

# Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

Zack Moore, MD, MPH

May 20, 2014



# Coronaviruses (CoVs)

- Human CoVs first isolated in the 1960s
- Six human CoVs identified to date:
  - HCoV-229E
  - HCoV-OC43
  - HCoV-NL63
  - HCoV-HKU1
  - SARS-CoV
  - Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

# Non-SARS Human CoVs: Epidemiology

- Worldwide
- Winter and spring in temperate climates
- Exposure common in early childhood
- Droplet, contact, and indirect contact
- Symptoms and viral loads high first few days of illness
- Incubation period 2–5 days

# Non-SARS Human CoVs: Clinical Spectrum of Illness

- Most often associated with upper respiratory tract infections in children
- Pneumonia and lower tract infections in immunocompromised individuals and the elderly
- May play a role in exacerbations of underlying respiratory diseases

# SARS

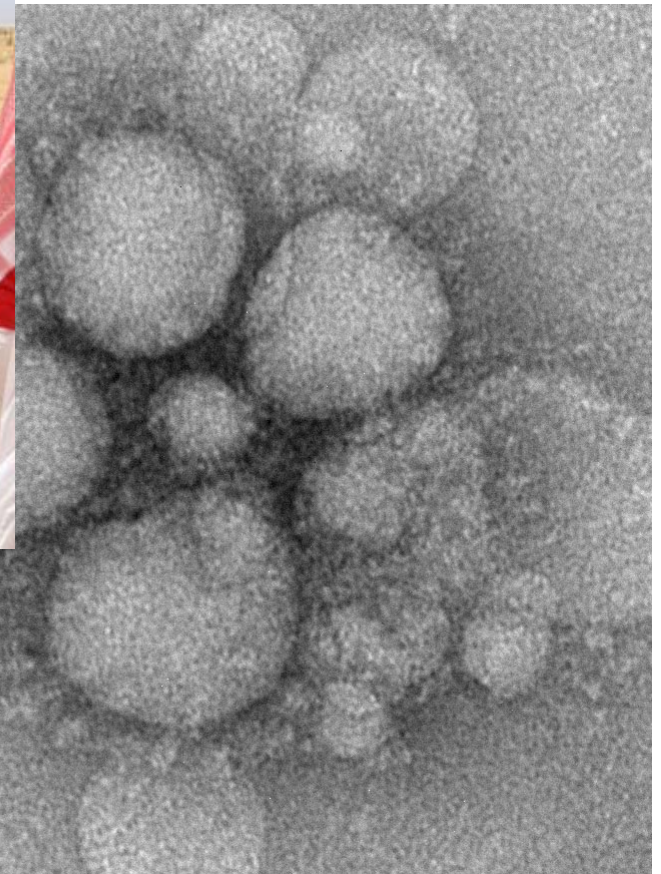
- First recognized Nov, 2002 as sporadic cases in Guandong province, China
- Outbreak period 2002–2003
- Hong Kong hotel contributed to spread of virus to several countries
- 8,098 probable SARS cases
  - 774 deaths (10%)



# SARS: Epidemiology

- Incubation period 2–10d (median 4d)
- Droplet transmission
  - Aerosol spread?
  - Fomites?
  - Fecal-respiratory transmission at an apartment complex in Hong Kong
- Transmission most likely during 2nd week of illness
- Super spreading events

