

COVID-19: an update

Timothy Brewer, MD, MPH
June 25, 2020

No relevant disclosures

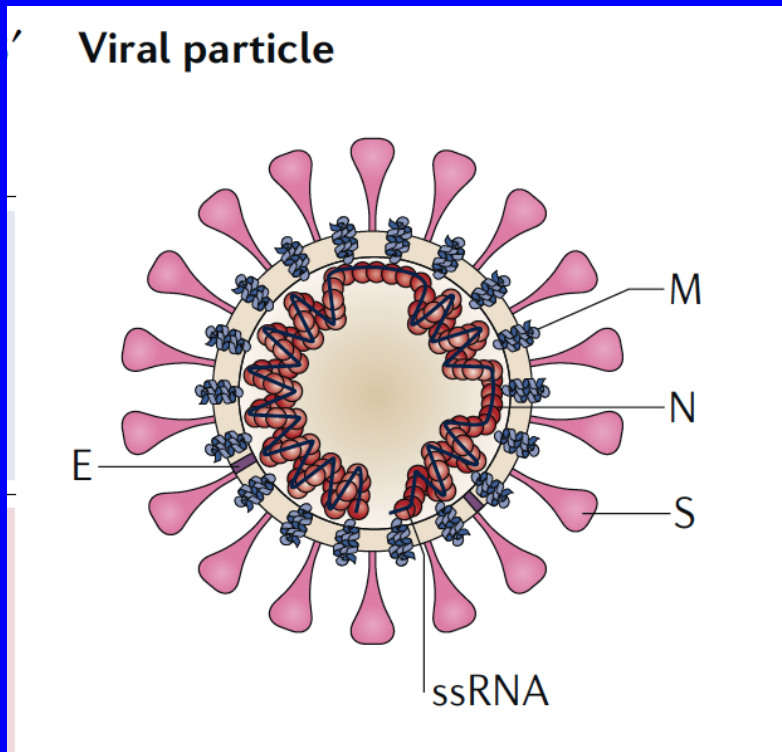


Overview

- COVID-19 origins and epidemiology
- Prevention
 - Case identification, masks, physical distancing, quarantine (shelter-in-place)
- Diagnosis
 - Antigen and antibody tests
- Treatment
- Vaccine development

