Emerging Infectious Diseases

Respiratory Tract Diseases: Influenza, MERS-Cov, SARS-Cov

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Objectives

- Define Emerging Infectious Diseases
- Understand the viral antigenic variations of influenza virus
- List the different hosts for influenza (according to influenza type)
- MERS-Cov and SARS-Cov
- Be familiar with the famous pandemics for each of these viral infections, and measures used to contain spread
- Identify the different elements in the infection cycle for these viral infections
- Provide appropriate prevention and control measures for each of these viral infections

Emerging Infectious Diseases

"New, reemerging, or drug-resistant infections whose incidence in humans has increased within the past two decades or whose incidence threatens to increase in the near future."

Emerging Infectious Diseases: A CDC Perspective

Emerging Infectious Diseases

"Fifty years ago many people believed the age-old battle of humans against infectious disease was virtually over, with humankind the winners."

"During the past two decades at least a dozen "new" diseases have been identified and traditional diseases that appeared to be "on their way out" are resurging."

Clearly, the battle has not been won.

Emerging Infectious Diseases

- (1) have not occurred in humans before (this type of emergence is difficult to establish and is probably rare); or
- (2) have occurred previously but affected only small numbers of people in isolated places (AIDS and Ebola hemorrhagic fever are examples); or
- (3) have occurred throughout human history but have only recently been recognized as distinct diseases due to an infectious agent (Lyme disease and gastric ulcers are examples)

Contributing factors

- changes in human demographics and behavior
- advances in technology and changes in industry practices
- economic development and changes in land-use patterns
- dramatic increases in volume and speed of international travel and commerce—movement not only of people but of animals, foodstuffs, and other commodities,
- microbial adaptation and change (a factor that makes infectious diseases unique and particularly challenging)
- breakdown of public health capacity required for infectious diseases at the local, state, national, and global levels.

Examples of Emerging Infectious Diseases

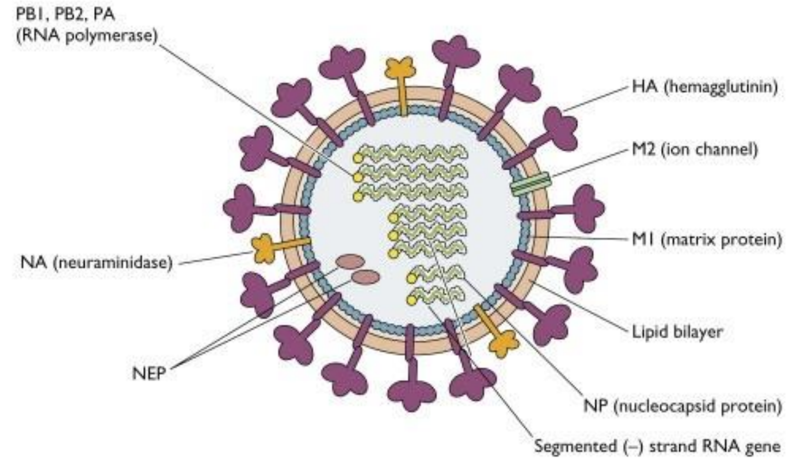
Disease	Infectious Agent	Year Recognized*	Contributing Factors
Lassa fever	*Arenaviridae* family (virus)	1969	urbanization and other conditions that favor the rodent host; nosocomial transmission
Ebola hemorrhagic fever	*Filoviridae* family (virus)	1977	unknown natural reservoir; nosocomial transmission
Legionnaire disease	*Legionella pneumophila* (bacterium)	1977	cooling and plumbing systems
hemolytic uremic syndrome	*Escherichia coli* 0157:H7 (bacterium)	1982	mass food production systems
Lyme borreliosis	*Borrelia burgdorferi* (bacterium)	1982	conditions favoring the tick vector and deer, such as reforestation near homes
AIDS	human immunodeficiency virus	1983	migration to cities, global travel, transfusions, organ transplants, intravenous drug use, multiple sexual partners
gastric ulcers	*Helicobacter pylori* (bacterium)	1983	newly recognized as due to infectious agent
cholera	*Vibrio cholerae* 0139 (bacterium)	1992	evolution of new strain of bacteria combining increased virulence and long-term survival in the environment
hantavirus pulmonary syndrome	*Bunyaviridae* family (virus)	1993	environmental changes favoring contact with rodent hosts
pandemic influenza	*Orthomyxoviridae* family (virus)	new viral strains emerge periodically	pig-duck agriculture (possibly)

Examples of Re-emerging Infectious Diseases

Disease	Infectious Agent	Contributing Factors
cryptosporidiosis	*Cryptosporidium parvum* (protozoa)	inadequate control in water supply; international travel; increased use of child-care facilities
diphtheria	*Corynebacterium diptheriae* (bacterium)	interruption of immunization program due to political changes
malaria	*Plasmodium* species (protozoon)	drug resistance; favorable conditions for mos-quito vector
meningitis, necrotizing fasci-itis (flesh-eating disease), toxic shock syndrome, and other diseases	Group A *Streptococcus* (bacterium)	uncertain
pertussis (whooping cough)	*Bordetella pertussis* (bacterium)	refusal to vaccinate based on fears the vaccine is not safe; other possible factors: decreased vaccine efficacy or waning immunity among vaccinated adults
rabies	*Rhabdovirus* group (virus)	breakdown in public health measures; changes in land use; travel
rubeola (measles)*	*Morbillivirus* genus (virus)	failure to vaccinate; failure to receive second dose of vaccine
schistosomiasis	*Schistosoma* species (helminth)	dam construction; ecological changes favoring snail host
tuberculosis	*Mycobacterium tuberculosis* (bacterium)	antibiotic-resistant pathogens; immunocompro-mised populations (malnourished, HIV-infected, poverty-stricken)
yellow fever	*Flavivirus* group (virus)	insecticide resistance; urbanization; civil strife

Epidemiology of Influenza

Influenza Virus

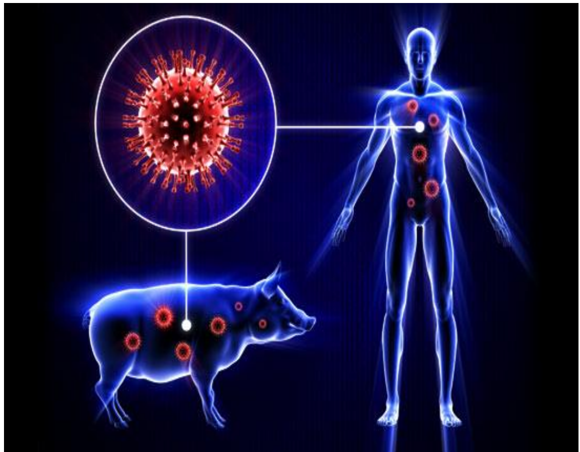


- Consists of eight segments of negative-sense single-stranded RNA within a Helical capsid.

- The viruses envelope contains 2 projecting glycoprotein spikes:
  1. Haemagglutinin (HA)
  2. Neuroaminidase (NA)
  - Classified on the basis of hemagglutinin (HA) and neuraminidase (NA) into 3 types:
  1. Influenza A
  2. Influenza B
  3. Influenza C

Influenza Virus

- Influenza viruses are members of the Orthomyxoviridae family of viruses
- Influenza A viruses of particular subtypes have been isolated from a variety of animal species, such as H1N1 viruses from swine and H3N8 from horses. Different subtypes have not been identified among influenza B viruses.



Influenza Virus

- The long-term epidemiologic success of influenza viruses is primarily due to **antigenic variation** that takes place in the two surface glycoproteins of the virus, the HA and NA. Antigenic variation renders an individual susceptible to new strains despite previous infection by influenza viruses or previous vaccination.

Antigenic Variation

- Influenza viruses tend to undergo changes from time to time. There are two types of changes: (1) antigenic shift, (2) antigenic drift. These changes in the antigenic characteristics of influenza viruses determine the extent and severity of influenza epidemics.

