



## Coronavirus Disease 2019 (COVID-19)

# Interim Guidance for Collection and Submission of Postmortem Specimens from Deceased Persons Under Investigation (PUI) for COVID-19, February 2020

State and local health departments who have identified a Persons Under Investigation (PUI) should immediately notify CDC's Emergency Operations Center (EOC) at 770-488-7100 to report a deceased PUI and determine whether testing for SARS-CoV-2, the virus that causes COVID-19, at CDC is indicated. The EOC will assist local/state health departments to collect, store, and ship specimens appropriately to CDC, including during afterhours or on weekends/holidays.

CDC is available for urgent consultation in the event that an autopsy on a COVID-19 PUI is being considered. CDC can be reached for urgent consultation by calling the EOC at 770-488-7100.

This interim guidance is based on what is currently known [about COVID-19](#). The Centers for Disease Control and Prevention (CDC) will update this interim guidance as needed and as additional information becomes available.

The CDC is closely monitoring an outbreak of respiratory illness caused by a novel (new) coronavirus (named SARS-CoV-2); this illness is now called coronavirus disease 2019 or COVID-19. This virus was first identified in Wuhan, Hubei Province, China and it continues to spread. CDC is working across the Department of Health and Human Services and other parts of the U.S. government in the public health response to COVID-19.

Much is unknown about COVID-19. Current knowledge is largely based on what is known about similar coronaviruses. Coronaviruses are a large family of viruses that are common in many different species of animals, including camels, cattle, cats, and bats. Rarely, animal coronaviruses can infect people and then spread between people such as with MERS-CoV, SARS-CoV, and now with SARS-CoV-2, the virus that causes COVID-19. Most often, spread from a living person happens with close contact (i.e., within about 6 feet) via respiratory droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. This route of transmission is not a concern when handling human remains or performing postmortem procedures. Postmortem activities should be conducted with a focus on avoiding aerosol generating procedures, and ensuring that if aerosol generation is likely (e.g., when using an oscillating saw) that appropriate engineering controls and personal protective equipment (PPE) are used. These precautions and the use of Standard Precautions should ensure that appropriate work practices are used to prevent direct contact with infectious material, percutaneous injury, and hazards related to moving heavy remains and handling embalming chemicals.

This document provides specific guidance for the collection and submission of postmortem specimens from deceased persons under investigation (PUI) for COVID-19. This document also provides recommendations for biosafety and infection control practices during specimen collection and handling, including during autopsy procedures. The guidance can be utilized by medical examiners, coroners, pathologists, other workers involved in the postmortem care of deceased PUI, and local and state health departments.

The following factors should be considered when determining if an autopsy will be performed for a deceased PUI: medicolegal jurisdiction, facility environmental controls, availability of recommended personal protective equipment (PPE), and family and cultural wishes.

**If an autopsy is performed**, collection of the following postmortem specimens is recommended:

- Postmortem clinical specimens for testing for SARS-CoV-2, the virus that causes COVID-19:
  - Upper respiratory tract swabs: Nasopharyngeal Swab AND Oropharyngeal Swab (NP swab and OP swab)
  - Lower respiratory tract swab: Lung swab from each lung
- Separate clinical specimens for testing of other respiratory pathogens and other postmortem testing as indicated
- Formalin-fixed autopsy tissues from lung, upper airway, and other major organs

**If an autopsy is NOT performed**, collection of the following postmortem specimens is recommended:

- Postmortem clinical specimens for testing for SARS-CoV-2, the virus that causes COVID-19, to include only upper respiratory tract swabs: Nasopharyngeal Swab AND Oropharyngeal Swab (NP swab and OP swab)
- Separate NP swab and OP swab specimens for testing of other respiratory pathogens

Detailed guidance for postmortem specimen collection can be found in the section: [Collection of Postmortem Clinical and Pathologic Specimens](#).

In addition to postmortem specimens, submission of any remaining clinical specimens (e.g., NP swab, OP swab, sputum, serum, stool) that may

have been collected prior to death is recommended. Please refer to [Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens from Persons Under Investigation \(PUIs\) for Coronavirus Disease 2019 \(COVID-19\)](#) for more information.

## Recommended Biosafety and Infection Control Practices

### Collection of Postmortem Upper Respiratory Tract Swab Specimens

Individuals in the room during the procedure should be limited to healthcare personnel (HCP) obtaining the specimen. If HCP are not performing an autopsy or conducting aerosol generating procedures (AGPs), follow Standard Precautions.

