

## **Middle East Respiratory Syndrome Coronavirus (MERS-CoV)**

### **REPORTING INFORMATION**

Although not specifically named in the Ohio Administrative Code, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is considered a Class A disease of major public health concern. It is reportable under 3701-3-03 (16):

“Any unexpected pattern of cases, suspected cases, deaths or increased incidence of any other disease of major public health concern, because of the severity of disease or potential for epidemic spread, which may indicate a newly recognized infectious agent, outbreak, epidemic, related public health hazard or act of bioterrorism.”

**Class A:** Report immediately via telephone the case or suspected case and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report immediately via telephone to the local public health department in which the reporting healthcare provider or laboratory is located.

- Reporting Form(s) and/or Mechanism:
  - *Immediately via telephone*
  - For local health departments, cases should also be entered into the Ohio Disease Reporting System (ODRS) within 24 hours of the initial telephone report to the Ohio Department of Health (ODH) as “Any unexpected...”
  - The Centers for Disease Control and Prevention (CDC) [MERS-CoV Person Under Investigation Form](#) is available for use to assist in local disease investigation. Information collected from the form should be entered into ODRS and not sent to ODH, unless otherwise requested.

### **AGENT**

MERS-CoV is a novel virus, representative of a new yet-to-be established species of Coronaviridae in lineage C of the genus beta-coronavirus. Coronaviruses are a large, diverse group of viruses that affect many animal species. Genetic sequence data indicate that this new virus is similar to bat coronaviruses, but not similar to any other coronavirus previously described in humans, including the coronavirus that caused Severe Acute Respiratory Syndrome (SARS).

### **Case Definition**

#### **Patient under Investigation (PUI)**

A person with the following characteristics:

- Fever ( $\geq 38^{\circ}\text{C}$ ,  $100.4^{\circ}\text{F}$ ) 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 within 14 days before symptom onset; OR
  - Close contact 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; 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 state and local health departments.

### **Confirmed Case**

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

### **Laboratory Criteria for Diagnosis**

Confirmatory laboratory testing requires a positive polymerase chain reaction (PCR) on at least two specific genomic targets or a single positive target with sequencing on a second. CDC has provided ODH Laboratory with the capacity needed to conduct testing for MERS-CoV using real-time reverse transcription-PCR assay. ODH Laboratory has the ability to test clinical respiratory, blood, and stool specimens.

Information about the current criteria for laboratory diagnosis of MERS-CoV is available at <http://www.cdc.gov/coronavirus/mers/case-def.html>.

The Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) on June 5, 2013, to authorize the use of the CDC Novel Coronavirus 2012 Real-time RT-PCR Assay (NCV-2-12 rRT-PCR Assay) to test for MERS-CoV in clinical samples. If infection with MERS-CoV is suspected based on current clinical and epidemiological screening criteria recommended by public health authorities, Please contact (614) 722-7221.

This test is available at ODH lab. It is authorized for use in the following clinical specimens: upper respiratory specimens, such as nasopharyngeal swabs (NPS) and oropharyngeal swabs (OPS); lower respiratory specimens, such as bronchoalveolar lavage (BAL), bronchial wash (BW), tracheal aspirate (TA), and sputum; serum; and stool. To increase the likelihood of detecting MERS Co-V, it is recommended to collect specimens from multiple. Consider lower respiratory tract, serum, and stool specimens a priority for collection and PCR testing. Specimens should be collected with appropriate infection control precautions (<http://www.cdc.gov/coronavirus/mers/downloads/Interim-Guidelines-MERS-Collection-Processing-Transport.pdf> and <http://www.cdc.gov/coronavirus/mers/guidelines-lab-biosafety.html>), following CDC guidance for case investigation and specimen collection and according to the manufacturer's instructions for the specimen collection device. "NEGATIVE" test results will be reported through the CDC Laboratory Response Network (LRN) within 24 hours. When a "PRESUMPTIVE POSITIVE" or "EQUIVOCAL" test result is obtained, CDC must be contacted immediately as per the assay protocol, and the result must also be reported to the LRN within 6 hours. Confirmation of a "PRESUMPTIVE POSITIVE" result by CDC is required, however this should not delay the local investigation and response, including the contact investigation.

