Update on Middle East Respiratory Syndrome (MERS)

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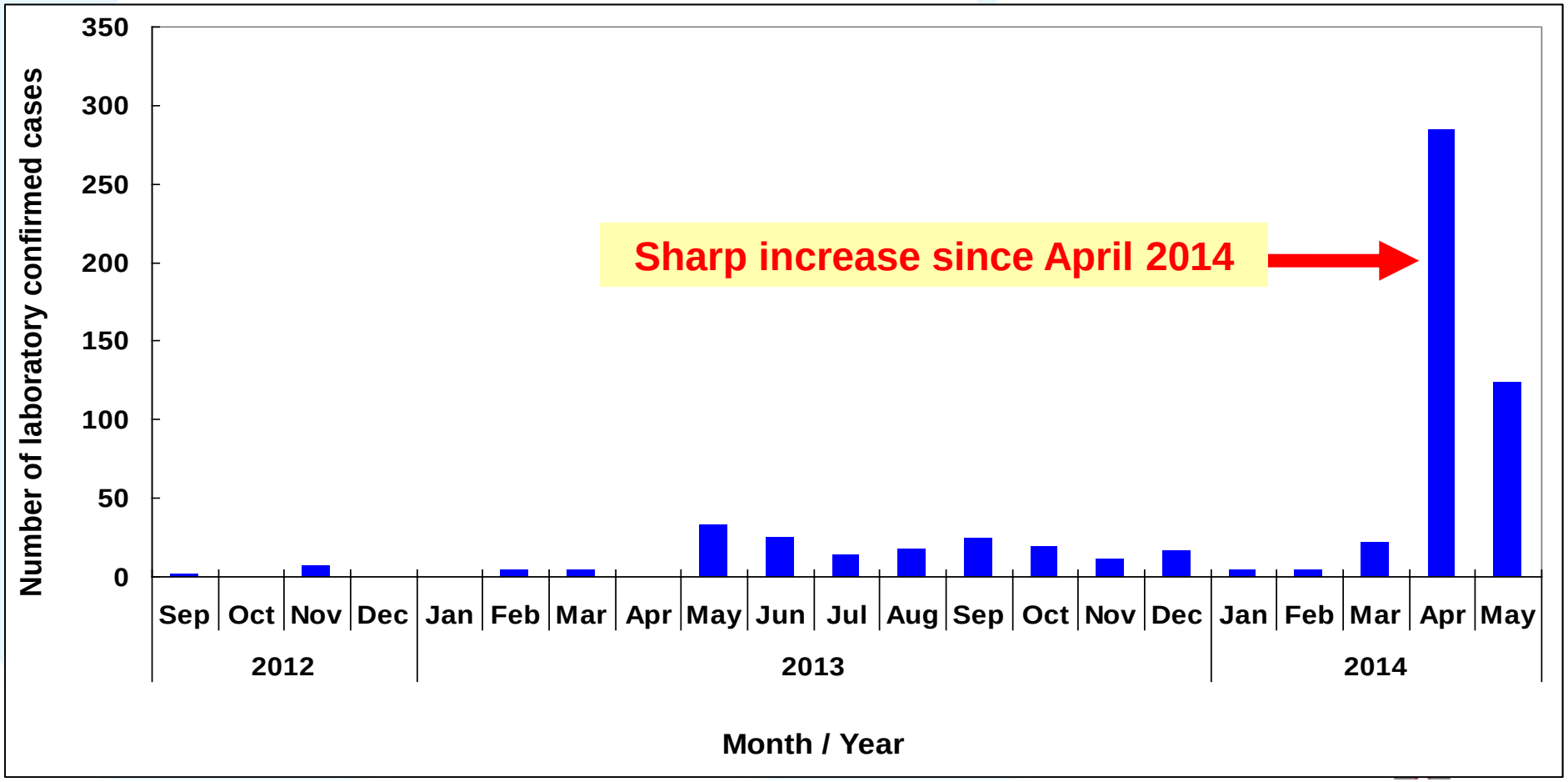
Monthly number of cases reported to WHO

Occurrence of new cases seems to follow a seasonal pattern, ***with increasing incidence from March-April onwards.***



Remarks: **(1) The cases in Apr 2014 include 229 cases reported by KSA between 11 April & 4 May 2014**
(2) The cases in May 2014 include 140 cases reported by KSA between 5 & 15 May 2014.

