NEW YORK
state department of
HEALTH

Lessons Learned from 2009 H1N1 and SARS: Parallels to H7N9 and MERS-CoV

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September 24, 2014

Why this Series?

- Continual mutations of influenza viruses
- Unknown when a new strain of flu may arise
  - H1N1 (2009)
- Appearance of new infectious agents
  - SARS (2003)
  - MERS-CoV (2012)
- More severe flu season 2012-2013 primarily due to H3N2
- ***Lessons learned in the past can help us improve response in the future***

Influenza Viruses

In the beginning…..

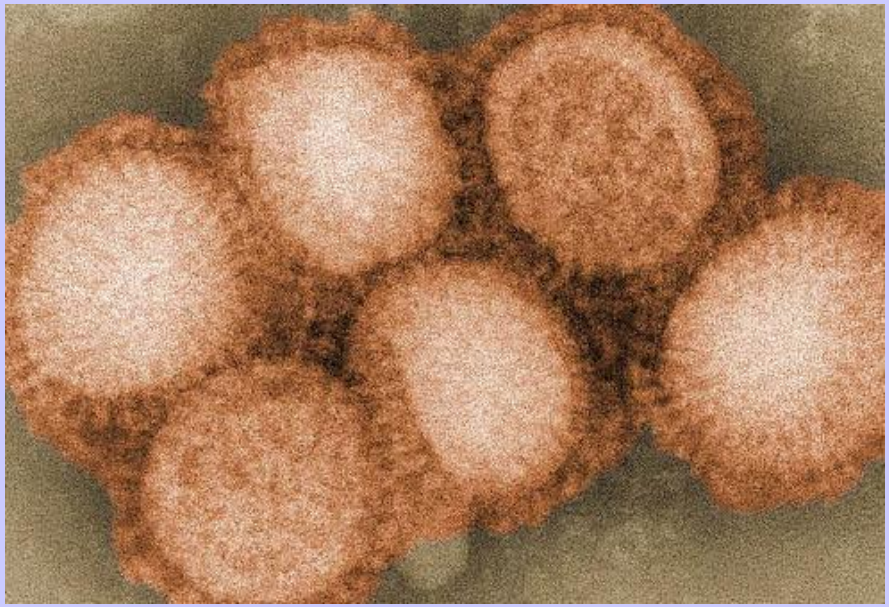
2009 H1N1 – Viral illness caused by an influenza virus

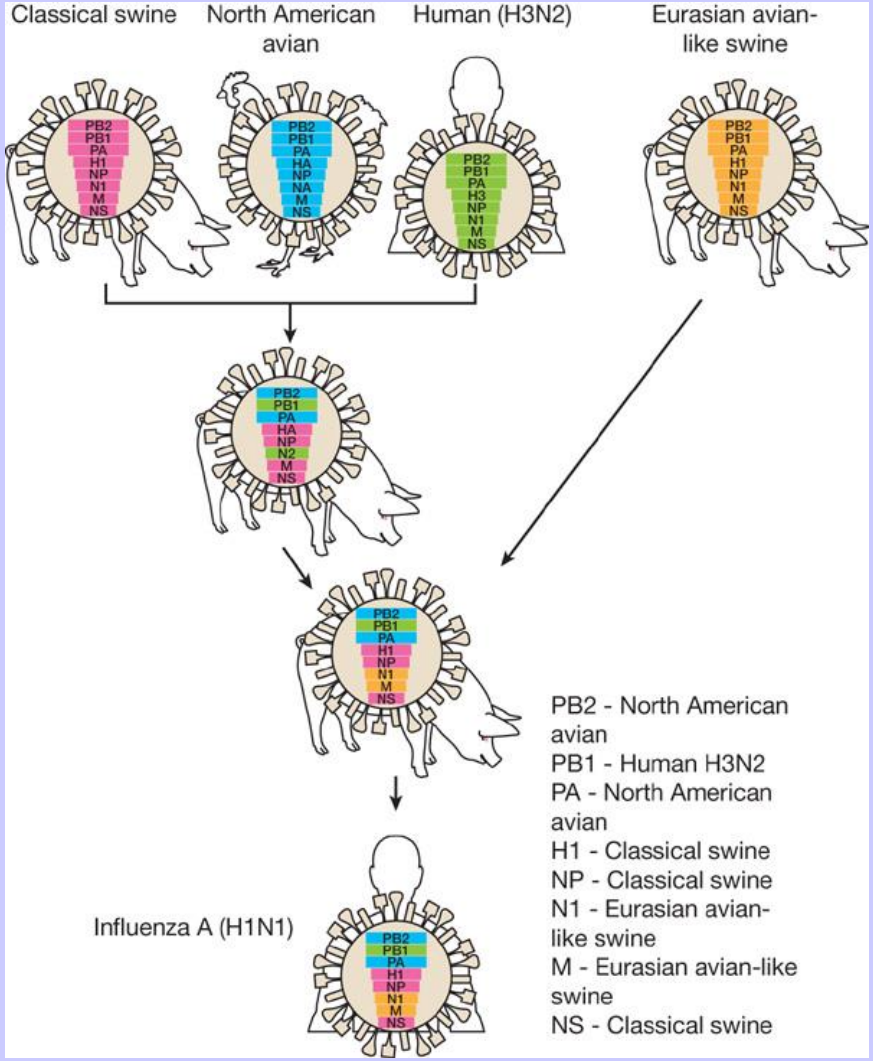
- First case in U.S. detected in 4/09
- Research indicates it resulted from a re-assortment of influenza viruses that occur naturally among pigs
- Between 43 million and 88 million cases of 2009 H1N1 occurred between April 2009 and March, 2010 (mid-level is about 60 million people infected with 2009 H1N1)

