2019-novel Coronavirus (COVID-19)

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Disclosure

- I have no conflicts of interest related to this presentation.

- Some discussion will occur about the "off-label" use of drugs in the treatment of COVID-19.

Objectives

- Understand what is coronavirus
- Identify the spike protein
- Differentiate between SARS, MERS, and COVID19
- Identify the symptoms of COVID19
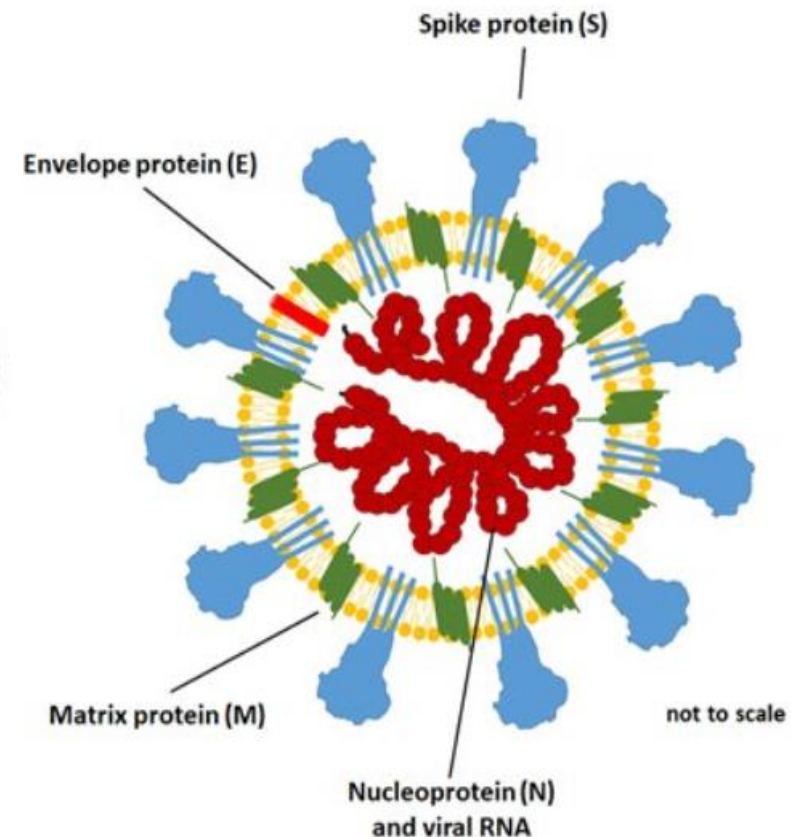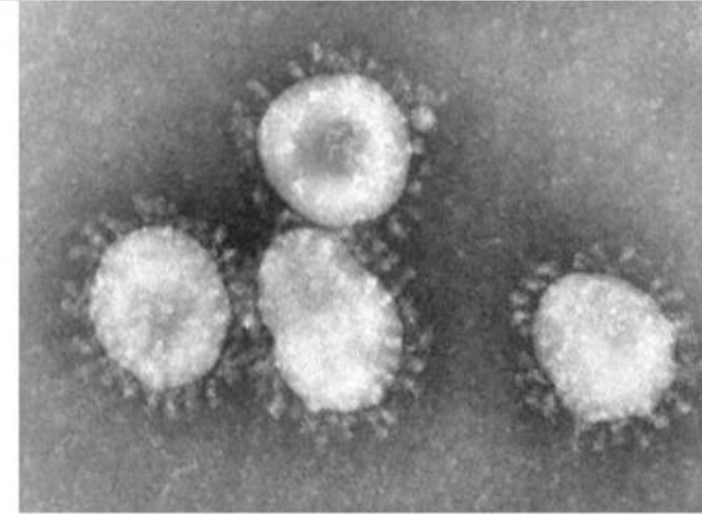- Identify Myths and Realities of COVID19

Coronavirus

Membrane Protein (M)

RNA

Nucleocapsid Protein (N)

Spike Protein (S)
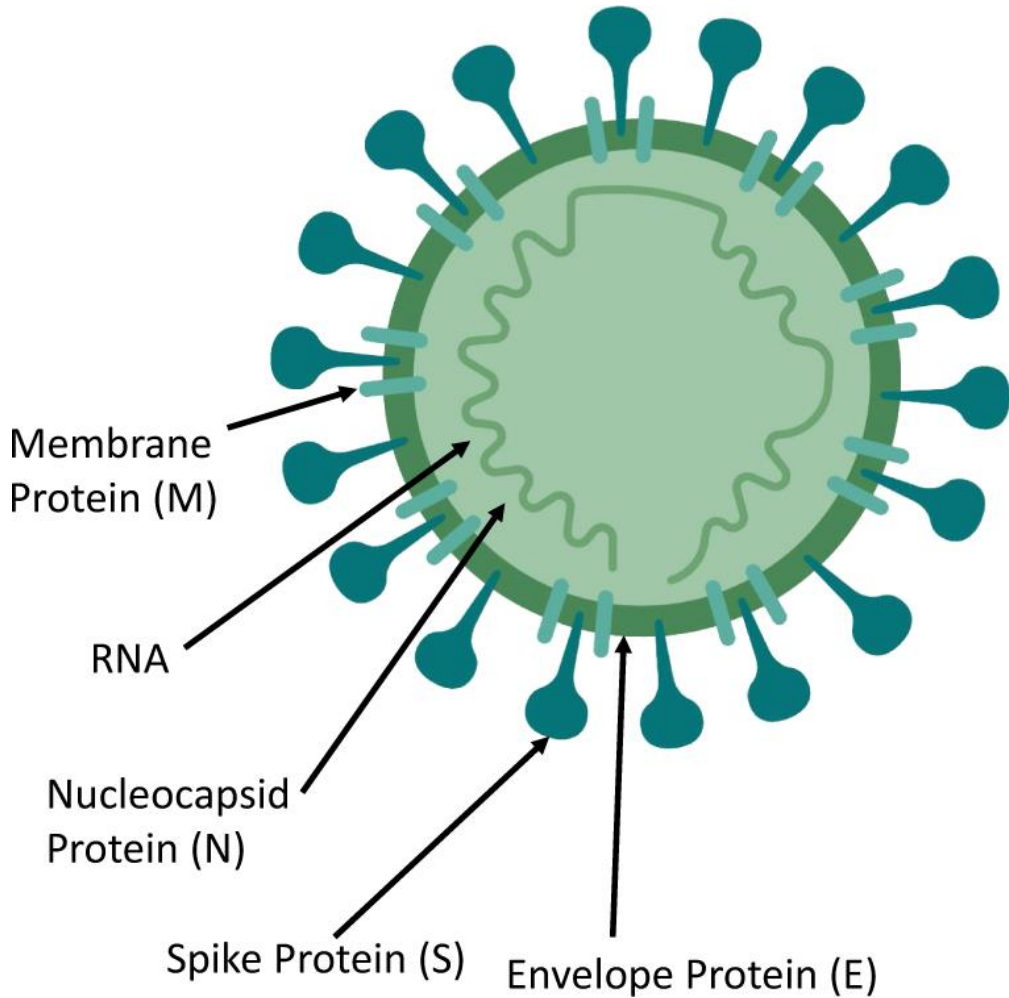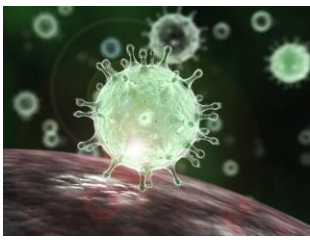
Envelope Protein (E)

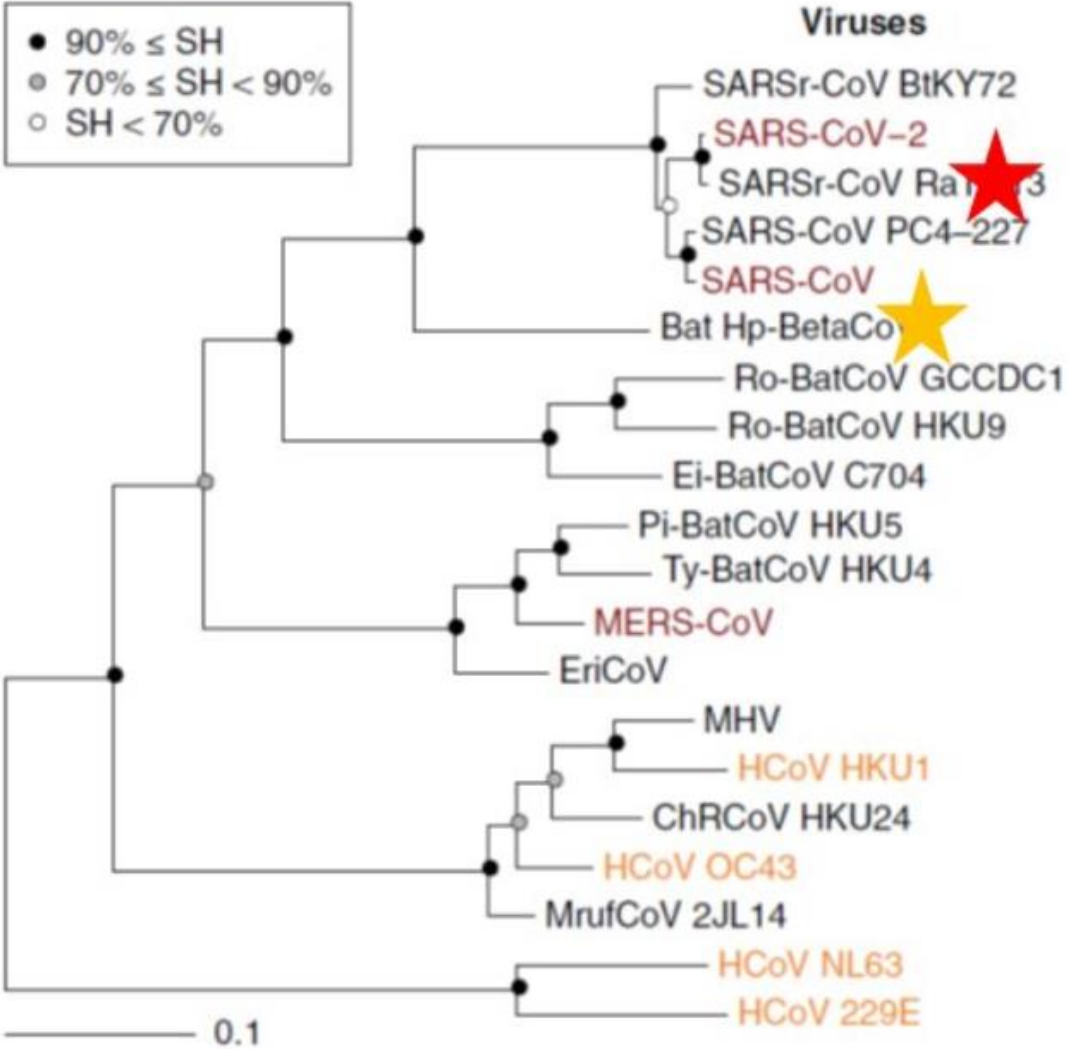| Structural Protein	Functional Protein
Nucleocapsid Protein (N)	• Bound to RNA genome to make up nucleocapsid
Spike Protein (S)	• Critical for binding of host cell receptors to facilitate entry of host cell
Envelop Protein (E)	• Interacts with M to form viral envelop
Membrane Protein (M)	• Central organizer of CoV assembly • Determines shape of viral envelop
NOTE: Some CoV's do not need to have the full ensemble of structural proteins to make virions, highlighting that certain proteins may be dispensable or compensated by the function of non-structural proteins.	

Hold on! What is a coronavirus???

- Family: *Coronaviridae*
- Corona → Crown
- Positive sense single stranded RNA viruses (+ssRNA, large >30kb genome)
- Enveloped
- 120nm in diameter
- Regular human coronaviruses (cause 30% of all colds)
  - Alphacoronaviruses: NL63, 229E
  - Betacoronaviruses: HKU1, OC43
- Zoonotic coronaviruses (all betacoronaviruses)
  - SARS-CoV-1 (2002-2004)
  - MERS-CoV

Spike protein (S)

Envelope protein (E)

Matrix protein (M)

Nucleoprotein (N) and viral RNA
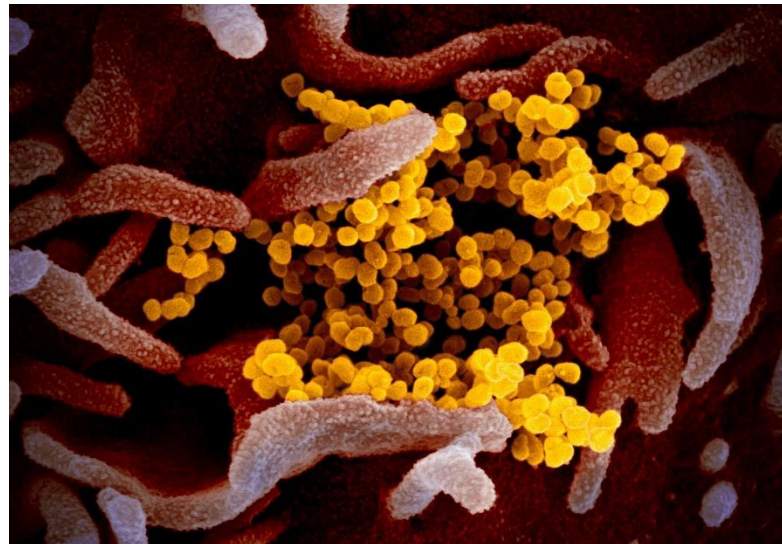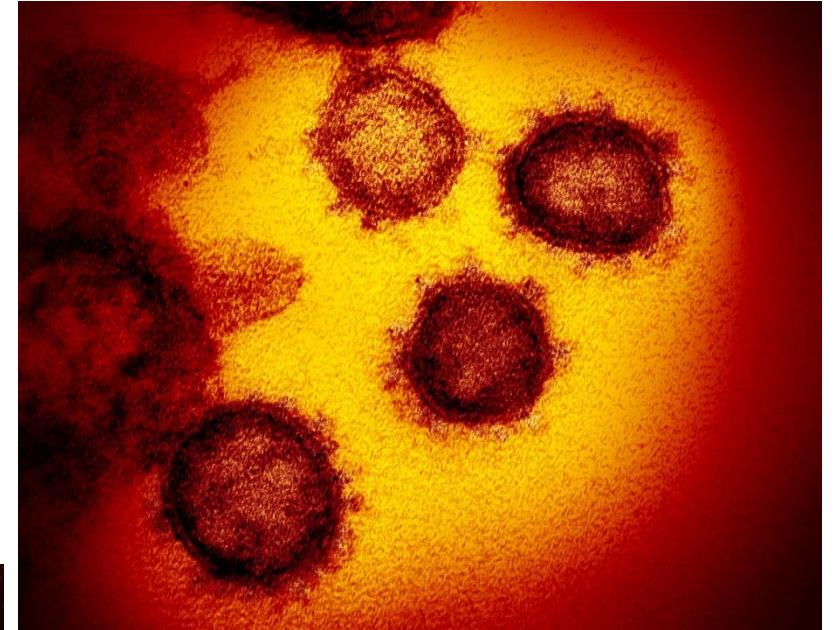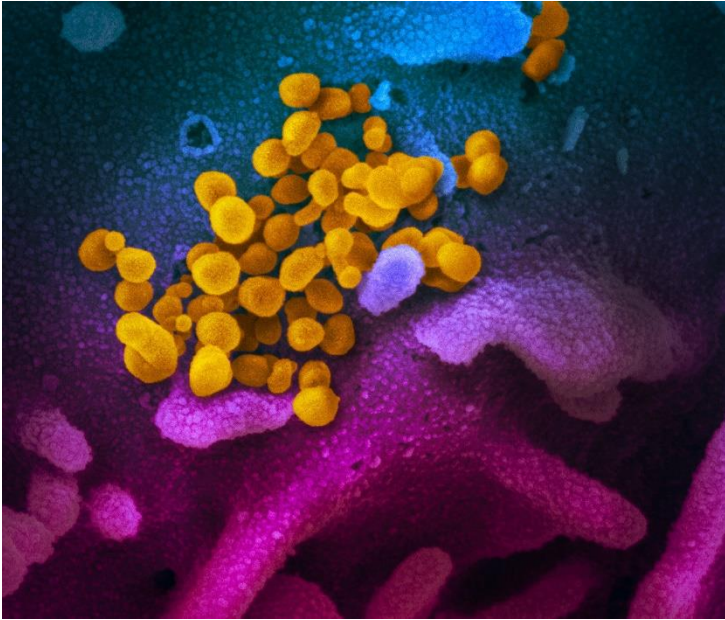
not to scale

How do we name it?