#### Engineering Control Recommendations:

Since collection of nasopharyngeal and oropharyngeal swab specimens from deceased persons will not induce coughing or sneezing, a negative pressure room is not required. Personnel should adhere to Standard Precautions as described above.

#### PPE Recommendations:

The following PPE should be worn at a minimum:

- Wear nonsterile, nitrile gloves when handling potentially infectious materials.
- If there is a risk of cuts, puncture wounds, or other injuries that break the skin, wear heavy-duty gloves over the nitrile gloves.
- Wear a clean, long-sleeved fluid-resistant or impermeable gown to protect skin and clothing.
- Use a plastic face shield or a face mask and goggles to protect the face, eyes, nose, and mouth from splashes of potentially infectious bodily fluids.

### Autopsy Procedures

[Standard Precautions, Contact Precautions, and Airborne Precautions with eye protection \(e.g., goggles or a face shield\)](#) should be followed during autopsy. Many of the following procedures are consistent with existing guidelines for safe work practices in the autopsy setting; see [Guidelines for Safe Work Practices in Human and Animal Medical Diagnostic Laboratories](#).

- AGPs such as use of an oscillating bone saw should be avoided for confirmed or suspected cases of COVID-19. Consider using hand shears as an alternative cutting tool. If an oscillating saw is used, attach a vacuum shroud to contain aerosols.
- Allow only one person to cut at a given time.
- Limit the number of personnel working in the autopsy suite at any given time to the minimum number of people necessary to safely conduct the autopsy.
- Limit the number of personnel working on the human body at any given time.
- Use a biosafety cabinet for the handling and examination of smaller specimens and other containment equipment whenever possible.
- Use caution when handling needles or other sharps, and dispose of contaminated sharps in puncture-proof, labeled, closable sharps containers.
- A logbook including names, dates, and activities of all workers participating in the postmortem and cleaning of the autopsy suite should be kept to assist in future follow up, if necessary. Include custodian staff entering after hours or during the day.

#### Engineering Control Recommendations

Autopsies on decedents with known or suspected COVID-19 should be conducted in Airborne Infection Isolation Rooms (AIIRs). These rooms are at negative pressure to surrounding areas, have a minimum of 6 air changes per hour (ACH) for existing structures and 12 ACH for renovated or new structures, and have air exhausted directly outside or through a HEPA filter. Doors to the room should be kept closed except during entry and egress. If an AIIR is not available, ensure the room is negative pressure with no air recirculation to adjacent spaces. A portable HEPA recirculation unit could be placed in the room to provide further reduction in aerosols. Local airflow control (i.e., laminar flow systems) can be used to direct aerosols away from personnel. If use of an AIIR or HEPA unit is not possible, the procedure should be performed in the most protective environment possible. Air should never be returned to the building interior, but should be exhausted outdoors, away from areas of human traffic or gathering spaces and away from other air intake systems.

#### PPE Recommendations:

The following PPE should be worn during autopsy procedures:

- Double surgical gloves interposed with a layer of cut-proof synthetic mesh gloves
- Fluid-resistant or impermeable gown
- Waterproof apron
- Goggles or face shield

- NIOSH-certified disposable N-95 respirator or higher
  - Powered, air-purifying respirators (PAPRs) with HEPA filters may provide increased worker comfort during extended autopsy procedures.
  - When respirators are necessary to protect workers, employers must implement a comprehensive respiratory protection program in accordance with the OSHA Respiratory Protection standard ([29 CFR 1910.134](#) [↗](#)) that includes medical exams, fit-testing, and training.

Surgical scrubs, shoe covers, and surgical cap should be used per routine protocols. Doff (take off) PPE carefully to avoid contaminating yourself and before leaving the autopsy suite or adjacent anteroom (<https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf> [↗](#)).

After removing PPE, discard the PPE in the appropriate laundry or waste receptacle. Reusable PPE (e.g., goggles, face shields, and PAPRs) must be cleaned and disinfected according to the manufacturer's recommendations before reuse. Immediately after doffing PPE, wash hands with soap and water for 20 seconds. If hands are not visibly dirty and soap and water are not available, an alcohol-based hand sanitizer that contains 60%-95% alcohol may be used. However, if hands are visibly dirty, always wash hands with soap and water before using alcohol-based hand sanitizer. Avoid touching the face with gloved or unwashed hands. Ensure that hand hygiene facilities are readily available at the point of use (e.g., at or adjacent to the PPE doffing area).

