

Emerging and Re-Emerging Infectious Diseases: From AIDS to COVID-19

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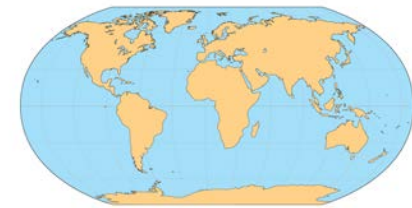
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Global Examples of Emerging and Re-Emerging Infectious Diseases



● Newly emerging ● Re-emerging/resurging ● "Deliberately emerging"

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Global Examples of Emerging and Re-Emerging Infectious Diseases

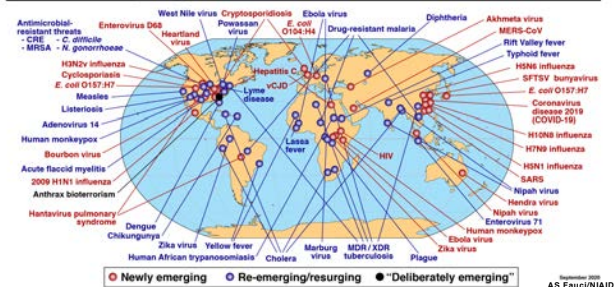


● Newly emerging ● Re-emerging/resurging ● "Deliberately emerging"

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Global Examples of Emerging and Re-Emerging Infectious Diseases



● Newly emerging ● Re-emerging/resurging ● "Deliberately emerging"

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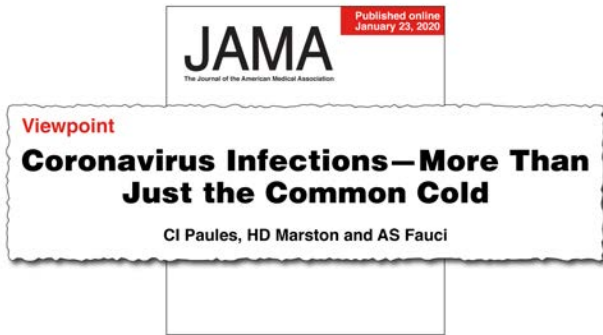
C-SPAN Interview – January 8, 2015



"Well, my one number one concern way out there is the idea of emerging and re-emerging infections that we haven't been exposed to before that's spread by a respiratory route."

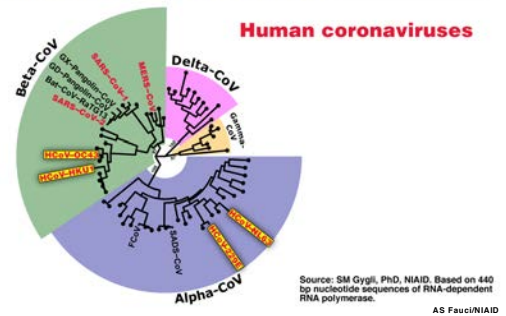
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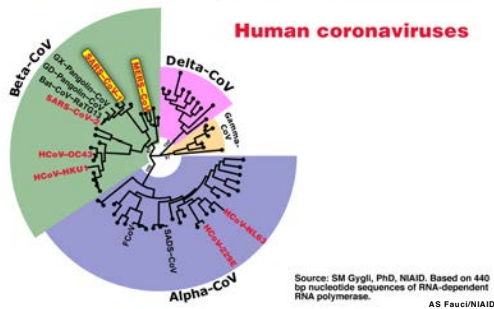
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Coronavirus Phylogenetic Tree



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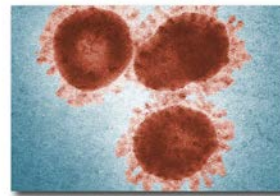
Coronavirus Phylogenetic Tree



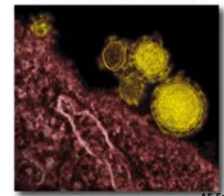
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Severe Human Coronavirus Disease: Past as Prologue

**Severe Acute Respiratory
Syndrome (SARS)
(2002–2003)**



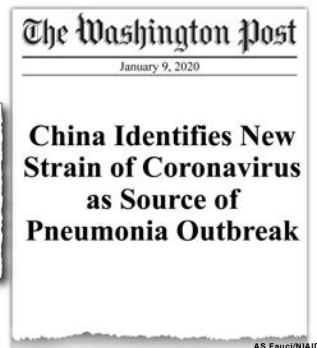
Middle East Respiratory Syndrome (MERS) (2012–present)