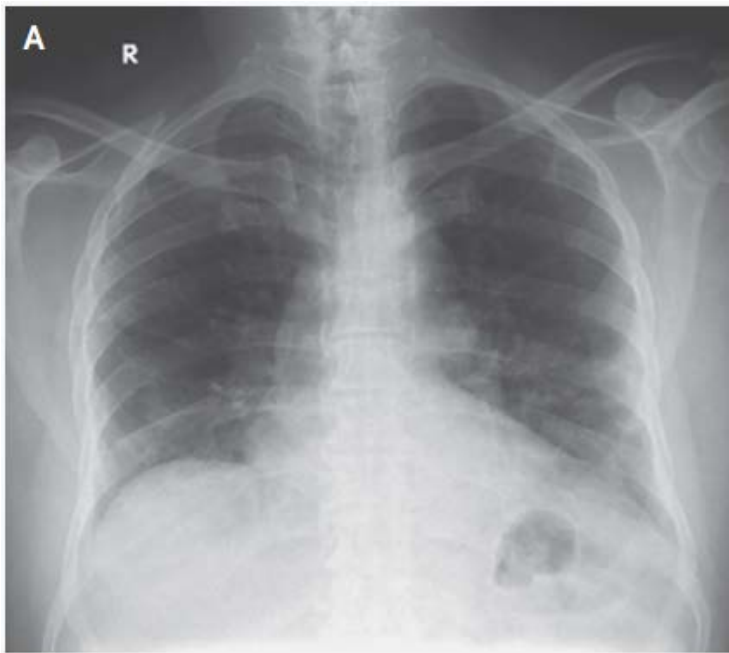
# Middle East Respiratory Syndrome



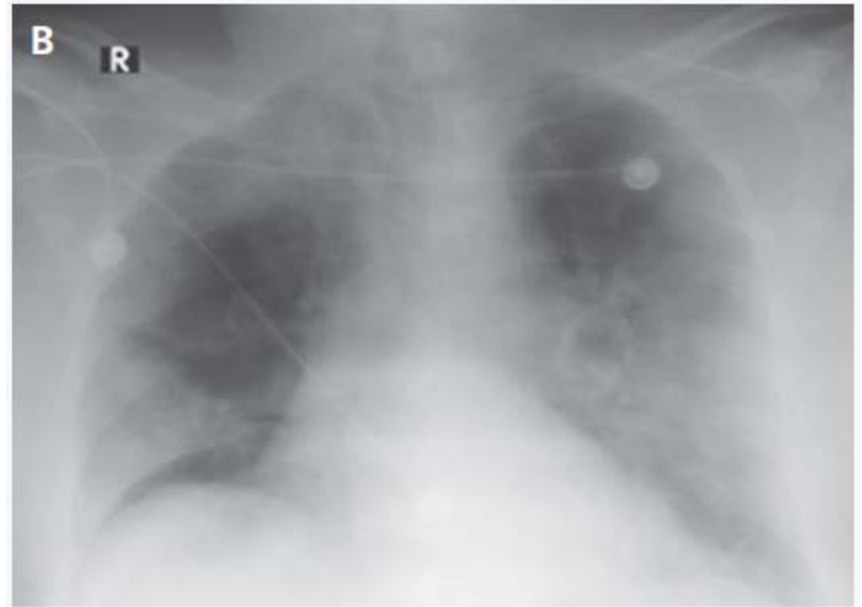
Images: [www.cdc.gov](http://www.cdc.gov)

# Case #1: June 13, 2012

- 60 year-old man from Saudi Arabia
- 7 days of fever, cough, shortness of breath



Hospital Day 1



Hospital Day 3



# Case #2: September 9, 2012

- 49 year-old man from Qatar
  - Recent travel to Saudi Arabia
  - History of farm (camels and sheep) exposure
- 6 days of cough, myalgia and arthralgia
- Admitted to Qatari hospital with bilateral pneumonia
- Transferred to London for respiratory and renal failure

# MERS-CoV: Identification

The NEW ENGLAND JOURNAL of MEDICINE

## BRIEF REPORT

### Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia

Ali Moh Zaki, M.D., Ph.D., Sander van Boheemen, M.Sc.  
Albert D.M.E. Osterhaus, D.V.M., Ph.D., and Ron

#### RAPID COMMUNICATIONS

Severe respiratory illness caused by a novel coronavirus,  
in a patient transferred to the United Kingdom from the  
Middle East, September 2012

A Bermingham<sup>1</sup>, M A Chand (meera.chand@hpa.org.uk)<sup>1</sup>, C S Brown<sup>2,4</sup>, E Aarons<sup>3</sup>, C Tong<sup>3</sup>, C Langrish<sup>3</sup>, K Hoschler<sup>1</sup>, K Brown<sup>1</sup>, M Galiano<sup>2</sup>, R Myers<sup>1</sup>, R G Pebody<sup>4</sup>, H K Green<sup>4</sup>, N L Boddington<sup>4</sup>, R Gopal<sup>1</sup>, N Price<sup>3</sup>, W Newsholme<sup>3</sup>, C Drosten<sup>4</sup>, R A Fouchier<sup>5</sup>, M Zambon<sup>1</sup>

1. Health Protection Agency (HPA), London, United Kingdom

2. Centre for Clinical Infection and Diagnostics Research, King's College London, London, England

3. Guy's and St Thomas' NHS Foundation Trust and King's Health Partners, London, United Kingdom

4. Institute of Virology, University of Bonn Medical Centre, Bonn, Germany

5. Department of Virology, Erasmus Medical Centre, Rotterdam, the Netherlands

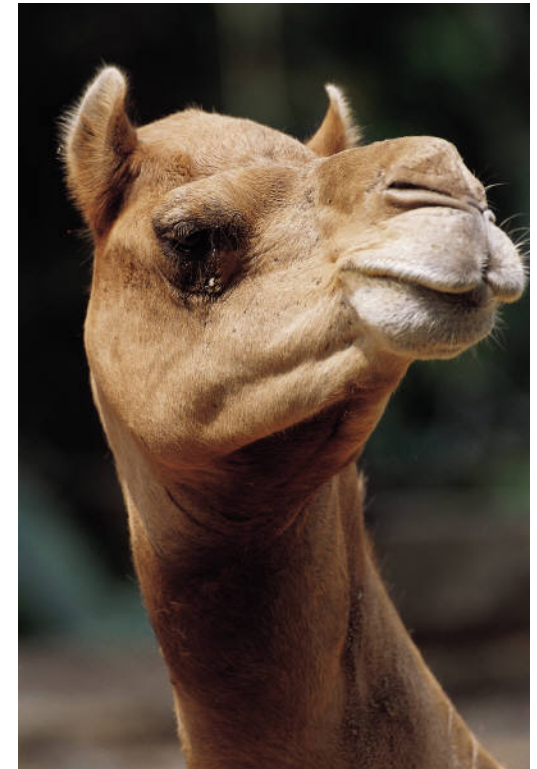
- Viruses from cases 1 and 2 99.5% identical

