

Middle East Respiratory Syndrome Coronavirus (MERS-CoV)



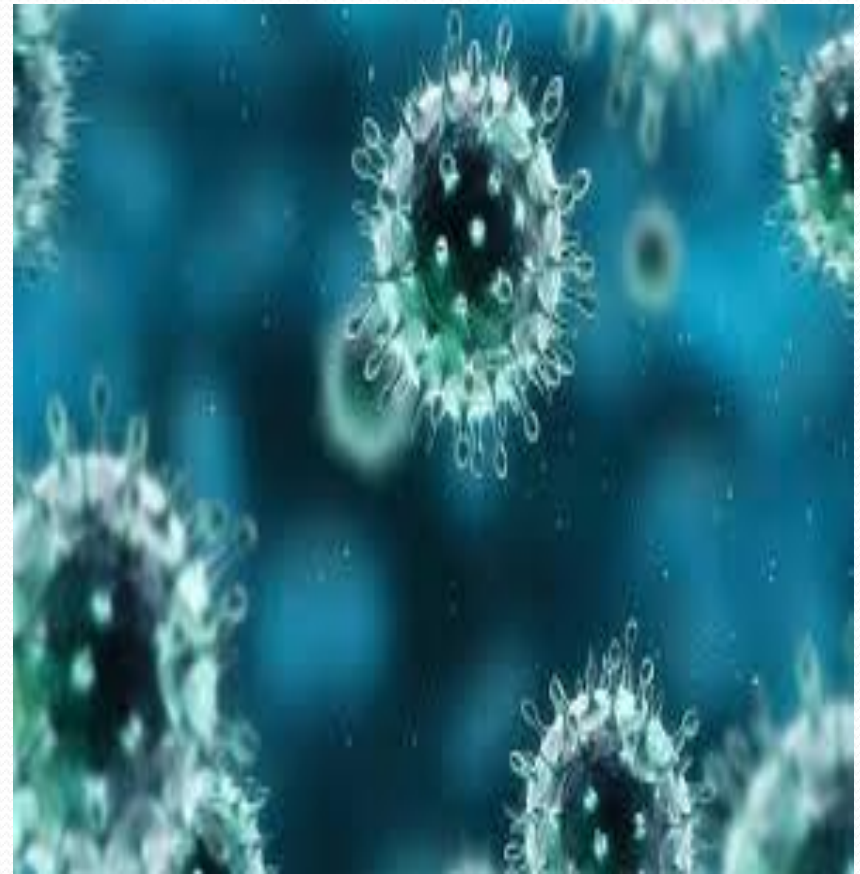
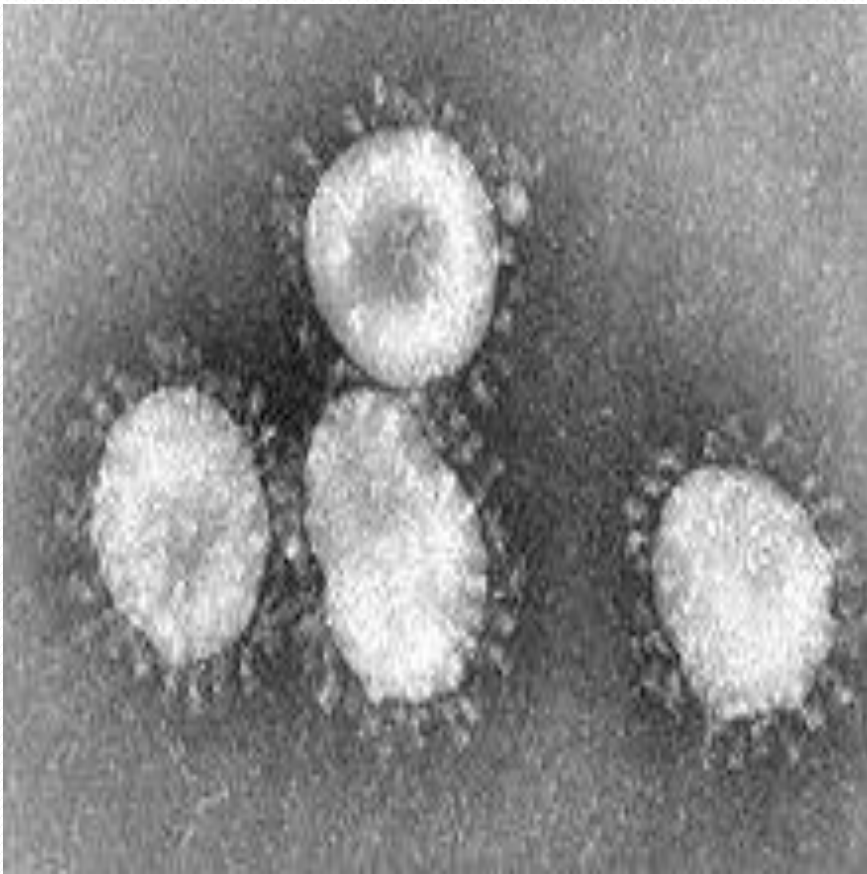
PRESENTED BY:
Dr.Wael Thanoon
Dr.Mohammed Khalid

Coronaviruses

- *Corona viruses* are species in the genera of virus belonging to the subfamily *Coronavirinae* in the family *Coronaviridae*.
- Corona viruses are enveloped viruses with a positive-sense RNA genome and with a nucleo-capsid of helical symmetry.