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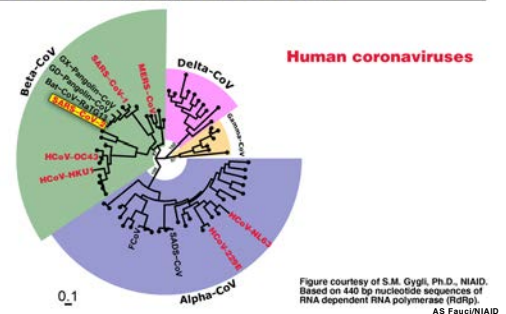


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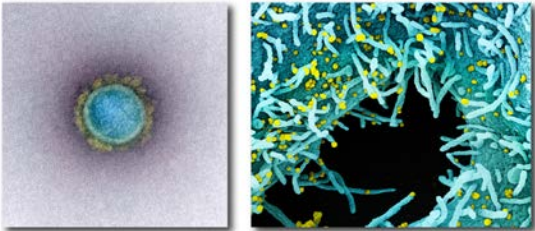
Coronavirus Phylogenetic Tree



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Coronavirus Disease 2019 (COVID-19)

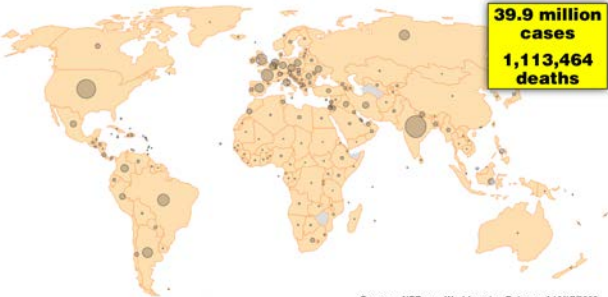
■ **COVID-19** is the disease caused by the novel coronavirus **SARS-CoV-2**



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COVID-19 Globally

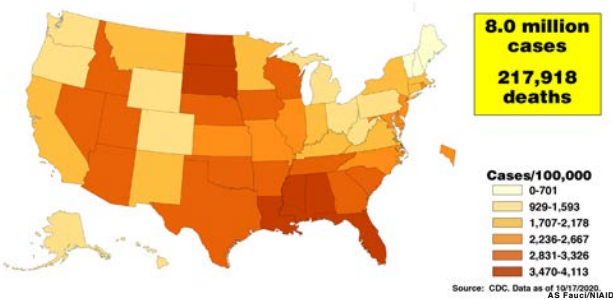


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Sources: NPR.org; Worldometer. Data as of 10/17/2020

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COVID-19 in the United States



Source: CDC. Data as of 10/17/2020
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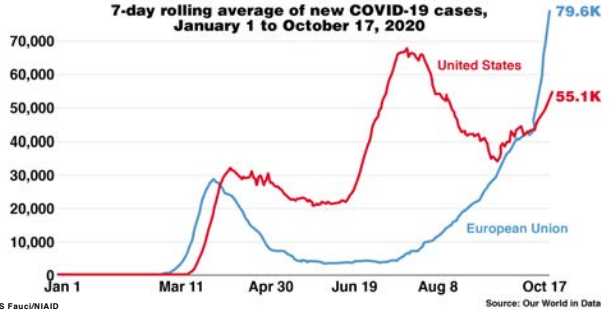
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United States vs. Europe

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New COVID-19 Cases: US vs. EU

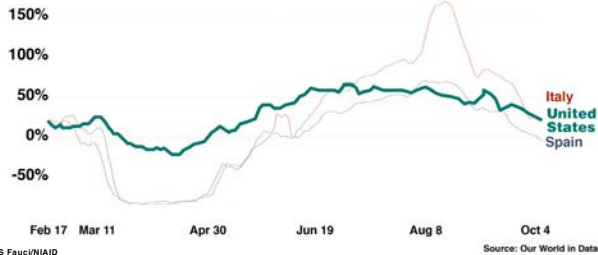


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Source: Our World in Data

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Change in Mobility Over Time: Parks and Outdoor Spaces