Number of cases reported to WHO (by place of reporting)

As of 16 May 2014, a total of 614 laboratory confirmed cases of MERS, including 181 deaths were reported to WHO.

Reporting country		Middle East cases	Cases reported *outside* Middle East	
			Cases imported directly from Middle East	Cases without travel history to Middle East but had exposure to a case acquired infection in Middle East
Middle East	KSA	509		
	UAE#	63		
	Qatar	7		
	Jordan	9		
	Kuwait	3		
	Oman	2		
	Lebanon	1		
	Yemen	1		
Non-Middle East	UK		2	2
	Tunisia		1	2
	France		1	1
	USA		2	0 *(a close contact was tested positive for MERS-CoV antibodies)*
	Netherlands		2	0
	Germany		2	0
	Egypt		1	0
	Greece		1	0
	Malaysia		1	0
	Italy		1	0

including a case who had returned to the Philippines before confirmation

without known onward transmission from imported case(s) so far

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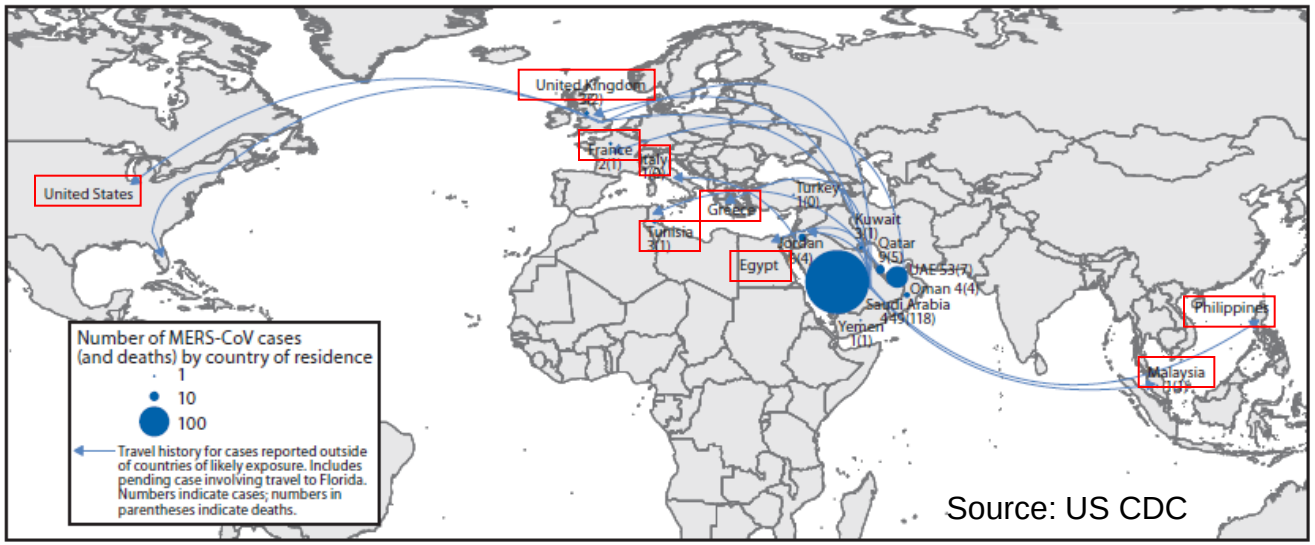
8 Middle East countries with confirmed MERS cases

- **All primary cases had exposure to MERS-CoV in Middle East**
- **Affected countries in Middle East include:**
  - **Jordan**
  - **Kuwait**
  - **Oman**
  - **Qatar**
  - **Kingdom of Saudi Arabia**
  - **United Arab Emirates**
  - **Yemen**
  - **Lebanon**

Source: US CDC

Cases outside Middle East

- Countries outside Middle East with confirmed cases include:
  - ***Europe***: France, Germany, Italy, UK, Greece, Netherlands
  - ***North Africa***: Tunisia, Egypt
  - ***Asia***: Malaysia, Philippines
  - ***North America***: United States
- All 19 cases had a link to the Middle East, either through
  - recent travel to the region within incubation period (14); or
  - exposure to a patient who acquired infection in the region (5).



