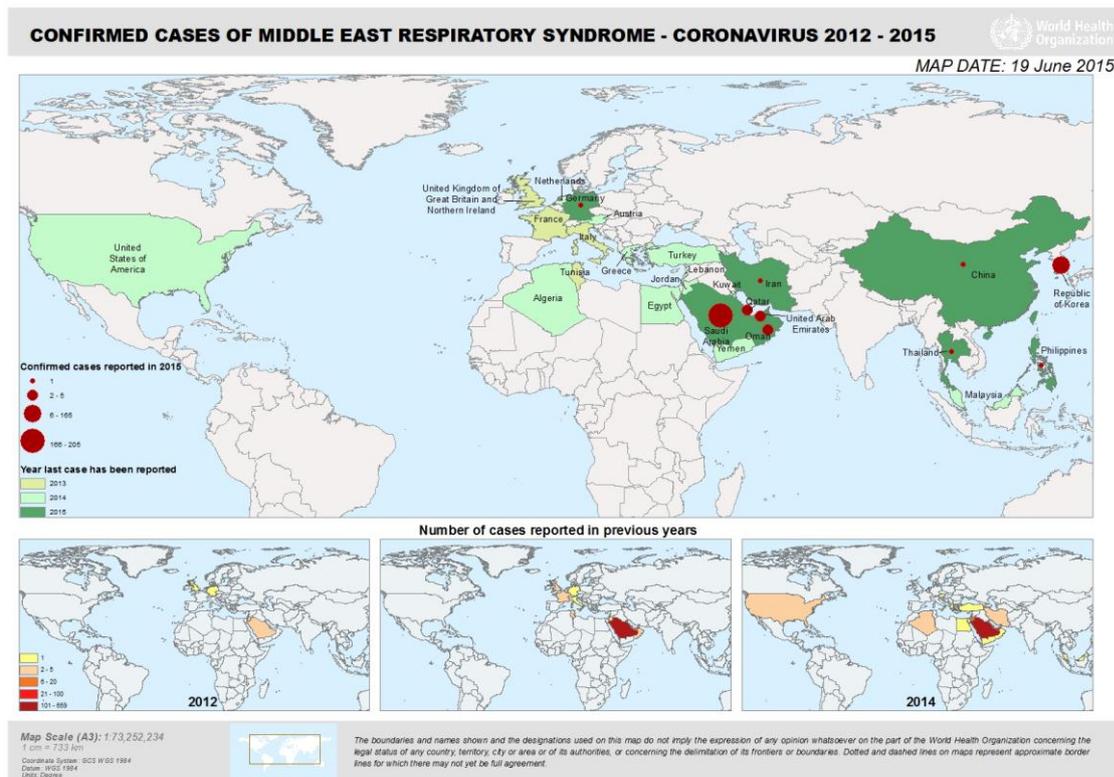


## Middle East respiratory syndrome coronavirus (MERS-CoV): Summary and Risk Assessment of Current Situation in the Republic of Korea and China – as of 19 June 2015

### Background

As of 19 June 2015, 1338 laboratory-confirmed cases of human infection with Middle East respiratory syndrome coronavirus (MERS-CoV) have been reported to WHO since 2012, including at least 475 deaths. Overall, 66% of cases reporting gender (n=1329) are male and the median age is 50 years (range 9 months–99 years; n=1335).

