

Infection Prevention and Control of Monkeypox - DUHS

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Background

Monkeypox, a zoonotic disease for which the animal reservoir is unknown, is endemic in several Central and West African countries. Prior outbreaks have been linked to recent travel to endemic areas, secondary contact with returning travelers, and/or contact with small mammals. However, ongoing investigation suggests person-to-person community transmission in the United States. Historically, documented reports of human-to-human transmission have been among household contacts and health care providers who have had very close, sustained contact with a patient or patient fomites (e.g., bedding).

Clinical Presentation

Patients with monkeypox typically experience a febrile prodrome 7–14 days after exposure (range = 5–21 days), which often includes lymphadenopathy, malaise, headache, and muscle aches. The prodrome is followed 1–4 days later by the onset of a characteristic deep-seated, vesicular or pustular skin rash with a centrifugal distribution; the lesions are well circumscribed and often umbilicate or become confluent, progressing over time to scabs. The rash can be disseminated. A person is considered infectious from the onset of illness until all lesions have crusted over, those crusts have separated, and a fresh layer of healthy skin has formed under the crust. Human-to-human transmission occurs by direct contact with infected body fluids or lesions or through respiratory secretions, typically requiring prolonged interaction. One systematic review described a secondary attack rate of approximately 8% (0-11%) among unvaccinated household contacts.

Some recent cases have begun atypically, with lesions in the genital and perianal region and without associated fever or other prodromal symptoms. Atypical cases might be confused with more commonly seen infections such as varicella zoster or sexually transmitted infections (STIs) (e.g., genital herpes or syphilis).

- **Incubation period:** ranges from 5-21 days from exposure (average 7-14 days)
- **Clinical symptoms of monkeypox:**
 - Fever

- Malaise
 - Muscle aches
 - Headache
 - Sore throat/cough (less common)
 - Lymphadenopathy (typically 1-2 days prior to rash onset, involving neck, axillary, and inguinal areas; may be unilateral or bilateral)
 - Rash (see below for more details)
- **Features of monkeypox rash** (see [CDC clinical info](#) for more detailed description of rash):
 - Typically develops 1-3 days after initial onset of prodrome
 - Lesions are deep-seated and well-circumscribed
 - Lesions tend to develop simultaneously and evolve together on any part of the body (i.e., lesions in the same area of body will typically be in the same stage).
 - Typical lesion progression: macules > papules > vesicles (may have central umbilication) > pustules > scabs
 - Tends to be centrifugal, concentrated on face and extremities; however, in several recent cases, lesions started in genital area
 - Lesions are often described as painful initially, becoming pruritic as they crust

Examples of Monkeypox lesions at various stages of evolution:



Case Definition

Epidemiologic Criteria:

Within 21 days of illness onset:

- Reports having contact with a person or people with a similar-appearing rash or who received a diagnosis of confirmed or probable monkeypox OR
- Had close or intimate in-person contact with individuals in a social network experiencing monkeypox activity, this includes men who have sex with men (MSM) who meet partners through an online website, digital application, or social event OR
- Traveled outside the US to a country with confirmed cases of monkeypox or where Monkeypox virus is endemic OR
- Had contact with a dead or live wild animal or exotic pet that is an [African endemic species](#) or used a product derived from such animals

Exclusion criteria:

- An alternative diagnosis can fully explain the illness OR
- An individual with symptoms consistent with monkeypox does not develop a rash within 5 days of illness onset OR
- A case where high-quality specimens do not demonstrate the presence of Orthopoxvirus or Monkeypox virus or antibodies to Orthopoxvirus

Suspect Case

- New characteristic rash **OR**
- Meets one or more of the epidemiologic criteria and has a high clinical suspicion for monkeypox

Precautions for Preventing Monkeypox Transmission

Screening

- Patients presenting with fever and rash should be immediately placed in a room with the door closed
- At present, patients are asked about fever and rash via COVID screening questions.

Patient Placement

- Patient should be placed on Special Airborne Contact Precautions (gown, gloves, N95 or PAPR, eye protection) during clinical assessment
- **When feasible**, patient should be placed in a room that meets requirements for an Airborne Infection Isolation room (i.e., Negative pressure ventilation or HEPA-filtered). When this is not feasible (e.g., outpatient settings), at minimum they should be placed in a private room with the door closed. Negative pressure is not required for routine care of monkeypox cases per CDC. The rationale for placing inpatients with monkeypox in All rooms is based on recommendation for All or HEPA for aerosol-generating procedures.
- Intubation, extubation, and any other procedures likely to spread oral secretions (i.e., aerosol generating procedures) should be performed in an airborne infection isolation room or with portable HEPA filter in place.
- The door should be kept closed (if safe to do so).
- The patient should have a dedicated bathroom.
- Transport and movement of the patient outside of the room should be limited to medically essential purposes. If the patient is transported outside of their room, they should use well-fitting source control (e.g., medical mask) and have any exposed skin lesions covered with a sheet or gown.
- There are no plans for dedicated monkeypox units at this time as we do not anticipate large numbers of inpatient cases. We expect admissions to be a rare event based on information from current global outbreak.

