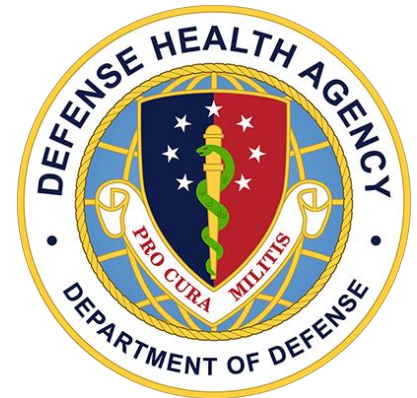


Department of Defense Armed Forces Health Surveillance Global MERS-CoV Surveillance Summary (21 OCT 2015)



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DEPARTMENT OF DEFENSE (AFHS)

Global MERS-CoV Surveillance Summary #69

21 OCT 2015 (next Summary 4 NOV 2015)



CASE REPORT: As of 21 OCT 2015, 1,683 (+11) cases of Middle East respiratory syndrome coronavirus (MERS-CoV) have been reported including 629 (+3) deaths in the Kingdom of Saudi Arabia (KSA) (+12), Jordan, Qatar, United Arab Emirates (UAE), United Kingdom (UK), France, Germany, Tunisia, Italy, Oman, Kuwait, Yemen, Malaysia, Greece, Philippines (-1), Egypt, Lebanon, Netherlands, Iran, Algeria, Austria, Turkey, Republic of Korea (ROK), China, Thailand, and the U.S. Historically, increases in MERS-CoV cases in the Arabian Peninsula have occurred in the spring. The previously reported case in the Philippines has been ruled out and removed from our case count. Since the Hajj Pilgrimage concluded, many of pilgrims have been placed under monitoring upon return to their home countries; however none have tested positive to date.

On 25 AUG, the Jordanian MOH reported one new case in Amman who had traveled to KSA; the first case reported in Jordan in 2015. This case sought treatment at two different hospitals (hospital names not yet released) before his death on 27 AUG. Since then, 15 additional cases and five additional deaths have been reported in Amman; most reported exposure history to at least one of the aforementioned hospitals in Amman.

Of the 12 new cases, 10 were reported in Riyadh, KSA. At least four hospitals (King Abdullaziz Medical City, King Saud, King Salman, and King Fahd Hospitals) appear to be part of an ongoing nosocomial cluster in Riyadh. Incidence has decreased significantly over the last month, although Riyadh is still reporting healthcare associated cases. Additionally, a new cluster appears to be associated with female Filipino cleaning workers contracted at the Princess Nora University in Riyadh. Four of the new cases in Riyadh have been officially linked to this cluster and four additional cases, reported as secondary household contacts, are likely connected to the cluster. On 13 SEP, the WHO Regional Office for the Eastern Mediterranean (EMRO) concluded [an assessment of the outbreak in Riyadh](#). The EMRO mission identified that most of the nosocomial cases reported where the outbreak is currently ongoing involved patient-to-patient transmission. The mission also identified overcrowding as well as breaches in infection control as being causative. On 10 OCT, local media [reported](#) that 33% of MERS-CoV cases in KSA over the past four years occurred within hospitals and that 13% resulted from exposure to ill persons inside the home. The KSA MOH has also announced that it intends to “clamp down” on hospitals that refuse to provide care to suspected MERS-CoV patients and to take “harsher” measures if patients refuse to comply with treatment.

ROK CASE REPORT: On 1 OCT, the last South Korean patient previously diagnosed with MERS-CoV tested negative for the virus; however, this individual relapsed and tested positive for the virus on 12 OCT. As a result, an official declaration of the end of the outbreak will be delayed until 28 days after the last MERS-CoV patient recovers and is discharged. The total case count remains at 186 confirmed cases, 4 suspect cases, and 36 deaths reported by the MOHW. A recent study by the ROK MOHW found that there may be sequelae associated with MERS-CoV. Of the 112 MERS-CoV survivors in ROK that were surveyed, the MOHW [found](#) that 40% experience anxiety and that 37% also complain of fatigue, headaches, and indigestion.