Disease: **COVID-19** (WHO)
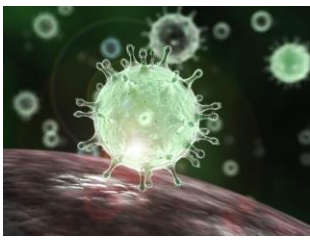
Coronavirus Disease 2019

Virus: **SARS-CoV-2** (ICTV)

Severe Acute Respiratory Syndrome Coronavirus 2

COVID-19 Electron Microscopy

Coronavirus Emergence

Severe Acute Respiratory Syndrome (SARS-CoV)
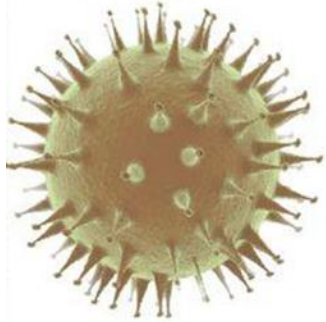
- Identified in 2003, first infected humans in China in 2002
- Thought to be from bats, spread to civet cats to humans

Middle East Respiratory Syndrome (MERS-CoV)
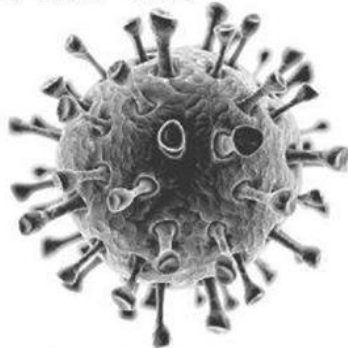
- First identified in Saudi Arabia in 2012
- From dromedary camels to humans
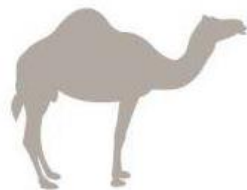
- Coronaviruses are a large family of viruses that are known to cause illness ranging from the common cold to more severe diseases such as **Middle East Respiratory Syndrome (MERS)** and **Severe Acute Respiratory Syndrome (SARS)**.

- **2019-novel coronavirus** (COVID-19) was identified in Wuhan, China. This is a new coronavirus that has not been previously identified in humans.

Coronavirus Emergence
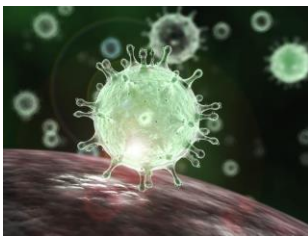
- **Severe Acute Respiratory Syndrome (SARS)**
  - First reported in Asia in February 2003. The illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained.
  - Since 2004, there have not been any known cases of SARS reported anywhere in the world.

Severe Acute Respiratory Syndrome (SARS)	
Total Number of Cases (Globally)	8,096
Total Number of Deaths (Globally)	774
Case Fatality Rate	9.6%
Total Imported Cases	~1.8%
Number of Healthcare Workers Affected	~21%
Total Number of Countries Affected	26

2003 Probable cases of SARS - Worldwide from November 1, 2002
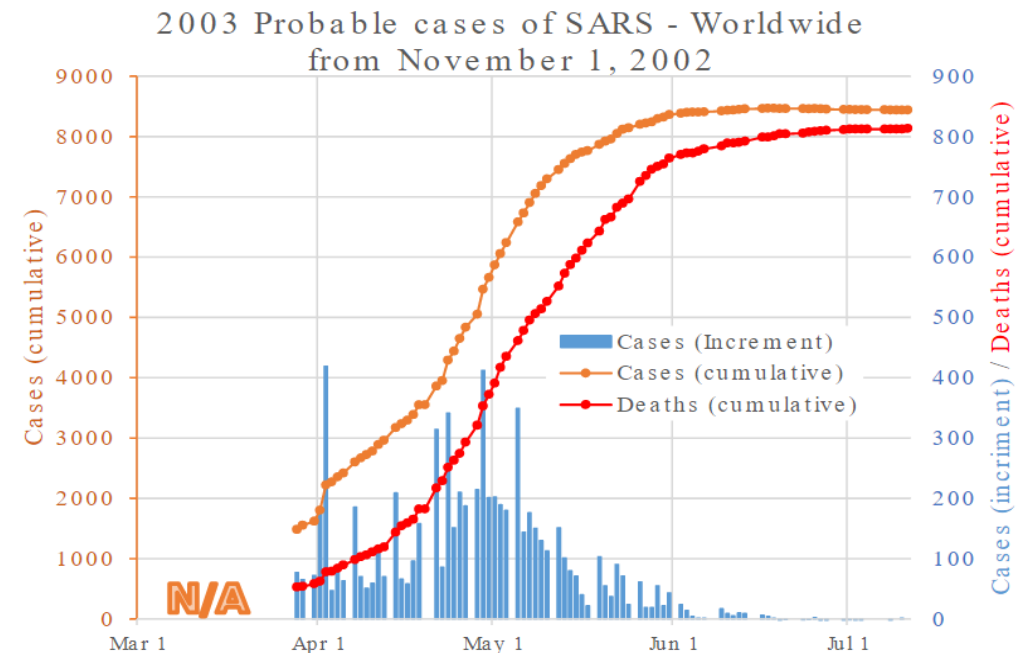
Coronavirus Emergence
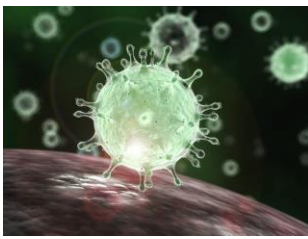
- **Middle East Respiratory Syndrome (MERS)**
  - Middle East Respiratory Syndrome (MERS) is viral respiratory illness that was first reported in Saudi Arabia in 2012 and has since spread to several other countries, including the United States.
  - Most people infected with MERS-CoV developed severe respiratory illness, including fever, cough, and shortness of breath.

Middle East Respiratory Syndrome (MERS)	
Total Number of Cases (Globally)	2,494
Total Number of Deaths (Globally)	858
Case Fatality Rate (%)	34.4%
Number of Healthcare Workers Affected	~19%
Total Number of Countries Affected	27

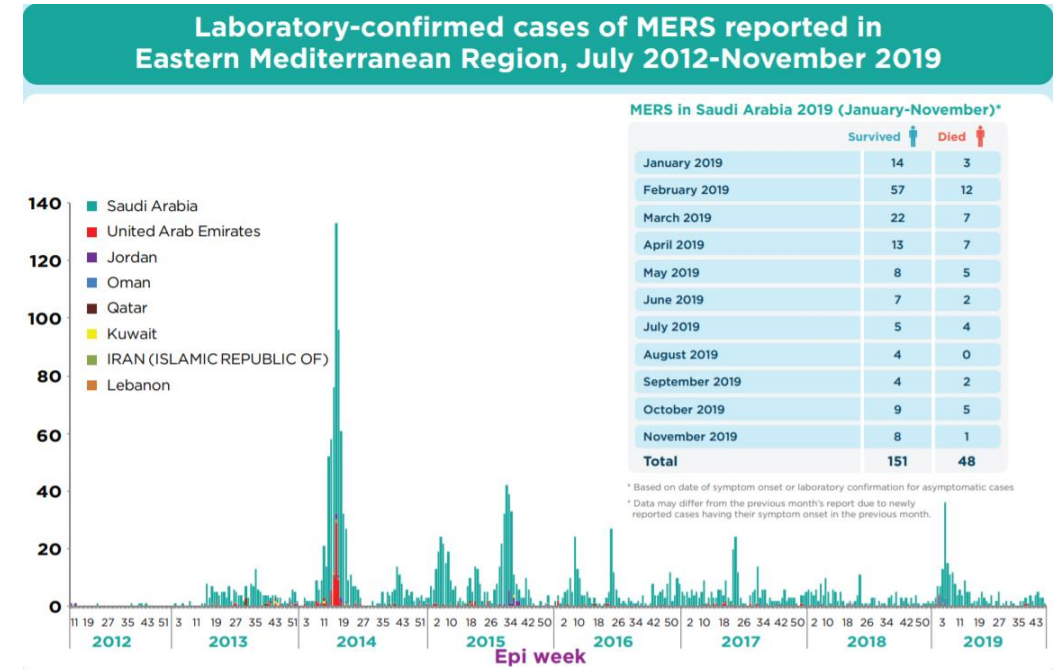Laboratory-confirmed cases of MERS reported in Eastern Mediterranean Region, July 2012-November 2019

MERS in Saudi Arabia 2019 (January-November)*	Survived	Died
January 2019	14	3
February 2019	57	12
March 2019	22	7
April 2019	13	7
May 2019	8	5
June 2019	7	2
July 2019	5	4
August 2019	4	0
September 2019	4	2
October 2019	9	5
November 2019	8	1
Total	151	48

* Based on date of symptom onset or laboratory confirmation for asymptomatic cases
* Data may differ from the previous month's report due to newly reported cases having their symptom onset in the previous month.

COVID-19 Outbreak: Key Events

12/31/2019
WHO Alerted by Chinese Authorities of a string of pneumonia in Wuhan

01/09/2020
1st death from the 2019-nCoV reported in Wuhan

01/13/2020
1st infection reported in Thailand

01/19/2020
Sudden spike in reporting of an additional 136 cases in Wuhan

01/21/2020
1st infection reported in United States & Taiwan

01/23/2020
1st infection reported in Singapore & Vietnam

Additional citied in China Huanggang, Ezhou quarantined

02/14/2020
1st infection reported in Egypt

01/23/2020 WHO Risk Assessment
CHINA – VERY HIGH
REGION – HIGH
GLOBAL - HIGH

02/29/2020
1st death reported in United States

01/01/2020
Hunan Seafood Market identified as source of pneumonia and CLOSED

01/10/2020
Gene sequencing data of 2019-nCoV established and shared globally

01/16/2020
1st infection reported in Japan

01/20/2020
1st infection reported in South Korea

01/22/2020
1st infection reported in Macau & Hong Kong

Wuhan placed in quarantine

02/12/2020
China changed its counting criteria to include clinical diagnoses in addition to lab-confirmed cases
Resulting in 10-fold increase in case

01/22/2020
South Korea reported HIGEST number of new cases after China

02/26/2020
First 2 confirmand cases reported in Pakistan

Bat SARS-like coronavirus (genus Betacoronavirus, subgenus Sarbecovirus)

Pangolin

COSTLIEST COVERUP EVER?

Sources believe coronavirus originated in Wuhan lab as part of China's efforts to compete with US

Coronavirus may have spread to humans by dogs not bats, bombshell new research claims

A team of scientists at the University of Ottawa in Canada have claimed that stray dogs in China may have become infected after eating bat meat before then transmitting the virus to humans
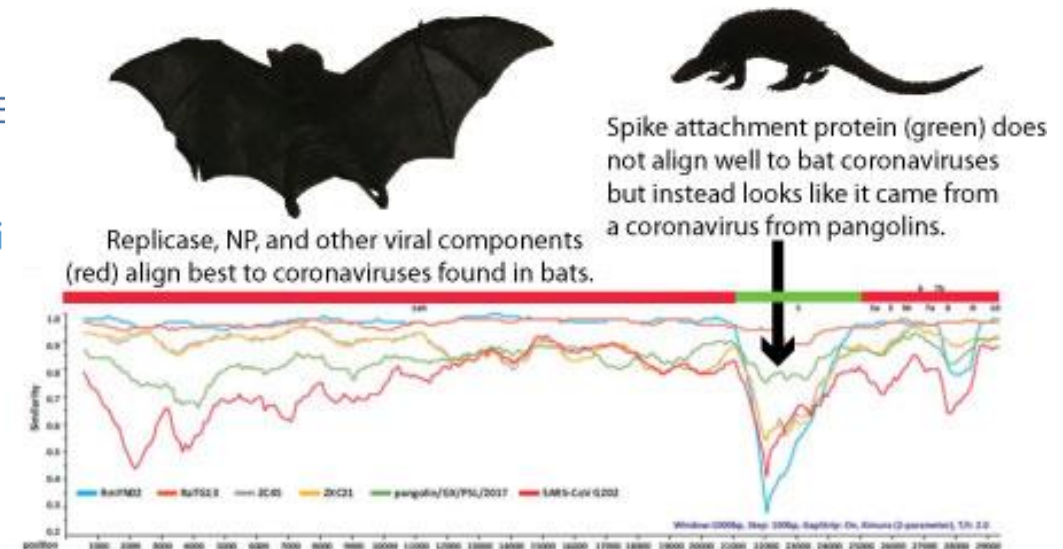
A SARS-like cluster of circulating bat coronaviruses shows potential for human emergence

Vineet D Menachery ✉, Boyd L Yount Jr, Kari Debbink, Sudhakar Agnihothram, Lisa E Gralinski, Jessica A Plante, Rachel L Graham, Trevor Scobey, Xing-Yi Ge, Eric F Donaldson, Scott H Randell, Antonio Lanzavecchia, Wayne A Marasco, Zhengli-Li Shi & Ralph S Baric ✉

Replicase, NP, and other viral components (red) align best to coronaviruses found in bats.

Spike attachment protein (green) does not align well to bat coronaviruses but instead looks like it came from a coronavirus from pangolins.

https://twitter.com/virusninja/status/1235773375076880387/photo/1

What do we know about the virus?

Virus culture

A pneumonia outbreak associated with a new coronavirus of probable bat origin

Peng Zhou, Xing-Lou Yang, Xian-Guang Wang, Ben Hu, Lei Zhang, Wei Zhang, Hao-Rui Si, Yan Zhu, Bei Li, Chao-Lin Huang, Hui-Dong Chen, Jing Chen, Yun Luo, Hua Guo, Ren-Di Jiang, Mei-Qin Liu, Ying Chen, Xu-Rui Shen, Xi Wang, Xiao-Shuang Zheng, Kai Zhao, Quan-Jiao Chen, Fei Deng, Lin-Lin Liu, Bing Yan, Fa-Xian Zhan, Yan-Yi Wang, Geng-Fu Xiao & Zheng-Li Shi
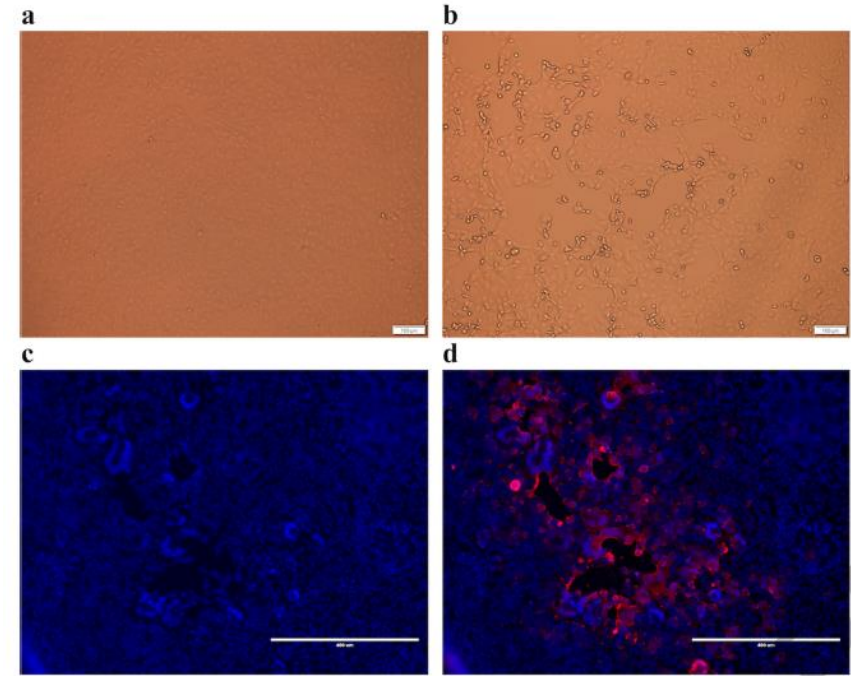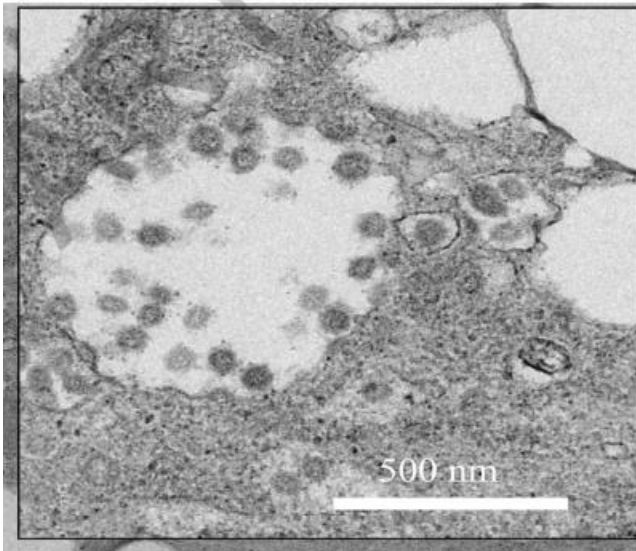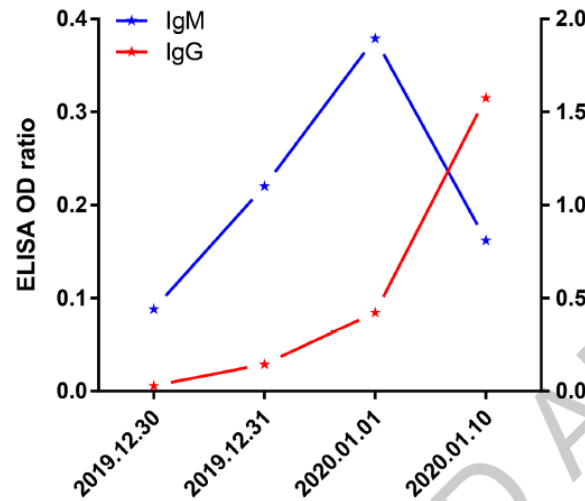
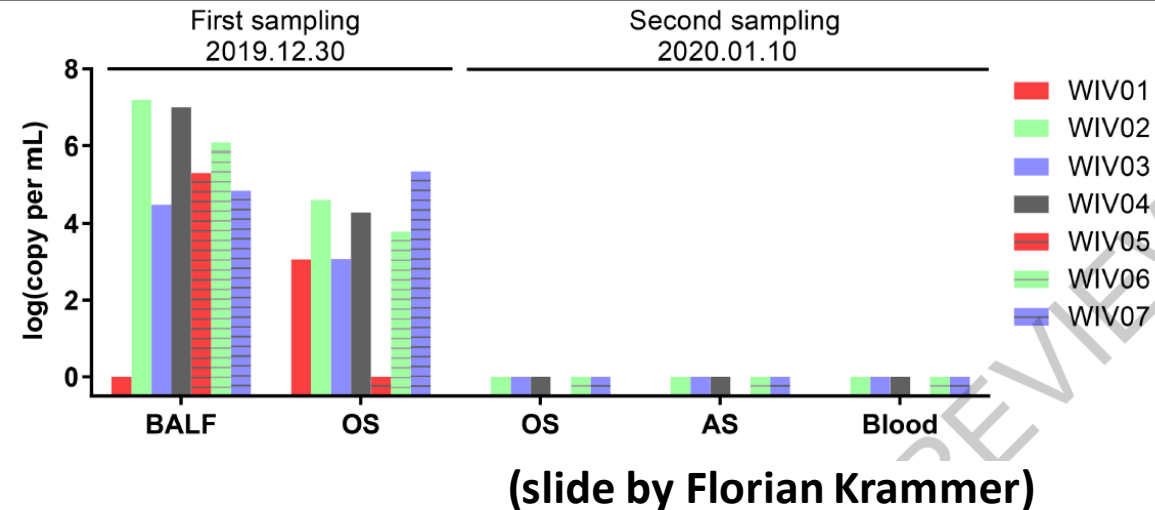**Wuhan Institute of Virology**

EM micrographs

Antibody response

Sampling sites, PCR methods

(slide by Florian Krammer)

How does the virus enter cells?