# MERS-CoV: Background

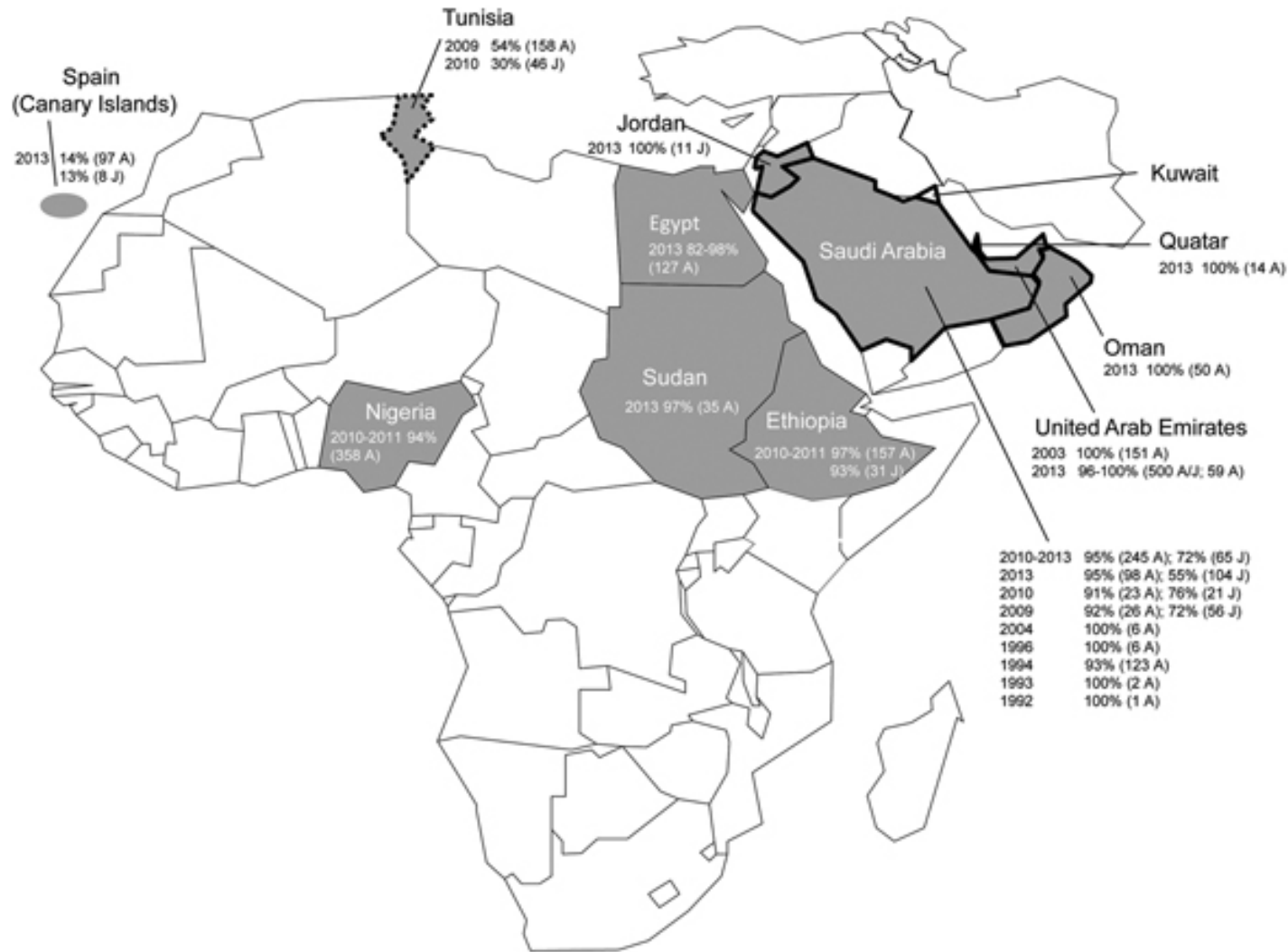
- First identified in September, 2012
- Cases retrospectively identified as early as March 2012
- Different from other coronaviruses in humans, including SARS
- Most similar to coronaviruses found in bats

# MERS-CoV: Origins

- Several studies have identified MERS-CoV in high proportion of camels
  - Likely reservoir
- Identical gene segment found in one bat
- Mode of transmission unclear
  - Respiratory? Foodborne?
  - Few primary cases with direct camel contact