H7N9 – Viral illness caused by an influenza virus

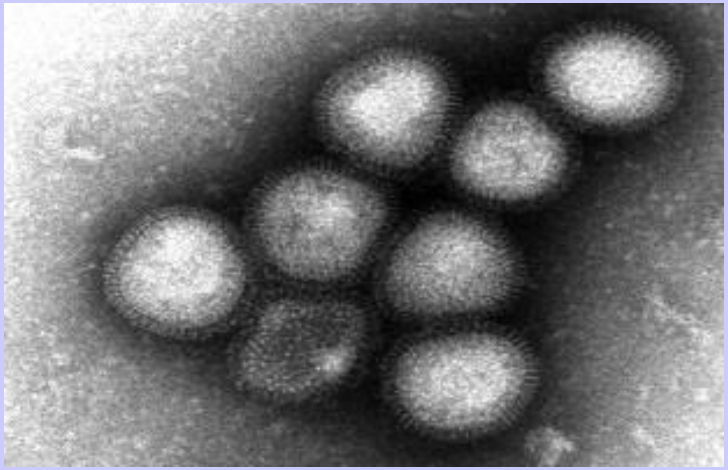
- First 3 cases reported to WHO by Chinese authorities in 3/13
  - 2 died; one critical
- Strain very different from previously seen H7N9 subtypes
  - Infecting humans and poultry
- 5 lab confirmed clusters, 1 lab confirmed asymptomatic infection
- More than 2,000 contacts followed, only 2 lab-confirmed positive
- 67 suspect cases in US, all negative