- **Uses human ACE2 as receptors**
  - **Similar to SARS-CoV-1 and NL63**

Viral membrane

Functional assessment of cell entry and receptor usage for SARS-CoV-2 and other lineage B betacoronaviruses

Michael Letko, Andrea Marzi and Vincent Munster
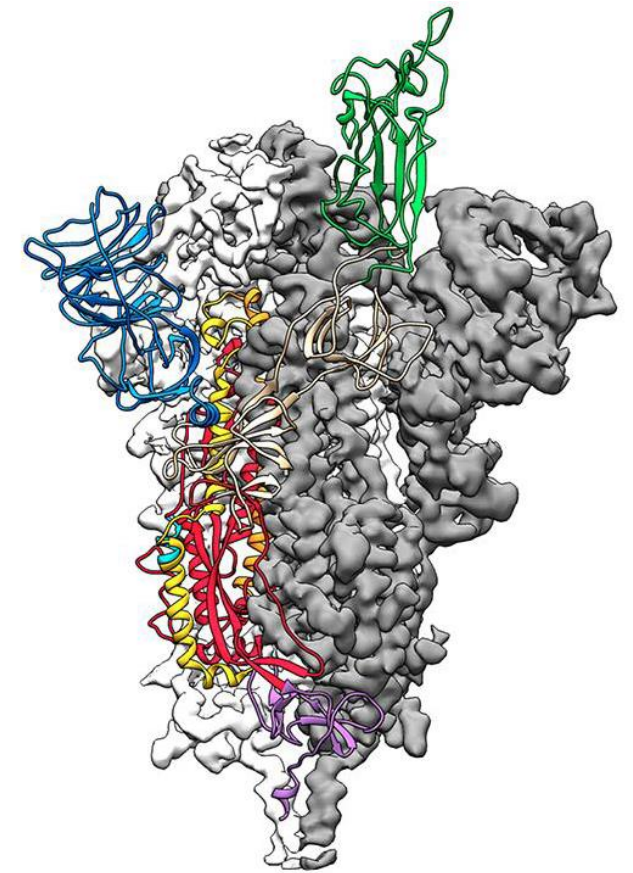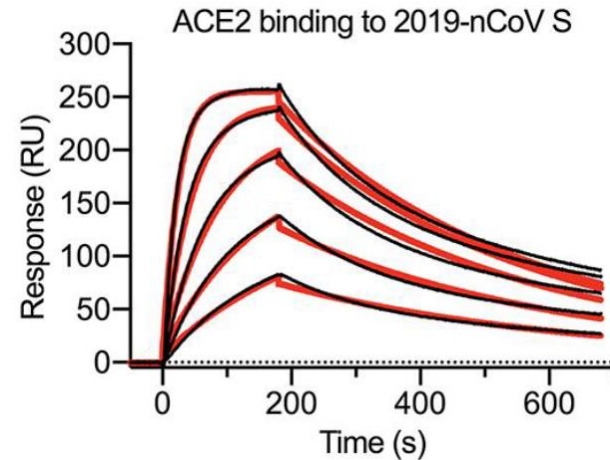
(slide by Florian Krammer)

Cryo-EM structure of the 2019-nCoV spike in the prefusion conformation

Daniel Wrapp[1]*, Nianshuang Wang[1]*, Kizzmekia S. Corbett[2], Jory A. Goldsmith[1], Ching-Lin Hsieh[1], Olubukola Abiona[2], Barney S. Graham[2], Jason S. McLellan[1]†

[1]Department of Molecular Biosciences, The University of Texas at Austin, Austin, TX 78712, USA. [2]Vaccine Research Center, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, MD 20892, USA.

What is a "Superspreader?"
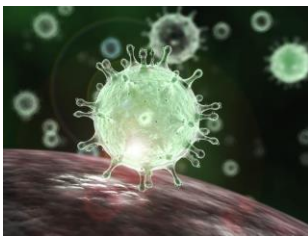
In general

- Infected person infects a number of other individuals, directly or indirectly
- This happens in many diseases including common flu
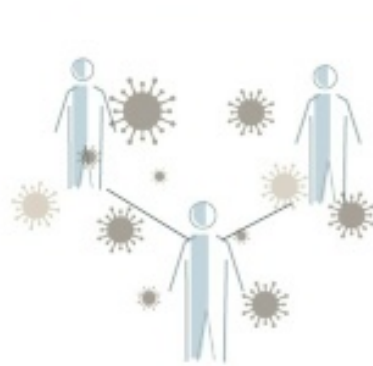
Common infection	Superspreader

- Weak immune system, behaviors, degree of contact, travel patterns, can contribute to spread but hard to trace.
- Person can spread virus without exhibiting symptoms.

Recent Cases

- Superspreader status

- Infected directly or indirectly

2020	2015	2003

British man catches COVID-19 in Singapore
• RECOVERED
11 people

Patient in South Korea with MERS virus
• DIED
82

Doctor with SARS virus in Hong Kong
• DIED
100 ++*
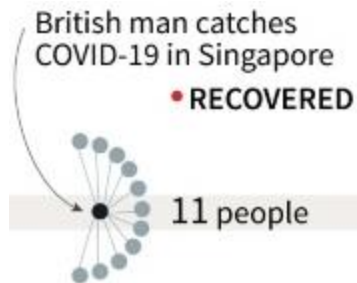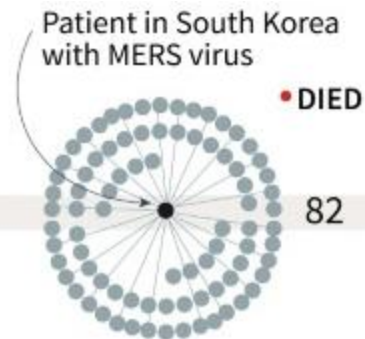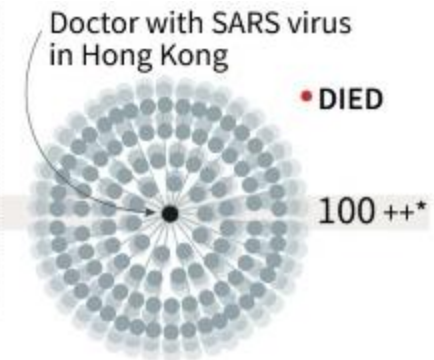
COVID-19 Cruise Ship Lab-confirmed Cases
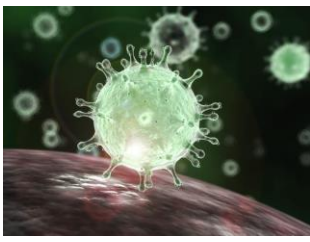
- Diamond Princess cruise ship was quarantined in Japan since February 3, 2020.

- 696 confirmed cases and 7 deaths.

- There were about 400 Americans on the ship.

- The returning passengers have been subject to a 14-day quarantine and will be housed at two locations: Travis Air Force Base in California and Joint Base San Antonio-Lackland in Texas.

- Passengers were screened before leaving Japan to avoid symptomatic people from boarding the plane.

- Once they return to the United States, the passengers were housed separately from the evacuees from Hubei province.

COVID-19 Nursing Home Outbreak: Seattle, Washington, USA
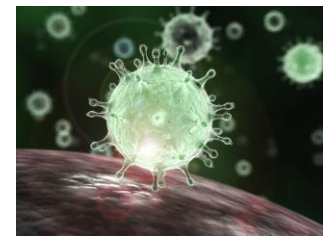
The outbreak at the Life Care in Kirkland, Washington
- 108 residents and 180 staff
- 50% showed signs and symptoms
- 16 fatalities

- Based on data from China the disease kills nearly 15% of people over 80 years old and 8% percent of people in their 70s — the very population that makes up more than half the population of US nursing homes & long-term/assisted living facilities.

- This outbreak exposed the great vulnerability of the nation's nursing homes and long-term/assisted living facilities, and the 2.5 million Americans who live in them.

What is happening in Washington State?
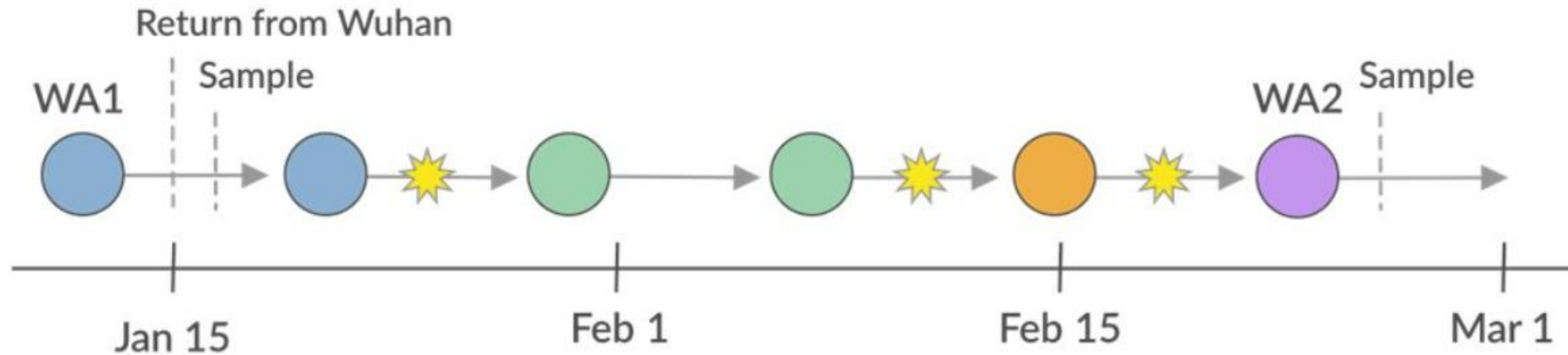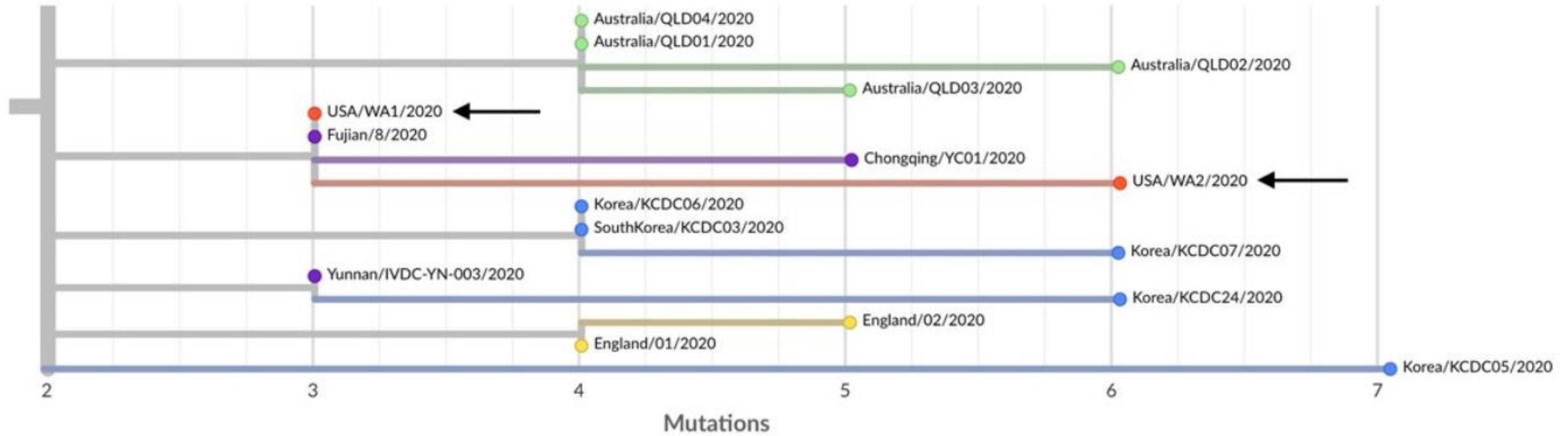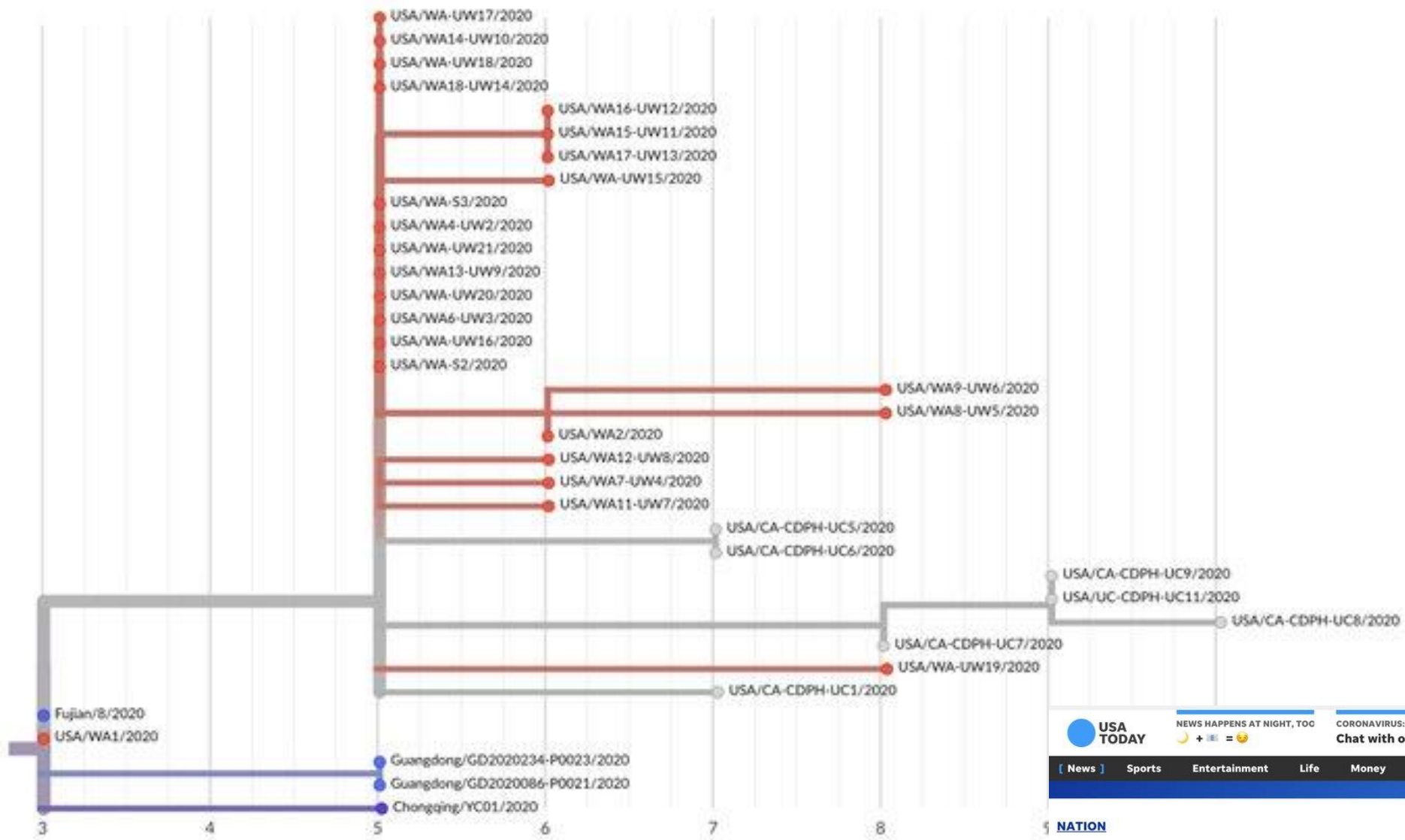
3/11/20; supports single introduction of virus

How COVID-19 Spreads?
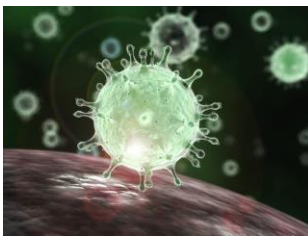
- There is much to learn about the newly emerged COVID-19, including how and how easily it spreads.
- Based on what is currently known, COVID-19 and SARS/MERS-CoV, spread is thought to occur mostly from person-to-person via respiratory droplets among close contacts.