- The name "coronavirus" is derived from the Latin corona, meaning crown or halo.
- Coronaviruses derive their name from the fact that under electron microscopic examination, each virion is surrounded by a "corona," or halo. This is due to the presence of viral spike peplomers emanating from each proteinaceous envelope.

Corona Virus



- Corona viruses primarily infect the upper respiratory and gastrointestinal tract of mammals and birds.
- The most publicized human corona virus, SARS-CoV which causes SARS, has a unique pathogenesis because it causes both upper and lower respiratory tract infections and can also cause gastroenteritis.
- Corona viruses are believed to cause a significant percentage of all common colds in human adults

Listing of human coronaviruses

- Human coronavirus 229E
- Human coronavirus OC43
- SARS-CoV
- Human Coronavirus NL63 (HCoV-NL63, New Haven coronavirus)
- Human coronavirus HKU1
- Middle East respiratory syndrome coronavirus (MERS-CoV), previously known as Novel coronavirus 2012 and HCoV-EMC.

MERS- CoV

- The novel corona virus, first detected in April 2012, is a new virus that has not been seen in humans before. In most cases, it has caused severe disease. Death has occurred in about half of cases.





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- This new corona virus is now known as Middle East respiratory syndrome corona virus (MERS-CoV). It was named by the Corona virus Study Group of the International Committee on Taxonomy of Viruses in May 2013.

Route of transmission



- Undetermined Droplet and direct contact probably
Large droplet transmission is suspected as the most likely route.
- A considerable proportion of MERS-CoV cases have been part of clusters in which limited non-sustained human-to-human transmission has occurred.
- Human-to-human transmission has occurred in health care settings, among close family contacts, and in the work place.

Site of infection

- Middle east Corona viruses primarily infect the upper respiratory and gastrointestinal tract of mammals and birds.



Incubation period

- Usually 9 to 12 days
- We do not yet know how people become infected with this virus. Investigations are underway to determine the source of the virus, the types of exposure that lead to infection, the mode of transmission, and the clinical pattern and course of disease.



Symptoms

- Common symptoms are acute, serious respiratory illness with fever, cough, shortness of breath and breathing difficulties.
- All MERS-CoV patients have primarily had respiratory disease, although a number of secondary complications have also been reported, including acute renal failure, multi-organ failure, acute respiratory distress syndrome (ARDS), and consumptive coagulopathy.



- Many patients have also reported gastrointestinal symptoms, including diarrhoea. More than half of infected patients have died.
- In people with immune deficiencies, the disease may have an atypical presentation.

