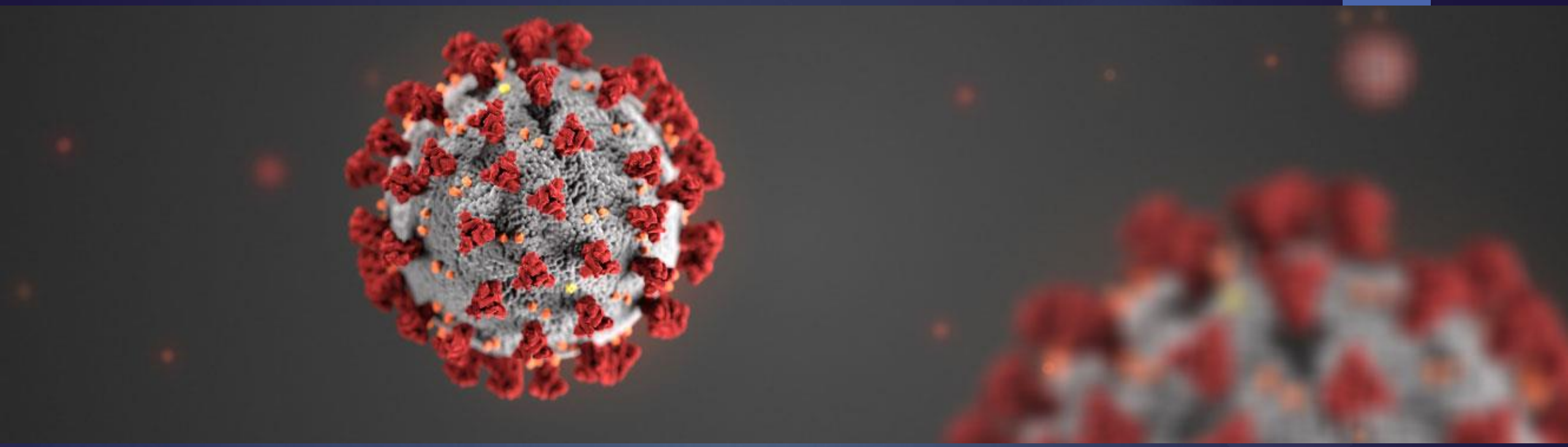

COVID 19

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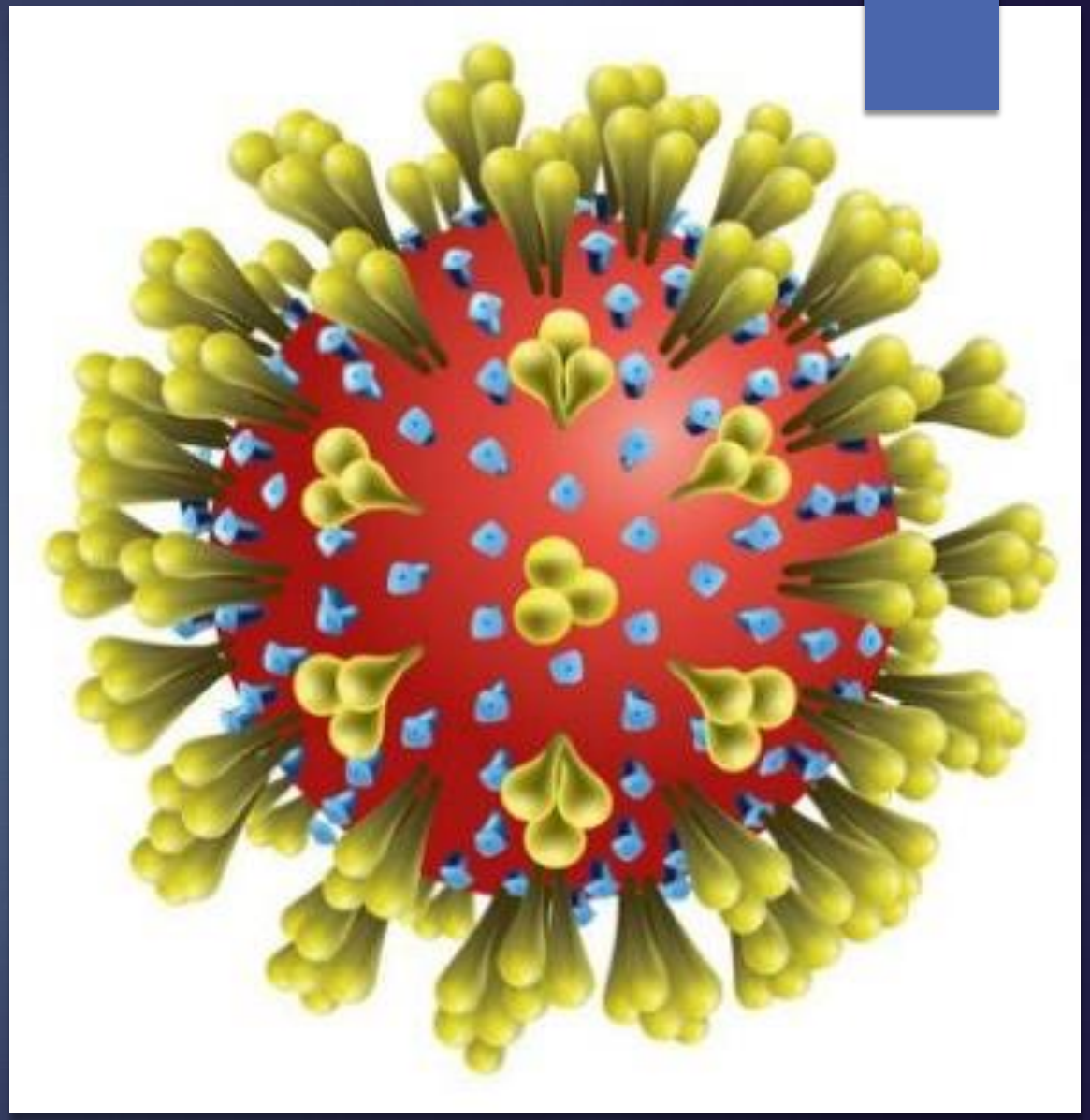
MERCY SAINT VINCENT MEDICAL CENTER

Objectives:

Review:

- Corona Viruses
- Epidemiology, Pathology, Diagnostics of COVID 19
- Responses to Pandemic