### **What does it mean if the specimen tests positive for MERS-CoV?**

A positive test result from the CDC NCV-2012 rRT-PCR Assay indicates that the patient is presumptively infected with MERS-CoV. The test does not indicate the stage of infection.

### **What does it mean if the specimen tests negative for MERS-CoV?**

A very small chance exists that this test can give a negative result that is wrong (false negative), meaning a patient could still have MERS-CoV even though the test is negative. Negative results do not rule out MERS-CoV infection, and should not be used as the sole basis for treatment or other patient management

decisions. The clinical features of the illness and the type and risk of exposure are the keys to making patient management and isolation decisions. A negative CDC NCV-2012 rRT-PCR Assay test result should not be interpreted as demonstrating that the patient does not have MERS-CoV infection. While expected to be very sensitive, there is limited experience testing patient samples and so the actual sensitivity of the test in diagnosing MERS-CoV, and the frequency of false negatives, is not yet known.

### **Case Classification**

**Probable:** A probable case is a PUI with absent or inconclusive laboratory results for MERS-CoV infection who is a close contact of a laboratory-confirmed MERS-CoV case. 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. 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.

**Confirmed:** A confirmed case is a person with laboratory confirmation of MERS-CoV infection. Confirmatory laboratory testing requires a positive PCR on at least two specific genomic targets or a single positive target with sequencing on a second. **Positive test results for another respiratory pathogen should not necessarily preclude testing for MERS-CoV.**

### **Not a Case**

At this time, a case may be excluded as MERS-CoV, if any of the following apply:

- Antibody to MERS-CoV is undetectable in a serum specimen obtained >28 days after onset of illness, OR
- The case was reported on the basis of contact with a person who was excluded subsequently as a case of MERS-CoV disease; then the reported case also is excluded, provided other epidemiologic or laboratory criteria are not present.

### **See also:**

- CDC MERS-CoV laboratory specimen criteria:  
<http://www.cdc.gov/coronavirus/mers/downloads/guidelines-clinical-specimens.pdf>
- CDC MERS-CoV Guidelines for Biosafety:  
<http://www.cdc.gov/coronavirus/mers/guidelines-lab-biosafety.html>

## **SIGNS AND SYMPTOMS**

In general, MERS-CoV begins with a high fever (temperature >100.4°F [>38.0°C]). Other symptoms may include headache, an overall feeling of discomfort and body aches. Most people who got infected with MERS-CoV developed severe acute respiratory illness with symptoms of fever, cough, and shortness of breath. Some people were reported as having a mild respiratory illness.

## **DIAGNOSIS**

Patients who meet the criteria for a PUI should also be evaluated for common causes of community-acquired pneumonia (e.g. influenza A and B viruses, respiratory syncytial virus, *Streptococcus pneumoniae*, and *Legionella pneumophila*). This

evaluation should be based on clinical presentation and epidemiologic and surveillance information.

Testing for MERS-CoV and other respiratory pathogens can be done simultaneously. Positive results for another respiratory pathogen should not necessarily preclude testing for MERS-CoV.

Clinicians should save any available clinical specimens (e.g. sputum, serum) for additional testing until a specific diagnosis is made. For additional laboratory specimen collection information please refer to:

<http://www.odh.ohio.gov/pdf/IDCM/mersspec.pdf>.

Laboratory safety information is available at:

<http://www.cdc.gov/coronavirus/mers/guidelines-lab-biosafety.html>.