# MERS-CoV Identification in Camels





# MERS-CoV: Clinical

- Range of presentations\*
  - 62% severe respiratory illness
  - 5% mild symptoms
  - 21% asymptomatic
- Data from early cases
  - High mortality
  - Lower respiratory tract illness, fever
- Data from more recent cases
  - Lower mortality
  - Higher proportion with upper respiratory tract illness
- No vaccine, no specific treatment

Cases with available data through 5/9/14; WHO

# MERS-CoV: Epidemiology

- Case demographics
  - 65% male
  - Median age 49 years (9 months–94 years)
- Incubation period 2–14 days
- Infectious period
  - Under investigation
  - Not believed contagious before onset

# MERS CoV: Transmission

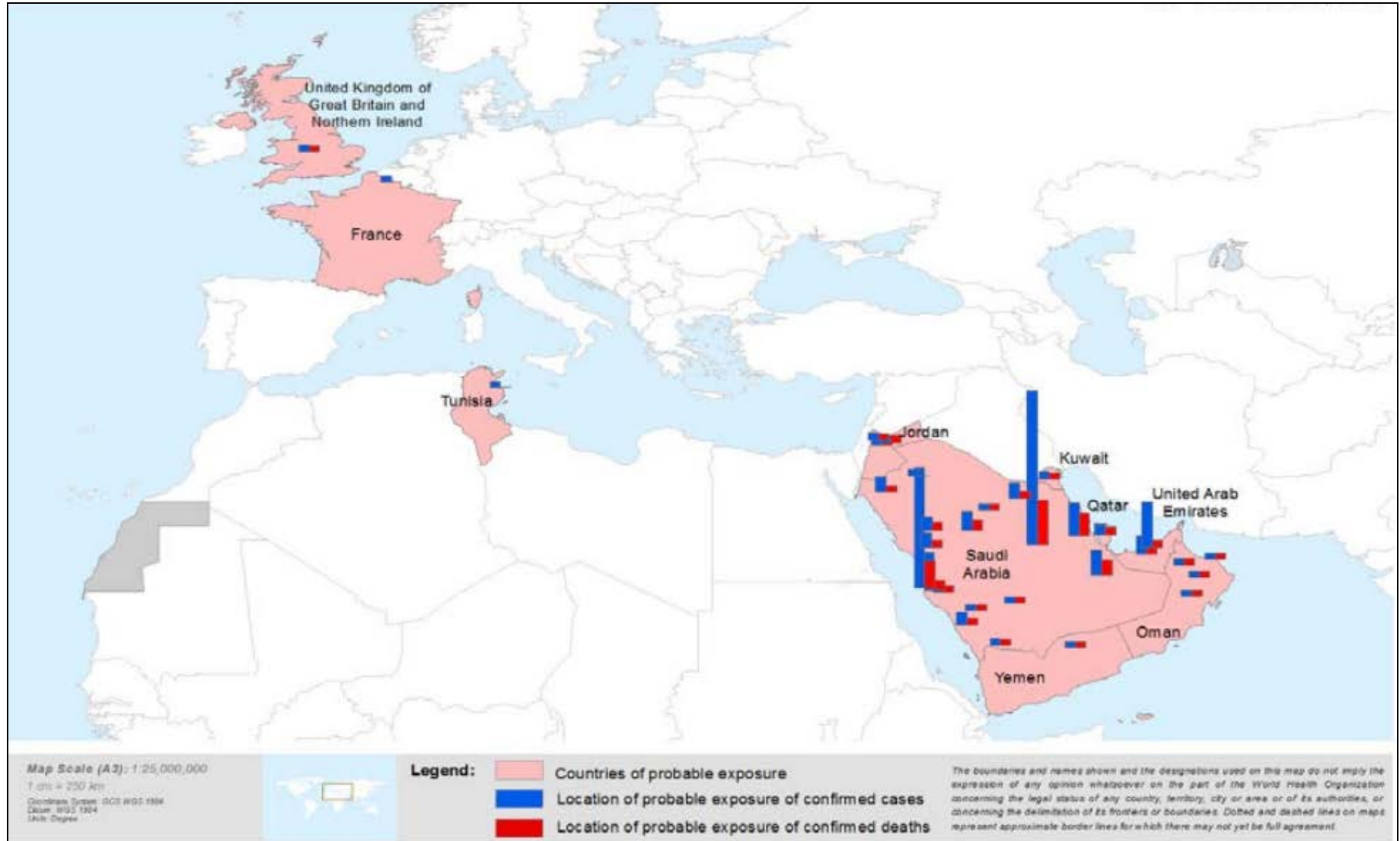
- ~75% identified as “secondary”
  - Mostly healthcare workers (19% of all cases)
  - Many with no or minor symptoms
- Many clusters identified
  - Healthcare
  - Household (estimated 1.3% secondary attack rate)
- No sustained person-to-person transmission



