



OIE AD HOC GROUP ON MERS-CoV INFECTION IN ANIMALS

Paris, 15-17 July 2014

A meeting of the OIE *ad hoc* Group on MERS-CoV Infection in Animals (hereinafter the Group) was held at the OIE Headquarters, Paris, from 15 to 17 July 2014.

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

Dr Bernard Vallat, Director General of the OIE welcomed the Group. He reminded the Group of their Terms of Reference and highlighted that MERS-CoV was an important topic owing to its public health impact. Dr Vallat highlighted that OIE was in permanent consultation with the WHO on MERS-CoV and that it was important to develop an expert opinion on certain aspects relating to MERS-CoV infections in animals.

Dr Vallat explained that the Group had been convened following recommendations made during the reports of the Biological Standards Commission and the Scientific Commission for Animal Diseases, at the 82nd OIE General Session in May 2014.

Dr Vallat introduced Dr Gideon Brückner, President of the OIE Scientific Commission for Animal Diseases, to chair the Group and Dr Alex Thiermann, President of the OIE Terrestrial Animal Health Standards Commission (Code Commission). Dr Vincenzo Caporale, President of the OIE Biological Standards Commission, sent his apologies for not being able to attend. In place of Dr Caporale the Biological Standards Commission was represented by the Chairman of the OIE *ad hoc* Group on camelid diseases, Dr Mehdi Elharrak.

The Group endorsed the proposed agenda.

The Terms of Reference and Agenda, and list of participants are presented as Appendix I and II, respectively.

Unless otherwise specified, in this report 'camel(s)' refers to 'dromedary camel(s)'.

2. Current state of knowledge about MERS-CoV in humans and animals

The experts from the World Health Organization (WHO), University of Hong Kong, and Erasmus Medical Centre, the Netherlands, presented the latest information on the disease situation in humans, findings from epidemiological studies in camels, scientific data on the performance of diagnostic tests, and outputs from research studies done in collaboration with Member Countries. Representatives from the Kingdom of Saudi Arabia presented plans for epidemiological studies in animals.

The Group noted that data from serological studies indicated that MERS-CoV infection of camels had been widespread across North Africa; that camels with high titres of antibodies to MERS-CoV had been reported to shed virus; that virus had been detected in nasal and oral secretions, in faeces, and in milk of camels (and that for milk samples testing positive, the possibility of cross contamination could not be ruled out). It was also noted that accurate serology and PCR tests were available for MERS-CoV and that several MERS-CoV lineages existed.

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 September 2016 report of the Scientific Commission for Animal Diseases because this report provides its considerations and comments. It is available at: <http://www.oie.int/en/international-standard-setting/specialists-commissions-groups/scientific-commission-reports/meetings-reports/>

3. Review of current public health guidance

The WHO representative presented the current General Recommendations on MERS-CoV transmission from animals to humans and interim recommendations for at risk groups ([Annex III](#)), explaining that in the absence of having a full understanding on the exact route of transmission from camels to humans the recommendations were based on basic hygiene principles; where possible, available evidence from ongoing studies had been considered in developing this guidance.

The Group were supportive of the recommendations and agreed that they should be regularly reviewed to account for new evidence. The Group also suggested that the recommendations specific to MERS-CoV should apply to countries where there was a risk of transmission of MERS-CoV from camels to humans.

4. Guidance on:

a) A case definition for MERS-CoV infection in animals

In accordance with Article 1.1.3.e) of the *Terrestrial Code (Version 2013)*, Member Countries are obliged to notify the occurrence of any emerging disease with significant morbidity, mortality, or zoonotic potential in their territories even though the pathogen is not included in the OIE List of Diseases. Detections of MERS-CoV in animals were considered to be reportable to the OIE owing to their zoonotic potential, even though there had been no evidence of any significant disease in animals.

The Group agreed that serological positive results from animals indicated previous infection with MERS-CoV and that positive serology findings should be further investigated with virological sampling. Virological positive results (by PCR or virus identification) in samples taken from camels or other animals should be reported to the OIE as an emerging disease with zoonotic potential.

b) Surveillance for MERS-CoV in camels

The Group agreed that for the topic under discussion, the term 'epidemiologic studies' may be more appropriate than 'surveillance', because there was not a defined systematic approach to sampling neither were there any animal health control measures to be implemented on positive findings.

The Group agreed that the epidemiologic studies should take into account the principles for Animal Health Surveillance described in Chapter 1.4 of the OIE *Terrestrial Code*.

The objectives of MERS-CoV epidemiologic studies in camels were driven by concern over the public health implications and should focus on:

- determining whether MERS-CoV infections were present in camels in a country, holding, or camel population;
- assessing the risk profile of a country;
- assessing public health risk and management measures;
- monitoring strains and lineages of MERS-CoV circulating in camel populations.

