Updates on Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

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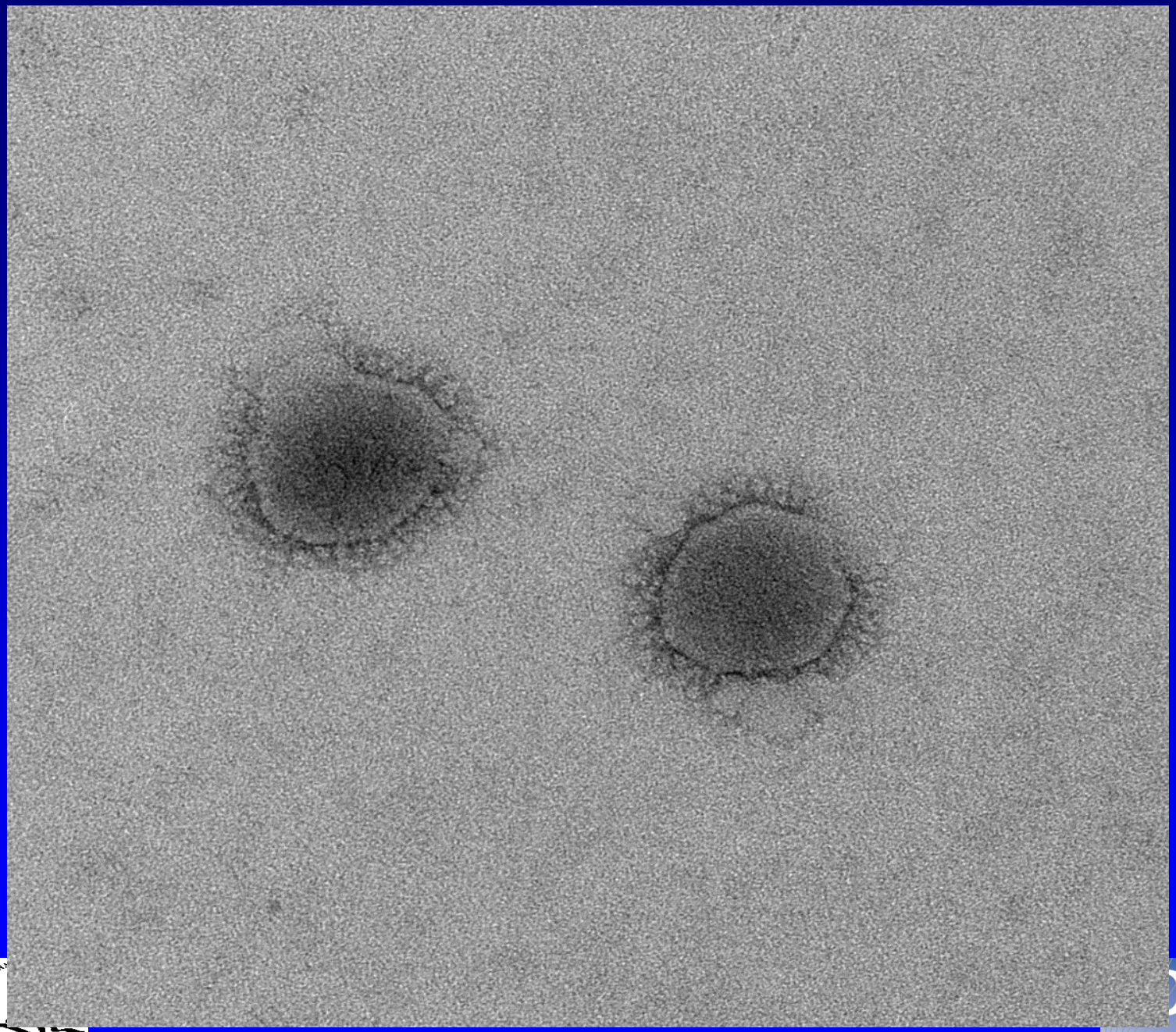
Coronaviruses (CoVs)

- Enveloped positive strand RNA virus
- Human CoVs isolated in the 1960s
- Six human CoVs (HCoVs) have been identified to date:
  - HCoV-229E
  - HCoV-OC43
  - HCoV-NL63
  - HCoV-HKU1
  - SARS-CoV
  - **Middle East Respiratory Syndrome Coronavirus (MERS-CoV)**