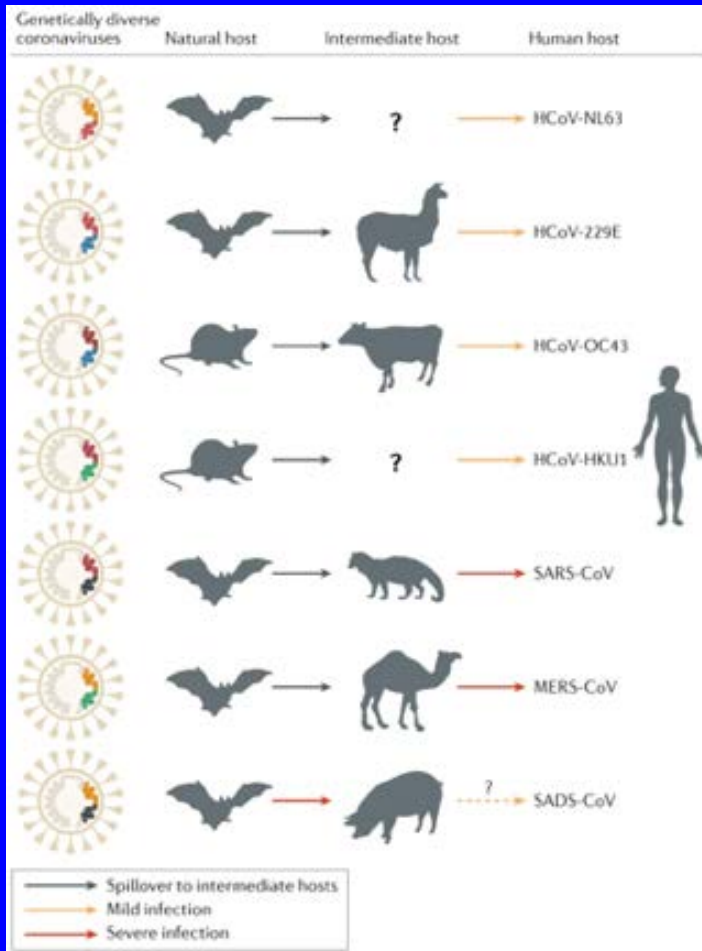


Coronaviruses



- Large single stranded RNA viruses
 - 4 genera α , β , γ , δ
 - α - and β coronaviruses
 - Respiratory tract infections in humans
 - Gastroenteritis in animals

SARS-CoV-2



- Zoonosis
 - Closely related to bat viruses (SL-CoVZC45 & SL-CoVZXC21)
 - Likely intermediate host animal
 - Binds to ACE-2 receptor in humans
 - Lu. Lancet 2020;395:565-74.

Cui. Nature Rev Micro 2019;17:181-92.



SARS-CoV-2 transmission

- Primarily respiratory droplets
 - 3 to 6 feet highest risk
 - Can survive on surfaces for hours to days
 - Up to 72 hours on plastic or stainless steel
 - Asymptomatic and pre-symptomatic transmission occurs
 - Aerosol transmission possible but not assumed to be major contributor
 - Lai. *Inter J Antimicrob Ag* 2020;55; van Doremalen. *New Engl J Med* 2020; Rothe. *New Engl J Med* 2020; WHO Joint Commission China Report 2020.



COVID-19 Epidemiology

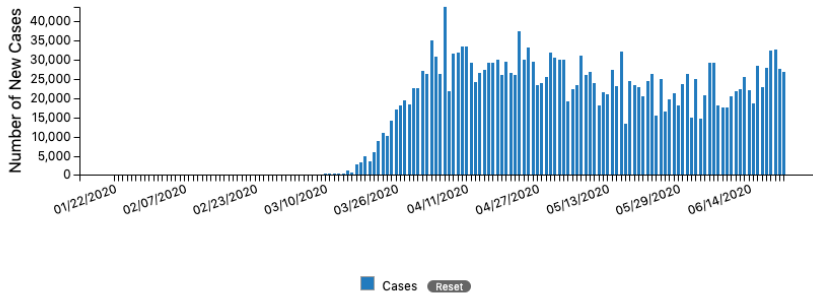
- Severe pneumonia of unknown etiology recognized in Wuhan, China in December, 2019
 - Initial cases had exposure to live seafood market or Wuhan
 - Isolated from respiratory secretions, saliva, stool
 - 16% (173/1099) had severe disease; 1.4% died
 - Guan. New Engl J Med 2020



