Middle East respiratory syndrome coronavirus (MERS-CoV)

Background (June 2023)
MERS-CoV Overview

- MERS-CoV is one of three high impact zoonotic coronaviruses with pandemic potential that have emerged in recent years.
- It was first reported in humans in 2012 in the Kingdom of Saudi Arabia (KSA) and Jordan.
- The animal reservoir is dromedary camels, though MERS-CoV causes no apparent disease signs in dromedaries.
- Human infection occurs directly from contact with dromedaries possibly indirectly, through consumption of camel-related products.

Image source: Sam Bradd, Drawing Change
MERS-CoV in Humans

• Human-to-human transmission, primarily in healthcare settings but also in households, has been observed.
• Symptoms in humans range from mild to severe respiratory disease; some cases infected with MERS-CoV experience no symptoms at all.
• The crude case fatality ratio (CFR) is high at approximately 36%.
• Being of older age and having comorbidities are associated with a greater risk of fatality from MERS-CoV.
• One of 9 WHO priority pathogens with pandemic potential, thus prioritized for research and development (R&D) activities.

Image source: Sam Bradd, Drawing Change
Prevention and clinical management of MERS-CoV

Extra caution must be taken when:
- Visiting camel farms or markets
- Consuming or handling raw dromedary products
- Coming into contact with an individual who has a known exposure to MERS-CoV

Improved infection prevention and control (IPC) measures in health care facilities have substantially reduced secondary transmission.

There are currently no licensed therapeutics or treatments for MERS-CoV; those infected can only be treated for their symptoms.
MERS is a global threat

There is a risk of international spread of any infectious disease, including MERS.

For example, a single imported MERS case in a traveler who had spent time in the Middle East sparked a major outbreak (186 cases) in the Republic of Korea from May to July 2015.

Those at highest risk of infection include:

- People in close contact with dromedary camels (e.g. farmers, abattoir workers, shepherds, camel owners) or consuming/handling raw dromedary products (e.g. milk or urine).
- Health and care workers caring for MERS patients, especially if not adhering to infection prevention and control (IPC) measures.
The Dromedary-Human Interface

- Camels play an important socioeconomic role in many cultures
- Dromedary camels do not show clinical signs when infected with MERS-CoV
- Detection of MERS-CoV in dromedary herds is through sampling and laboratory testing
- Infected camels should be isolated from the rest of the herd and humans until they test negative
- Immunity to MERS-CoV is not lifelong, and so dromedaries can be reinfected
- Vaccines, for dromedaries and for humans, are in development, but need further investment

Image source: Sam Bradd, Drawing Change
MERS in other Animal Species

• Other camelid species, like llamas and alpacas, have been found susceptible to MERS-CoV infection in affected areas or in laboratory experiments.

• Bats, while thought to be the source of a MERS-CoV ancestor virus that then spilled over and adapted to camels, does not appear to play a role in the current epidemiology of the disease.
MERS-CoV phylogenetic analysis

- MERS-CoV is enzootic in dromedary camels in large areas of **Africa**, the **Middle East** and **South Asia**: This results in vast geographic areas where dromedary camels can infect humans.

- There are phylogenetic differences in the virus detected globally:
  - **Arabian Peninsula:**
    - Clade A (extinct)
    - Clade B
  - **Africa:**
    - Clade C

- WHO strongly encourages undertaking genetic sequencing where possible and sharing of sequences and meta-data including uploading this to a publicly available database. Doing so enables these important analyses and risk assessment to be undertaken.
Circulation of MERS-CoV in dromedaries in Africa

- Possible hypotheses for the lack of human case reports from the Africa region include:
  - Lower viral replication levels in Clade C, which may suggest lower pathogenicity in humans
  - Lack of active human case finding (although sero-surveys provided evidence of past human exposure)
  - Differences in zoonotic transmission risk
  - Environmental differences
  - Behavioral differences

- This phenomenon is not due to a lack of exposure

- The risk of spillover is high, thus enhanced surveillance in this region is critically needed

Map source: FAO
Applying a One Health (OH) approach

For the effective surveillance, preparedness and response to MERS-CoV the One Health (OH) approach is key, and a multitude of players, institutions and organizations need to be engaged.