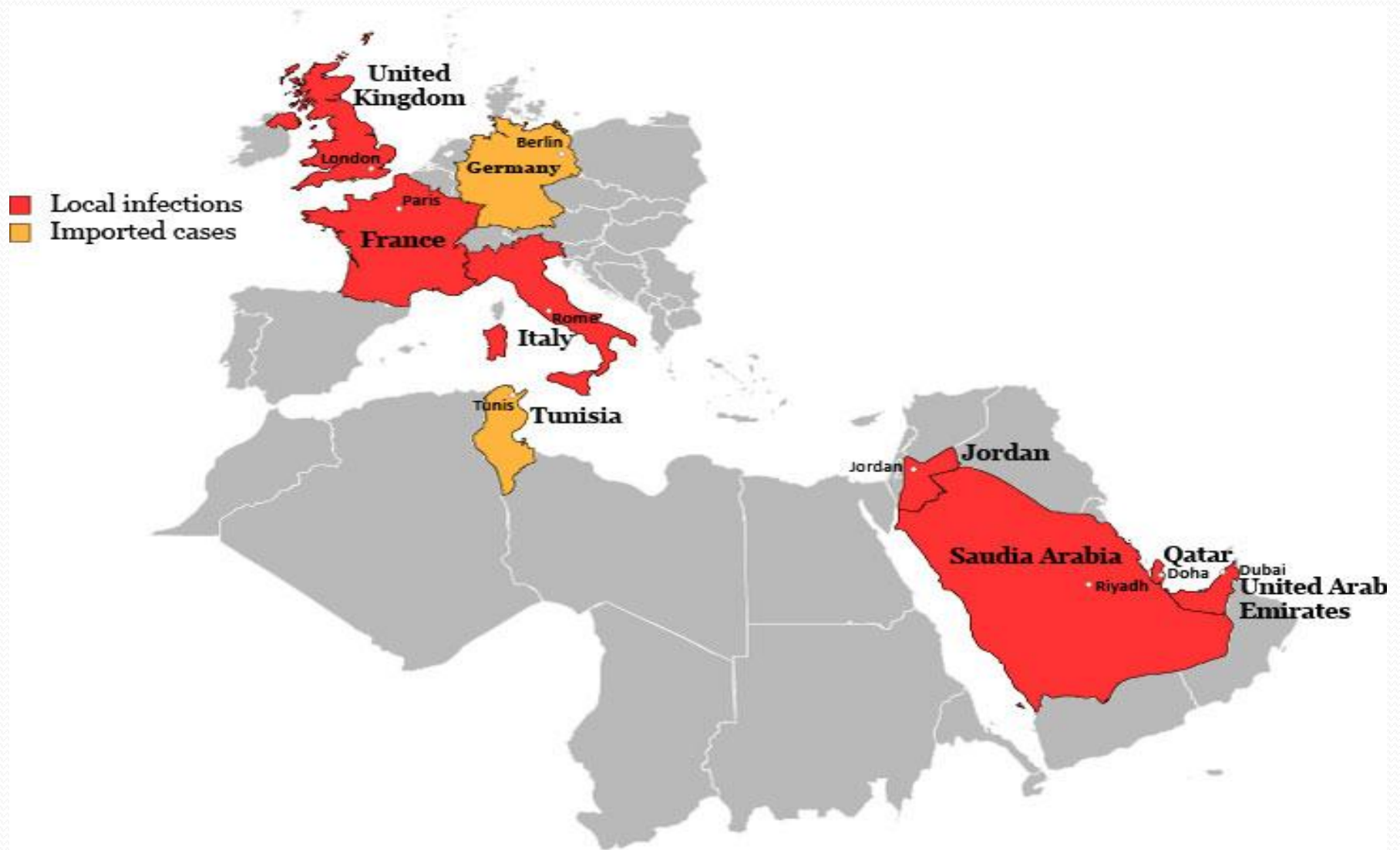


- A small number of cases had had co-infection with other viruses including influenza A, parainfluenza, herpes simplex, and pneumococcus.
- As of 6 June, the median age of reported laboratory-confirmed cases is 56 years (Range 2–94 years) and majority (72%) are males.

Prevalence of disease

- Nine countries have now reported cases of human infection with MERS-CoV.
- Cases have been reported in France, Germany, Italy, Jordan, Qatar, Saudi Arabia, Tunisia, the United Arab Emirates, and the United Kingdom.