The Group recommended that there was benefit in sampling camels from different industry sectors within a country e.g. racing, dairy, meat, show camels. Sampling could also be targeted to account for age groups and points of camel gathering (races, markets, slaughterhouses). Evidence suggested that serological surveillance should focus on older camels (older than two years) and virological studies should focus on younger camels (less than two years old). Epidemiological studies should also aim to gather and generate data on basic epidemiologic characteristics (incubation period, shedding period etc.) and risk factors for infection.

The Group also highlighted the critical importance of investigating significant morbidity and mortality events in camels (and other species of animals) where the cause was unknown.

The Group strongly endorsed the recommendation of the OIE *ad hoc* Group on camelid diseases ‘to include veterinary counterparts in the investigation of human and animal MERS cases in the field’.

c) Surveillance for MERS-CoV in other animal species if relevant

The Group suggested that in countries where MERS-CoV is present in camels, studies to assess the presence of MERS-CoV in wild and other domestic species can be conducted to detect possible infection in other hosts and to contribute to understanding the origins of the virus.

d) Appropriate guidance on action, if any, to be taken on positive surveillance findings in animals

The Group recommended that the general public health recommendations ([Annex III](#)) of the World Health Organisation (WHO) should be implemented when animals were confirmed as being virological positive for MERS-CoV.

e) Appropriate science-based animal health management measures to limit potential for further human infections

The Group highlighted that there was currently not enough evidence to make specific recommendations about possible animal health management measures. However in the future when more evidence became available it may be possible to propose disease management procedures and interventions to reduce transmission within the camel population and to propose science-based recommendations to mitigate the risk at the human-animal interface.

f) Communications strategy including updating of Questions and Answers (Q and A) on the OIE website and fact sheet for multiple audiences

The Group reviewed and amended the current OIE Q and A on MERS-CoV reflecting the latest scientific knowledge. It was also recommended that the Scientific Commission for Animal Diseases, with the help of the OIE Scientific and Technical Department, compose an OIE Fact Sheet on MERS similar to other fact sheets currently on the OIE Website. An updated version of the Q and A can be found in [Appendix IV](#).

5. Recommendations on further research studies in animals

The Group discussed the importance of conducting further epidemiologic and research studies aimed at better understanding the behaviour of MERS-CoV infections in animals, and identifying measures to reduce risks to public and animal health. The Group endorsed the previous recommendations of the OIE *ad hoc* Group on camelid diseases relating to research activities and identified an updated list of research priorities as follows:

- To further develop and validate user-friendly diagnostic tests for MERS-CoV as fit for purpose for surveillance of infections in animal populations (live animals and at slaughter).
- Comparative epidemiological studies, in all countries with significant camel populations, to determine the prevalence, distribution, and demographics of MERS-CoV infections in camels in different settings
- Studies to characterise the clinical and pathological effects, kinetics of virus shedding, and immune response to MERS-CoV in experimentally and naturally infected camels
- Studies to assess risk factors and potential exposure sources for camel infection and the relationship between camel infections and human cases of MERS

- Studies to investigate and assess the potential effectiveness of intervention measures aimed at reducing public health risk
- Conduct genetic analyses of both MERS-CoV and infected hosts from different geographical areas to gain a better understanding of the properties of MERS-CoV and to monitor evolution of the virus
- Presence, viability and survival of MERS-CoV in different animal products and the environment
- Research on immunology and vaccine development
- Identification and evaluation of socioeconomic factors that are associated with risk of MERS-CoV infection in camel populations
- Assess potential socioeconomic impact of the MERS-CoV infections, and interventions and control strategies in camels, including on trade
- Studies to obtain an insight into culturally acceptable risk reduction measures
- Studies to determine the original animal source of the virus, including wildlife

6. Recommendations concerning solicitation of interest for possible establishment of an OIE Reference Centre

The Group was informed that the OIE had already received requests from OIE Member Countries to establish an OIE Reference Centre of expertise for MERS-CoV. The Group noted the mandate of OIE Reference Laboratories and OIE Collaborating Centres and agreed that the establishment of an OIE Reference Centre with expertise in MERS-CoV would be helpful in supporting further disease surveillance and research, as well as providing technical advice to the OIE Member Countries. Experts from institutes, including WHO Reference Centres, recognised to have relevant expertise were encouraged to apply for OIE Reference Centre status.

It was noted that whilst current available diagnostic tests were accurate and fit for purpose for animal surveillance they had not yet been validated according to OIE Standards for validation of diagnostic assays for infectious diseases. The Group agreed that an OIE Reference Centre could also undertake such validation work, in close collaboration with the OIE *ad hoc* Group on camelid diseases and the Biological Standards Commission.