CS Goldsmith, MG Metcalfe, A Tamin

First Two Patients Reported with MERS-CoV Infections, 2012

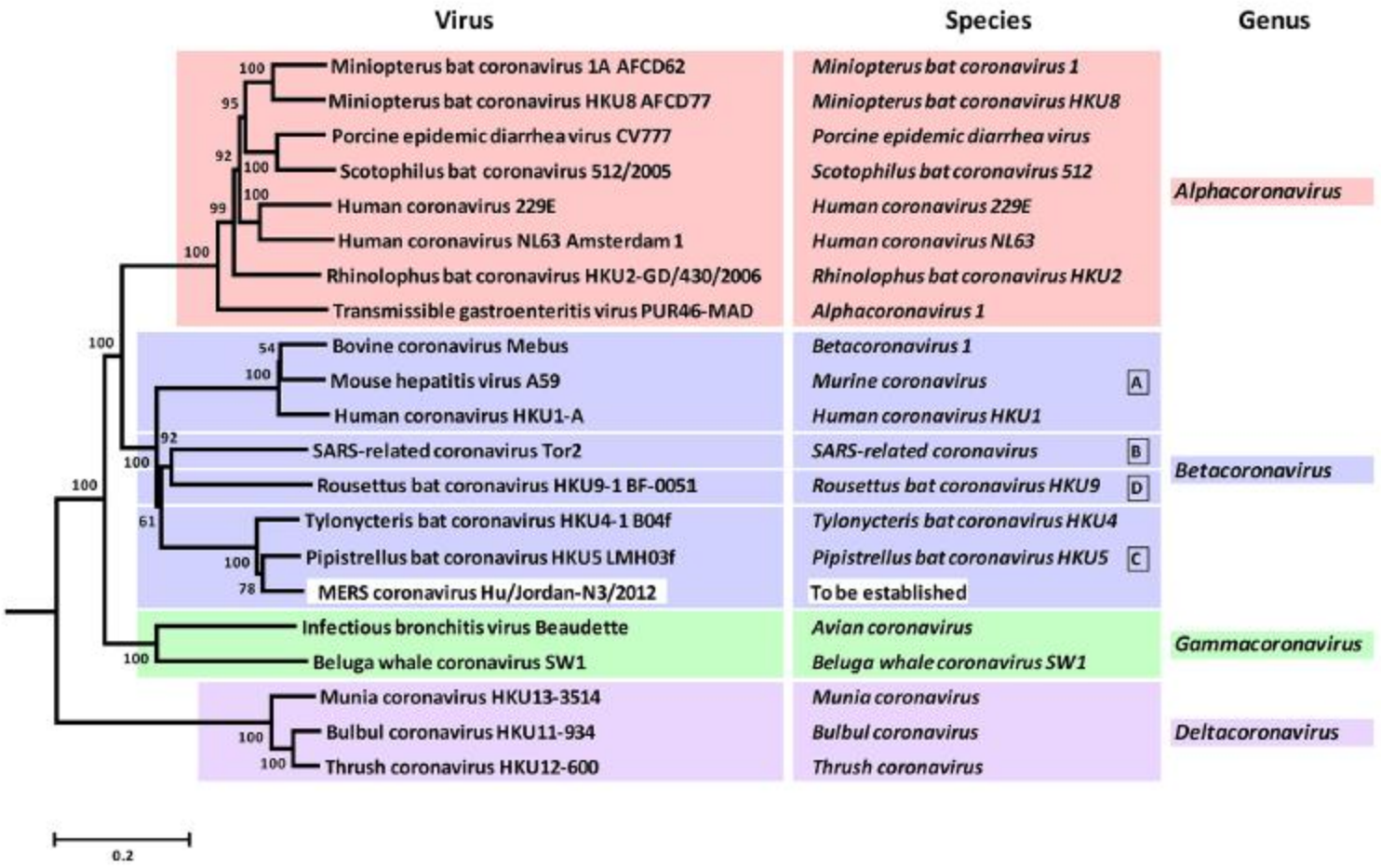
- Saudi Arabia
  - 60 year old man with acute respiratory distress syndrome and multi-organ dysfunction syndrome in June, 2012
- Qatar
  - 49 year old Qatari national with respiratory failure and renal failure
  - Admitted to a London intensive care unit in September, 2012

Zaki et al. N Engl J Med 2012 367:1814-20
Eurosurv, Vol. 17:40, Oct. 4, 2012

MERS-CoV: Link

- Virus from second case compared to virus isolated from lung tissue of first case
- 99.5% identity: One nucleotide mismatch over regions (replicase) compared
- Genome sequence: JX869059.1

Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

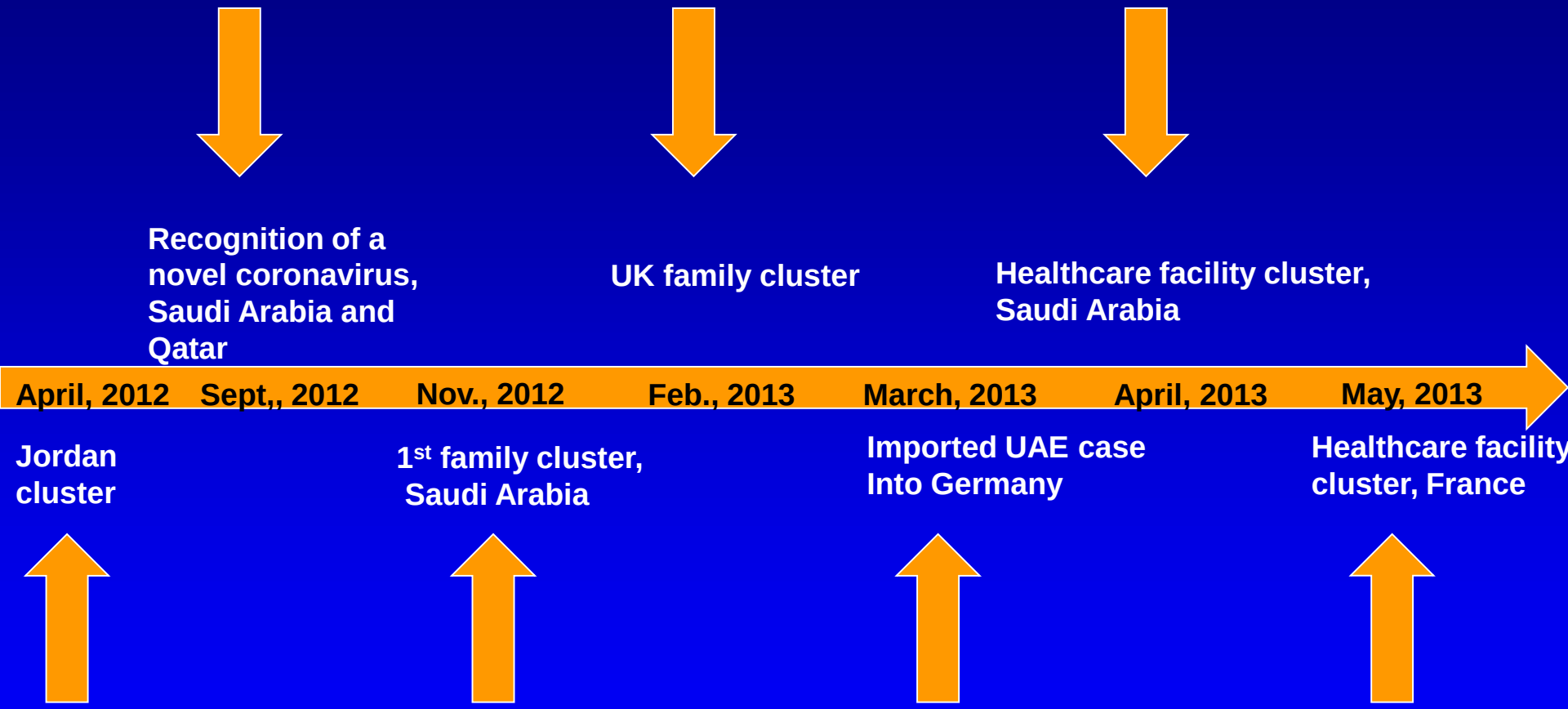


de Groot et al. J Virol. May, 2013; Epub ahead of print

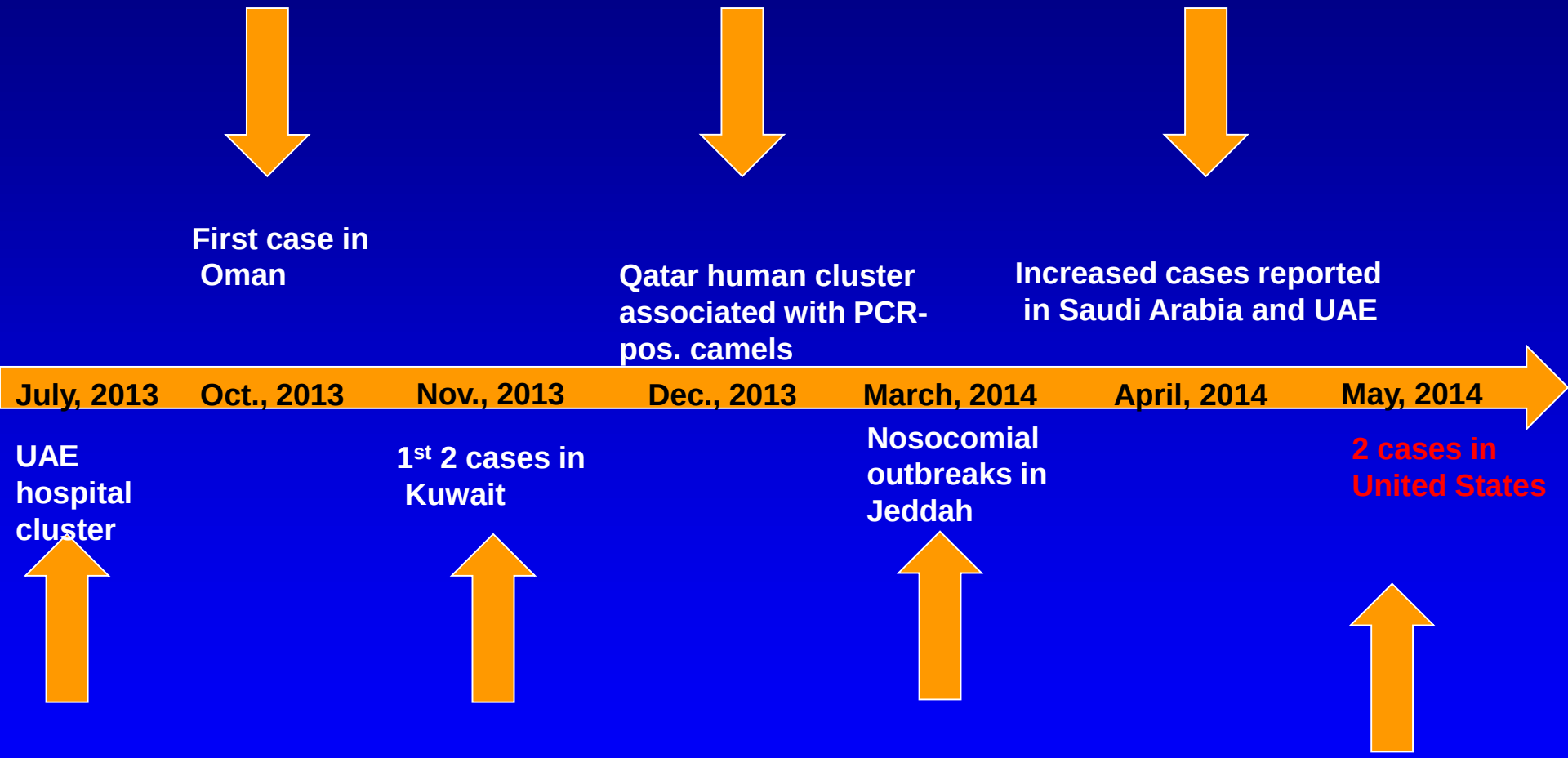
MERS Clinical Presentation

- Wide clinical spectrum reported:
  - Asymptomatic infection
  - Acute upper respiratory illness
  - Rapidly progressive pneumonitis, respiratory failure, septic shock, multi-organ failure resulting in death.
- Common signs and symptoms at admission:
  - Fever, chills/rigors, headache, non-productive cough, dyspnea, and myalgia
- Other symptoms:
  - Sore throat, coryza, sputum production, dizziness, nausea and vomiting, diarrhea, and abdominal pain
