# MERS-CoV Guidance for Healthcare and Public Health Providers
# Michigan Department of Community Health

This interim guidance outlines Michigan Department of Community Health (MDCH) recommendations on surveillance, reporting, testing, and infection control for healthcare providers for Middle East Respiratory Syndrome (MERS). MERS is caused by a coronavirus called MERS-CoV and was first reported in Saudi Arabia in 2012. Most MERS patients have developed severe acute respiratory illness, and about 30% have died. The most commonly reported symptoms included fever, cough, and shortness of breath. Most patients had abnormal findings on chest x-ray. See Clinical Features within the General Guidance Section (*page 2*).

At this time, all cases have been linked to countries in or near the Arabian Peninsula. The virus has spread from ill people to others usually through close and prolonged contact. No current evidence exists for sustained human-to-human transmission. ***Michigan healthcare providers should be vigilant for suspect cases.*** For more information please see: http://www.cdc.gov/coronavirus/mers/ or call the MDCH Division of Communicable Disease at 517-335-8165.

## General Guidance on Case Identification, Reporting, Testing, and Infection Control

**1.*Patients who develop fever and pneumonia or acute respiratory distress syndrome should be asked about travel within 14 days from the Arabian Peninsula or neighboring countries or close contact with an ill traveler from the region.*** Healthcare professionals should evaluate suspected cases of MERS-CoV infection according to the CDC patient under investigation (PUI) definition (*page 3*). Persons who meet the criteria for PUI should also be evaluated for common causes of community-acquired pneumonia.[1] Positive results for another respiratory pathogen should not necessarily preclude testing for MERS-CoV.

**2.*Healthcare providers should immediately report confirmed or probable PUIs to their state or local health department.***[2] Contact your local health department[2] or MDCH at 517-335-8165 to immediately report suspect cases. To collect data on PUIs, fill out the Michigan MERS PUI short form found at http://www.michigan.gov/documents/mdch/MERS_Investigation_ShortForm_438699_7.pdf Healthcare providers should notify MDCH by phone (517-335-8165) prior to submitting PUI short forms to MDCH (FAX: 517-335-8263).

**3.*Clinical specimens from PUIs should be submitted to MDCH.*** To arrange prior testing approval (required) for specimens, contact MDCH at 517-335-8165 prior to submitting the PUI short form or specimens. See Interim Guidelines for Collecting, Handling and Testing Clinical Specimens from PUIs (*pages 9-11*) for more information.

**4.*Appropriate infection-control measures include immediately initiating contact and airborne precautions while managing a patient with known or suspected MERS-CoV infection.*** For CDC guidance on MERS-CoV infection control in healthcare settings, see Infection Prevention and Control (*pages 6-8*).

**5.*Any person who has had close contact with a confirmed case, probable case, or PUI while the person was ill, should be carefully monitored for the appearance of illness.*** Close contacts of a confirmed or probable case of MERS while the case was ill should be evaluated in consultation with MDCH and the local health department. This includes exposed health care workers not using recommended infection control precautions. Other contacts, such as community contacts or contacts on conveyances should also be evaluated. See Evaluation and Management of Contacts (*page 4*). If fever and respiratory symptoms develops within the first 14 days following the contact, the individual should be evaluated for MERS-CoV infection. See Case Definitions (*page 3*) for the definition of a close contact.

**6.*Clusters of severe acute respiratory illness without recognized links to a MERS case or travelers from countries in or near the Arabian Peninsula should be evaluated and tested for compatible respiratory pathogens, preferably by molecular or antigen detection methods.*** Clusters[3] should be thoroughly investigated with immediate notification to your local health department. MERS-CoV testing should be considered in consultation with MDCH.

