

 National Institute of Allergy and Infectious Diseases

The image shows the JAMA logo at the top, which consists of the letters "JAMA" in a large, bold, serif font, with the text "The Journal of the American Medical Association" in a smaller, sans-serif font below it. To the right of the logo is a red rectangular box with white text that reads "Published online January 23, 2020". Below the logo and box is a white rectangular area with a black border. Inside this area, the word "Viewpoint" is written in a red, sans-serif font on the left. To its right, the title "Coronavirus Infections—More Than Just the Common Cold" is written in a large, bold, black, sans-serif font. Below the title, the authors "CI Paules, HD Marston and AS Fauci" are listed in a smaller, black, sans-serif font.

AS Fauci/NIH

2

Human coronaviruses

Source: SM Gylli, PhD, NIAID. Based on the nucleotide sequences of RNA-dependent RNA polymerase.

Source: SM Gygil, PhD, NIAID. Based on 440 bp nucleotide sequences of RNA-dependent RNA polymerase.

AS Fauci/NIH

3

**Human coronaviruses**

Source: SM Gylli, PhD, NIAID. Based on the nucleotide sequences of RNA-dependent RNA polymerase.

Source: SM Gyll, PhD, NIAID. Based on 440 bp nucleotide sequences of RNA-dependent RNA polymerase.

AS Fauci/NIH

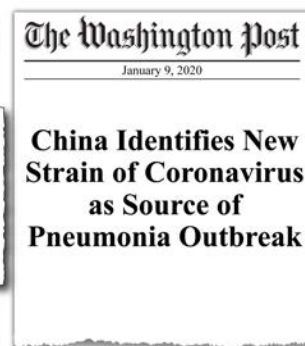
4

AS Fungi/NAID

5



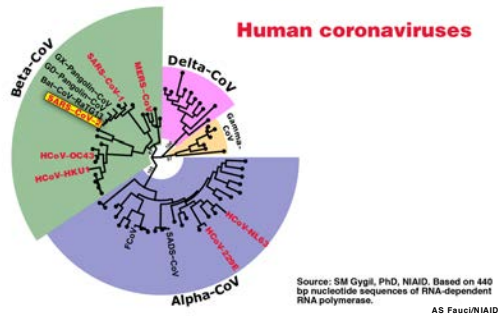
6



AS\_Egul@MAIL



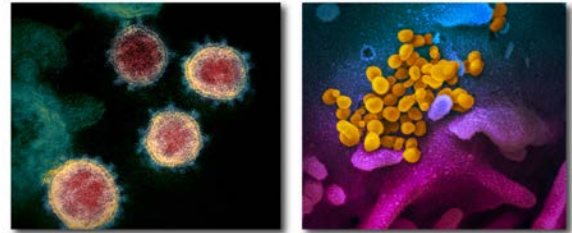
## Coronavirus Phylogenetic Tree



7

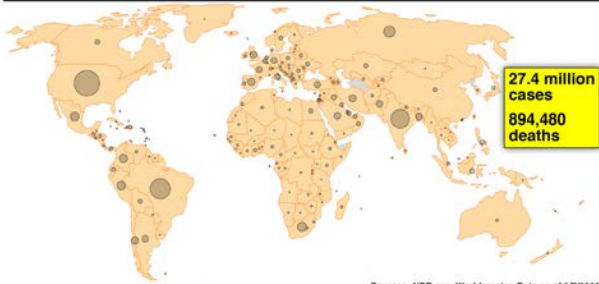
## Coronavirus Disease 2019 (COVID-19)

■ **COVID-19** is the name of the disease caused by the novel coronavirus **SARS-CoV-2**



8

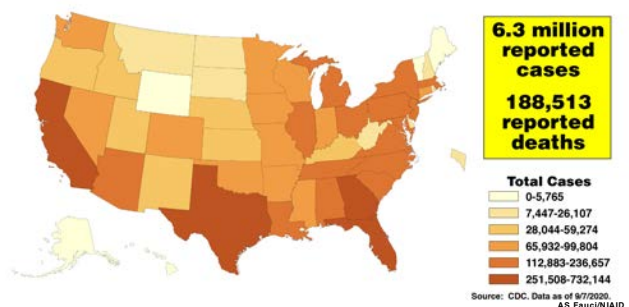
## COVID-19 Globally: 27.4 Million Cases in 215 Countries and Territories