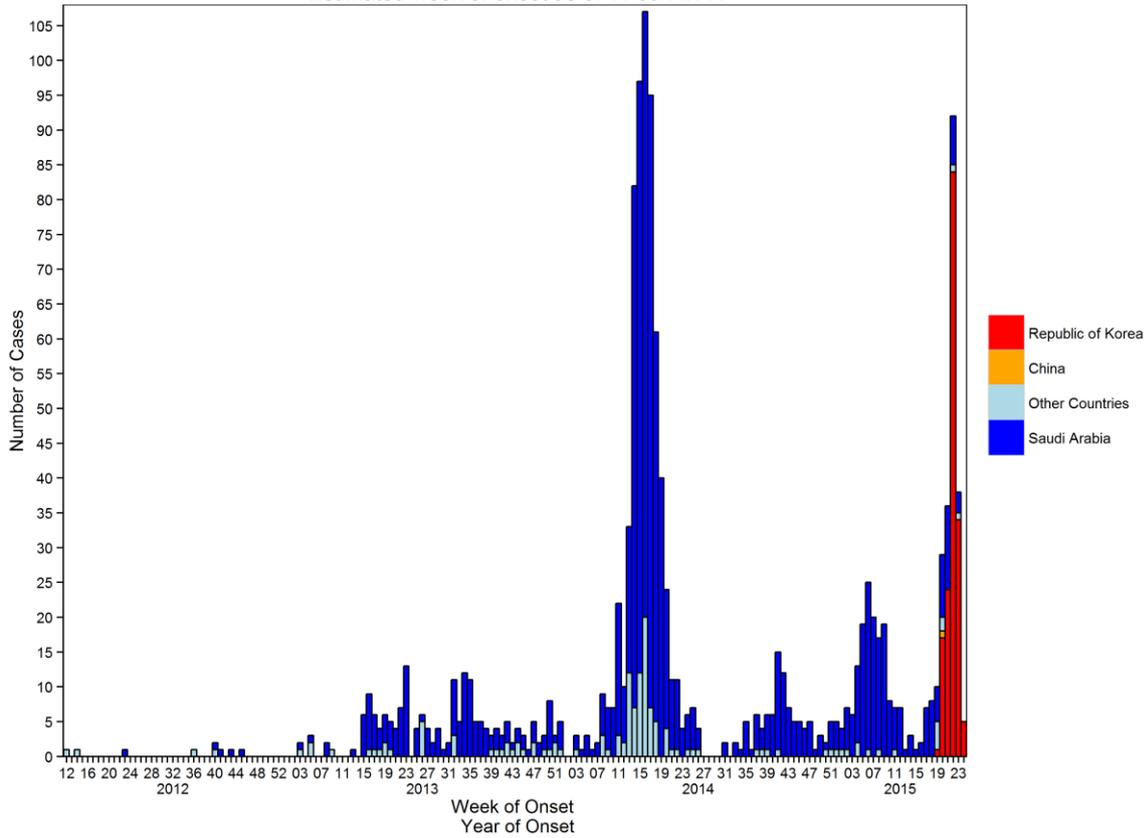
To date, 26 countries have reported cases, including countries in the Middle East (Figure 1): Egypt, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia (KSA), United Arab Emirates (UAE) and Yemen; in Africa: Algeria, and Tunisia; in Europe: Austria, France, Germany, Greece, Italy, the Netherlands, Turkey and the United Kingdom; in Asia: China, the Republic of Korea, Malaysia Philippines and Thailand; and in North America: the United States of America (USA). The majority of cases (>85%) have been reported from KSA. Since 1 January 2015, 393 cases have been reported from KSA (210), the Republic of Korea (165), United Arab Emirates (5), Oman (4), Qatar (4), China (1), Germany (1), Iran (1) the Philippines (1), and Thailand (1) (Table 1; Figure 2).