Transmission during the ROK outbreak was attributed to delayed diagnosis and isolation of the index case, lapses in infection control, and care of patients by family members rather than HCWs. This interpretation was supported by WHO, which announced no mutations linked to transmissibility or pathogenesis were found in virus sequences obtained in ROK or China. A [study](#) presented at the 2015 Infectious Disease Week found that most of the “touchable environments” in MERS-CoV units in ROK were contaminated by patients and HCWs. The study also found that viable MERS-CoV virus could be shed through respiratory secretions of patients who had clinically fully recovered and were conventional-PCR negative. While it was previously known that MERS-CoV could survive on surfaces for long periods of time, the extent of persistent contamination and the period of prolonged viral shedding observed during the MERS-CoV outbreak in ROK is significant for hygiene and infection control practices.

Text updated from the previous report will be printed in red; items in (+xx) represent the change in number from the previous Summary (7 OCT 2015).

All information has been verified unless noted otherwise. Sources include USFK, ROK MOHW, KCDC, U.S. CDC, WHO, EMRO, KSA MOH, ECDC, Arab News, and ID Week.

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BACKGROUND: In SEP 2012, [WHO reported two cases of a novel coronavirus](#) (now known as MERS-CoV) from separate individuals - one with travel history to the KSA and Qatar and one a KSA citizen. This was the sixth strain of human coronavirus identified (including SARS). Limited human-to-human transmission has been identified in at least 35 spatial clusters predominately involving close contacts. Limited camel-to-human transmission of MERS-CoV has been proven to occur; and [studies suggest](#) camels infected with MERS-CoV may appear asymptomatic but are able to shed large quantities of the virus from the upper respiratory tract.

A [study](#) published in the Annals of Saudi Medicine, found that the wave of MERS-CoV cases observed from MAR-JUN 2014 in the Makkah region was likely a result of nosocomial transmission. This springtime spike in cases was previously attributed to camel breeding season. Another recent [study](#) in the International Journal of Infectious Diseases found that three waves of MERS-CoV transmission appeared to follow waves of influenza A in the Middle East during the 1 MAY 2012 to 31 MAY 2015 time period. While the connection between these two diseases is not yet clear, both present a significant health care burden and possibly share seasonality. **On 17 OCT, a [study by the University of Liverpool](#), published in PLOS ONE, found that approximately half (47%) of dromedary camels from nine herds in Laikipia County, Kenya tested positive for MERS-CoV antibodies, showing they had been previously exposed to the virus.**

The most recent known date of symptom onset is **26 SEP 2015**; however at least 40% of symptomatic cases have been reported without onset date. Due to inconsistencies in reporting, it is difficult to determine a cumulative breakdown by gender, however AFHS is aware of at least **482 (+9) cases in females** to date. CDC reports 283 of the total cases have been identified as healthcare workers (HCWs). Of these, 174 were from KSA, 31 from UAE, 7 from Jordan, 2 from Iran, 1 from Tunisia, and 29 from ROK. Characteristics of reported cases are limited, however, CDC reports among 241 HCW cases with available information: 11 died; 55 were asymptomatic; 20 had comorbidities; and 15 presented with only mild symptoms.

On 8 OCT, researchers at the University of North Carolina [announced](#) that they had successfully genetically engineered a mouse to be infected with MERS-CoV. Mice are not naturally susceptible to the MERS-CoV virus, so this engineered mouse model can be used as a vehicle for animal trials of MERS-CoV drugs and vaccines. On 20 OCT, Margaret Chan, director-general of the WHO, [announced](#) that the U.S. and KSA are in discussions to prepare a vaccine for MERS-CoV ahead of the next outbreak of the disease.

INTERAGENCY/GLOBAL ACTIONS: WHO convened the [Tenth International Health Regulations \(IHR\) Emergency Committee](#) on 2 SEP and concluded the conditions for a Public Health Emergency of International Concern (PHEIC) have not yet been met. However, the Committee also emphasized that they have a heightened sense of concern as transmission from camels to humans continues in some countries and instances of human-to-human transmission continue to occur in health care settings. Moreover, the current outbreak is occurring close to the start of the Hajj and many pilgrims will return to countries with weak surveillance and health systems. The Committee further noted that its advice has not been completely followed as asymptomatic cases that have tested positive for the virus are not always being reported as required.

CDC maintains their [Travel Alert Level 2](#) for MERS-CoV in the Arabian Peninsula, which includes specific precautions for the Hajj pilgrimage. CDC is maintaining their travel notice for MERS-CoV in the ROK at a [Travel Watch Level 1](#).