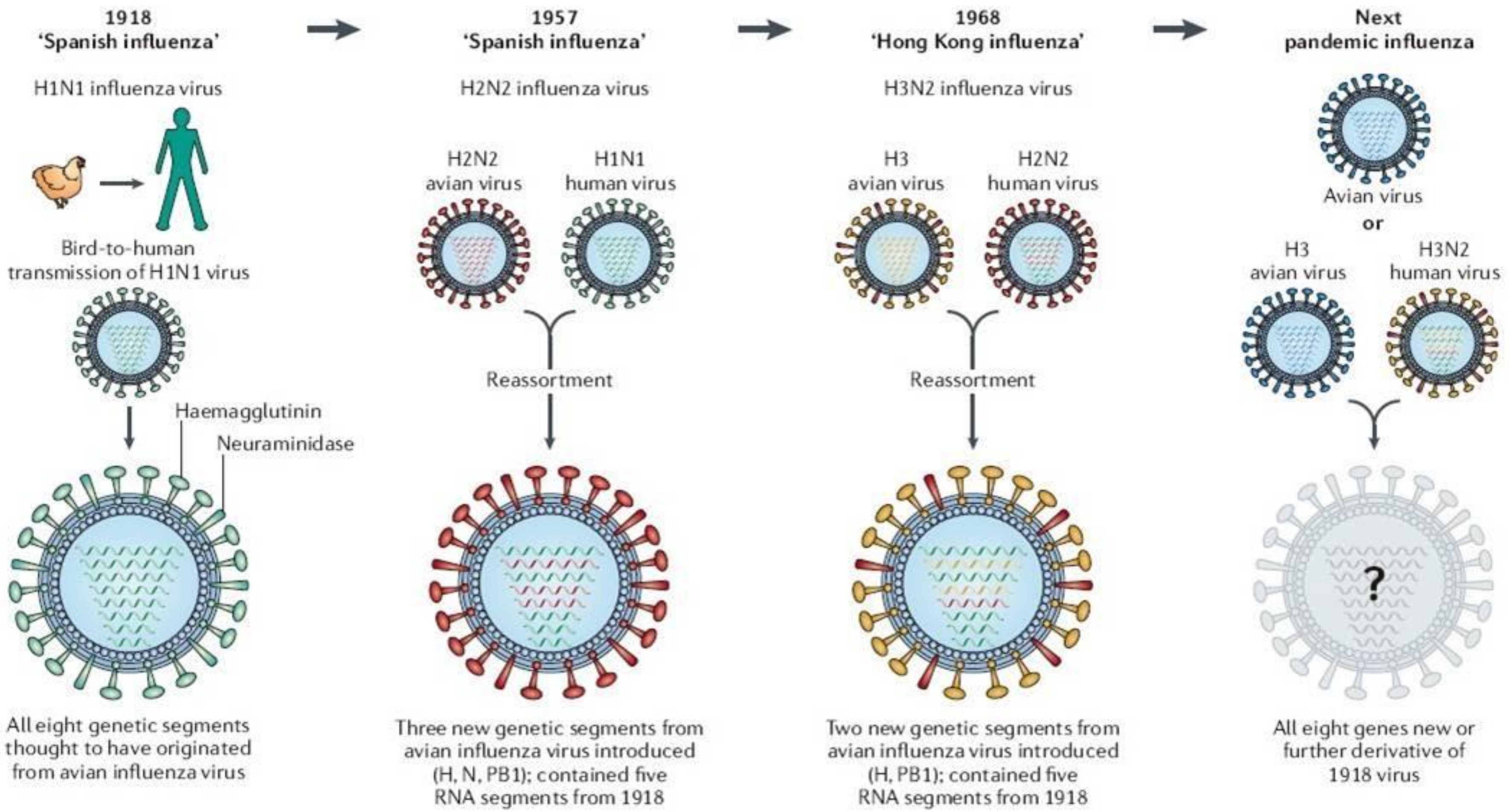
Antigenic Shift

- This term denotes MAJOR changes in HA and NA resulting from reassortment of gene segments involving two different influenza viruses.
- When this occurs, worldwide epidemics may be the consequence since the entire population is susceptible to the virus.

Antigenic Drift

- This term denotes MINOR changes in HA and NA of influenza virus.
- This results from mutation in the RNA segments coding for either the HA or NA
- This involves no change in serotype; there is merely an alteration in amino acid sequence of HA or NA leading to change in antigenicity.

How the Flu Virus Can Change: “Drift” and “Shift”



Importance of Influenza

- One of the most important emerging and reemerging infectious diseases.
- Causes high morbidity and mortality in communities (epidemic) and worldwide (pandemic).

Mode of Transmission In Human

- Influenza transmission not fully understood

- Influenza viruses are spread primarily by small-particle aerosols of virus-laden respiratory secretions that are expelled into the air by infected persons during coughing, sneezing, or talking. It is also generally accepted that direct person-to-person spread is the mechanism for maintenance of influenza viruses in the human population.

Symptoms

These can include:

- Fever
- Nasal nongestion or runny nose
- Sneezing
- Headache
- Sore throat
- Coughing
- Chills
- Myalgia

Symptoms

- These symptoms typically begin one to four days after exposure to the virus and usually last for about 7 days
- Most people recover from flu after around a week. However, for older people, pregnant women, newborn babies and people with other health problems, for example heart disease or chest problems, flu can be more serious.

Clinical Diagnosis

- The clinical picture of influenza is nonspecific.
- Influenza-like illness can be caused by many microbial agents other than influenza virus, such as adenovirus, parainfluenza viruses, coronavirus, Mycoplasma pneumoniae.

Complications

- Pneumonia (Most common)
- Bacterial infection
- Dehydration
- Ear infections
- Sinus infections, especially in children.
- May worsen long-term medical conditions, like congestive heart failure, asthma, or diabetes.
- Myocarditis
- Pericarditis

People at High Risk for Developing Flu-Related Complications

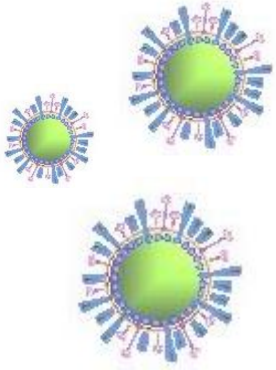
- Children younger less than 2 years.
- Adults 65 years of age and older.
- Persons of any age with certain medical conditions (pregnant, CVD, pulmonary, rtenal, hepatic or metabolic disorders.

Seasonal Innfluenza

- Influenza reaches peak prevalence in winter, and because the Northern and Southern Hemispheres have winter at different times of the year, there are actually two different flu seasons each year.
- It occurs globally with an annual attack rate estimated at 5%–10% in adults and 20%–30% in children.
- An influenza epidemic can take an economic toll through lost workforce productivity and strain health services.

Seasonal Influenza

- Seasonal influenza is an acute viral infection caused by influenza virus.
- There are 3 types of seasonal influenza viruses – A (H1N1, H3N2), B and C. Type C influenza cases occur much less frequently than A and B. That is why only influenza A and B viruses are included in seasonal influenza vaccines.



EPIDEMIOLOGY OF INFLUENZA WORLDWIDE

- The World Health Organization (WHO) reports that throughout the world, annual outbreaks result in 3–5 million severe cases and between 250,000 and 500,000 deaths

- In the Northern and Southern parts of the world outbreaks occur mainly in winter while in areas around the equator outbreaks may occur at any time of the year.

- Yearly, influenza epidemics can affect all populations.

EPIDEMIOLOGY OF INFLUENZA WORLDWIDE

- With the growth of global trade and travel, a localized epidemic can transform into a pandemic rapidly, with little time to prepare a public health response.

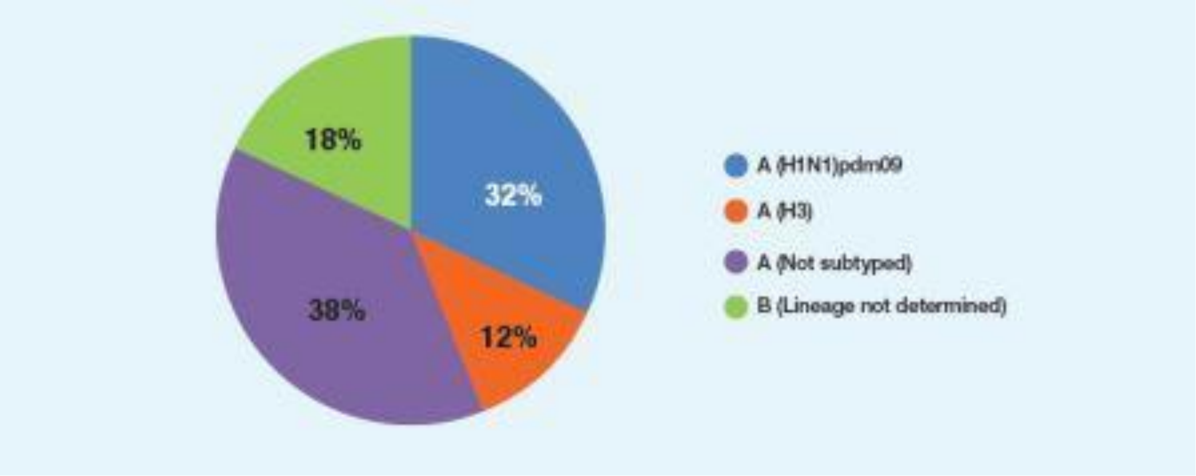
Flu Pandemics

- Several Influenza pandemics accrued through out history.

Name of pandemic	Date	Deaths	Case fatality rate	Subtype involved	Pandemic Severity Index
1889–1890 flu pandemic (Asiatic or Russian Flu)	1889–1890	1 million	0.15%	possibly H3N8 or H2N2	N/A
1918 flu pandemic (Spanish flu)	1918–1920	50 to 100 million	2%	H1N1	5
Asian Flu	1957–1958	1 to 1.5 million	0.13%	H2N2	2
Hong Kong Flu	1968–1969	0.75 to 1 million	<0.1%	H3N2	2
Russian flu	1977–1978	no accurate count	N/A	H1N1	N/A
2009 flu pandemic	2009–2010	105,700-395,600	0.03%	H1N1	N/A

EPIDEMIOLOGY OF INFLUENZA IN SAUDI ARABIA

- Outbreaks of infectious diseases that spread through respiratory route, such as influenza, are highly frequent among Hajj.
- In July 2017 Saudi Arabia reported circulation of influenza A (novel H1N1) and influenza.



H5N1 (2003)

- Human infections with avian and zoonotic influenza viruses have been reported. Human infections are primarily acquired through direct contact with infected animals or contaminated environments
- In 1997, human infections with the HPAI A(H5N1) virus were reported during an outbreak in poultry in Hong Kong, China. Since 2003, this avian virus has spread from Asia to Europe and Africa, and has become entrenched in poultry populations in some countries. Outbreaks have resulted in millions of poultry infections, several hundred human cases, and many human deaths.

H5N1 Epidemic in Saudi Arabia

- In March 2007 Saudi Arabia saw its first major outbreak of H5N1 Avian flu
- Outbreaks…..epidemics
- Millions of birds have died of H5N1 influenza and hundreds of millions of birds have been slaughtered and disposed of, to limit the spread of the virus.

H1N1 (2009-2010)

- Swine fluvirus was first identified in Mexico in April 2009 and was also known as Mexican flu. It became known as swine flu because the virus closely resembled known influenza viruses that cause illness in pigs.

- It spread rapidly from country to country because it was a new type of flu virus that only few people were immune to.

- In **2010**, the WHO declared the pandemic was officially over.

- The virus now circulates worldwide as one of three seasonal flu viruses.

H1N1 Epidemic in Saudi Arabia

- The MOH has announced in June, 2009 the detection of the first case of swine flu in Saudi Arabia.

- The MOH applied the national plan for the prevention of swine flu in accordance with WHO's recommendations. Accordingly, patients were isolated and treated.

- According to the Saudi MOH, the number of laboratory-confirmed cases in Saudi Arabia as of December 30, 2009 was 15850, with 124 deaths.

Control Measures

-Immunoprophylaxis with vaccine.

- Chemoprophylaxis and chemotherapy.

Immunoprophylaxis with vaccine

- The most effective way to prevent the disease and/or its severe complications is to keep taking the vaccine annually.
- Among healthy adults, influenza vaccine can provide up to 90% protection, the vaccine may reduce severity of disease by 60% amongst the elderly and incidence of complications and deaths by 80%.

Route of admission of influenza vaccines

Influenza vaccine by nasal spray (Nasal-Spray Flu Vaccine)

a vaccine that contains a live weakened virus vaccine that does not cause influenza infection. This is given to people between the age of 2 years to 49 years and is not given to pregnant women, children under two years nor the elderly over 65 years.