***7.See CDC Preparedness Checklists for Healthcare Providers and Healthcare Facilities*** (*pages 12-14).*

Clinical Features

- A wide clinical spectrum of MERS-CoV infection has been reported ranging from asymptomatic infection to acute upper respiratory illness, and rapidly progressive pneumonitis, respiratory failure, septic shock and multi-organ failure resulting in death.
- Most MERS-CoV cases have been reported in adults (median age approximately 50 years, male predominance), although children and adults of all ages have been infected.
- Most hospitalized MERS-CoV patients have had chronic co-morbidities.
- Limited clinical data for MERS-CoV patients are available; most published clinical information to date is from critically ill patients.
  - At hospital admission, common signs and symptoms include fever, chills/rigors, headache, non-productive cough, dyspnea, and myalgia.
  - Other symptoms can include sore throat, coryza, nausea and vomiting, dizziness, sputum production, diarrhea, vomiting, and abdominal pain.
  - Atypical presentations including mild respiratory illness without fever and diarrheal illness preceding development of pneumonia have been reported.
  - Patients who progress to requiring admission to an intensive care unit (ICU) often have a history of a febrile upper respiratory tract illness with rapid progression to pneumonia within a week of illness onset.
- The median incubation period for secondary cases associated with limited human-to-human transmission is approximately 5 days (range 2-13 days).
- In patients with community-acquired MERS-CoV infection who are hospitalized with more severe disease, the median time from illness onset to hospitalization is approximately 4 days.
- In critically ill patients, the median time from onset to intensive care unit (ICU) admission is approximately 5 days, and median time from onset to death is approximately 12 days.
- Laboratory findings at admission may include leukopenia, lymphopenia, thrombocytopenia, and elevated lactate dehydrogenase levels. Radiographic findings may include unilateral or bilateral patchy densities or opacities, interstitial infiltrates, consolidation, and pleural effusions.
- Rapid progression to acute respiratory failure, acute respiratory distress syndrome (ARDS), refractory hypoxemia, and extrapulmonary complications (acute kidney injury requiring renal replacement therapy, hypotension requiring vasopressors, hepatic inflammation, septic shock) has been reported.
- Co-infection with other respiratory viruses and a few cases of co-infection with community-acquired bacteria at admission has been reported
- MERS-CoV virus can be detected with higher viral load and longer duration in the lower respiratory tract compared to the upper respiratory tract, and has been detected in feces, serum, and urine. However, very limited data are available on the duration of respiratory and extrapulmonary MERS-CoV shedding.

***Footnotes: General Guidance***

[1]Examples of respiratory pathogens causing community-acquired pneumonia include influenza A and B, respiratory syncytial virus, *Streptococcus pneumoniae*, and *Legionella pneumophila*.

[2]For local health department contact information, see http://www.michigan.gov/mdch/0,4612,7-132-2939-96747--,00.html

[3]A cluster is defined as two or more persons with onset of symptoms within the same 14 days period, and who are associated with a specific setting such as a classroom, workplace, household, extended family, hospital, other residential institution, military barracks, or recreational camp.

# Case Definitions

***Patient Under Investigation (PUI)***

Clinicians and health care professionals should immediately report PUIs for MERS-CoV infection to MDCH (517-335-8165) and/or local health department. MDCH and local health departments (via MDCH) should immediately report PUIs for MERS-CoV infection to CDC. Probable cases should also be reported.

**A patient under investigation (PUI) is a person with the following characteristics:**

A. Fever (≥38°C, 100.4°F) and pneumonia or acute respiratory distress syndrome (based on clinical or radiological evidence) AND EITHER

- history of travel from countries in or near the Arabian Peninsula[1] within 14 days before symptom onset, OR
- close contact[2] with a symptomatic traveler who developed fever and acute respiratory illness (not necessarily pneumonia) within 14 days after traveling from countries in or near the Arabian Peninsula[1] OR
- is a member of a cluster of patients with severe acute respiratory illness (e.g. fever and pneumonia requiring hospitalization) of unknown etiology in which MERS-CoV is being evaluated, in consultation with MDCH and the local health department.

**OR**

B. Close contact[2] with a confirmed or probable case of MERS while the case was ill AND

- fever (>100.4°F) or symptoms of respiratory illness within 14 days following the close contact. (This is a lower threshold than category A).

**Confirmed Case:**

- A confirmed case is a person with laboratory confirmation[3] of MERS-CoV infection.

**Probable Case:**

- A probable case is a PUI with absent or inconclusive[4] laboratory results for MERS-CoV infection who is a close contact[2] of a laboratory-confirmed MERS-CoV case.