Special considerations for Ambulatory/ED settings:

- Patients should be placed in a private room with the door closed upon arrival, or as soon as the diagnosis of monkeypox is being considered.
- Patients should be placed on Special Airborne Contact Precautions to facilitate PPE used. Negative pressure is not required for outpatient settings as we do not anticipate intubation, extubation, or other high-risk aerosol-generating procedures.
- There are no private bathrooms available in ambulatory/ED settings. As such, we would recommend closing the bathroom until it can be terminally cleaned. Individual practices will need to develop workflows for how to clean bathrooms outside of regularly scheduled cleaning times. As a reminder, monkeypox is easily killed by approved disinfectants (see Environmental Cleaning section).

Personal Protective Equipment

PPE used by healthcare personnel who enter the patient's room should include:

- Gown
- Gloves
- Eye protection (i.e., goggles or a face shield that covers the front and sides of the face)
- N95 or PAPR

Duration of Isolation

Isolation precautions should be continued until all lesions have resolved, the scabs have fallen off, and a fresh layer of intact skin has formed. Decisions regarding discontinuation of isolation precautions will be made in consultation with Infection Prevention, Infectious Diseases, as well as local and state public health authorities.

Relevant Infection Status and Isolation Status Information In EPIC

The infection status is automatically linked to orders placed for monkeypox testing to facilitate healthcare personnel awareness of isolation requirements for patients with suspected or confirmed monkeypox. Since discontinuation of isolation for confirmed cases of monkeypox is entirely symptom-based (I.e.

dependent on resolution of rash), primary teams will need to collaborate with infection prevention on the timing of discontinuing precautions in inpatient settings.

<i>Infection Status</i>	<i>Use</i>	<i>Needed isolation</i>	<i>Crosses encounters</i>	<i>Expiration (days)</i>	<i>Expires while admitted?</i>
Monkeypox	Confirmed case	Special airborne/contact	Yes	28	No
Rule-out Monkeypox	Suspected case	Special airborne/contact	Yes	28	No
Exposed to Monkeypox*	Exposure to confirmed case	Contact/droplet	Yes	21	Yes
Other	Generic use	None	Yes	None	Yes, but only if expiration date is manually added

Clinical Evaluation and Determination of Level of Suspicion for Monkeypox

- Ensure that adult patients being evaluated with a fever and rash are placed on Special Airborne Contact isolation (gown, gloves, N95 or PAPR, eye protection) during clinical assessment.**

NOTE: At this time, no pediatric cases of Monkeypox have been reported. Numerous fever and rash syndromes occur in pediatric patients. Contact and Droplet isolation should be used in the evaluation of most pediatric patients presenting with fever and a rash. However, Special Airborne Contact isolation (gown, gloves, N95 or respirator, eye protection) should be used when there is any suspicion of measles, varicella, or fever & rash in an unvaccinated pediatric patient. Guidance will be updated if active monitoring identifies pediatric Monkeypox cases in the United States.

- Assess likelihood of Monkeypox versus more common etiologies of rash**, such as COVID-19, herpes simplex virus, secondary syphilis, molluscum contagiosum, varicella zoster, lymphogranuloma venereum, disseminated gonococcal infection, etc.
 - Review for any risk of monkeypox exposure/infection (see Epidemiologic Criteria above)
 - Determine if clinical presentation is consistent with Monkeypox (see Clinical Presentation and Case Definition above and CDC information [here](#))
- Document relevant clinical information and upload clinical photos of rash in EPIC to facilitate any additional discussions/consultations with infectious diseases.** IP/ID developed a dot phrase within EPIC based on the above questions to facilitate information gathering and documentation. **(.monkeypoxquestions)**

- Record relevant clinical information regarding symptoms:

Symptom	Yes	No	Unknown	Date of Onset	Comments
Fever > 101					
Chills					
Malaise					
Cough					
Rash (upload photo(s) into EPIC)					Description: <input type="checkbox"/> Papular <input type="checkbox"/> Macular <input type="checkbox"/> Vesicular <input type="checkbox"/> Pustular <input type="checkbox"/> Raised <input type="checkbox"/> Flat <input type="checkbox"/> Umbilicated <input type="checkbox"/> Well-circumscribed <input type="checkbox"/> Irregular borders <input type="checkbox"/> Firm <input type="checkbox"/> Soft Color: Location of rash: <input type="checkbox"/> Face <input type="checkbox"/> Intra-oral <input type="checkbox"/> Back <input type="checkbox"/> Chest