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Suspected case acquired locally in US

- Index patient (1st imported case in US) traveled by plane from KSA to Chicago, Illinois on Apr 24
- Had symptom onset on Apr 27, admitted for isolation on Apr 28
- One asymptomatic male contact aged 70+ with underlying medical condition met with index on 2 occasions before onset of index:
  - extended face-to-face contact within 6 feet on Apr 25 in a 40-minute business meeting and handshaking
  - another brief contact on Apr 26
- Nasopharyngeal & oropharyngeal swabs collected 10 days after contact with index were tested negative for MERS-CoV by PCR on May 5
- Serum collected on 9 May (i.e.14 days after contact with index) was tested positive for antibodies to MERS-CoV by serologic assays (screening ELISA assay & immunofluorescence confirmatory test)

Demographic distribution

- Age range: 9 months - 94 years (median: 49 years)
- 66% affected male

	Median age (years)*	% male*
Primary cases	58	80%
Secondary cases (considered to have acquired the infection from another infected person)	45	58%

*Note: Among 206 cases according to the latest WHO Update (as of 27 Mar 2014)

Clinical features (1)

- Incubation period[1,2]
  - 2-14 days
  - Generally < 1 week
  - A minority of cases >1 week but < 2 weeks
- Among 286 cases with details announced by WHO, 211 patients (73.8%) presented with relatively more severe illnesses (such as pneumonia), 28 patients (9.8%) had mild illnesses (such as influenza-like illness), while the remaining 47 patients (16.4%) were reported to be asymptomatic
- Clinical presentations[3]
  - Acute respiratory illness with fever, cough, shortness of breath
  - Pneumonia
  - Gastrointestinal symptoms, including diarrhoea
  - Renal failure
  - People with immune deficiencies may have an atypical presentation
- Overall case fatality rate: 29.5%[4]
- Health care workers: 21.3%
  - Majority had mild or no symptoms

1. WHO. MERS-CoV summary and literature update – as of 20 June 2013.
2. WHO. Risk Assessment on MERS (as of 24 April 2014)
3. WHO FAQs on MERS 9 May 2014
4. WHO. MERS-CoV latest update – as of 16 May 2014

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Clinical features (2)

- 53% reported to have underlying medical condition
- Patients with underlying co-morbidities had high risk of severe disease due to MERS-CoV infection

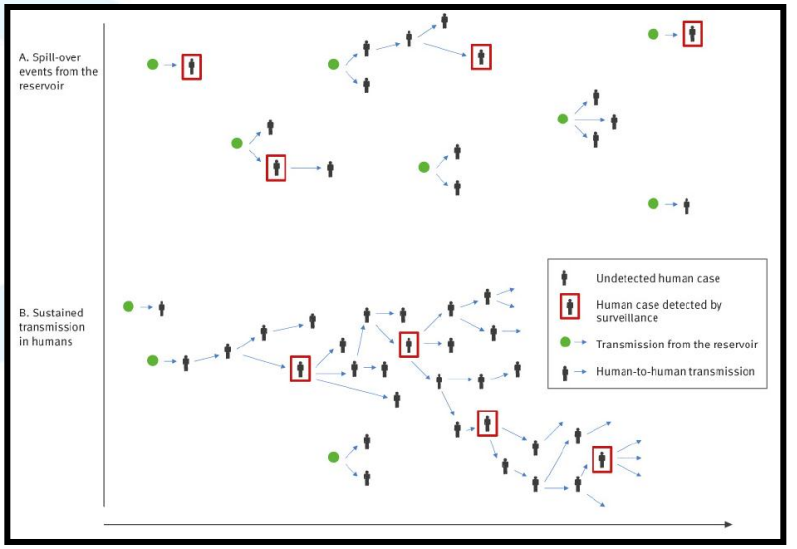
	Presented with severe illnesses	Case fatality rate
Cases **with** known chronic diseases	94.7%	41.7%
Cases **without** known chronic diseases	54.2%	10.4%

