



**REPORT OF THE MEETING OF THE OIE AD HOC GROUP
ON MIDDLE EAST RESPIRATORY SYNDROME CORONAVIRUS (MERS-CoV)¹**

Paris, 22-24 January 2019

The meeting of the OIE *ad hoc* Group on Middle East Respiratory Syndrome Coronavirus (hereafter referred to as the Group) was held at the OIE Headquarters in Paris from 22 to 24 January 2019.

1. Opening, adoption of agenda and appointment of chairperson and rapporteur

Dr Matthew Stone, Deputy Director General of the OIE for International Standards and Science, welcomed the Group and thanked them for their participation in this meeting. He noted that the Group had been convened following a recommendation from Biological Standards Commission to draft a chapter in the OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* on MERS-CoV and emphasised that the purpose of the *Terrestrial Manual* chapter is to provide internationally agreed diagnostic laboratory methods to contribute to the improvement of animal health services world-wide.

Dr Stone explained that the OIE 6th Strategic Plan 2016-2020 emphasises the importance of scientific excellence as a basis for the development of OIE international standards, and the One Health approach through the Tripartite collaborations with FAO and WHO for controlling the risks at the human-animal-environment interface. He referred to the WHO Eastern Mediterranean Regional Office publication of MERS-CoV situation update (December 2018) which reported that 12 countries in the Middle Eastern Region have reported laboratory-confirmed MERS-CoV cases in humans.

In concluding, Dr Stone emphasised that the members of the Group were nominated by the Director General of the OIE according to their internationally recognised expertise and geographically balanced representation, but they were not representing their own countries or institutions in the meeting. He noted that all members of the Group were asked to declare any actual or potential conflict of interest and to respect the confidentiality of the process.

Dr Mehdi El Harrak was appointed as the Chairperson and Dr William Karesh as Rapporteur of the meeting. The draft agenda was adopted by the Group.

The Terms of Reference and agenda and list of participants are presented as Appendices I, II and III, respectively of this report.

2. Update on the MERS-CoV situation in humans and dromedary camels

The representative from the WHO Eastern Mediterranean Regional Office, Egypt gave an overview of the current situation of MERS-CoV in humans. At the end of December 2018, a total of 2279 laboratory-confirmed cases of MERS-CoV in humans were reported globally. Dr Malik noted that dromedary camels are considered to be the natural host of MERS-CoV with repeated sporadic introductions into the human populations in the Arabian Peninsula. He showed the current geographic range of countries that have reported MERS-CoV in dromedary camels, countries with documented spill-over of dromedary camel-to-human transmission with subsequent human-to-human transmission and countries with reported human-to-human transmission.

¹ Note: This ad hoc Group report reflects the views of its members and may not necessarily reflect the views of the OIE. This report should be read in conjunction with the February 2019 report of the Biological Standards Commission because this report provides its considerations and comments. It is available at: <http://www.oie.int/en/international-standard-setting/specialists-commissions-groups/laboratories-commission-reports/meetings-reports/>

The expert from the Abu Dhabi Food Control Authority, Abu Dhabi, UAE gave a presentation on MERS-CoV situation in dromedary camels. MERS CoV remains primarily an infection of dromedary camels and the viral RNA have been detected in respiratory specimens, feces and milk collected from dromedary camels. He noted that there were at least eight occasions in which scientific evidence of zoonotic transmission of MERS-CoV from dromedary camels to humans occurred. He highlighted several challenges faced by veterinary diagnostic laboratories, including the lack of a standard testing algorithm for animal MERS-CoV testing, lack of standard diagnostic materials and quality assurance procedures, lack of a clear understanding of viral kinetics in animals, and lack of available MERS-CoV diagnostic kits that are validated for use in dromedary camels.

The expert from Saudi Arabia presented data from two field studies on MERS-CoV surveillance in dromedary camels in Saudi Arabia. The study indicated the prevalence of MERS-CoV infection among dromedary camels in livestock markets and slaughterhouses, especially in young age animals and during winter months. Genomic analysis indicated genetic similarity between viruses isolated from dromedary camels and humans.