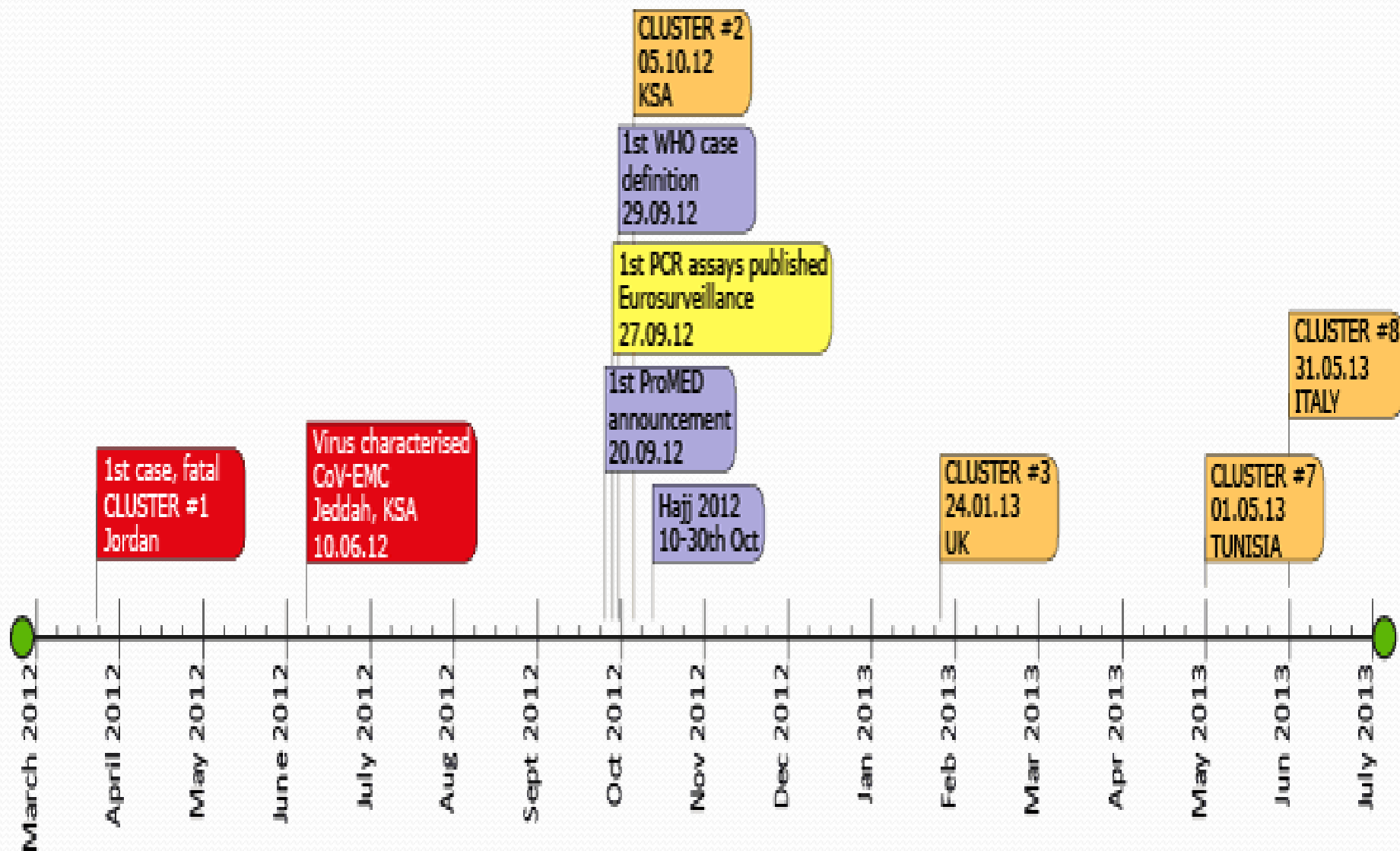
Showing Area affected





- All cases have had some connection (whether direct or indirect) with the Middle East.
- In France, Italy, Tunisia and the United Kingdom, limited local transmission has occurred in people who had not been to the Middle East but who had been in close contact with laboratory-confirmed or probable cases.

Time trend



MERS-CoV particles as seen by negative stain electron microscopy. Virions contain characteristic club-like projections emanating from the viral membrane.

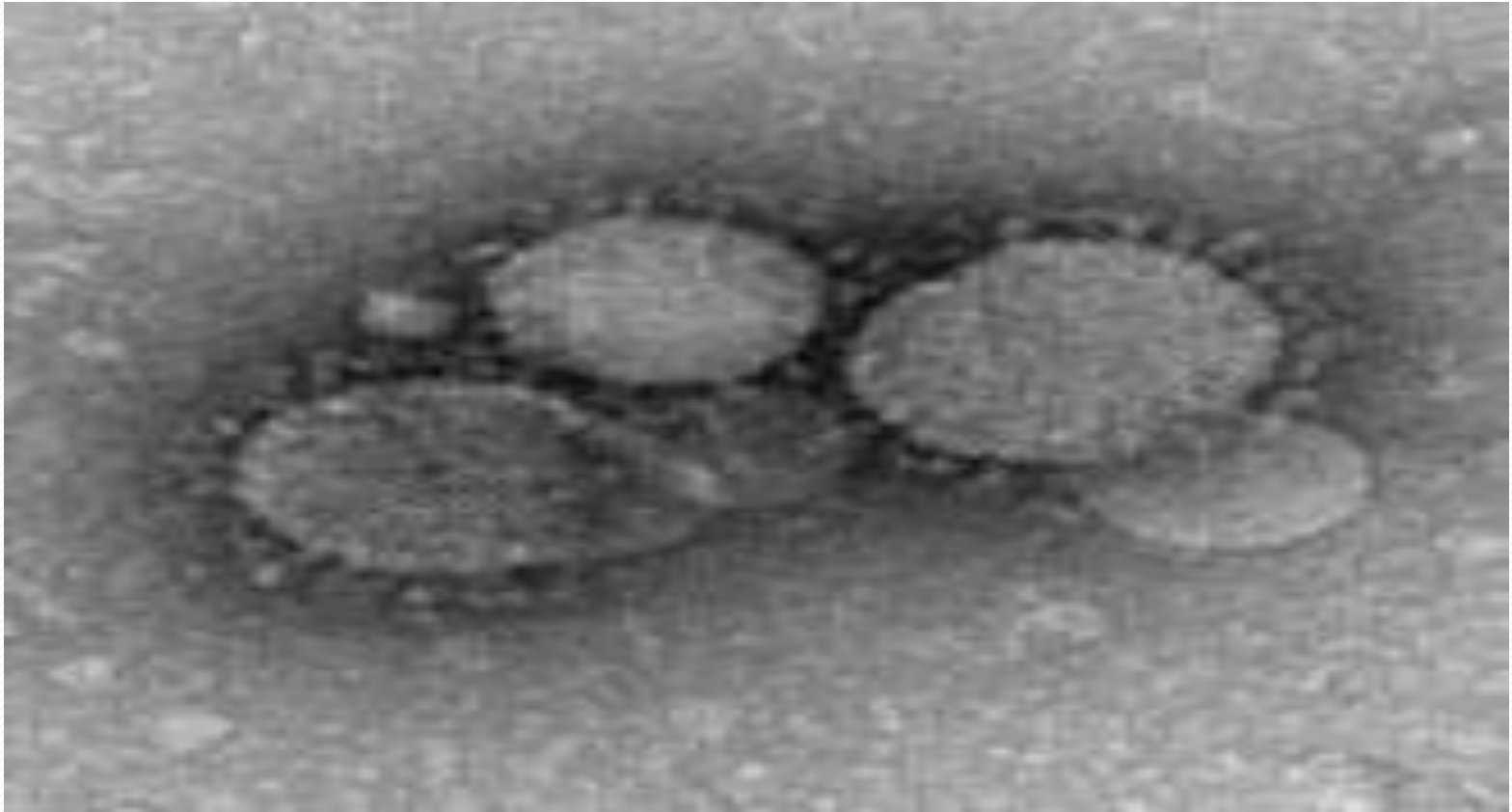


Image source: Cynthia Goldsmith/Maureen Metcalfe/Azaibi Tamin

An electron micrograph of a thin section of MERS-CoV, showing the spherical particles and cross-sections through the viral nucleocapsid.