AS Fauci/NIAID

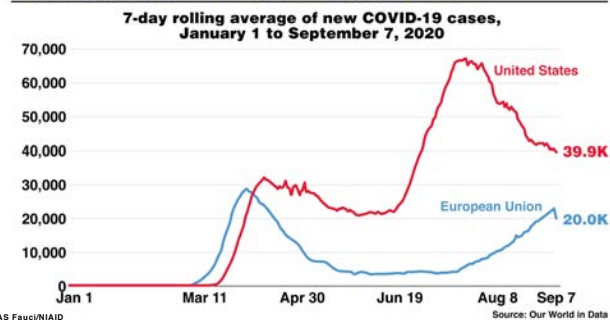
9

## COVID-19 in the United States



10

## New COVID-19 Cases: US vs. EU

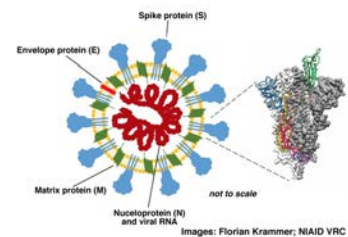


AS Fauci/NIAID

11

## SARS-CoV-2 Virology

- **Beta-CoV:** same subgenus as SARS CoV-1 and some bat CoVs
- **RNA virus:** enveloped, positive-sense, single-stranded
- **Large genome:** ~30,000 Kb
- **4 structural proteins:** S, E, M, N
  - **S** allows virus to attach to and fuse with cell membrane
- **ACE2 receptor:** cell receptor



AS Fauci/NIAID

12



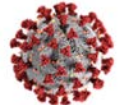
## Transmission

13

AS Fauci/NIAID

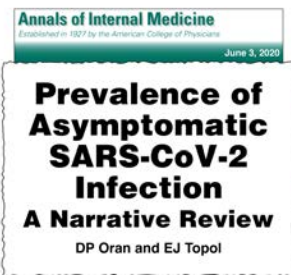
### SARS-CoV-2 Transmission

- Transmission between people in close contact
- Transmission via particles that remain in the air over time and distance
- Infected surfaces
- Virus found in stool, blood, semen and ocular secretions; role in transmission unknown
- Animals (including domesticated) not major source of human infection



AS Fauci/NIAID

14



- Data from 16 cohorts, total n= 45,000+
- Asymptomatic persons account for ~40-45% of SARS-CoV-2 infections

AS Fauci/NIAID

15



- Modeling study estimates that individuals without symptoms account for >50% of transmission

AS Fauci/NIAID

16

## Clinical Manifestations

17

AS Fauci/NIAID

### COVID-19 Clinical Presentation

■ Fever	83–99%
■ Cough	59–82
■ Fatigue	44–70
■ Anorexia	40–84
■ Shortness of breath	31–40
■ Myalgias	11–35

#### Other non-specific symptoms reported

- Sore throat, nasal congestion, headache, diarrhea, nausea, vomiting. Loss of smell/taste preceding the onset of respiratory symptoms.

Source: WHO, 5/2020  
AS Fauci/NIAID

18



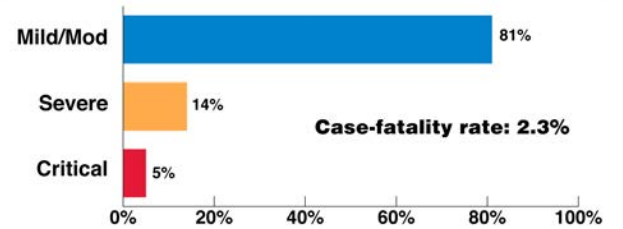
## COVID-19: Wide Spectrum of Disease

<b>Asymptomatic Illness</b>	No symptoms
<b>Mild Illness</b>	Uncomplicated upper respiratory tract infection
<b>Moderate Disease</b>	Pneumonia without the need for supplemental oxygen
<b>Severe Pneumonia</b>	Pneumonia plus one of the following: respiratory rate > 30 breaths/min; severe respiratory distress; or SpO <sub>2</sub> < 90% on room air
<b>Critical Illness</b>	ARDS, sepsis, septic shock, multiple organ dysfunction/failure