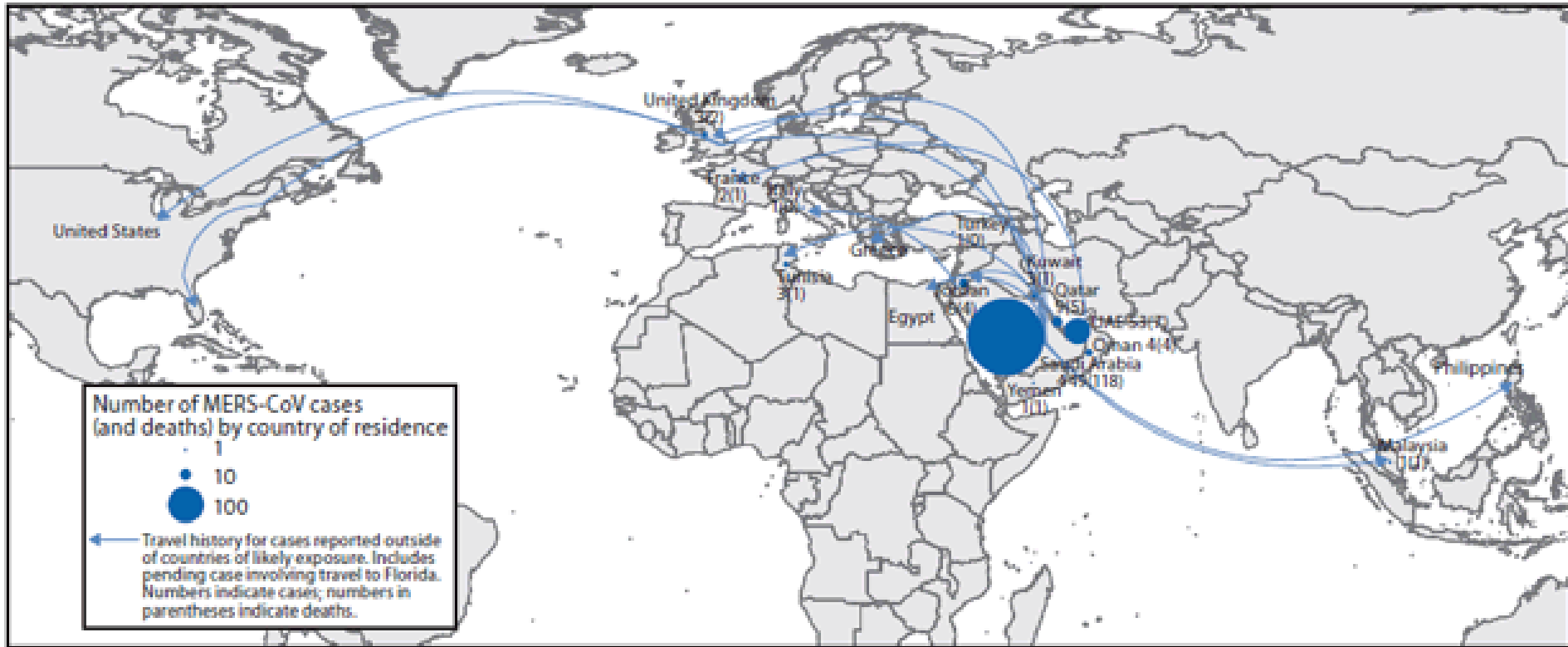
# MERS Co-V: Current Status\*

- 614 cases\*
  - 181 deaths (29%)
- Majority of case in Saudi Arabia
- Other affected countries
  - United Arab Emirates, Qatar, Oman, Jordan, Kuwait, Yemen, Lebanon
  - UK, France, Turkey, Tunisia, Italy, Greece, Malaysia, USA, Egypt, Netherlands