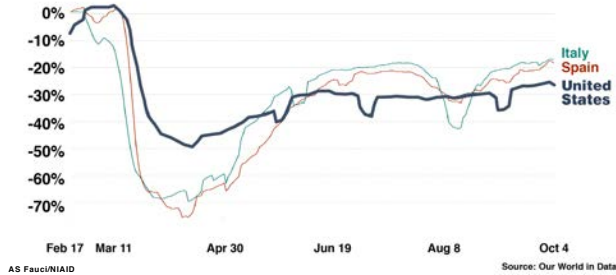


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Source: Our World in Data

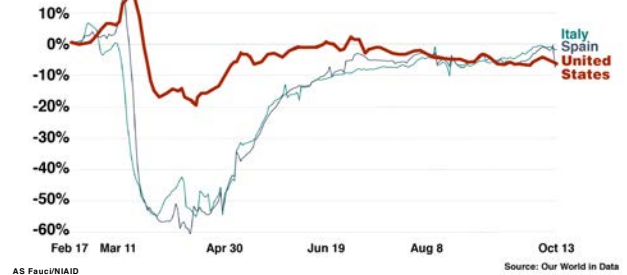
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Change in Mobility Over Time: Workplaces



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Change in Mobility Over Time: Grocery and Pharmacy Stores

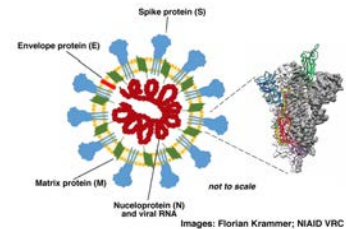


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Virology

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



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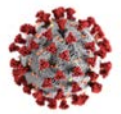
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Transmission

SARS-CoV-2 Transmission

- Mainly through exposure to respiratory droplets when close (≤ 6 ft) to an infected person
- Sometimes through droplets or particles that remain in the air (aerosols) over time and various distances ($>$ or < 6 ft)
- Less commonly through contact with contaminated surfaces
- Virus found in stool, blood, semen and ocular secretions; role in transmission unknown



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Risk of Transmission

- Varies by type and duration of exposure, prevention measures used, and individual factors (e.g., viral load)
- Transmissions most common among household contacts, in congregate or health care settings when PPE not used, and in closed settings (e.g., cruise ships, nursing homes, prisons)
- Factors that may increase the risk of airborne transmission include:
 - Crowded, enclosed spaces with poor ventilation
 - Singing, speaking loudly, or breathing heavily

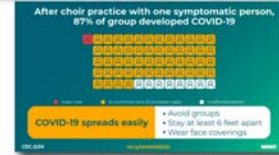
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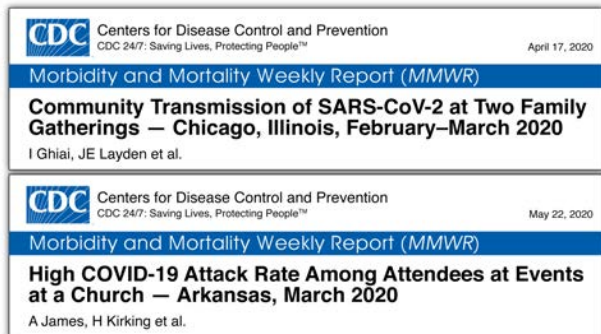
High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington, March 2020

L Hamner, H Leibrand et al.



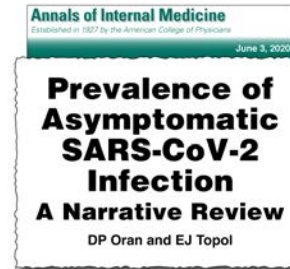
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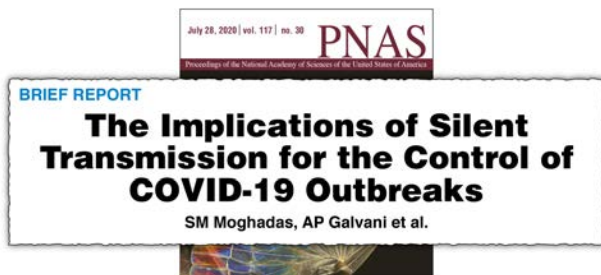


