

Update August 2014 - Questions & Answers on Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

What is MERS-CoV?

MERS-CoV is a coronavirus (CoV) which causes Middle East Respiratory Syndrome (MERS), a severe respiratory disease, in humans. It was identified in humans in April 2012.

Sporadic human cases of MERS have occurred and continue to occur over a wide geographical distribution with the majority of cases reported from the Arabian Peninsula. Infections in dromedary camels also have been detected in a wide geographic distribution and appear to be widespread in some countries. Some human MERS cases are thought to be related to zoonotic transmission (transmission from animals to humans). In other cases human infections are either linked to health care settings or are unexplained. There is no evidence of sustained human to human transmission in the community but the clusters that have occurred in health care settings and households demonstrate that human to human transmission is possible.

So far, three patterns of infection have been reported by the World Health Organization (WHO):

1. community acquired cases (the exposure sources remain unknown and are believed to include direct or indirect contact with animals, especially camels, or environmental source)
2. hospital acquired infections
3. infections acquired through close human to human contact (household).

MERS-CoV and antibodies to MERS-CoV have been detected in samples taken from camels. To date, MERS-CoV has only been isolated from dromedary camels* and humans, but the exact relationship between MERS-CoV infections in humans and animals remains unclear.

What are coronaviruses?

Coronaviruses are a family of RNA (ribonucleic acid) viruses. They are called coronaviruses because under an electron microscope the virus particle exhibits a characteristic 'corona'(crown) of spike proteins around its lipid envelope. Coronavirus infections are common in animals and humans, and there is a history of coronaviruses crossing species and adapting to new hosts. There are many species and strains of coronavirus which have different characteristics, causing a range of clinical signs – from mild to severe disease – in humans and in different animal species.

MERS-CoV is genetically and biologically distinct from other known coronaviruses, e.g. the coronavirus causing Severe Acute Respiratory Syndrome (SARS) in humans.

Why the concern?

MERS-CoV is considered by the WHO to be a serious public health threat to humans, because:

1. the infection can cause severe disease in humans
2. infection appears to be widespread in dromedary camels
3. coronaviruses may adapt to new hosts, and then become more easily transmittable between humans

For these reasons, it is important to prevent introduction of these viruses into the human population.

What is the source of MERS-CoV?

MERS-CoV is thought to have an origin in animals. Evidence suggests that MERS-CoV has adapted to camels and that camels are a host for the virus. However, not all community acquired cases of MERS-CoV had reported prior animal contact and it is unclear how these persons were infected. Therefore, investigations of human cases of MERS-CoV infection should continue to include gathering of information about potential sources of exposure, including other humans, camels (including certain raw products, such as raw milk and meat and secretions/excretions), other domestic and wild animals, as well as the environment, food and water.

The OIE together with its partner organisations, the WHO, the Food and Agriculture Organization of the United Nations (FAO) and national animal health authorities of affected countries is closely following investigations which aim to better understand the epidemiological aspects of the disease, including its transmission and the potential relationship between human and animal infections with MERS-CoV.

Are animals responsible for MERS-CoV infections in people?

MERS-CoV has been isolated from humans and camels and recent studies suggest that camels are a source of human infections. Nevertheless, the exact relationship between MERS-CoV infections in camels and humans remains unclear. Joint human health and animal health investigations are needed to establish the source for human infections with MERS-CoV when not acquired from another human.

There remains the possibility that other animal species may be involved in the maintenance and transmission of MERS-CoV.

What is known about MERS-CoV in camels?

Between November 2013 and July 2014, Qatar, Oman and Kuwait have met their obligations to OIE by reporting that MERS-CoV has been identified in camels.

Other published studies have indicated that MERS-CoV and genetic material from MERS-CoV have been identified in camels in countries in the Middle East and North Africa; antibodies to MERS-CoV or a very similar virus have been identified in samples taken from camels in the Middle East and Africa. Similar strains of MERS-CoV have been identified in samples taken from camels and humans in the same locality and in some cases there has been an association between infections in humans and camels.

Serological studies suggest that antibodies to MERS-CoV have been detected with a prevalence range of 0-100% (varying within countries and between countries) in populations of camels in Middle East and African countries. This range of prevalence indicates the need to assess risk factors for infection between and within herds.

Infections with MERS-CoV have sometimes been associated with mild respiratory signs in camels, but this needs further investigation. Significant morbidity or mortality of unknown etiology should be investigated.

Evidence from MERS-CoV infections in camels suggests that infection has resulted in virus shedding for a limited period. The possibility for reinfection of camels cannot at this stage be excluded since immunity to infection is poorly understood. MERS-CoV has been identified in camels which have antibodies against the virus. The implications of these findings for management and control recommendations need further investigation. .