- Atypical presentations include:
  - Mild respiratory illness without fever
  - Diarrheal illness preceding development of pneumonia

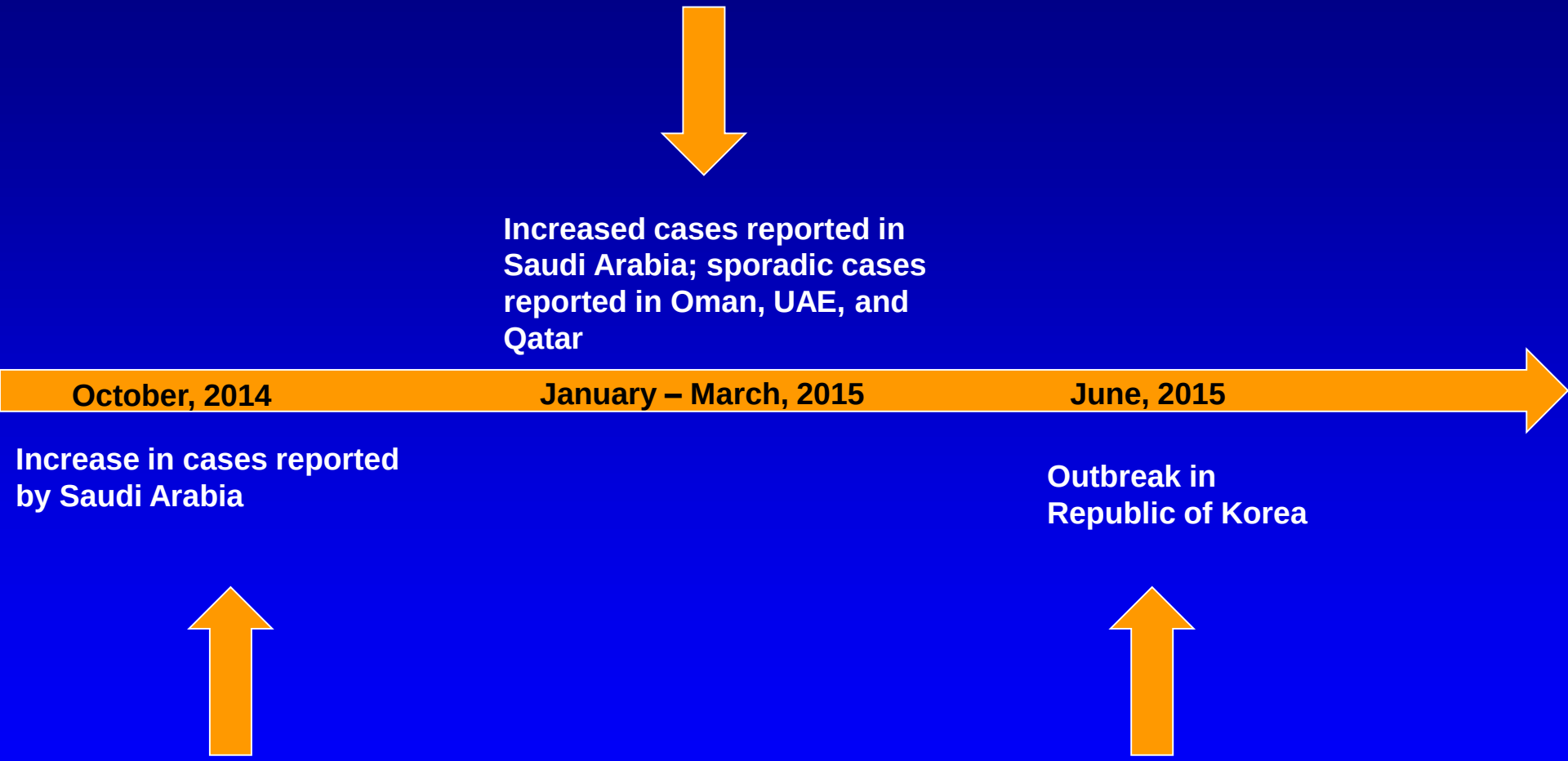
Emergence of a Novel Virus



Emergence of a Novel Virus: Part 2



Emergence of a Novel Virus: Part 3



MERS-CoV Overall Epidemiology

- 1218 laboratory confirmed cases, 449 (37%) deaths
- Gender: 393 females, 791 males, 34 unknown
- Median age: 50 years (0-99y)
- 17% of cases are identified as healthcare personnel
- All cases have an epidemiologic link to 9 countries:
  - Saudi Arabia, Qatar, United Arab Emirates, Jordan, Yemen, Oman, Lebanon, Iran, and Kuwait