In the presence of person-to-person transmission of MERS-CoV anywhere in the world, healthcare providers should ask all people **hospitalized with chest x-ray-confirmed pneumonia** 3 key screening questions:

1. "Do you have a history of recent travel (within 14 days) to Bahrain, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Palestinian territories, Qatar, Kingdom of Saudi Arabia (KSA), Syria, the United Arab Emirates (UAE), or Yemen; or close contact with ill persons with a history of travel to such areas?"
2. "Are you employed as a healthcare worker with direct patient contact or work in a laboratory where exposure to MERS-CoV is possible?"

If the answer to any of the 3 screening questions is "yes," healthcare providers will need to:

1. Institute standard contact and airborne precautions.
2. Notify the local health department.
3. Consider MERS-CoV testing.

## **EPIDEMIOLGY**

### **Source**

As of May 9, 2014, 536 laboratory-confirmed cases of human infection with Middle East respiratory syndrome coronavirus (MERS-CoV) have been reported to WHO, including 145 deaths. To date, reporting countries in the Middle East include Jordan, Kuwait, Oman, Qatar, KSA and the UAE; in Europe: France, Germany, Greece, Italy and the United Kingdom (UK); in North Africa: Tunisia; in Asia: Malaysia and the Philippines; and in North America: United States.

The occurrence of new cases seems to follow a seasonal pattern, with increasing incidence from March-April onwards. The number of cases sharply increased since mid-March 2014, essentially in KSA and UAE, where two important healthcare-associated outbreaks are occurring.

As much as 75% of the recently reported cases appear to be secondary cases, meaning that they are considered to have acquired the infection from another infected person. The majority of these secondary cases are mainly healthcare workers who have been infected within the healthcare setting, although several patients who were in the hospital for other reasons are also considered to have been infected with MERS-CoV in the hospital. The majority of the infected

healthcare workers presented with no or minor symptoms. Only four instances of transmission within households have been reported, and no large family cluster has been identified. When human-to-human transmission occurred, transmission was not sustained, and to date only two possible tertiary cases have been reported.

The number of cases who acquired the infection in the community has also increased since mid-March. These cases have no reported contacts with other laboratory confirmed cases, and some have reported contacts with animals. Recent studies support the premise that camels serve as the primary source of the MERS-CoV infecting humans and that other livestock are not involved. Although camels are suspected to be the primary source of infection for humans, the exact routes of direct or indirect exposure remain unknown.. Investigations to identify the source of infection and routes of exposure are still ongoing.

### **Occurrence**

The continued reporting of new cases indicates that there is an ongoing risk for transmission to humans in the area of the Arabian Peninsula. New reports of cases outside the region raise concerns about importation to other geographic areas. Nosocomial outbreaks with transmission to healthcare personnel highlight the importance of infection control procedures. Recent data suggest that mild respiratory illness might be part of the clinical spectrum of MERS-CoV infection, and presentations might not initially include respiratory symptoms. In addition, patients with comorbidities or immunosuppression might be at increased risk for infection, severe disease, or both.

### **Mode of Transmission**

The majority of the cases now reported have likely acquired infection through human-to-human transmission and only about a quarter are considered as primary cases, which suggests slightly more human-to-human transmission than previously observed. One hypothesis is that the transmission pattern and transmissibility have not changed and that the occurrence of two large nosocomial outbreaks reflects inadequate infection prevention and control measures, coupled with intensive contact tracing and screening. Several elements would support this hypothesis: i) the clinical picture appears to be similar to what was observed earlier; secondary cases tend to present with a milder disease than that of primary cases; however, we note that many secondary cases have been reported as asymptomatic; ii) only 2 possible tertiary cases have been reported; iii) the recent exported cases did not transmit further; iv) screening of contacts revealed very few instances of household transmission; and v) no increase in the size or number of household or community clusters has been observed. An alternative hypothesis is that transmissibility of the virus has increased and is resulting in more human-to-human transmission as the basis for the recent upswing in cases. It is possible that current levels of surveillance are missing cases of mild infection within the community. At this point, there is insufficient information on the recent cases to definitively exclude these hypotheses.