The expert from the Erasmus Medical Centre reported the work with recombinant protein vaccine and modified vaccinia virus Ankara (MVA) vaccine in Llamas and dromedary camels respectively. He mentioned that these platform technologies can be used to prepare vaccines for humans and dromedary camels.

3. Update of case definition for reporting MERS-CoV infection in dromedary camels to OIE

The Group reviewed and amended the case definition for reporting MERS-CoV infection in dromedary camels to OIE drafted in May 2017. The Group agreed that only RT-PCR or antigen positive laboratory confirmed cases should be notifiable to the OIE as an emerging disease and “suspected cases” do not need to be reported to the OIE. Nevertheless, the Group asked to highlight the critical importance of investigating the suspected cases in the case definition for the purpose of surveillance within a country.

Since the virus is widely circulating in some populations of dromedary camels resulting in high antibody prevalence, serological evidence is not useful for determination of active infection or for purpose of definition of case confirmation.

The Group also discussed whether MERS-CoV is still an “emerging disease” as it has become established since 2012 in many dromedary camel-raising countries. Nevertheless, it was concluded that MERS-CoV would still be considered an emerging disease for the reason that MERS-CoV detection is expanding geographically and remaining uncertainty regarding the epidemiological factors involved in the transmission from dromedary camels to humans.

The amended case definition is presented as [Appendix IV](#).

4. Proposal to develop a preliminary draft chapter in the OIE *Terrestrial Animal Health Code*

The Group offered to develop a draft chapter of the *Terrestrial Animal Health Code (Terrestrial Code)* for consideration if a decision is made for MERS-CoV to be included in the OIE listed diseases. The objective of preparing a concise *Terrestrial Code* chapter for Infection with MERS-CoV would be to provide Member Countries with recommendations on surveillance and guidance for facilitating safe trade of dromedary camels and their products. This guidance could serve the interests of Veterinary Services and dromedary camel owners whose animals are assembled for sales, shows, races and milk production. It was noted the chapter should highlight that the surveillance in dromedary camels is essential for prevention and control of human disease.

The Group recommended that the case definition for MERS-CoV in dromedary camels (Appendix IV) be presented to the Scientific Commission on Animal Diseases providing the scientific rationale for listing “Infection with MERS-CoV in dromedary camels” as a notifiable disease. The Group noted that the purpose of timely and consistent notification to the OIE is to support Member Countries by providing information needed to take appropriate action to prevent the transboundary spread of animal diseases, including zoonoses.

The Group expressed their concern that Member Countries may implement unjustified trade barriers as a consequence of notification and highlighted that Member Countries should not impose bans on the trade of dromedary camels or their products in response to such a notification, or other information shared on the presence of MERS-CoV, unless supported by an import risk assessment.

5. Assessment of whether MERS-CoV infection in dromedary camels should be included in the OIE listed diseases.

Dr Gregorio Torres, the Acting Head of the Science Department explained the criteria for inclusion of diseases, infections and infestations on the OIE list and the rationale for doing so. The Group assessed the MERS-CoV infection in dromedary camels according to the criteria provided in the Article 1.2.2 of the *Terrestrial Code* based on the recent published scientific data.

1) *International spread of the agent (via live animals or their products, vectors or fomites) has been proven*

The Group concluded that based on currently available field studies and genetic analyses, there is strong scientific evidence for international spread of MERS-CoV through live dromedary camels^{2,3}.

AND

2) *At least one country has demonstrated freedom or impending freedom from the disease, infection or infestation in populations of susceptible animals, based on the animal health surveillance provisions of the Terrestrial Code, in particular those contained in Chapter 1.4*

The Group noted that currently MERS-CoV is not included in the OIE listed diseases and therefore no country had yet self-declared freedom from MERS-CoV from animal populations according to Chapter 1.6 of the *Terrestrial Code*. However, it was recognised that some countries are able to demonstrate freedom from their camel populations. The Group noted the demonstration of absence of MERS-CoV antibodies in feral dromedary camels in Australia⁴ and lack of published evidence of natural infections of camelids in the Americas.

AND

3) *A reliable means of detection and diagnosis exists and a precise case definition is available to clearly identify cases and allow them to be distinguished from other diseases, infections and infestations*

The Group observed that although there are no specific clinical signs in dromedary camels, accurate molecular and serological diagnostic techniques are available to detect past and current infections of MERS-CoV in dromedary camels.