Influenza vaccine by injection

it is a vaccine that contains inactivated virus (Inactivated Vaccine), injected to people aged 6 months and above, including healthy adults, pregnant women and those suffering from chronic diseases.

Immunoprophylaxis with vaccine

- The immune system produces antibodies to fight the virus, which may take two weeks, after that the body acquires protective immunity against seasonal influenza infection

Immunoprophylaxis with vaccine

The influenza vaccination is most effective when the vaccine provided closely matches the circulating viruses each year.

What is the correct dose (volume) of vaccine?

- The amount of inactivated (injectable) vaccine that should be administered intramuscularly is based on the age of the patient and the vaccine product you are using.
- For children 6–35 months of age, the correct dose is:
  - 0.25 mL for Fluzone Quadrivalent
  - 0.5 mL for FluLaval Quadrivalent
- For persons 3 years of age and older, the correct dose is 0.5 mL for all inactivated influenza vaccine products

- Administer 2 doses of seasonal influenza vaccine separated by at least 4 weeks to children age 6 months through 8 years of age who:
  - Have never been vaccinated against influenza or have an unknown vaccination history
  - Have not received at least 2 doses of seasonal influenza vaccine (trivalent or quadrivalent) before July 1, 2017
- Administer 1 dose of seasonal influenza vaccine to persons:
  - 6 months through 8 years of age who have received at least 2 doses of seasonal influenza vaccine (trivalent or quadrivalent) before July 1, 2017
  - 9 years of age and older, regardless of their immunization history (persons 9 years of age and older should receive 1 dose of influenza vaccine each season)

Antiviral Drugs

- Amantadine, rimantadine. Effective for prevention and treatment of flu A only.
- Zanamivir, oseltamivir are approved for treatment of uncomplicated flu A & B; oseltamivir also approved for prophylaxis.
- Prophylaxis must be continued throughout the epidemic; treatment must begin within 24 hrs of onset of illness.

Prevention and Control

- Washing your hands frequently with soap and water.

- Other ways to stay healthy include the following:
- Avoid close contact with people who are ill.
- Eat a well-balanced diet and drink plenty of fluids.
- Exercise regularly.
- Get proper amounts of rest.
- Manage stress levels.

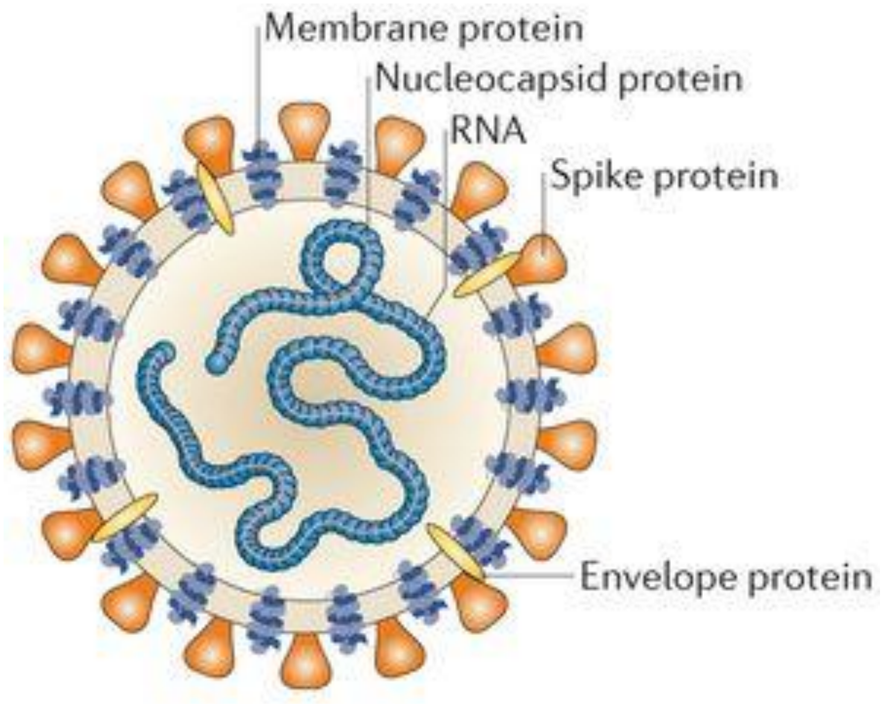
Treatment

- Rest
- Hydration
- Relieve flu symptoms using over-the-counter medications

Coronaviruses

Coronaviruses

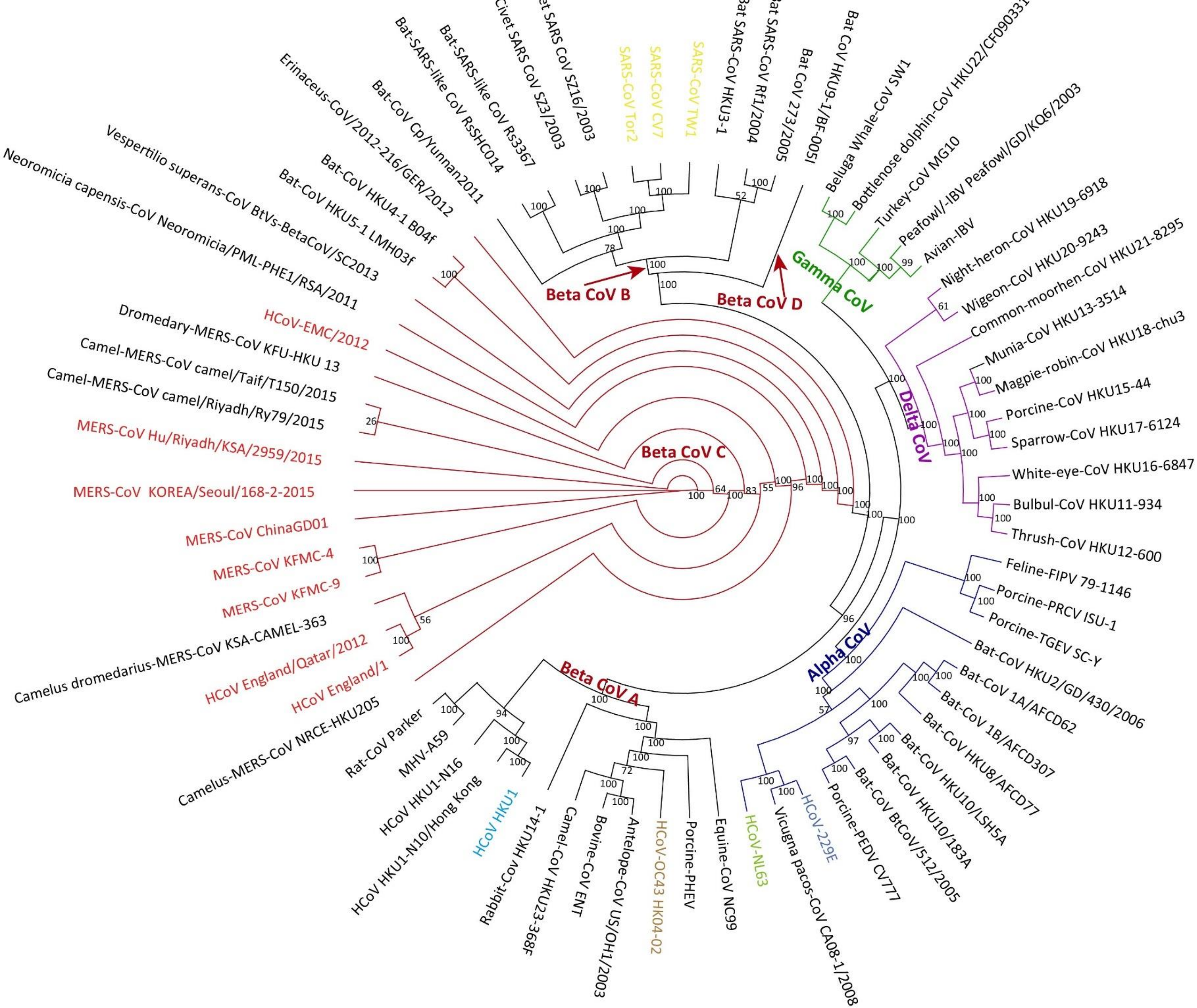
Enveloped viruses with a single-strand, positive-sense RNA genome approximately 26–32 kilobases in size, which is the largest known genome for an RNA virus



Nature Reviews | Microbiology

Coronaviruses

- Human coronaviruses (HCoVs) were first described in the 1960s for patients with the common cold.
- Coronaviruses are a large family of viruses that can cause diseases ranging from the common cold to Severe Acute Respiratory Syndrome (SARS).
- Six coronaviruses (CoVs) are known to infect humans: 229E, OC43, SARS-CoV, NL63, HKU1, and MERS-CoV.
- Many CoVs are simultaneously maintained in nature, allowing for genetic recombination, resulting in novel viruses.