- Close contact can occur while caring for a patient, including:
  - Being within approximately 6 feet (2 meters) of a patient with COVID-19 for a prolonged period of time.
  - Having direct contact with infectious secretions from a patient with COVID-19.
  - Infectious secretions may include sputum, serum, blood, and respiratory droplets.
  - If close contact occurs while not wearing all recommended PPE, healthcare personnel may be at risk of infection.
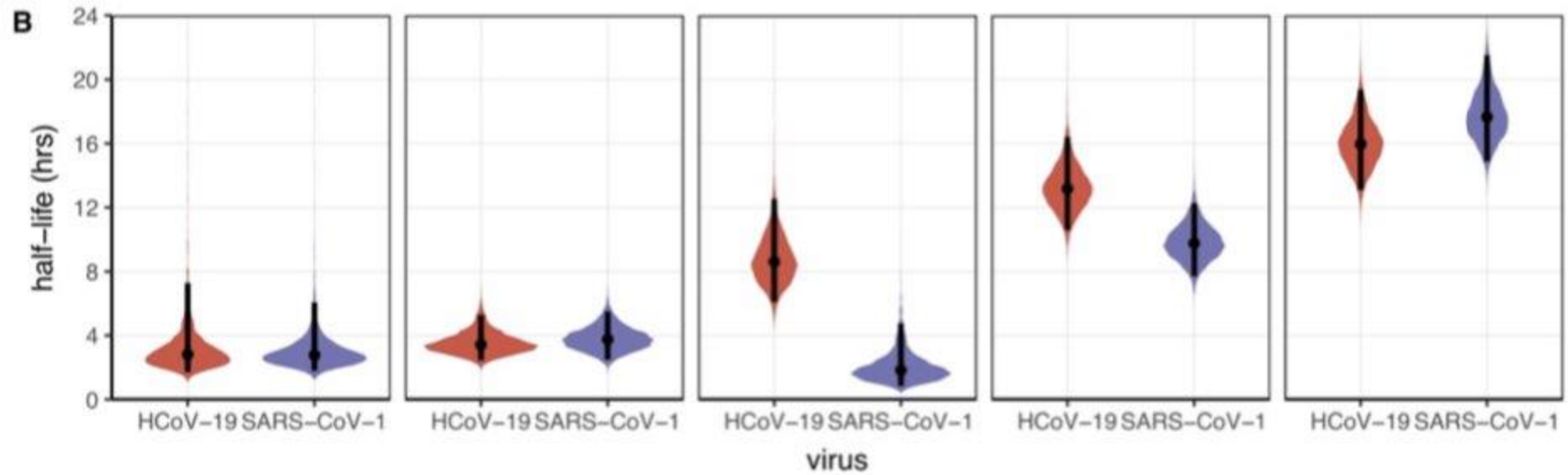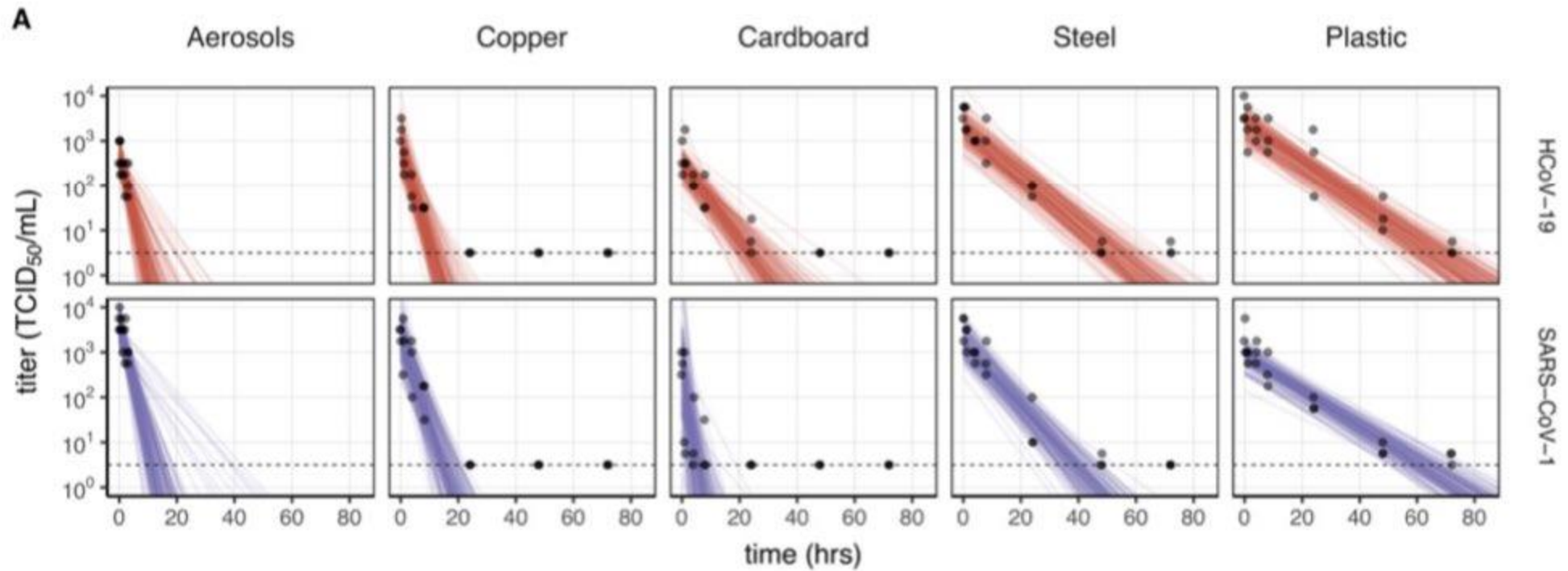
Symptoms of COVID-19
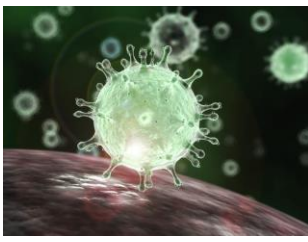
Symptoms may appear 2-14 days after exposure.

Common signs of infection

- **Fever**   - **Cough**   - **Shortness of breath**

- **Breathing difficulties**   - Diarrhea/GI   - Anosmia

Severe cases

- **Pneumonia**   - **Severe acute respiratory syndrome**
- **Kidney failure**   - **DEATH**

Treatment

-   **No vaccines or antiviral drugs available/approved**
-   **Hydroxychloroquine?**
-   **Supportive therapy and treatment of symptoms**

Disease Profile

- Illness Spectrum:
  - Asymptomatic ?
  - Mild respiratory viral illness (>80%)
  - Non-life-threatening pneumonia
  - Severe pneumonia/ ARDS/Cardiomyopathy
- Severe cases appear bimodal
- Incubation: 1-14 days (avg 5-6)
- Duration:
  - 2 weeks (mild)
  - 3-6 weeks (severe)
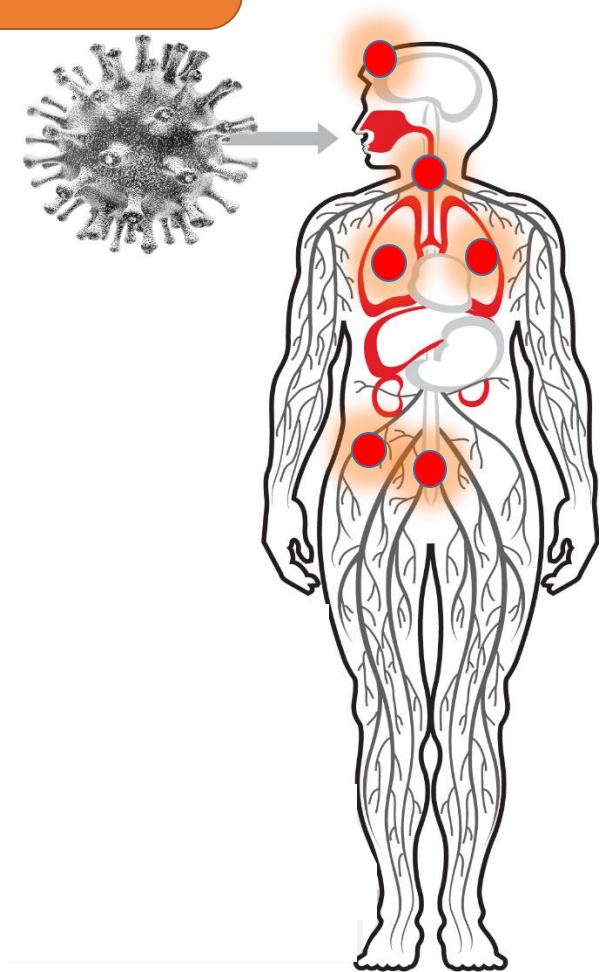
COVID-19 COMPARISON
CORONAVIRUS vs. COLD vs. FLU vs. ALLERGIES

SYMPTOMS	COVID-19*	COLD	FLU	ALLERGIES
Fever	Common (100F or higher)	Rare	High (100-102F, can last 3-4 days)	No
Headache	Sometimes	Rare	Intense	Sometimes
General aches, pains	Sometimes	Slight	Common, (often severe)	No
Fatigue, weakness	Sometimes	Slight	Common (often severe)	Sometimes
Extreme exhaustion	Sometimes (progresses slowly)	Never	Common (starts early)	No
Stuffy Nose	Rare	Common	Sometimes	Common
Sneezing	Rare	Common	Sometimes	Common
Sore Throat	Rare	Common	Common	No
Cough	Common	Mild to moderate	Common, (can become severe)	Sometimes
Shortness of breath	In more serious infections	Rare	Rare	Common
Runny nose	Rare	Common	Sometimes	Common
Diarrhea	Sometimes	No	Sometimes**	No

* Information is still evolving   ** Sometimes for children

OKLAHOMA State Department of Health   HEALTH   THD TULSA HEALTH Department

INFORMATION + UPDATES
CORONAVIRUS.HEALTH.OK.GOV
CALL CENTER: 877-215-8336 OR 2-1-1

Who gets (symptomatically) infected?
Based on >44,000 cases
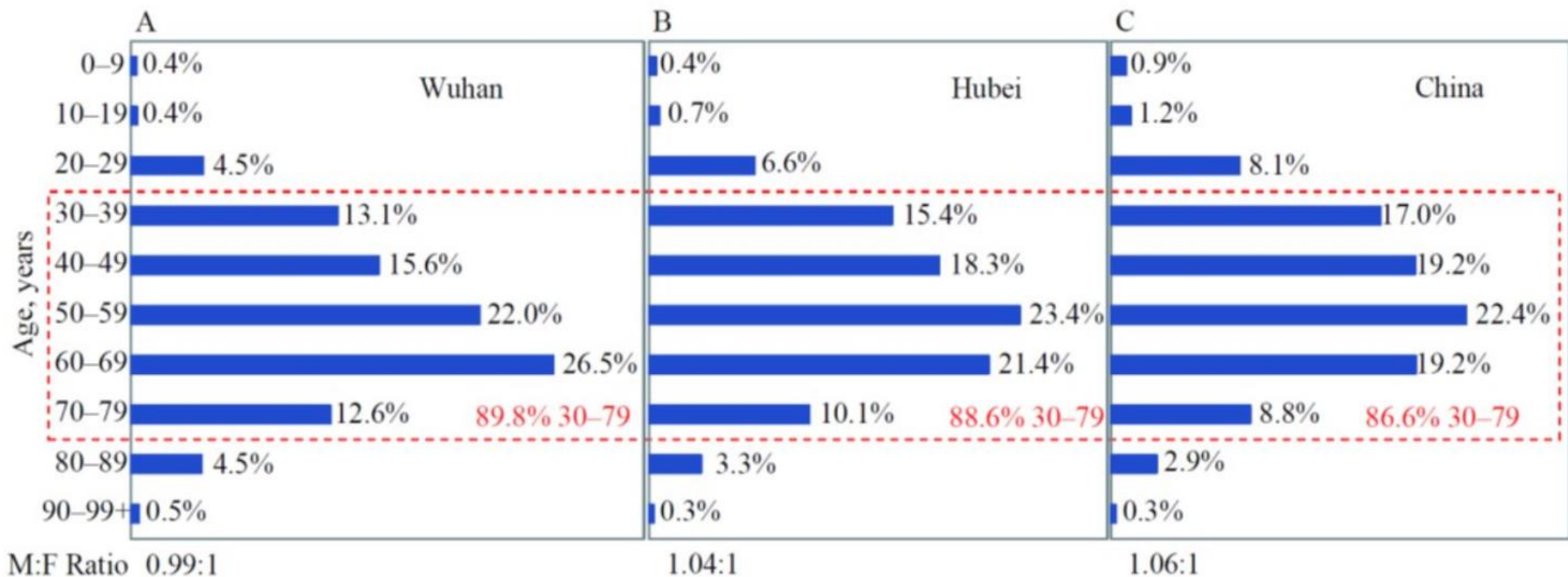
Coronavirus Pneumonia Emergency Response Epidemiology Team. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020[J]. China CDC Weekly, 2020, 2(8): 113-122

