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# A Review on Middle East Respiratory Syndrome (MERS) Infection: In Human and its Management



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## ABSTRACT

Middle East respiratory syndrome coronavirus (MERS-CoV) is a zoonotic virus from camels. Is a responsible for acute respiratory syndrome in human. Although in recent outbreak majority of human cases of MERS have been attributed to human-to-human infections. Camels are likely to be a major reservoir host for MERS - CoV and an animal source of MERS infection in humans. Camels are suspected to be the primary source of infection for humans but the exact routes of direct or indirect exposure are not fully understood and further studies (particularly case control studies) are needed. In sustained community, transmission has not been observed transmission to close contacts of imported cases including to healthcare workers other patients and visitors in hospitals has been reported most recently in South Korea but also in France. It is unclear as to when the virus was introduced to dromedary camels but data from studies that investigated stored dromedary camel sera and geographical distribution of involved dromedary camel populations suggested that the virus was present in dromedary camels several decades ago. In which dromedary camels seem to be the only animal host responsible for the spill over human infections.

## HISTORY

The Middle East respiratory syndrome (MERS) is a viral respiratory disease caused by a novel coronavirus (MERS-CoV) that was first identified in Saudi Arabia in 2012. On 25 September 2012, the World Health Organization (WHO) announced that it is "engaged in further characterizing the novel coronavirus" and that it has "immediately alerted all its Member States" about the virus and has been leading the coordination and providing guidance to health authorities and technical health agencies.<sup>[5]</sup> Egyptian virologist Dr. Ali Mohamed Zaki isolated and identified a previously unknown coronavirus from the man's lungs. A second case was found in September 2012, a 49-year-old male living in Qatar presented with similar flu symptoms and a sequence of the virus was nearly identical to that of the first case. In November 2012, similar cases appeared in Qatar and Saudi Arabia. Additional cases were noted with deaths associated and rapid research and monitoring of this novel coronavirus began. More than 2,000 confirmed cases of MERS have been reported in more than 27 countries; all reported cases have originated in the Arabian Peninsula or been linked to a case who had recently traveled there.<sup>[1,2]</sup>

## INTRODUCTION

The first known cases of Middle East respiratory syndrome (MERS) associated with infection by a novel coronavirus (CoV).<sup>[10]</sup> MERS- CoV is a betacoronavirus found in human being as well as camels and related to multiple bat Coronaviruses.<sup>[12]</sup> They often result in upper respiratory tract infections (simple colds) in humans causing mild illnesses usually of short lasting nature with a rhinitis, cough, sore throat as well as fever.<sup>[5]</sup> The year of 2012 witnessed the birth of a new infectious disease on Earth and that was the Middle East Respiratory Syndrome caused by an infection with the MERS coronavirus.<sup>[12]</sup> MERS-CoV sequences have been found in a bat and in many dromedary camels (DC).<sup>[10]</sup> Coronaviruses are a large family of viruses that can cause diseases ranging from the common cold to Severe Acute Respiratory Syndrome (SARS).<sup>[14]</sup>