- Data from 16 cohorts, total n= 45,000+

- Asymptomatic persons account for ~40-45% of SARS-CoV-2 infections

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

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Fundamentals to Prevent Acquiring and Transmitting SARS-CoV-2

- Universal wearing of masks/cloth face coverings
- Maintain physical distance – at least 6 feet
- Avoid crowds and congregate settings
- Outdoors better than indoors
- Frequent washing of hands

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Clinical Manifestations

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COVID-19 Clinical Presentation

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

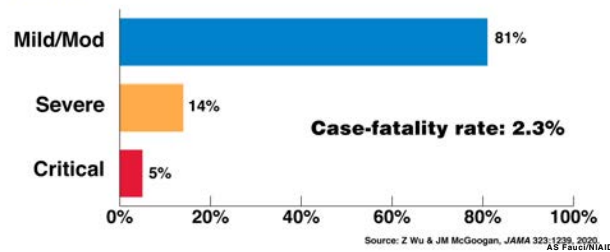
Other non-specific symptoms reported

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

Source: WHO, 5/2020
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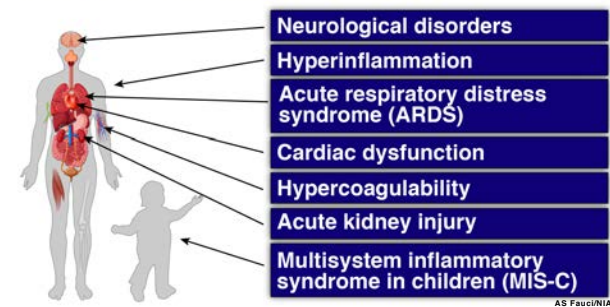
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Spectrum of Disease Among 44,672 Individuals with Confirmed COVID-19, China



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Manifestations of Severe COVID-19



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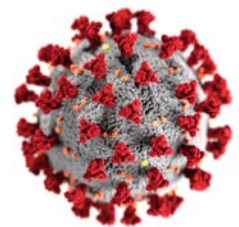
Post-COVID-19 Syndrome



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People at Increased Risk for Severe COVID-19 Illness

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

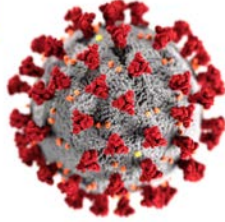
Source: CDC, 6/25/2020
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People at Increased Risk for Severe COVID-19 Illness

Older adults

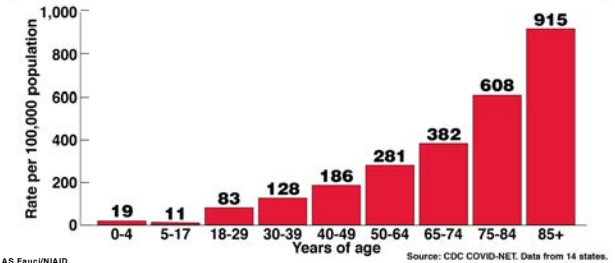
- People of any age with certain underlying medical conditions



Source: CDC, 6/25/2020
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Cumulative Rates of Laboratory-Confirmed COVID-19-Associated Hospitalizations by Age, United States, March 1 – October 10, 2020

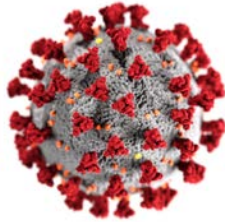


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People at Increased Risk for Severe COVID-19 Illness

Older adults

- People of any age with certain underlying medical conditions



Source: CDC, 6/25/2020
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Underlying Medical Conditions Associated with Increased Risk for Severe COVID-19 Illness

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

Source: CDC, 10/6/2020
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Underlying Medical Conditions That May Confer Increased Risk for Severe COVID-19 Illness

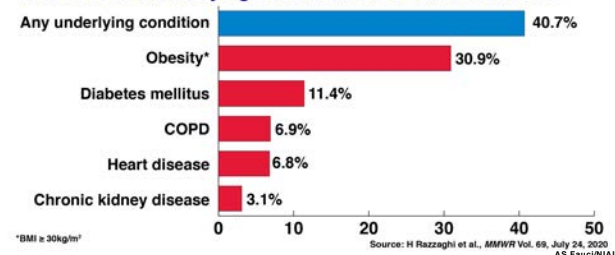
- Asthma (moderate-to-severe)
- Cerebrovascular disease
- Cystic fibrosis
- Diabetes, type 1
- Hypertension
- Immunocompromised state from blood or bone marrow transplant, immune deficiencies, HIV, use of corticosteroids or other immune-weakening medicines
- Neurologic conditions (e.g. dementia)
- Liver disease
- Overweight (BMI > 25 but < 30)
- Pregnancy
- Pulmonary fibrosis
- Thalassemia