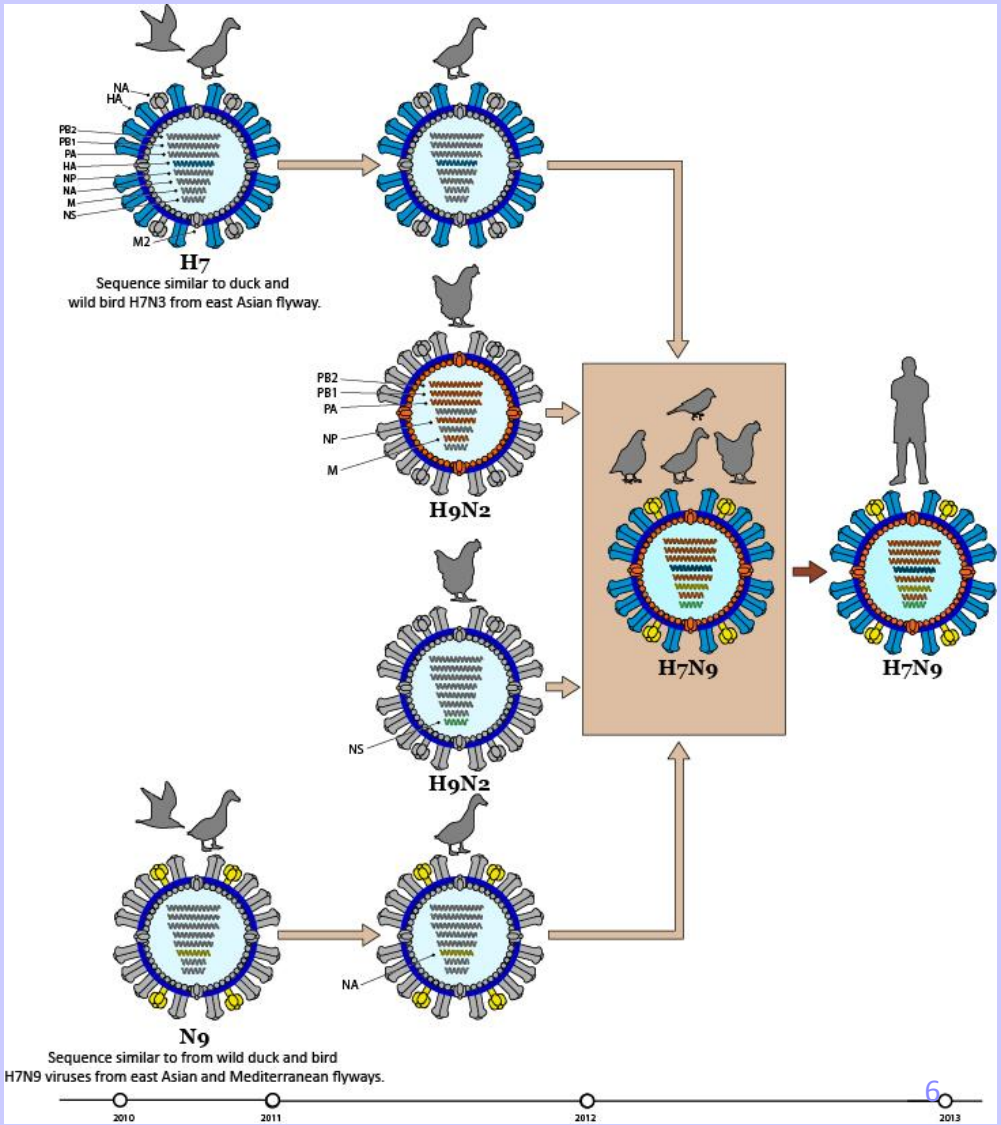
H1N1




Classical swine
North American avian
Human (H3N2)
Eurasian avian-like swine
PB2
PB1
PA
H1
NP
N1
M
NS
HA
NA
H3
N2
Influenza A (H1N1)
PB2 - North American avian
PB1 - Human H3N2
PA - North American avian
H1 - Classical swine
NP - Classical swine
N1 - Eurasian avian-like swine
M - Eurasian avian-like swine
NS - Classical swine

H7N9




NA
HA
PB2
PB1
PA
HA
NP
NA
M
NS
M2
H7
Sequence similar to duck and
wild bird H7N3 from east Asian flyway.
PB2
PB1
PA
NP
M
H9N2
NS
H9N2
H7N9
H7N9
NA
N9
Sequence similar to from wild duck and bird
H7N9 viruses from east Asian and Mediterranean flyways.
2010
2011
2012
2013

Where are we now?

2009 H1N1

- Between 192,000 and 398,000 H1N1-related hospitalizations occurred between 4/09 and 3/10 (mid-level about 270,000)
- Between 8,720 and 18,050 H1N1-related deaths occurred in same age range (mid-level about 12,270)
- Recent data suggests 151,700 to 575,400 deaths during the first year of the flu virus' spread, with a median of about 284,500
  - 80% < 65; 33% healthy

H7N9

- Evidence to date suggests that people are infected after contact with infected poultry or contaminated environments
- To date (June 2014), 450 lab-confirmed cases, with 165 deaths
- Case fatality rates = 36%
- Symptoms are high fever, cough, progression to severe pneumonia and multi-organ failure
- Predominantly severe disease in older men with underlying conditions – median age = 58
- Appears more transmissible than H5N1

Where are we now?