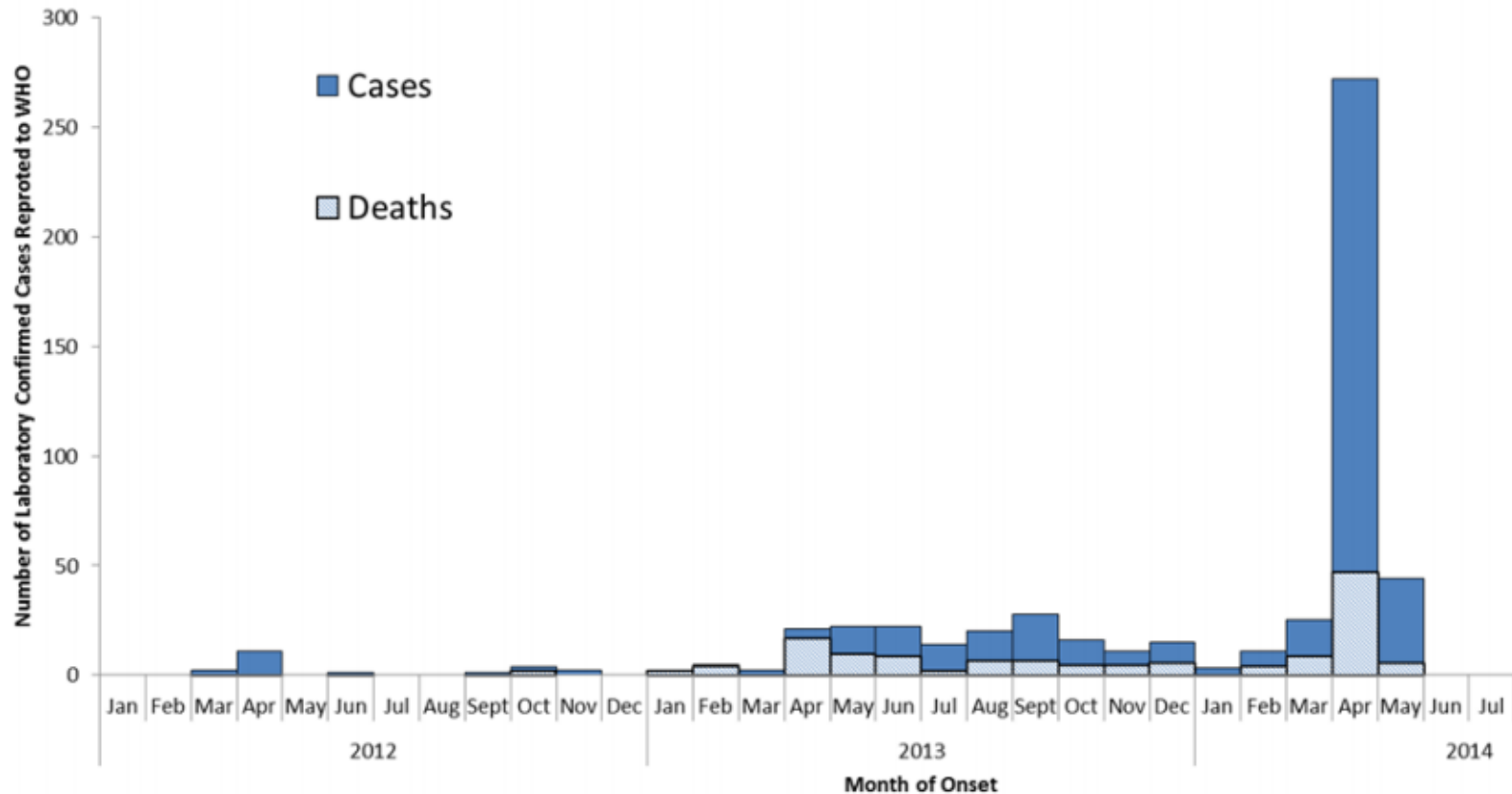
# MERS-CoV Cases by Country of Presumed Exposure