DIAGNOSTICS: Clinical diagnostic testing is available at BAACH, NAMRU-3, LPMC, MAMC, NHRC, USAFSAM, SAMMC, Tripler AMC (TAMC), WBAMC, WRNMMC, and NIDDL (NMRC). Surveillance testing capability is available at NHRC, AFRIMS, NAMRU-2, NAMRU-3, NAMRU-6, and Camp Arifjan. All 50 state health laboratories and the NYC DOHMH were offered clinical testing kits. On 16 JUL, AFHS updated [MERS-CoV testing guidelines](#) for DoD components; which are aimed at capturing mild cases that may present in healthier populations such as DoD personnel.

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All information has been verified unless noted otherwise. Sources include WHO, Ann of Saudi Med, IJID, MD Magazine, Reuters and CDC.

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MEDICAL COUNTERMEASURES IN DEVELOPMENT

RESEARCH GROUP	TYPE OF COUNTERMEASURE	STAGE OF DEVELOPMENT
ROK MOHW	Plasma treatment	Clinical trials stage
Inovio Pharmaceuticals and GeneOne Life Sciences	DNA-based vaccine	Phase 1 trial announced
Novavax and University of Maryland School of Medicine	Recombinant nanoparticle vaccine	Preclinical Testing phase
U.S. NIH and Fudan University	M336 antibody treatment	Preclinical Testing Phase
Greffex	Treatment	Not yet announced
Abviro	Treatment	Not yet announced
Shanghai Kaibao	Treatment	Not yet announced
Nanovirivide	Treatment	Not yet announced
Purdue University	Enzyme Inhibition Treatment	Not yet announced
Ludwig-Maximilians-Universitaet (LMU) in Munich	Modified Vaccinia virus Ankara (MVA) vaccine	Phase 1 clinical trials
Institute for Research in Biomedicine, Universita della Svizzera italiana	Antibody therapy (LCA60)	Preclinical Testing Phase
The University of Pennsylvania, NIAID, Inovio Pharmaceuticals	Vaccine	Preclinical Testing Phase
China MOH, China CDC	Recombinant Receptor-Binding Domain (rRBD)	Preclinical Testing Phase
Medizone International, Inc.	Hospital disinfection system (AsepticSure®)	Purchased by Al-Hidaya International Medical Services Company in KSA

Table Summary: This table shows the various medial countermeasures for MERS-CoV in their respective stages of development.