## Different types of Corona Virus <sup>[5, 9]</sup>

- **ALPHA CO -V:**

Human examples: HCoV-229E, HCoV-NL63

Pig, dog, and cat CoVs

- **BETA CO-V:**

HCoV - OC43, HCoV -HKU1, HCoV –SARS

MHV, rat, pig and cow CoVs

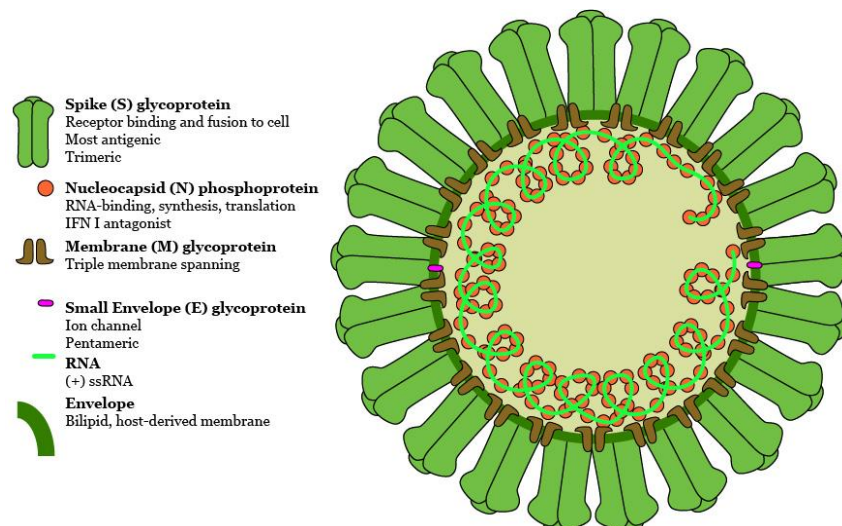
MERS-CoV

- **GAMMA CO-V:**

Chicken and turkey CoVs

- **DELTA CO-V:**

Bird CoVs



**Fig1: Structure of Coronavirus <sup>[26]</sup>**

The virus of MERS- CoV contains mainly spike like structures mainly consists of glycoprotein for mainly receptor binding and antigenic activity. It also contains nucleocapsid phosphoprotein for RNA- binding Membrane glycoprotein for triple membrane spanning and positive strand RNA (+) ssRNA. <sup>[5]</sup> The first human coronavirus was cultivated in 1965 on human ciliated embryonal tracheal cells. Literature about human coronaviruses was limited up until the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) outbreak in 2002. <sup>[21]</sup> Coronaviruses are enveloped viruses with a positive – sense RNA genome and with a nucleocapsid of helical symmetry. The genomic size of coronaviruses ranges from approximately 26 to 32 kilobases extraordinarily large for an RNA virus. <sup>[5]</sup> The virus also appears to pass from an infected person to another person in close contact. This has been seen among family member's patients and health-care workers. Besides, scientific studies supported the premise that camels serve as the primary source of MERS coronavirus infecting humans. <sup>[8]</sup> Approximately 35% of reported patients with MERS have died. <sup>[2]</sup> The virus does not seem to pass easily from person to person unless there is close contact such as occurs when providing unprotected care to a patient. Health care associated outbreaks have occurred in several countries with the largest outbreaks seen in Saudi Arabia, United Arab Emirates and the Republic of Korea. <sup>[2,1]</sup> This assessment is based on information available as of 19 May 2017 and will be revised as circumstances change. It focuses on livestock-related aspects and is therefore restricted to an exposure assessment at the animal-human interface. <sup>[23]</sup>

## SOURCE

The origins of the virus are not fully understood but according to the analysis of different virus genomes. It is believed that it originated in bats and was transmitted to camels sometime in the distant past. <sup>[14]</sup> The findings of a higher MERS-CoV seroprevalence in adult camels and the seronegativity in sheep are consistent with other studies. <sup>[11]</sup> MERS-CoV has been identified in dromedaries in several countries including Egypt, Oman, Qatar, Saudi Arabia and MERS-CoV specific antibodies (a finding that indicates an animal has previously been infected with MERS-CoV) have been identified in dromedaries in the Middle East, Africa and South Asia. <sup>[2]</sup> Viral sampling for research purposes could include serial upper and lower respiratory tract, blood, stool and urine samples for monitoring of viral load and persistence within body compartments. <sup>[15]</sup>

## **SIGN AND SYMPTOMS**

Some infected people had mild symptoms or no symptoms at all but most people infected with MERS-CoV developed severe respiratory illness. They had fever ( $\geq 38^{\circ}\text{C}/100.4^{\circ}\text{F}$ ), cough and shortness of breath. Others reported having gastrointestinal symptoms like diarrhea, nausea, vomiting and kidney failure. MERS can even be deadly. Many people have died.<sup>[3]</sup> Pneumonia is a common finding but not always present. Gastrointestinal symptoms including diarrhea have also been reported.<sup>[2]</sup> Severe illness can cause respiratory failure that requires mechanical ventilation and support in an intensive care unit. Approximately 36% of reported patients with MERS - CoV have died.<sup>[14]</sup>