2009 H1N1

- At least 20% of all people, and almost half (46%) of all children aged 5 to 19 years, were infected with H1N1 influenza during the first year of the 2009 pandemic
  - *Influenza and Other Respiratory Viruses*, January 2013
- Trivalent or quadrivalent vaccine available for 2014-2015 influenza season

H7N9

- Cases have begun to increase since June, 2014
- Virus has several highly unusual traits that could lead to another pandemic
  - H7 viruses have been cause of numerous explosive poultry outbreaks including NYS, Canada, Mexico, and Italy
  - In almost all cases, spilled over to humans

Challenges

2009 H1N1

- Influenza viruses continually mutate
- Resistant to amantadines
- Oseltamivir resistance, sometimes within 1 week of treatment initiation, reported particularly among immunocompromised patients with 2009 H1N1 virus infection
  - Infection-control measures especially important for immunocompromised patients

H7N9

- High severity of illness
- Genetic changes associated with human adaptation and transmission
- Birds (chickens and quail) may shed virus without symptoms, but shedding well
  - Challenge for control efforts
  - Need ongoing surveillance in animals
- No vaccine

Concerns about influenza viruses with pandemic potential, widespread transmission of 2009 pandemic influenza A (H1N1), and the limited treatment options available for severely ill patients has prompted renewed interest in development of additional antiviral drugs with activity against influenza viruses

Coronaviruses

In the beginning……

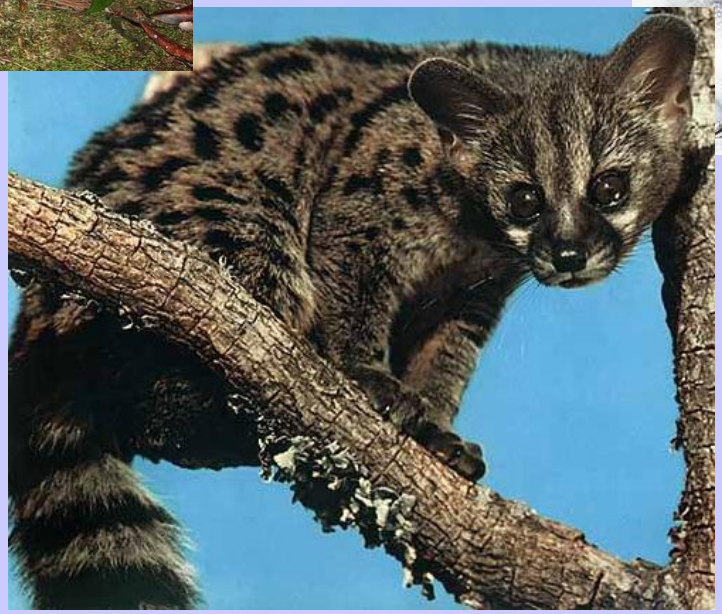
SARS-CoV – Viral illness caused by a coronavirus

- First outbreak in China, 11/02; reported in Asia in 2/03
  - 305 cases, 5 deaths
- First case in Toronto reported as possible TB 3/9/03
- WHO alert of "atypical pneumonia" 3/12/03
- First case hospitalized died on 3/13/03
- Hospital workers became ill 3/21/03
- Made a reportable disease 3/24/03
  - Designated "Communicable and Virulent"

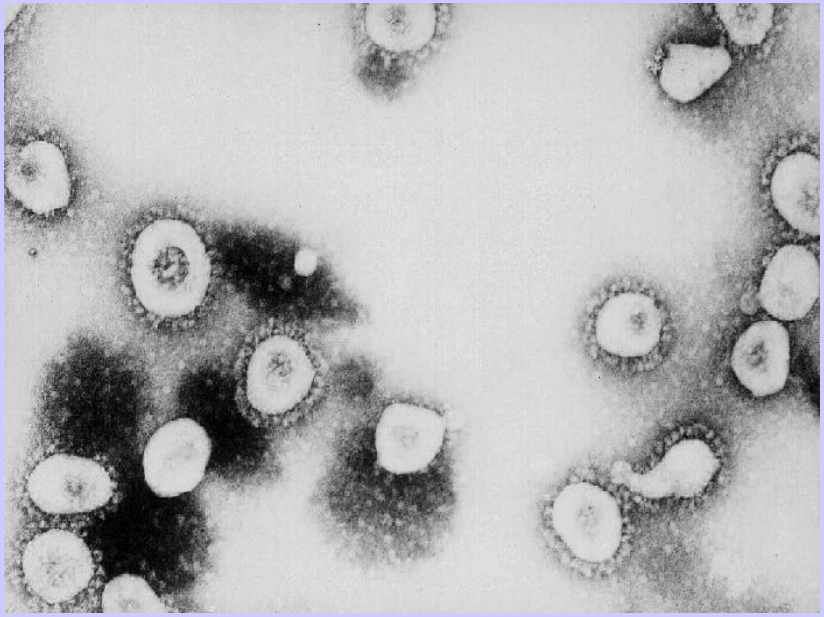
MERS-CoV – Viral illness caused by a coronavirus