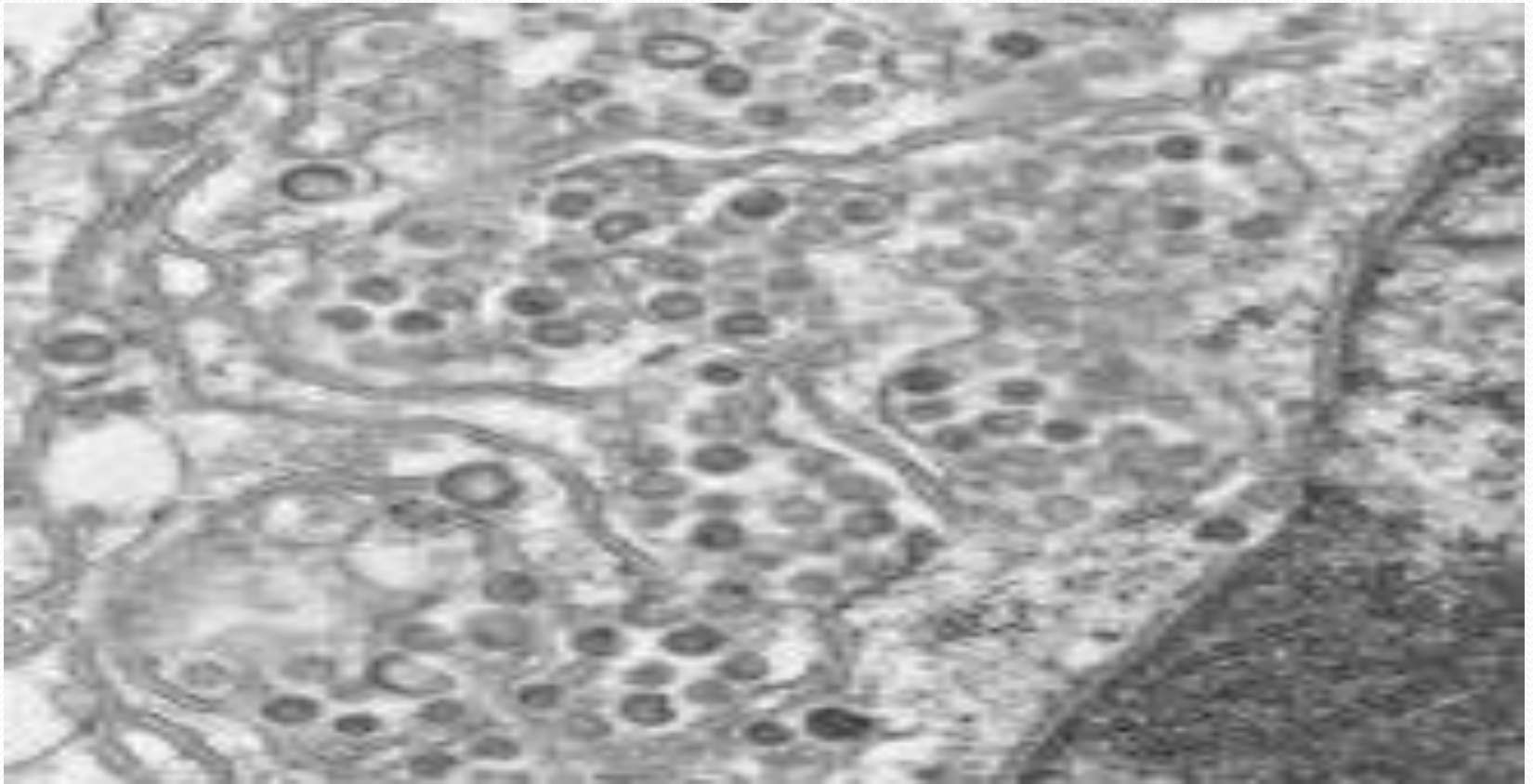


Image source: Maureen Metcalfe/Azaibi Tamin

Negative stain electron microscopy shows a MERS-CoV particle with club-shaped surface projections surrounding the periphery of the particle, a characteristic feature of coronaviruses.