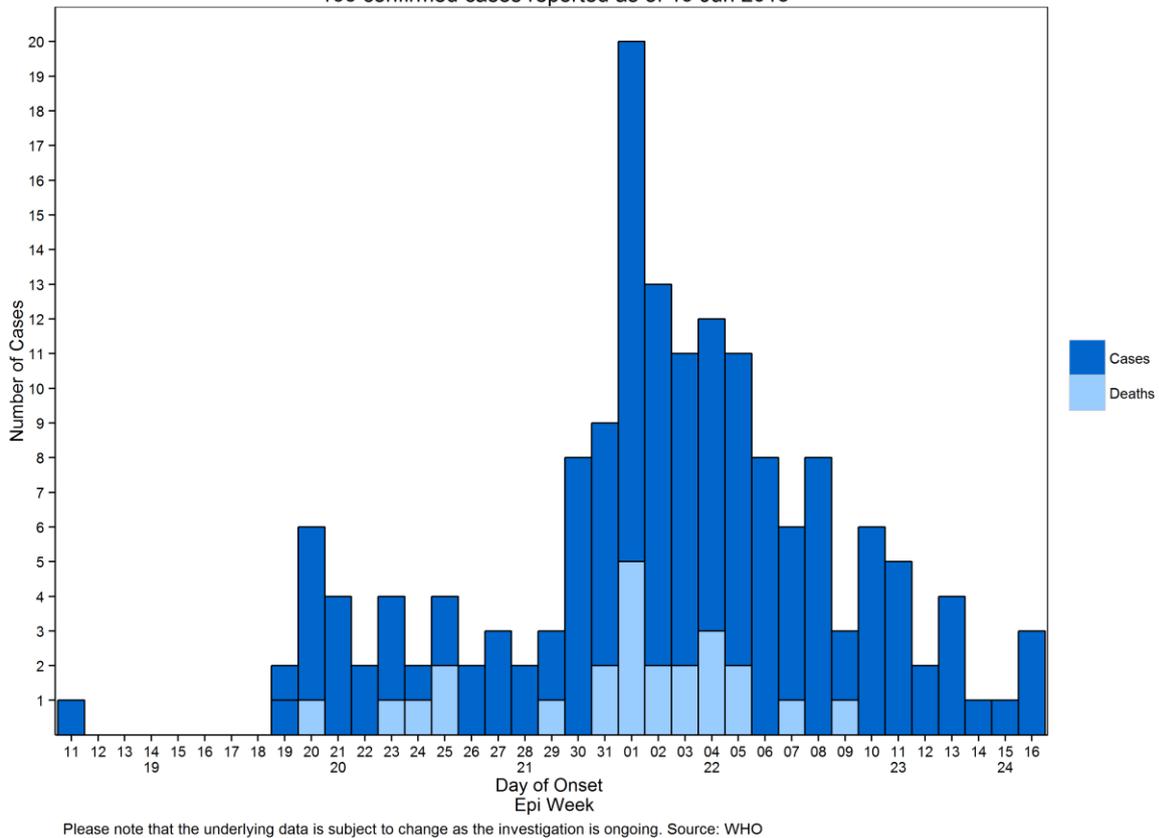
[View full size map](#)

**Figure 1. Number of laboratory confirmed cases MERS-CoV cases reported by countries as of 19 June 2015**

MERS CoV confirmed cases in Republic of Korea, China, Saudi Arabia and other Countries  
 Estimated week of onset as of 19 Jun 2015



MERS CoV confirmed cases and deaths in Republic of Korea and China  
 Estimated date of onset between 11 May and 16 Jun 2015  
 166 confirmed cases reported as of 19 Jun 2015



**Figure 2a Global epidemic curve of MERS-CoV cases reported by date of symptom onset; 2b Epidemic Curve of MERS-CoV cases reported by the Republic Korea and China by date of symptom onset**

**Table 1. Number of Laboratory-Confirmed MERS-CoV Cases Reported by Country and by Year**

<b>Country of reporting</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>Total</b>
Algeria	0	0	2	0	2
Austria	0	0	1	0	1
China	0	0	0	1	1
Egypt	0	0	1	0	1
France	0	2	0	0	2
Germany	1	1	0	1	3
Greece	0	0	1	0	1
Iran	0	0	5	1	6
Italy	0	1	0	0	1
Jordan	2	0	10	0	12
Kuwait	0	2	1	0	3
Lebanon	0	0	1	0	1
Malaysia	0	0	1	0	1
Netherlands	0	0	2	0	2
Oman	0	1	1	4	6
Philippines	0	0	0	1	1
Qatar	0	7	2	4	13
Republic of Korea	0	0	0	165	165
Saudi Arabia	5	136	679	210	1030
Thailand	0	0	0	1	1
Tunisia	0	3	0	0	3
Turkey	0	0	1	0	1
United Arab Emirates	0	12	57	5	74
United Kingdom	1	3	0	0	4
United States of America	0	0	2	0	2
Yemen	0	0	1	0	1
<b>Total</b>	<b>9</b>	<b>168</b>	<b>768</b>	<b>393</b>	<b>1338</b>

On 20 May 2015, the Republic of Korea notified WHO of the first laboratory-confirmed case of Middle East respiratory syndrome coronavirus (MERS-CoV). The index case had recently travelled to the Kingdom of Saudi Arabia (KSA), Qatar, the United Arab Emirates (UAE), and Bahrain. The person was not ill during travel and his source of infection is under investigation, however thus far no contact with camels or health care facilities in the Middle East has been identified.

As of 19 June 2015, 166 laboratory-confirmed cases including 24 deaths have been identified, all of whom appear to be linked to contact with the index case or with secondary cases. Investigations into the source of infection of the newly reported cases are ongoing. One of these 166 cases travelled to the People's Republic of China via China, Hong Kong Special Administrative Region and was reported by China (see below).