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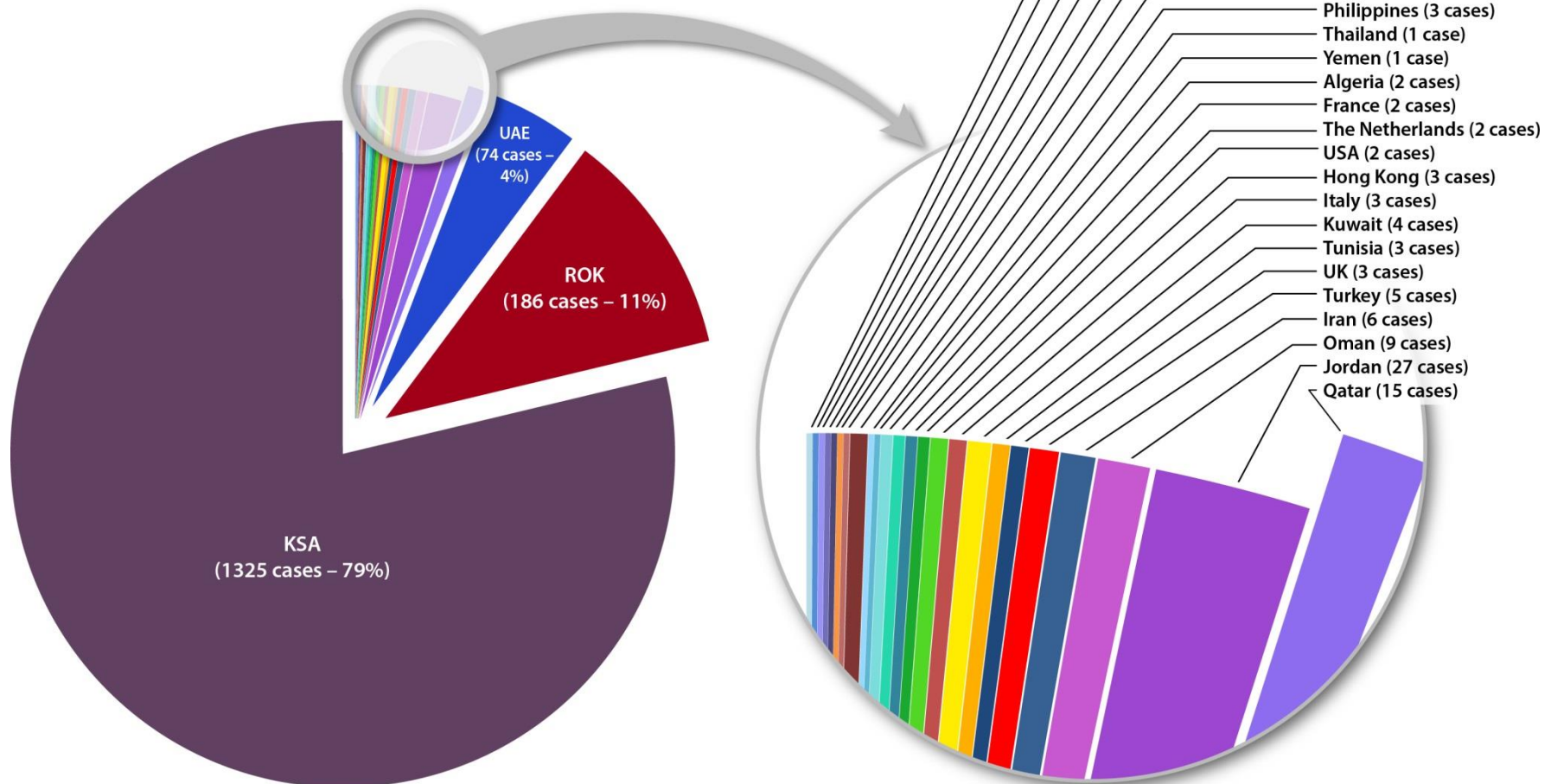
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Global Distribution of Reported MERS-CoV Cases* (SEP 2012 – OCT 2015)