- Patients can shed virus after resolution of symptoms, but duration of infectivity is unknown. Patients are not contagious during incubation period[1]

1. WHO. Risk Assessment on MERS (as of 24 April 2014)

Clusters

- Reported in France, Jordan, KSA, Tunisia, UAE, UK and Qatar
  - healthcare settings
  - households
  - workplaces
- 2 possible scenarios[1]
  - ? Ongoing transmission in an animal reservoir with sporadic spillover into humans resulting in non-sustained clusters
  - ? Unrecognized sustained transmission among humans with occasional severe cases
- At least 26 clusters were identified in healthcare facilities or households.
  - Sizes ranged from 2 to 28 cases with a total of 127 cases (44.4%) involved.



2 illustrative scenarios for transmission of MERS-CoV[1]

1. Cauchemez S et al. Middle East respiratory syndrome coronavirus: quantification of the extent of the epidemic, surveillance bias, and transmissibility. The Lancet Infectious Diseases, Vol 14, Issue 1, Pg 50 - 56, Jan 2014.

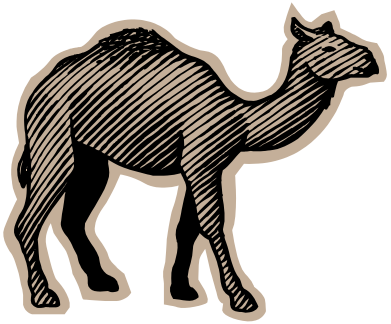
Evidence of camels serving as primary source of MERS-CoV

- MERS-CoV has recently been found in camels to which human cases have been exposed
- Serological studies showed widespread transmission of MERS-CoV in camels
- Camel-derived virus were similar to human-derived virus collected in same area
- Available genetic sequence data suggested current observed pattern of disease in humans is resulted from repeated introductions into human populations from camels, with subsequent limited human-to-human transmission

WHO. MERS-CoV summary and literature update – as of 27 March 2014.

Role of camels in transmission

- Direct or indirect source of human MERS-CoV infection. Transmission could potentially occur via respiratory or faecal shedding, or other types of contact
- Juvenile dromedary camels animals have higher virus load indicating higher likelihood of transmission
- However, the way humans become infected from an animal and/or environmental source is still under investigation
- Most primary human cases did not have history of direct exposure to animals
- Overall, only 35 cases (12%) were reported to have recent contact with animals such as camels



Sources:

- ECDC. 9th Updated Rapid Risk Assessment on MERS-CoV. 24 Apr 2014.
- WHO. Risk Assessment on MERS (as of 24 April 2014)
- WHO. MERS-CoV summary and literature update – as of 20 January 2014.

Latest global situation

- No. of cases has been rising sharply since mid-Mar 2014 with outbreaks occurring in healthcare facilities (esp. in KSA & UAB)
- Apparent seasonal increase in primary cases may be related to weaning of young camels from their mothers in spring
- More human-to-human transmission than previously observed
  - As much as 75% of recently reported cases appeared to have acquired the infection from another infected person
- No sustained community transmission so far
- Majority of secondary cases affected HCWs who mainly presented with minor symptoms or were asymptomatic
  - 15% of recently affected HCWs in KSA presented with severe disease

Outbreaks in Jeddah, KSA

- Upsurge in cases can be explained by an increase, possibly seasonal, in number of primary cases amplified by several outbreaks in hospitals due to breaches in infection prevention and control measures.
- Majority of human-to-human infections occurred in health care facilities. One quarter of cases involved HCWs.
- Secondary transmission in community and households is much lower than in health care settings.