					<input type="checkbox"/> Abdomen <input type="checkbox"/> Genitals <input type="checkbox"/> Peri-rectal <input type="checkbox"/> Buttocks <input type="checkbox"/> Hands <input type="checkbox"/> Palms <input type="checkbox"/> Legs <input type="checkbox"/> Feet <input type="checkbox"/> Soles
Lymphadenopathy					Location: <input type="checkbox"/> Axillary <input type="checkbox"/> Inguinal <input type="checkbox"/> Cervical <input type="checkbox"/> Other Laterality:

- b. Take a de-identified photo(s) (i.e., limiting inclusion of patient’s face if possible) and upload to Epic/Maestro Care.
 - i. Clean your phone/camera as follows:
 - a. Keep the phone/camera out prior to donning PPE
 - b. Set phone/camera on clean surface in the exam room
 - c. Get consent from patient to take clinical photo(s)
 - d. At the point of the exam where you will take pictures (i.e. patient has site(s) of rash exposed):
 - i. remove gloves
 - ii. perform hand hygiene
 - iii. take photos and set phone back down on clean surface
 - iv. perform hand hygiene
 - v. put on a new pair of gloves for the rest of encounter
 - e. Clean the phone with a hospital-approved disinfectant wipe at the end of the encounter. Remove excess fluid from the disinfectant wipe before wiping down your device.

**Alternatively, the phone could be placed in a clear plastic bag during the encounter if one is available.

- c. Record relevant clinical information regarding risk factors:

Risk Factors	Yes	No	Unknown	Relevant Questions	Comments
Contact with another individual with similar skin lesions in prior 21 days?				With whom? When?	Description of contact:
Contact with another individual with probable or confirmed monkeypox in prior 21 days?				With whom? When?	Description of contact:
Identify as a man who has sex with men (MSM)?				Recent sexual activity?	Description of contact, if applicable:
Travel in the past 3 weeks?				Where?	Description of travel-related activities:

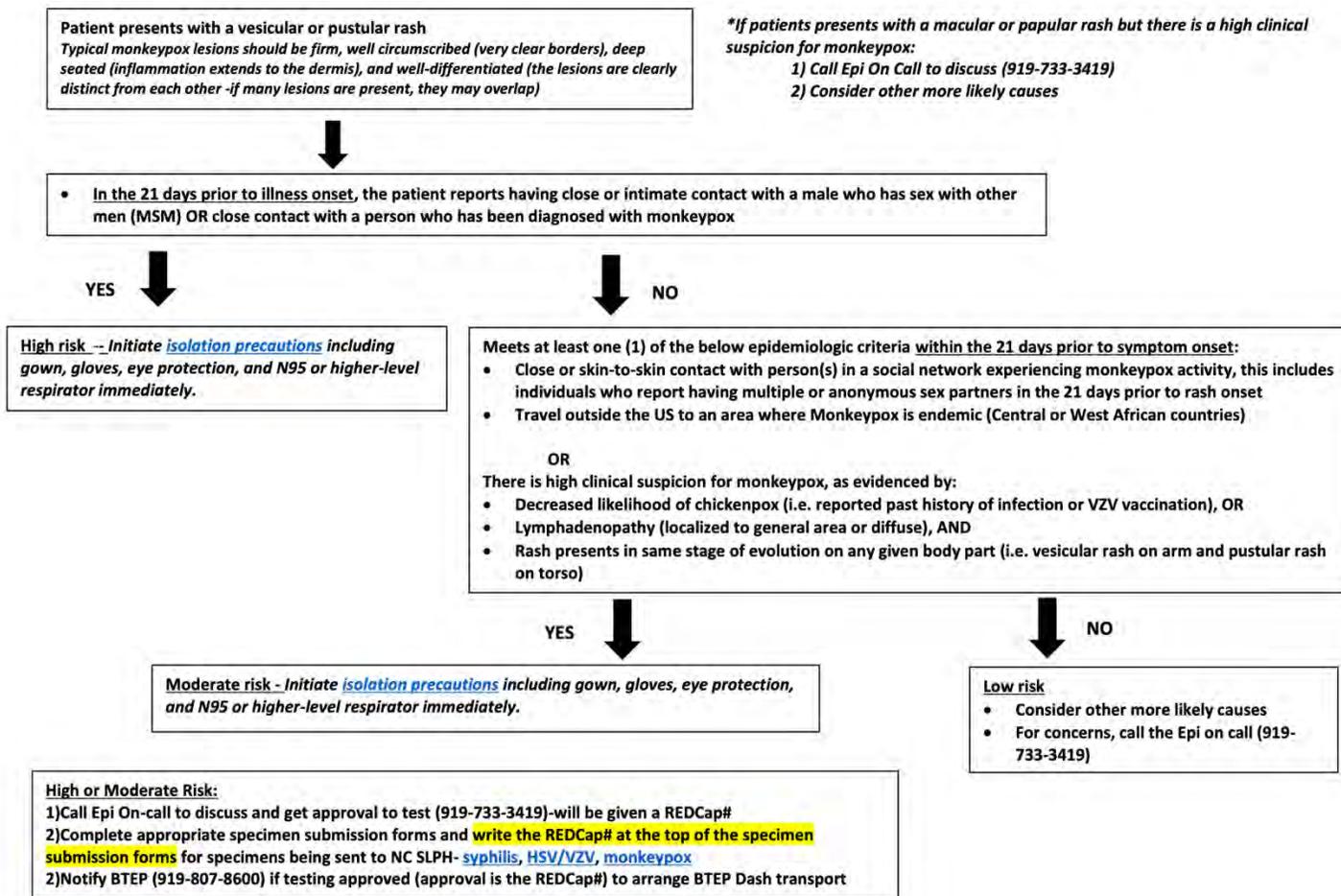
Other high risk sexual behavior?				When?	Description of contact:
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d. Ask other relevant questions:

- i. Has the patient undergone monkeypox testing prior to this encounter? If so, at which institution or laboratory?
- ii. How high is the clinical suspicion for monkeypox?
- iii. What other diagnoses are being considered?
- iv. Has the patient been vaccinated against smallpox? If so, please provide date:

4. Determine the level of suspicion for monkeypox based on clinical presentation and epidemiologic history.

Current [NCDHHS algorithm](#):



TESTING, COLLECTION PPE, & TRANSPORT:

Suspicion for monkeypox infection	Non-monkeypox testing	Monkeypox testing	Specimen collection PPE	Specimen packaging / transport
Low (No epidemiologic criteria and rash/clinical presentation is atypical)	Up to patient & provider	Not indicated	No special precautions	Routine process

Moderate (No epidemiologic criteria but consistent clinical presentation)	Yes, in parallel with monkeypox testing	Yes, proceed as below	Gloves, gown, face shield, & N95 or PAPR	Routine process
High (1 or more Epidemiologic Criteria and consistent clinical presentation)	Yes, in parallel with monkeypox testing	Yes, proceed as below	Gloves, gown, face shield, & N95 or PAPR	Routine process

5. **If you need additional assistance from infection prevention, please reach out to your entity IP on call. Note the IPs are not in-house overnight so we ask that you do not page between 10p-6a unless there is an emergency.**

- a. DUH: 970-9721
- b. DRH: 470-4636 #7171
- c. DRaH: 206-3311
- d. DPC: (919) 896-2428
- e. PDC: 919-451-8228

**If additional guidance is needed during or after this process, please page the ID hospital epidemiologist on call at 919-970-3439. You will need to provide all the relevant history, physical exam, photos, and epidemiologic risk assessment for the ID hospital epidemiologist to assist you.

Diagnostic Testing, Specimen Collection, Specimen Handling & Transport

1. **Place order for monkeypox testing in EPIC (Maestro Care):**
 - a. DUHS Inpatient and Outpatient:
 - Lab Order: **“Monkeypox (non-variola Orthopoxvirus) Virus PCR - LabCorp” (LAB3281)**
 - Answer order entry questions
 - b. PDC LabCorp Clinics and Kernodle
 - Lab Order: **“Monkeypox (Orthopoxvirus), PCR” (LABC8303)**
 - Answer order entry questions

Screenshot Inpatient:

Monkeypox (non-variola Orthopoxvirus) Virus PCR – SENDOUT LABCORP ✓ Accept ✗ Cancel

Clinical signs/symptoms

- Fever (100.4 or higher)
- Fatigue
- Muscle aches
- Headache
- Sore throat
- Cough
- Lymphadenopathy
- Maculo-papular / vesico-pustular rash

Epidemiologic risk factors

- Close/intimate contact with a confirmed or suspected case of monkeypox
- Close/intimate contact with individuals in a social network experiencing monkeypox activity, including men who have sex with men (MSM)
- Traveled outside the US to a country with confirmed cases of monkeypox or where Monkeypox virus is endemic
- Known contact with a dead or live wild animal or exotic pet that is an African endemic species or used a product derived from such animals

Additional resources

- Refer to [Duke CustomID](#) for helpful Monkeypox resources, including a toolkit for clinician guidance.
- Please utilize the SmartPhrase "monkeypoxquestions" in a separate note to assist Infection Prevention with evaluation of the case (e.g., potential contact tracing or PEP).