***Footnotes: Case Definition***

1. Countries considered in or near the Arabian Peninsula: Bahrain, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Palestinian territories, Qatar, Saudi Arabia, Syria, the United Arab Emirates (UAE), and Yemen.
2. Close contact is defined as a) any person who provided care for the patient, including a healthcare worker or family member, or had similarly close physical contact; or b) any person who stayed at the same place (e.g. lived with, visited) as the patient while the patient was ill.
3. Confirmatory laboratory testing requires a positive PCR on at least two specific genomic targets or a single positive target with sequencing on a second (the latter is not available at MDCH Laboratories).
4. Examples of laboratory results that may be considered inconclusive include a positive test on a single PCR target, a positive test with an assay that has limited performance data available, or a negative test on an inadequate specimen.

# Evaluation and Management of Close Contacts

CLOSE CONTACTS OF A CONFIRMED OR PROBABLE CASE

- Close contacts[1] of a confirmed or probable case of MERS while the case was ill should be evaluated in consultation with MDCH and the local health department.
- Close contacts[1] of a confirmed or probable case, if not using recommended infection control precautions, are at increased risk and should be evaluated and monitored by healthcare professionals with a higher index of suspicion to detect MERS-CoV infection.
- Other contacts of the ill person, such as community contacts or contacts on conveyances (e.g., airplane, bus), should also be evaluated in consultation with MDCH and local health departments.

EXPOSURE TO HEALTHCARE PROFESSIONALS

- Healthcare professionals exposed to a confirmed or probable case will be actively monitored by the local health department and should carefully monitor for the appearance of fever (>100°F) or respiratory symptoms within 14 days following the close contact. One of these signs would meet the criteria for PUI.
    - Other early symptoms can include headache, chills, myalgia, nausea/vomiting, diarrhea.
- Healthcare workers may be under home quarantine during this monitoring period.
- Surveillance testing would be requested on asymptomatic healthcare professionals.

TESTING SYMPTOMATIC AND ASYMPTOMATIC CASES

- Symptomatic contacts should be evaluated and, depending on their clinical history and presentation, considered for more extensive MERS-CoV testing, including rRT-PCR testing of lower respiratory and serum specimens, and possibly MERS-CoV serology.
- However, the spectrum of illness due to MERS-CoV infection is incompletely defined. Although most reported cases have had severe acute lower respiratory illness, mild and asymptomatic infections have been reported and in some cases, diarrhea preceded respiratory symptoms.
- Testing nasopharyngeal and oropharygeal swabs by rRT-PCR to detect MERS-CoV should be considered on initial evaluation, regardless of the presence or nature of symptoms.

ISOLATION AND QUARANTINE – See Interim Home Care and Isolation Guidance (*page 5)*

- Close contacts[1] who are ill and being evaluated for MERS-CoV infection and do not require hospitalization for medical reasons may be cared for and isolated[2] in their home.
- For asymptomatic close contacts[1] who are being evaluated for MERS-CoV, the possible benefit of home quarantine or other measures, such as wearing masks, is uncertain due to lack of information about transmissibility. However, asymptomatic contacts who test positive by PCR, especially in respiratory specimens or serum, likely pose a risk of transmission.
- Providers should contact MDCH and their local health department to discuss measures for close contacts, especially for patients who test positive.

CLOSE CONTACTS OF A PUI

- Discuss evaluation and management of close contacts[1] of a PUI with MDCH and the local health department.
- Close contacts of a PUI should monitor themselves for fever and respiratory illness and seek medical attention if they become ill within 14 days after contact.
- Healthcare providers should consider the possibility of MERS.

***Footnotes: Evaluation and Management of Close Contacts***

1. Close contact is defined as a) any person who provided care for the patient, including a healthcare worker or family member, or had similarly close physical contact; or b) any person who stayed at the same place (e.g. lived with, visited) as the patient while the patient was ill.
2. Isolation is defined as the separation or restriction of activities of an ill person with a contagious disease from those who are well.

# Interim Home Care and Isolation Guidance

This guidance is for those coordinating the home care and isolation of ill[1] people who are being evaluated for Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection. Ill people who are being evaluated for MERS-CoV infection and do not require hospitalization for medical reasons may be cared for and isolated[2] in their home. The guidance is currently based on what is currently known about viral respiratory diseases and MERS-CoV and is subject to change.