# MERS-CoV Cases by Country of Residence



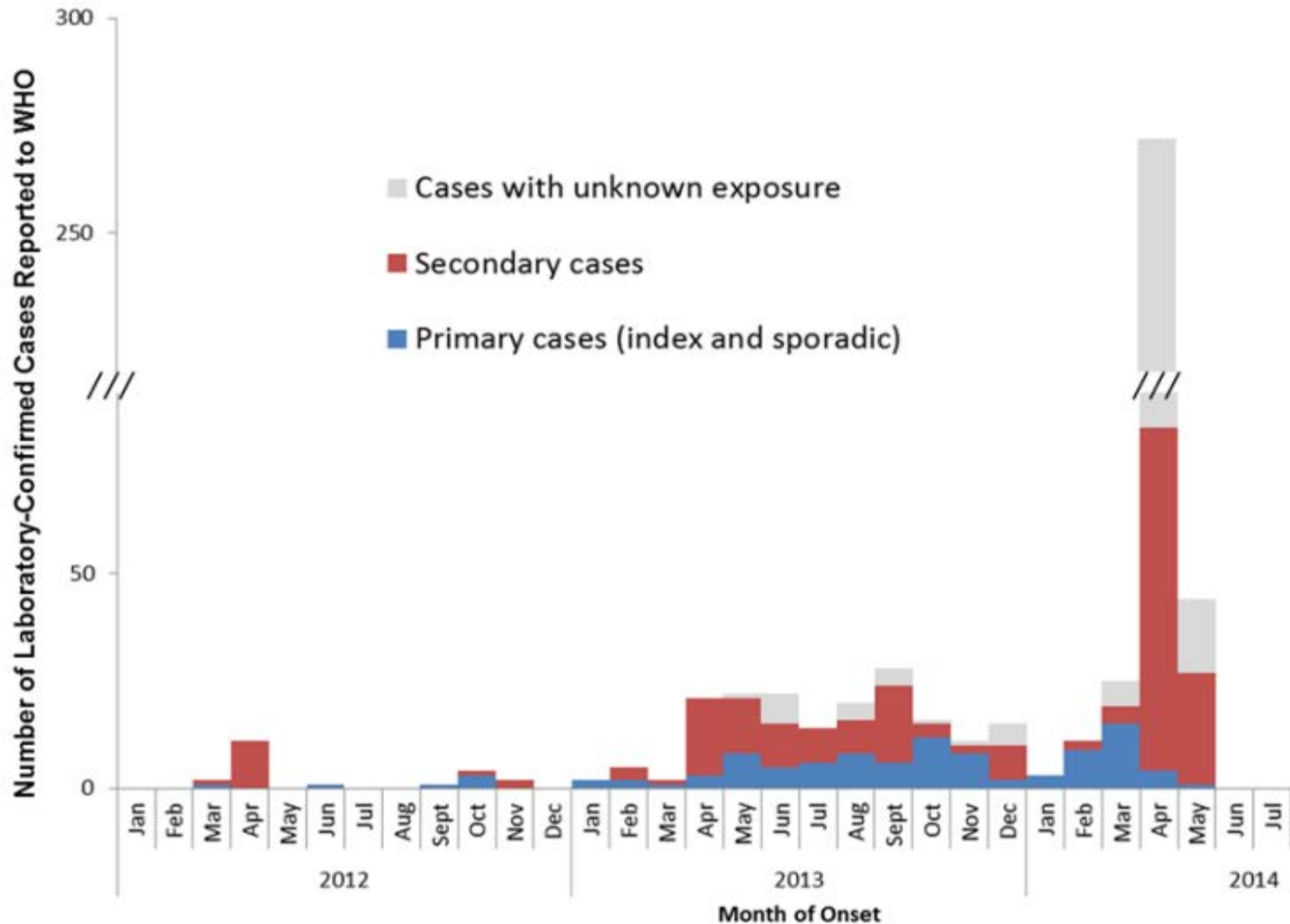
# MERS-CoV: Epidemic Curve



**Figure 2. Epidemic curve of 536 laboratory-confirmed cases MERS-CoV cases by outcome (as of 8 May 2014)**

Source: WHO

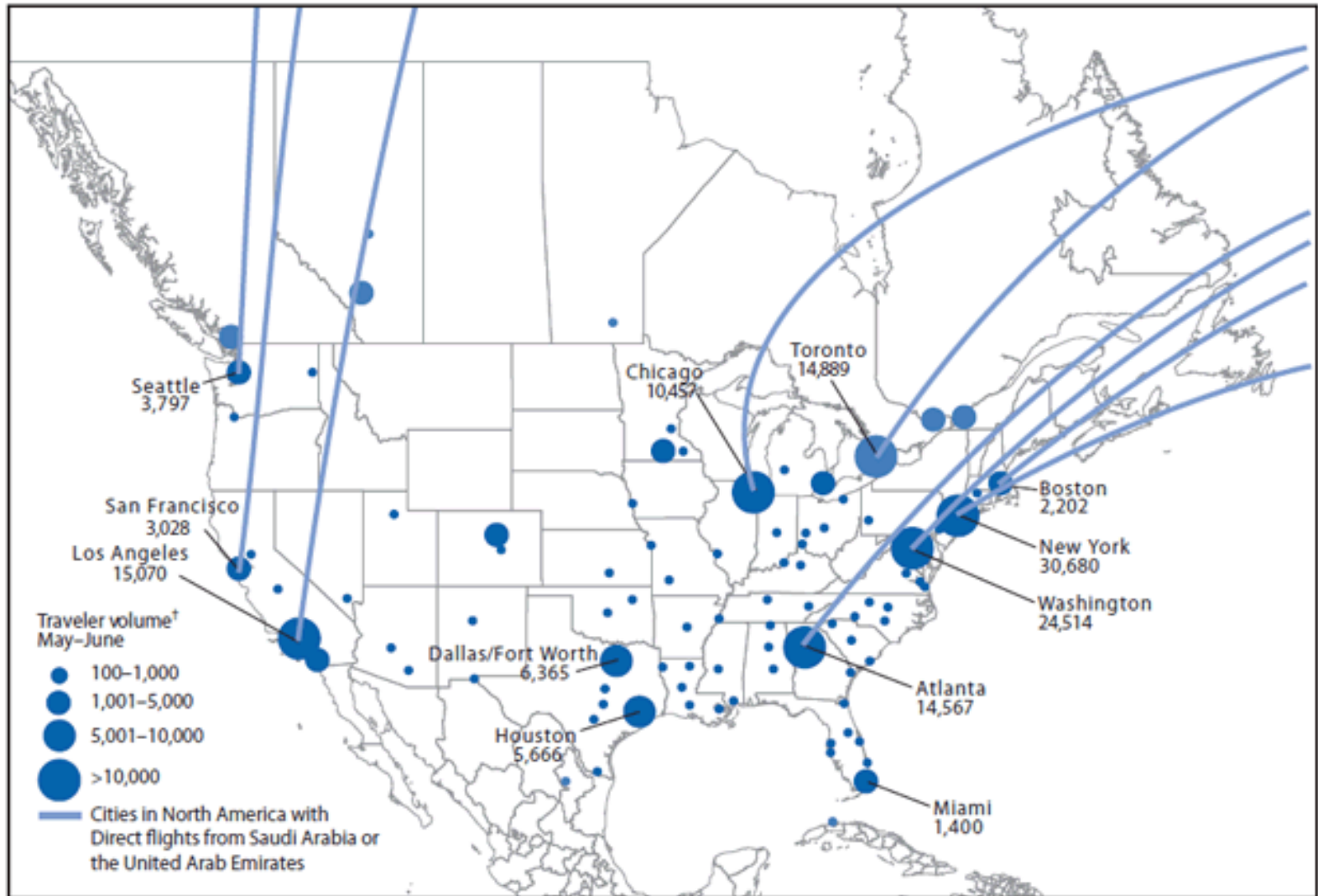
# MERS-CoV Cases by Case Type



# MERS in the United States

- First case confirmed May 2, 2014
  - HCW from Saudi Arabia
  - Diagnosed and hospitalized in Indiana
- Second case confirmed May 11, 2014
  - HCW from Saudi Arabia
  - Diagnosed and hospitalized in Florida

# Volume of Travelers from Saudi Arabia and the United Arab Emirates, April-May, 2014



# MERS-CoV: Public Health Actions

**Contact Epi On-Call *immediately* for any patient  
in whom MERS is considered**



# Patient Under Investigation: A

- Fever and pneumonia or acute respiratory distress syndrome

AND EITHER

- Travel from affected region within 14 days before symptom onset

OR

- Close contact with a symptomatic traveler

OR

- Member of a cluster of patients with severe acute respiratory illness of unknown etiology in which MERS-CoV is being evaluated

# Patient Under Investigation: B

- Close contact with a confirmed or probable case of MERS while the case was ill

AND

- Fever ( $>100^{\circ}\text{F}$ ) or symptoms of respiratory illness within 14 days following the close contact. (lower threshold than category A.)

# MERS-CoV: Close Contact Definition

- Provided care for a MERS patient
  - Healthcare worker
  - Family member
  - Similarly close physical contact
- Stayed at same place (e.g. lived with, visited) as MERS patient while the patient was ill

# MERS-CoV: Testing

- Available at SLPH with prior approval
- Guidance available on DPH website



North Carolina Department of Health and Human Services  
State Laboratory of Public Health

Pat McCrory  
Governor

Aldona Z. Wos, M.D.  
Ambassador (Ret.)  
Secretary DHHS

Scott J. Zimmerman, DrPH, MPH, HCLD (ABB)  
Laboratory Director