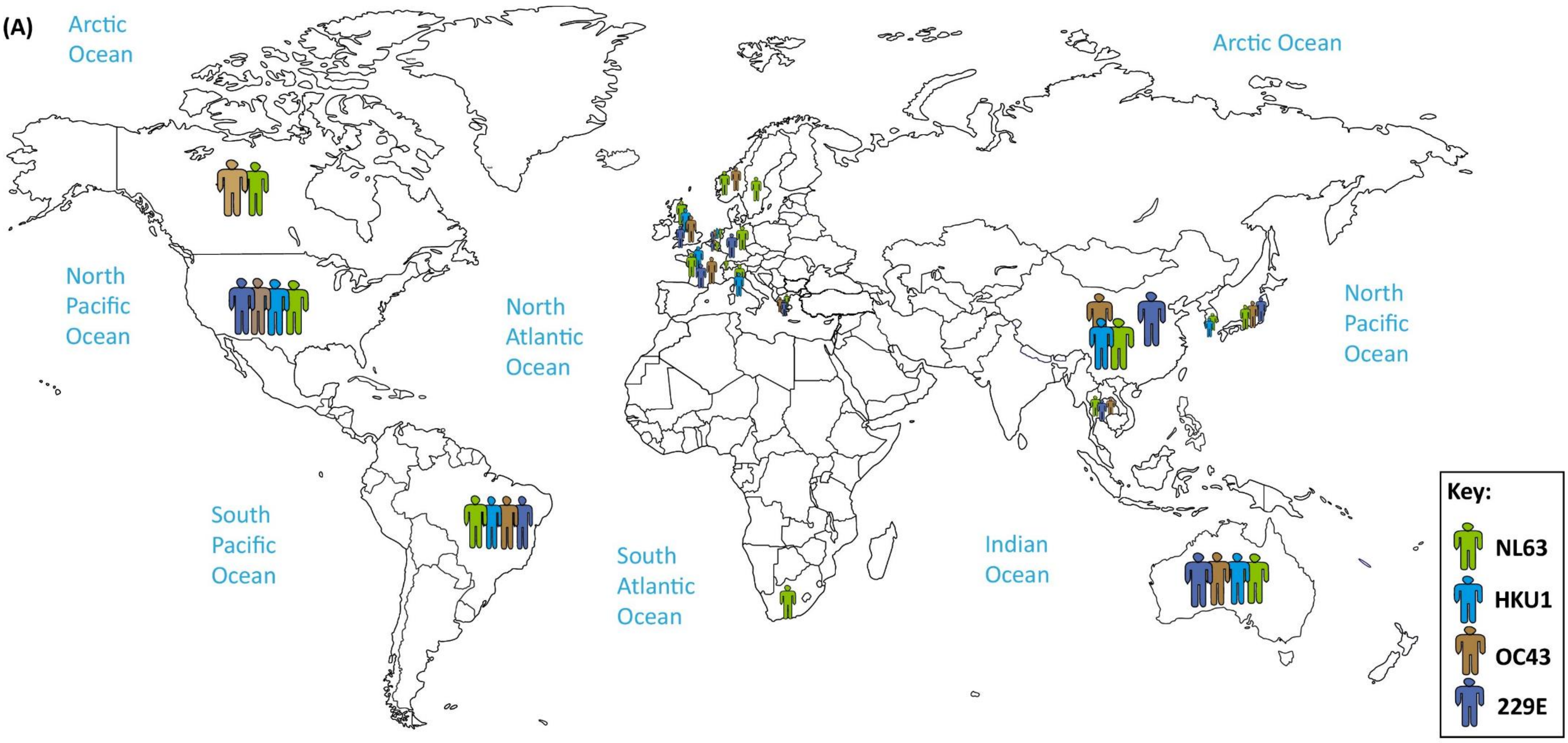


Trends in Microbiology

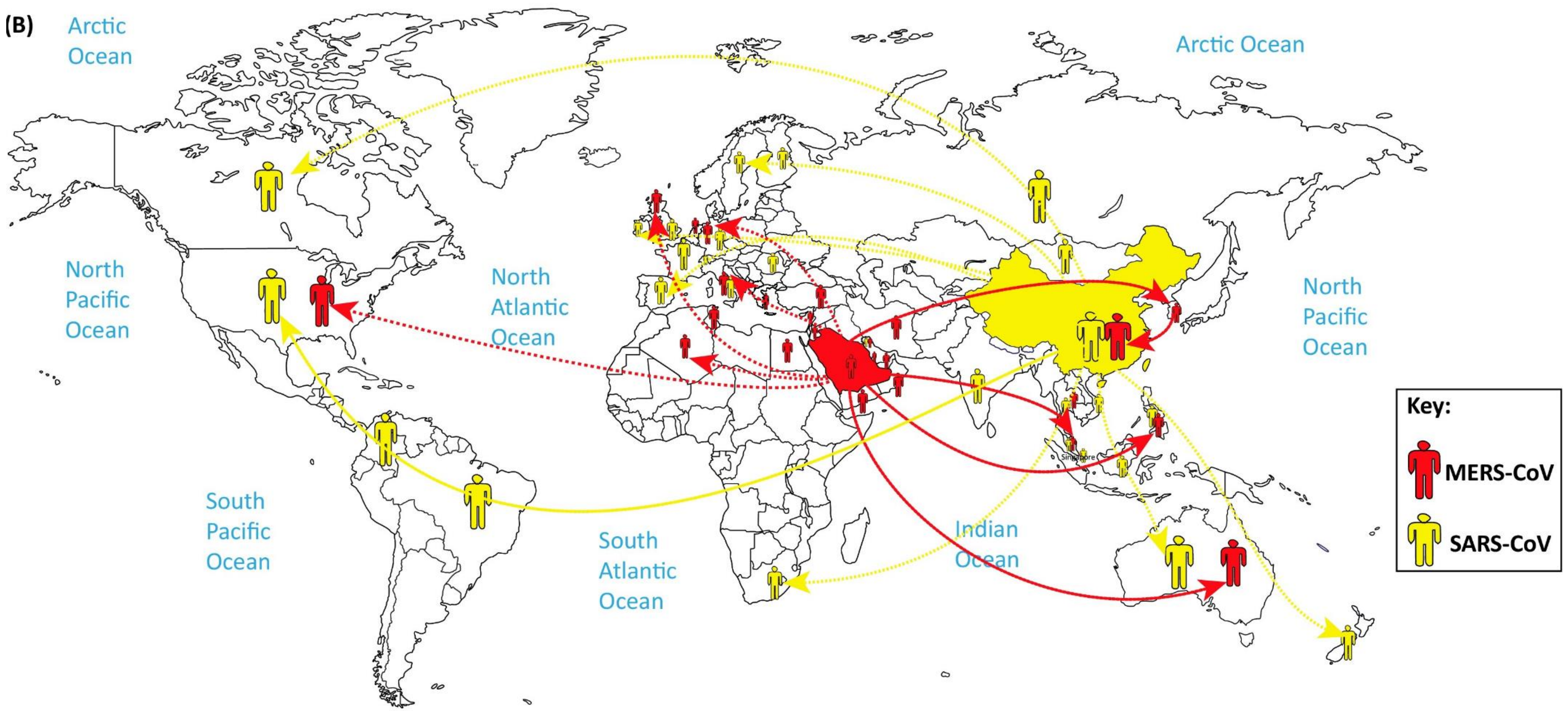
The six coronaviruses that can infect people are:

- Common human coronaviruses
  - 229E (alpha coronavirus)
  - NL63 (alpha coronavirus)
  - OC43 (beta coronavirus)
  - HKU1 (beta coronavirus)
- Other human coronaviruses
  - MERS-CoV (the beta coronavirus that causes Middle East Respiratory Syndrome, or MERS)
  - SARS-CoV (the beta coronavirus that causes severe acute respiratory syndrome, or SARS)