To develop a more complete understanding of the potential role of camels (and other animals) in the epidemiology of MERS several types of investigation are needed:

- Comparative epidemiological studies, in all countries with significant camel populations, to determine the prevalence, distribution, and demographics of MERS-CoV infections in camels
- Studies to characterise the clinical and pathological effects and kinetics of virus shedding and immune response to MERS-CoV in experimentally and naturally infected camels
- Studies to assess risk factors and potential sources for camel infection and the relationship between camel infections and human cases of MERS
- Studies to assess the potential effectiveness of intervention measures aimed at reducing public health risk
- To conduct genetic analyses of both MERS-CoV and infected hosts from different geographical areas to gain better understanding of the properties of MERS-CoV and to monitor evolution of the virus
- To further assess diagnostic tests used for MERS-CoV surveillance in camels (and other animals) for the reliability of their results in these species.

OIE together with WHO and FAO reiterate the importance of the public health sector and the animal health sector working together to share data and design studies to develop a better understanding of the overall epidemiology of MERS.

Are other animal species involved?

Although genetically related viruses have already been detected in bat species around the world, and a fragment of viral genetic material matching the MERS-CoV was found in one bat from Saudi Arabia, current evidence does not indicate a direct link between bats and MERS-CoV in humans. More evidence is needed to directly link the MERS-CoV to bats or other animal species.

According to published literature other species of animals (including sheep, goats, cattle, water buffalo and wild birds) have tested negative for the presence of antibodies to MERS-CoV. However owing to the relatively small sample sizes the results of these studies cannot exclude infection in other animal species. Based on receptor studies other animal species have been identified as potential hosts.

In countries where MERS-CoV is present, studies to assess the presence of MERS-CoV in wild and other domestic species should be conducted to detect possible infection in other hosts.

It is important to remain open minded about all potential sources of exposure for humans and camels until more information is available.

How can camels and other animals be tested for MERS-CoV infection or previous exposure?

Serological tests detect antibodies produced by the host against the virus but do not detect the virus itself. Depending on the test that is used, the presence of antibodies may indicate previous exposure to MERS-CoV or a similar virus. Virus neutralisation is the most specific assay.

PCR (molecular) tests detect genetic material of the virus. Genome sequencing of the virus (parts of, or full genome) is the best way to confirm that the genetic material belongs to a MERS-CoV. Genetic data also provide important information about the evolution of the virus and how closely related MERS-CoV isolates are.

It is important that diagnostic tests used to detect MERS-CoV in animals are assessed for reliability of results when used in different animal species and when reported to the OIE.

Specific confirmatory molecular and serology diagnostic tests are now available for MERS-CoV. Positive results from screening tests should be confirmed using a confirmatory test. Processing of samples and laboratory testing should be conducted under appropriate biorisk management conditions.

What action should be taken when an animal is confirmed to be positive for MERS-CoV?

Infection by MERS-CoV in animals is confirmed by a positive detection of the virus or genetic material belonging to the virus in a sample taken from an animal.

OIE Member Countries are obliged to report a confirmed case of MERS-CoV in animals to the OIE, as an “*emerging disease*” with zoonotic potential in accordance with [article 1.1.3](#) of the

OIE *Terrestrial Animal Health Code*. If MERS-CoV is identified in an animal this would not necessarily mean that the animal is a source of human infection. Detailed investigations are needed to understand the relationship between any animal cases and human cases, and whether a finding in animals would be significant for human infection.

Given the current situation there is no evidence to support the implementation of specific animal health measures following the detection of MERS-CoV in animals or herds. When MERS-CoV is identified in an animal or herd, precautionary public health measures should be implemented to reduce the risk of human infection in accordance with WHO's guidance on the WHO website. OIE will regularly review its guidance based on the latest scientific information.

Is a vaccine or treatment currently available for MERS-CoV in animals?

There are no vaccines or treatments available for MERS-CoV in animals. Further research is needed to assess the likely effectiveness of intervention measures.

What is OIE doing?

OIE is working closely with its partner organisations FAO and WHO to collate and share data to gain a better understanding about the disease situation in animals and to assess implications for animal and human health.

OIE has consulted its *Ad Hoc Group on MERS-CoV Infections in Animals* and the *Ad Hoc Group on Camelid diseases* to provide advice on the latest scientific information and to provide recommendations and guidance, including on priority research activities for the animal health sector.

The OIE is also working closely with its Member Countries to provide technical support and to encourage reporting of MERS-CoV detections in animals.

OIE develops and publishes international standards and guidelines on the prevention, control and surveillance of animal diseases including zoonoses (animal diseases transmissible to humans). These science-based standards provide guidance on the best control measures which should be applied, where appropriate, to allow control of infection in the identified animal source.

The OIE is the reference organisation for international standards relating to animal health and zoonoses under the World Trade Organization Sanitary and Phytosanitary Agreement (SPS Agreement). Decisions related to safe trade in terrestrial animals and animal products must respect the standards, recommendations and guidelines found in the [OIE Terrestrial Animal Health Code](#).

For further information about public health implications visit the [WHO website](#).

*In this text 'camel(s)' refers to 'dromedary camel(s)'.