Priority: Routine

Frequency: Once Early AM DC Pend

At: Today Tomorrow

Specimen Source: Swab

! What is your estimated pre-test probability for Monkeypox (see algorithm in CustomID Toolkit in Reference Hyperlink below)?

High Moderate Low

! Provider's best callback number (for Infection Prevention follow up).

Release to patient: Immediate Delayed release

Comments: + [Add Comments](#)

Reference Links: [CustomID Guidance/Toolkit](#)

Screenshot Ambulatory:

Monkeypox (non-variola Orthopoxvirus) Virus PCR – SENDOUT LABCORP ✓ Accept ✗ Cancel

Clinical signs/symptoms

- Fever (100.4 or higher)
- Fatigue
- Muscle aches
- Headache
- Sore throat
- Cough
- Lymphadenopathy
- Maculo-papular / vesico-pustular rash

Epidemiologic risk factors

- Close/intimate contact with a confirmed or suspected case of monkeypox
- Close/intimate contact with individuals in a social network experiencing monkeypox activity, including men who have sex with men (MSM)
- Traveled outside the US to a country with confirmed cases of monkeypox or where Monkeypox virus is endemic
- Known contact with a dead or live wild animal or exotic pet that is an African endemic species or used a product derived from such animals

Additional resources

- Refer to [Duke CustomID](#) for helpful Monkeypox resources, including a toolkit for clinician guidance.
- Please utilize the SmartPhrase "monkeypoxquestions" in a separate note to assist Infection Prevention with evaluation of the case (e.g., potential contact tracing or PEP).

Status: Normal Standing Future

Class: Clinic Collect Lab Collect

External

Priority: Routine STAT

Specimen Source: Swab

! What is your estimated pre-test probability for Monkeypox (see algorithm in CustomID Toolkit in Reference Hyperlink below)?

High Moderate Low

! Provider's best callback number (for Infection Prevention follow up).

Release to patient: Immediate Delayed release

Comments: + [Add Comments](#)

Reference Links: [CustomID Guidance/Toolkit](#)