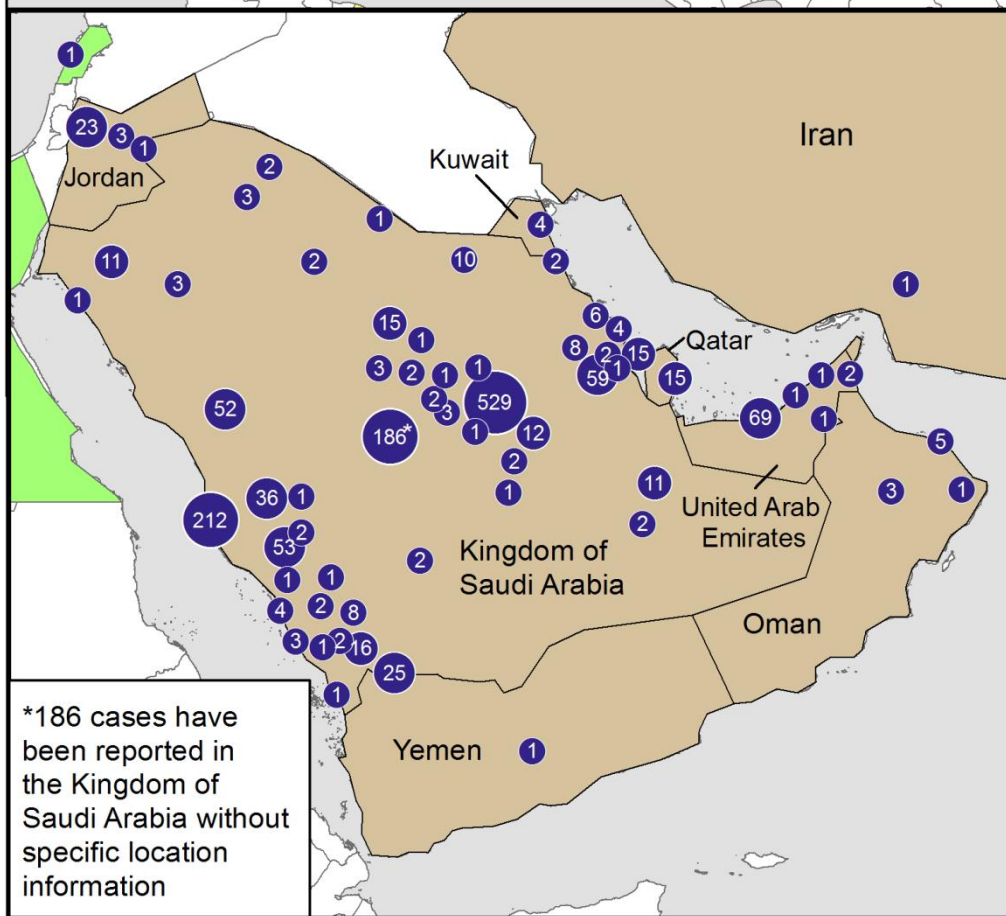
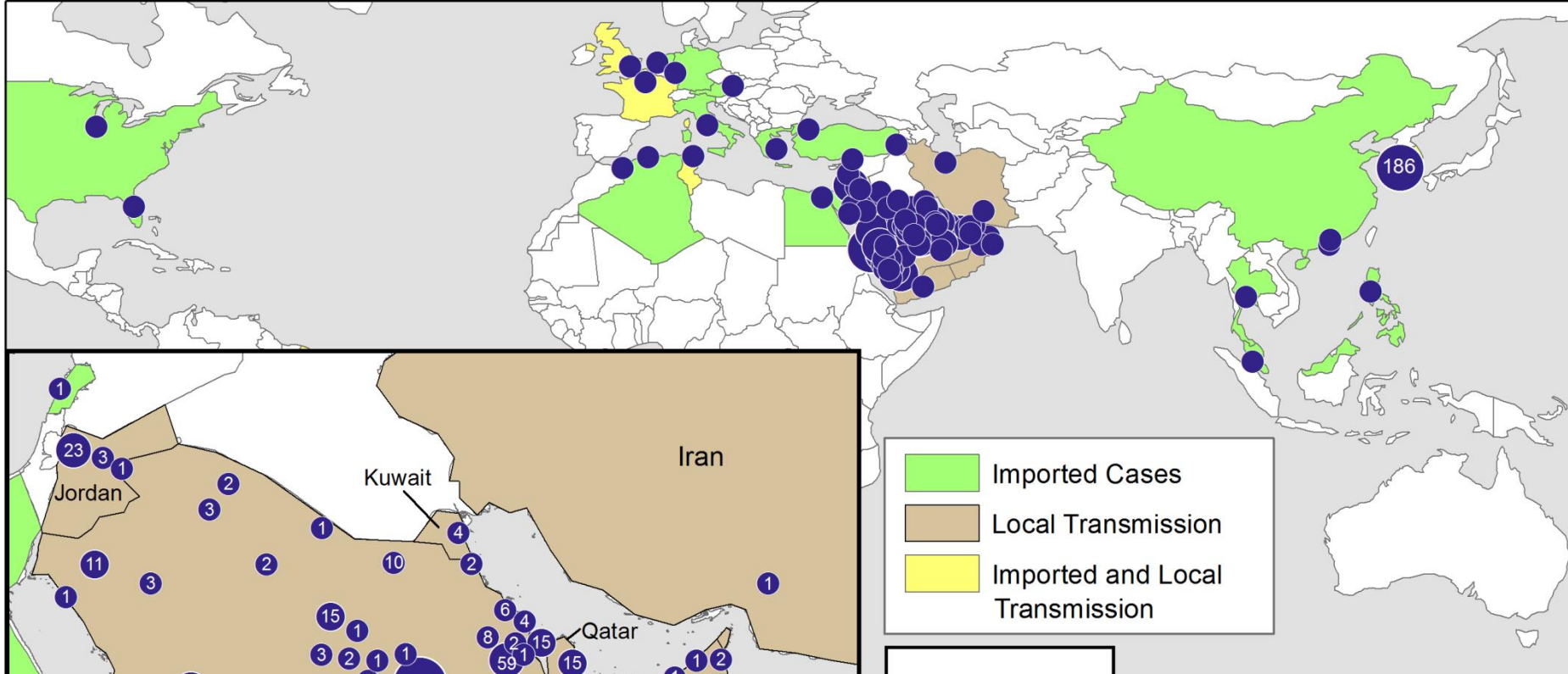


*Data includes confirmed, suspect and probable cases reported by WHO, CDC, and various country MOHs

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*186 cases have been reported in the Kingdom of Saudi Arabia without specific location information