## Before the Ill Person is Isolated at Home

In conjunction with MDCH and your local health department, a healthcare professional should assess whether the home is suitable and appropriate for isolating the ill person. You can conduct this assessment by phone or direct observation:

- The home should have a functioning bathroom that only the ill person and household members use. If there are multiple bathrooms, one should be designated solely for the ill person.
- The ill person should have his or her own bed and preferably a private room for sleeping.
- Basic amenities, such as heat, electricity, potable and hot water, sewer, and telephone access, should be available.
- If the home is in a multiple-family dwelling, such as an apartment building, the area in which the ill person will stay should use a separate air-ventilation system, if one is present.
- There should be a primary caregiver who can follow the healthcare provider's instructions for medications and care. The caregiver should help the ill person with basic needs in the home and help with obtaining groceries, prescriptions, and other personal needs.

## If the Home is Suitable and Appropriate for Home Care and Isolation

Review and provide CDC's Interim Guidance for Preventing MERS-CoV from Spreading in Homes and Communities to the ill person, the caregiver, and household members. This guidance can be found at: http://www.cdc.gov/coronavirus/mers/hcp/home-care-patient.html

***Footnotes: Home Care and Isolation Guidance***

1. For this guidance, an ill person is someone who has mild to severe symptoms that are consistent with MERS-CoV infection. This includes a) persons under investigation (PUIs) with symptoms of fever, pneumonia, and/or acute respiratory distress syndrome, and b) close contacts of PUIs who might have symptoms such as chills, body aches, sore throat, runny nose, headache, diarrhea, nausea/vomiting.
2. Isolation is defined as the separation or restriction of activities of an ill person with a contagious disease from those who are well.

# Infection Prevention and Control

Standard, contact, and airborne precautions are recommended for management of hospitalized patients with known or suspected MERS-CoV infection, based on CDC's case definition for patient under investigation. Additional infection prevention precautions may be necessary depending on co-infections (e.g., tuberculosis, *Clostridium difficile*, and multi-drug resistant organisms). These recommendations are based upon available information and considerations of MERS-CoV. These recommendations will be re-evaluated and updated as needed.

Healthcare personnel (HCP) refers all persons, paid and unpaid, working in healthcare settings who have the potential for exposure to patients and/or to infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air.

HCP include, but are not limited to, physicians, nurses, nursing assistants, therapists, technicians, emergency medical service personnel, dental personnel, pharmacists, laboratory personnel, autopsy personnel, students and trainees, contractual personnel, home healthcare personnel, and persons not directly involved in patient care (e.g., clerical, dietary, house-keeping, laundry, security, maintenance, billing, chaplains, and volunteers) but potentially exposed to infectious agents that can be transmitted to and from HCP and patients.

**This guidance is not intended to apply to persons outside of healthcare settings.**

## Selected Components of Standard, Contact, and Airborne Precautions Recommended for Prevention of MERS-CoV Transmission in Hospitals

| Component | Recommendation(s) | Comments |
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| **Patient placement** | • Airborne Infection Isolation Room (AIIR) | • If an AIIR is not available, the patient should be transferred as soon as is feasible to a facility where an AIIR is available. Pending transfer, place a facemask on the patient and isolate him/her in a single-patient room with the door closed. The patient should not be placed in any room where room exhaust is recirculated without high-efficiency particulate air (HEPA) filtration.<br>• Once in an AIIR, the patient's facemask may be removed; the facemask should remain on if the patient is not in an AIIR.<br>• When outside of the AIIR, patients should wear a facemask to contain secretions<br>• Limit transport and movement of the patient outside of the AIIR to medically-essential purposes.<br>• Implement staffing policies to minimize the number of personnel that must enter the room.<br>• After a potentially infectious patient leaves a room, unprotected individuals, including HCP, should not be allowed in the room until sufficient time has elapsed for enough air changes to remove potentially infectious particles. |
| **Aerosol Generating Procedure** | • Use a combination of measures to reduce exposures from aerosol-generating procedures when performed on MERS-CoV patients.<br>• Limiting the number of HCP present during the procedure to only those essential for patient care and support. | • Although there are limited data available to definitively define a list of aerosol generating procedures, procedures that are usually included are those planned ahead of time, such as bronchoscopy, sputum induction, elective intubation and extubation; and some procedures that often occur in unplanned, emergent settings and can be life-saving, such as cardiopulmonary |