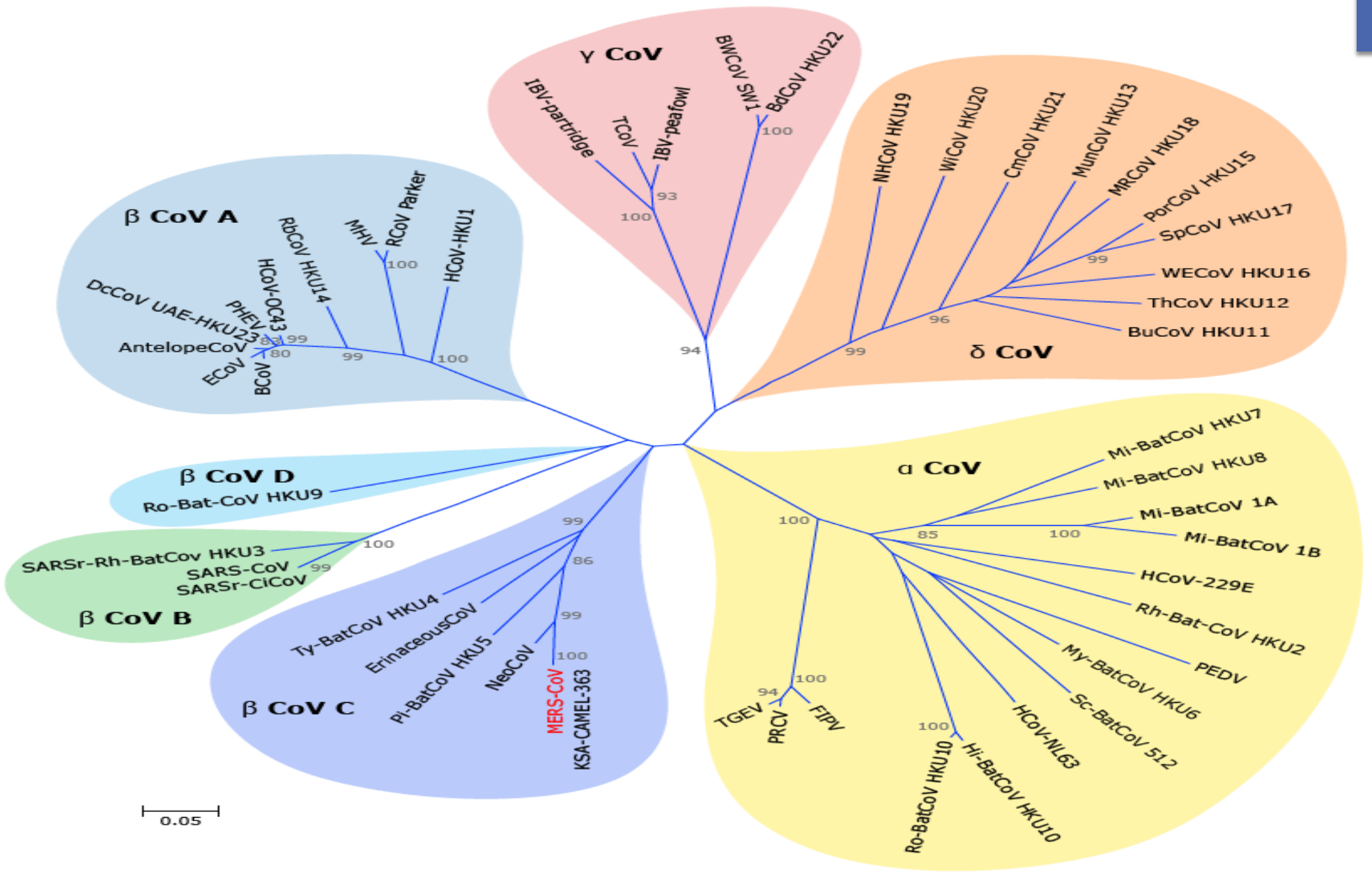
- Separate Science from Fiction



CORONA VIRUSES

- Enveloped RNA viruses. Broad distribution among humans, animals
- Cause respiratory, enteric, hepatic and neurologic diseases in animals
- Seven Species known to cause human disease:
- Four: 229E, OC43, NL63 and HKU1 are community acquired infections
- Three: are Zoonoses
  - SARS-CoV : Severe Acute Respiratory Syndrome. 2002-2003
  - MERS-CoV: Severe Middle Eastern Respiratory Distress Syndrome. 2012
  - SARS-CoV2: COVID-19

Coronavirus phylogenetic tree



1.-Community Acquired Human Coronaviruses

Respiratory:

- 229E and OC43 Proven to induce the common cold with rhinorrhea, nasal congestion.
- NL63 and HKU1 assumed to do same.
- **Children:** Acute otitis media
- **Adults:** 5-10% of all acute resp. tract infections. During outbreaks up to 25-35%.
- Found in 4-6 % of exacerbations of COPD
- Can cause LRTI with and w/o pneumonia
- CAP: similar frequency as Influenza, Rhinovirus and RSV.

Enteric:

- Diarrhea in infants
- Necrotizing enterocolitis in newborns

Neurologic:

- Few reports of demyelinating disease in immunocompromised hosts
- Association between HCoVs, MS and demyelinating disease remains tentative and unproven.

2.- CORONA VIRUSES: ZOONOSES

- Infections that spread from animals to humans
- Three Beta coronaviruses that originate in bats:
  - **SARS-CoV** : Severe Acute Respiratory Syndrome. 2002-2003
    - Bats to civets to humans
  - **MERS-CoV**: Severe Middle Eastern Respiratory Distress Syndrome. 2012-2015
    - Bats to camels to humans
  - **SARS-CoV2**: COVID-19
    - Bats to ? to humans
    - Close genetic homology with SARS-CoV