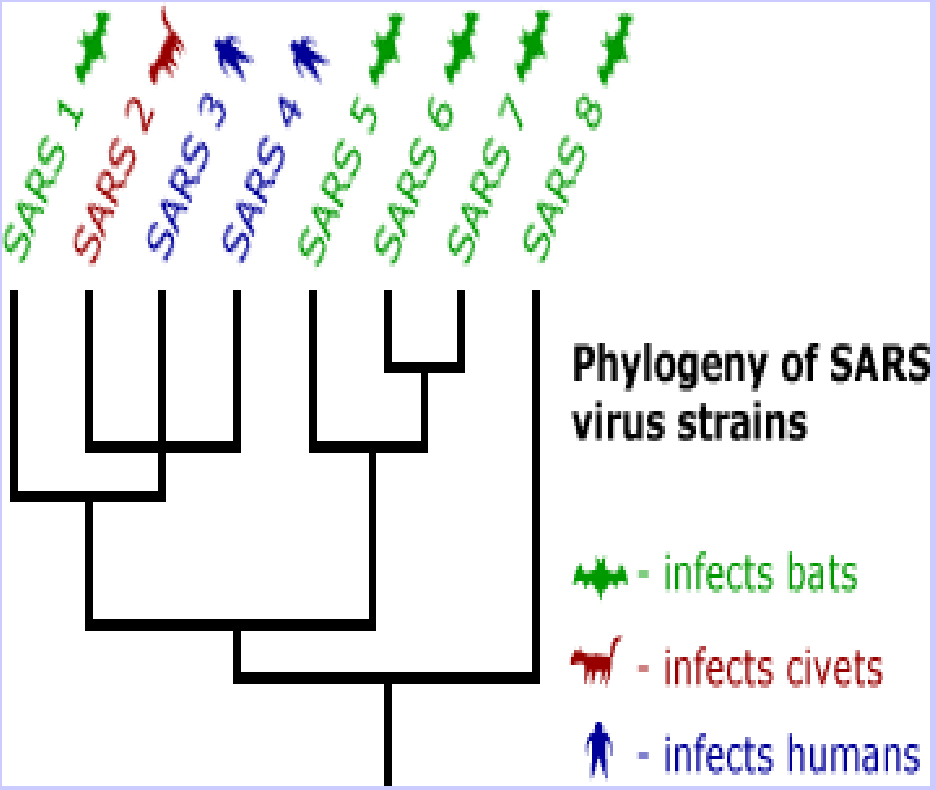
- First reported in Saudi Arabia in September, 2012
  - As of 9/18/14, 749 cases, 316 deaths
- Surveillance still underway to determine source of infection
  - Most likely the Egyptian tomb bat, though camels have very high seropositivity rate in Middle East, and as far away as the Canary Islands