Transmission of MERS-CoV

- Person-to-person transmission well documented
- 59 spatiotemporal clusters reported
  - Household and healthcare settings
- Median incubation period just over 5 days, range (2-14 days)
- Routes of transmission not fully known
- No clear evidence of sustained community transmission

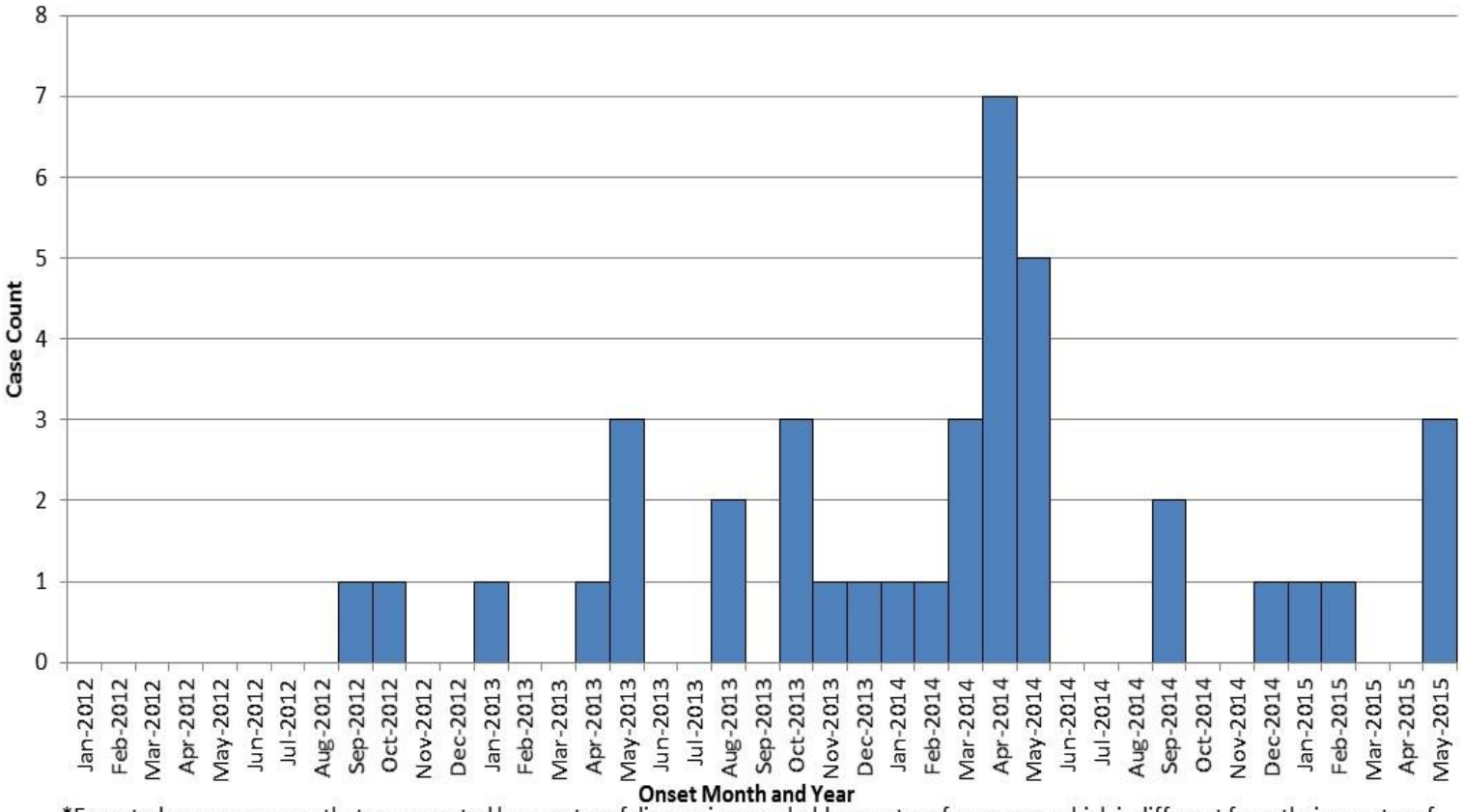
MERS-CoV Neutralizing Antibodies in Dromedary Camels

- Oman
- Spain
- United Arab Emirates- since 2003
- Egypt- since 1997
- Jordan
- Saudi Arabia- since 1992
- Nigeria
- Tunisia
- Ethiopia
- Kenya- since 1992
- Somalia- since 1983
- Sudan- since 1984

MERS-CoV Sequences Detected in Dromedary Camels

- Saudi Arabia
  - Virus isolated and sequenced from a patient and camel- genome sequences demonstrate patient acquired virus from the camel
- Qatar
  - Virus isolated from a nasal specimen from a dromedary camel
  - 3 dromedary camels with confirmed MERS- CoV sequences associated with 2 human cases
- Egypt
- Oman
- UAE

