states based on population, and at-risk communities will be targeted in the vaccination campaign. This includes those who had close physical contact with someone diagnosed with monkeypox, those who know their sexual partner was diagnosed with monkeypox, and men who have sex with men who have recently had multiple sex partners or close physical contact in a venue where there was known to be monkeypox or in an area where monkeypox is spreading. The timeframe to vaccinate individuals is 4 days from the exposure to prevent illness and up to 14 days from exposure for the vaccination to lessen the severity of the disease. In addition, CDC has a limited supply of Vaccinia immune globulin (VIG) that can be used in critically ill patients.

## **Vaccine Distribution and Storage**

To continue to protect researchers, health care workers and laboratory personnel working with monkeypox, CDC is following a similar process to that used with ACAM2000 vaccine ordering. There are some important and specific handling, administrative, and documentation requirements that currently must be adhered to and this may create a bottle neck in some situations.

A roster must be submitted to CDC with specific individuals on it. There must be a “PI” who describes the virus strain they will be working with, what they’re doing, and how they’ll handle it. Each research protocol needs its own order form filled out with its PI and study specifics; any clinical care team needs a separate request. There must also be a “receiving MD” who assumes responsibility for storage, administration, and documentation. The receiving MD must submit their license and CV to CDC. Both physicians must sign the order form. If approved for this specific group, CDC sends exactly the right number of frozen, single dose vials. It takes 2 hours to thaw and once thawed it must be administered within 12 hours.

The vaccine can only be administered to people who are listed on the original request. Any unused vaccine still in a sealed vial must be returned within 60 days still frozen; it cannot be reallocated to someone who is not on the roster.

The need to identify the people who will receive the vaccine prior to the order submission, the inflexibility in substituting out recipients of the vaccine, and the requirement to administer within 12 hours of thawing, really requires attention to preordering education and staff screening, and once vaccine is on hand, careful coordination and administration with vaccine storage/thawing.

## **Who Should Acquire the Monkeypox Vaccine?**

The most effective paradigm for smallpox and monkeypox vaccine use have been via the ring vaccination strategy. This approach, along with contact tracing and isolation and quarantine, is responsible for the elimination of smallpox from the globe in 1977. In this strategy, the primary contact is identified and then all secondary (and rarely tertiary) contacts are identified and vaccinated. This is the current strategy that is being used in the EU and North America for the cluster of outbreaks of monkeypox.

CDC’s Advisory Committee on Immunization Practices (ACIP) currently and for the past 40 years has recommended pre-exposure vaccination for high-risk individuals following occupational exposure to any non-highly attenuated Vaccinia virus. This now includes any exposure to a confirmed case of monkeypox.

Consequently, the vaccine eligibility has been expanded to all individuals with confirmed or presumed exposure. In addition, CDC has identified the following applicable occupational groups for vaccination:

- Research laboratory personnel working with orthopoxviruses.
- Those who directly handle cultures/animals contaminated or infected with replication-competent vaccinia virus, recombinant vaccinia viruses derived from replication-competent vaccinia strains (i.e., those that

are capable of causing clinical infection and producing infectious virus in humans), or other orthopoxviruses that infect humans (e.g., monkeypox, cowpox, and variola).

- Current clinical laboratory personnel (especially in those Ebola-designated regional hospitals who are likely to receive seriously ill monkeypox victims) who directly handle samples contaminated or infected with vaccinia, recombinant vaccinia, or other orthopoxviruses.
- Current health care workers (such as physicians and nurses) in those Ebola designated hospitals who will serve as the front-line teams caring for seriously ill monkeypox victims.
- Individuals who have contact with these viruses due to direct patient care or contact-contaminated materials (e.g., dressings). Despite adhering to appropriate infection control measures, these individuals are probably at higher risk for inadvertent infection than laboratory workers who work in more controlled environments. Fortunately, it does not appear that most people need inpatient management.

Current outbreaks are “atypical” as they are occurring in non-endemic countries. Even in endemic countries (i.e., Africa), the actual mode of transmission for monkeypox, the animal reservoir, is still unclear. Household transmission is more likely in West and Central African nations, while non-endemic countries report mostly cases in men who have sex with men.

### **Preventive Measures – How to Reduce Your Risk of Contracting Monkeypox?**

The current outbreak is predominantly transmitted by intimate skin-to-skin contact; however, a few cases have also occurred in close household members. Transmission from human to human occurs by direct contact with infected body fluids or lesions, via infectious fomites (clothing, bedding, towels, sex toys), or through respiratory secretions (e.g., kissing), typically with prolonged exposure.

CDC recommends patient isolation, use of effective hand hygiene and appropriate PPE by household members and home caregivers, and use of appropriate EPA-approved disinfectants. Contact with pets or other animals should be avoided to prevent potential subsequent spread of the virus. Patients with symptoms who may have monkeypox should isolate and avoid sexual activity. In endemic areas, it is also advised to avoid eating meat that comes from wild game or using products (such as creams, powders, or lotions) that come from wild animals from Africa.