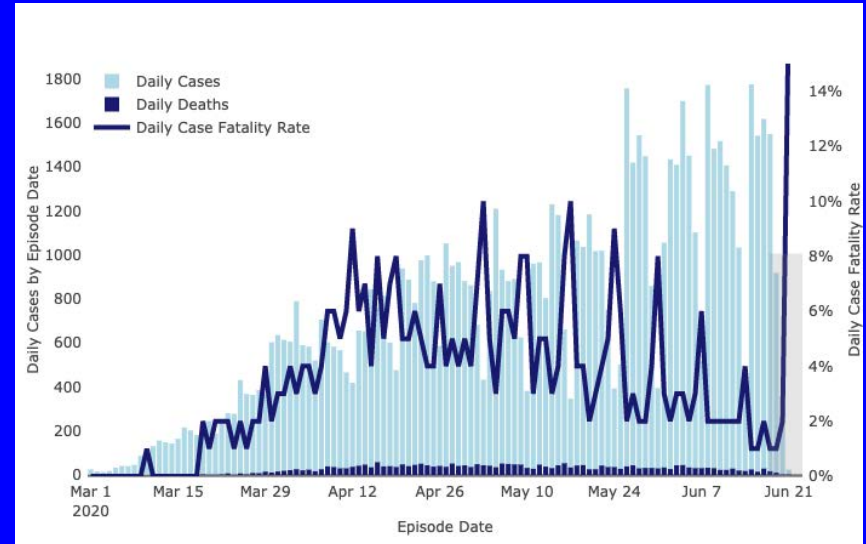
Current case trends, US and LA

New Cases by Day

The following chart shows the number of new COVID-19 cases reported each day in the U.S. since the beginning of the outbreak. Hover over the bars to see the number of new cases by day.



<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html>



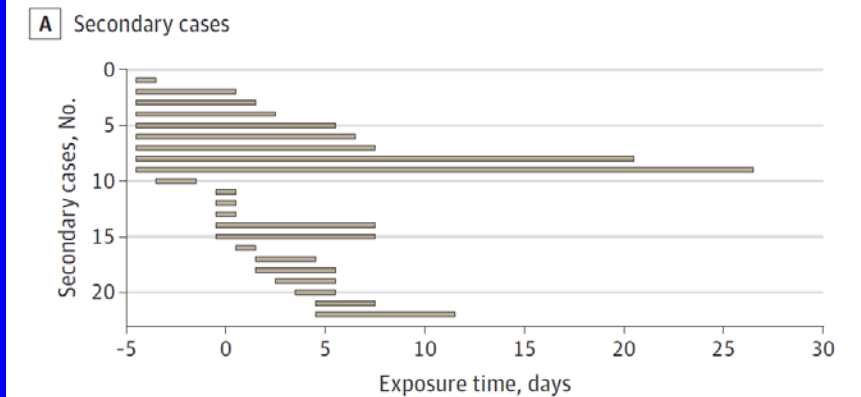
http://dashboard.publichealth.lacounty.gov/covid19_surveillance_dashboard/



SARS-CoV-2 transmission

- 2761 close contacts of 100 COVID-19 patients in Taiwan
 - 22 secondary cases
 - 0.7%, 95 CI 0.4-1.0%
 - No cases in 852 contacts occurring ≥ 6 days of symptoms
 - Household contact, severe disease associated with transmission