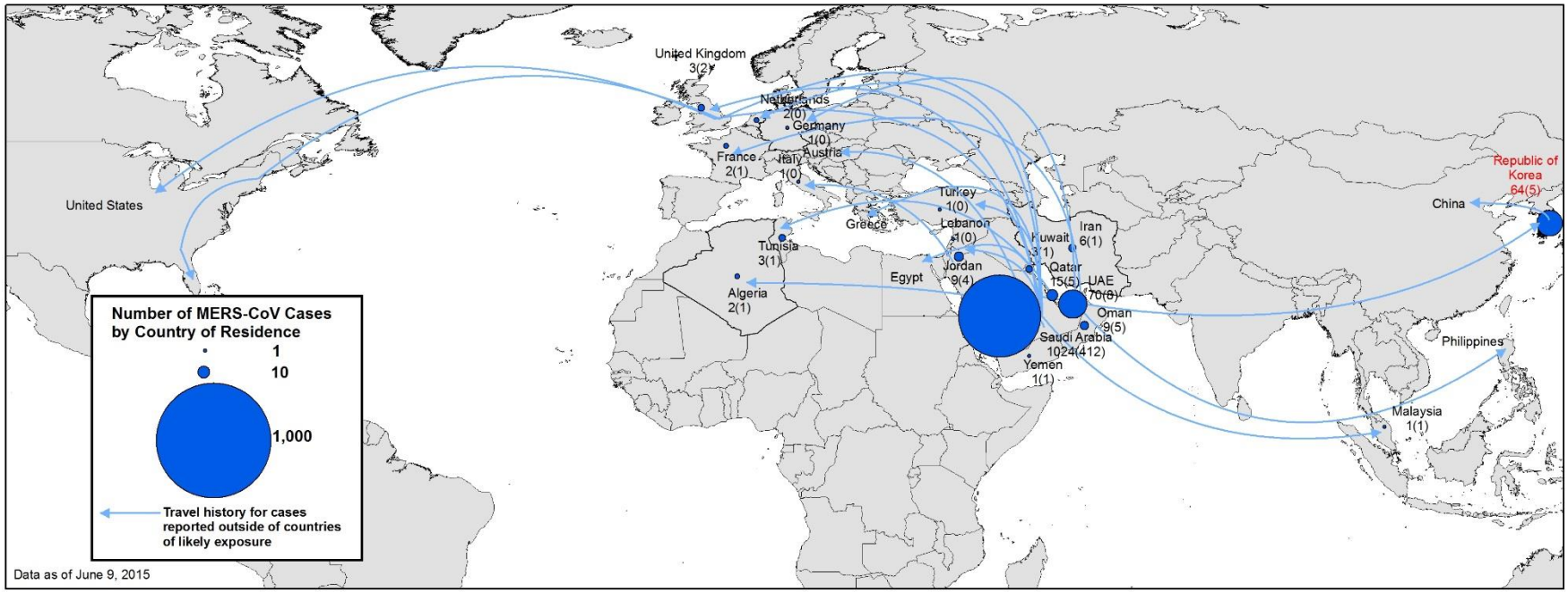
Middle East Respiratory Syndrome Coronavirus (MERS-CoV) 2012--2015, Known Exported Cases (Total=39)



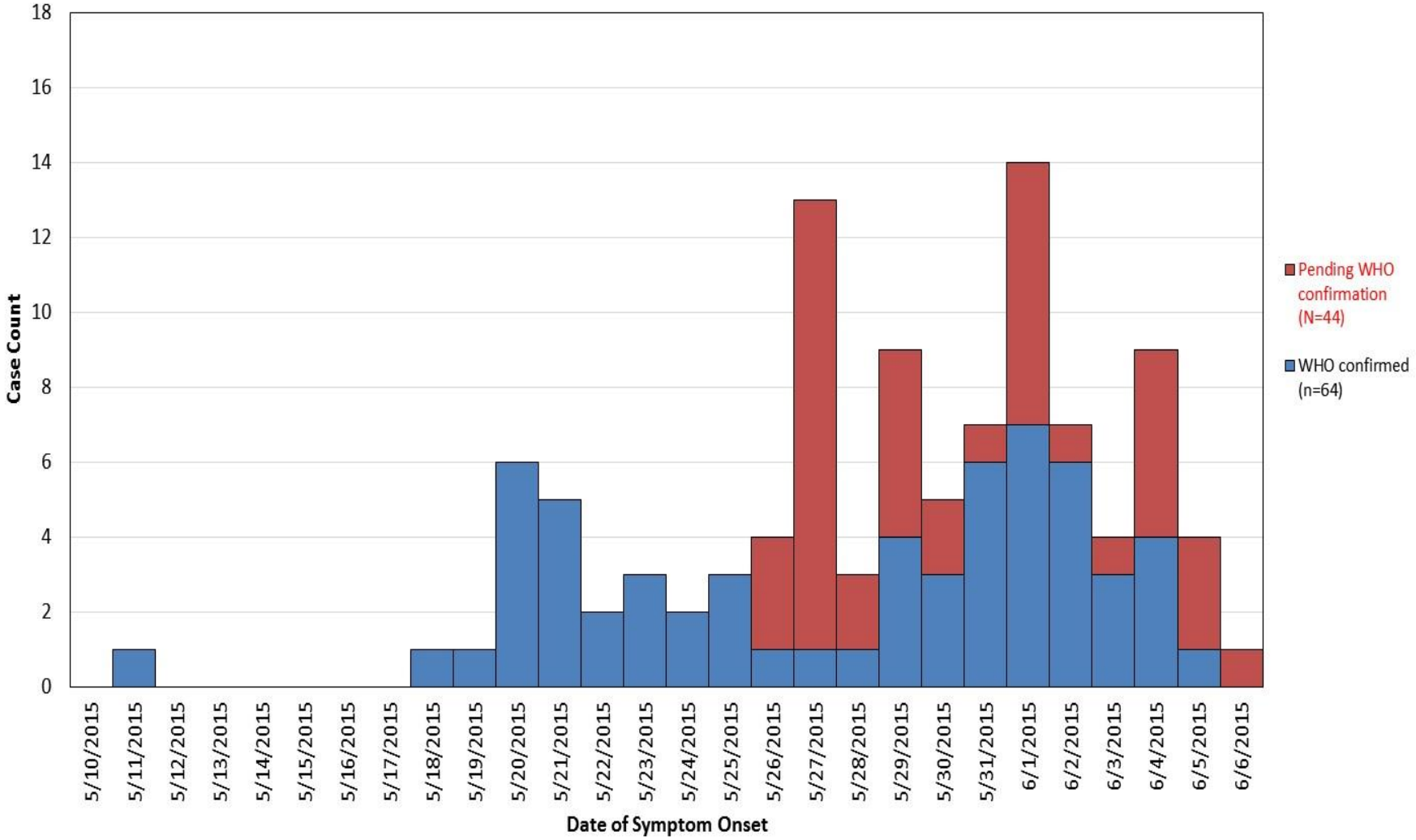
Cases have been exported to 21 countries: Algeria, Austria, China, Egypt, France, Germany, Greece, Italy, Jordan, Kuwait, Malaysia, Netherlands, Philippines, Oman, Qatar, Republic of Korea, Tunisia, UAE, UK, USA, & Turkey