7. Evaluation on whether MERS-CoV infection in camels should be an OIE listed disease

The President of the OIE Terrestrial Animal Health Standards Commission explained the criteria for inclusion of diseases, infections and infestations on the OIE list and the rationale for doing so. The Group reviewed each criterion (described in Chapter 1.2 of the *Terrestrial Code*) against current data on MERS-CoV.

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

The Group decided that although it was plausible that camels may have spread MERS-CoV infections internationally (and there was some genetic and field evidence to suggest that international spread had occurred), it had not yet been sufficiently proven that MERS-CoV had been spread internationally by camels or their products. Potential routes of spread other than camels could not be ruled out.

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 agreed that no country had yet carried out systematic surveillance in accordance with the requirements of Chapter 1.4 of the *Terrestrial Code* to demonstrate freedom of MERS-CoV from animal populations. However it was recognised that some countries, with small camel populations, may be able to demonstrate freedom from their camel populations relatively easily if they implement the prescribed surveillance guidelines to do so.

AND

- 3a) *Natural transmission to human has been proven, and human infection is associated with severe consequences*

The Group agreed that evidence from epidemiologic studies (including case control studies) and outbreak investigations suggested that natural transmission of MERS-CoV from camels to humans had occurred, and that MERS-CoV had been demonstrated to cause severe disease in humans.

- 3b) *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. However the Group recommended that further studies were needed to assess the pathogenicity and prevalence of MERS-CoV infections in camels.

- 3c) *The disease has been shown to, or scientific evidence indicates that it would, cause significant morbidity or mortality in wild animal populations*

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

- 4) *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 agreed that although there is no clear clinical syndrome in camels, accurate molecular and serological diagnostic techniques were available to detect past and current infections of MERS-CoV in camels.

In conclusion, the Group decided that based on available scientific evidence, infections with MERS-CoV in camels did not meet the criteria for an OIE listed disease. However, the Group emphasised that MERS-CoV was a serious public health problem with zoonotic potential and that infection in animals should remain reportable to OIE as an emerging disease. The Group also recommended that the status of MERS-CoV should be kept under review. More data should be collected by Member Countries, and generated by research, to provide evidence for science based recommendations, particularly in relation to whether MERS-CoV should be listed. These data should include data from Member Countries on baseline surveillance in camel populations and the geographic distribution of MERS-CoV infections.

8. Any other business

The Group were thanked for their efforts and their contribution to the meeting.

9. Finalisation and adoption of the report

The report was finalised and adopted by the Group.

.../Appendices

OIE AD HOC GROUP ON MERS-COV INFECTION IN ANIMALS
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Terms of Reference

1. To summarise the latest scientific evidence relating to the potential role of animals in the epidemiology of MERS, and available diagnostic methods
 2. To review current public health guidance on:
 - a. Surveillance in humans with a high degree of contact with camels
 - b. Personal protection and hygiene practices for those handling potentially infected camels
 - c. Consumption of camel products (raw milk, raw meat, urine) from potentially infected animals
 3. To develop guidance on
 - a. A case definition for MERS-CoV infection in animals
 - b. Surveillance for MERS-CoV in camels (location and sampling strategy)
 - c. Surveillance for MERS-CoV in other animal species if relevant (target species, sampling strategy)
 - d. Appropriate guidance on action, if any, to be taken on positive surveillance findings in animals
 - e. Appropriate science-based animal health management measures to limit potential for further human infections
 - f. Communications strategy including updating of Q's and A's on website and fact sheet for multiple audiences
 4. To provide recommendations on further research studies in animals
 5. To provide recommendations concerning solicitation of interest for possible establishment of an OIE Reference Laboratory
 6. To provide an opinion on whether MERS-CoV infection in camels should be an OIE Listed Disease
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Agenda

1. Welcome and introductions
 2. Current state of knowledge about MERS-CoV in humans and animals
 - a. Update from WHO
 - b. Country updates (Qatar, Kingdom of Saudi Arabia)
 - c. Updates from researchers
 3. Review of current public health guidance on:
 - a. Surveillance in humans with a high degree of contact with camels
 - b. Personal protection and hygiene practices for those handling potentially infected camels
 - c. Consumption of camel products (raw milk, raw meat, urine) from potentially infected camels
 4. Guidance on
 - a. A case definition for MERS-CoV infection in animals
 - b. Surveillance for MERS-CoV in camels (location and sampling strategy)
 - c. Surveillance for MERS-CoV in other animal species if relevant (target species, sampling strategy)
 - d. Appropriate guidance on action, if any, to be taken on positive surveillance findings in animals
 - e. Appropriate science-based animal health management measures to limit potential for further human infections
 - f. Communications strategy including updating of Q's and A's on website and fact sheet for multiple audiences
 5. Recommendations on further research studies in animals
 6. Recommendations concerning solicitation of interest for possible establishment of an OIE Reference Centre
 7. Opinion on whether MERS-CoV infection in camels should be considered as an OIE Listed Disease
 8. Any other business
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Middle East respiratory syndrome coronavirus (MERS-CoV) 13 June 2014

Update on MERS-CoV transmission from animals to humans, and interim recommendations for at-risk groups

Over the past year, several investigations into the animal source of MERS-CoV have been conducted. MERS-CoV genetic sequences from humans and camels in Egypt, Oman, Qatar and Saudi Arabia demonstrate a close link between the virus found in camels and that found in people in the same geographic area. These and other studies have found MERS-CoV antibodies in camels in Africa and the Middle East.