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| **Aerosol Generating Procedure (cont)** | • Conduct the procedures in a private room and ideally in an AIIR when feasible. Room doors should be kept closed except when entering or leaving the room, and entry and exit should be minimized during and shortly after the procedure.<br>• HCP should adhere to PPE precautions in this interim guidance (i.e., gloves, a gown, and either a face shield that fully covers the front and sides of the face or goggles, and respiratory protection that is at least as protective as a fit-tested N95 filtering facepiece respirator [e.g., powered air purifying or elastomeric respirator]) during aerosol-generating procedures.<br>• Conduct environmental surface cleaning following procedures (see section below on environmental infection control). | resuscitation, emergent intubation, and open suctioning of airways.<br>• Once the patient vacates a room where aerosol generating procedures were conducted, unprotected individuals, including HCP, should not be allowed in that room until sufficient time has elapsed for enough air changes to remove potentially infectious particles. |
| **Personal Protective Equipment (PPE) for Healthcare personnel (HCP)** | • Gloves<br>• Gowns<br>• Eye protection (goggles or face shield)<br>• Respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering facepiece respirator.<br>o If a respirator is unavailable, a facemask should be worn. In this situation respirators should be made available as quickly as possible. | • Recommended PPE should be worn by HCP upon entry into patient rooms or care areas.<br>• Upon exit from the patient room or care area, PPE should be removed and either<br>o Discarded, or<br>o For re-useable PPE, cleaned and disinfected according to the manufacturer's reprocessing instructions<br>o Hand hygiene should be performed after removal of PPE |
| **Hand Hygiene** | • HCP should perform hand hygiene frequently, including before and after all patient contact, contact with potentially infectious material, and before putting on and upon removal of PPE, including gloves.<br>• Healthcare facilities should ensure that supplies for performing hand hygiene are available. | • Hand hygiene in healthcare settings can be performed by washing with soap and water or using alcohol-based hand rubs. If hands are visibly soiled, use soap and water, not alcohol-based hand rubs. |
| **Environmental Infection Control** | • Follow standard procedures, per hospital policy and manufacturers' instructions, for cleaning and/or disinfection of:<br>o Environmental surfaces and equipment<br>o Textiles and laundry<br>o Food utensils and dishware | • Use EPA-registered hospital disinfectants to disinfect hard non-porous surfaces.<br>o Follow label instructions for use |
| **Duration of Infection Control Precautions** | • At this time, information is lacking to definitively determine a recommended duration for keeping patients in isolation precautions.<br>• Duration of precautions should be determined on a case-by-case basis, in conjunction with local, state, and federal health authorities. | • Factors that should be considered include: presence of symptoms related to MERS-CoV, date symptoms resolved, other conditions that would require specific precautions (e.g., tuberculosis, *Clostridium difficile*) and available laboratory information. |
| **Monitoring and Management of Potentially Exposed Personnel** | • HCP who care for patients with MERS-CoV should be advised to monitor and immediately report any signs or symptoms of acute illness to their supervisor or a facility designated person (e.g., occupational health services) for a period of 14 days after the last known contact with the sick patient.<br>• HCP who develop respiratory symptoms or fever after an unprotected exposure (i.e. not wearing recommended PPE at the time of contact) to a patient with MERS-CoV should:<br>o not report to work or immediately stop working | |