Sources: CDC, WHO  
AS Fauci/NIAD

19

## Spectrum of Disease Among 44,672 Individuals with Confirmed COVID-19, China



Source: Z Wu & JM McGoogan, JAMA 323:1239, 2020.  
AS Fauci/NIAD

20

## Manifestations of Severe COVID-19 Disease

- Acute respiratory distress syndrome (ARDS)
- Hyperinflammation
- Acute cardiac injury, arrhythmias, cardiomyopathy
- Acute kidney injury
- Neurological disorders
- Hypercoagulability leading to thromboembolic complications, including pulmonary embolism and acute stroke
- Multisystem inflammatory syndrome in children (MIS-C)

AS Fauci/NIAD

21

## COVID "Long-Haulers"

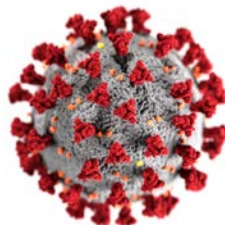


AS Fauci/NIAD

22

## People at Increased Risk for Severe COVID-19 Illness

- Older adults
- People of any age with certain underlying medical conditions

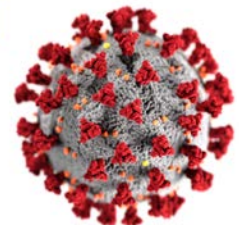


Source: CDC, 6/25/2020  
AS Fauci/NIAD

23

## People at Increased Risk for Severe COVID-19 Illness

- Older adults
- People of any age with certain underlying medical conditions

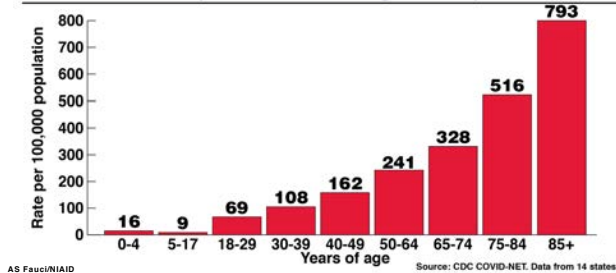


Source: CDC, 6/25/2020  
AS Fauci/NIAD

24



### Cumulative Rates of Laboratory-Confirmed COVID-19-Associated Hospitalizations by Age, United States, March 1 – August 29, 2020



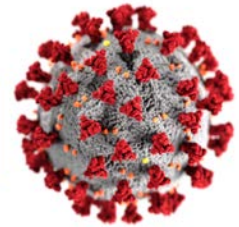
AS Fauci/NIAD

25

### People at Increased Risk for Severe COVID-19 Illness

Older adults

People of any age with certain underlying medical conditions

Source: CDC, 6/25/2020  
AS Fauci/NIAD

26

### Underlying Medical Conditions Strongly Associated with Increased Risk for Severe COVID-19 Illness

- Serious heart conditions (e.g. heart failure, coronary artery disease, cardiomyopathies)
- Chronic kidney disease
- Chronic obstructive pulmonary disease (COPD)
- Diabetes, type 2
- Obesity (BMI  $\geq 30$ )
- Cancer
- Sickle cell disease
- Immunocompromised state from solid organ transplant

Source: CDC, 7/28/2020  
AS Fauci/NIAD

27

### Underlying Medical Conditions That May Confer Increased Risk for Severe COVID-19 Illness

- Asthma
- Other chronic lung diseases
- Cerebrovascular disease
- Diabetes, type 1
- Hypertension
- Immunocompromised state from bone marrow transplant, immune deficiencies, HIV, use of corticosteroids or other immunosuppressive medications
- Inherited metabolic disorders
- Neurologic conditions
- Liver disease
- Pregnancy
- Smoking
- Thalassemia