COVID-19 cases by Sex and Age

F   M

China CDC/NHC 2020
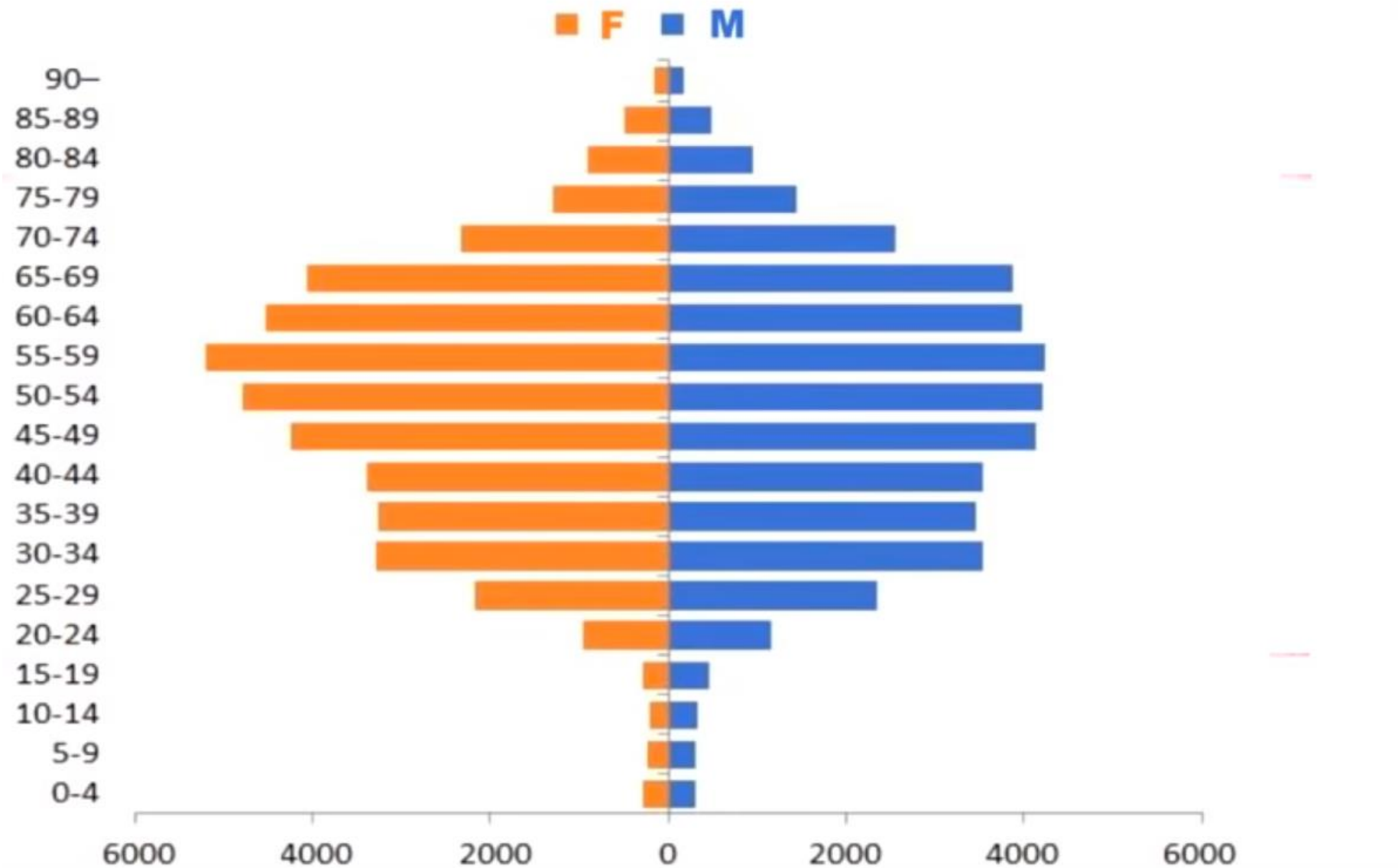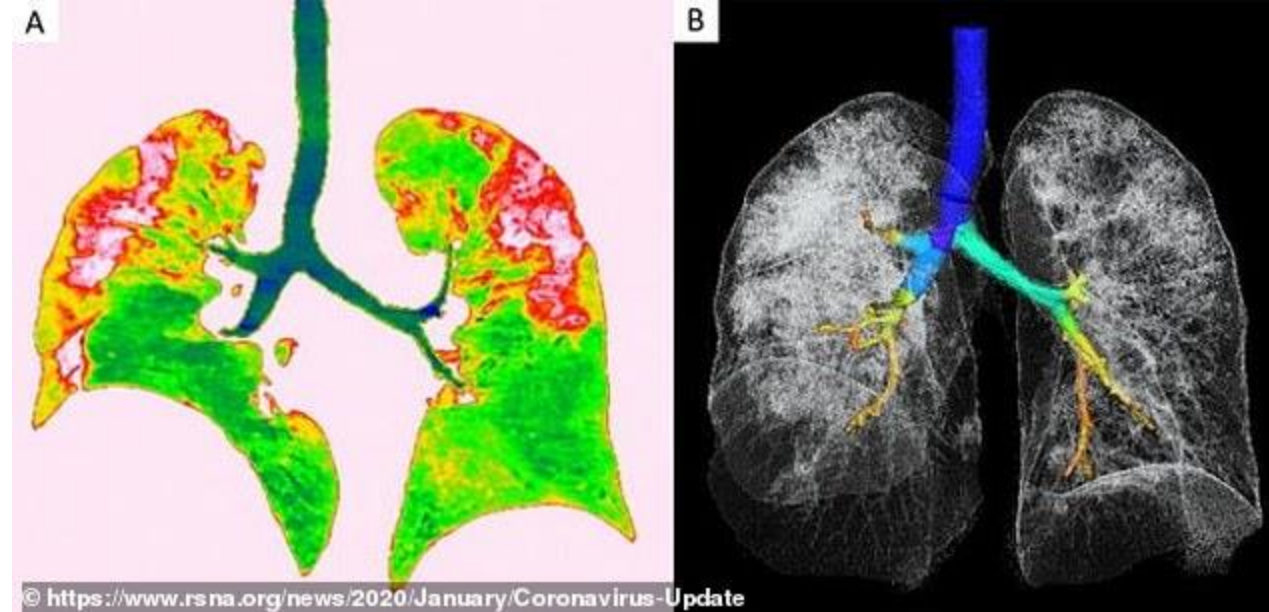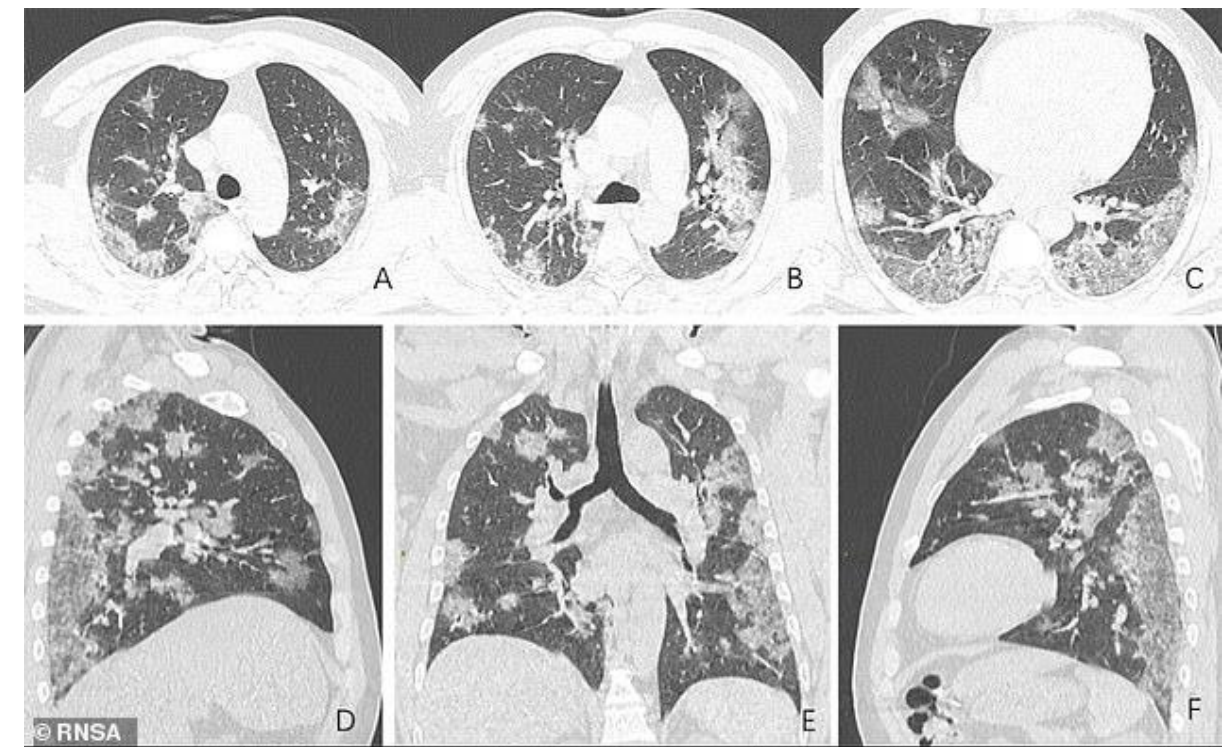
Risk Factors of COVID-19
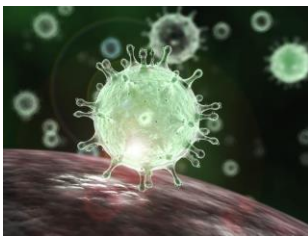
- Elderly persons above the age of 50 persons with underlying diseases like diabetes, Parkinson's disease, cardiovascular diseases.

- Health care workers caring for patients with the COVID-19.

- Based upon data collected from China:
  - ≤10 years: No deaths
  - Between 10-39 years: fatality 0.2%
  - Between 60-69 years: fatality 3.6%
  - Between 70-79 years: fatality 8.0%
  - ≥80 years: 14.8%

Flowchart to Identify and Assess 2019 Novel Coronavirus
For the evaluation of patients who may be ill with or who may have been exposed to 2019 Novel Coronavirus (2019-nCoV)

A. **Identify**
if in the *past 14 days since first onset of symptoms* a history of *either*

| Travel to China | ← OR → | Close contact with a person known to have 2019-nCoV illness* |

B. **AND the person has**
Fever or symptoms of lower respiratory illness
(e.g., cough or shortness of breath)

if both exposure and illness are present
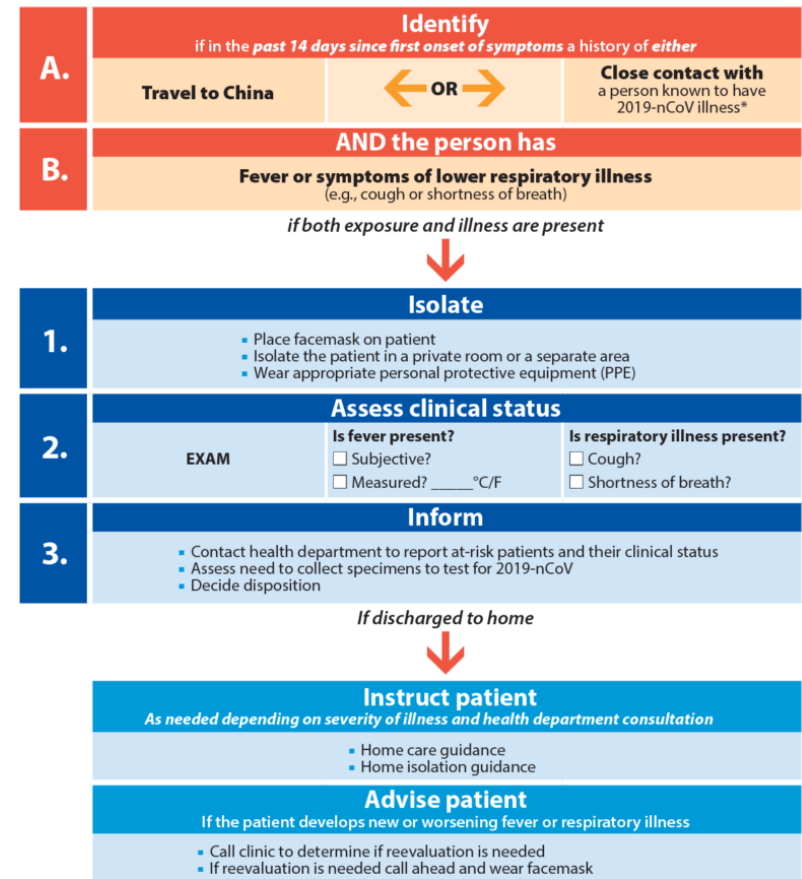
1. **Isolate**
- Place facemask on patient
- Isolate the patient in a private room or a separate area
- Wear appropriate personal protective equipment (PPE)

2. **Assess clinical status**
EXAM

Is fever present?
☐ Subjective?
☐ Measured? _____ °C/F

Is respiratory illness present?
☐ Cough?
☐ Shortness of breath?

3. **Inform**
- Contact health department to report at-risk patients and their clinical status
- Assess need to collect specimens to test for 2019-nCoV
- Decide disposition

If discharged to home

Instruct patient
As needed depending on severity of illness and health department consultation
- Home care guidance
- Home isolation guidance

Advise patient
If the patient develops new or worsening fever or respiratory illness
- Call clinic to determine if reevaluation is needed
- If reevaluation is needed call ahead and wear facemask

* Documentation of laboratory-confirmation of 2019-nCoV may not be possible for travelers or persons caring for patients in other countries. For more clarification on the definition for close contact see CDC's Interim Guidance for Healthcare Professionals: www.cdc.gov/coronavirus/2019-nCoV/hcp/clinical-criteria.html

Case fatality rate by age based on >44,000 confirmed cases in China
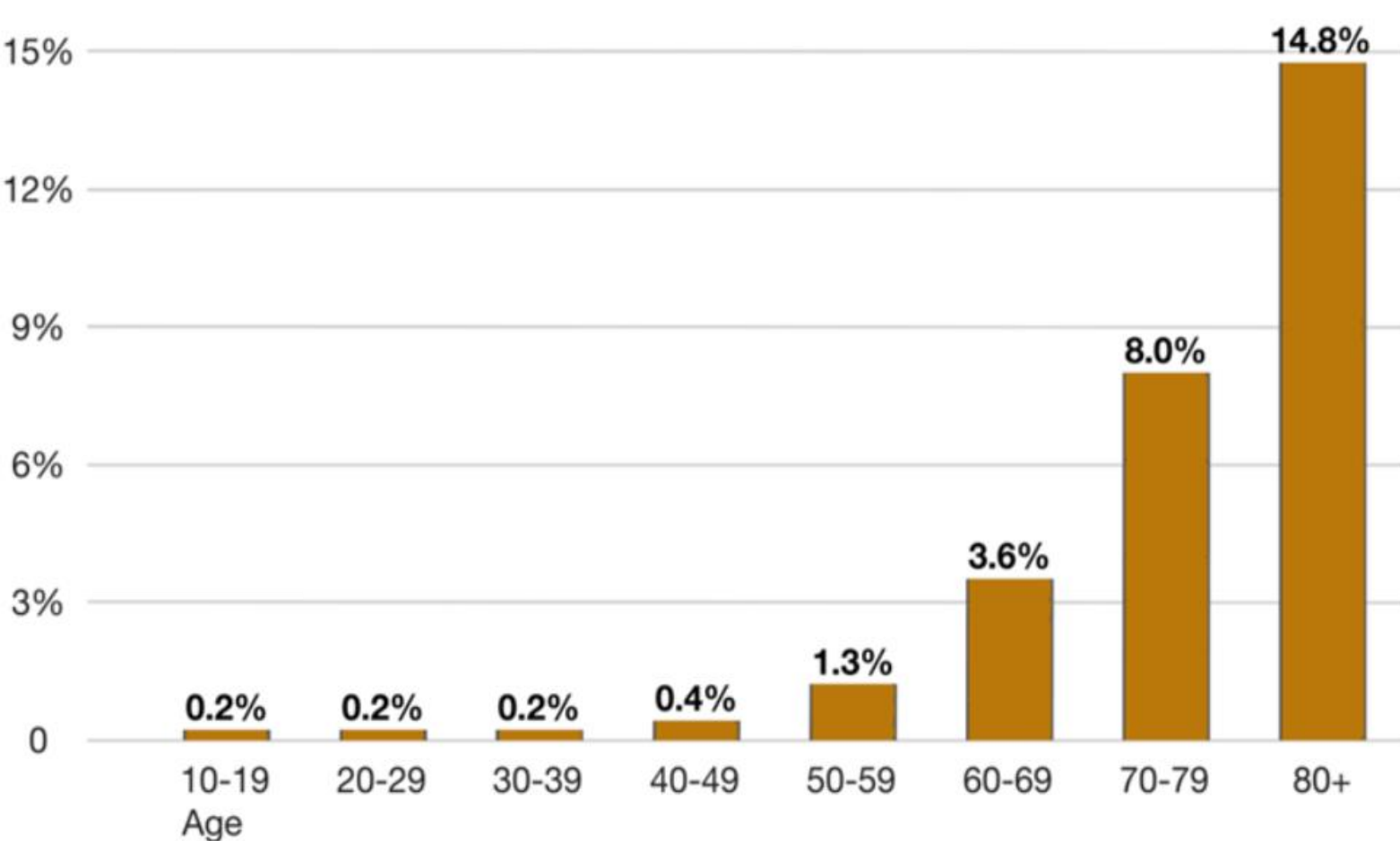
Overall CFR 2.3%

Males: 2.8
Females: 1.7

Hypertension, diabetes, cardiovascular disease, chronic respiratory disease, cancer: 5.6-10.5%

No deaths in kids 0-9 years of age

Cases are in the hospital for a long time before they succumb to infection (6-41 days)

Coronavirus Pneumonia Emergency Response Epidemiology Team. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020[J]. China CDC Weekly, 2020, 2(8): 113-122

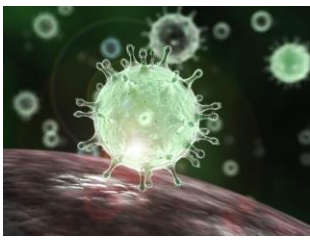# Children can catch SARS-COV-2, they just aren't as likely to show symptoms

Table 1: Demographic and clinical characteristics of cases by contact-based vs. symptom-based surveillance.