AND

4a) *Natural transmission to human has been proven, and human infection is associated with severe consequences*

The Group agreed that evidence from published epidemiologic studies and outbreak investigations has shown that natural transmission of MERS-CoV from dromedary camels to humans has occurred, and that MERS-CoV has been demonstrated to cause severe disease in humans⁵.

² AL HAMMADI, Z.M., CHU D.K., ELTAHIR, Y.M., AL HOSANI F., AL MULLA, M., TARNINI W., HALL, A.J., PERERA, R.A., ABDELKHALEK M.M., PEIRIS J.S., AL MUHAIRI S.S., POON L.L. Asymptomatic MERS-CoV Infection in Humans Possibly Linked to Infected Dromedaries Imported from Oman to United Arab Emirates, May 2015. *Emerg Infect Dis*. 2015 Dec;21(12):2197-200. doi: 10.3201/eid2112.151132. <https://www.ncbi.nlm.nih.gov/pubmed/26584223>

³ YUSOF M.F., ELTAHIR Y.M., SERHAN W.S., HASHEM F.M., ELSAYED E.A., MARZOUQ B.A., ABDELAZIM A.S., BENSALAH O.K. & AL MUHAIRI S.S. Prevalence of Middle East respiratory syndrome coronavirus (MERS-CoV) in dromedary camels in Abu Dhabi Emirate, United Arab Emirates. *Virus Genes*. 2015 Jun;50(3):509-13. doi: 10.1007/s11262-015-1174-0. Epub 2015 Feb 5. <https://www.ncbi.nlm.nih.gov/pubmed/25653016>

⁴ CRAMERI G., DURR P.A., BARR J., YU M., GRAHAM K., WILLIAMS O.J., KAYALI G., SMITH D., PEIRIS M., MACKENZIE J.S. & LIN-FA WANG L.-F. Absence of MERS-CoV antibodies in feral Camels in Australia: Implications for the pathogen's origin and spread. *One Health*. 2015 Nov 2;1:76-82. doi: 10.1016/j.onehlt.2015.10.003. eCollection 2015 Dec. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5441328/>

⁵ CONZADE R., GRANT R., MALIK M.R. ELKHOLY A., ELHAKIM M., SAMHOURI D., EMBAREK P.K.B & VAN KERKHOVE M.D. Reported direct and indirect contact with dromedary camels among laboratory-confirmed MERS-CoV cases. *Viruses*. 2018 Aug; 10(8): 425. Published online 2018 Aug 13. doi: [10.3390/v10080425](https://doi.org/10.3390/v10080425) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6115845/>

OR

- 4b) *The disease has been shown to cause significant morbidity or mortality in domestic animals at the level of a country or zone*

The Group agreed that significant morbidity or mortality in domestic animals had not been attributed to MERS-CoV infection.

OR

- 4c) *The disease has been shown to, or scientific evidence indicates that it would, cause significant morbidity or mortality in wild animal populations*

The Group noted that significant morbidity and mortality in wild animals had not been attributed to MERS-CoV infection.

In conclusion, the Group arrived at the consensus that infection with MERS-CoV in dromedary camels meets criteria 1,2,3 and 4a and therefore it should be considered for inclusion as an OIE listed disease. An important consideration is that, although MERS-CoV infection in dromedary camels poses a relatively minimal threat to the health of infected animals, MERS-CoV presents a significant public health impact, especially for people in close direct and indirect contact with dromedary camels. The significant public health impact and the role of dromedary camels as a potential source of primary infections in people, necessitates rigorous control measures to minimise the risk of this route of transmission.

6. Drafting a chapter in the OIE *Terrestrial Manual* on infection with MERS-CoV in dromedary camels.

The Group was provided the standardised template to draft a new chapter in the OIE *Terrestrial Manual*. The chapter will set laboratory standards and provide validated procedures that reflect international consensus to be used for MERS-CoV confirmatory diagnosis in animals.

As a first step, the Group worked on and finalised the critical table that provides test methods available and their purpose for MERS-CoV.