Contact tracing in the Republic of Korea is ongoing. The outbreak in the Republic of Korea has been associated with health care facilities and have thus far involved 72 health care facilities which have treated patients. To date, 6 health care facilities have documented nosocomial transmission. All cases reported so far include healthcare workers caring for confirmed cases, patients who were being cared for at the same healthcare facilities as confirmed patients, and family members of confirmed patients or of patients. .

There have been three large clustering events among the 166 cases reported thus far (described further in the Appendix), involving "Hospital B" (Pyeongteak St Mary's Hospital), "Hospital D" (Samsung Medical Center) and one case ("Case 16") who seeded two smaller outbreaks in Hospital E (Dae Cheong Hospital) and F (KonYang University Hospital). As the outbreak is ongoing, our knowledge of the factors associated with these outbreaks is increasing as more investigations are carried out. There is evidence of tertiary transmission among cases, but it will be some time before transmission is fully understood.

This is the largest outbreak of MERS outside the Middle East. Since the identification of the first laboratory confirmed case, aggressive contact tracing has been in place and as of 19 June 2015, more than 10,000 contacts are being followed and are in quarantine or isolation at home or in state-run facilities.

Included in the 166 cases reported to date, one case whose exposure was in the Republic of Korea travelled to China, Hong Kong SAR by plane, and then to Guangdong, China, by bus. The case was symptomatic while travelling. Chinese authorities have placed this person in isolation and have identified contacts in China, Hong Kong SAR and China. The contacts are in quarantine and are being followed and tested for MERS-CoV. This is the first MERS-CoV case reported in China. No additional cases have been identified among contacts in China, Hong Kong SAR (n=28) or in China (n=75).

At the invitation of the Government of the Republic of Korea, WHO sent a team to the Republic of Korea from 8 to 13 June 2015 to assessing the epidemiological patterns of MERS CoV in the Republic of Korea as well as the characteristics of the virus and clinical features. The mission team also reviewed the public health measures implemented to date. WHO is continuing to work closely with Korean and Chinese health authorities and international technical organizations to control this outbreak, ensure proper treatment of ill persons, prevent further cases and gain a better understanding of transmission patterns and risk factors in this outbreak. WHO is also providing the international community with regular updates and analysis of the situation as well as updated technical guidance documents related to MERS-CoV.

## **Risk Assessment**

The ongoing outbreak in the Republic of Korea started from a single person who travelled to the Middle East (KSA, Qatar, UAE and Bahrain). WHO has been in contact with health authorities in these countries to investigate the potential source of exposure(s) of the index case. Interviews with business partners and friends of the index case in the four countries have found that no contacts

with animals or visits to health care facilities or contact with confirmed cases of MERS. The source of his infection remains unknown.

In the Republic of Korea, the index case transmitted infection to close relatives, patients with whom he shared a room/ward and health care workers providing care. Subsequently, some of these cases further infected other relatives, patients and health care workers in a similar pattern. Three clustering events in three different hospitals have generated the majority of cases in the Korean outbreak. Each of these clusters can be explained by a combination of different factors such as crowded environments in emergency wards, close and unprotected contacts with a symptomatic case and possibly fomite transmission, particularly in St Mary's Hospital and Samsung Medical Center. The large number of health care facilities involved in this event can be explained by the fact that many cases have visited several health care facilities before being isolated. These exposures happened before MERS-CoV was suspected or diagnosed. Nosocomial and home-based transmission have been previously observed (e.g., in KSA, UAE, France, United Kingdom). This is the largest nosocomial outbreak that has occurred outside of the Middle East. This is also the first time MERS CoV has been exported to the Republic of Korea or China. The individual who travelled to China was symptomatic.

In this outbreak, all known transmission of this virus have occurred before adequate infection prevention and control procedures were applied and reflects transmission patterns seen in previous nosocomial outbreaks in the Middle East. Monitoring of the situation and contacts is ongoing and more information is being gathered to better assess the risks associated with this particular event. So far all the cases have been linked to the same chain of transmission in health care settings.