SARS-CoV



SARS-CoV

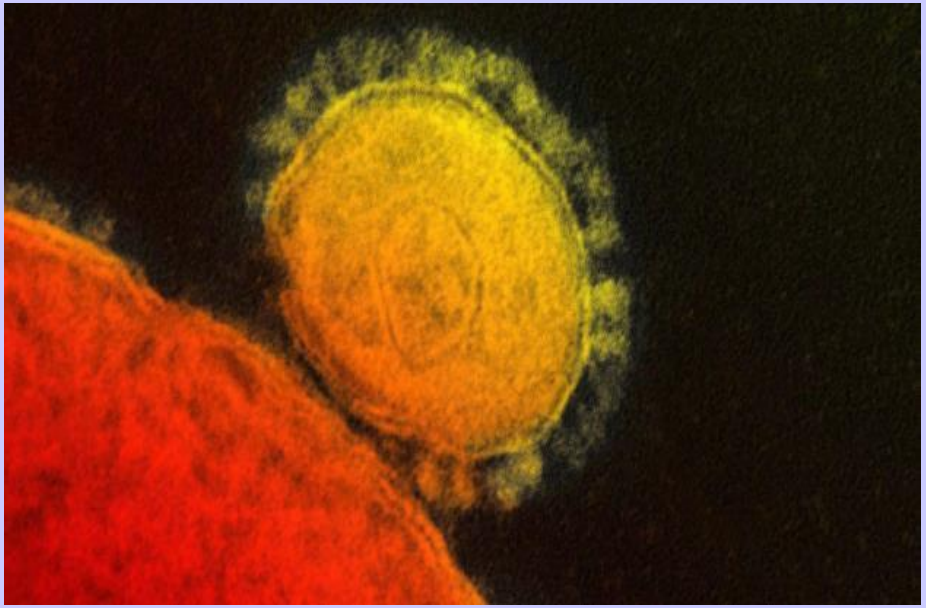


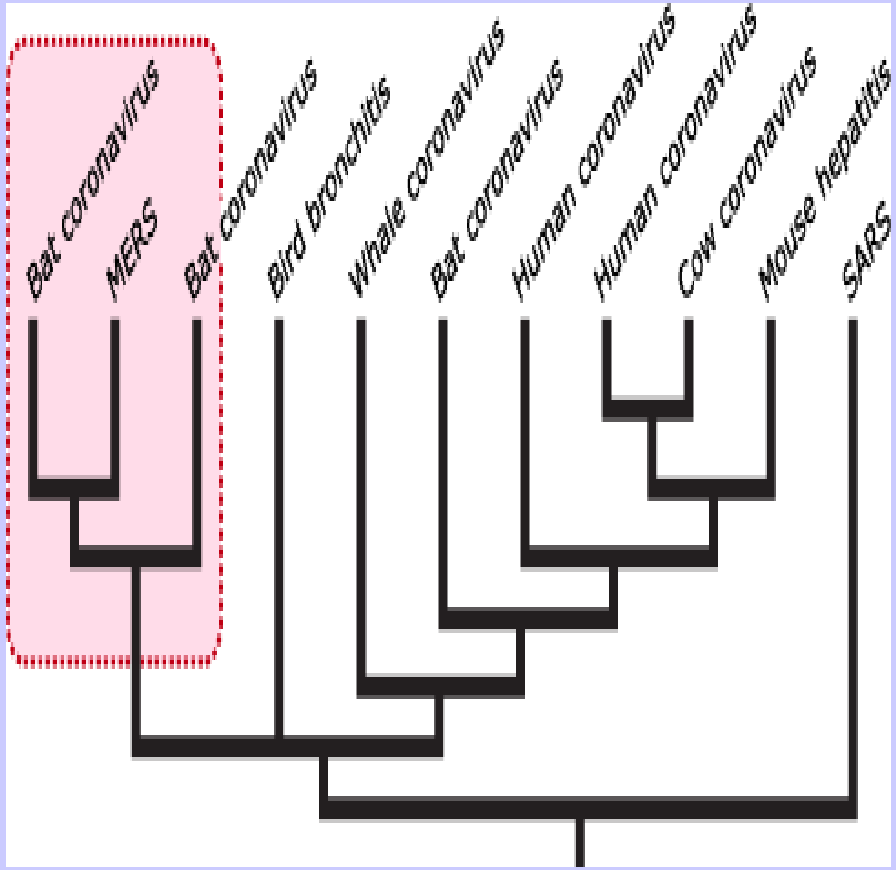

SARS 1
SARS 2
SARS 3
SARS 4
SARS 5
SARS 6
SARS 7
SARS 8
Phylogeny of SARS virus strains
- infects bats
- infects civets
- infects humans

Horseshoe bat

MERS-CoV

MERS-CoV




Bat coronavirus
MERS
Bat coronavirus
Bird bronchitis
Whale coronavirus
Bat coronavirus
Human coronavirus
Human coronavirus
Cow coronavirus
Mouse hepatitis
SARS

Egyptian Tomb Bat

Where are we now?