SARS: Summary

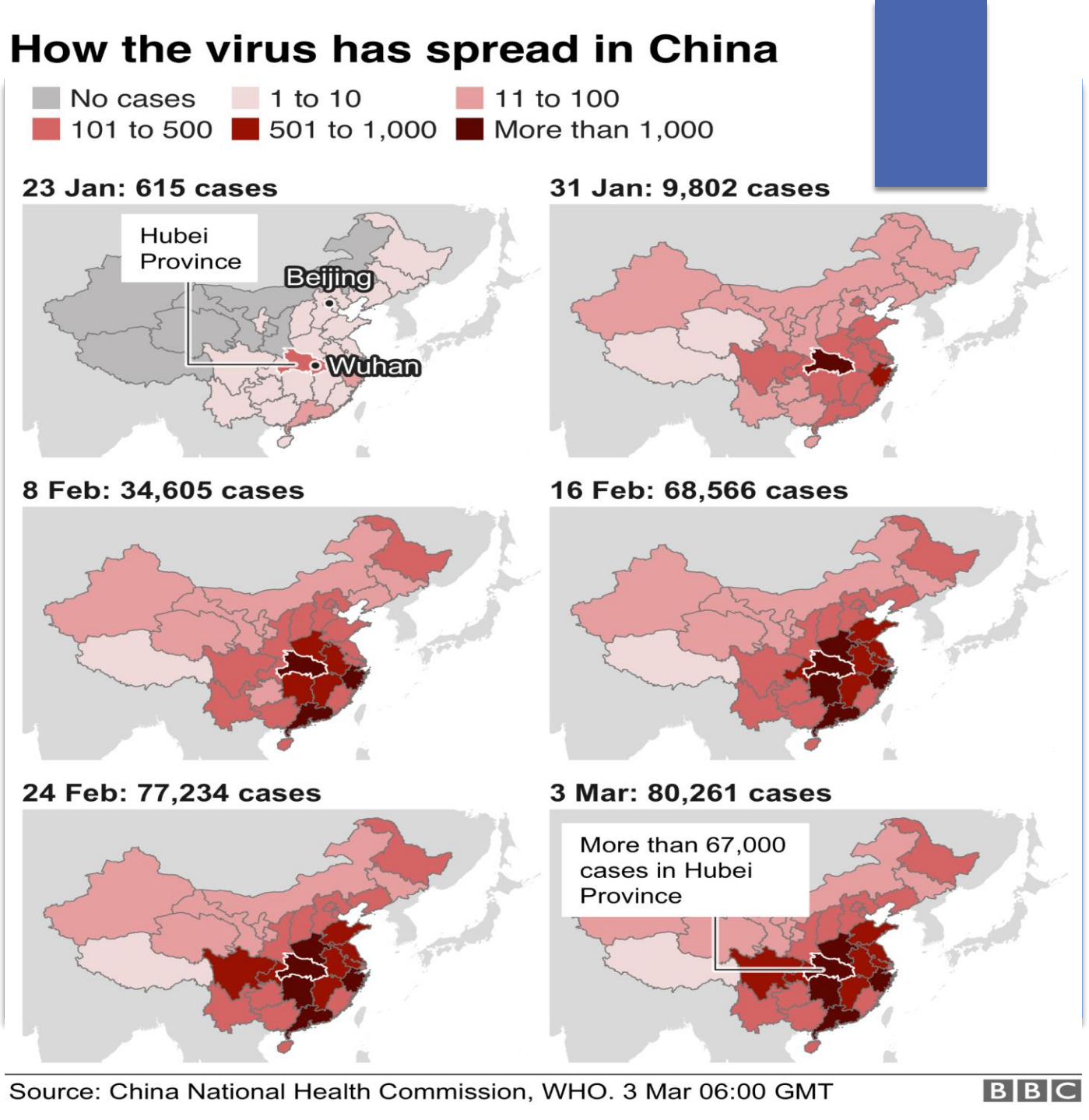
- February 2003 Outbreak in Guangdong Province China
- Spread within a month to Hong Kong, Singapore, Vietnam and Canada
- Total 8,096 cases with 774 deaths. **Case fatality rate 9-12 %**
- Clusters in Hong Kong and Canada demonstrated person to person spread. Face to face contact via droplets.
  - Other possible routes: Fecal-oral, airborne and fomites
- Prodrome 3-7 days: Fever, malaise, headache, myalgias.
- Respiratory phase: non-productive cough, dyspnea, respiratory distress. ARDS with diffuse alveolar damage with varying degrees of organization.
- Control: Meticulous Infection Control

MERS: Summary

- Saudi Arabia 2012 Onset of outbreak by novel corona virus (MERS-CoV)
- Spread to North Africa, Europe, Asia and North America.
- Persisted through 2015 with numerous small community and health-care-associated outbreaks
- Reservoir: Bats. Intermediate host: Camels
- Transmission by human to human contact
- Cases 2,494 with 858 fatalities. Case fatality ratio: 34 %
- Death from ARDS