Total Cases

N = 1,683

- 1 - 10
- 11 - 20
- 21 - 75
- 76 - 150
- 151 - 300
- >300

Geographic Distribution of MERS-CoV Cases

1 APR 2012 - 21 OCT 2015



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Global MERS-CoV Epidemiological Curve - 21 OCT 2015

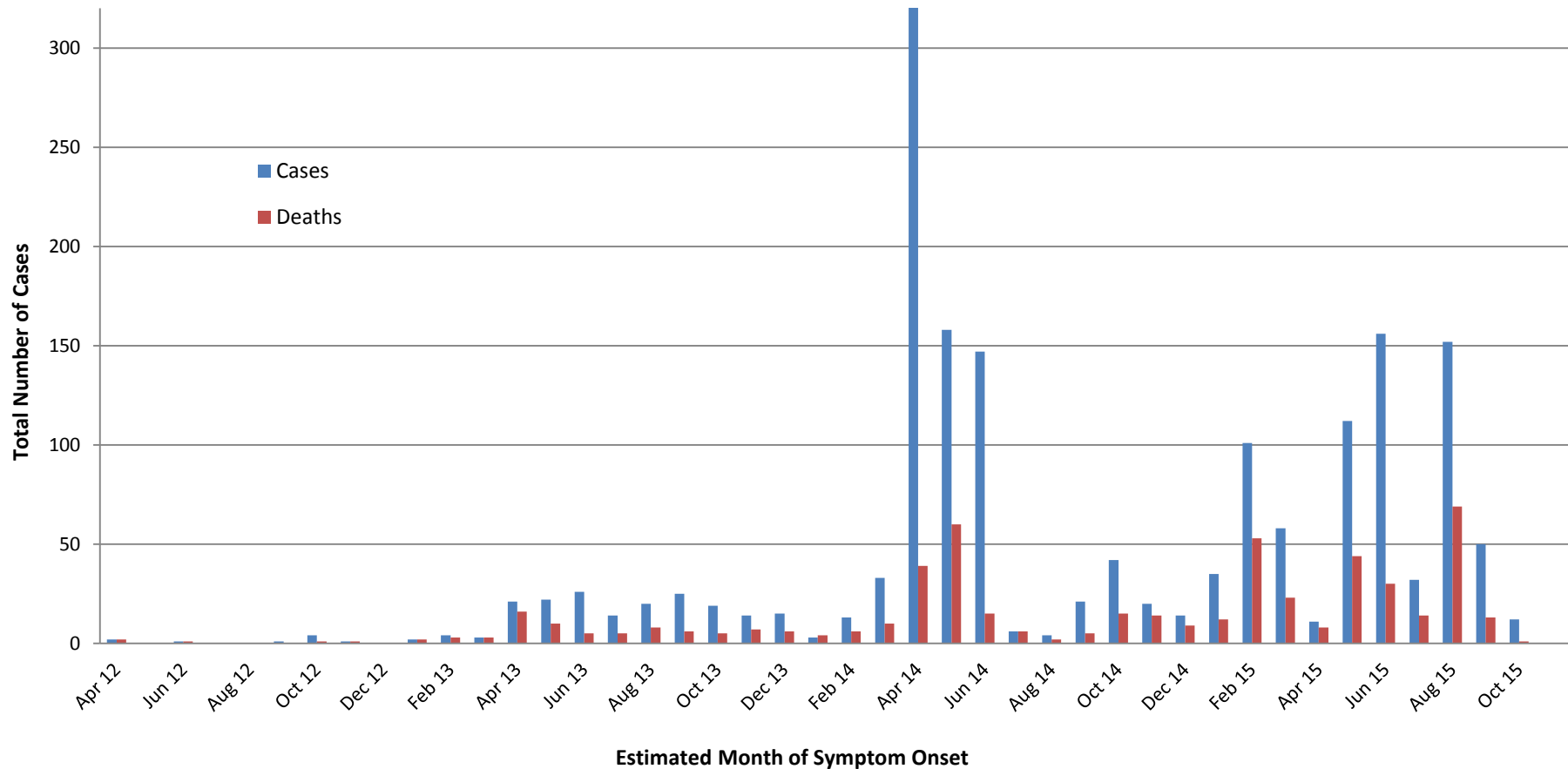


Figure Summary: This figure shows an epidemiological curve for MERS-CoV cases and deaths since APR 2012 to the present.