Test methods available for the diagnosis of MERS and their purpose

Method	Purpose					
	Population freedom from infection	Individual animal freedom from infection prior to movement	Contribute to eradication policies	Confirmation of clinical cases	Prevalence of infection – surveillance	Immune status in individual animals or populations post-vaccination
Agent identification						
Real-time RT-PCR	-	+++	+	+++	+++	-
Antigen detection	-	+	+	++	++	-
Virus isolation and identification	-	+	-	+++	-	-
Detection of immune response						
IgG indirect and competitive ELISAs	++	-	++	-	++	+
Pseudo-particle neutralisation assay	+	-	+	-	+	+++

Method	Purpose					
	Population freedom from infection	Individual animal freedom from infection prior to movement	Contribute to eradication policies	Confirmation of clinical cases	Prevalence of infection – surveillance	Immune status in individual animals or populations post-vaccination
Plaque reduction assay	+	-	+	-	+	+++
VN	+	-	+	-	+	+++

Key: +++ = recommended for this purpose; ++ = recommended but has limitations; + = suitable in very limited circumstances; – = not appropriate for this purpose; RT-PCR = reverse-transcription polymerase chain reaction; ELISA = enzyme-linked immunosorbent assay; VN = virus neutralisation.

The Group could not finalise the full draft *Terrestrial Manual* chapter elaborating all the above diagnostic tests during the 3-day meeting and agreed to share the responsibility to write it after the meeting. The Group descriptions of the various diagnostic tests listed in the table will be sent to the OIE Secretariat. The OIE Secretariat will collate all the sections and circulate the full draft chapter to the experts for their further review and comments.

For the section on requirements for vaccines in the *Terrestrial Manual*, the Group noted that to reduce primary cases of MERS-CoV in humans, vaccination of dromedary camels may be considered. However, yet there are currently no vaccines commercially available. So, the Group agreed to add a paragraph in the *Terrestrial Manual* about MERS-CoV vaccines under development for animal use and discuss the vaccination strategies, ideally in combination with other antigens such as camel pox.

7. Update of the Question and Answer document on MERS-CoV

The Group reviewed and amended the OIE Question and Answer document on MERS-CoV (August 2014 version) reflecting the latest scientific knowledge. The recent update included scientific evidence to prove dromedary camels are the natural host of MERS-CoV and that dromedary viruses are similar to those infecting humans. Countries like Qatar, Oman, Jordan, Saudi Arabia, Iran and Kuwait have met their obligations to OIE by reporting that MERS-CoV has been identified in dromedary camels. A precise case definition was developed by OIE for reporting confirmed cases of MERS-CoV in dromedary camels. Positive PCR findings in dromedary camels should trigger joint animal-human investigations and initiate public health risk mitigation measures. Isolation of infected dromedary camel(s) should be done until RT-PCR testing is negative. An updated version of the Question and Answer document can be found in [Appendix V](#).

8. Review of guidance for managing MERS-CoV at the human-animal interface

The Group reviewed a recommendation document that was drafted in MERS-CoV regional workshops, Muscat (2014) and Doha (2015) and subsequently updated following the Tripartite FAO/OIE/WHO MERS-CoV meeting for managing the MERS-CoV at the human animal interface in September 2017, Geneva, Switzerland. The Group proposed comments to update various sections of the document on MERS-CoV surveillance, management of PCR positive animals, joint outbreak investigation, case control studies, testing of animals at quarantine and entry points, food safety and environment, risk communication and awareness raising, inter-sectoral collaboration and coordination, addressing knowledge gaps.

The Group considered this document as a good source of best practices and recommendations that could be followed by Member Countries for managing the MERS-CoV at the human-animal interface. However, the Group noted that the document lacks detailed protocols and guidelines for managing cases in specific situations like sales, shows, races, movement etc. and these need to be established in future.

9. Any other issues

OIE Reference Laboratories for MERS-CoV

The Group noted that currently there are no OIE Reference Laboratories for MERS-CoV and recommended that animal health and public health laboratories with necessary expertise in MERS-CoV should consider applying as per the standard procedures to be recognised as an OIE Reference Laboratory. This would be useful in supporting disease surveillance and research, as well as providing technical advice to Member Countries.

10. Adoption of the report

The Group reviewed the draft report provided by the rapporteur and agreed to circulate it electronically for comments before the final adoption.