## NCSLPH MERS-CoV Specimen Collection and Testing Guidelines, 5/2/14

**Testing Criteria for Middle East Respiratory Syndrome Coronavirus (MERS-CoV):** All suspect or probable cases of MERS-CoV infections should be reported to the **NC DPH Communicable Disease Branch at (919) 733-3419 for prior approval for laboratory testing.** A Patient Under Investigation (PUI) is a person with:

- Fever ( $\geq 38^{\circ}\text{C}$ ,  $100.4^{\circ}\text{F}$ ) and pneumonia or acute respiratory distress syndrome (based on clinical or radiological evidence);  
AND EITHER
- History of travel from countries in or near the Arabian Peninsula within 14 days before symptom onset;

# MERS-CoV: Infection Control

- Healthcare settings
  - Contact, droplet and airborne isolation
    - Fit-tested N95 or higher level respirators
    - Gowns, gloves and eye protection
    - Negative-pressure airborne infection isolation
  - Surgical mask when out of room
- Home
  - Follow guidance for ill persons, care givers and close contacts

# MERS: Isolation and Quarantine

- Recommendations evolving
  - Voluntary home quarantine used for close contacts to IN and FL cases
  - Other contacts asked to self-monitor if asymptomatic
- Based on degree of risk
  - Higher risk: Household contact and HCWs with unprotected exposures
  - Lower risk: Travel contacts, ED patient contacts, community contacts

# CDC Travel Alert Level 2

- Travelers going to provide health care services are advised to practice CDC's recommendations for infection control of confirmed or suspected cases and to monitor their health closely
- Travelers who are going for other reasons are advised to follow standard precautions, such as hand washing and avoiding contact with people who are ill

# Summary

- New virus with high case-fatality rate
- Spreads person-to-person but no sustained transmission
- Rapid increase in number of cases during Spring 2014
  - First US cases identified May 2014
- Need for provider and public education to increase chances of early detection