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Global MERS-CoV NUMBERS AT A GLANCE

	Total in 2012	Total in 2013	Total in 2014	Total in 2015	Cumulative Total (2012-2015)
Cases	9	171	777	726 cases (+11)	1,683 cases (+11)
Deaths*	6 deaths	72 deaths	277 deaths	274 deaths (+3)	at least 629 deaths (+3)
Case-Fatality Proportion	66%	42%	36%	38%	37%
Mean Age	45 years	51 years	49 years	55 years	52 years
Gender Breakdown*	1 female	at least 58 females	at least 175 females	248 females (+9)	at least 482 females (+9)
# of Healthcare Workers (HCWs) reported*	at least 2 HCWs	at least 31 HCWs	at least 87 HCWs	104 HCWs	at least 283 HCWs

Table Summary: This table shows a breakdown of MERS-CoV statistics including the yearly and cumulative totals for cases, deaths, case-fatality proportion, mean age, gender breakdown and cases reported in HCWs.

***Disclaimer:** Data reported on MERS-CoV cases are limited and adapted from multiple sources including various Ministries of Health, CDC, and WHO. Consequently, yearly information may not equate to the cumulative totals provided by WHO and CDC.

Legend: Text updated from the previous report will be printed in red; items in (+xx) represent the change in number from the previous Summary (7 OCT 2015).

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MERS-CoV Web Sites

- [WHO](#)
- [WHO Lab Testing Guidance](#)
- [WHO Travel Advice for Pilgrimages](#)
- [WHO 10th IHR Meeting Press Release](#)
- [CDC](#)
- [CDC Travel Advisory for the Arabian Peninsula](#)
- [CDC Travel Advisory for ROK](#)
- [CDC MMWR](#)
- [ECDC](#)
- [AFHSC Detecting and Reporting Guidelines for MERS-CoV](#)

Information and News

- [World health chief says U.S., Saudi discussing MERS vaccine](#) (Reuters, 20 OCT)
- [Camels test positive for respiratory virus in Kenya](#) (Arab News, 17 OCT)
- [40% of Recovered MERS Patients Experience Anxiety](#) (KBS, 17 OCT)
- [Owners question camels' link with MERS](#) (Arab News, 16 OCT)
- [Saudi MOH Statement on Riyadh MERS Cluster Among University Workers](#) (Avian Flu Diary, 15 OCT)
- ['No conclusive proof' camels spread MERS: Expert](#) (Arab News, 14 OCT)
- [Latest WHO DON on MERS-CoV in Jordan](#) (WHO, 12 OCT)
- [Latest WHO DON on MERS-CoV in the Arabian Peninsula](#) (WHO, 12 OCT)
- [Last South Korean Mers patient tests positive again](#) (Straits Times, 12 OCT)
- [33% MERS infections occurred in hospitals](#) (Arab News, 10 OCT)
- [Persistent environmental contamination and prolonged viral shedding in MERS patients during MERS-CoV outbreak in South Korea](#) (IDSA, 10 OCT)
- [Researchers Create a Mouse that Can Get MERS](#) (MD Magazine, 8 OCT)
- [Jordan Reports 16th MERS Case Of 2015](#) (Avian Flu Diary, 7 OCT)
- [Differences in the seasonality of MERS-CoV and influenza in the Middle East](#) (IJID, SEP 2015)
- [Descriptive epidemiology and characteristics of confirmed cases of Middle East respiratory syndrome coronavirus infection in the Makkah Region of Saudi Arabia, March to June 2014](#) (AnnSaudiMed, SEP 2015)
- [Association of Higher MERS-CoV Virus Load with Severe Disease and Death, Saudi Arabia, 2014](#) (CDC EIDJ, SEP/NOV 2015)
- [Asymptomatic MERS-CoV Infection in Humans Possibly Linked to Infected Camels Imported from Oman to United Arab Emirates, May 2015](#) (CDC EIDJ, 10 AUG)
- [MERS coronavirus: Candidate vaccine gears up for clinical](#) (EurekAlert, 22 JUN)
- [Presence of Middle East respiratory syndrome coronavirus antibodies in Saudi Arabia: a nationwide, cross-sectional, serological study](#) (Lancet, 5 MAY)
- [WHO DON on first novel coronavirus infection](#) (WHO, 23 SEP 2012)