*Exported cases are cases that are reported by country of diagnosis or probable country of exposure, which is different from their country of residence. Data as of June 10, 2015

MERS-CoV Overall Epidemiology



Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Reported Cases
Republic of Korea Outbreak 2015 (Total=108)



*3 confirmed cases missing onset information. Onset dates are imputed for 44 pending cases. Data as of June 10, 2015

Exportation of MERS-CoV to the Republic of Korea

- 68 year old male with history of travel to Bahrain, UAE, Saudi Arabia, and Qatar prior to returning to Korea on May 4
- Onset of illness May 11, and diagnosed with MERS-CoV on May 20
- Exportation of a secondary case to China on May 26, tested positive for MERS-CoV in China on May 29
- The Republic of Korea reports 108 cases, including 9 deaths as of June 10

Outbreak of MERS-CoV in the Republic of Korea

- All reported cases are epidemiologically linked to the index case and are healthcare-associated
- Secondary and tertiary transmission has been documented
- Reported exposures up to ~ May 31 (at this time)
- Cases include healthcare personnel, patients, and visitors in healthcare facilities where case-patients receive care
- Transmission has been reported to be associated with ward, clinic, and emergency department settings

Republic of Korea MERS-CoV Sequence

- MERS-CoV sequence from a virus isolate from a Korean MERS-CoV patient is closely related to recent viruses circulating in the Arabian Peninsula

- No significant genetic changes observed in the sequence of the virus

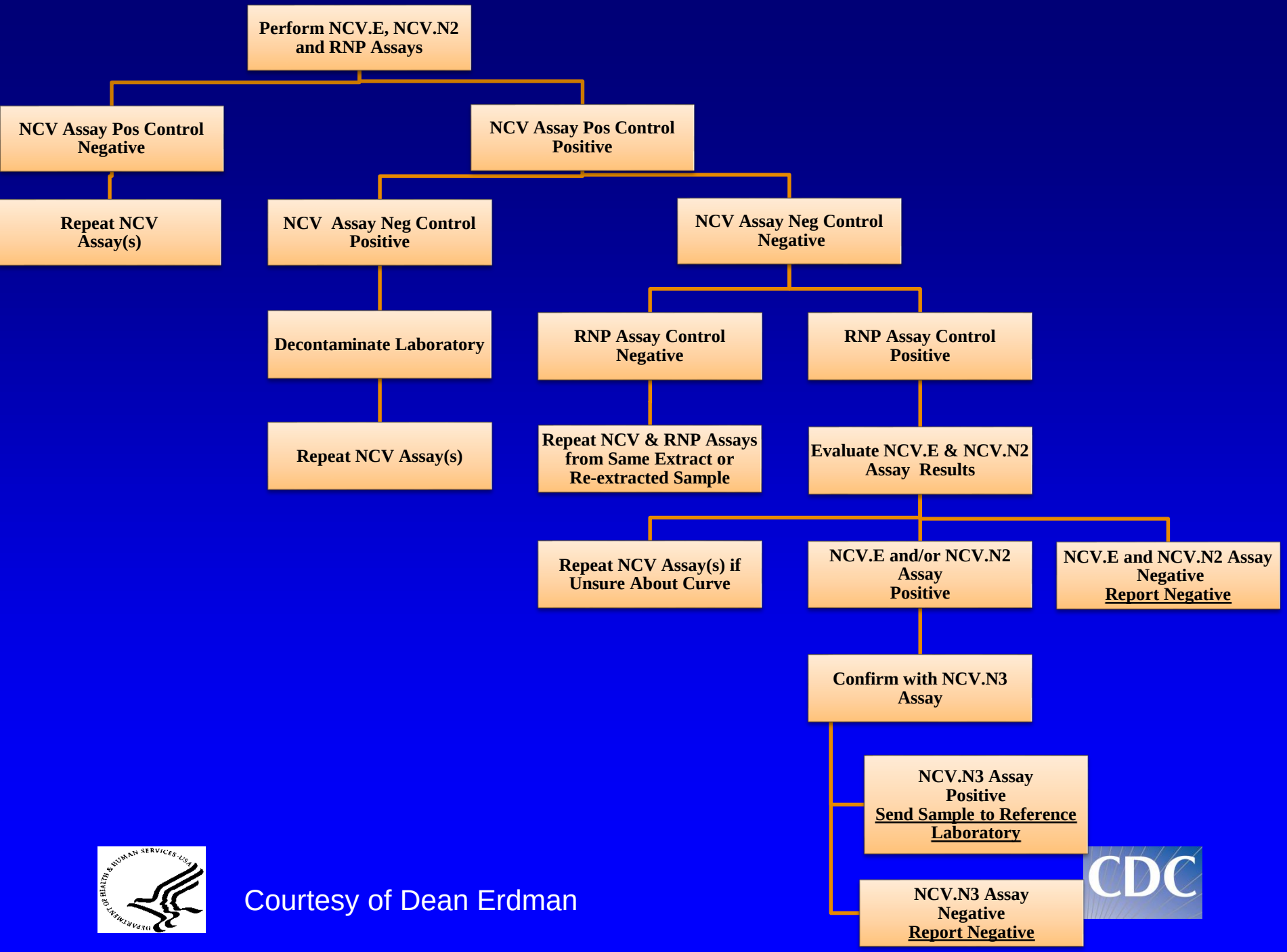
Patient Under Investigation (PUI)