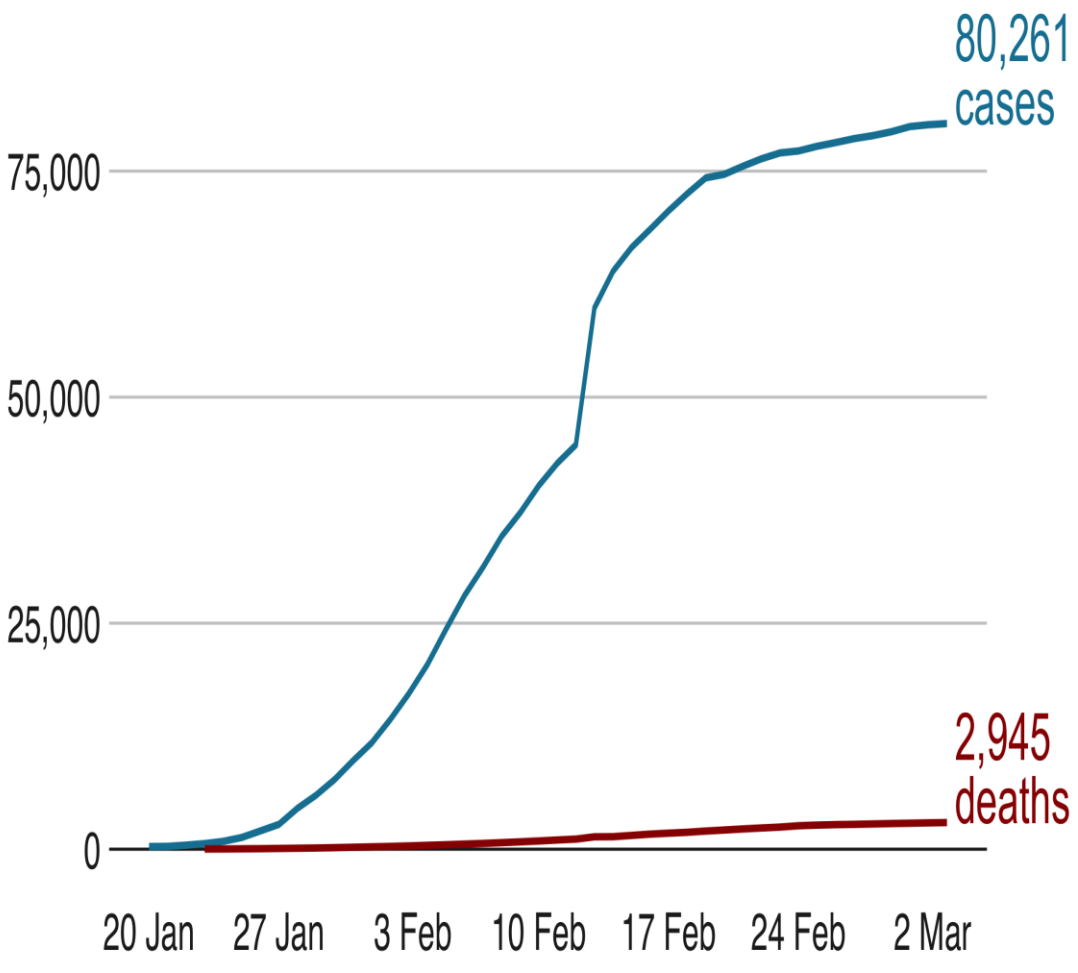
COVID-19

- Onset early December 2019 in Wuhan, Hubei Province China
- Recognized late Dec. 2019
- Rapid spread. Doubled #s every 6 days
- Peaked in China late Jan early Feb 2020
- Incidence of new cases and mortality seems to be decreasing
- However it has spread to 85 other countries



More than 80,000 cases in China so far

Total confirmed cases of coronavirus in the country

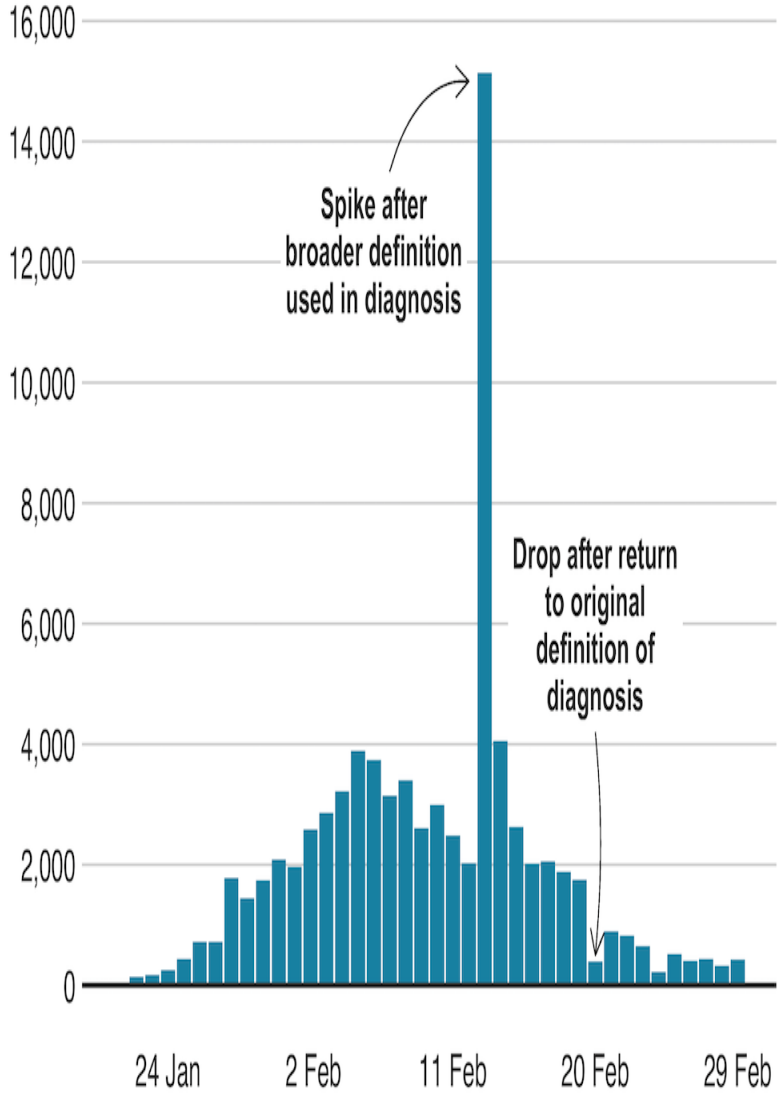


Source: China National Health Commission, WHO, Updated: 3 Mar 06:00 GMT BBC

Case Fatality Rate 3.6 %

Cases in China remain low

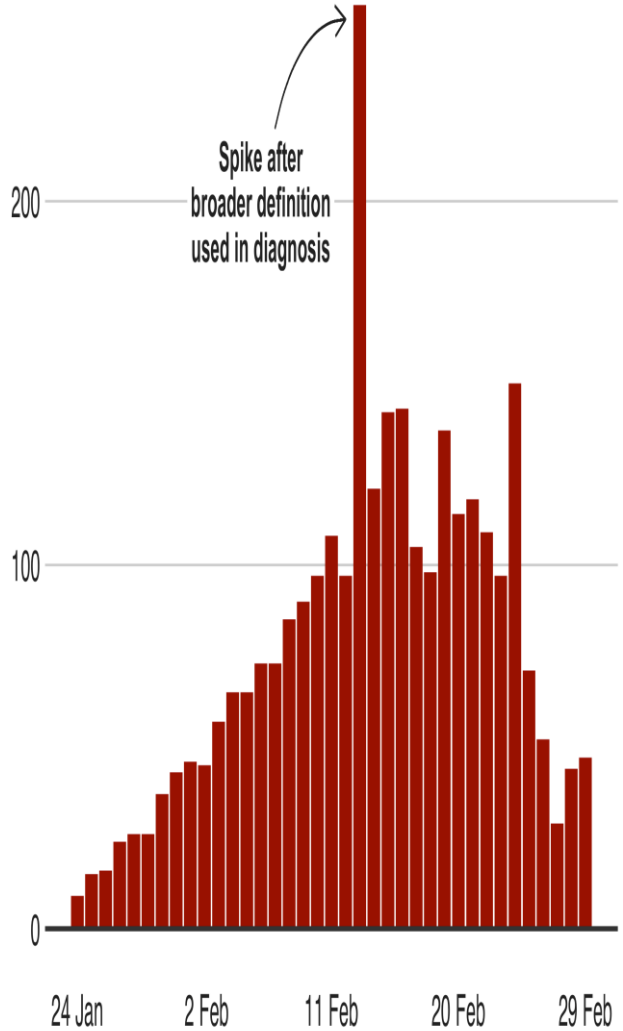
Daily confirmed cases of coronavirus in China