WHO. MERS-CoV summary and literature update – as of 9 May 2014.

Clusters in healthcare settings

- An outbreak from Apr - May 2013 in eastern KSA involving 23 confirmed cases in 4 healthcare facilities

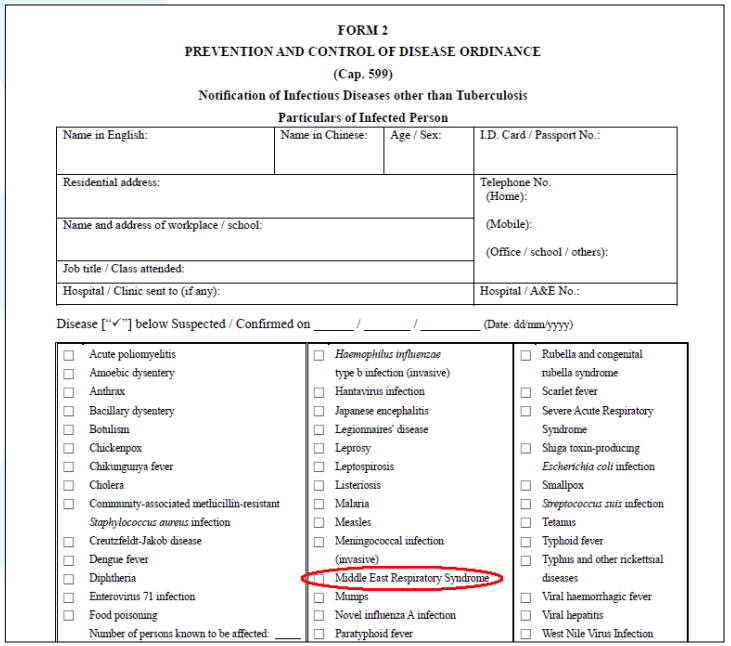
- In mid-Apr 2014, the UAE health authority identified a cluster of 27 new MERS cases (HCWs & close contacts) (as of May 15) epidemiologically linked to a fatal MERS case in Abu Dhabi who died on Apr 10.
  - All affected persons had been exposed to this index case
  - They were in stable condition
  - One case was an asymptomatic male Filipino HCW working in UAE. He returned to Philippines on Apr 15 and was identified as 1st case in Philippines

Risk assessment

- Both HCWs and other patients in contact with cases appear to be at risk.
- Very likely that more primary cases would occur, resulting in further transmission.
- Cases would continue to be exported to other areas through travellers or pilgrims who might acquire the infection following exposure to animals, environment or other confirmed patients.

Local situation

- No MERS has been detected in Hong Kong.
- Enhanced surveillance in place
  - MERS was made statutorily notifiable on Sept 28, 2012. Medical practitioners should notify CHP any suspected cases fulfilling the reporting criteria.
  - Surveillance at borders – suspected cases will be referred to HA for investigation.
  - Routine laboratory testing for the following groups of patients, irrespective of their travel history:
    - severe pneumonia with unknown cause (not responding to treatment)
    - pneumonia cases who require intensive care
    - clusters of pneumonia
    - healthcare workers with pneumonia
- 77 suspected cases were reported to CHP (as of 19 May 2014) and all were tested negative for MERS-CoV



FORM 2

PREVENTION AND CONTROL OF DISEASE ORDINANCE

(Cap. 599)

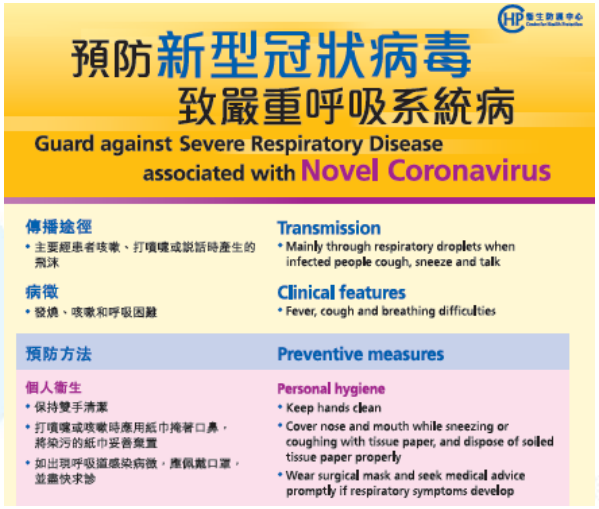
Notification of Infectious Diseases other than Tuberculosis