Variable	Value	Contact-based surveillance (N=87)	Symptom-based surveillance (N=292)	Unknown/other (N=12)	Total (N=391)
sex	female	63 (72.4%)	131 (44.9%)	10 (83.3%)	204 (52.2%)
	male	24 (27.6%)	161 (55.1%)	2 (16.7%)	187 (47.8%)
age	0-9	13 (14.9%)	6 (2.1%)	1 (8.3%)	20 (5.1%)
	10-19	5 (5.7%)	6 (2.1%)	1 (8.3%)	12 (3.1%)
	20-29	11 (12.6%)	23 (7.9%)	0 (0.0%)	34 (8.7%)
	30-39	15 (17.2%)	71 (24.3%)	1 (8.3%)	87 (22.3%)
	40-49	9 (10.3%)	49 (16.8%)	2 (16.7%)	60 (15.3%)
	50-59	10 (11.5%)	63 (21.6%)	1 (8.3%)	74 (18.9%)
	60-69	20 (23.0%)	60 (20.5%)	6 (50.0%)	86 (22.0%)
	70+	4 (4.6%)	14 (4.8%)	0 (0.0%)	18 (4.6%)
severity	mild	18 (20.7%)	82 (28.1%)	2 (16.7%)	102 (26.1%)
	moderate	66 (75.9%)	180 (61.6%)	8 (66.7%)	254 (65.0%)
	severe	3 (3.4%)	30 (10.3%)	2 (16.7%)	35 (9.0%)
symptomatic	no	17 (19.5%)	8 (2.7%)	0 (0.0%)	25 (6.4%)
	yes	70 (80.5%)	284 (97.3%)	12 (100.0%)	366 (93.6%)
fever	no	25 (28.7%)	34 (11.6%)	2 (16.7%)	61 (15.6%)
	yes	62 (71.3%)	258 (88.4%)	10 (83.3%)	330 (84.4%)

The R_0 of SARS-CoV-19 compared with influenza A

Year/disease	Moniker/strain	Studies (n)	Median R_0 (IQR)
1918 pandemic	Spanish / H1N1	24	1.80 (1.47-2.27)
1957 pandemic	Asian / H2N2	6	1.65 (1.53-2.27)
1968 pandemic	Hong Kong / H3N2	4	1.80 (1.56-1.85)
2009 pandemic	Swine / H1N1	57	1.46 (1.30-1.70)
Seasonal influenza	The flu	24	1.28 (1.19-1.37)
2020 COVID-19	**SARS-CoV-19**	**14**	**2.79 (1.63-3.95)**

Biggerstaff et al. BMC Infectious Diseases 2014, 14:480

Liu et al., J. Trav. Med. 27:2, 2020
https://doi.org/10.1093/jtm/taaa021

COVID-19 MYTHS vs. REALITY

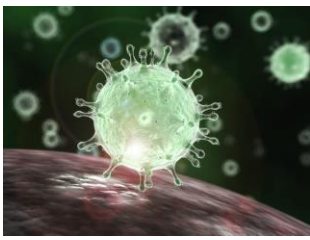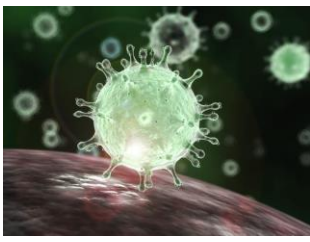| Question	Answer	What is the correct way
Are Hand Dryers effective in killing the virus?	NO	Frequently wash hands and/or clean hands with alcohol-based hand rub. Once cleaned dry them thoroughly by using paper towel or warm hand dryer
Can ultraviolet (UV) disinfection lamp kill the virus?	NO	UV lamps should NOT be used to sterilize hands or other areas of the skin as UV radiation can cause skin irritation
How effective are thermal scanners in detecting people infected with the virus?	Thermal scanners are effective in detecting fever	Thermal scanners cannot detect who are infected but are not yet sick with fever. This is because it takes 2-14 days before people who are infected become sick and develop fever
Can spraying alcohol or chlorine all over the body kill the virus?	NO	Spraying such substances can be harmful to clothes or mucous membranes (i.e., eyes, mouth). Beware that both alcohol and chlorine can be useful to disinfect surfaces, but have to be used under appropriate recommendations
Is it safe to receive a letter or a package from China?	YES	It is safe. People receiving packages from China are not at risk for contracting the virus. Previous analysis has shown that the coronaviruses do not survive long on objects, such as letters or packages

COVID-19 MYTHS vs. REALITY

Question	Answer	What is the correct way
Can pets at home spread the virus?	?	It is a good idea to wash hands with soap and water after contact with pets. This protects against various common bacteria such as E. coli and Salmonella that can pass between pets and humans
Do vaccines against pneumonia protect against the novel coronavirus?	NO	Vaccines against pneumonia, such as pneumococcal vaccine or Haemophilus influenza type B (Hib), do not provide protection against the new coronavirus
Can regularly rinsing your nose with saline help prevent infection with the virus?	NO	There is no evidence that regular rinsing the nose with saline has protected people from infection with the new coronavirus. There is some limited evidence that rinsing the nose with saline can help people recover more quickly from common cold
Can gargling mouthwash protect from infection from this virus?	NO	There is no evidence that using mouthwash will protect from infection from the new coronavirus

COVID-19 MYTHS vs. REALITY

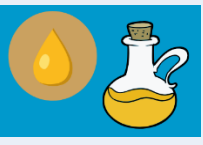| Question	Answer	What is the correct way
Can eating garlic help prevent infection with this virus?	NO	Garlic is a healthy food that may have some antimicrobial properties. However, there is no evidence from the current outbreak that eating garlic has protected people from the new coronavirus
Does putting on sesame oil block the new coronavirus from entering the body?	NO	Sesame oil does not kill the new coronavirus
Does the new coronavirus affect older people, or are younger people also susceptible?	People of all ages can be infected	Older people, and people with pre-existing medical conditions, such as asthma, diabetes, heart disease, appear to be more vulnerable to becoming severely sick with this virus. It is advised that people of all ages take proper precautions such as good hand and respiratory hygiene
Are antibiotics effective in preventing & treating this virus?	NO	Antibiotics do not work against viruses, only bacteria. The new coronavirus is a virus, therefore, antibiotics should not be used as a means to prevention or treatment. However, if hospitalized for the 2019-nCoV, antibiotics can be used to treat bacterial co-infections
Are there any specific medicines to prevent or treat this virus?	?	Some specific treatments are under investigation, and will be tested through clinic trial

What Do All These Things Mean?

- **Community spread** means people have been infected with the virus in an area, including some who are not sure how or where they became infected.

- **Social distancing** means remaining out of congregate settings, avoiding local public transportation (e.g., bus, trains, ride share), and maintaining distance (approximately 6 feet) from others.

- **Congregate settings** are public places where close contact with others may occur, such as shopping centers, theaters, stadiums, workplaces and schools.

- **Incubation period** refers to the time from exposure to an infection to the onset of symptoms. Different diseases have different incubation periods.

- **Isolation** separates those with who **are sick** with a contagious disease from those who are not to avoid transmission.

- **Quarantine** separates and restricts movement of people who **may have been exposed** to a contagious disease, but **do not show symptoms.**

- **Epidemic** is a rapid increase in the number of cases of a disease above what is normally expected in a specific population.

- **Pandemic** refers to a global epidemic or one that has spread over several countries or continents, affecting many people.

- **Outbreak** carries the same definition as epidemic, but it is used for a more limited geographic area.

■ **Antivirals, monoclonal antibodies and other agents are being tested**

- **Remdesivir (nucleotide analogue)**, has shown promise against coronaviruses in animal models

- **Kaletra (lopinavir/ritonavir) (protease inhibitors)** and **interferon-beta** have been used investigationally for other coronaviruses

- Other **broad-spectrum antivirals**

- **Chloroquine**

- **Drug screening and targeted drug design**

- **Monoclonal antibodies being isolated and tested**

A Seattle Intensivist's One-pager on COVID-19

Nick Mark, MD
🐦 @nickmmark

Nomenclature

Infection: Coronavirus Disease 2019 a.k.a. COVID-19
Virus: SARS-CoV-2, 2019 Novel Coronavirus
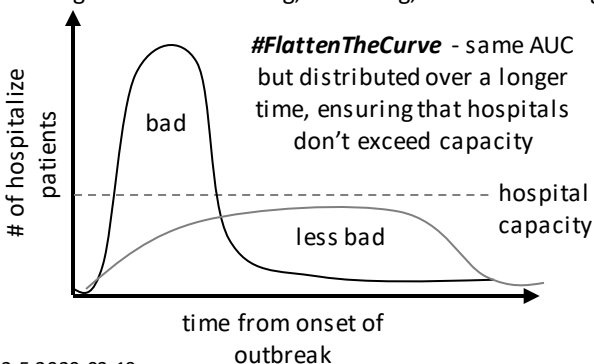NOT "Wuhan Virus" NOT "China Virus"

Biology

- 30 kbp, +ssRNA, enveloped coronavirus
- Likely zoonotic infection; source/reservoir unclear (Bats? / Pangolins? → people)
- Now spread primarily *person to person*;
  - Can be spread by asymptomatic carriers!
- Viral particles enter into lungs via *droplet* nuclei
  - CDC/WHO recommend AIRBORNE isolation
- Viral S spike binds to ACE2 on type two pneumocytes
- Effect of ACE/ARB is unclear; not recommended to change medications at this time.
- Other routes of infection (contact, enteric) possible but unclear if these are significant means of spread

Epidemiology

- Attack rate = 30-40% (China)
- R_0 = 2-4
- Case fatality rate (CFR) = 2.3% (China)
- Incubation time = 3-14 days (up to 15 days)
- Viral shedding – median 20 days (max 37 days)
- Breakdown of disease severity
  - **80%** Non-severe (mild pneumonia)
  - **15%** Severe (hypoxia, respiratory distress)
  - **5%** Critical (respiratory failure)

Disease clusters: SNFs, Conferences, other
Strategies: contact tracing, screening, social distancing

#FlattenTheCurve - same AUC but distributed over a longer time, ensuring that hospitals don't exceed capacity

Diagnosis/Presentation

Symptoms

- 65-80% **cough**
- 45% **febrile** on presentation (85% febrile during illness)
- 20-40% dyspnea
- 15% URI symptoms
- 10% GI symptoms

Labs

- CBC: Leukopenia & **lymphopenia** (80%+)
- BMP: ↑BUN/Cr
- LFTs: ↑AST/ALT/Tbili
- ↑ D-dimer, ↑ CRP, ↑ LDH
- ↑ IL-6, ↑ Ferritin
- ↓ Procalcitonin
  PCT may be high w/ superinfxn

Imaging – (imaging is NOT diagnostic)

- CXR: hazy **bilateral**, **peripheral** opacities
- CT: **ground glass opacities** (GGO), crazy paving, consolidation, *rarely may be unilateral*
- POCUS: numerous B-lines, pleural line thickening, consolidations w/ air bronchograms
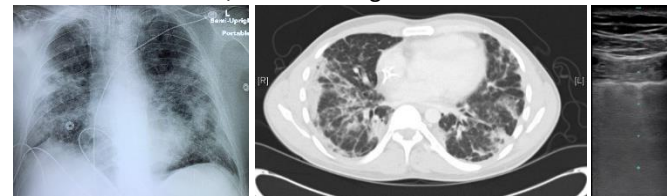
Isolation

- Phone call is the best isolation (e.g. move to telemed)
- Place patient in mask, single room, limit/restrict visitors

Precautions

- **In correct sequence**: STANDARD + CONTACT (double glove) + either AIRBORNE (for aerosolizing procedures: intubation, extubation, NIPPV, suctioning, etc) or DROPLET (for everything else; *ideally* airborne)
- N95 masks must be fit tested; wear eye protection
- PPE should be donned/doffed with trained observer
- Hand hygiene: 20+ seconds w/ soap/water or alcohol containing hand gel

Treatment

- Isolate & send PCR test early (may take **days** to result)
- GOC discussion / triage
- Notify DOH, CDC, etc
- **Fluid sparing** resuscitation
- Avoid NSAIDS; use acetaminophen/paracetamol for fever
- ± empiric antibiotics
- Intubate early under controlled conditions: **RSI**, no bagging, **VL**, have suction & capnography connected to avoid circuit breaks.
- Avoid HFNC or NIPPV (aerosolizes virus) unless *individualized* reasons exist (e.g. COPD, DNI status, etc); consider **helmet mask** interface (if available) if using NIPPV; avoid nebulizers
- Mechanical ventilation for ARDS
  - **LPV** per ARDSnet protocol
  - 7 P's for good care of ARDS patients: e.g **PEEP**/**Paralytics**/**Proning**/inhaled **Prostacyclins**, etc
  - ? High PEEP ladder may be better
  - ? ECMO in select cases (unclear who)
- Consider using POCUS to monitor/evaluate lungs
- Investigational therapies: consider clinical trial enrollment
  - Remdesivir - not approved; used investigationally
  - Hydroxychloroquine (HCQ) – available; limited evidence
  - Chloroquine (CQ) – available; limited evidence
  - Tocilizumab – available; investigational for pt in **shock**
  - Lopinavir/ritonavir – available; recent negative RCT
  - Oseltamivir - **not** recommended (no evidence of efficacy)
  - Corticosteroids – **not** recommended (? harmful)

Prognosis
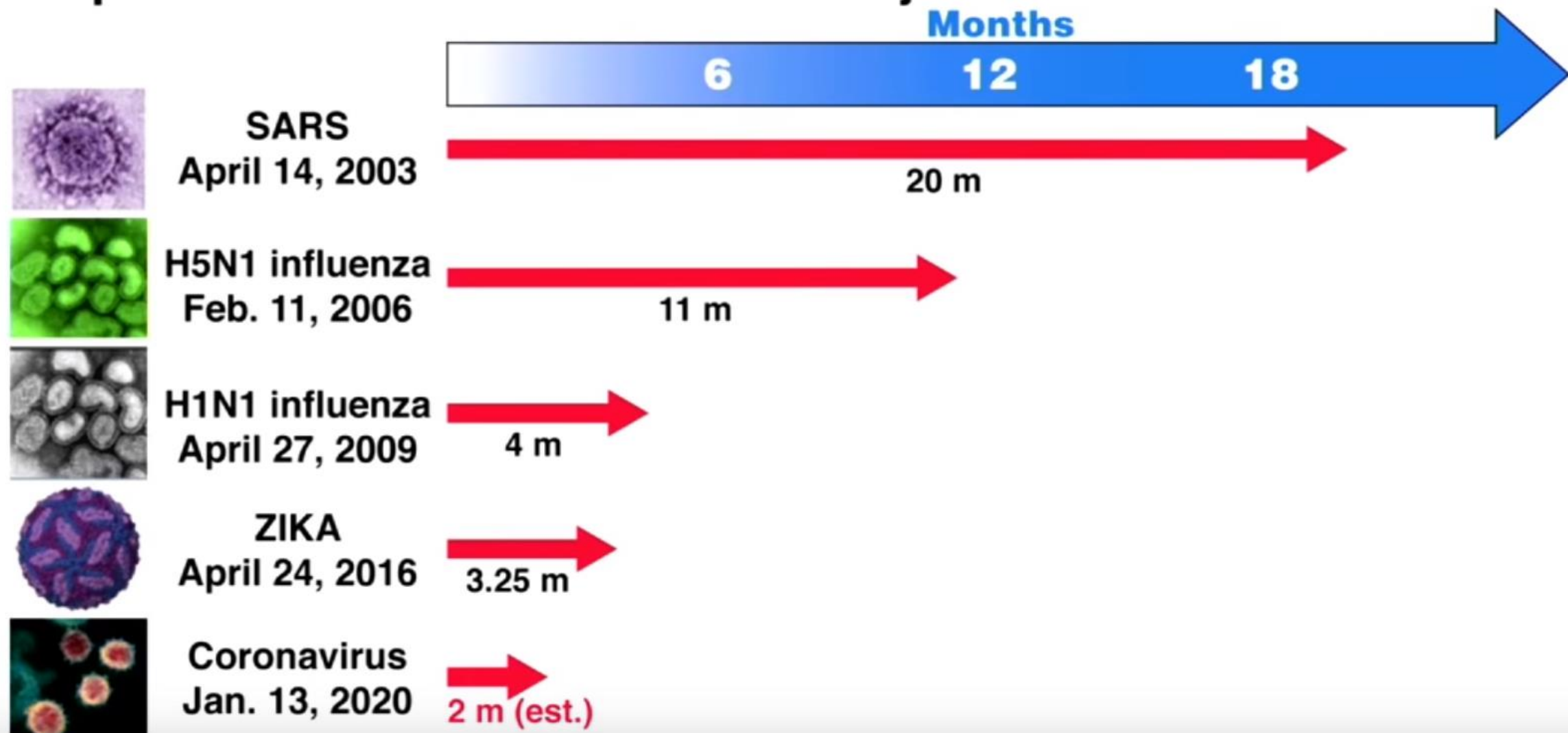
- **Age** and **comorbidities** (**DM**, **COPD**, **CVD**) are significant predictors of poor clinical outcome; admission **SOFA** score also predicts mortality.
- Lab findings predict mortality (↑ d-dimer, ferritin, troponin, cardiac myoglobin)
- Expect prolonged MV (median
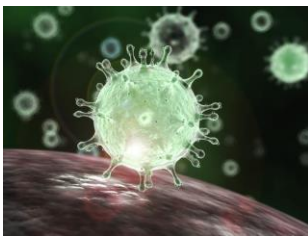- Watch for complications: Secondary infection (VAP), **Cardiomyopathy**
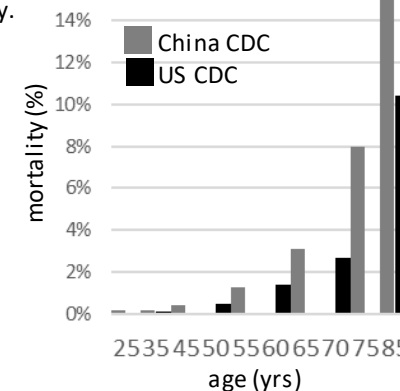
Sequence Selection to 1st Human Injection

COVID-19 Summary

- COVID-19 was first reported in Wuhan, China on December 31, 2019.
- This virus jumped the animal species and found humans as a good host.
- China provided the gene sequence of the COVID-19 on January 10, 2020.
- China changed its counting criteria to include clinical diagnoses in addition to lab-confirmed cases on February 12, 2020 resulting in an increase in the total case count.