Additional safety and health guidance is available for workers handling deceased persons under investigation (PUI) for COVID-19 at the [Occupational Safety and Health Administration \(OSHA\)](#), [COVID-19 website](#) [↗](#).

## Collection of Postmortem Clinical and Pathologic Specimens

Implementing proper biosafety and infection control practices is critical when collecting specimens. Please refer to [Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Coronavirus Disease 2019 \(COVID-19\)](#) for additional information.

### Collection of Postmortem Clinical Specimens for SARS-CoV-2 Testing

CDC recommends collecting and testing postmortem upper respiratory specimens (nasopharyngeal and oropharyngeal swabs) and, if an autopsy is performed, lower respiratory specimens (lung swabs).

Use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts, as they may contain substances that inactivate some viruses and inhibit PCR testing. Place swabs immediately into sterile tubes containing 2-3 ml of viral transport media. NP, OP, and lung swab specimens should be kept in separate vials. Refrigerate specimen at 2-8°C and ship overnight to CDC on ice pack.

#### Upper Respiratory Tract Specimen Collection: Nasopharyngeal Swab AND Oropharyngeal Swabs (NP swab, OP swab)

- *Nasopharyngeal swab*: Insert a swab into the nostril parallel to the palate. Leave the swab in place for a few seconds to absorb secretions. Swab both nasopharyngeal areas with the same swab.
- *Oropharyngeal swab (e.g., throat swab)*: Swab the posterior pharynx, avoiding the tongue.

#### Lower respiratory tract: Lung swabs

- Collect one swab from each lung.

### Collection of Postmortem Clinical Specimens for Other Routine Diagnostic Testing

Separate clinical specimens (e.g., NP swab, OP swab, lung swabs) should be collected for routine testing of respiratory pathogens at either clinical or public health labs. Note that clinical laboratories should NOT attempt viral isolation from specimens collected from COVID-19 PUIs.

Other postmortem specimen collection and evaluations should be directed by the decedent's clinical and exposure history, scene investigation, and gross autopsy findings, and may include routine bacterial cultures, toxicology, and other studies as indicated.

### Collection of Fixed Autopsy Tissue Specimens

The preferred specimens would be a minimum of eight blocks and fixed tissue specimens representing samples from the respiratory sites listed below in addition to specimens from major organs (including liver, spleen, kidney, heart, GI tract) and any other tissues showing significant gross pathology.

The recommended respiratory sites include:

1. Trachea (proximal and distal)
2. Central (hilar) lung with segmental bronchi, right and left primary bronchi

### 3. Representative pulmonary parenchyma from right and left lung

Viral antigens and nucleic acid may be focal or sparsely distributed in patients with respiratory viral infections and are most frequently detected in respiratory epithelium of large airways. For example, larger airways (particularly primary and segmental bronchi) have the highest yield for detection of respiratory viruses by molecular testing and immunohistochemistry (IHC) staining. Performance of specific immunohistochemical, molecular, or other assays will be determined using clinical and epidemiologic information provided by the submitter and the histopathologic features identified in the submitted tissue specimens.

Collection of tissue samples roughly 4-5 mm in thickness (i.e., sample would fit in a tissue cassette) is recommended for optimal fixation. The volume of formalin used to fix tissues should be 10x the volume of tissue. Place tissue in 10% buffered formalin for three days (72 hours) for optimal fixation.

## Safely Preparing the Specimens for Shipment

After collecting and properly securing and labeling specimens in primary containers with the appropriate media/solution, they must be transferred from the autopsy suite in a safe manner to laboratory staff who can process them for shipping.

1. Within the autopsy suite, primary containers should be placed into a larger secondary container.
2. If possible, the secondary container should then be placed into a resealable plastic bag that was not in the autopsy suite when the specimens were collected.
3. The resealable plastic bag should then be placed into a biological specimen bag with absorbent material; and then can be transferred outside of the autopsy suite.
  - a. Workers receiving the biological specimen bag outside the autopsy suite or anteroom should wear disposable nitrile gloves.

## Submission of Specimens to CDC

State and local health departments who have identified a PUI should immediately notify CDC's Emergency Operations Center (EOC) at 770-488-7100 to report a deceased PUI and determine whether SARS-CoV-2, the virus that causes COVID-19, testing at CDC is indicated. The EOC will assist local/state health departments to collect, store, and ship specimens appropriately to CDC, including during afterhours or on weekends/holidays.