Global Distribution

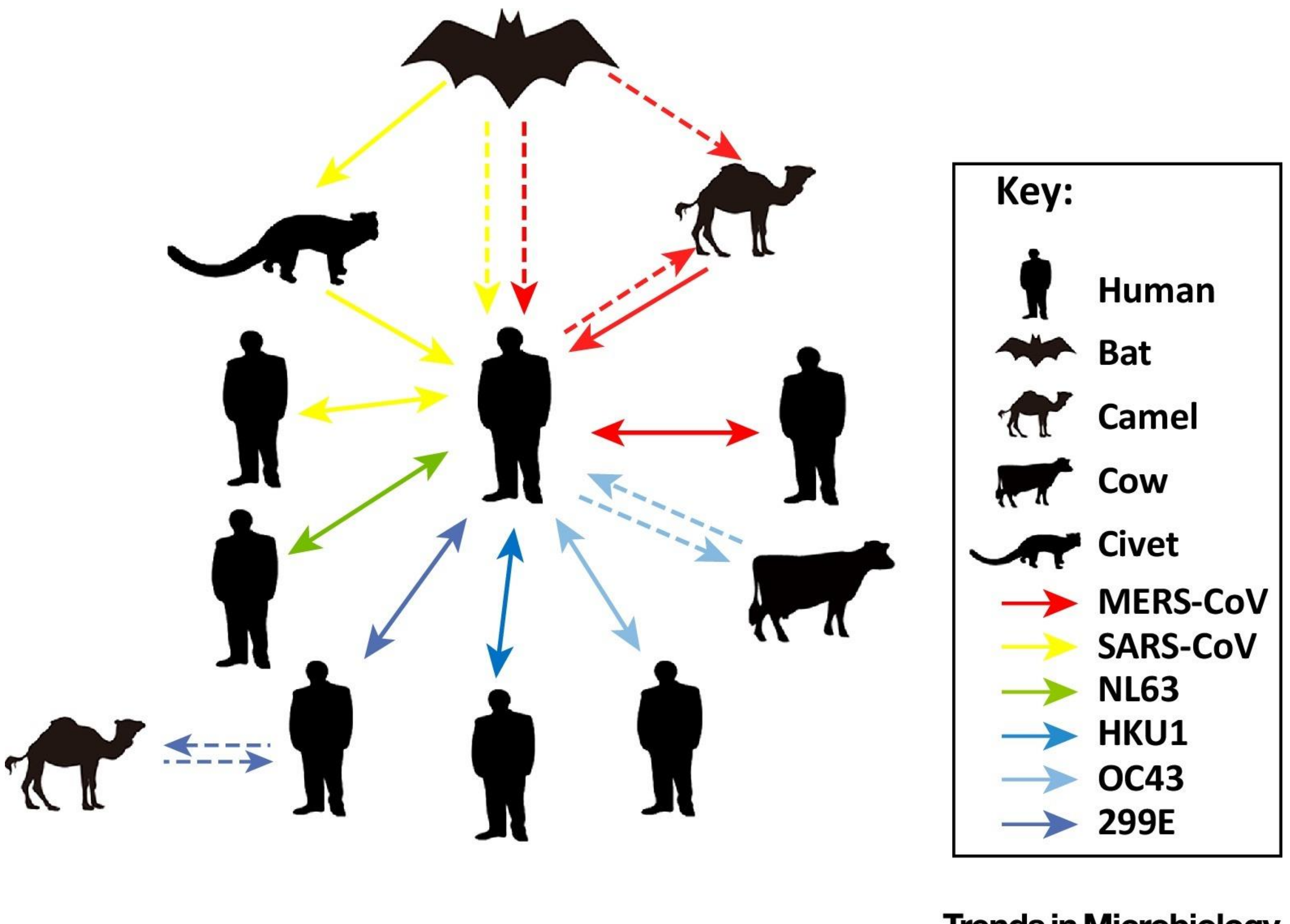


Global Distribution



Trends in Microbiology

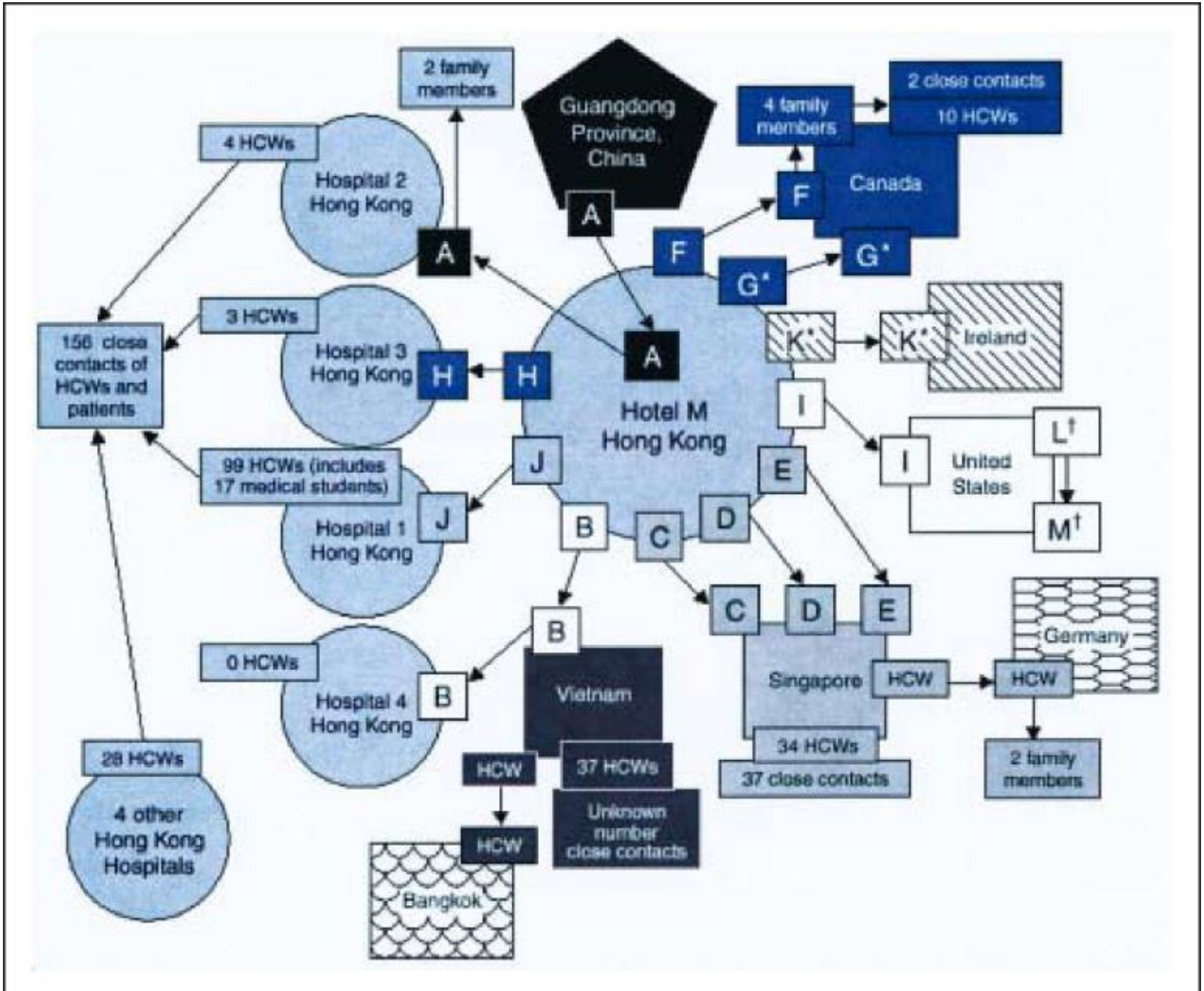
Intra- and Inter-Species Transmission



HCoV	Clinical Symptoms	Case Fatality Rate	Incubation Period	Median Time to Death
229E	General malaise, Headache Nasal discharge, Sneezing Sore throat Fever and cough (10–20% of patients) } 15–29% of all common colds	N/A	2–5 days	—
OC43	General malaise, Headache Nasal discharge, Sneezing Sore throat Fever and cough (10–20% of patients)	N/A	2–5 days	—
SARS-CoV	Fever, Myalgia Headache, Malaise, Chills Followed by: Nonproductive cough, Dyspnea, Respiratory distress Diarrhea (30–40% of patients)	9%	2–11 days	23 days
NL63	Cough, Rhinorrhea Tachypnea Fever Hypoxia Obstructive laryngitis (croup) } 4.7% of common respiratory diseases Primarily young children, the elderly, and immunocompromised	N/A	2–4 days	—
HKU1	Fever Running nose Cough Dyspnea } first discovered during January 2005	N/A	2–4 days	—
MERS-CoV	Fever, Cough, Chills Sore throat, Myalgia, Arthralgia Followed by: Dyspnea, Pneumonia Diarrhea and vomiting (one-third of patients) Acute renal impairment	36%	2–13 days	14 days

Severe acute respiratory syndrome (SARS)

- SARS was first reported in Asia in February 2003.
- The illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained.
- Since 2004, there have not been any known cases of SARS reported anywhere in the world.
- 8,098 people worldwide became sick with SARS during the 2003 outbreak. Of these, 774 died (case-fatality rate: 9.5%)
- Healthcare workers, especially those involved in procedures generating aerosols, accounted for 21% of all cases


2 family members
Guangdong Province, China
A
4 family members
2 close contacts
10 HCWs
4 HCWs
Hospital 2 Hong Kong
Canada
F
A
F
G*
G*
3 HCWs
K*
K*
Ireland
156 close contacts of HCWs and patients
Hospital 3 Hong Kong
H
H
A
I
Hotel M Hong Kong
L†
I
United States
99 HCWs (includes 17 medical students)
J
E
J
Hospital 1 Hong Kong
B
C
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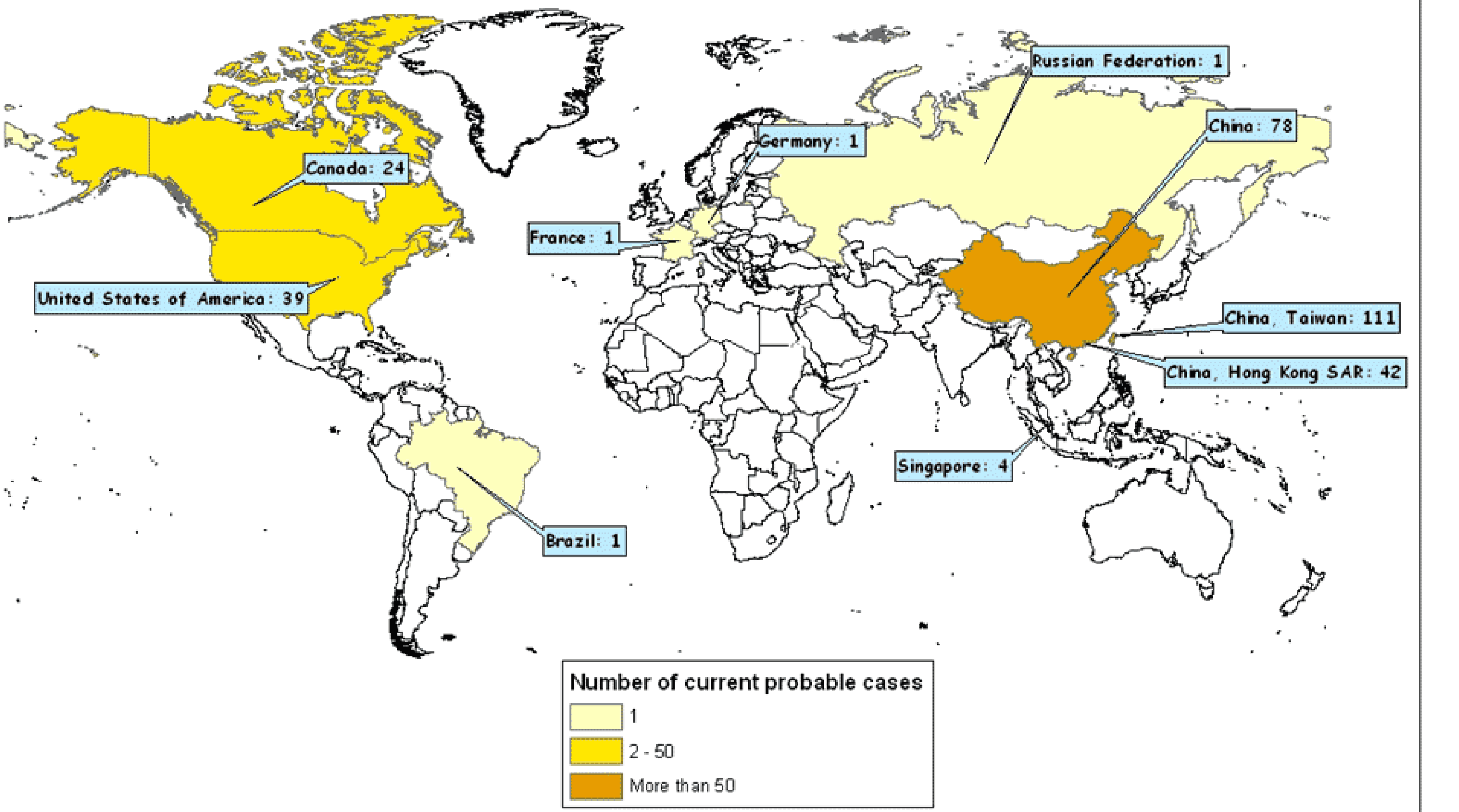
M†
C
D
E
B
Germany
0 HCWs
Hospital 4 Hong Kong
B
Vietnam
Singapore
HCW
HCW
28 HCWs
HCW
37 HCWs
34 HCWs
37 close contacts
2 family members
4 other Hong Kong Hospitals
HCW
Unknown number close contacts
Bangkok

SARS: Number of Current Probable Cases as of 24 June 2003, 17:00 GMT+2



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Data Source: World Health Organization
Map Production: Public Health Mapping Team
Communicable Diseases (CDS)

Probable cases of SARS by week of onset
Worldwide* (n=5,910), 1 November 2002 - 10 July 2003

* This graph does not include 2,527 probable cases of SARS (2,521 from Beijing, China), for whom no dates of onset are currently available.