### **Period of Communicability**

Patients can shed the virus after resolution of symptoms, but the duration of infectivity is unknown. Patients are not contagious during the incubation period. Asymptomatic cases might not be contagious.

### Incubation Period

As a result of investigations, incubation periods for MERS-CoV may range from 2 to 14 days (median 5 days).

## PUBLIC HEALTH MANAGEMENT

### Case

#### Investigation

Obtain information about the patient's occupation, history of travel outside the United States, contact with suspected or confirmed MERS-CoV case or close contact with an ill individual who traveled to a MERS-affected area within 14 days of illness onset. Use the [\(CDC\) MERS-CoV Person Under Investigation Form](#). Please fax to ODH, and ODH will fax to CDC.

#### Treatment

No specific recommendations can be made at this time. There is no specific treatment for MERS-CoV infection; care is supportive.

#### Isolation

CDC recommends isolation of all persons known or suspected as having MERS-CoV and persons exhibiting symptoms of respiratory illness clinically consistent with MERS-CoV who have also been identified as having close contact to a known or suspect MERS-CoV case. CDC has provided the following details about patient placement, personal protective equipment and environmental infection control.

Component	Recommendation(s)	Comments
<b>Patient placement</b>	Airborne Infection Isolation Room (AIIR)	<p>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.</p> <p>Once in an AIIR, the patient's facemask may be removed; the facemask should remain on if the patient is not in an AIIR.</p> <p>When outside of the AIIR, patients should wear a facemask to contain secretions</p> <p>Limit transport and movement of the patient outside of the AIIR to medically-essential purposes.</p>

		Implement staffing policies to minimize the number of personnel that must enter the room.
<b>Personal Protective Equipment (PPE) for Healthcare personnel (HCP)</b>	<ul style="list-style-type: none"> <li>• Gloves</li> <li>• Gowns</li> <li>• Eye protection (goggles or face shield)</li> <li>• Respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering facepiece respirator.</li> </ul> <p>If a respirator is unavailable, a facemask should be worn. In this situation respirators should be made available as quickly as possible.</p>	<p>Recommended PPE should be worn by HCP upon entry into patient rooms or care areas.</p> <p>Upon exit from the patient room or care area, PPE should be removed and either</p> <ul style="list-style-type: none"> <li>• Discarded, OR</li> <li>• For re-useable PPE, cleaned and disinfected according to the manufacturer's reprocessing instructions</li> </ul>
<b>Environmental Infection Control</b>	<p>Follow standard procedures, per hospital policy and manufacturers' instructions, for cleaning and/or disinfection of:</p> <ul style="list-style-type: none"> <li>• Environmental surfaces and equipment</li> <li>• Textiles and laundry</li> <li>• Food utensils and dishware</li> </ul>	

Ill people who are being evaluated for MERS-CoV infection and do not require hospitalization for medical reasons may be cared for and isolated in their home. Isolation is defined as the separation or restriction of activities of an ill person with a contagious disease from those who are well.

Specific Guidance for home care and isolation may be found at:  
<http://www.cdc.gov/coronavirus/mers/hcp/home-care.html>

In addition to CDC guidelines above, the World Health Organization (WHO) has added droplet precautions. WHO notes, it is not always possible to identify patients with MERS-CoV early because some have mild or unusual symptoms. For this reason, it is important that health-care workers apply standard precautions consistently with all patients – regardless of their diagnosis – in all work practices all the time.

Droplet precautions should be added to the standard precautions when providing care to all patients with symptoms of acute respiratory infection. Contact precautions and eye protection should be added when caring for probable or confirmed cases of MERS-CoV infection. Airborne precautions should be applied when performing aerosol generating procedures.