## **RISK**

### **Humans being exposed to MERS-CoV in affected areas through:**

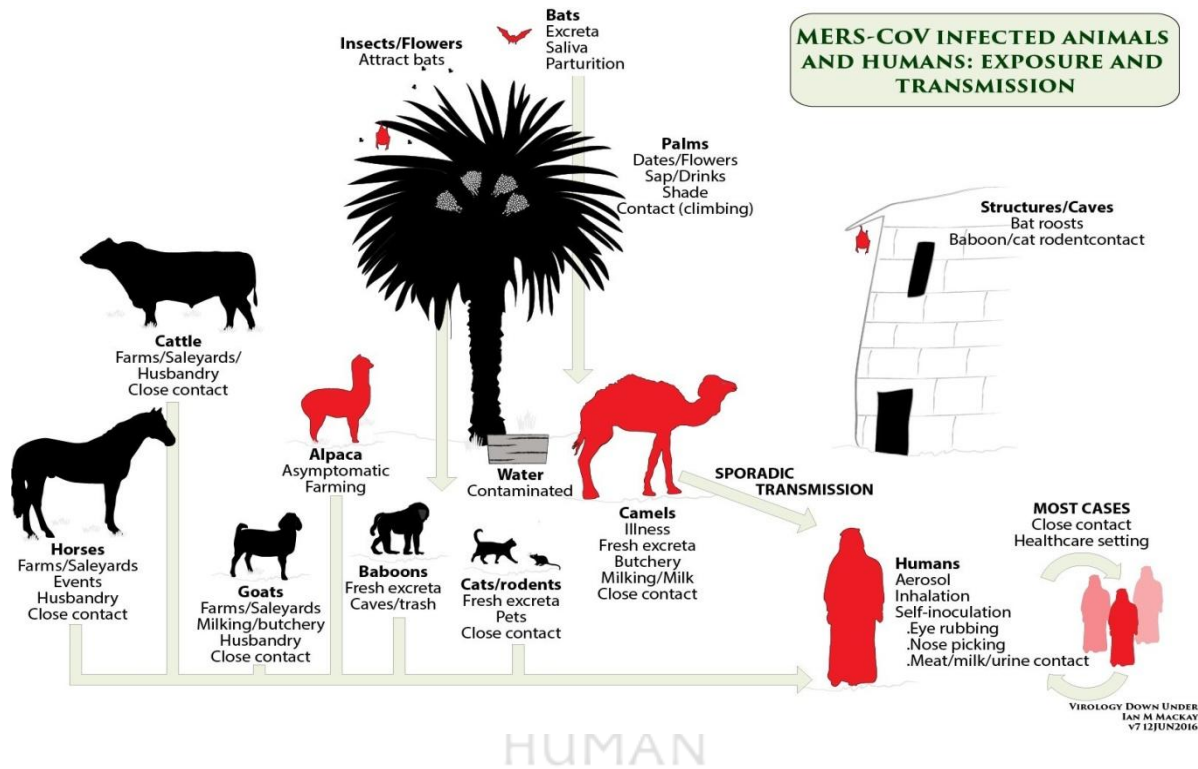
- Direct contact with dromedary camels
- Handling or consumption of dromedary products (meat, milk) body fluids and excreta
- Contact with other domestic species
- Contact with bats and other wildlife species.<sup>[23]</sup>
- Infected people have spread MERS-CoV to others in healthcare settings such as hospitals.<sup>[20]</sup>
- The risk will be higher in healthcare workers exposed to MERS - CoV who have not adhered to UK infection control procedures or not used adequate personal protective equipment.<sup>[16]</sup>

## **TRANSMISSIONS**

Transmission of MERS-CoV is defined as sporadic (not sustained), intra-familial often healthcare associated inefficient and requiring close. MERS- CoV positive index patients were RNA or antibody positive. The rate of general transmission even in outbreaks is around 3 %.<sup>[7, 10]</sup> the mechanism by which transmission occurred in these instances whether respiratory (e.g. coughing, sneezing) or direct physical contact with the patient or via fomites after contamination of the environment by the patient is unknown.<sup>[17]</sup>

**Non-human to human transmission:-**

The route of transmission from animals to humans is not fully understood but dromedary camels are a major reservoir host for MERS-CoV and an animal source of infection in humans.<sup>[2]</sup>



**Fig 2: Transmission of MERS in Human** <sup>[4]</sup>

**Human-to-human transmission:-**

There is no evidence of sustained human-to-human transmission in the community nor is there evidence of airborne transmission.<sup>[13]</sup> The virus does not appear to pass easily from person to person unless there is close contact such as providing unprotected care to an infected patient.<sup>[14]</sup> Where human-to-human transmission appears to be more probable especially when infection prevention and control practices are inadequate.<sup>[14]</sup>

**DIAGNOSIS**

It is not always possible to identify patients with MERS- CoV early or without testing, because symptoms and other clinical features may be non- specific.<sup>[14]</sup> Convalescent plasma containing MER - CoV antibodies or interferon and lopinavir may be considered for specific treatment of MERS patients.<sup>[15]</sup>