.../Appendices

MEETING OF THE OIE AD HOC GROUP ON MERS-CoV

Paris, 22 – 24 January 2019

MERS-CoV is not an OIE listed disease. However, OIE Member Countries would be obliged to report to the OIE a confirmed case of MERS-CoV in animals, as an “emerging disease” with public health impact in accordance with Article 1.1.4 of the OIE *Terrestrial Animal Health Code*. A detailed case definition for reporting positive MERS-CoV cases to the OIE that was published in May 2017 would help Member Countries to identify confirmed and suspected MERS-CoV cases in dromedary camels and, accordingly, report positive cases to the OIE.

<http://www.oie.int/en/scientific-expertise/specific-information-and-recommendations/mers-cov/>

Over the past few years, national animal health and public health laboratories are using a variety of sensitive and specific diagnostic assays for detecting MERS-CoV in animals. The Biological Standards Commission, in its February 2017 meeting, noted that there is not a chapter for MERS-CoV in the *Terrestrial Manual* that would help Member Countries’ laboratory confirmation of positive cases by validated testing methods. The Commission recommended that the President of the OIE *ad hoc* Group on MERS-CoV develop a chapter in consultation with other MERS-CoV experts.

Also in September 2017, at a tripartite global technical meeting on MERS-CoV at WHO headquarters in Geneva, experts recognized the need for international organizations to update technical standards for compliance by the countries in the areas of harmonization of testing methods, management of PCR positive animals and procedures for testing of imported animals and quarantine measures to be adopted.

In view of this, the OIE Director General agreed to convene the OIE *ad hoc* group on MERS-CoV with the following terms of reference.

Terms of Reference

1. Review the current case definition for reporting positive MERS-CoV cases to OIE for any updates if needed.
2. To evaluate whether MERS-CoV infection in dromedary camels should be an OIE Listed Disease based on the criteria for inclusion of the disease.
3. To draft a chapter in the OIE *Terrestrial Manual* to provide validated diagnostic tests available for MERS-CoV as fit for purpose for surveillance and detection of infections in animal populations for the Member Countries.
4. Appropriate guidance on control measures and action, if any, to be taken on positive surveillance findings in dromedary camels.
5. Appropriate science-based animal health management measures for management of animals to limit potential for further human infections.
6. Guidance on quarantine measures to be adopted when importing animals.
7. Recommendations on research priorities arising from the discussions related to 1-6 above.
8. Update on the MERS-CoV Question and Answer document on the OIE website.
9. Review of animal vaccines and vaccination strategies as intervention measures based on recent research findings.

MEETING OF THE OIE AD HOC GROUP ON MERS-CoV

Paris, 22 – 24 January 2019

Agenda

1. Welcome and introductions
 2. Appointment of chair and rapporteur
 3. Adoption of the agenda
 4. Brief update of MERS-CoV situation in humans and dromedary camels
 5. To evaluate whether MERS-CoV infection in dromedary camels should be an OIE Listed Disease based on the criteria for inclusion of the disease
 6. Review the current case definition for reporting positive MERS-CoV cases to OIE for any updates if needed
 7. To draft a chapter in the OIE *Terrestrial Manual* to provide validated diagnostic tests available for MERS-CoV as fit for purpose for surveillance and detection of infections in animal populations for the Member Countries. The chapter will be drafted using a standardised template with the following headings:
 - Introduction with a brief description of the disease
 - Table providing test methods available for diagnosis of MERS-CoV in animals and their purpose
 - Identification of the agent – description of methods applied
 - Serological diagnosis
 - Requirements for vaccines and diagnostic biologicals when applicable
 8. Review and update the MERS-CoV Question and Answer document on OIE website
 9. Review and comment on the MERS-CoV at the human-animal interface document drafted in regional workshops and updated in other meetings.
 10. Any other issues
 11. Adoption of the report
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**MEETING OF THE OIE AD HOC GROUP ON MERS-CoV
Paris, 22 – 24 January 2019**

List of Participants

MEMBERS

Dr Mehdi El Harrak
R&D Director, MCI Santé Animale
BP278 ZI SO
28810 Mohammedia
MOROCCO
elharrak_m@hotmail.com