Particulars of Infected Person

Name in English:	Name in Chinese:	Age / Sex:	I.D. Card / Passport No.:
Residential address:			Telephone No. (Home): (Mobile): (Office / school / others):
Name and address of workplace / school:			
Job title / Class attended:			
Hospital / Clinic sent to (if any):			Hospital / A&E No.:

Disease ["✓"] below Suspected / Confirmed on _____ / _____ / _____ (Date: dd/mm/yyyy)

☐ Acute poliomyelitis	☐ *Haemophilus influenzae* type b infection (invasive)	☐ Rubella and congenital rubella syndrome
☐ Amoebic dysentery	☐ Hantavirus infection	☐ Scarlet fever
☐ Anthrax	☐ Japanese encephalitis	☐ Severe Acute Respiratory Syndrome
☐ Bacillary dysentery	☐ Legionnaires' disease	☐ Shiga toxin-producing *Escherichia coli* infection
☐ Botulism	☐ Leprosy	☐ Smallpox
☐ Chickenpox	☐ Leptospirosis	☐ *Streptococcus suis* infection
☐ Chikungunya fever	☐ Listeriosis	☐ Tetanus
☐ Cholera	☐ Malaria	☐ Typhoid fever
☐ Community-associated methicillin-resistant *Staphylococcus aureus* infection	☐ Measles	☐ Typhus and other rickettsial diseases
☐ Creutzfeldt-Jakob disease	☐ Meningococcal infection (invasive)	☐ Viral haemorrhagic fever
☐ Dengue fever	☐ Middle East Respiratory Syndrome	☐ Viral hepatitis
☐ Diphtheria	☐ Mumps	☐ West Nile Virus Infection
☐ Enterovirus 71 infection	☐ Novel influenza A infection	
☐ Food poisoning	☐ Paratyphoid fever	
Number of persons known to be affected: ____		



預防新型冠狀病毒
致嚴重呼吸系統病

Guard against Severe Respiratory Disease associated with Novel Coronavirus

傳播途徑
- 主要經患者咳嗽、打噴嚏或說話時產生的飛沫

Transmission
- Mainly through respiratory droplets when infected people cough, sneeze and talk

病徵
- 發燒、咳嗽和呼吸困難

Clinical features
- Fever, cough and breathing difficulties

預防方法

個人衞生
- 保持雙手清潔
- 打噴嚏或咳嗽時應用紙巾掩著口鼻，將染污的紙巾妥善棄置
- 如出現呼吸道感染病徵，應佩戴口罩，並盡快求診

Preventive measures

Personal hygiene
- Keep hands clean
- Cover nose and mouth while sneezing or coughing with tissue paper, and dispose of soiled tissue paper properly
- Wear surgical mask and seek medical advice promptly if respiratory symptoms develop

Recommendations for HCWs

- Maintain vigilance against MERS
- Adhere to strict infection control measures while handling suspected or confirmed cases to reduce risk of transmission
- Look out for atypical presentation in people with underlying medical conditions
- Manage patients as potentially infected when clinical and epidemiological clues strongly suggest MERS-CoV infection even if an initial test on a nasopharyngeal swab is negative
- Repeat test in highly suspected cases, preferably on specimens from lower respiratory tract
- Notify any suspected cases to CHP for prompt investigation