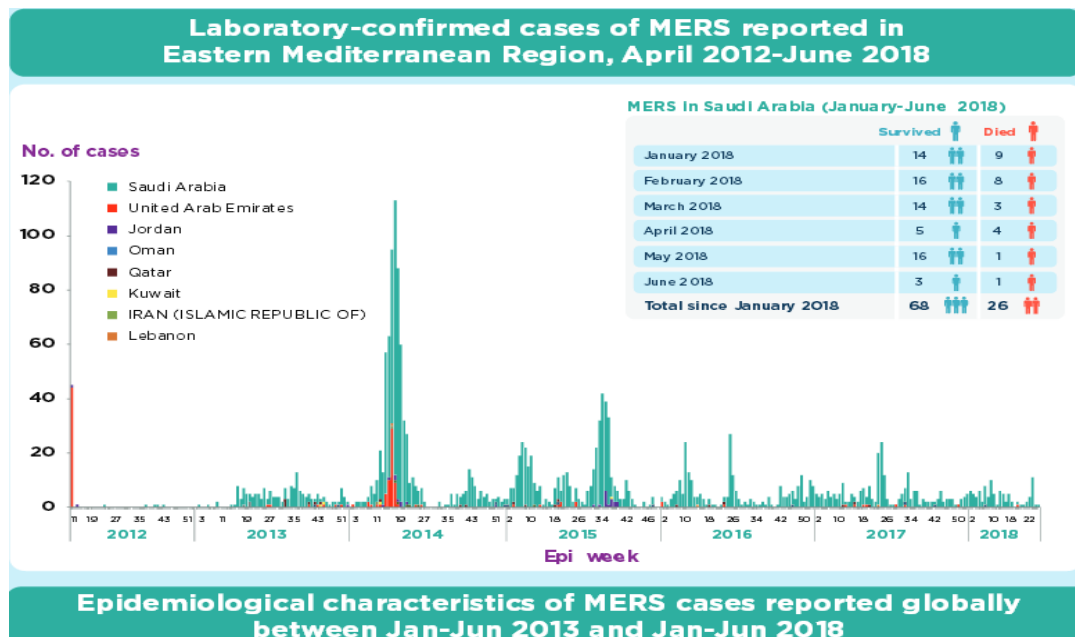
**SUMMARY AND LITERATURE UPDATE**

- At the end of June 2018, a total of 2229 laboratory- confirmed cases of Middle East respiratory syndrome (MERS), including 791 associated deaths (case–fatality rate: 35.5%) were reported globally. The majority of these cases were reported from Saudi Arabia (1853 cases, including 717 related deaths with a case–fatality rate of 38.7%).<sup>[2]</sup>



**Fig 3: Laboratory- confirmed cases of Middle East respiratory syndrome (MERS)**

The affected countries in the Middle East include Jordan, Kuwait, Oman, Qatar, Saudi Arabia (KSA), United Arab Emirates (UAE) and Yemen and the Philippines who were infected in the Middle East.<sup>[22]</sup>



**Fig 4: MERS reported globally cases in Eastern Mediterranean region between June 2013- June2018**



The age group 50–59 years continues to be at highest risk for acquiring infection of primary cases. The age group 30–39 years is most at risk for secondary cases. The number of deaths is higher in the age group 50–59 years for primary cases and 70–79 years for secondary cases.

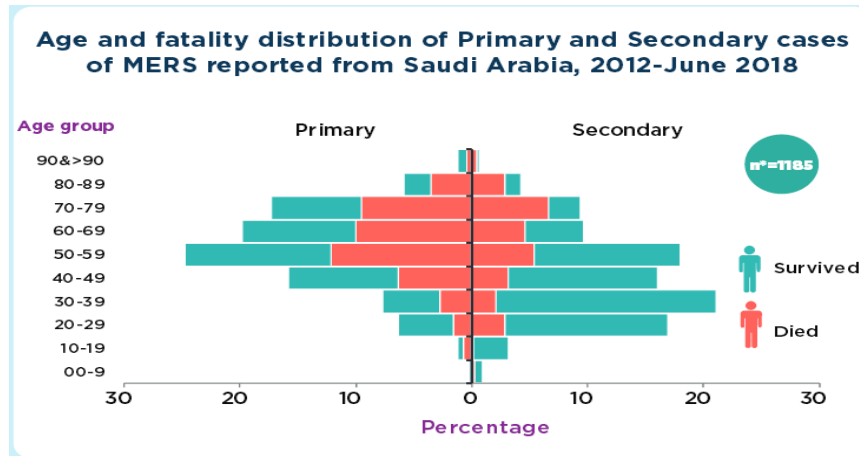


Fig 5: Age and fatality distribution of primary and secondary cases of MERS.