## Submission of Postmortem Clinical Specimens for SARS-CoV-2 Testing

This section applies to submission of postmortem NP swab, OP swab, and lung swabs

- Store specimens at 2-8°C and ship overnight to CDC on ice pack.
- Label each specimen container with the patient's ID number (e.g., medical record number), unique specimen ID (e.g., laboratory requisition number), specimen type (e.g., tissue), and the date the sample was collected.
- Complete a [CDC Form 50.34](#) for each specimen submitted.
- In the upper left box of the form provide the following: (1) for *test requested* select "Respiratory virus molecular detection (non-influenza) CDC-10401" and (2) for *At CDC, bring to the attention of* enter "Stephen Lindstrom: 2019-nCoV PUI – Autopsy specimens".

Clinical specimens from COVID-19 PUIs must be packaged, shipped, and transported according to the current edition of the [International Air Transport Association \(IATA\) Dangerous Goods Regulations](#) [\[3\]](#). Store specimens at 2-8°C and ship overnight to CDC on ice pack. If a specimen is frozen at -70°C ship overnight to CDC on dry ice. Additional useful and detailed information on packing, shipping, and transporting specimens can be found at [Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Coronavirus 2019 \(COVID-19\)](#).

## Submission of Fixed Autopsy Tissue Specimens

CDC's Infectious Diseases Pathology Branch will perform histopathologic evaluation; testing for SARS-CoV-2, as well as other respiratory viral pathogens (e.g., influenza); and bacterial and other infections, as indicated.

### Paraffin-embedded tissue blocks

In general, this is the preferred specimen and is especially important to submit in cases where tissues have been in formalin for a significant time. Prolonged fixation (>2 weeks) may interfere with some immunohistochemical and molecular diagnostic assays.

### Wet tissue

If available, we highly recommend that unprocessed tissues in 10% neutral buffered formalin be submitted in addition to paraffin blocks.

## Requirements for submitting fixed tissues to CDC

- A. Contact CDC's Infectious Diseases Pathology Branch at [pathology@cdc.gov](mailto:pathology@cdc.gov) who will provide a pre-populated [CDC Form 50.34](#) for your convenience. Include in the email:
1. A brief clinical history
  2. A description of gross or histopathologic findings in the tissues to be submitted
- B. After you receive email approval from [pathology@cdc.gov](mailto:pathology@cdc.gov):
1. Electronically fill, save, and print both pages of the [CDC Form 50.34](#).
  2. In the upper left box of the form, Select Test Order Code CDC-10365 ("Pathologic Evaluation of Tissues for Possible Infectious Etiologies")
  3. Enter "COVID-19 PUI" and provide any applicable CDC and State Case ID numbers in the Comments section on Page 2 of the CDC 50.34 form.
  4. In addition to the CDC 50.34 form, enclose the following in the specimen submission package:
    1. Surgical pathology, autopsy report (preliminary is acceptable), or both
    2. Relevant clinical notes, including admission History and Physical (H&P), discharge summary, if applicable
- C. Mailing/Contact Info:
1. Formalin-fixed wet tissues and/or formalin-fixed paraffin-embedded tissue blocks should be shipped in suitable packaging at ambient temperature. **Do not freeze fixed tissues.**
  2. Ship to: Dr. Sherif Zaki, CDC, IDPB, 1600 Clifton Rd NE, MS: H18-SB, Atlanta, GA 30329-4027
  3. Send tracking number to [pathology@cdc.gov](mailto:pathology@cdc.gov)
  4. Tel: 404-639-3132, Fax: 404-639-3043, Email: [pathology@cdc.gov](mailto:pathology@cdc.gov)

## Cleaning and Waste Disposal Recommendations

The following are general guidelines for cleaning and waste disposal following an autopsy of a decedent with confirmed or suspected COVID-19. The surface persistence of SARS-CoV-2 is uncertain at this time. Other coronaviruses such as those that cause MERS and SARS can persist on nonporous surfaces for 24 hours or more.

Routine cleaning and disinfection procedures (e.g., using cleaners and water to pre-clean surfaces prior to applying an Environmental Protection Agency (EPA)-registered, hospital-grade disinfectant for appropriate contact times as indicated on the product's label) are appropriate for COVID-19 in these settings.