2. Specimen Collection

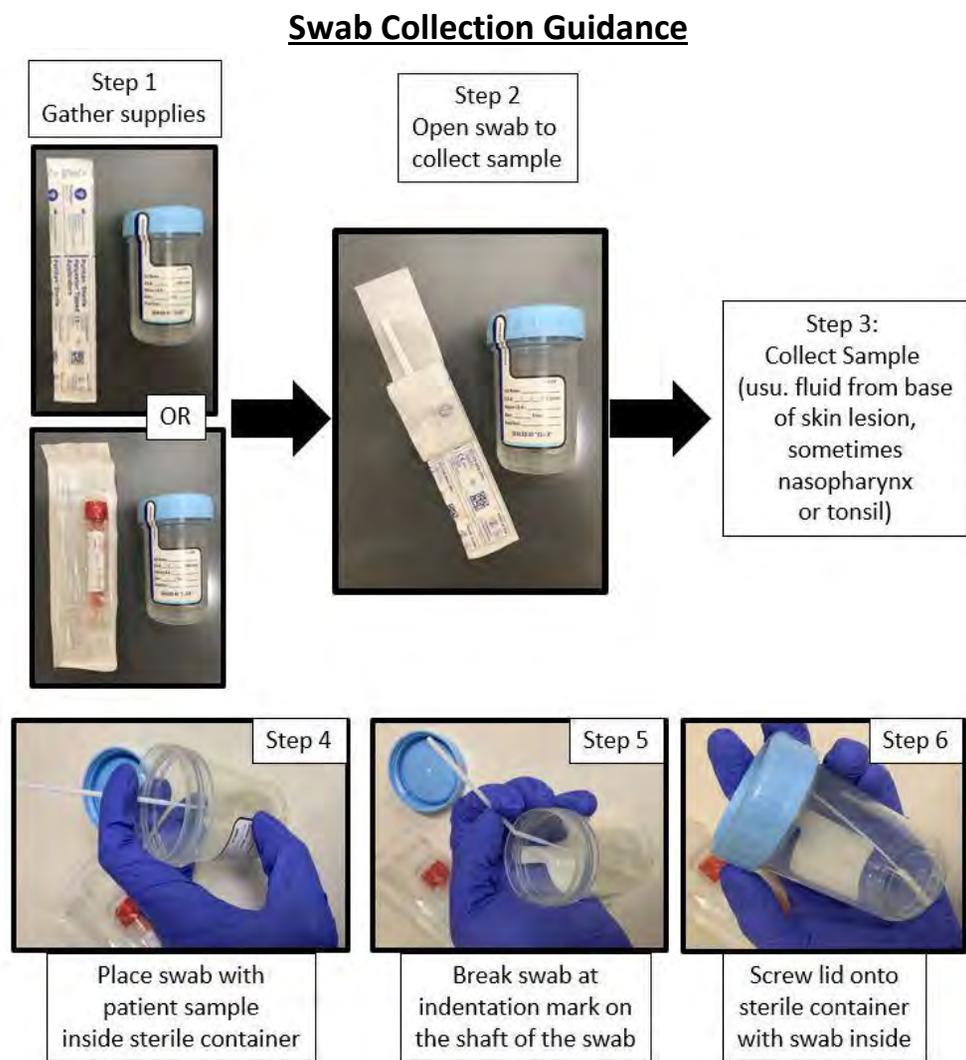
- a. Monkeypox testing - collect 2 specimens (swabs) per site and place both into a single container, from at least 2 sites for a total of **four specimens (swabs)** for monkeypox testing. See step-by-step pictures below and instructions.
 - i. Refer to images below for step-by-step instructions on swab and sterile container management.
- b. Non-monkeypox testing - most patients with monkeypox testing should also be tested for varicella zoster virus (VZV), herpes simplex virus (HSV), syphilis and other etiologies as clinically indicated.
 - i. [Syphilis, Screen \(LAB9478\)](#) – serology test, serum sample
 - ii. [Varicella Zoster Virus, PCR \(LAB6898\)](#) – swab collected from rash lesion (vesicle base or fluid)
 - iii. [Herpes Simplex Virus, PCR \(LAB945\)](#) – swab collected from rash lesion (vesicle base or fluid)

Other tests as indicated

- iv. Blood cultures
- v. Gonorrhea/chlamydia PCR
- vi. HIV

3. Specimen Packaging and Transport

- a. **All non-monkeypox test specimens** (i.e. HSV/VZV) can be packaged and transported following routine processes including use of pneumatic tube transport.
- b. **Monkeypox test specimens:**
 - i. Refrigerate specimens while waiting for transport
 - ii. Transport specimens at 2-8° C (on cold pack) following routine processes including courier or use of pneumatic tube transport where available.



- Step 1: Gather supplies: Sterile container plus swab or swab with VTM pack from HSV/VSV or Respiratory Viral Collection Kit
- Step 2: Open swab package and remove swab to collect sample.
- Step 3: Collect sample with swab (base of skin lesion is preferred sample)
- Step 4: Place the swab with patient sample inside a sterile container
- Step 5: Break swab at the indentation mark in the shaft of the swab.
- Step 6: Repeat swab collection from the same site and place the second swab in the same container.
- Step 7: Once both swabs are collected, screw lid onto sterile container with swab inside.

- **MUST have 2 swabs per site/container**

Exposure Investigation and Post-Exposure Prophylaxis

Upon notification of a suspected case of monkeypox, a multidisciplinary team (Infection Prevention ID hospital epidemiology, EOHW, OESO, local and state public health authorities) will evaluate for high-risk exposures among DUHS team members, patients, and/or visitors. In particular, the team will perform a risk assessment based on CDC criteria for high, medium, low, and no risk to determine who meets criteria for post-exposure monitoring and prophylaxis.

There are currently two available vaccines for post-exposure prophylaxis, and infection prevention and employee health will work with local and state authorities to procure vaccine for high-risk exposures.

Waste Management

As the current monkeypox pandemic has been associated with the West African clade, routine handling of all medical waste will satisfy the current DOT requirements. Waste contaminated with West African clade monkeypox virus should be managed as regular medical waste. If epidemiological risk factors indicate a risk for Congo Basin clade monkeypox virus (i.e., through travel history), waste should be managed as a [Category A](#) infectious substance pending clade confirmation, and while local and state public health authorities are consulted.

Previous studies have defined two distinct Monkeypox clades, West African and Congo Basin, with unique disease manifestations (i.e., how disease presents in people, the severity of its effects, and how readily it spreads). Human disease associated with West African clade monkeypox virus infection is less severe and associated with less human-to-human transmission compared to infections with Congo Basin monkeypox virus. Because of this, recommendations for managing waste contaminated with monkeypox virus differ based on the clade of the virus as outlined below.