Identification and isolation of symptomatic cases early in the outbreak was not optimal, which allowed for further transmission. It can be expected that further cases will be detected in the coming days and weeks including in settings outside health care facilities. Preventing transmission from symptomatic cases through systematic, prompt and strict isolation will be key to curbing the further spread of this event. The Korean Government has significantly intensified their actions for case and contact management, which will likely reduce further transmission

Sequencing of the viruses obtained from a small number of patients in the Republic of Korea and China is underway. On 7 June, WHO convened a group of experts to evaluate the sequence data obtained and to compare with MERS-CoV sequences available from other affected countries. The data currently available do not indicate any substantial changes of the virus.

[\(http://www.who.int/csr/disease/coronavirus\\_infections/risk-assessment-9june2015/en/\)](http://www.who.int/csr/disease/coronavirus_infections/risk-assessment-9june2015/en/)

The assessment of the joint the Republic of Korea/WHO Mission team is as follows:

- This outbreak in the Republic of Korea, which started with the introduction of MERS-CoV infection into the country by a single infected traveller, was amplified by infection in hospitals and movement of cases within and among hospitals.
- A combination of older and new cases continue to be reported, but, as shown in the epidemic curve (Figure 2a), the number of new cases (vs. cases that are linked to large hospital clusters, e.g., Hospital B and D) occurring each day appears to be declining. This decline has coincided with much stronger contact tracing, monitoring and quarantine, suggesting that disease control measures are working. These measures are greatly facilitated by expanded laboratory testing. However, several weeks will be required to confirm the impact of the measures and whether the outbreak is fully controlled.

- Several factors appear to have contributed to the initial spread of this virus.
  - The appearance of MERS-CoV was unexpected and unfamiliar to most physicians
  - Infection prevention and control measures in hospitals were not optimal
  - Extremely crowded Emergency Rooms and multi-bed rooms contributed significantly to nosocomial infection in some hospitals.
  - The practice of seeking care at a number of medical facilities (“doctor shopping”) may have been a contributing factor
  - The custom of having many friends and family members accompanying or visiting patients may have contributed to secondary spread of infection among contacts.
- The rapid increase in numbers of cases has led to much speculation as to whether there may be new contributing factors to transmission. It is too early to draw definitive conclusions at this time, but certain observations can be made:
- There is no strong evidence at present to suggest that the virus has changed to make the virus more transmissible.
- Thus far, the epidemiological pattern of this outbreak appears similar to hospital-associated MERS-CoV outbreaks that have occurred in the Middle East. However, this Mission has not been able to determine whether environmental contamination, inadequate ventilation, or other factors have had a role in transmission of the virus in this outbreak. There is a compelling need for further investigation.
- While there is no evidence at present of ongoing community transmission of MERS-CoV in the Republic of Korea, continued monitoring for this possibility is critical. Because the outbreak has been large and complex and more cases can be anticipated, the Government should remain vigilant and continue intensified disease control, surveillance, and prevention measures until the outbreak is clearly over.

MERS-CoV is considered a zoonotic virus that can lead to secondary infections among people. Most infections have occurred in the Middle East and among them, many community-acquired infections are thought to be associated with direct or indirect contact with infected dromedary camels or camel-related products. Infection acquired by exposure to camels represent a minority of all cases. Once a person is infected by MERS CoV and is symptomatic, the person can transmit infection to others, but the specific modes of transmission, risk factors and conditions facilitating transmission are not well established. In no location has community wide transmission been observed. While human-to-human transmission has been observed in households in affected countries, most human cases reported to date have resulted from human-to-human transmission in health care settings. Suboptimal infection prevention and control in health care settings have sometimes resulted in large numbers of secondary cases, as was seen in KSA in April-May of 2014. For comparison, in the Jeddah outbreak in 2014 the numbers of cases reported by hospital ranged from 1-180 cases per hospital.

WHO expects that additional cases of MERS-CoV infection will be reported from the Republic of Korea among the persons who were in contact with symptomatic cases before these were identified and isolated. Mitigation measures have recently been intensified in the Republic of Korea by the public health authorities to actively find cases, increase compliance with home isolation, increase laboratory capacity, and improve infection prevention control measures in hospitals. It will take

several weeks to determine if these measures have an effect on the outbreak, but the incidence of new cases appears to be declining. Consistent application of adequate infection and prevention and public health measures has stopped transmission in previous clusters but it is too early to conclude if this outbreak is truly declining.