Contacts should be followed for 21 days, and postexposure vaccine prophylaxis is recommended for intermediate and high-risk contacts. Intermediate risk includes being within six feet of an unmasked patient for more than 3 hours without at least a surgical mask. High-risk includes unprotected contact with skin or mucous membranes, lesions, or body fluids.

### **Disinfection**

Like Covid-19, monkeypox is an “enveloped” virus, a type that is more susceptible to disinfectants than other viruses because its outer layers can be punctured, preventing its contents from being transmitted.

### **Gathering Guidance**

In the context of the current outbreak, monkeypox-associated risks should be considered and factored in when planning a gathering event. Postponing or cancelling gatherings in areas where monkeypox cases have been detected is not required as a default measure. However, the World Health Organization recommends a risk-based approach in deciding to hold, modify, postpone, or cancel gatherings of any size and type which is tailored to the event characteristics under consideration and the process be repeated at regular intervals.

The risk-based approach entails 3 steps:

1. *Risk evaluation*: identification and quantification of the baseline risks based on the characteristics of the event and the context in which it takes place;
2. *Risk mitigation*: application of a package of precautionary measures aimed at decreasing the baseline risk; and
3. *Risk communication*: proactive dissemination of information on the measures adopted, their rationale and purpose, and on how the relevant decisions were taken.

## **Addressing Employer Issues**

### **Should employers start implementing strategies to get their employees vaccinated?**

At present, individuals at risk for occupational exposure to orthopoxviruses include research laboratory workers performing diagnostic testing for monkeypox virus and health care worker response teams. Additional guidance on targeting vaccines for these occupational groups is available.<sup>8,9</sup>

### **How can employers minimize the risk for occupational exposures?**

Laboratory personnel should only perform culture-based testing for monkeypox virus if they have validated and appropriately approved protocols, BSL-3 containment facilities, and smallpox vaccinated staff as detailed within the Biosafety in Microbiological and Biomedical Laboratories (BMBL) Protocol. Furthermore, the virus may still find other networks with similar characteristics that may have made the outbreak worse. The inability to prevent a “sustained transmission” of monkeypox worldwide could see the virus move into certain high-risk groups, such as pregnant women, immunocompromised individuals, and children.<sup>10</sup>

Although droplet transmission and contaminated surfaces are of lesser importance compared to COVID-19, in outpatient and inpatient settings and especially household settings, careful thorough cleaning and disinfection of the patient environment or surfaces is necessary. Door handles and other waiting and treatment rooms contact surfaces should be regularly disinfected. Medical devices such as stethoscopes should be disinfected immediately after use. Laundry items such as towels and bed linen should be collected and transported for treatment in sealed bags. Contaminated waste should be disposed via established protocol. Health care professionals should use the same viricidal hand sanitizer proven effective for COVID-19. All staff should wear disposable gloves and face mask around suspected cases.

### **Should traveling employees acquire the vaccine?**

Since early May 2022, cases of monkeypox have been reported from countries where the disease is not endemic and continue to be reported in several endemic countries. Although there does not seem to be a monkeypox pandemic, confirmed and suspected cases of monkeypox are starting to appear with no direct travel links to previously affected areas. Therefore, even one case of monkeypox in a newly affected country is considered an outbreak. Health care providers and relief workers traveling to endemic areas to offer medical assistance or to study monkeypox in endemic areas are recommended to receive pre-exposure smallpox vaccine.

### **When should work restrictions be used for health care professionals exposed to monkeypox or infected with monkeypox?**

The CDC makes the following recommendations as to when to apply work restrictions for health care professionals<sup>9</sup>:

**Table 2. Work Restrictions**

HCP Exposure/Symptoms	Work Restrictions	Monitoring
Asymptomatic HCP with exposure to monkeypox virus	Do not need to exclude from work	Should be monitored (e.g., at least a daily assessment conducted by exposed HCP for signs & symptoms of monkeypox infection) for 21 days after last exposure.
HCP with symptoms	<p>If positive, follow monitoring recommendations</p> <p>If monkeypox infection is ruled out, may still have work restrictions recommended if diagnosis is one where restriction from work is recommended (e.g., varicella).</p>	<p>During the 21-day monitoring period:</p> <ul style="list-style-type: none"> <li>■ If rash occurs, HCP should be excluded from work until: 1) the rash can be evaluated; 2) testing is performed, if indicated; and 3) the results of testing are available and negative.</li> <li>■ If other symptoms present, but no rash, HCP should be excluded from work for 5 days after development of any new symptom, even if the 5-day period extends beyond original 21-day monitoring period.</li> <li>■ If 5 days have passed without development of any new symptom and a thorough skin examination reveals no skin changes, HCP could return to work with permission from their occupational health program.</li> <li>■ If a new symptom develops at any point during the 21-day monitoring period, the HCP should be excluded from work and a new 5-day isolation period should begin.</li> </ul>

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