Monkeypox virus		
Clade	<i>Any clade(s) except West African</i>	<i>West African clade</i>
Classification	Category A, always (until inactivated)	Regulated Medical Waste (RMW)
DOT Special Permit (SP) issued?	None issued as of publication of this document. See PHMSA's Infectious Substance Special Permit website for status: https://www.phmsa.dot.gov/transporting-infectious-substances/infectious-substance-special-permits	No, not required unless using a packaging not currently authorized by the HMR.
Packaging	Package in accordance with requirements for Category A infectious substances found in 49 CFR § 173.196.	Package in accordance with applicable regulations for RMW found in 49 CFR § 173.197.
Shipping Name	United Nations (UN) 2814, Infectious substances, affecting humans (Monkeypox waste)	United Nations (UN) 3291, Regulated medical waste (Monkeypox waste)
Inactivation methods (must be validated)	Autoclaving, incineration, chemical	Treat and/or dispose of such waste in accordance with applicable SLTT laws and regulations for RMW.
<i>Autoclaving</i>	Validated cycle that reaches $\geq 121^{\circ}\text{C}/250^{\circ}\text{F}$ for ≥ 30 minutes; time and temperature depend on type, state, and volume of material	
<i>Incineration</i>	Cycle must reduce materials to ash	
Disinfectant(s)	U.S. Environmental Protection Agency (EPA)-registered hospital disinfectant with an emerging viral pathogen label claim or any product on List Q with an emerging pathogen label claim , whenever EPA's Emerging Viral Pathogens Policy is active for monkeypox virus	

Linen Management

Soiled laundry (e.g., bedding, towels, personal clothing) should be handled in accordance with recommended standard practices, avoiding contact with lesion material that may be present on the laundry. Soiled laundry should be gently and promptly contained in an appropriate laundry bag, the bag should be tied and never be shaken or handled in a manner that may disperse infectious material.

Environmental Cleaning

Standard cleaning and disinfection procedures should be performed using an EPA-registered hospital-grade disinfectant with an emerging viral pathogen claim. Products with [Emerging Viral Pathogens claims](#) may be found on EPA's [List Q](#). Follow the manufacturer's directions for concentration, contact time, and care and handling. **Our current hospital-approved cleaning products are effective against monkeypox.**

For inpatient terminal room cleaning:

PPE: EVS team members should wear a gown, gloves, N95 or PAPR, and eye protection while performing daily or terminal cleaning.

Adjunctive UVC: TRU-D UVC disinfection should be performed after routine terminal cleaning is completed based on the primary mode of transmission for monkeypox (direct/indirect contact).

Room downtime: No room downtime/closure is required prior to initiating terminal cleaning procedures.

Special considerations: Activities such as dry dusting, sweeping, or vacuuming should be avoided. Wet cleaning methods are preferred.

Food Services

Management of food service items should be performed in accordance with routine procedures.

Visitation

Please follow the same [visitation guidelines](#) as for COVID-19 infected patients.

Autopsy and Handling of Human Remains

All post-mortem procedures require adherence to standard precautions with the use of appropriate personal protective equipment (PPE) and facilities with appropriate safety features.

When possible, personnel with an up-to-date smallpox vaccination (within 3 years) should participate in autopsy or mortuary care for patients with confirmed or suspected monkeypox. If unvaccinated personnel must be utilized, persons **without** contraindications to vaccination are preferred.

Transfer of Human Remains

Personnel who perform post-mortem care of remains should wear PPE as recommended for Standard, Contact, and Airborne Precautions. The body should be prepared following routine healthcare facility procedures for cleaning and containing body fluids and then wrapped in a plastic shroud. Wrapping should be done to prevent contamination of the outside of the shroud; a change of gown and gloves may be necessary.

If an autopsy is performed, the shrouded body should be placed on a mortuary stretcher and covered with a clean linen sheet for transportation to the morgue. If the remains go directly to a mortuary, they should be placed in a body bag prior to removal. Persons transporting prepared and covered human remains should wear gloves, but other PPE is not required.

Personal Protective Equipment

People who transfer remains from a mortuary stretcher onto the autopsy table should wear a gown and gloves. Personnel who perform or assist with the autopsy should wear the following PPE as required for Standard, Contact, and Airborne Precautions in the autopsy setting:

- **Protective garments:** Surgical scrub suit, surgical cap, impervious gown with full sleeve coverage, eye and face protection (e.g., face shield), shoe covers and double surgical gloves with an interposed layer of cut-proof synthetic mesh gloves should be used.
- **Respiratory protection:** N95 or N100 respirators; or powered air-purifying respirators (PAPR) equipped with a high efficiency particulate air (HEPA) filter should be worn. A PAPR is recommended for any procedures that may result in mechanical generation of aerosols (e.g., use of oscillating saws). Autopsy personnel who cannot wear N95 respirators because of facial hair or other fit limitations should wear PAPRs.