Reference: [http://www.who.int/csr/don/2014\\_05\\_05\\_mers/en/](http://www.who.int/csr/don/2014_05_05_mers/en/)

## **Contacts**

### Investigation

CDC does not recommend the quarantine of asymptomatic individuals who have had exposure to MERS-CoV; however, asymptomatic contacts are advised to monitor their health for at least 14 days after the last possible contact with an infected person. They should immediately seek medical attention if they develop symptoms such as fever, respiratory symptoms (including coughing and shortness of breath), or diarrhoea.

Persons who may have been exposed to MERS-CoV should be vigilant for fever (i.e. measure temperature twice daily) and respiratory symptoms over the 14 days following exposure. During this time, in the absence of both fever and respiratory symptoms, persons who may have been exposed to MERS-CoV patients need not limit their activities outside the home and should not be excluded from work, school, out-of-home child care, church or other public areas.

Exposed persons should notify their healthcare provider immediately if fever or respiratory symptoms develop. Exposed persons should also notify their healthcare provider when they will be arriving at the healthcare facility for evaluation so arrangements can be made to prevent any possible transmission of MERS-CoV to individuals in the healthcare setting.

Symptomatic persons exposed to MERS-CoV should follow the following infection control precautions:

- If fever or respiratory symptoms develop, the person should limit interactions outside the home and not go to work, school, out-of-home child care, church or other public areas. In addition, the person should use infection control precautions in the home to minimize the risk for transmission, and he/she should continue to measure his/her temperature twice daily.
- If symptoms improve or resolve within 72 hours after first symptom onset, the person may be allowed, after consultation with local public health authorities, to return to work, school, out-of-home child care, church or other public areas and infection control precautions can be discontinued.
- For persons who meet or progress to meet the case definition for suspected MERS-CoV (i.e. develop fever and respiratory symptoms), infection control precautions should be continued until 14 days after the resolution of fever, provided respiratory symptoms are absent or improving.

- If the illness does not progress to meet the case definition, but the individual has persistent fever or unresolving respiratory symptoms, infection control precautions should be continued for an additional 72 hours, at the end of which time a clinical evaluation should be performed. If the illness progresses to meet the case definition, infection control precautions should be continued as described above. If case definition criteria are not met, infection control precautions can be discontinued after consultation with local public health authorities and the evaluating clinician. Factors that might be considered include the nature of the potential exposure to MERS, the nature of contact with others in the residential or work setting and any evidence for an alternative diagnosis.

### **Additional Resources**

CDC guidelines for health departments. Available at:  
<http://www.cdc.gov/coronavirus/mers/health-departments.html>.

CDC Interim Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Available at: <http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html>.

United States Food and Drug Administration. (2013). Fact Sheet for Health Care Professionals: Interpreting CDC Novel Coronavirus 2012 Real-time RT-PCR Assay Test Results. Available at:  
<http://www.fda.gov/MedicalDevices/Safety/EmergencySituations/ucm355530.htm>.

WHO guidelines for investigation of cases of human infection with Middle East Respiratory Syndrome Coronavirus (MERS-CoV). (July 2013). Available at:  
[http://www.who.int/csr/disease/coronavirus\\_infections/MERS\\_CoV\\_investigation\\_guideline\\_Jul13.pdf](http://www.who.int/csr/disease/coronavirus_infections/MERS_CoV_investigation_guideline_Jul13.pdf).

**Q: What is MERS?**

**A:** Middle East Respiratory Syndrome (MERS) is a viral respiratory illness that is caused by a [coronavirus](#) called "Middle East Respiratory Syndrome Coronavirus" (MERS-CoV).

**Q: What is MERS-CoV?**

**A:** MERS-CoV is a beta [coronavirus](#). It was first reported in 2012 in Saudi Arabia. MERS-CoV used to be called "novel coronavirus," or "nCoV".

**Q: Is MERS-CoV the same as the SARS virus?**

**A:** No, MERS-CoV is different from other coronaviruses that have been found to infect people. It is not the same coronavirus that caused SARS in 2003. However, like SARS, MERS-CoV has caused severe acute respiratory illness and pneumonia in many reported cases. CDC is still learning about MERS.