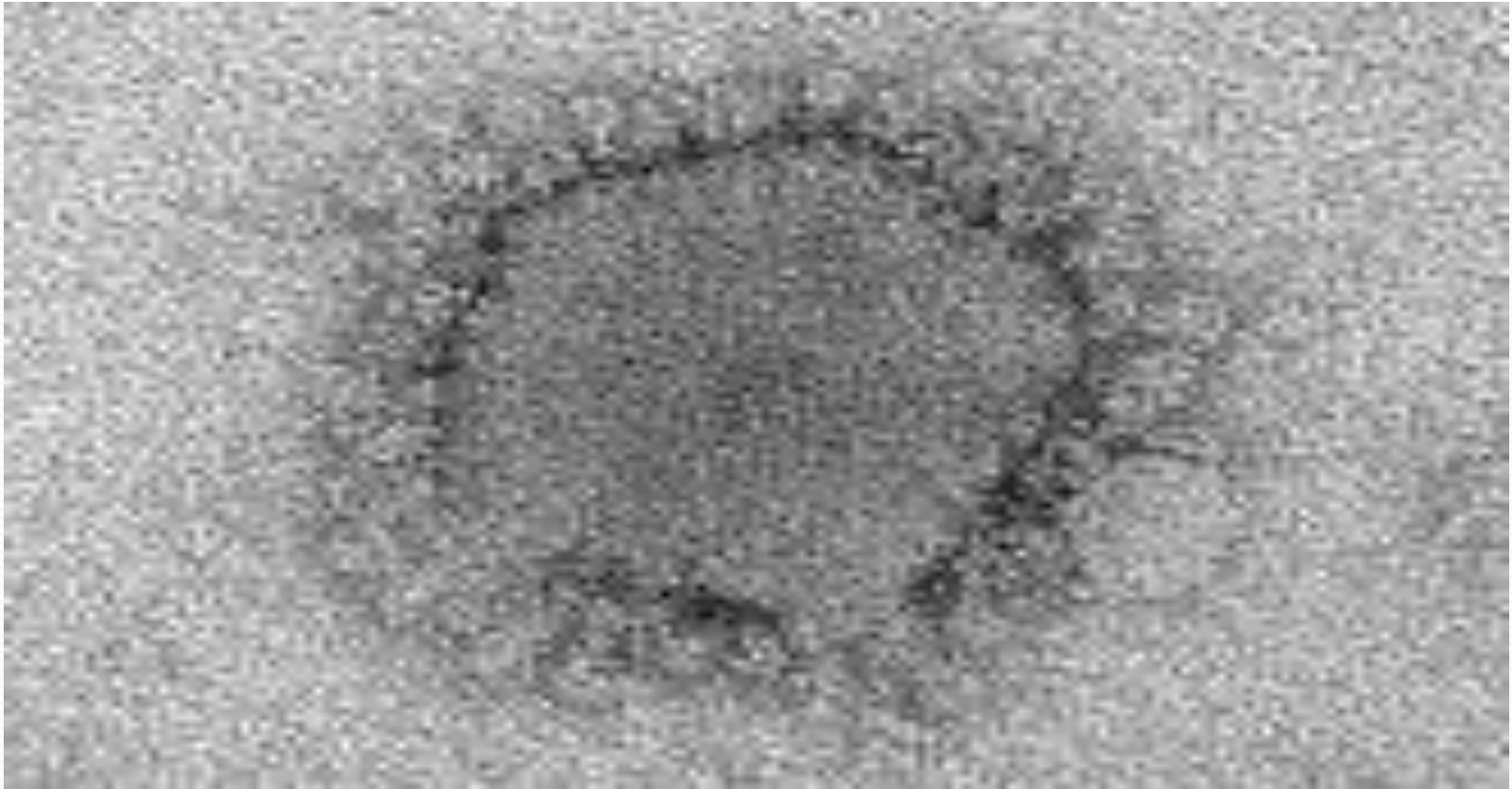
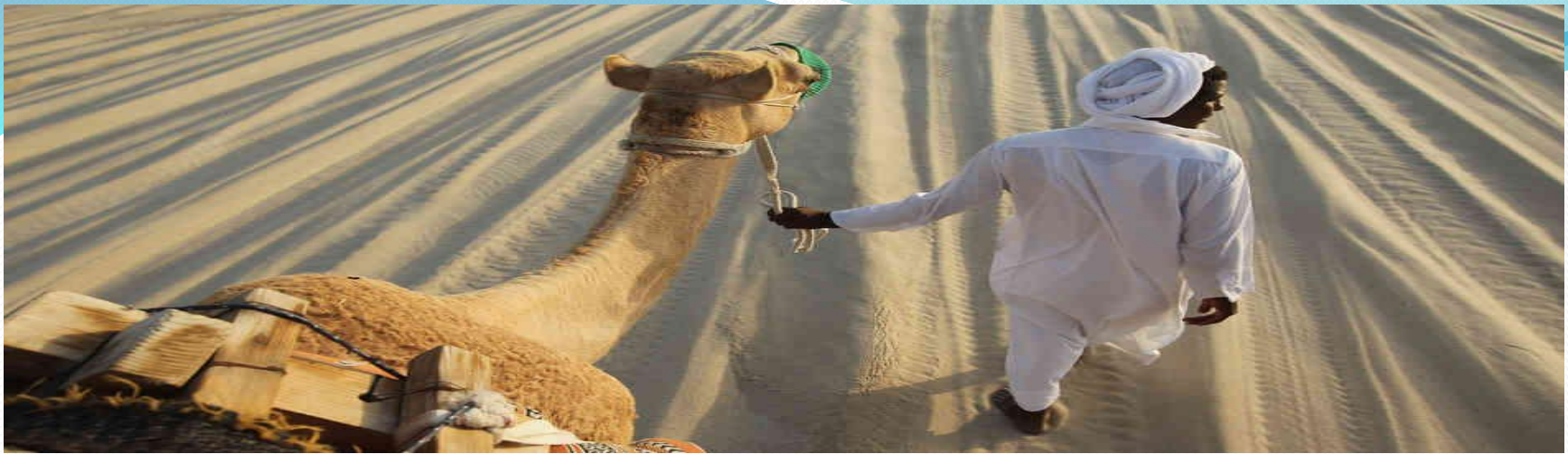