Reduce your risk of coronavirus infection:

Clean hands with soap and water or alcohol-based hand rub

Cover nose and mouth when coughing and sneezing with tissue or flexed elbow

Avoid close contact with anyone with cold or flu-like symptoms

Thoroughly cook meat and eggs

Avoid unprotected contact with live wild or farm animals

World Health Organization

Report coronavirus cases

| Now | Yesterday | | | | | Search: [   ] |

| All | Europe | North America | Asia | South America | Africa | Oceania |

Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop
World	2,035,294	+37,434	130,712	+4,112	503,386	1,401,196	51,414	261	16.8		
USA	618,893	+5,007	27,086	+1,039	47,069	544,738	13,473	1,870	82	3,142,244	9,493
Spain	177,633	+3,573	18,579	+324	70,853	88,201	7,371	3,799	397	600,000	12,833
Italy	165,155	+2,667	21,645	+578	38,092	105,418	3,079	2,732	358	1,117,404	18,481
France	143,303		15,729		28,805	98,769	6,730	2,195	241	333,807	5,114
Germany	133,154	+944	3,592	+97	72,600	56,962	4,288	1,589	43	1,317,887	15,730
UK	98,476	+4,603	12,868	+761	N/A	85,264	1,559	1,451	190	398,916	5,876
China	82,295	+46	3,342	+1	77,816	1,137	113	57	2		
Iran	76,389	+1,512	4,777	+94	49,933	21,679	3,643	909	57	299,204	3,562
Turkey	65,111		1,403		4,799	58,909	1,809	772	17	443,626	5,260

Now | Yesterday

Search:

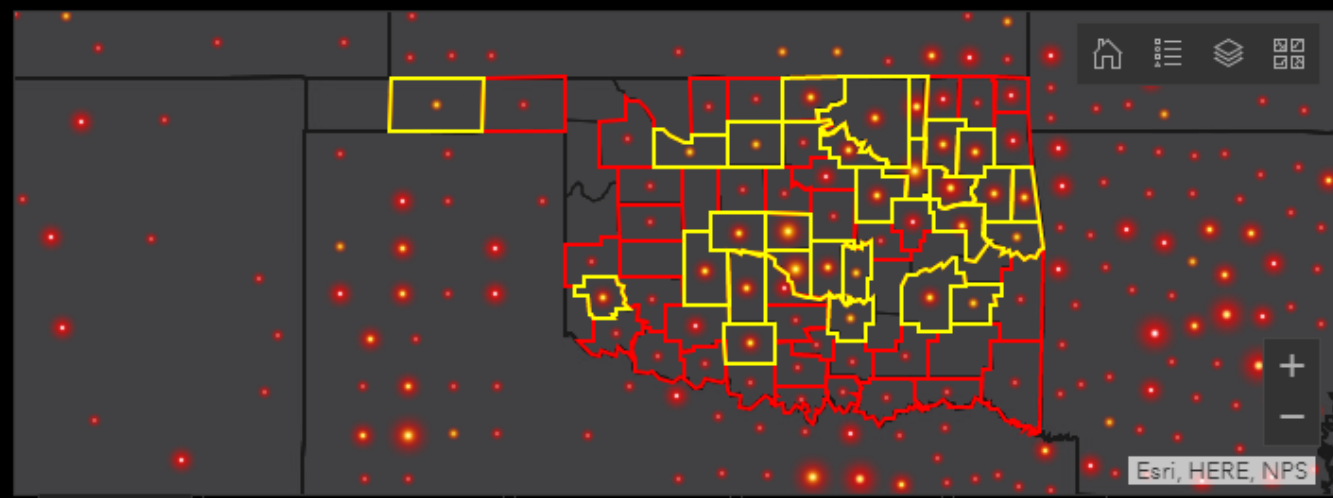| USA State	Total Cases	New Cases	Total Deaths	New Deaths	Active Cases	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop
USA Total	618,893	+5,007	27,086	+1,039	544,738	1,870	82	3,142,244	9,493
New York	203,123		11,586	+752	167,650	10,354	591	499,143	25,443
New Jersey	68,824		2,805		64,748	7,749	316	131,219	14,774
Massachusetts	28,163		957		26,477	4,123	140	126,551	18,528
Michigan	27,001		1,768		24,790	2,712	178	76,014	7,634
Pennsylvania	26,490	+1,025	696		25,144	2,071	54	137,584	10,756
California	25,803	+267	790	+8	23,663	659	20	215,400	5,502
Illinois	23,247		868		22,329	1,813	68	110,616	8,627
Florida	22,081	+453	591	+20	20,846	1,072	29	205,413	9,972
Louisiana	21,518		1,013		20,455	4,614	217	118,422	25,393
Texas	15,107	+94	350	+5	12,177	542	13	146,467	5,253
Georgia	14,987	+409	552	+28	14,404	1,455	54	64,090	6,224
Connecticut	13,989		671		13,253	3,906	187	45,841	12,799

Coronavirus Disease 2019 Status

Country Selector: All Countries

United States

Positive

608,590

Deaths

26,011

Death Rate: 4.27%

United States | International

Confirmed Cases by State

New York
Positive: 203,377 | Deaths: 10,842

**New Jersey**
Positive: 68,824 | Deaths: 2,805

Massachusetts
Positive: 28,163 | Deaths: 957

States / Territories

53

United States

Esri, HERE, NPS

COVID-19 | CDC Situation Summary | Impact Planning | WHO Statistics | Resources

Oklahoma COVID-19 Timeline

- Positive
- Deaths
- Hospitalizations

OK Timeline

Oklahoma
*Counts Only Include Oklahoma

Positive

2,263

Deaths

123

Hospitalized

510

Death Rate: 5.44%

Updated at 11:00 on April 15, 2020
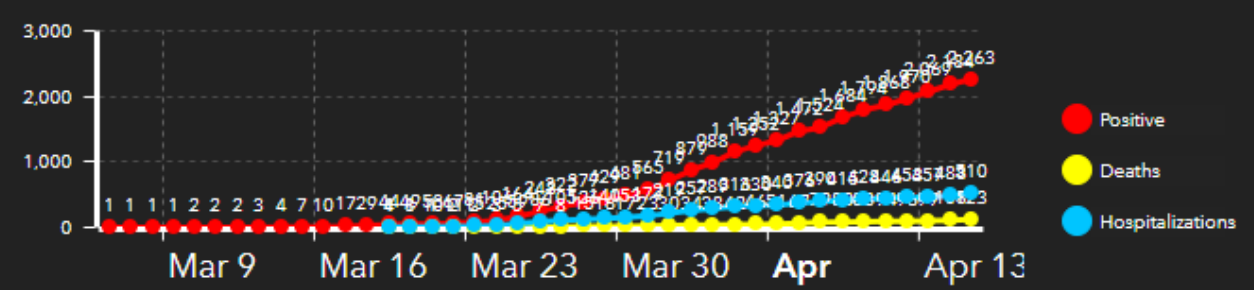
Oklahoma Cases by County

OKLAHOMA
Positive: 483 | Deaths: 22

TULSA
Positive: 362 | Deaths: 21

CLEVELAND
Positive: 294 | Deaths: 18

Counties

64

THD
TULSA HEALTH
Department

English

FOOD SAFETY   PERSONAL AND FAMILY HEALTH   COMMUNITY HEALTH   HEALTHY LIFESTYLES   ENVIRONMENTAL HEALTH

🇬🇧 English

Tulsa County COVID-19 Cases
(Last updated: 4/15/2020 | Data Source: Acute Disease Service, Oklahoma State Department of Health)

Current Active Cases
315

Total Confirmed Cases
363

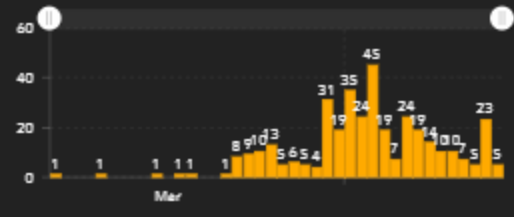Tulsa County Total   OK State Total   USA Total

Total Recovered
27

Daily Case Counts

60
40
20
0

1   1   1 1 1   1   8 9 10 13   5 6 5 4   31 35   24 19   24 19   14 10 7   23   5

Mar

45

Daily Counts   Timeline

Total Deaths
21

Cases by Age Groups
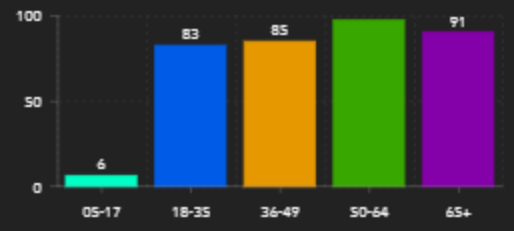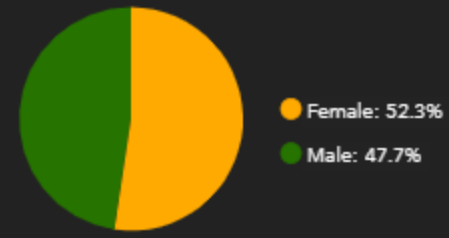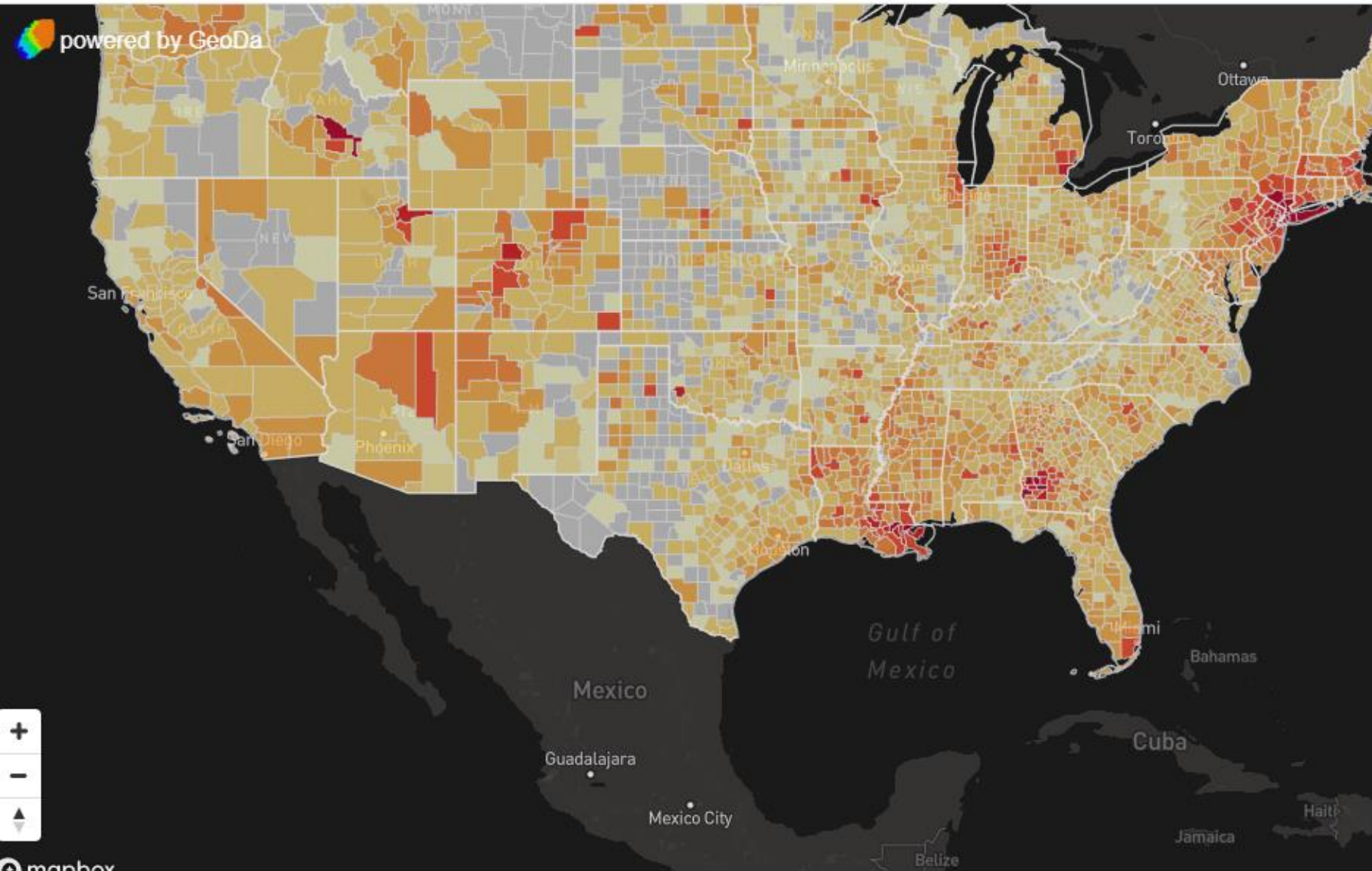
100

50

0

6   83   85   99   91

05-17   18-35   36-49   50-64   65+

Total Exposure Type

- Community 35% Spread * :
- Investigation 45.2% Ongoing :
- Link to 10.7% Confirmed Case :
- Travel 9.1% Associated :

* Community spread is defined as the spread of an illness for which the source of infection is unknown.

Cases by Gender

- Female: 52.3%
- Male: 47.7%

unacast.
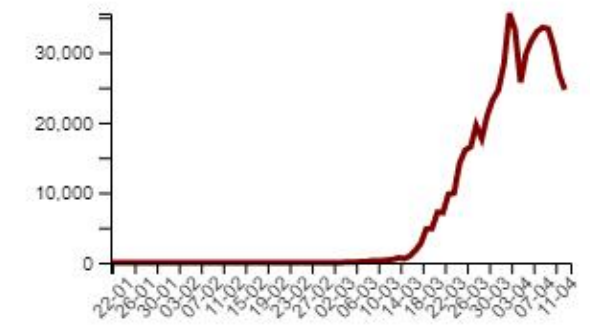
Q Search for state and county

Last updated human mobility data: Apr 15, 2020, 9:01:06 AM
Last updated COVID-19 cases: Apr 15, 2020, 3:27:05 AM
For more details on data accuracy please refer to our methodology section.
Explore this report in Tableau
unacast-covid-scoreboard@1.1.0-2248338

United States   C →

606,400 confirmed cases

40 - 55% Reduction in Average Mobility (Based on Distance Traveled)   C →

60 - 65% Reduction in Non-Essential Visits   C →

74 - 82% Decrease in Encounters Density Compared to National Baseline   C →
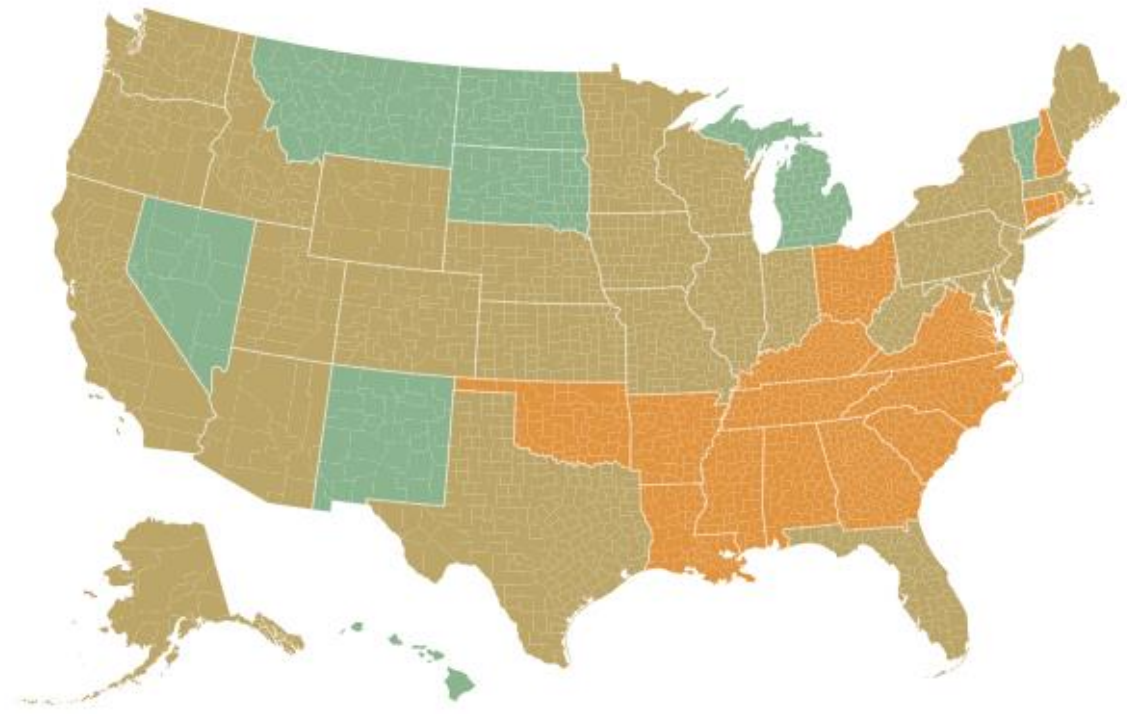
States Counties   ↓↑

Montana   B ↗

Nevada   B →

South Dakota   B ↗

A
B
C
D
F

⦿ Change in Average Mobility (Based on Distance Traveled)   ○ Change in Non-Essential Visits   ○ Difference in Encounter Density

• Reported COVID-19 Cases   ● COVID-19 Events

90%

🌿 IHME   COVID-19 Projections   GHDX   VIZ HU

COVID-19 projections assuming full social distancing through May 2020

Last updated April 13, 2020 (Pacific Time).

FAQ | Update Notes | Article

All dates below are calculated based on the local time of the selected location.

Oklahoma ∨

Government-mandated social distancing ⓘ

Our projections assume that Oklahoma will implement 3 out of 4 social distancing measures by April 19, 2020.

As of our most recent update on April 13, 2020, Oklahoma had only implemented 2 out of 4 social distancing measures. See our FAQ page for details.