## PREVENTION AND CONTROL

### A special prevention for persons who travels in Arabian and neighboring country:

CDC does not recommend that travelers change their plans because of MERS. However, the Saudi Arabia Ministry of Health has made special recommendations for travelers to Hajj and Umrah. Saudi Arabia recommends that the following groups should postpone their plans for travel this year:

- People over 65 years old
- Children under 12 years old
- Pregnant women
- People with chronic diseases (such as heart disease, kidney disease, diabetes or respiratory disease)
- People with weakened immune systems
- People with cancer or terminal illnesses.<sup>[5]</sup>



The European centre for disease prevention and control (ECDC) has recommended all travelers to the Peninsula to avoid interaction with camels, attending camel farms, eating, unpasteurized milk or undercooked meat of camel with stress on the importance of hand and hygiene. Foods are prepared under unsanitary conditions and properly washing fruits and vegetables before eating the food.<sup>[12]</sup> Patients who develop pneumonia or pneumonitis often require mechanical ventilation and other organ support.<sup>[17]</sup> As a general precaution anyone visiting farms, markets, barns or other places where camels and other animals are present should practice general hygiene measures including regular hand washing before and after touching animals and should avoid contact with sick animals.<sup>[14]</sup> Wash hands often with soap and water. When hands are not visibly dirty a hand rub can be used.<sup>[6,24]</sup> Camel meat and camel milk are nutritious products that can continue to be consumed after pasteurization, cooking or other heat treatments.<sup>[14]</sup>

On 2 September 2015, the WHO IHR Emergency Committee advice included that further to previous advice, national authorities should:

- Ensure the readiness of all healthcare facilities
- Collaborate across human and animal health sectors
- Ensure the rapid and timely sharing of all information of public health importance.<sup>[18]</sup>

**All persons present should wear:**

- A well-fitted FFP2 or FFP3 respirator
- Tight-fitting eye protection
- Gloves and a long-sleeved impermeable protective gown.<sup>[19]</sup>

**TREATMENT**

A decision support tool for treatment of MERS was published by ISARIC (International Severe Acute Respiratory and Emerging Infection Consortium) on 29 July 2013.<sup>[19]</sup> There is no specific antiviral treatment recommended for MERS-CoV infection.<sup>[20]</sup> Medical care is supportive and to help relieve symptoms. Only symptomatic treatment is given to the patients according to its severity.<sup>[5]</sup>

**Testing and initial infection control and public health actions for MERS- CoV should be undertaken for persons with:-**

A. Fever and pneumonia or pneumonitis or acute respiratory distress syndrome

(ARDS)

- History of travel from or residence in affected countries in the Middle East 2 within 14 days before symptom onset.

Where WHO recommends RT- PCR testing of nose/throat swabs of asymptomatic close contacts is considered if feasible. RT-PCR-positive asymptomatic close contacts in this setting should be isolated, monitored closely for symptoms and only released from isolation following two negative RT-PCR tests separated by 24 hours.<sup>[17]</sup> Ribavirin has also been associated with significant adverse effects in both SARS and MERS patients.<sup>[15]</sup>

## **RESULTS AND DISCUSSION**

The result and discussed of this study to prevent and control the MERS (Middle East respiratory syndrome) from transmission one person to another person and their updates. In this Research article including given to sign, symptoms, diagnosis of respiratory syndrome and treatment.

## **CONCLUSION**

Currently, the risk of human infections and sustainable human-to-human transmission in Europe remains low. Specifically, several healthcare associated clusters in Saudi Arabia and UAE have been reported which have been responsible for large numbers of cases. Given the current increase in nosocomial infections and travel-associated cases of MERS in the Arabian Peninsula and the large number of people travelling between the Arabian peninsula and Europe. It is likely that more cases will be imported and detected in the EU/EEA. The origin of MERS-CoV viral infection is not very well understood. It could have originated in bats and transmitted to dromedary camels at some unknown time in the past. The virus seems to be well maintained in dromedaries. Which serve as a reservoir with a spillover human infection. Sporadic human cases in areas where MERS-CoV is endemic in dromedary camels are likely to continue to happen. It became apparent early on that MERS-CoV spread relatively ineffectively from human-to-human. Despite ongoing and possibly seasonal

introduction of virus to the human population via infected DCs and perhaps other animals yet to be identified the vast majority of MERS-CoV transmission has occurred from infected to uninfected humans in close and prolonged contact through circumstances created by poor infection control in healthcare settings. The basic virology of MERS-CoV has advanced over the course of the past three years, understanding what is happening in and the interplay between camel, environment and human is still in its infancy. The result and discussed of this study to prevent and control the MERS (Middle East respiratory syndrome) from transmission one person to another person and their updates. In this Research article including given to sign, symptoms, diagnosis of respiratory syndrome and treatment.

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