Image source: Cynthia Goldsmith/Azaibi Tamin

What is the significance of recent findings of virus antibodies in camels



- The recent study by Reusken and colleagues suggests that MERS-CoV or a virus very similar to the MERS-CoV has been recently circulating among camels.
- More study is needed to know whether the virus is actually the identical to that found in humans. To do this, it is important to recover the MERS virus itself from a camel.



- The paper provides a very important clue to the source of the virus and a direction for further investigation. The most critical question remains to be answered, that is, the type of human exposures that result in infection.
- Most human cases do not have a history of direct contact with camels; if camels or other animals are the source, the route of transmission to humans may be indirect.

The virus being transmitted to humans

- We still do not know the answer to this question. It is unlikely that transmission of the MERs-CoV to people occurs through direct exposure to an infected camel, as very few of the cases have reported a camel exposure.



- Because neither the source of the virus nor the mode of transmission is known, it is not possible to give specific advice on prevention of infection.
- Contact with any obviously sick animals (including birds) should be avoided, and basic hygiene measures taken, especially frequent hand washing and changing of clothes and shoes or boots, after handling animals or animal products.

- Sick animals should never be slaughtered for consumption.
- 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 cooking or pasteurization are safe for consumption but should also be handled with care, to avoid cross-contamination with uncooked foods.
- Other hygiene measures include avoiding unwashed fruits or vegetables.

“Patient under investigation” (PUI)

Persons who meet the following criteria should be reported and evaluated for MERS-CoV infection:

- A person with an acute respiratory infection, which may include fever ($= 38^{\circ}\text{C}$, 100.4°F) and cough
- Suspicion of pulmonary parenchymal disease (e.g., pneumonia or acute respiratory distress syndrome based on clinical or radiological evidence of consolidation)

- 
- History of travel from the Arabian Peninsula or neighboring countries within 14 days
 - Symptoms not already explained by any other infection or etiology, including clinically indicated tests for community-acquired pneumonia

- Persons may be considered for evaluation for MERS-CoV infection:
- Persons who develop severe acute lower respiratory illness of known etiology within 14 days after traveling from the Arabian Peninsula or neighboring countries but who do not respond to appropriate therapy.

A man wearing a yellow hard hat and a white respirator mask is writing 'MERS-CoV' on a whiteboard. He is holding a black marker in his right hand. The background is white with a blue and white curved graphic on the left side.

MERS-CoV

- Persons who develop severe acute lower respiratory illness who are close contacts of a symptomatic traveler who developed fever and acute respiratory illness within 14 days of traveling from the Arabian Peninsula or neighboring countries



MERS-CoV

- Close Contact of MERS-CoV
 - a) Any person who provided care for the patient, including a healthcare worker or family member, or had similarly close physical contact.
 - b) Any person who stayed at the same place (e.g. lived with, visited) as the patient while the patient was ill.

Probable Case of MERS-CoV

- **Any person who meets:**
- The criteria for Patient Under Investigation and has clinical, radiological, or histo-pathological evidence of pulmonary parenchyma disease (e.g. pneumonia or ARDS), but no possibility of laboratory confirmation exists, either because the patient or samples are not available or there is no testing available for other respiratory infections

- Person is a close contact with a laboratory-confirmed case
- Person has illness not already explained by any other infection or aetiology, including all clinically indicated tests for community-acquired pneumonia
- Any person with severe acute respiratory illness with unknown aetiology
- An epidemiologic link to a confirmed MERS case.

Confirmed Case of MERS-CoV

- A person with laboratory confirmation of infection with MERS-CoV.

Laboratory Testing

- **Novel Coronavirus 2012 Real-time RT-PCR Assay** (NCV-2-12 rRT-PCR Assay) is used to confirm MERS- CoV in respiratory, blood and stool samples.
- Lower respiratory tract specimens should be a priority for collection and PCR testing.
- Stool specimens are of lower priority.



- To increase the likelihood of detecting MERS-CoV, CDC recommends collection of specimens from different sites--for example, a nasopharyngeal swab and a lower respiratory tract specimen such as sputum, bronchoalveolar lavage, bronchial wash, or tracheal aspirate.

Treatment

There are no specific treatments for illnesses caused by MERS-CoV. Medical care is supportive and to help relieve symptoms.

The most important recommendation remains that general supportive care continues to be the keystone of management, as similarly expressed in the Surviving Sepsis Campaign guidelines for the care of the critically ill, and that any additional benefit of novel pharmacological agents remains uncertain.