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| **Monitoring and Management of Potentially Exposed Personnel (cont)** | o notify their supervisor<br>o implement respiratory hygiene and cough etiquette<br>o seek prompt medical evaluation<br>o comply with work exclusion until they are deemed no longer infectious to others<br>• For asymptomatic HCP who had an unprotected exposure (i.e. not wearing recommended PPE at the time of contact) to a patient with MERS-CoV<br>o Consider exclusion from work for 14 days to monitor for signs and symptoms of respiratory illness and fever<br>o If necessary to ensure adequate staffing of the facility the asymptomatic provider could be considered for continuing work if they wear a facemask for source control (i.e., limiting transmission from exposed HCP to other HCP or patients),<br>o The facemask should be worn at all times while in the healthcare facility for 14 days from the last unprotected exposure<br>o HCP continuing to work while wearing a facemask should be reminded that if caring for patients under airborne precautions, to change the facemask to respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering facepiece respirator (without an exhalation valve) (i.e., the HCP should not wear both a facemask and respirator at the same time.) When respirator use is no longer needed, the HCP should put a facemask back on for source control. | |
| **Monitoring, Management, and Training of Visitors** | • Establish procedures for monitoring managing and training visitors.<br>• Limit visitors to those who are essential for the patient's wellbeing and care.<br>• Visits should be scheduled and controlled to allow for:<br>o Screening of symptoms for acute respiratory illness before entering the hospital and upon arrival to hospital<br>o Facilities to evaluate risk to the health of the visitor (e.g., visitor might have underlying illness putting them at higher risk for MERS-CoV) and ability to comply with precautions<br>o Facilities to provide instruction, before entry into the patient care area on hand hygiene, limiting surfaces touched, and use of PPE according to the current facility policy while in the patient's room<br>o Facilities should consider tracking (e.g., logbook) of all visitors who enter patient rooms<br>o Visitors should not be present during aerosol-generating procedures<br>o Visitors should be instructed to limit their movement within the facility | • Visitors who have been in contact with the MERS-CoV patient before and during hospitalization are a possible source of MERS-CoV for other patients, visitors, and staff. |

For full details of these precautions, see 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings at http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html

# Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens from Patients Under Investigation (PUIs) for MERS-CoV

Before collecting and handling specimens for MERS-CoV testing, determine whether the person meets the current definition for a "patient under investigation" (PUI) for MERS-CoV infection prepared by the Centers for Disease Control and Prevention (CDC). See http://www.cdc.gov/coronavirus/mers/case-def.html

***Specimen Type and Priority***

To date, little is known about pathogenic potential and transmission dynamics of MERS-CoV. To increase the likelihood of detecting infection, CDC recommends collecting multiple specimens from different sites at different times after symptom onset, if possible.

Points to consider when determining which specimen types to collect from a patient under investigation for MERS include:

- The number of days between specimen collection and symptom onset
- Symptoms at the time of specimen collection

Additional points to consider:

- Maintain proper infection control when collecting specimens
- Use approved collection methods and equipment when collecting specimens
- Handle, store, and ship specimens following appropriate protocols

Lower respiratory specimens are preferred, but collecting nasopharyngeal and oropharyngeal (NP/OP) specimens, as well as stool and serum, are strongly recommended depending upon the length of time between symptom onset and specimen collection. For example, if symptom onset for a PUI with ongoing lower respiratory tract infection was 14 or more days ago, a single serum specimen for serologic testing (see Section II. Blood Components – Serum) in addition to a lower respiratory specimen and an NP/OP specimen (see Section I. Respiratory Specimens) are recommended.

Respiratory specimens should be collected as soon as possible after symptoms begin – ideally within 7 days and before antiviral medications are administered. However, if more than a week has passed since symptom onset and the patient is still symptomatic, respiratory samples should still be collected, especially lower respiratory specimens since respiratory viruses can still be detected by rRT-PCR.

***General Guidelines***

For short periods (≤ 72 hours), most specimens should be held at 2-8°C rather than frozen. For delays exceeding 72 hours, freeze specimens at -70°C as soon as possible after collection (with exceptions noted below). Label each specimen container with the patient's ID number, specimen type and the date the sample was collected.

I. Respiratory Specimens

A. Lower respiratory tract

i. Broncheoalveolar lavage, tracheal aspirate
Collect 2-3 mL into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

ii. Sputum
Have the patient rinse the mouth with water and then expectorate deep cough sputum directly into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

B. Upper respiratory tract

i. Nasopharyngeal AND oropharyngeal swabs (NP/OP 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 specimens can be combined, placing both swabs in the same vial. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

Nasopharyngeal swabs -- 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.

Oropharyngeal swabs -- Swab the posterior pharynx, avoiding the tonsils and tongue.

ii. Nasopharyngeal wash/aspirate or nasal aspirates
Collect 2-3 mL into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

II. Blood Components

A. Serum (for serologic testing)
For serum antibody testing: Serum specimens should be collected during the acute stage of the disease, preferably during the first week after onset of illness, and again during convalescence, ≥ 3 weeks after the acute sample was collected. However, since we do not want to delay detection at this time, a single serum sample collected 14 or more days after symptom onset may be beneficial. Serologic testing is currently available at CDC upon request and approval. Please be aware that the MERS-CoV serologic test is for research/surveillance purposes and not for diagnostic purposes – it is a tool developed in response to the MERS-CoV outbreak. Contact MDCH (517-335-8165) for consultation and approval regarding serologic testing.