Prof. Leo Poon
Professor
School of Public Health
The University of Hong Kong
HONG KONG
lmpoon@hku.hk

Dr William B. Karesh
Executive Vice President for Health and
Policy
EcoHealth Alliance / Wildlife Trust
460 West 34th St., 17th Floor
New York, NY. 10001 - USA
karesh@ecohealthalliance.org

Prof. Ulrich Wernery
Central Veterinary Research Laboratory
P.O. Box 597, Dubai
UAE
cvgl@cvgl.ae

Dr. Abdelmalik Khalafalla
Abu Dhabi Food Control Authority
Abu Dhabi
UAE
abdelmalik.khalafalla@ADFCA.GOV.ABUDH.AE

Dr Ibrahim Ahmad Qasim
General Director of Animal Resources
Services
Ministry of Environment, Water and
Agriculture
65 King Abdulaziz road
Riyadh 11195
SAUDI ARABIA
i.qasim@mewa.gov.sa

Dr Faisal Bayoumi
Veterinary consultant
Ministry of Environment, Water and
Agriculture
65 King Abdulaziz road
Riyadh 11195
SAUDI ARABIA
faisalbayoumi@yahoo.com

Dr Bart Haagmans
Department of Viroscience
Erasmus MC Rotterdam
NETHERLANDS
b.haagmans@erasmusmc.nl

OBSERVERS

Dr Sophie VonDobschuetz
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00153 Rome
ITALY
Sophie.VonDobschuetz@fao.org

Dr Mamunur Rahman Malik
Manager, Infectious Hazard Management
World Health Organization
Eastern Mediterranean Regional Office
EGYPT
malikm@who.int

SPECIALIST COMMISSIONS

Dr Franck Berthe
Senior Livestock Specialist, Food and Agriculture Global Practice
World Bank
1818 H Street NW
Washington, DC 20433
USA
fberthe1@worldbank.org

OIE HEADQUARTERS

Matthew Stone
Deputy Director General
12 rue de Prony
75017 Paris
FRANCE
oi@oie.int

Gregorio Torres
Acting Head of Science Department
g.torres@oie.int

Gounalan Pavade
Chargé de mission
Science Department
g.pavade@oie.int

Sara Linane
Scientific Editor
Science Department
s.linane@oie.int

Glen Gifford
Chargé de mission
AMR & VP Department
g.gifford@oie.int

**Case Definition for reporting MERS-CoV in dromedary camels to OIE
(Update January 2019)**

Introduction

Middle East respiratory syndrome (MERS) is a viral respiratory infection of humans and dromedary camels which is caused by a coronavirus called Middle East Respiratory Syndrome Coronavirus (MERS-CoV).

Dromedary camels (*Camelus dromedarius*) have been confirmed by several studies to be the natural host and zoonotic source of the MERS-CoV infection in humans. Other species may be susceptible to infection with MERS-CoV. However, their epidemiological significance has not been proven.

MERS-CoV has been associated with mild upper respiratory signs in some dromedary camels. While the impact of MERS-CoV on animal health is very low, human infections has a significant public health impact.

Positive RT-PCR results for MERS-CoV or isolation of the virus from dromedary camels is notifiable to the OIE because MERS is an emerging disease with a significant public health impact to human. The aims of reporting to the OIE are to mitigate the human health risk of MERS-CoV and to prevent international spread, while ensuring safe international trade of dromedary camels and their products.

Confirmed case

The following defines a laboratory confirmed case of MERS-CoV infection (with or without clinical signs):

- 1) MERS-CoV has been isolated from a dromedary camel; OR
- 2) Viral nucleic acid has been identified in a sample from a dromedary camel on:
 - a. at least two specific genomic targets; OR
 - b. a single positive target with sequencing of a secondary target; OR
 - c. a single positive target and tested positive to rapid MERS-CoV antigen test

Additional notes

A case can be suspected based on a direct epidemiological link with a confirmed human case, living or traveling together in close proximity to a MERS-CoV infected dromedary camel or sharing the same environment with an individual dromedary infected with MERS-CoV. If testing for MERS-CoV is unavailable, negative or inconclusive on a single inadequate specimen, the case should also be suspected. Inconclusive tests may include a positive screening test on a single real time RT-PCR target without further confirmation. Animals with an inconclusive initial test should undergo additional sampling and testing to determine if the animal can be classified as a confirmed MERS-CoV case. Preference should be a repeat nasopharyngeal specimen. Other types of clinical specimens could also be considered for molecular testing if necessary, including blood/serum, and stool/rectal swab. These generally have lower titres of virus than respiratory tract specimens but have been used to confirm cases when other specimens were inadequate or unobtainable.