AS Fauci/NIAD

Source: CDC, 7/28/2020

28

### Underlying Medical Conditions That May Confer Increased Risk for Severe COVID-19 Illness

- Asthma
- Other chronic lung diseases
- Cerebrovascular disease
- Diabetes, type 1
- Hypertension
- Inherited metabolic disorders
- Neurologic conditions
- Liver disease
- Pregnancy
- Smoking
- Thalassemia
- Immunocompromised state from bone marrow transplant, immune deficiencies, HIV, use of corticosteroids or other immunosuppressive medications

AS Fauci/NIAD

Source: CDC, 7/28/2020

29



### COVID-19 in Persons Living with HIV – What Do We Know Today

C del Rio

- Analysis of 8 studies in Europe and U.S. show similar rates of SARS-CoV-2 in persons with HIV vs. general population
- HIV does not increase risk for SARS-CoV-2 infection, COVID-19 disease course or outcomes
- Comorbidities major driver of severe COVID-19 in persons with/without HIV coinfection

AS Fauci/NIAD

30



May 11, 2020

**JAMA**  
The Journal of the American Medical Association

**Viewpoint**

**COVID-19 and Racial/Ethnic Disparities**

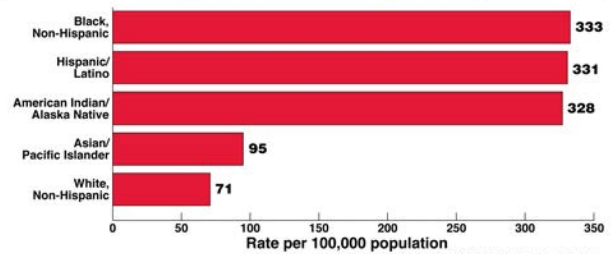
MW Hooper, AM Nápoles and EJ Pérez-Stable

*"The most pervasive disparities are observed among African American and Latino individuals, and where data exist, American Indian, Alaska Native, and Pacific Islander populations."*

AS Fauci/NIAD

31

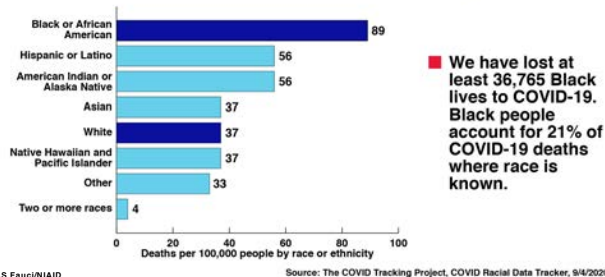
### Age-Adjusted COVID-19-Associated Hospitalization Rates by Race and Ethnicity, United States, March 1 – August 29, 2020



AS Fauci/NIAD

32

### Nationwide, Black People are Dying at 2.4 Times the Rate of White People



AS Fauci/NIAD

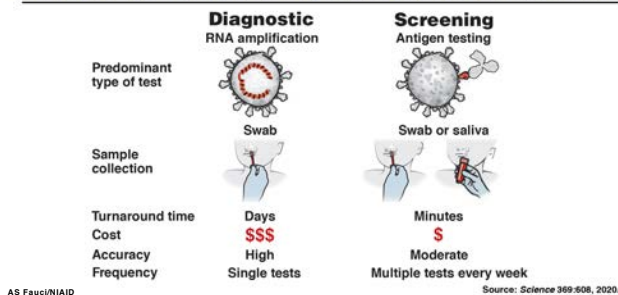
33

## Diagnostics

AS Fauci/NIAD

34

### The Potential Important Role of Rapid, Inexpensive Screening Tests for SARS-CoV-2



AS Fauci/NIAD

35

August 27, 2020

**Science**

NEWS

**In 'Milestone,' FDA OKs Simple, Accurate Coronavirus Test that Could Cost Just \$5**

RF Service

Abbott

CONTROL  
SAMPLE

ResultNOW  
COVID-19 Ag  
CARD

- EUA issued 8/26/2020 for 15-min antigen test
- Requires no specialized laboratory equipment