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Thank you

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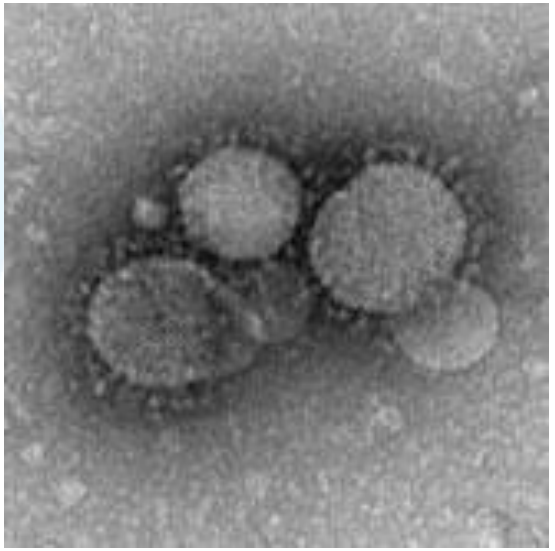
Introduction

- Emerged in Middle East in 2012
- Caused by the newly identified virus - Middle East Respiratory Syndrome Coronavirus (MERS-CoV)
- WHO reported 1st confirmed case in Sep 2012 (KSA)
- Case reported to WHO with earliest onset date had disease onset in Mar 2012 (Jordan)
- Spread across Middle East since late 2012



Source: US CDC

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Reporting criteria

An individual fulfilling both the ***Clinical Criteria*** **AND** ***Epidemiological Criteria*** should be reported to CHP for further investigation

Clinical Criteria

A person with acute respiratory syndrome which may include fever (≥ 38°C , 100.4°F) and cough

- requiring hospitalization

OR

- with suspicion of lower airway involvement (clinical or radiological evidence of consolidation) not explained by any other infection or any other aetiology

AND

Epidemiological Criteria

One or more of the followings within 14 days before onset of illness

- close contact*with a confirmed or probable case of Middle East Respiratory Syndrome while the case was ill

OR

- Residence in or history of travel to the Arabian Peninsula or neighboring countries**

***Close contact is defined as:**

- Anyone who provided care for the patient, including a health care worker or family member, or who had other similarly close physical contact;
- Anyone who stayed at the same place (e.g. lived with, visited) as a probable or confirmed case while the case was ill.

**This refers to areas/countries bounded by Iran, Turkey and Egypt (including Iran, but not Turkey and Egypt)

Map No. 4102 Rev. 5 UNITED NATIONS
November 2011

Department of Field Support
Cartographic Section

Possible sources of infection – Camels (1)

- Genetic studies
  - Confirmation of MERS-CoV in camels (3 in 14) in Qatar[1]
    - linked to 2 confirmed human cases who had cared for the camel
    - not able to determine the direction of transmission
  - Complete genomic sequences of MERS-CoV found in contemporary camels in KSA[2]
    - identical to sequences of viruses recovered from human cases
    - dromedary camels are potential reservoirs for human transmission
  - 4 of 110 nasal swab specimens from dromedary camels in Egypt (imported from Sudan/Ethiopia) were PCR positive for MERS-CoV[3]
    - a near full-length genome of one sample was analysed and the genomic sequence was found to be >99% similar to a type of MERS-CoV found in human cases
    - dromedary camels can be a potential source of human MERS-CoV infections

1. Haagmans BL, et al. Middle East respiratory syndrome coronavirus in dromedary camels: an outbreak investigation. Lancet Infect Dis. 2013 Dec 16.
2. A Alagaili et al. Middle East respiratory syndrome coronavirus (MERS-CoV) infection in dromedary camels in Saudi Arabia. mBio DOI: 10.1128/mBio.00884-14 (2014).
3. Chu DKW, et al. MERS coronaviruses in dromedary camels, Egypt. Emerg Infect Dis. Volume 20, Number 6, June 2014 (Ahead of print – 27 Feb 2014)

Possible sources of infection – Camels (2)

- Genetic studies (continued)
  - A study in KSA revealed high similarity of MERS-CoV carried by a human case and camels[1]
    - The nearly complete viral genome of the virus from a patient and about 15% of the MERS-CoV genome derived from one of two sick camels the patient had cared for and tested positive for MERS-CoV were sequenced.
    - Analysis yielded identical nucleotide polymorphism signatures suggestive of cross-species transmission. Camels may act as a direct source of human MERS-CoV infection.