Source: China National Health Commission, WHO. Updated: 29 Feb 1600 BBC

Daily death toll in China is dropping

Daily deaths from coronavirus in China

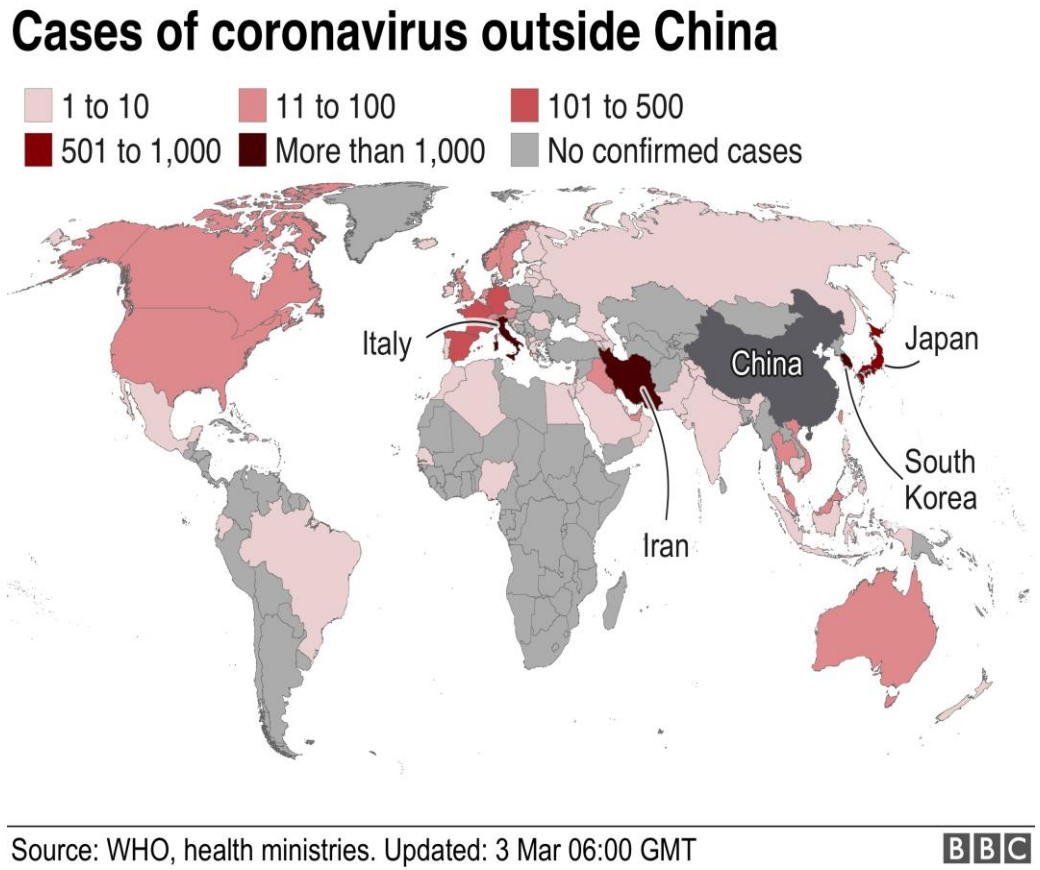


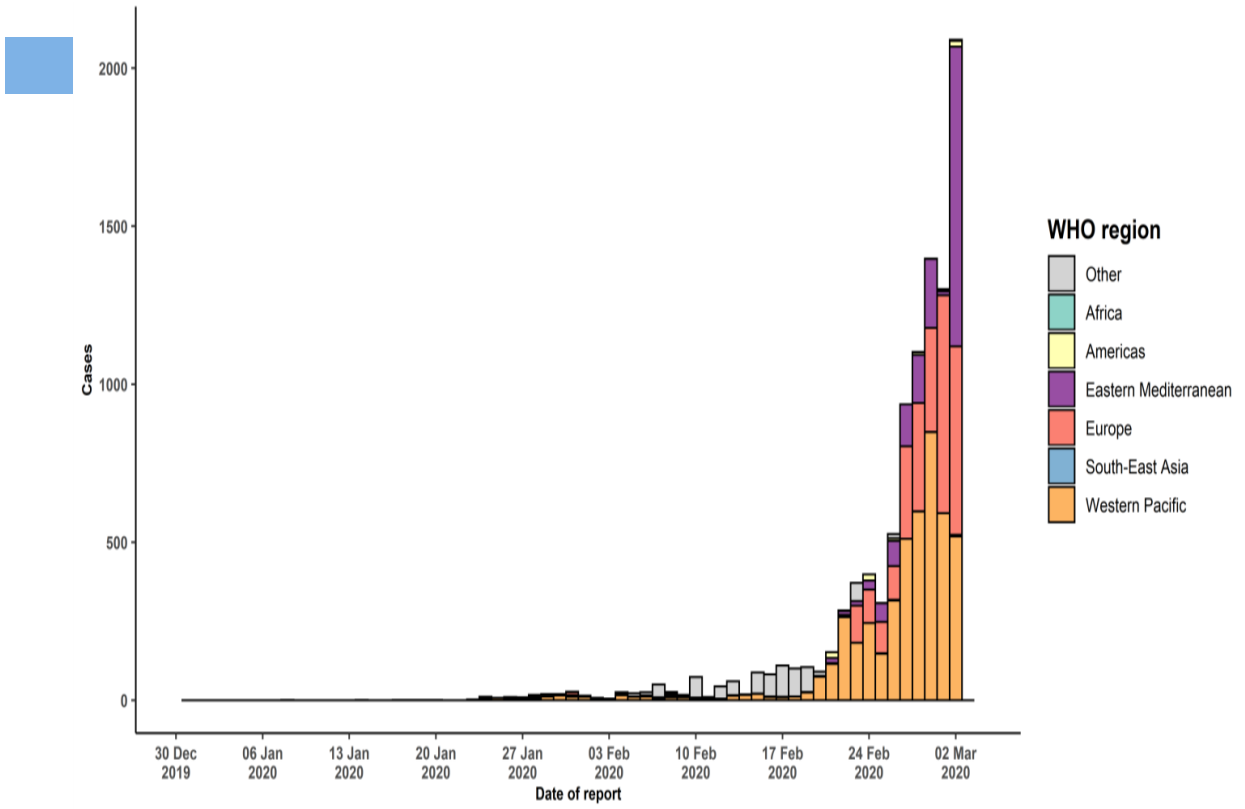
Source: China National Health Commission, WHO. Updated: 29 Feb 1600 BBC

COVID-19 OUTSIDE CHINA:

14,768 confirmed (2098 new)
85 countries (5 new) 267 deaths (53 new) as of 3-6-20

(Estimate 75% as yet Undetected)





Epidemiology of the Spread of Infectious Diseases

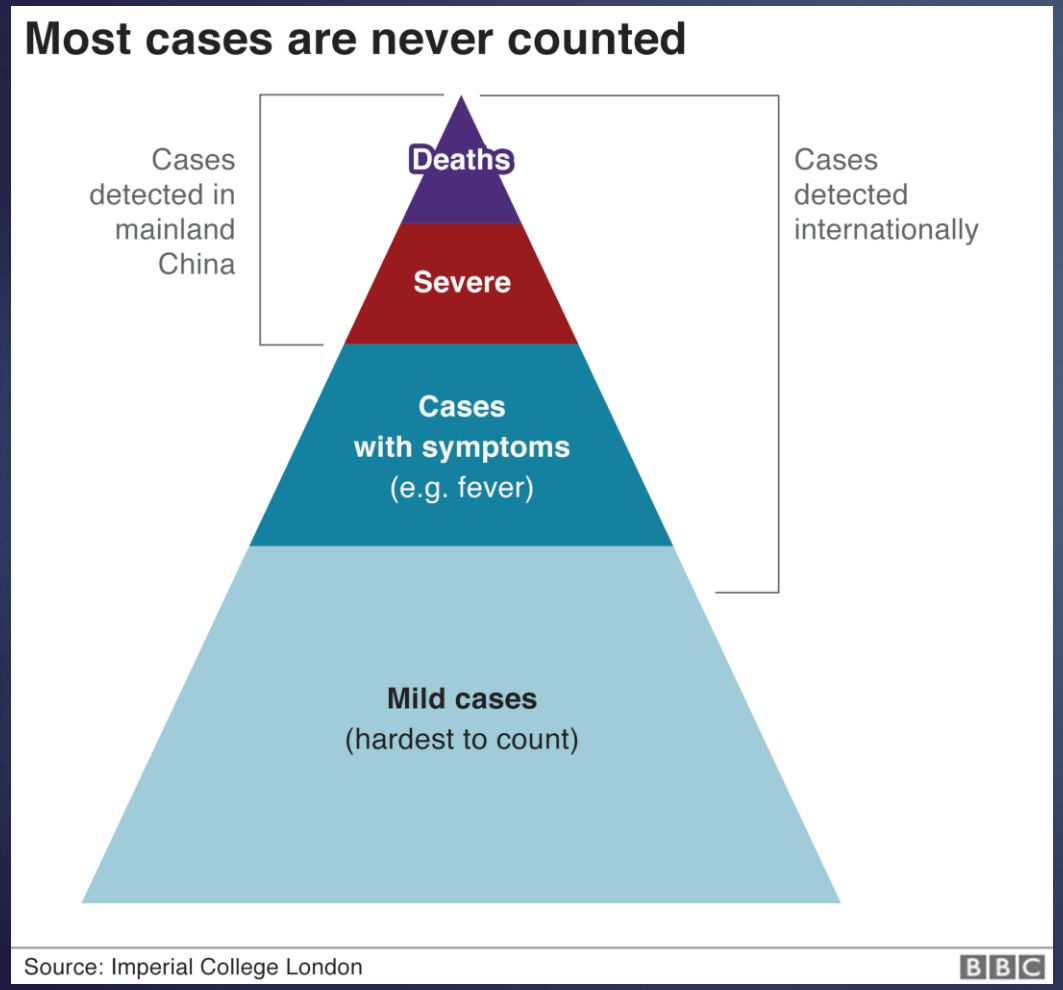
- **Four important factors:**

1. **Basic Reproduction Number: Ro**
    1. Number of people that will be infected by index case
    2. Ro < 1: Disease will die out
    3. Ro > 1: Disease will spread
2. **Secondary Rates of Infection- Role of superspreaders**
    1. Number of Infected People in specific populations/gatherings.
3. **Geographical Dissemination**
    1. Localized
    2. Widespread
4. **Case Fatality Rate**
    1. Number of people who will die in an infected population (%)

Epidemiology of Infectious Diseases

Pathogen	Basic Reproductive Rate Ro	Case Fatality rate %	Geographical Distribution	Mortality
Measles	17	0.2-10	Widespread	1-3/1000
Common Cold-Rhinovirus	6	Very Low	Widespread	Very low
Influenza (Normal Year)	2-3	0.1	Widespread	36,000 USA 250-500,000 World
Influenza 2017-18	2-3	0.14	Widespread	61,000 USA
SARS	2-3	9-10	Localized	2,933
MERS	2-3	36	Localized	774
Covid 19 Overall	2.3 ?	3.6	Widespread ?	36K- 1,296,000 ? 61K-2,196,000 ?
Covid in ICU	2.0	67	Widespread ?	

Difficulties with Establishing Number of Affected People



Diagnostics:

Viral cultures or PCR of secretions

- Lack of access to kits
- Problems with test kits (CDC)

CAT scans

- Delay in onset of changes
- Nonspecific

Serum antibodies

Not validated yet

Can COVID-19 be Contained

1-Optimistic Viewpoint:

- If Ro is 2.2 then only over half of infections need to be contained to bring Ro to less than 1
- This can be done if transmission occurs mainly from symptomatic patients
- Even if 20 % of transmission occurs from pre-symptomatic patients. Isolation of symptomatic hosts should lead to containment

2- Not so optimistic Viewpoint:

- Ro 1.5 Transmission 0%. Little contact tracing needed
- Ro 1.5 Most scenarios (different prodromal delays) controllable with <50 % contacts traced
- Ro 2.5 . Requires tracing >70% of contacts. Not enough manpower
- Ro 3.5. Requires > 90 % contacts be traced. Not enough manpower

1- Thompson R. Lancet Infect Dis 2-27-2020
2- Hellewell J, Abbot S. Lancet 2-28-2020

Secondary Attack Rate and Super-spreaders

- Nine outbreaks with a single index case with Covid-19 each
- 137 people exposed
- With a Ro of 2.0, expected # new infections = 18
- Actual # of new infections observed = 48
- Indicates 35% (95% CI 27-44) probability of infection among close contacts.
- Reduction of infection at such gatherings would disproportionately reduce overall transmission

Location	Date	Activity	# Exposed	# Infected
Harbin, China	1-24-2020	Meal-home	8	8
Nanjing, China	1-23-2020	Meal	8	7
Enshi, China	?	Meal	47	10