**Q: What are the symptoms of MERS?**

**A:** Most people who got infected with MERS-CoV developed severe acute respiratory illness with symptoms of fever, cough, and shortness of breath. About one-third of them died. Some people were reported as having a mild respiratory illness.

**Q: Does MERS-CoV spread from person to person?**

**A:** MERS-CoV has been shown to spread between people who are in close contact. Transmission from infected patients to healthcare personnel has also been observed. Clusters of household cases in several countries are being investigated.

**Q: Has anyone in the United States gotten infected?**

**A:** So far, there have been two reports of United States citizens getting infected with MERS-CoV.

**Q: Can I still travel to countries in the Arabian Peninsula or neighboring countries where MERS-CoV cases have occurred?**

**A:** Yes. CDC does not recommend that anyone change their travel plans because of MERS. The current CDC travel notice is a Watch (Level 1) which advises travelers to countries in or near the Arabian Peninsula to follow standard precautions, such as hand washing and avoiding contact with people who are ill.

For the most current CDC information, see CDC's travel notice: A Novel Coronavirus Called "MERS-CoV" in the Arabian Peninsula.

**Q: What if I recently traveled to countries in the Arabian Peninsula or neighboring countries and got sick?**

**A:** If you develop a fever and symptoms of lower respiratory illness, such as cough or shortness of breath, within 14 days after traveling from countries in the Arabian Peninsula or neighboring countries, you should see your healthcare provider and mention your recent travel. Countries in the Arabian Peninsula include Bahrain, Iran, Iraq, Jorda, Kuwait, Lebanon, Palestinian territories, Oman, Qatar, KSA, Syria, UAE, and Yemen.

**Q: How can I help protect myself?**

**A:** ODH advises that people follow these tips to help prevent respiratory illnesses:

- Wash your hands often with soap and water for 20 seconds, and help young children do the same. If soap and water are not available, use an alcohol-based hand sanitizer.
- Cover your nose and mouth with a tissue when you cough or sneeze then throw the tissue in the trash.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Avoid close contact, such as kissing, sharing cups, or sharing eating utensils, with sick people.
- Clean and disinfect frequently touched surfaces, such as toys and doorknobs.

**Q: Is there a vaccine?**

**A:** No, but CDC is discussing with partners the possibility of developing one.

**Q: What are the treatments?**

**A:** There are no specific treatments for illnesses caused by MERS-CoV. Medical care is supportive and to help relieve symptoms.

**Q: Is there a lab test?**

**A:** Lab tests (polymerase chain reaction or PCR) for MERS-CoV are available at ODH Lab, CDC, and some international labs. Otherwise, MERS-CoV tests are not routinely available. There are a limited number of commercial tests available, but these are not FDA-approved.

**Q: What should healthcare providers and health departments do?**

**A:** For recommendations and guidance on the case definitions; infection control, including personal protective equipment guidance; case investigation; and specimen collection and shipment, see [Interim Guidance for Health Professionals](#).

**GLOBAL MERS-CoV OUTBREAK, 2012-2014**

**Q: How many people contracted MERS-CoV worldwide from its recognition in 2012 through May 9, 2014 outbreak? How many people died of MERS-CoV worldwide?**

- A:** As of May 9, 2014, 536 laboratory-confirmed cases of human infection with Middle East respiratory syndrome coronavirus (MERS-CoV) have been reported to WHO, including 145 deaths).
- Reported illness onsets were between April 2012 and May 9, 2014. The majority (96%) of the cases resided in or recently traveled from Saudi Arabia, UAE, Qatar, Oman, Kuwait or Jordan.

**Q: How many people in the United States have contracted MERS-CoV? How many people died of MERS-CoV in the United States?**

**A:** Nationally, from September 2012 to May 12, 2014, CDC has been informed of a total of 2 laboratory-confirmed cases of infection with MERS-CoV in the United States. No deaths have been reported in the United States.