B. Serum (for rRT-PCR testing)
For rRT-PCR testing (i.e., detection of the virus and not antibodies), a single serum specimen collected optimally during the first week after symptom onset, preferably within 3-4 days, after symptom onset, may be also be beneficial. *NOTE: These time frames are based on SARS-CoV studies. The kinetics of MERS-CoV are not well understood and may differ from SARS-CoV. Once additional data become available, these recommendations will be updated as needed.*

Children and adults. Collect 1 tube (5-10 mL) of whole blood in a serum separator tube. Allow the blood to clot, centrifuge briefly, and separate sera into sterile tube container. The minimum amount of serum required for testing is 200 µL. Refrigerate the specimen at 2-8°C and ship on ice- pack; freezing and shipment on dry ice is permissible.

Infants. A minimum of 1 mL of whole blood is needed for testing of pediatric patients. If possible, collect 1 mL in an EDTA tube and in a serum separator tube. If only 1 mL can be obtained, use a serum separator tube.

C. EDTA blood (plasma)
Collect 1 tube (10 ml) of heparinized (green-top) or EDTA (purple-top) blood. Refrigerate specimen at 2-8 °C and ship on ice-pack; **do not freeze.**

III. Stool
Collect 2-5 grams of stool specimen (formed or liquid) in sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

IV. Shipping

Specimens from suspected MERS cases must be packaged, shipped, and transported according to the current regulations.

Specimens should be stored and shipped at the temperatures indicated above. If samples are unable to be shipped within 72 hours of collection, they should be stored at -70°C and shipped on dry ice.

For additional information, contact MDCH at 517-335-8165. Specimens should be shipped for overnight delivery. If Saturday delivery is planned, special arrangements must be made with the shipping company.

***Summary of MERS-CoV rRT-PCR Testing Guidelines for Respiratory Specimens***

Testing for MERS-CoV and other respiratory pathogens can be done simultaneously. Virus isolation in cell culture and initial characterization of viral agents recovered in cultures of MERS-CoV specimens are NOT recommended at this time. However, if done, these activities must be performed in a BSL-3 facility using BSL-3 work practices.

Test for MERS-CoV

MDCH Bureau of Laboratories is approved for MERS-CoV testing using the CDC rRT-PCR assay. Contact your local health department or MDCH at 517-335-8165 to coordinate testing as prior approval is required. The local investigation and response, including the contact investigation, should not be delayed pending the receipt of laboratory results.

Test for Other Respiratory Pathogens

Testing for common respiratory pathogens by molecular or antigen detection methods (not by viral culture) is strongly recommended. Common respiratory pathogens include 1) influenza A, influenza B, respiratory syncytial virus, human metapneumovirus, human parainfluenza viruses, adenovirus, human rhinovirus and other respiratory viruses; 2) *Streptococcus pneumoniae*, *Chlamydia pneumophila*, and other pathogens that cause severe lower respiratory infections. Clinical presentation, epidemiologic and surveillance information, and season should be considered when selecting which pathogens to test for. A few MERS-CoV cases have had other respiratory pathogens detected, so identification of a respiratory pathogen prior to MERS-CoV testing should not preclude testing for MERS-CoV, especially if MERS is strongly suspected. If your laboratory does not have molecular or antigen testing capability for respiratory pathogens, contact MDCH Bureau of Laboratories.