Figure 1. Exposure Window Period Among Secondary Cases and Noncase Contacts

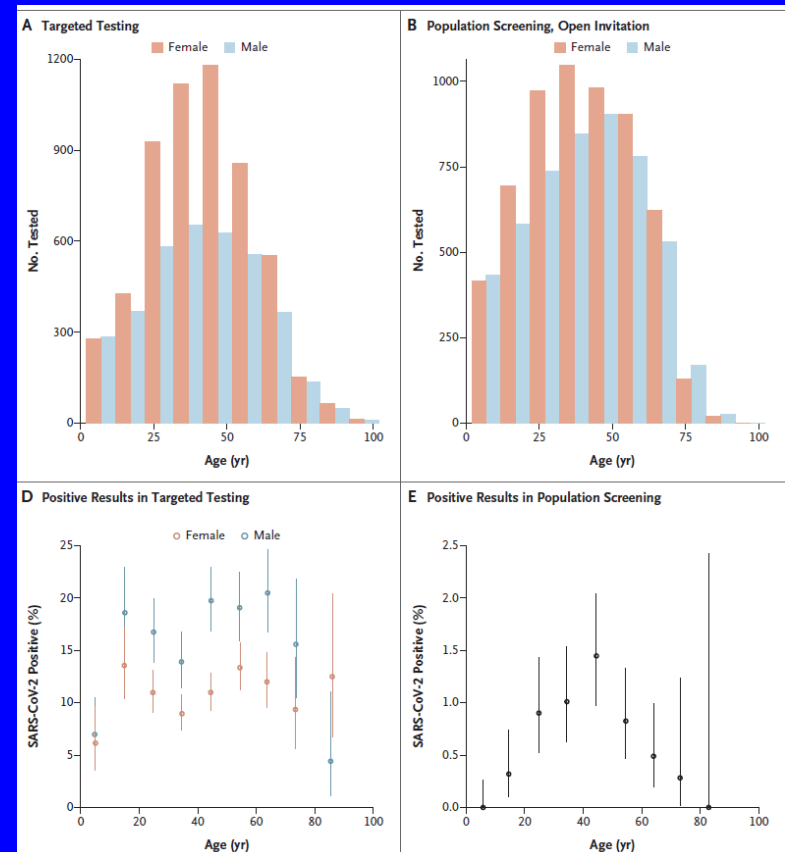


Cheng. JAMA Intern Med.
doi:10.1001/jamainternmed.2020.
2020



Targeted and population-based testing, Iceland

- 1221/9199 (13.3%) targeted tested positive
 - symptomatic after HR travel, contact of case
- 100/13,080 (0.8%) random sample positive
- Adults, males more likely positive



Gudbjartsson. New Engl J Med 2020; 382;24:2302.



Prevention and control

- Case identification, isolation and contact tracing
- Physical distancing
- Masks and facial coverings
- Hand washing
- Quarantine (shelter-in-place)
 - “Stay-at-home”, “lockdown”



Contact tracing and rates/million population

- More effective programs
 - China 58 cases, 3 deaths
 - Israel 2284 cases, 33 deaths
 - South Korea 243 cases, 5 deaths
 - Less effective
 - USA 7152 cases, 370 deaths
 - United Kingdom 4498 cases, 628 deaths
 - Brazil 5131 cases, 239 deaths
- <https://www.worldometers.info/coronavirus/#countries>



Laboratory-based studies

- Hand washing with wet towel containing soap or sodium hypochlorite
 - 96.62 to 99.98% of low pathogenic avian influenza virus removed
- Face masks blocked 95.15% (homemade mask) to 99.98% of virus particles (N95 respirator)
 - Ma. J Med Virol. 2020;1–5.



Observational Study meta-analysis

- Physical distancing of 1 meter
 - 2.6% transmission risk vs. 12.8% risk at no distance, adjusted OR 0.18 (95% CI 0.20 to 0.44)
- Face mask
 - 3.1% with mask vs 17.4%, aOR 0.15 (0.07-0.34)
- Eye protection
 - 5.5% vs 16.0%, aOR 0.34 (0.22 to 0.52)
 - Chu. Lancet June 1, 2020.
[https://doi.org/10.1016/S0140-6736\(20\)31142-9](https://doi.org/10.1016/S0140-6736(20)31142-9)



Shelter-in-place (Quarantine)

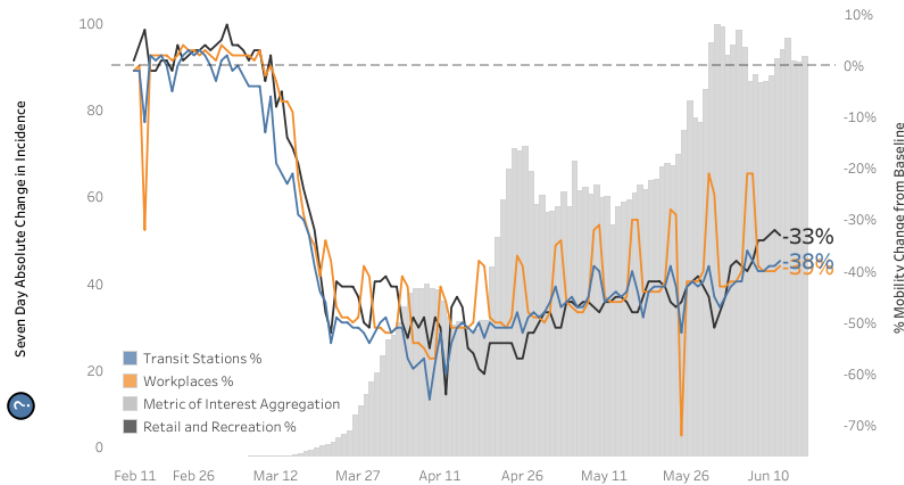
EXPLORE HUMAN MOBILITY AND COVID-19 TRANSMISSION IN YOUR LOCAL AREA

? SELECT STATE: CA
? SELECT COUNTY: Los Angeles County
? SELECT URBAN/RURAL COUNTY CLASSIFICATION: All
? SELECT METRIC OF INTEREST: Seven Day Absolute Change in Incidence