- **Handling of protective equipment:** Protective outer garments must be removed when leaving the immediate autopsy area and discarded in appropriate laundry or waste receptacles, either in an antechamber to the autopsy suite or immediately inside the entrance if an antechamber is not available. Hands should be washed upon glove removal.

Before an autopsy begins the following engineering strategies and facility designs should be considered:

- **Air handling systems:** Autopsy suites must have adequate air-exchanges per hour, and correct directionality and exhaust of airflow. Autopsy suites should have a minimum of 12 air-exchanges per hour and should be at a negative pressure relative to adjacent passageways and office spaces. Air should not be returned to the building interior, but should be exhausted outdoors, away from areas of human traffic or gathering spaces (e.g., off the roof) and other air intake systems. For autopsies, local airflow control (i.e., laminar flow systems), can direct aerosols away from personnel; however, this safety feature does not remove the need for appropriate personal protective equipment.
- **Doors and windows:** During autopsy, keep doors and windows to the autopsy suite closed.
- **Containment devices:** Biosafety cabinets or chemical fume hoods should be available for handling and examining smaller specimens. Oscillating saws are available with vacuum shrouds to reduce the amount of particulate and droplet aerosols generated. These devices should be used whenever possible to decrease the risk of occupational exposure.

Autopsy procedures and Specimen Collection

The following safety procedures should be used for autopsies and post-mortem assessment of monkeypox cases:

- **Prevention of percutaneous injury:** All sharps should be carefully handled; never recap, bend, or cut needles, and ensure that appropriate sharps containers are available.
- **Procedures:** The number and extent of procedures should be minimized, both to decrease opportunities for worker risk and the potential for environmental contamination. Perform autopsies only to the extent required to obtain needed information. Omit examinations that generate aerosols and increase the risk of environmental contamination (e.g., using oscillating saws to open the skull).

Samples should be taken from all major organs. Particular attention and extensive sampling should include tissues demonstrating gross pathology or involvement as suggested by clinical presentation. Autopsy specimens should include:

- Skin
- Spleen
- Lymph nodes and tonsils
- Liver
- Lung
- Kidney
- Heart

Place representative tissues in 10% buffered formalin for immunohistochemical or histopathologic evaluation and store at room temperature.

A second set of representative fragments of tissues listed above should be collected using sterile techniques and placed in sterile 1.5-2 mL screw-capped plastic vials with O-ring, or any tube with a gasket seal that can be shipped under the required conditions. DO NOT ADD ANY VIRAL TRANSPORT MEDIA. Specimens should be refrigerated at 4°C if the shipment will occur within 24 hours, otherwise specimens may be frozen. For more information on labeling and packaging specimens for transport read [Submitting Specimens to CDC Shipping and Packing](#).

After specimen collection:

- All non-reusable specimen collection and barrier protection materials should be placed in biohazard bags for handling as medical waste.
- All reusable equipment should be cleaned and disinfected according to standard laboratory procedures.
- All surfaces should be thoroughly cleaned with 0.5% sodium hypochlorite or another EPA-approved high-level disinfectant.

Patient Information

Persons suspected or confirmed to have monkeypox who do not require hospitalization or are discharged within the infectious period should isolate at home.

Persons are considered infectious until all lesions have resolved and scabs fallen off, and any respiratory symptoms have resolved. If isolation is not feasible (e.g., a child or an individual dependent on caregivers), close contacts should use protective measures.

[Monkeypox At Home Guidance](#) - it may be helpful to copy and paste this document into an AVS for outpatients with suspected or confirmed monkeypox in addition to any other recommendations they receive from public health authorities.

Important Phone Numbers

1. **North Carolina Public Health Epidemiologist On-Call:** 919-733-3419
2. **DUHS Microbiology Fellow:** Pager 919-970-8885
3. **DUHS Clinical Microbiology Lab:** 919-684-2089
4. **Infection Prevention**
 - DUH: 970-9721
 - DRH: 470-4636 #7171
 - DRaH: 206-3311
 - DPC: (919) 896-2428
 - PDC: 919-451-8228
5. **Infectious Diseases Hospital Epidemiologist On-Call:** 970-3439

References

1. CDC Monkeypox: <https://www.cdc.gov/poxvirus/monkeypox/index.html>
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