**Healthcare Provider Preparedness Checklist for MERS-CoV**

*Front-line healthcare providers in the United States should be prepared to evaluate patients for new and emerging infectious diseases such as Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The following checklist highlights key steps for healthcare providers to take in preparation for transport and arrival of patients potentially infected with MERS-CoV.*

- ☐ Stay up to date on the latest information about signs and symptoms, diagnostic testing, and case definitions for MERS-CoV disease (http://www.cdc.gov/coronavirus/mers/case-def.html)
- ☐ Review your infection control policies and CDC infection control recommendations for MERS-CoV http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html for:
  - ☐ Assessment and triage of acute respiratory infection patients
  - ☐ Patient placement
  - ☐ Visitor management and exclusion
  - ☐ Personal protective equipment (PPE) for healthcare personnel
  - ☐ Source control measures for patients (e.g., put facemask on suspect patients)
  - ☐ Requirements for performing aerosol generating procedures
- ☐ Be alert for patients who meet the MERS-CoV case definition (http://www.cdc.gov/coronavirus/mers/case-def.html)
- ☐ Promptly implement source control for potential MERS-CoV patients before transport or upon entry to the facility and triage according to facility plans (e.g., place in private room) for evaluation
- ☐ Know how to report a potential MERS-CoV case or exposure to facility infection control leads and public health officials
- ☐ Know who, when, and how to notify and when to seek evaluation by occupational health following an unprotected exposure (i.e., not wearing recommended PPE) to a suspected or confirmed MERS-CoV patient
- ☐ Know how to contact and receive information from your state or local public health agency
- ☐ Remain at home if you are ill

For more information, visit http://www.cdc.gov/coronavirus/mers/preparedness/checklist-provider-preparedness.html

Centers for Disease Control and Prevention (CDC), July 11, 2013

**Healthcare Facility Preparedness Checklist**

*All U.S. healthcare facilities need to be prepared for new and emerging infectious disease threats such as Middle East Respiratory Syndrome Coronavirus (MERS-CoV). All hospitals should be equipped and ready to care for a limited number of infected patients as part of routine operations and also to potentially care for a larger number of patients in the context of escalating transmission. Facilities should outline plans for administrative, environmental, and communication measures and define the individual work practices that will be required to detect the introduction of MERS-CoV or other emerging infectious diseases, prevent spread, and manage the impact on patients, the facility, and staff.*

*The following checklist highlights some key areas for healthcare facilities to review in preparation for MERS-CoV. The checklist format is not intended to set forth mandatory requirements or establish national standards.*

- ☐ Ensure facility infection control policies are consistent with the Centers for Disease Control and Prevention's MERS-CoV guidance (http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html)
- ☐ Review procedures for rapidly implementing appropriate isolation and infection practices for potential MERS-CoV patients
- ☐ Review policies and procedures for screening and work restrictions for exposed or ill HCP including ensuring that HCP have ready access, including via telephone, to medical consultation
- ☐ Review procedures for laboratory submission of specimens for MERS-CoV testing
- ☐ Review plans for implementation of surge capacity procedures and crisis standards of care
- ☐ Develop plans for visitor restriction if MERS-CoV is circulating in the community
- ☐ Ensure that specific persons have been designated within the facility who are responsible for communication with public health officials and dissemination of information to other HCP at the facility
- ☐ Confirm the local or state health department contact for reporting MERS-CoV cases and confirm reporting requirements
- ☐ Assure ability to implement triage activities based on public health guidance including at the facility and using remote (i.e., phone, internet-based) methods where appropriate to minimize demand on the health care system
- ☐ Ensure that negative-pressure airborne infection isolation rooms are functioning correctly and are appropriately monitored for airflow and exhaust handling
- ☐ Ensure that HCP who will provide patient-care have been medically cleared, fit-tested, and trained for respirator use
- ☐ Provide education and refresher training in the next six weeks to HCP regarding MERS-CoV diagnosis, how to obtain specimen testing, appropriate PPE use, triage procedures including patient placement, HCP sick leave policies, and how and to whom MERS-CoV cases should be reported, procedures to take following unprotected exposures (i.e., not wearing recommended PPE) to suspected MERS-CoV patients at the facility

- ☐ Assess availability of personal protective equipment (PPE) and other infection control supplies (e.g., hand hygiene supplies) that would be used for both healthcare personnel (HCP) protection and source control for infected patients (e.g., facemask on the patient)
- ☐ Have contingency plans if the demand for PPE or other supplies exceeds supply
- ☐ Assess effectiveness of environmental cleaning procedures; provide education/refresher training for cleaning staff (http://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html)
- ☐ Monitor the situation at CDC's MERS website: http://www.cdc.gov/coronavirus/mers/index.html

For more information, visit http://www.cdc.gov/coronavirus/mers/preparedness/checklist-facility-preparedness.html

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