Clinical features		Epidemiologic Risk
Severe illness **Fever and pneumonia or acute respiratory distress syndrome (based on clinical or radiological evidence)**	and	A history of travel from countries in or near the Arabian Peninsula[1] within 14 days before symptom onset, or close contact[2] with a symptomatic traveler who developed fever and acute respiratory illness (not necessarily pneumonia) within 14 days after traveling from countries in or near the Arabian Peninsula[1]. -- or -- A history of being in a healthcare facility (as a patient, worker, or visitor) in the Republic of Korea within 14 days before symptom onset.. -- or -- A member of a cluster of patients with severe acute respiratory illness (e.g., fever and pneumonia requiring hospitalization) of unknown etiology in which MERS-CoV is being evaluated, in consultation with state and local health departments in the US.
Milder illnesses **Fever and symptoms of respiratory illness (not necessarily pneumonia; e.g. cough, shortness of breath)**	and	A history of being in a healthcare facility (as a patient, worker, or visitor) within 14 days before symptom onset in a country or territory in or near the Arabian Peninsula in which recent healthcare-associated cases of MERS have been identified.
Fever or symptoms of respiratory illness (not necessarily pneumonia; e.g. cough, shortness of breath)	and	Close contact[2] with a confirmed MERS case while the case was ill.

1,2 Countries considered in the Arabian Peninsula and neighboring include: Bahrain; Iraq; Iran; Israel, the West Bank, and Gaza; Jordan; Kuwait; Lebanon; Oman; Qatar; Saudi Arabia; Syria; the United Arab Emirates (UAE); and Yemen.
Close contact is defined as: a) being within approximately 6 feet (2 meters) or within the room or care area for a prolonged period of time (e.g., healthcare personnel, household members) while not wearing recommended personal protective equipment (i.e., gowns, gloves, respirator, eye protection– see Infection Prevention and Control Recommendations(http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html); or b) having direct contact with infectious secretions (e.g., being coughed on) while not wearing recommended personal protective equipment (i.e., gowns, gloves, respirator, eye protection – see Infection Prevention and Control Recommendations(http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html). Data to inform the definition of close contact are limited. At this time, brief interactions, such as walking by a person, are considered low risk and do not constitute close contact.

Guidelines for Collecting and Testing Clinical Specimens

- Test “patients under investigation”
- Consider timing of collection
- Collect multiple specimens
- Lower respiratory (BAL, sputum) preferred
- Also NP/OP, serum (PCR and serology)



Courtesy of Dean Erdman

MERS-CoV US Patients Under Investigation

- 584 patients have tested negative for MERS-CoV in the United States
- 2 patients have tested positive for MERS-CoV (Indiana and Florida in May, 2014)
- 45 states have submitted specimens to CDC or performed their own testing

Interim Infection Prevention and Control Recommendations for Hospitalized Patients

- Standard, contact, and airborne precautions are recommended for management of hospitalized patients with known or suspected MERS-CoV infection
- These recommendations are consistent with those recommended for the coronavirus that caused severe acute respiratory syndrome (SARS)
- Updated guidance on MERS-CoV infection control

MERS-CoV RNA Detection in Two Patients Over Time

- MERS-CoV RNA was detected in lower respiratory tract specimens ~ a month after onset of illness
- MERS-CoV RNA was detected in whole blood and urine several days after onset of illness, but not so for rectal swabs

Poissy et al. J Clin Virol. 61: 275-8, 2014

Identification of MERS-CoV in the United States

- PUI guidance
- Obtain a travel history with dates
- Ask about healthcare exposure
- Check date of onset of illness
- Remember multiple specimens and types with respect to onset of illness
- Appropriate specimen types
- Call local/state health department

One More Thing….

- Thank you for working with us on identification and testing of PUIs

  – *The MERS-CoV Team*