Preliminary results from an ongoing investigation in Qatar show that people working closely with camels (e.g. farm workers, slaughterhouse workers and veterinarians) may be at higher risk of MERS-CoV infection than people who do not have regular close contacts with camels. In Qatar and several other countries, animals, including goats, cows, sheep, water buffalo, swine and wild birds, have been tested for antibodies to MERS-CoV, with no positive results. The absence of antibodies in these animals indicates that the likelihood of other animals having a substantial role in transmission of MERS-CoV is very low. These studies provide evidence that camels are a likely primary source of the MERS-CoV that is infecting humans.

The current pattern of disease appears to be the result of repeated introductions of the virus from camels to people, resulting in limited human-to-human transmission, but not in sustained transmission. Therefore, discovery of the routes of transmission, whether direct or indirect, between camels and people, is critical to stopping transmission of the virus.

WHO is working with partner agencies with expertise in animal health and food safety, including FAO, OIE and national authorities, to facilitate ongoing investigations.

Investigation protocols and guidelines for dealing with new cases are available on the WHO website (http://www.who.int/csr/disease/coronavirus_infections/en/).

General recommendations

As a general precaution, anyone visiting farms, markets, barns or other places where camels are present should practice general hygiene measures, including regular hand washing after touching animals, avoiding touching eyes, nose or mouth with hands, and avoiding contact with sick animals. People may also consider wearing protective gowns and gloves while handling animals.

The consumption of raw or undercooked animal products, including milk and meat, carries a high risk of infection from a variety of organisms that might cause disease in humans. Animal products processed appropriately through proper cooking or pasteurization are safe for consumption but should also be handled with care, to avoid cross-contamination with uncooked foods. Recent studies in Qatar show that MERS-CoV can be detected in raw milk from infected camels. Whether camels excrete MERS-CoV in milk or the virus gets into the milk through cross-contamination during milking is unclear. However, if MERS-CoV is present, it will be destroyed by pasteurization or cooking. Camel meat and camel milk are nutritious products that can continue to be consumed after cooking, pasteurization, or other heat treatments. Safe alternatives should be developed to the tradition of sales of raw camel milk for direct consumption, along roadsides and farm gates.

Recommendations for at-risk groups

Until more is understood about MERS, people with diabetes, renal failure, chronic lung disease, and immunocompromised persons are considered at high risk of severe disease from MERS-CoV infection. Therefore, these people should avoid contact with camels, should not drink raw camel milk or camel urine, and should not eat meat that has not been properly cooked. Such recommendations should also be disseminated to travellers, tourists and pilgrims with above mentioned underlying conditions coming to the region from around the world.

Preliminary results from recent studies in Qatar indicate that people handling or working with camels are at increased risk of infection with MERS-CoV compared with people who do not have contact with camels. Until more evidence is gathered, it is prudent for camel farm workers, slaughterhouse workers, market workers, veterinarians and those handling camels at racing facilities to practice good personal hygiene, including frequent hand washing after touching animals. They should wear facial protection where feasible and protective clothing, which should be removed after work and washed daily.

Workers should also avoid exposing family members to soiled work clothing, shoes, or other items that may have come into contact with camel excretions. It is therefore recommended that these clothes and items remain at the workplace for daily washing and that workers have access to and use shower facilities at their workplaces before leaving the premises.

Camels infected with MERS-CoV may not show any signs of infection. It is therefore not possible to know whether an animal in a farm, market, race track or slaughterhouse is excreting MERS-CoV that can potentially infect humans. However, infected animals may shed MERS-CoV through nasal and eye discharge, faeces, and potentially in their milk and urine. The virus may also be found in the organs and meat of an infected animal. Therefore, until more is known about infection in animals, the best protection is to practice good hygiene and avoid direct contact with all of these. Obviously sick animals should never be slaughtered for consumption; dead animals should be safely buried or destroyed.

People who are not wearing protective gear should avoid contact with any animal that has been confirmed positive for MERS-CoV until subsequent tests have confirmed that the animal is free of the virus.

Update August 2014 – OIE 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 camels¹ 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.

¹ In this text 'camel(s)' refers to 'dromedary camel(s)'.

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 aetiology 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](#).

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