Adapted from World Health Organization. Epidemic curves - Severe Acute Respiratory Disease (SARS) http://www.who.int/csr/sars/epicurve/epiindex/en/index1.html

Control Measures

- Aggressive and unprecedented measures were taken
- Quarantine of thousands of people
- Travel restrictions
- Screening of passengers at airports and seaports
- Singapore used its military forces to assist in contact tracing and enforcement of home quarantine
- Imposition of a no-visitors rule for all public hospitals
- Dedicated private ambulance for SARS patients
- SARS-designated hospital

Symptoms

- SARS begins with fever
- Other symptoms may include headache, an overall feeling of discomfort, and body aches.
- Some people also have mild respiratory symptoms at the outset.
- About 10 to 20 percent of patients have diarrhea.
- After 2 to 7 days, SARS patients may develop a dry cough.
- Most patients develop pneumonia.

Source of the virus

- Epidemiology data implicated masked palm civets (*Paguma larvata*) from live animal markets (LAM) in Guangdong Province, China, as a route of exposure to SARS-CoV
- However, masked palm civets from the wild or from farms without LAM exposure were largely negative for SARS-CoV
- This suggests that palm civets were an intermediate host, but not a reservoir for SARS-CoV.
- Subsequent studies have shown that wild horseshoe bats (Rhinolophidae family), which can also be found in LAM in China and served in some Chinese restaurants in Guangdong, China, have detectable levels of antibodies against SARS-CoV and a SARS-CoV-like virus, suggesting a bat origin for SARS-CoV.
- Genetic (ORF8) analysis of the SARS-like CoVs in bats suggests that Chinese horseshoe bats are the natural reservoirs of SARS-CoV and that intermediate hosts might not be needed for direct human infection, particularly for some bat SARS-CoV-like viruses.

International business times. 2016

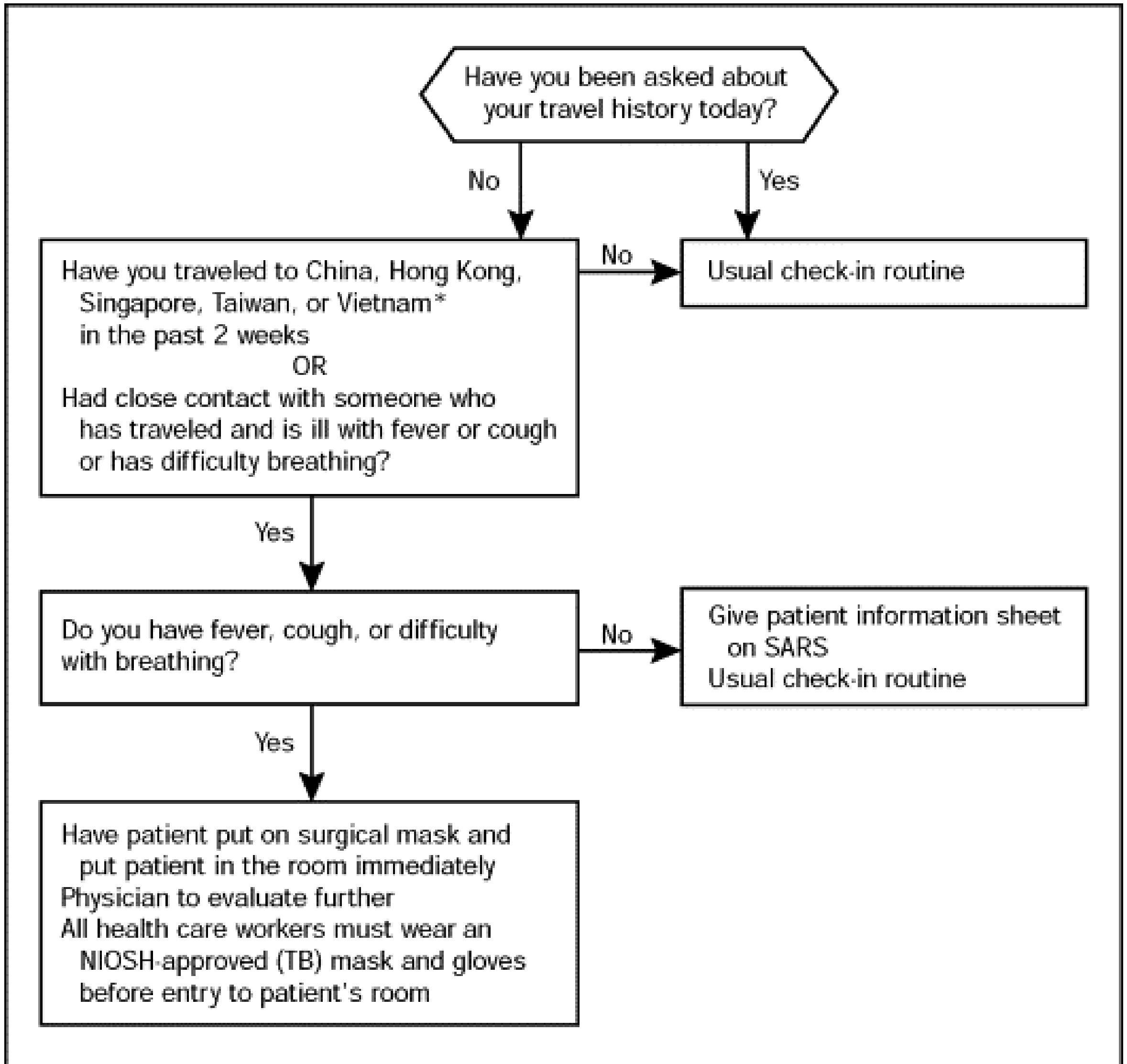
Transmission

- The main way that SARS seems to spread is by close person-to-person contact.
- The virus that causes SARS is thought to be transmitted most readily by respiratory droplets (droplet spread) produced when an infected person coughs or sneezes.
- Droplet spread can happen when droplets from the cough or sneeze of an infected person are propelled a short distance (generally up to 3 feet) through the air and deposited on the mucous membranes of the mouth, nose, or eyes of persons who are nearby.
- The virus also can spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose, or eye(s).
- In addition, it is possible that the SARS virus might spread more broadly through the air (airborne spread) or by other ways that are not now known.

Prevention

- There is no vaccine or specific treatment
- Prompt identification of persons with SARS, their contacts
- Effective isolation of SARS patients in hospitals
- Appropriate protection of medical staff treating these patients
- Comprehensive identification and isolation of suspected SARS cases
- Infection control measures including hand-hygiene and well-fitted masks
- Exit screening of international travelers
- Timely and accurate reporting and sharing of information with other authorities and governments

Screening and Triage



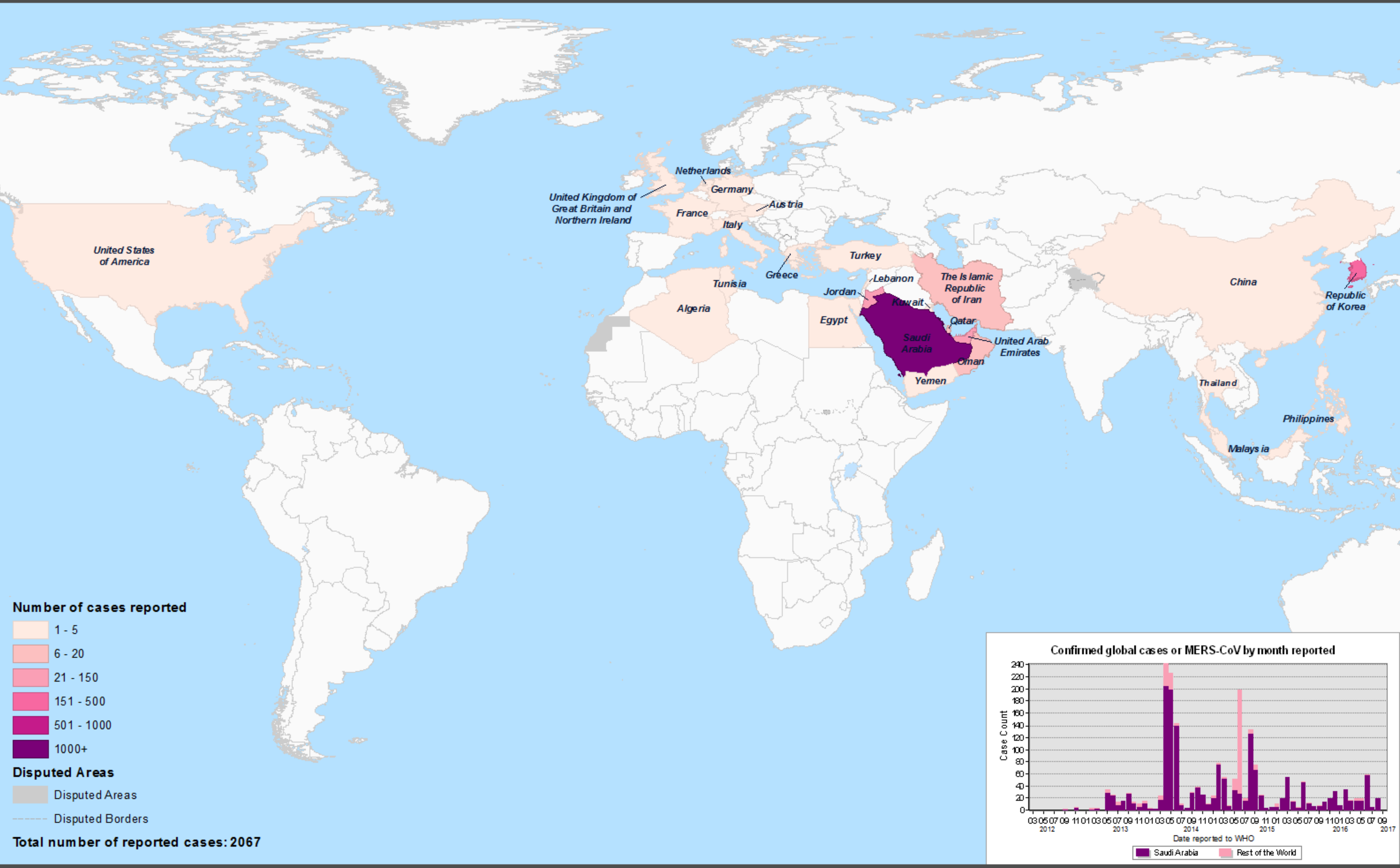
Infection control

- Place patient in a negative pressure, specially vented room
- Maintain a log of all persons entering the patient's room
- Restrict visitors as much as possible
- Limit the number of hospital personnel caring for the patient
- All health care workers entering the room should use a combination of contact (gowns, gloves, hand hygiene) and airborne (N-95 respirator) precautions and eye protection
- Do not bring pens, hospital charts, etc, in and out of the patient's room
- Minimize air turbulence when changing linens
- Clean surfaces in the room carefully and frequently with hospital-grade disinfectant
- Limit cough-inducing procedures (sputum induction, administration of nebulized medications, suctioning, bronchoscopy)
- Avoid use of noninvasive positive pressure ventilation (eg., CPAP, BiPAP)
- For patients receiving mechanical ventilation, use closed-suctioning devices, HEPA filtration on exhalation valve port
- Educate personnel involved in the care of these patients to be vigilant for symptoms of SARS for 10 days after contact with the patient
- Quarantine personnel with unprotected contact with a SARS patient during an aerosol-generating procedure