🏠	🏫	🏪	✈
Not implemented	**March 17, 2020**	**April 1, 2020**	**Not implemented**
Stay at home order	Educational facilities closed	Non-essential services closed	Travel severely limited

Hospital resource use ⓘ

15 days until peak resource use on

April 30, 2020

Resources needed for COVID-19 patients on peak date

All beds needed		All beds available		Bed Shortage
882 beds	→	**5,457** beds	→	**0** beds
ICU beds needed		ICU beds available		ICU Bed Shortage
218 beds	→	**467** beds	→	**0** beds

Invasive ventilators needed

192 ventilators

COVID Projections Tracker

Historical model projections for a given country or region (currently only supports IHME projections)
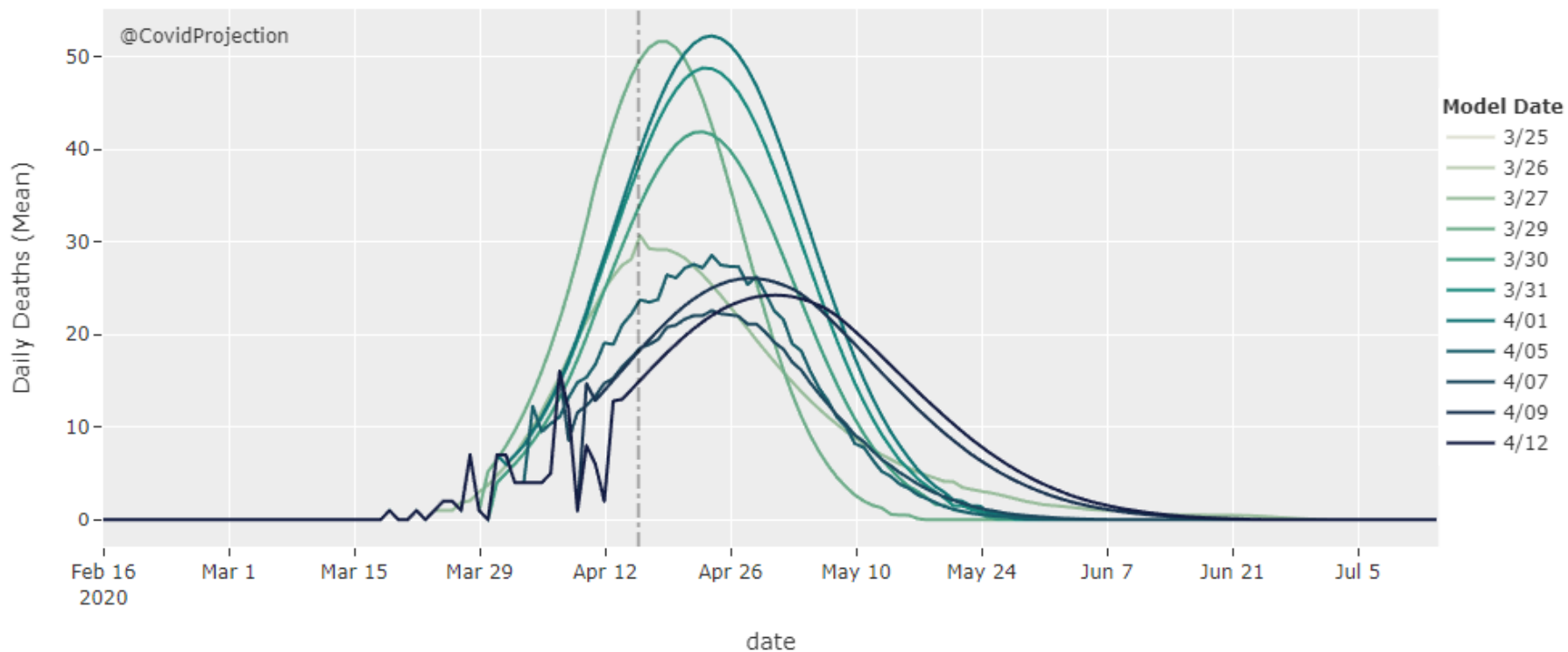
Filters

Model

IHME ✕ ▼

Location

Oklahoma ✕ ▼

Metric

Daily Deaths (Mean) ✕ ▼

Model Date

03/25/2020 →

04/15/2020

IHME - Oklahoma - Daily Deaths (Mean)

@CovidProjection

Daily Deaths (Mean)

Model Date
— 3/25
— 3/26
— 3/27
— 3/29
— 3/30
— 3/31
— 4/01
— 4/05
— 4/07
— 4/09
— 4/12

Feb 16 2020   Mar 1   Mar 15   Mar 29   Apr 12   Apr 26   May 10   May 24   Jun 7   Jun 21   Jul 5

date

COVID-19 RESPONSE SUMMARY

MISSION

Oklahoma State University

Building on its **land-grant** heritage, Oklahoma State University promotes learning, advances knowledge, enriches lives, and stimulates economic development through teaching, research, extension, outreach and creative activities.

OSU Medicine

Oklahoma State University Medicine educates and trains osteopathic physicians, research scientists, and other health care professionals with an emphasis on serving **rural and underserved Oklahoma**.

OSU MEDICINE: OVERVIEW
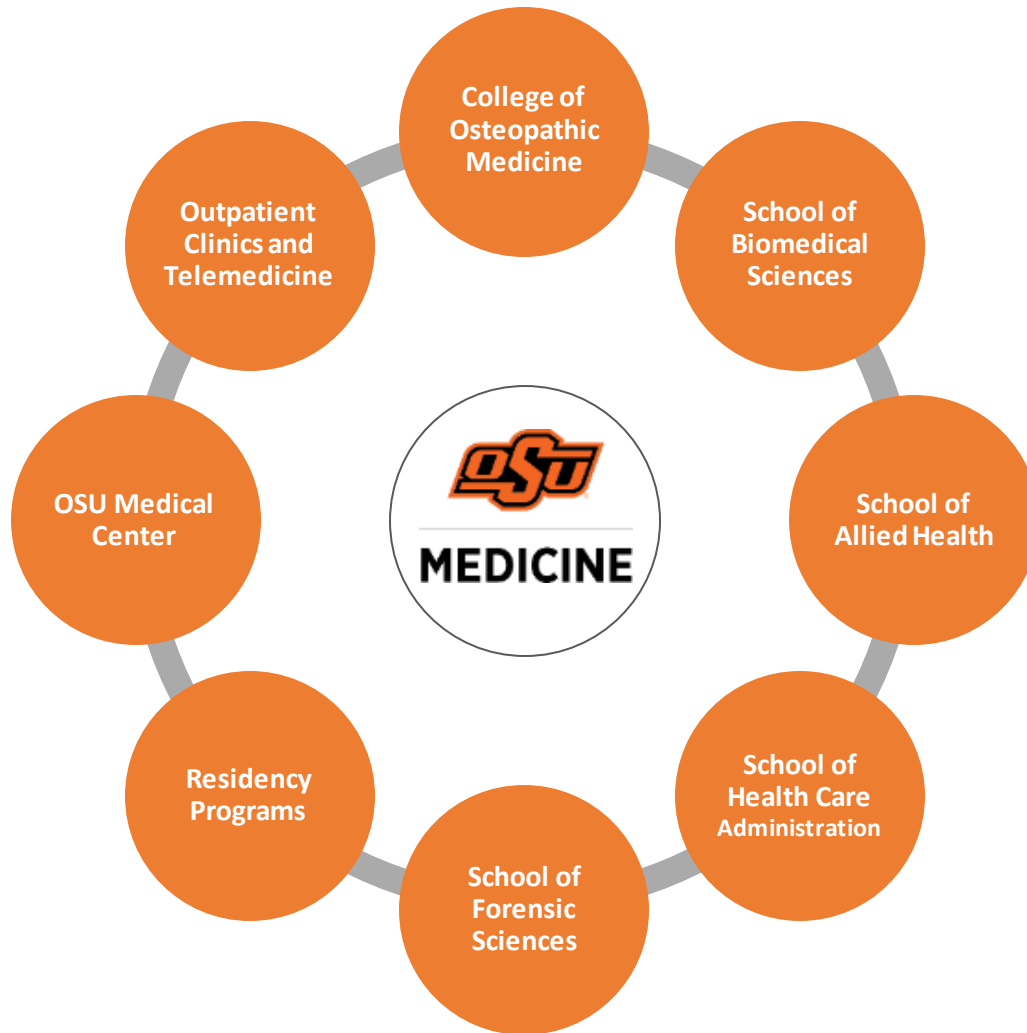
Education Provider

- Over 1,000 medical and professional students
- Osteopathic medicine, master's, doctorate and certificate academic programs

Residency Programs

- 9 residency training sites across the state
- 340+ residents training under OSU Medicine's purview

Health Care Delivery System

- OSU Medical Center
- 28 outpatient clinics
- Telemedicine network

Research Enterprise

- Clinical research
- Biomedical research
- Public health research

OSU MEDICINE RESPONDS TO COVID-19

- **Statewide Leadership**. Dr. Kayse Shrum, President of OSU Center for Health Sciences, joins Governor Stitt's COVID-19 Solutions Task Force.

- **Testing Capacity**. OSU Medicine expands the state's COVID-19 testing capacity on March 30th, by 45x (350 to 16,000 tests).

- **Knowledge Sharing**. OSU Medicine launches COVID-19 ECHO service line on March 20th. Sessions are held 3 times each week at no cost to the participant.

- **Primary Care Capacity**. OSU Medicine launches telemedicine network to support providers overwhelmed by COVID-19 patients.

- **Treatment Expertise**. OSU Medicine proposes that OSU Medical Center be designated as a COVID-19 hospital.

LEADING IN TIMES OF CRISIS

DR. KAYSE SHRUM
Statewide testing, PPE procurement, provider readiness, modeling, surge planning, crisis care standards documentation, etc.

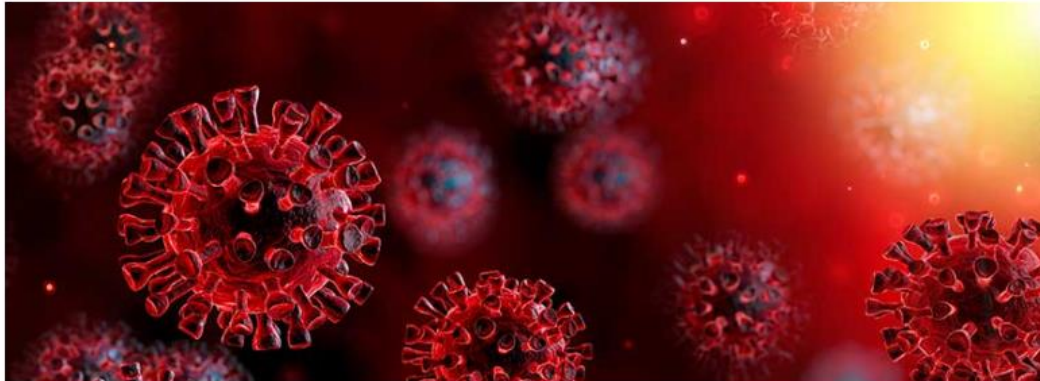Give myOKSTATE Directory Centernet Departments A to Z

CENTER FOR HEALTH SCIENCES

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COVID-19 Reports

Health Alert
Campus FAQ
Student FAQ
COVID-19 FAQ
Social Distancing
HR Faculty & Staff Resources
Project ECHO COVID-19
OSU Medicine COVID-19 Guidelines

OSU-CHS Health Alert - Coronavirus

Coronavirus: What You Need to Know

With the continued rise of COVID-19 cases in Oklahoma, OSU Center for Health Sciences is dedicated to helping our communities

MEDICINE
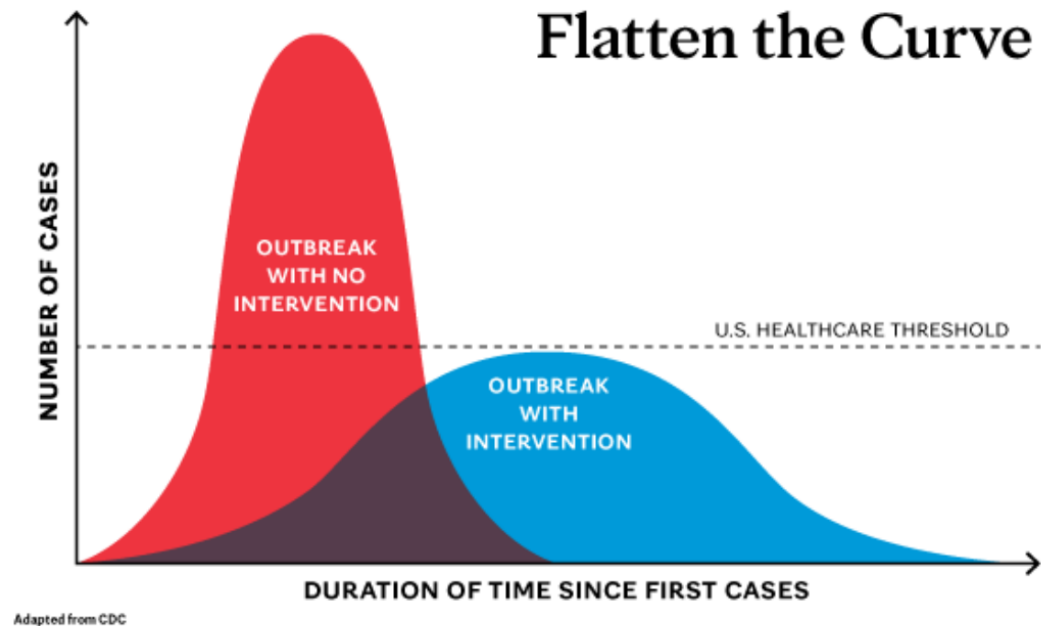### COVID19
HANDBOOK
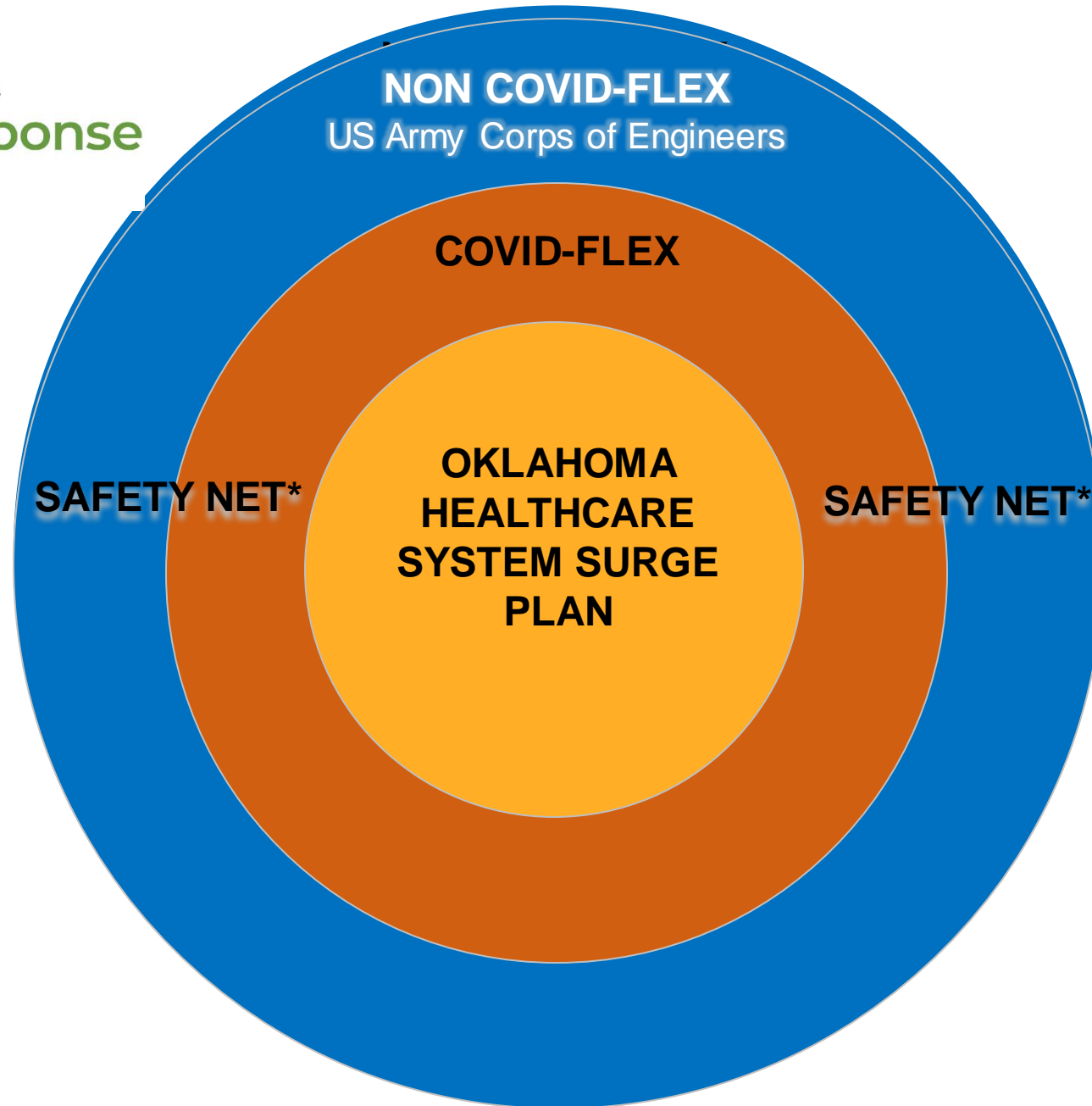
CDC Mitigation Strategies

Prevention

KEEP CALM

WASH YOUR HANDS

STAY HOME

Flatten the Curve

In epidemiology, the idea of slowing a virus' spread so that fewer people need to seek treatment at any given time is known as "flattening the curve." It's a phrase you've likely heard in the news, and it is an important goal for governments and health care leaders during the COVID-19 pandemic.

Questions