## **General Recommendations**

Enhancing infection prevention and control awareness and implementation measures is critical to prevent the nosocomial spread of MERS-CoV in healthcare facilities. It is not always possible to identify patients with MERS-CoV early and for this reason, all health care facilities should have standard infection prevention and control practices in place for infectious diseases in general. If MERS-CoV is suspected, policies and procedure for rapid screening and assessment of potential MERS-cases should be in place to ensure rapid care of the patient and to minimize the number of contacts among other patients, visitors and health workers. Droplet precautions, including eye protection, should be added to the standard precautions when providing care to any patient with symptoms of acute respiratory infection.

Other measures involve linen management, cleaning and disinfection and waste management. Airborne precautions are not generally recommended except when performing aerosol-generating procedures.

Health workers and facilities in all countries should maintain a high level of vigilance for the possibility of MERS-CoV especially among travellers or migrant workers returning from the Middle East. Countries should ensure adequate surveillance for MERS-CoV according to WHO guidelines, along with infection prevention and control procedures in healthcare facilities.

WHO continues to request that Member States rapidly report all confirmed and probable cases of MERS-CoV along with information about exposures, testing, and clinical course. A better understanding of how health care workers are infected in health care settings is urgently needed.

### **Specific Recommendations for the Government of the Republic of Korea**

The joint Republic of Korea/WHO Mission team made the following high-level recommendations to the Government of the Republic of Korea:

1. Infection prevention and control measures should immediately be strengthened in all healthcare facilities across the country.
2. All patients presenting with fever or respiratory symptoms should be asked about: contact with a MERS patient; visits to a healthcare facility where a MERS patient has been treated; and history of travel to the Middle East in the 14 days before symptom onset. Any patient with positive responses should be promptly reported to public health authorities and managed as a suspected case while the diagnosis is being confirmed.
3. Close contacts of MERS cases should not travel during the period when they are being monitored for the development of symptoms.
4. Strong consideration should be given to re-opening schools, as schools have not been linked to transmission of MERS-CoV in the Republic of Korea or elsewhere.

5. The most important steps needed to stop further cases involve continued implementation of basic public health measures by all health authorities. These include:
  - a. early and complete identification and investigation of all contacts
  - b. robust quarantine/isolation and monitoring of all contacts and suspected cases
  - c. full implementation of infection prevention and control measures; and
  - d. prevention of travel, especially internationally, of infected persons and contacts
6. Local governments must be fully engaged and mobilized in the national fight against this outbreak.
7. In parallel with disease prevention and control measures, steps should be taken to strengthen domestic and international confidence and trust. The most important actions involve improving risk communications. The Ministry of Health and Welfare should provide regularly updated information (in Korean and English) on the epidemiological situation, investigations, and disease control measures.
8. Additional staff (for “surge capacity”) are urgently required for the response and to provide relief for staff already working on the outbreak.
9. Selected hospitals should be designated for safe triage and assessment of suspected MERS cases. This will require trained personnel, facility management, and communication with the public.
10. Comprehensive research studies designed to close critical gaps in knowledge, including sero-epidemiological studies, should be completed and the results widely communicated as quickly as possible
11. The Republic of Korea should ensure that it is able to optimally respond to future outbreaks. In particular, it should strengthen the medical facilities needed to deal with serious infectious diseases, including increased numbers of negative-pressure isolation rooms; consider how to reduce the practice of “doctor shopping”; train more infection prevention and control specialists, infectious disease experts, laboratory scientists, epidemiologists, and risk communication experts; and invest in strengthening public health capacities and leadership, including at KCDC.

### **WHO Guidelines and Investigation Tools**

WHO guidelines and tools on investigations can be found here:

- [WHO guidelines for investigation of cases of human infection with Middle East Respiratory Syndrome Coronavirus \(MERS-CoV\) pdf, 359kb](#)
- [Middle East Respiratory Syndrome Coronavirus \(MERS-CoV\) Initial Interview Questionnaire of Cases pdf, 114kb](#)
- [Case-control study to assess potential risk factors related to human illness caused by Middle East Respiratory Syndrome Coronavirus \(MERS-CoV\) pdf, 257kb](#)
- [Seroepidemiological Investigation of Contacts of Middle East Respiratory Syndrome Coronavirus \(MERS-CoV\) Patients](#)