SARS-CoV

- Swept through 29 countries, infecting 8,098 people and killing 774
  - Severe respiratory infection
  - 6% cases female; average age at death was 71
- Aggressive quarantine measures terminated the first outbreak
  - WHO announced end of SARS outbreak on 7/5/03
- A few isolated lab-related cases in 2004, but no other outbreaks detected since that year

MERS-CoV

- Genetic analysis has traced the beginning of the virus to mid-2011
- Recent report in the *Lancet* raised possibility that MERS-CoV could be dying out
  - Estimated the reproduction number (number of people an infected person is likely to spread the virus to)
  - This suggests that in its current form, the virus doesn't have epidemic potential

Challenges

SARS-CoV

- Isolation/quarantine very difficult mentally, physically, emotionally and financially
- Post-quarantine acceptance back into school and workplace
- Stigmatization of affected groups
- Biggest risk is unrecognized patients
- Easier to control the disease than fear

MERS-CoV

- High severity of disease
- Method of transmission unclear
- Designation of cases as sporadic instead of linked has been problematic
- Mutations could make virus more transmissible
- No vaccine

Lessons Learned

2009 H1N1

- Public information and risk communication critical
- Collaborations with partners across disciplines and State agencies key
- Consistent regular communication with partners
  - Concise highlights, talking points needed
- Recommendation for priority groups needs to be made early and repeatedly
  - Clear explanation of LAIV vs inactivated vaccine needed

H7N9 – Old Lessons for a New Virus

- Marked fall in demand for poultry
  - Major effect on livelihoods of rural poor and women who rely on sale of chickens for their income
  - Alternate support needed for these individuals and families
    - Slaughter houses and freezers needed
- Support for alternative jobs for poultry farmers

Lessons Learned

2009 H1N1

- Mandatory flu vaccine for healthcare workers was not as problematic as portrayed
- Schools taught responsible respiratory etiquette
- Hospitals identified "physician champions" to encourage vaccination
- Hospitals identified those staff who had been vaccinated with special stickers
  - Patients did not want those without sticker to care for them

H7N9 – Old Lessons for a New Virus

- Farm biosecurity measures need to strengthened
  - Affordable and aligned with existing production systems
- No evidence that widespread culling was more effective than limited culling and surveillance
- Additional surveillance in wild birds needed
- Genetic sequences of influenza viruses should be shared as soon as available

Lessons Learned

2009 H1N1

- Allowing additional healthcare providers to vaccinate, particularly EMTs and pharmacists, was a significant help
- Alternate triage sites worked well
- Partnerships with pharmacies to serve un- and underinsured worked very well
- Sufficient vaccine absolutely critical prior to mass vaccination campaigns

H7N9 – Old Lessons for a New Virus

- Strong rationale for vaccination needs to be explained once a vaccine available
- All countries need an appropriate stockpile of antivirals

Lessons Learned

SARS-CoV

- Transmission of SARS-CoV occurred predominately through close interactions with infected persons
- Persons with unrecognized SARS-CoV disease could contribute to the initiation or expansion of an outbreak, particularly in healthcare settings
- Patients with SARS-CoV disease needed to be isolated to reduce risk of transmission to others
- Patients with mild disease could be safely isolated in locations other than acute care facilities

MERS Co-V – Still learning…

- Some patients with MERS-CoV infection might present with **atypical**, or **mild symptoms**
- Patients with mild symptoms are less likely to be thoroughly investigated and current case counts might not reflect the true burden of the disease
- **Testing** is difficult, and samples taken from the **upper respiratory system** may be **unreliable**
- **Repeated negative test results** of lower respiratory tract specimens are required to rule out infection

Lessons Learned

SARS-CoV

- Certain high-risk procedures and events increased the risk of SARS-CoV transmission, which is spread through airborne droplets
- Infection control was THE most important public health intervention for containing the spread of SARS-Co-V

MERS Co-V – Still learning….

- While many exposed HCWs have not fallen ill, it is prudent to take precautions against **airborne transmission**
- Further investigations are needed into the presence or absence of MERS v**iral shedding via the stool**
- Scientists and clinicians investigating the virus stress the importance of **travel and contact history-taking**

Lessons Learned

SARS Co-V

- Critical control measures taken
  - Quarantine of close contacts
  - Creation of special Family Health Teams for home visits of quarantined clients
  - Isolation orders if necessary
  - Disease surveillance
  - Managing community relations

MERS Co-V – And still concerned

- With millions of people heading to Saudi Arabia in October for Hajj (October 1-6, 2014), there's still a risk that MERS could be spread via international travel.
  - Air travel famously helped SARS spread across the globe
  - Slaughter of potentially infected animals cause for concern

Questions

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