Middle East respiratory syndrome coronavirus (MERS-CoV)

- MERS-CoV was first identified in Saudi Arabia in 2012.
- 2,254 laboratory-confirmed cases of infection with MERS-CoV.
- 800 MERS-CoV associated deaths (case-fatality rate: 35.5%)
- 27 countries have reported cases of MERS-CoV
- Majority of cases were reported from Saudi Arabia (1882 cases, including 729 deaths)
- 12 countries from Eastern Mediterranean Region reported cases

CONFIRMED GLOBAL CASES OF MERS-COV 2012 - 2017



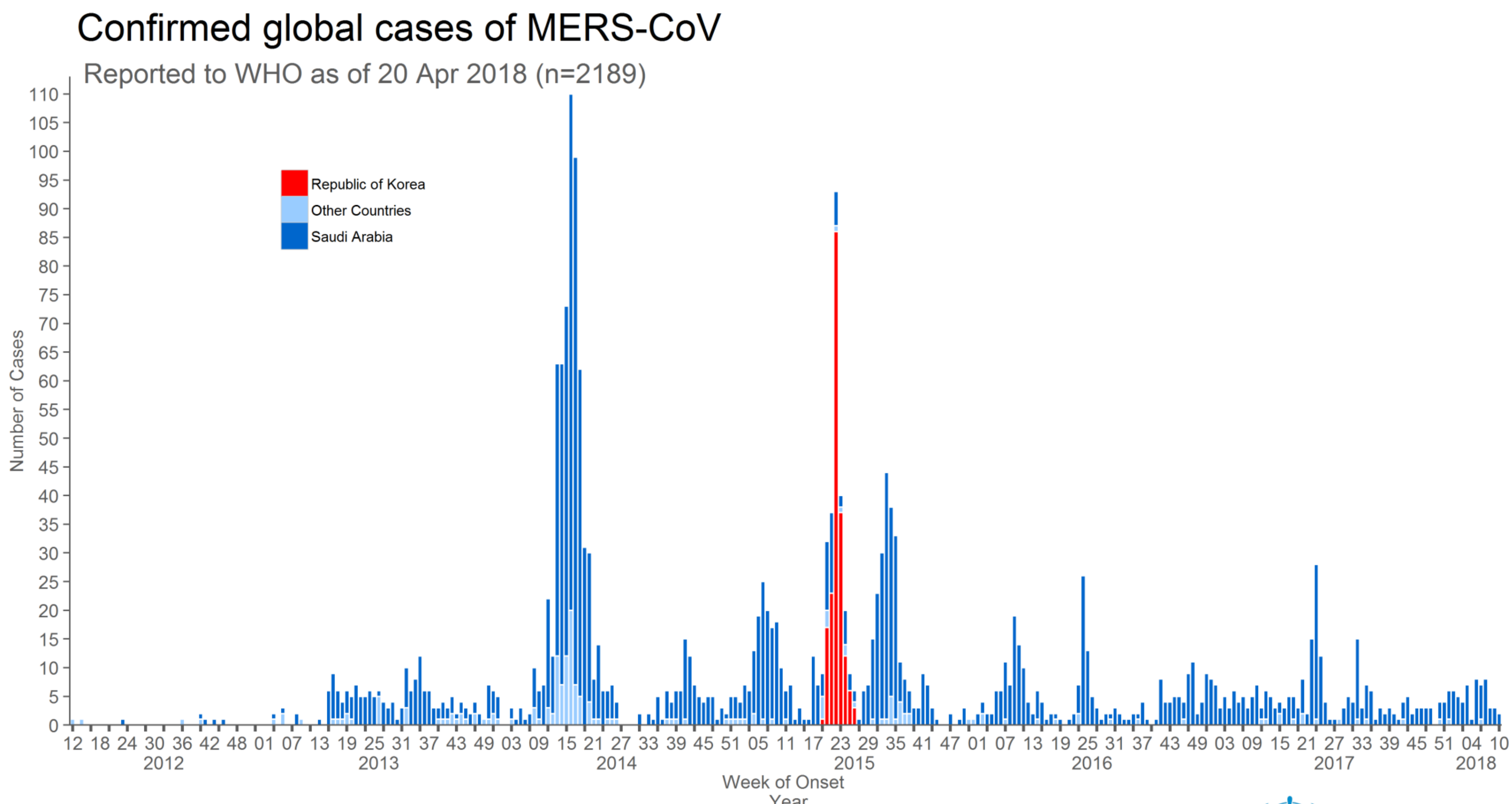
Map Scale (A3): *1:1,109,175,783*
1 cm = 11,092 km
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization

Map date: 01/09/2017

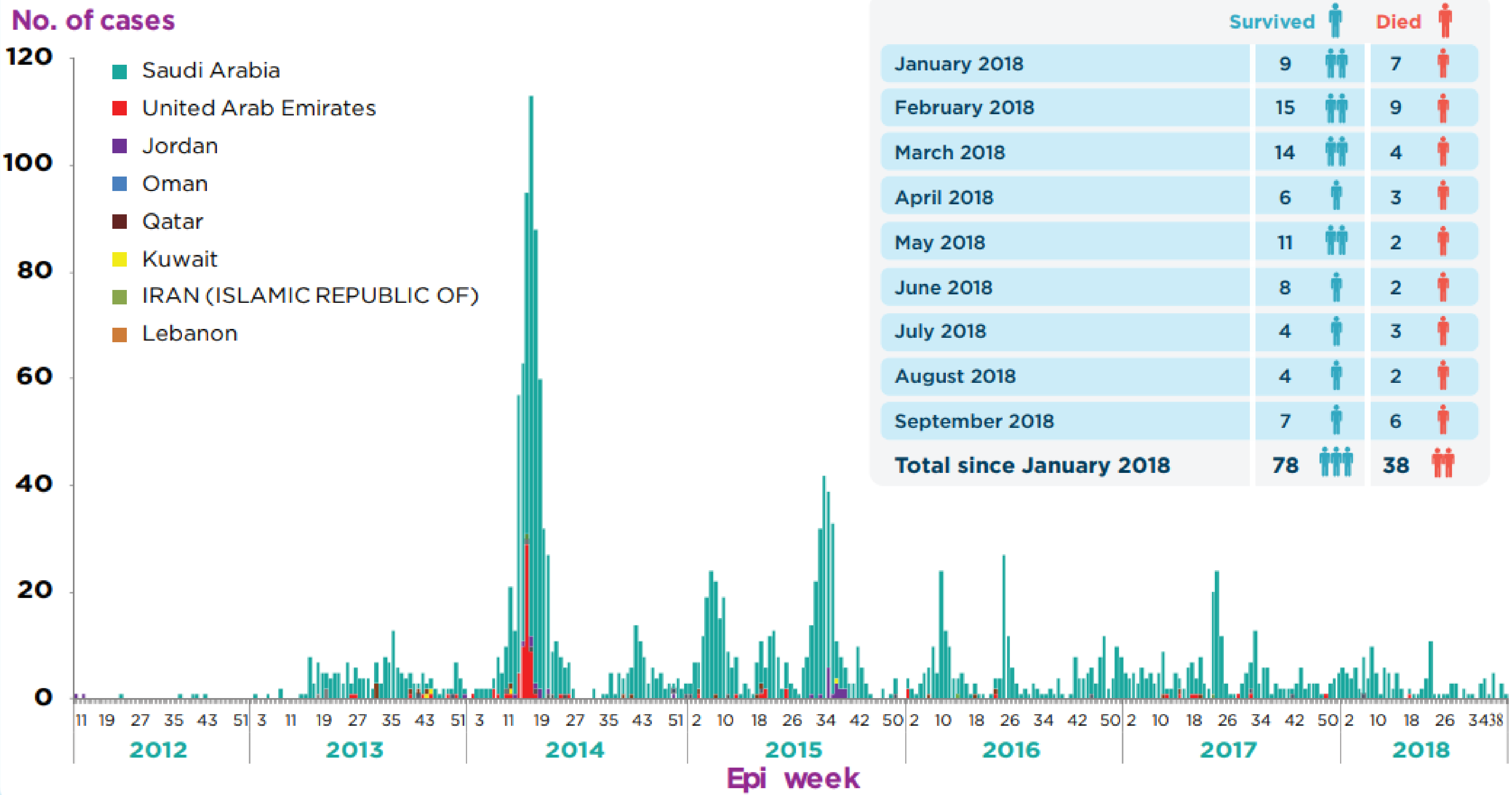
World Health Organization



Other countries: Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman, Philippines, Qatar, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States of America, Yemen
Please note that the underlying data is subject to change as the investigations around cases are ongoing. Onset date estimated if not available.