Agent can be use:

- Convalescent plasma
- Interferon
- Protease Inhibitors
- Intravenous Immunoglobulin
- Nitazoxanide
- Cyclosporin A
- Ribavirin
- Corticosteroids
- Interferon plus ribavirin

Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Corona virus (MERS-CoV)

These recommendations are based upon available information (as of June 10, 2013) and the following considerations:

- Suspected high rate of morbidity and mortality among infected patients
- Evidence of limited human-to-human transmission
- Poorly characterized clinical signs and symptoms
- Unknown modes of transmission of MERS-CoV
- Lack of a vaccine and chemoprophylaxis
- Absence of confirmed or probable MERS-CoV cases in the United States

Component	Recommendation(s)	Comments
Patient placement	•Airborne Infection Isolation Room (AIIR)	<ul style="list-style-type: none">•If an AIIR is not available, the patient should be transferred as soon as is feasible to a facility where an AIIR is available.•Pending transfer, place a facemask on the patient and isolate him/her in a single-patient room with the door closed.•The patient should not be placed in any room where room exhaust is recirculated without high-efficiency particulate air (HEPA) filtration.

Component	Recommendation(s)	Comments
		<ul style="list-style-type: none">•Once in an AIIR, the patient's facemask may be removed; the facemask should remain on if the patient is not in an AIIR.•When outside of the AIIR, patients should wear a facemask to contain secretions•Limit transport and movement of the patient outside of the AIIR to medically-essential purposes.•Implement staffing policies to minimize the number of personnel that must enter the room.

Component	Recommendation(s)	Comments
Personal Protective Equipment (PPE) for Healthcare personnel (HCP)	<ul style="list-style-type: none"> •Gloves •Gowns •Eye protection (goggles or face shield) •Respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering facepiece respirator. <ul style="list-style-type: none"> • If a respirator is unavailable, a facemask should be worn. In this situation respirators should be made available as quickly as possible. 	<ul style="list-style-type: none"> •Recommended PPE should be worn by HCP upon entry into patient rooms or care areas. •Upon exit from the patient room or care area, PPE should be removed and either <ul style="list-style-type: none"> • Discarded, or • For re-useable PPE, cleaned and disinfected according to the manufacturer's reprocessing instructions

Component	Recommendation(s)	Comments
Environmental Infection Control	<ul style="list-style-type: none"> • Follow standard procedures, per hospital policy and manufacturers' instructions, for cleaning and/or disinfection of: <ul style="list-style-type: none"> • Environmental surfaces and equipment • Textiles and laundry • Food utensils and dishware 	



Healthcare Provider Preparedness Checklist for MERS-CoV

- The following checklist highlights key steps for healthcare providers to take in preparation for transport and arrival of patients potentially infected with MERS-CoV.
- Stay up to date on the latest information about signs and symptoms, diagnostic testing, and case definitions for MERS-CoV disease.

- Review your infection control policies and CDC infection control recommendations for MERS-CoV for:
 - Assessment and triage of acute respiratory infection patients
 - Patient placement
 - Visitor management and exclusion
 - Personal protective equipment (PPE) for healthcare personnel
 - Source control measures for patients (e.g., put facemask on suspect patients)
 - Requirements for performing aerosol generating procedures

- Be alert for patients who meet the MERS-CoV case definition
- Promptly implement source control for potential MERS-CoV patients before transport or upon entry to the facility and triage according to facility plans (e.g., place in private room) for evaluation
- Know how to report a potential MERS-CoV case or exposure to facility infection control leads and public health officials

- Know who, when, and how to notify and when to seek evaluation by occupational health following an unprotected exposure (i.e., not wearing recommended PPE) to a suspected or confirmed MERS-CoV patient
- Know how to contact and receive information from your state or local public health agency
- Remain at home if you are ill

MERS-CoV Vaccine



- **Novavax** on June 6, 2013 announced that it had successfully produced a vaccine candidate designed to provide protection against the recently emerging Middle East Respiratory Syndrome Coronavirus (MERS-CoV).
- The vaccine candidate was made using Novavax' nanoparticle vaccine technology, is based on the major surface spike (S) protein.

Travelers guidelines



- CDC recommends that US travellers to countries in or near the Arabian Peninsula pay attention to their health during and after their trip.
- Travellers should see a doctor right away if they develop fever and symptoms of lower respiratory illness, such as cough or shortness of breath, within 14 days after travelling from countries in or near the Arabian Peninsula.
- They should tell the doctor about their recent travel.

CDC does not recommend that most travelers change their plans because of MERS.

However, the Saudi Arabia Ministry of Health has made special recommendations for travelers to Hajj and Umrah.



Because of the risk of MERS, Saudi Arabia recommends that the following groups should postpone their plans for Hajj and Umrah 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

- Pilgrims should pay attention to their health when traveling in the Arabian Peninsula and seek medical care if they develop a fever with cough or shortness of breath within 14 days after returning from their trip.

MERS Cases and Deaths, April 2012 - Present

- Current as of September 16, 2013, 9:00 AM EDT

Countries	Cases (Deaths)	Countries
France	2	1
Italy	3	0
Jordan	2	2
Qatar	5	2
Saudi Arabia	90	44
Tunisia	3	1
United Kingdom (UK)	3	2
United Arab Emirates (UAE)	6	2
Total	114	54

References

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THANK
YOU