The Quadripartite:
- the World Health Organization (WHO)
- the Food and Agricultural Organization of the United Nations (FAO)
- the World Organization for Animal Health (WOAH)
- the United Nations Environment Program (UNEP)

is an example of an active OH collaboration working on and responding to the threats posed by MERS-CoV.

Image source: Sam Bradd, Drawing Change
Since 2012, there have been approximately 2,600 confirmed human cases from 27 countries globally.
Impact of the COVID-19 pandemic on MERS-CoV

- The substantial drop in the number of MERS cases reported to WHO since the beginning of the COVID-19 pandemic could be explained by:
  - **Surveillance** being pivoted to focus on SARS-CoV-2 resulting in reduced detection of MERS-CoV
  - **Public health and social measures (PHSM)** implemented to control the spread of SARS-CoV-2 also reducing opportunities for MERS-CoV to spread
- However, the COVID-19 pandemic has acted as a catalyst for infrastructure investments and capacity development. We must harness these advances in technology to address the outstanding research gaps in our fight against MERS-CoV.
- Further research is needed to understand any cross-protection between SARS-CoV-2 infection and MERS-CoV infection.

Image source: Sam Bradd, Drawing Change
One of the human vaccines in development for MERS-CoV was leveraged for the development of SARS-CoV-2 vaccines. This vaccine (Oxford-AstraZenica) was rolled out across the world within a year of the emergence of this new virus.

All of WHO’s guidance and information products for MERS-CoV were adapted for what was initially called nCoV. This included testing platforms, surveillance protocols, clinical management for severe acute respiratory syndrome, readiness checklists, infection prevention and control (IPC).

MERS-CoV expert networks were initially called upon to provide technical advice to WHO across all aspects of the early response to SARS-CoV-2, particularly regarding the development of vaccines.

Global investments for MERS-CoV prevention and control were critical at the beginning of the COVID-19 pandemic response.

Mathematical models of disease transmission and control were often designed using the epidemiological information known from MERS-CoV, and/or results from similar analyses from MERS-CoV were used to contextualize results from the novel coronavirus SARS-CoV-2.
The 2021 Global Technical Meeting: highlighting global priorities for MERS-CoV Research and Development

• Increase MERS-CoV surveillance and reporting in camels and humans, with renewed emphasis across the Middle East and a particular focus in Africa.

• Integrate surveillance for MERS-CoV in humans into surveillance for respiratory pathogens in MERS-CoV-affected regions and at-risk areas for importation.

• Plan and strengthen One Health interventions with consideration given to community priorities and needs.

• Strengthen and test One Health data sharing mechanisms ahead of future MERS outbreaks.

• Re-evaluate and advocate for the feasibility of camel vaccines.

• Conduct studies to explore the acceptance of camel vaccination.

• Leverage the scientific achievements of the COVID-19 pandemic for other diseases, including MERS-CoV.

Further information: Global technical meeting on MERS-CoV and other emerging zoonotic coronaviruses (who.int)
Further resources

• MERS Fact sheet

• MERS Overview
  https://www.who.int/health-topics/middle-east-respiratory-syndrome-coronavirus-mers

• MERS global summary and assessment of risk
  https://www.who.int/publications/i/item/WHO-MERS-RA-2022.1

• EMRO MERS page
  https://www.emro.who.int/health-topics/mers-cov/mers-cov.html

• FAO MERS Update in animals

• WHO Disease outbreak news
  https://www.who.int/emergencies/disease-outbreak-news

• WOAH Chapter on MERS-CoV
  https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.05.02_MERS-CoV.pdf

Image source: Sam Bradd, Drawing Change