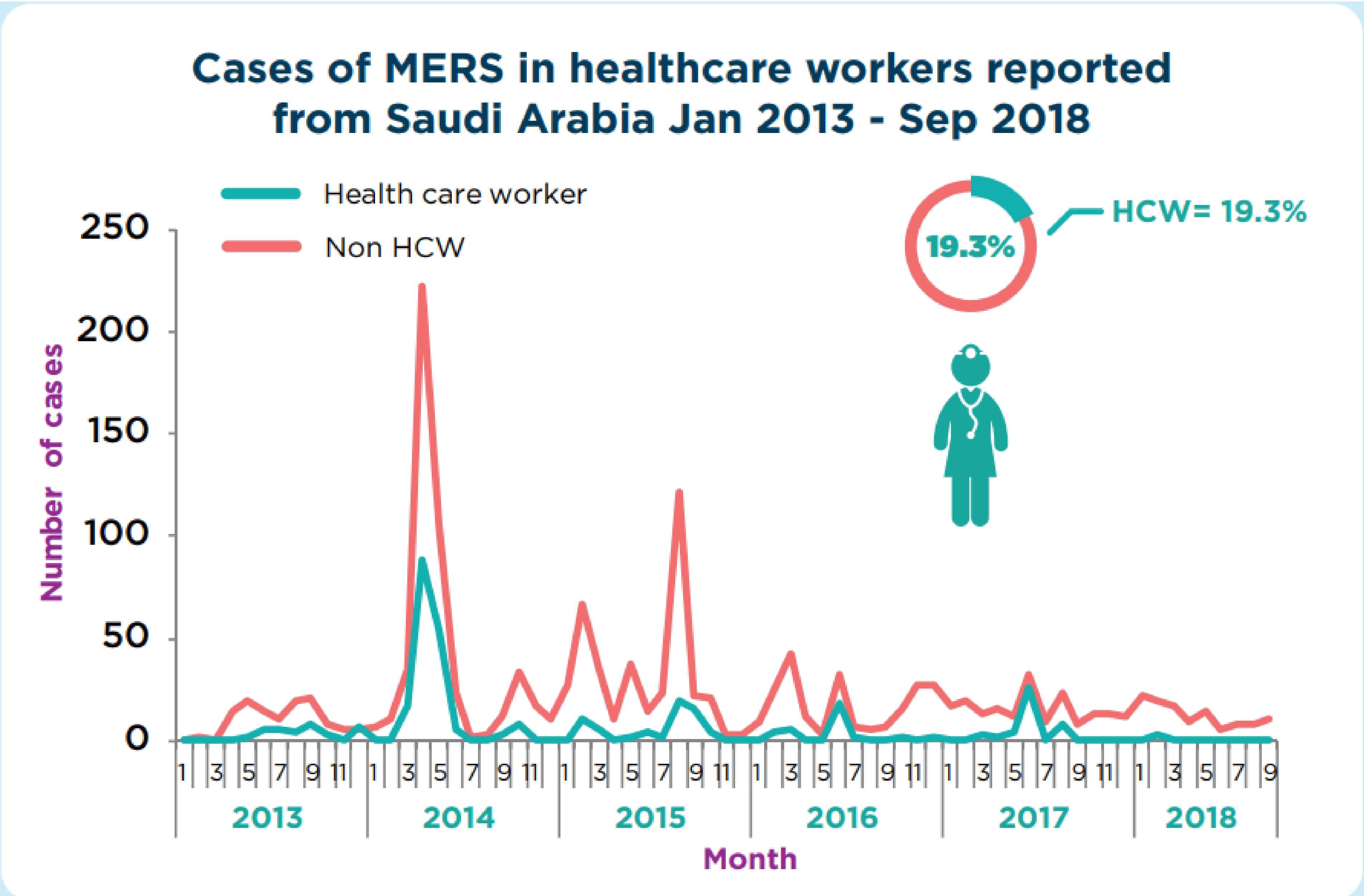
World Health Organization

Laboratory-confirmed cases of MERS reported in Eastern Mediterranean Region, April 2012-September 2018

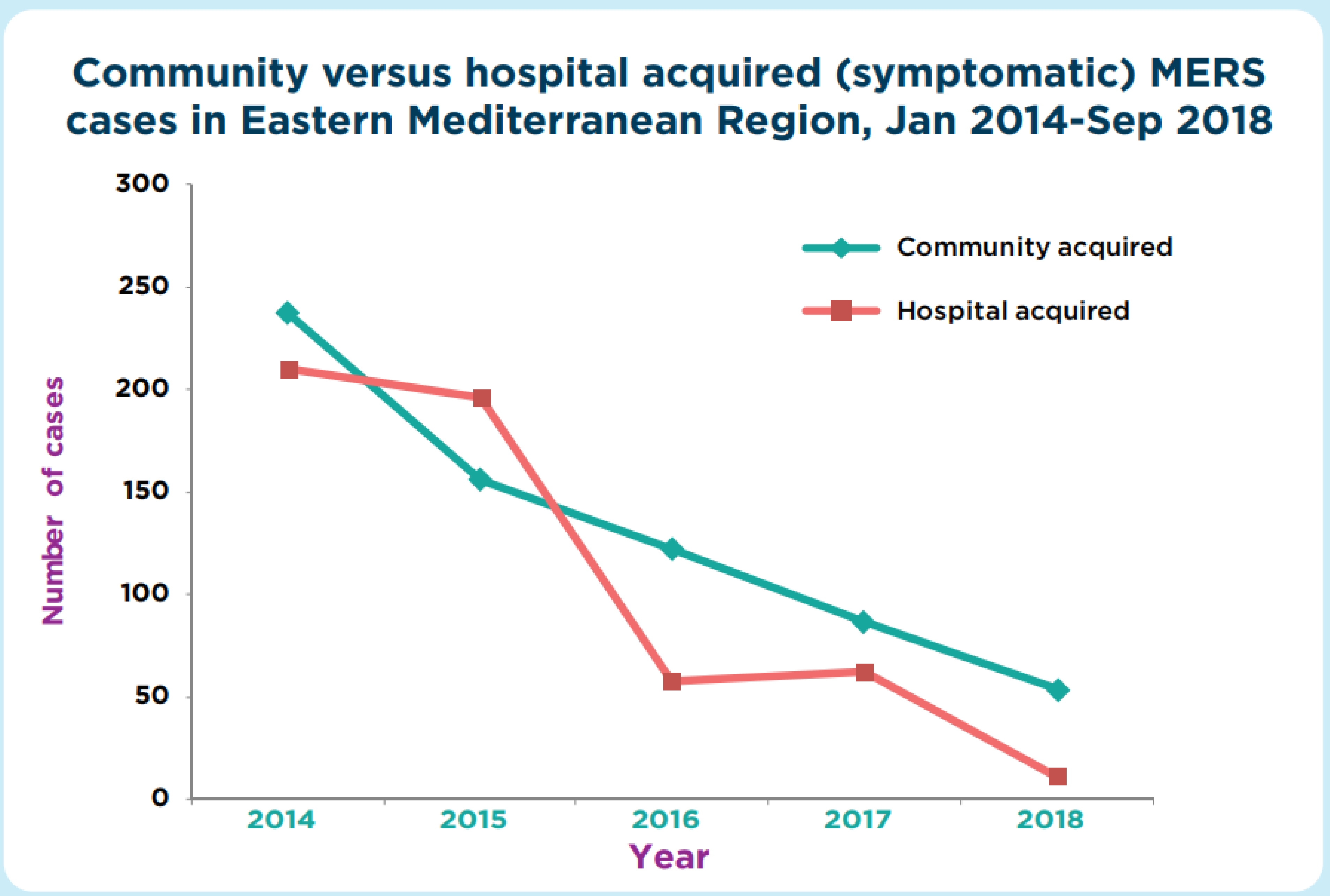


MERS in Saudi Arabia (January-September 2018)

	Survived	Died
January 2018	9	7
February 2018	15	9
March 2018	14	4
April 2018	6	3
May 2018	11	2
June 2018	8	2
July 2018	4	3
August 2018	4	2
September 2018	7	6
Total since January 2018	**78**	**38**



Cases of MERS in healthcare workers reported from Saudi Arabia Jan 2013 - Sep 2018
Health care worker
Non HCW
19.3%
HCW= 19.3%
Number of cases
250
200
150
100
50
0
1 3 5 7 9 11
2013
2014
2015
2016
2017
2018
Month



Community versus hospital acquired (symptomatic) MERS cases in Eastern Mediterranean Region, Jan 2014-Sep 2018
300
250
200
150
100
50
0
Number of cases
Community acquired
Hospital acquired
2014
2015
2016
2017
2018
Year

Age groups at risk

- The age group 50–59 years continues to be at highest risk for acquiring infection of primary cases.
- The age group 30–39 years is most at risk for secondary cases.
- The number of deaths is higher in the age group 50–59 years for primary cases and 70–79 years for secondary cases.

Symptoms

- Range from no symptoms (asymptomatic) or mild respiratory symptoms to severe acute respiratory disease and death.
- A typical presentation of MERS-CoV disease is fever, cough and shortness of breath.
- Pneumonia is a common finding, but not always present.
- Gastrointestinal symptoms, including diarrhoea, have also been reported.
- Severe illness can cause respiratory failure that requires mechanical ventilation and support in an intensive care unit.
- The virus appears to cause more severe disease in older people, people with weakened immune systems, and those with chronic diseases such as renal disease, cancer, chronic lung disease, and diabetes.
- Approximately 35% of patients with MERS have died, but this may be an overestimate of the true mortality rate, as mild cases of MERS may be missed by existing surveillance systems.

Source of the virus

- MERS-CoV is a zoonotic virus, which means it is a virus that is transmitted between animals and people.
- Studies have shown that humans are infected through direct or indirect contact with infected dromedary camels.
- MERS-CoV has been identified in dromedaries in several countries, including Egypt, Oman, Qatar, and Saudi Arabia, and MERS-CoV specific antibodies (a finding that indicates an animal has previously been infected with MERS-CoV) have been identified in dromedaries in the Middle East, Africa and South Asia.
- The origins of the virus are not fully understood but, according to the analysis of different virus genomes, it is believed that it may have originated in bats and was transmitted to camels sometime in the distant past.

Transmission

- Non-human to human transmission
  - not fully understood
  - dromedary camels are a major reservoir host
- Human-to-human transmission
  - the precise ways are not well understood
  - It's thought to spread from an infected person's respiratory secretions, such as through coughing
  - does not pass easily from person to person
  - close contact needed, such as providing unprotected care to an infected patient.

Prevention and treatment

- No vaccine or specific treatment is currently available.
- Treatment is supportive and based on the patient's clinical condition.
- As a general precaution, anyone visiting farms, markets, barns, or other places where dromedary camels and other animals are present should practice general hygiene measures, including regular hand washing before and after touching animals, and should avoid contact with sick animals.
- The consumption of raw or undercooked animal products, including milk and meat, carries a high risk of infection from a variety of organisms that might cause disease in humans.
- People with diabetes, renal failure, chronic lung disease, and immunocompromised persons are considered to be at high risk of severe disease from MERS-CoV infection.
- Infection prevention and control measures are critical to prevent the possible spread of MERS-CoV in health-care facilities.

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Thank You