Source: CDC, 10/6/2020
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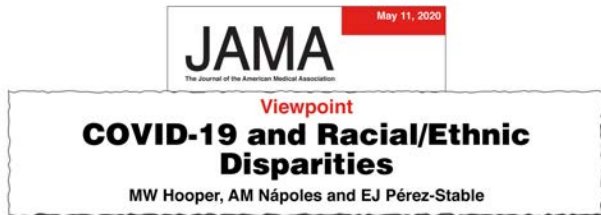
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More Than 40% Of U.S. Adults Are Susceptible To Severe COVID-19

Prevalence of underlying conditions in U.S. adults in 2018



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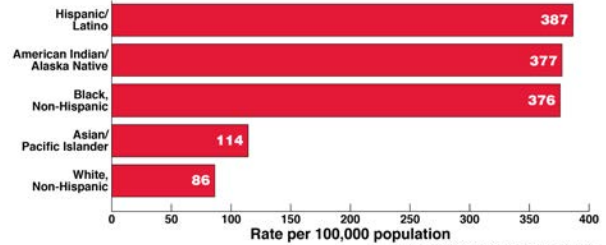


"The most pervasive disparities are observed among African American and Latino individuals, and where data exist, American Indian, Alaska Native, and Pacific Islander populations."

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Age-Adjusted COVID-19-Associated Hospitalization Rates by Race and Ethnicity, United States, March 1 – October 10, 2020



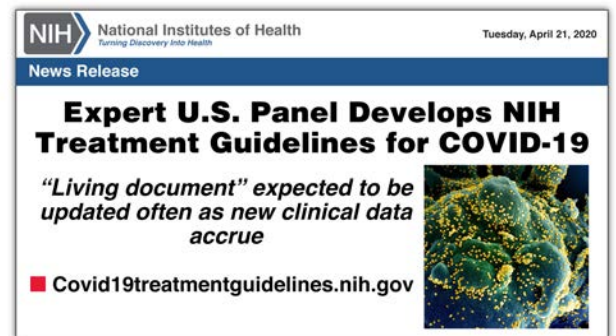
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Therapeutics

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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



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Remdesivir for the Treatment of Covid-19 — Final Report

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

- Hospitalized patients on remdesivir recovered more quickly than those on placebo (median 10 days vs 15 days, $P < 0.001$)
- A trend toward decreased mortality: hazard ratio = 0.73 (95% CI: 0.52–1.03)
- 1,062 patients from 10 countries: U.S., Europe and Asia

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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

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Vaccines

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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.

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Selected COVID-19 Vaccine Candidates

Platform	Developer	Phase 1/2	Phase 2/3
Nucleic acid	moderna	Enrolled	Ongoing
	BIONTECH	Enrolled	Ongoing
Viral vector	OXFORD AstraZeneca	Enrolled	Ongoing
	Janssen Johnson & Johnson	Enrolled	Ongoing
	MERCK	Ongoing	--
Protein subunit	NOVAVAX	Ongoing	Ongoing
	gsk SANOFI	Ongoing	--

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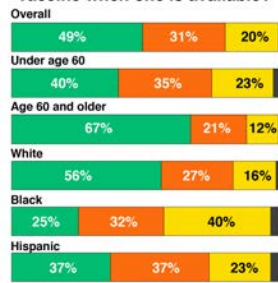
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Just 50% of Americans Plan to Get a COVID-19 Vaccine. Here's How to Win Over the Rest

W Cornwall

Do you plan to get a coronavirus vaccine when one is available?



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Perspective Emerging Pandemic Diseases: How We Got To COVID-19

DM Morens and AS Fauci

"Disease emergence reflects dynamic balances and imbalances, within complex globally distributed ecosystems comprising humans, animals, pathogens, and the environment. Understanding these variables is a necessary step in controlling future devastating disease emergences."

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