AS Fauci/NIAD

36



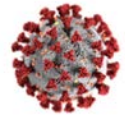
## Prevention

37

AS Fauci/NIAD

### COVID-19 Prevention: Personal Preventive Measures

- Diligent hand washing
- Avoiding close contact
  - Avoiding crowds/mass gatherings
  - Physical distancing, >6 feet
- Covering mouth and nose with mask/cloth face cover
- Covering sneezes/coughs
- Avoiding face-touching
- Regular cleaning/disinfecting of frequently touched objects

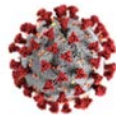


AS Fauci/NIAD

38

### COVID-19 Prevention: Public Health Measures

- Social/physical distancing orders
- Stay-at-home orders
- School, venue, and nonessential business closure
- Bans on public gatherings
- Travel restriction with exit and/or entry screening
- Aggressive case identification and isolation
- Contact tracing and quarantine




AS Fauci/NIAD

39

## Therapeutics

AS Fauci/NIAD

40



National Institutes of Health  
Turning Discovery Into Health

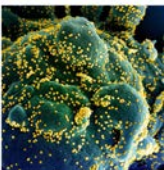
Tuesday, April 21, 2020

News Release

### Expert U.S. Panel Develops NIH Treatment Guidelines for COVID-19

*"Living document" expected to be updated often as new clinical data accrue*

■ [Covid19treatmentguidelines.nih.gov](https://www.covid19treatmentguidelines.nih.gov)



AS Fauci/NIAD

41

### Therapeutics for COVID-19

#### Recommended by the NIH COVID-19 Treatment Guidelines Panel for Certain Patients

- Remdesivir (investigational antiviral)
- Dexamethasone (corticosteroid)

#### Examples of Other Investigational Therapies

- Antivirals
- Blood-derived products, e.g., convalescent plasma, hyperimmune globulin
- Monoclonal antibodies against SARS-CoV-2
- Immunomodulators, e.g., cytokine inhibitors, interferons
- Adjunct therapies, e.g., anticoagulants



AS Fauci/NIAD

42





### Remdesivir for the Treatment of Covid-19 – Preliminary Report

JH Beigel, HC Lane et al. for the ACTT-1 Study Group Members

- Patients who received remdesivir had a 32% faster time to recovery than those who received placebo ( $p<0.001$ )
- Results also suggested a survival benefit
- N=1,063 patients from 10 countries in U.S., Europe, Asia

AS Fauci/NIAID

43



### Effect of Dexamethasone in Hospitalized Patients with COVID-19: Preliminary Report

The RECOVERY Collaborative Group

- RECOVERY trial in UK -- 6,425 patients randomized to receive dexamethasone 6 mg once per day (oral or IV) for up to ten days or usual care alone
- Dexamethasone reduced 28-day mortality by 36% in ventilated patients and by 18% in other patients receiving oxygen
- No benefit for patients not receiving respiratory support

AS Fauci/NIAID

44

## Vaccines



### A Strategic Approach to COVID-19 Vaccine R&D

L Corey, JR Mascola, AS Fauci & FS Collins

- Unprecedented collaboration and resources will be required to research and develop safe and effective vaccines for COVID-19 that can be manufactured and delivered in the scale of billions of doses to people globally.

AS Fauci/NIAID

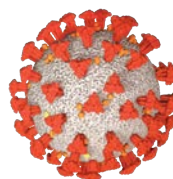
46

### Selected COVID-19 Vaccine Candidates

Platform	Developer	Phase 1/2	Phase 2/3
Nucleic acid	moderna	Completed	Ongoing
	BIONTECH	Completed	Ongoing
Viral vector	OXFORD AstraZeneca	Completed	Ongoing
	janssen	Ongoing	--
	MERCK	TBD	--
Protein subunit	NOVAVAX	Ongoing	--
	gsk SANOFI	Ongoing	--

AS Fauci/NIAID

47



## COVID-19 Prevention Network

[coronaviruspreventionnetwork.org](https://coronaviruspreventionnetwork.org)

AS Fauci/NIAID

48