After an autopsy of a decedent with confirmed or suspected COVID-19, the following recommendations apply for the autopsy room (and anteroom if applicable):

- Keep ventilation systems active while cleaning is conducted.
- Wear disposable gloves recommended by the manufacturer of the cleaner or disinfectant while cleaning and when handling cleaning or disinfecting solutions.
  - Dispose of gloves if they become damaged or soiled and when cleaning is completed, as described below. Never wash or reuse gloves.
- Use eye protection, such as a faceshield or goggles, if splashing of water, cleaner/disinfectant, or other fluids, is expected.
- Use respiratory protection if required on cleaner or disinfectant label.
- Ensure workers are trained on OSHA's Hazard Communication standard, [29 CFR 1910.1200](#) [\[PDF\]](#), to communicate with workers about the hazardous chemicals used in the workplace.
- Wear a clean, long-sleeved fluid-resistant gown to protect skin and clothing.
- Use disinfectants with EPA-approved products with label claims against human coronaviruses. All products should be used according to label instructions.
  - Clean the surface first, and then apply the disinfectant as instructed on the disinfectant manufacturer's label. Ensure adequate contact time for effective disinfection.
  - Adhere to any safety precautions or other label recommendations as directed (e.g., allowing adequate ventilation in confined areas and proper disposal of unused product or used containers).
  - Avoid using product application methods that cause splashing or generate aerosols.
  - Cleaning activities should be supervised and inspected periodically to ensure correct procedures are followed.
- Do not use compressed air and/or water under pressure for cleaning, or any other methods that can cause splashing or might re-aerosolize infectious material.
- Gross contamination and liquids should be collected with absorbent materials, such as towels, by staff conducting the autopsy wearing designated PPE. Gross contamination and liquids should then be disposed of as described below:
  - Use of tongs and other utensils can minimize the need for personal contact with soiled absorbent materials.
  - Large areas contaminated with body fluids should be treated with disinfectant following removal of the fluid with absorbent material. The area should then be cleaned and given a final disinfection.
  - Small amounts of liquid waste (e.g., body fluids) can be flushed or washed down ordinary sanitary drains without special procedures.
  - Hard, nonporous surfaces may then be cleaned and disinfected as described above.






- Follow standard operating procedures for the containment and disposal of used PPE and regulated medical waste. SARS-CoV-2 is not considered a Category A infectious substance. State and local governments should be consulted for appropriate disposal decisions.
- Dispose of human tissues according to routine procedures for pathological waste.
- Clean and disinfect or autoclave non-disposable instruments using routine procedures, taking appropriate precautions with sharp objects.
- Materials or clothing that will be laundered can be removed from the autopsy suite (or anteroom, if applicable) in a sturdy, leak-proof biohazard bag that is tied shut and not reopened. These materials should then be sent for laundering according to routine procedures.
- Wash reusable, non-launderable items (e.g., aprons) with detergent solution, decontaminate using disinfectant, rinse with water, and allow items to dry before next use.
- Keep camera, telephones, computer keyboards, and other items that remain in the autopsy suite (or anteroom, if applicable) as clean as possible, but treat as if they are contaminated and handle with gloves. Wipe the items with appropriate disinfectant after use. If being removed from the autopsy suite, ensure complete decontamination with appropriate disinfectant according to the manufacturer's recommendations prior to removal and reuse.
- When cleaning is complete and PPE has been removed, wash hands immediately with soap and water for 20 seconds. If hands are not visibly dirty and soap and water are not available, an alcohol-based hand sanitizer that contains 60%-95% alcohol may be used. However, if hands are visibly dirty, always wash hands with soap and water before using alcohol-based hand sanitizer. Avoid touching the face with gloved or unwashed hands. Ensure that hand hygiene facilities are readily available at the point of use (e.g., at or adjacent to the PPE doffing area).

## Transportation of Human Remains

Follow standard routine procedures when transporting the body after specimens have been collected and the body has been bagged. Disinfect the outside of the bag with an EPA-registered hospital disinfectant applied according to the manufacturer's recommendations. Wear disposable nitrile gloves when handling the body bag.

## Additional Resources:

- [CDC Guidelines for Safe Work Practices in Human and Animal Diagnostic Laboratories](#) 
- [OSHA COVID-19 Guidance](#) 
- [WHO Guidance on regulations for the transport of infectious substances 2017-2018](#) 
- [CDC Tools for Protecting Healthcare Personnel](#)
- [CDC Environmental Infection Control Guidelines](#)
- [CDC Medical Examiners, Coroners, and Biologic Terrorism](#)

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