Liu Y, Eggo M Lancet 2-27-2020

Comparison between new coronavirus and similar outbreaks

Worldwide cases

Source: World Health Organization, Updated: 3 Mar 06:00 GMT

BBC

Comparisons SARS vs COVID-19

Similarities :

- SARS-COV2 has 86% genome similarity with SARS-COV 2
- Both zoonoses originating in Bats
- Original transmission: Open food markets
- Transmission: droplets, fecal-oral
- Median incubation: 5 days
- Mean serial interval 7.5 d vs 8.4 d for SARS
- Ro 2.2 vs 2,2—3.6 for serial intervals of 8-12 d (SARS)
- Risk Fx: Old age and comorbidities

Reasons why COVID19 has spread more:

- Wuhan Size 11 million. Transportation hub
- Different Infectious period. SARS peak transmission when symptomatic. COVID 19 transmission while asymptomatic
- Higher Ro. Average 3. 28, median 2.79. Diamond Princess: 19%
- Clinical spectrum different: 81 % mild. 14 % severe, 5% critical vs SARS (severe, critical)
- Wider Community spread vs SARS mainly hospital spread. Estimates several 100 K infections in China yet undetected. Outside China 75 % cases yet undetected.

Wilder-Smith A, Chiew C, Lee V. Lancet ID, Mar 5,2020

Clinical Spectrum

- Asymptomatic Infection
- Mild URTI
- Pneumonia:

1. Mild
2. Severe: Respiratory failure, ARDS, death

- Prodrome: Fever, fatigue, cough Median 5 days (2-7-days)
- Respiratory Phase: Pneumonia with severe pneumonia in second week.

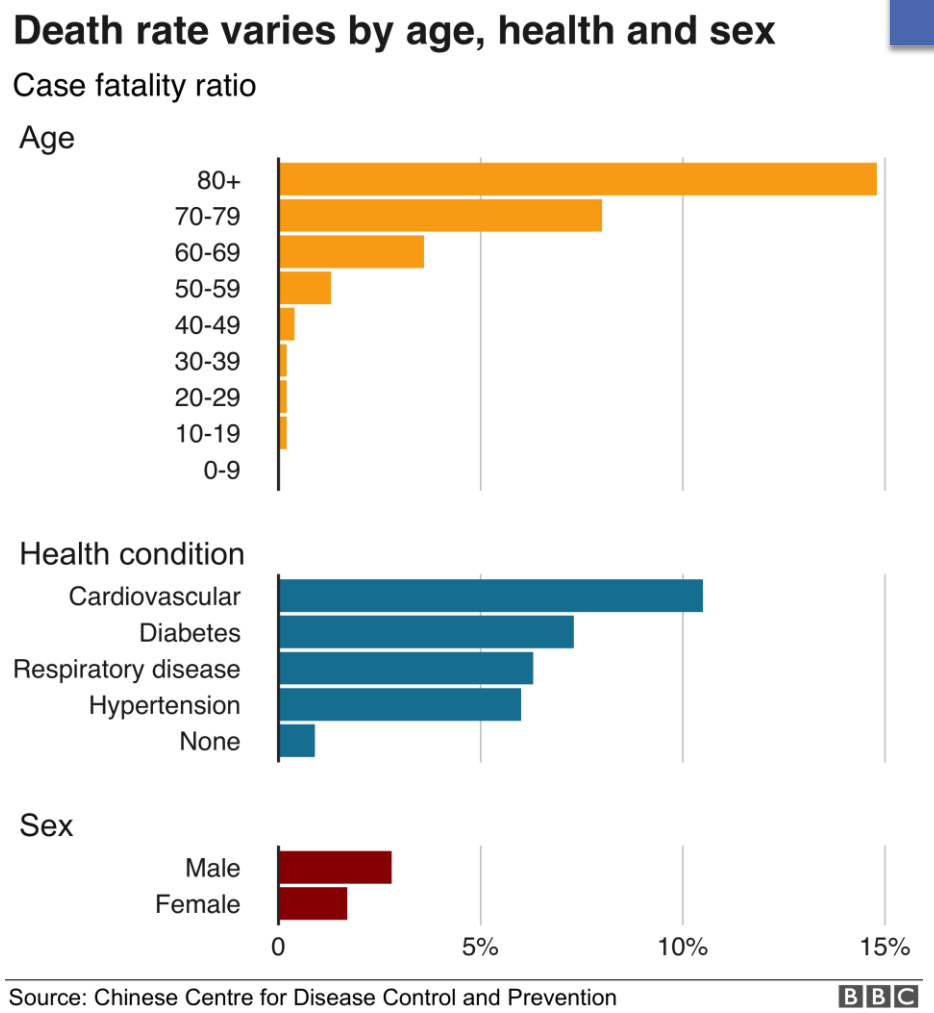
Yang X et al Lancet 2-24-2020

- Pneumonia requiring ICU admission
- 710 screened. 52 enrolled
- Mean Age: 59.7 y (SD 13.3)
- Men: 35 (67%)
- Chronic illness: 21 (40 %)
- Fever: 51 (98%)
- Death: 32 (61% at 28 days)
- Mean duration from admission to ICU to death: 7 days (IQR 3-11 d)
- Non survivors Older: 64.6 (SD 11.2) vs Survivors 51.9 yr (SD 12.9)
- Overall Vent Use 37 (71%)
- Ventilator 30 (94%) vs 7 (35% of survivors)
- ARDS 35 (67%), AKI, Liver Dys 15 (29%), Cardiac injury 12 (23%)