Update January 2019
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-CoV 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 widespread in some countries. Some human MERS-CoV cases could be linked to zoonotic transmission (transmission from animals to humans). In other cases, human infections are either linked to health care settings or remain 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.

The patterns of infection in humans include:

1. community acquired cases and reported links to dromedary camels
2. infections acquired through close human to human contact mostly in health care settings.

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 very 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 to be a serious public health threat to humans, because:

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

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

What is the source of MERS-CoV?

Evidence suggests that MERS-CoV has adapted to dromedary camels which are a natural 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 information about potential sources of exposure, including other humans, dromedary 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 World Health Organisation (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 between animals and from animals to humans.

Are animals responsible for MERS-CoV infections in people?

MERS-CoV has been isolated from humans and dromedary camels and studies suggest that dromedary camels can be a source for human infections. MERS-CoV strains isolated from dromedary camels are genetically and phenotypically similar to those infecting humans. Joint human health and animal health investigations are needed to establish the mechanism of transmission and 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, but evidence gathered so far does not point towards their epidemiological importance.

What is known about MERS-CoV in dromedary camels?

Between November 2013 and January 2019, Qatar, Oman, Jordan, Saudi Arabia, Iran and Kuwait have met their obligations to OIE by reporting that MERS-CoV has been identified in dromedary camels.

Other published studies have indicated that MERS-CoV or viral RNA from MERS-CoV have been identified in dromedary camels in countries in the Middle East and North Africa; antibodies to MERS-CoV have been identified in samples taken from dromedary camels in the Middle East and Africa. Similar strains of MERS-CoV have been identified in samples taken from dromedary camels and humans in the same locality and in some cases there has been an association between infections in humans and dromedary camels. So far, all human index cases outside the Arabian Peninsula have been epidemiologically linked to Middle East countries. However, zoonotic transmissions of MERS-CoV from dromedary camel to human outside the Arabian Peninsula cannot be excluded at this stage.

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 dromedary 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 dromedary camels, but this needs further investigation. Significant morbidity or mortality of unknown aetiology should be investigated.

Evidence from MERS-CoV infections in dromedary camels suggests that infection has resulted in virus shedding for a limited period. Reinfection has been shown to occur and immunity to infection is poorly understood. MERS-CoV has been identified in dromedary camels which have antibodies against the virus. The implications of these findings for management and control recommendations need further investigation.

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-CoV.

Are other animal species involved?

Although genetically related viruses have already been detected in bat species, 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.

Recently there is a single report from Africa following surveillance of other domestic mammalian species like sheep, goat, cow and donkeys that are in contact with infected dromedary camels showed positive for MERS-CoV infection informing that domestic livestock in contact with MERS-CoV infected dromedary camels may be at risk of infection.

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.

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.

RT-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.

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 1.1.4](#) of the OIE *Terrestrial Animal Health Code*.

Positive findings should trigger joint animal-human investigations and initiate public health risk mitigation measures. Isolation of infected dromedary camel(s) should be done until RT-PCR testing is negative. Precautionary public health measures should be implemented to reduce the risk of human infection in accordance with WHO’s guidance on the WHO website (https://www.who.int/csr/disease/coronavirus_infections/transmission-and-recommendations/en/).

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

There are no treatments available for MERS-CoV in animals. However, research for commercially licensed vaccines is underway to develop and assess potential intervention measures targeted at dromedary camels to prevent transmission of MERS-CoV among dromedary camels, and from dromedary camels to humans.

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 recommendations and guidance, including on priority research activities for the animal health sector, based on latest scientific information.

The OIE is also working closely with its Member Countries to provide technical support and to encourage reporting of MERS-CoV detections in animals. The OIE has updated the case definition for reporting confirmed MERS-CoV cases in dromedary camels.

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 and prevent geographic spread.

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](#).