1.Memish ZA, et al. Human infection with MERS coronavirus after exposure to infected camels, Saudi Arabia, 2013. Emerg Infect Dis [Ahead of print –20 Mar 2014].

Possible sources of infection – Camels (3)

- Serology studies
  - Evidence of MERS-CoV in camels from Qatar[1], KSA[2] , Canary Islands, Jordan, Oman and UAE[3]
  - Earliest findings of antibodies in camels from 1992 in KSA[2]
    - a closely related virus has been circulating in camels for at least 2 decades
  - Latest study with camels in Egypt[4]
    - 48 out of 52 (92%) serum samples collected from dromedary camels (imported from Sudan/Ethiopia) were found to contain antibodies against MERS-CoV, indicating that past-infection is very common.
    - Human serum samples obtained from 179 persons working in the abattoirs (including 114 persons working in the 2 abattoirs with nasal swabs from camels tested positive for MERS-CoV) were tested negative for antibody against MERS-CoV.

1. Haagmans BL, et al. Middle East respiratory syndrome coronavirus in dromedary camels: an outbreak investigation. Lancet Infect Dis. 2013 Dec 16.
2. A Alagaili et al. Middle East respiratory syndrome coronavirus (MERS-CoV) infection in dromedary camels in Saudi Arabia. mBio DOI: 10.1128/mBio.00884-14 (2014).
3. WHO. MERS-CoV summary and literature update – as of 20 Jan 2014.
4. Chu DKW, et al. MERS coronaviruses in dromedary camels, Egypt. Emerg Infect Dis. Volume 20, Number 6, June 2014 (Ahead of print – 27 Feb 2014).

Possible sources of infection - Bats

- Bats
  - Nucleotide sequence of a fragment of viral genetic material in a fecal sample obtained from an Egyptian tomb bat (*Taphozous perforatus*) in Bisha of Saudi Arabia was identical to the MERS-CoV from the human index case in Bisha[1]
- More evidence is needed to directly link the MERS-CoV to bats.[2]

1. Ziad A. Memish et al. Middle East Respiratory Syndrome Coronavirus in Bats, Saudi Arabia, Emerging Infectious Diseases Volume 19, Number 11—November 2013

2. OIE. Update January 2014 - Questions and Answers MERS coronavirus (CoV)

Transmissibility

- Estimation of basic reproduction number (R_0)
  - 0.6 (optimistic) & 0.69 (pessimistic) by Brehan[1]
  - 0.63 & 0.8-1.3 (without control measures) by Cauchemez[2]
- Genetic diversity in Al-Hasa cluster in KSA suggested ≥1 virus introduction[3]
  - support Brehan's[1] optimistic R_0 scenario

1. Romulus Breban, et al. Interhuman transmissibility of Middle East respiratory syndrome coronavirus: estimation of pandemic risk, The Lancet, Available online 5 July 2013.
2. Cauchemez S, et al. Middle East respiratory syndrome coronavirus: Quantifying the extent of the epidemic, surveillance biases and transmissibility. The Lancet Infectious Diseases, 13 Nov 2013.
3. M. Cotton et al. Transmission and evolution of the Middle East respiratory syndrome coronavirus in Saudi Arabia: a descriptive genomic study. The Lancet, Volume 382, Issue 9909, Pages 1993 - 2002, 14 Dec 2013.

Enhanced port health measures

- Airlines arrange the delivery of health leaflets (with Arabic translation) to arriving travellers coming from affected countries.
- In-flight announcement of health messages to alert travellers in direct flights coming from countries of Arabian Peninsula have been arranged with airlines.
- Tourism industry has been updated on the latest situation through Travel Industry Council and Tourism Commission.
- All incoming travellers who fulfill the reporting criteria will be referred to public hospital for further investigation.
- Updated travel health advice on pilgrims to KSA was issued.