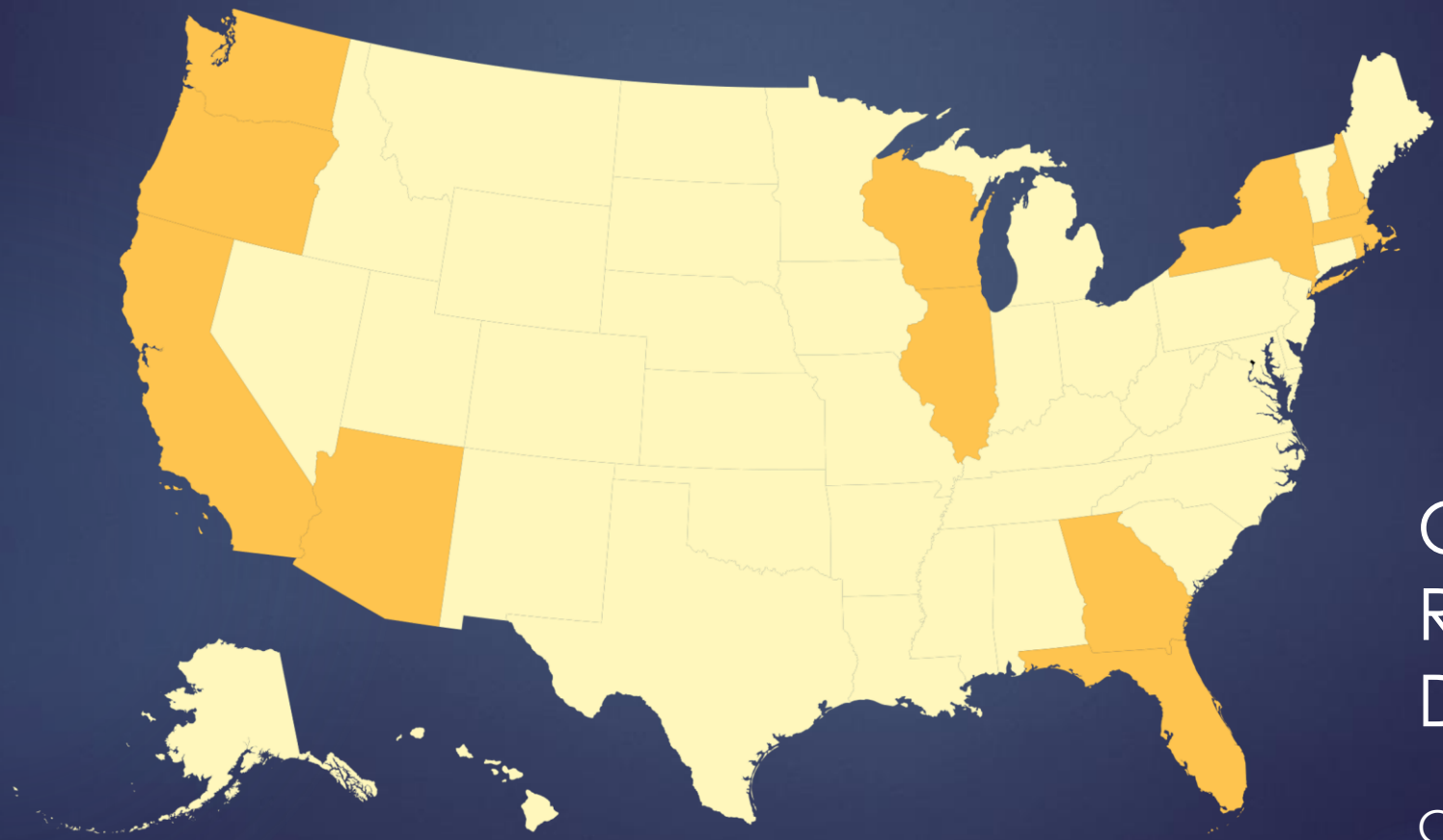
COVID-19 China. Severity of Illness. N=44,500

Severity:

- **Mild:** 81 %
  - No or mild pneumonia
- **Severe:** 14 %
  - Dyspnea, hypoxia, or >50 percent lung involvement on imaging within 24 to 48 hours
- **Critical:** 5 % ,
- Respiratory failure, shock, or multiorgan dysfunction



COVID-19 Situation in USA:



Cases: 134
Repatriated 48
Deaths: 11

CDC 3-6-20

CDC Specimen Collection

- Combined Nasopharyngeal Swab
- If positive: Repeat every 3 days until negative
- If negative: Repeat second test next day
- If two consecutive tests are negative: Discontinue Isolation

- Lower respiratory specimen is preferred when applicable
- Airborne and contact isolation is recommended.
- For further information contact Infection Control Practitioner

CDC February 28, 2020

CDC Protocol Treatment COVID-19

COVID-19 URTI

(Fever, rhinorrhea, cough, no pulmonary infiltrate. Positive PCR)

- Chloroquine phosphate 500 mg PO BID X 5 days, plus
- Oseltamivir 150 mg PO BID x 5 days

COVID-19 Pneumonia

- Chloroquine phosphate 500 mg PO BID X 10 days, plus
- Darunavir/Cobicistat (Rezolta: 800 mg/150 mg daily) x 14 days
- OR
- Atazanavir 400 mg PO daily x 14 days, plus
- Oseltamivir 150 mg PO BID x 14 days
- +/-
- Methyl prednisolone 40 mg IV q 12 hr x 5 days

CDC February 28,2020

COVID-19 Public Health Strategies

Containment:

- Attempt to limit entry of virus into the country
- Identification, isolation, contact tracing to limit spread

Mitigation:

- If unable to contain
- Social Distancing
  - **Cancelling public gatherings**
  - **School closures**
  - **Remote working**
  - **Home isolation**
  - **Monitoring of health of individuals by phone or online consultations**
  - **Provision of life support systems: 02, ventilators, ECMO**

- **Race against Time:**
  - Arrival of Warmer weather
    - Break in summer
    - Second wave in Fall ?
  - More knowledge of full spectrum of illness
  - Vaccine testing, Antiviral trials
  - Availability of hyperimmune Gamma Globulin

WHO Recommendations

1. Close monitoring of changes in Epidemiology and the effectiveness of public health strategies and their social acceptance
2. Enhanced communication to general public and populations at risk of actionable information for self protection and guidance for treatment seeking.
3. Continued intense source control containment. Identification, isolation, tracking of contacts.
4. Preparation of resilience of health systems anticipating severe infections in older people and other at risk populations

Summary:

- SARS-COVID2 new Corona virus, with 96 % homology with a Bat virus and 86% sequence homology to SARS Virus.
- Responsible for COVID-19 pandemic
- Behavior similar to the SARS Virus
- Affinity for epithelial cells in upper and lower respiratory tract-ACE2 receptor
- Can cause asymptomatic carriage and shedding for longer periods of time than SARS. Therefore more difficult to identify and contain.
- Causes URTI & LRTI with or without pneumonia
- Most cases of Pneumonia are mild
- However severe pneumonia, ARDS and death do occur

Summary

- It is exact epidemiology, Basic reproduction rate (Ro), Case fatality rate (CFR), Geographical distribution are not yet completely known and change daily.
- Transmission seems to be primarily by droplets and close face to face contact but fecal shedding occurs.
- Mortality is highest among those 50 years or older and those with comorbid conditions.
- Current strategies of Containment and treatment of the sickest are placing tremendous strains on public health and medical services.
- If containment fails a strategy of Mitigation will become necessary requiring public education, cooperation, close coordination of public health and medical services.

Whatever You Do