The Human Mobility and COVID-19 Transmission Dashboard was created in partnership with the Georgia Tech Research Institute. References to the Georgia Tech Research Institute do not imply endorsement or government sanction by the U.S. Centers for Disease Control and Prevention.

Los Angeles County, CA

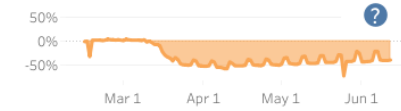


SHELTER IN PLACE ORDERS

Hover over bar for dates and details (Select a state from dropdown to show orders)

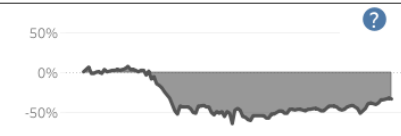
WORKPLACES

-39%



RETAIL AND RECREATION

-33%



TRANSIT STATIONS

-38%



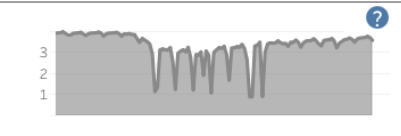
% AT HOME

38%



MOBILITY INDEX

3.6



Data Sources: Case data are courtesy of USAFacts.org. Refer to USAFacts for methods of data collection and processing. Officially verified U.S. case data are available on CDC's U.S. Cases page. The mobility metrics are generated utilizing Google Mobility Reports (<https://www.google.com/covid19/mobility/>), Safegraph Social Distancing Metrics (<https://docs.safegraph.com/docs/social-distancing-metrics>), and Cuebiq Mobility Insights (<https://www.cuebiq.com/visitation-insights-covid19/>). The shelter in place orders are collected and compiled by CDC's COVID-19 response.

Limitations: The Google Mobility Reports data are not updated as frequently as other sources and often has a lag between updates. The Safegraph Social Distancing Metrics may undercount the number of at home devices due to the fact that GPS does not register as often for people who are stationary. Also, GPS does not consistently update throughout the day, therefore someone may have taken a short trip (or not taken the device) and returned home before a sample was taken. In this case they would be counted as at-home. The shelter in place order data do not contain other types of government orders.



California Shelter in Place

- 125.5 to 219.7/100,000 pop reduction in COVID-19 cases
- 1.9 to 4.2/100,000 pop reduction in COVID-19-related deaths
 - pre-treatment COVID-19 rates, population density, urbanicity, and other COVID-related policies
 - More cases averted/lives saved in 2nd & 3rd weeks
- 8 to 14 job losses per case averted, 421 to 917 job losses per life saved
 - Friedson. NBER Working Paper Series #26992. April, 2020



Clinical Characteristics

- 5 to 6 day incubation
 - Range 1 to 14 days
- Fever, cough, dyspnea most common
 - Sore throat, loss of smell or taste, diarrhea, myalgias, fatigue
 - Rhinorrhea uncommon
 - Vasculitis (Kawasaki syndrome) and blood clots reported
 - Zhou. Lancet 2020;395:1054; Lai. Intern J Antimicrob Ag 2020;55; WHO Joint Commission China Report 2020.



COVID-19 Clinical Course

- 1,320,488 US patients between January 22nd – May 30th
- 14% required hospitalization
 - 2.3% required ICU admission
- 5.4% died
 - 19.5% with underlying conditions
 - 1.6% without
 - Stokes. MMWR June 19, 2020 / 69(24);759–765

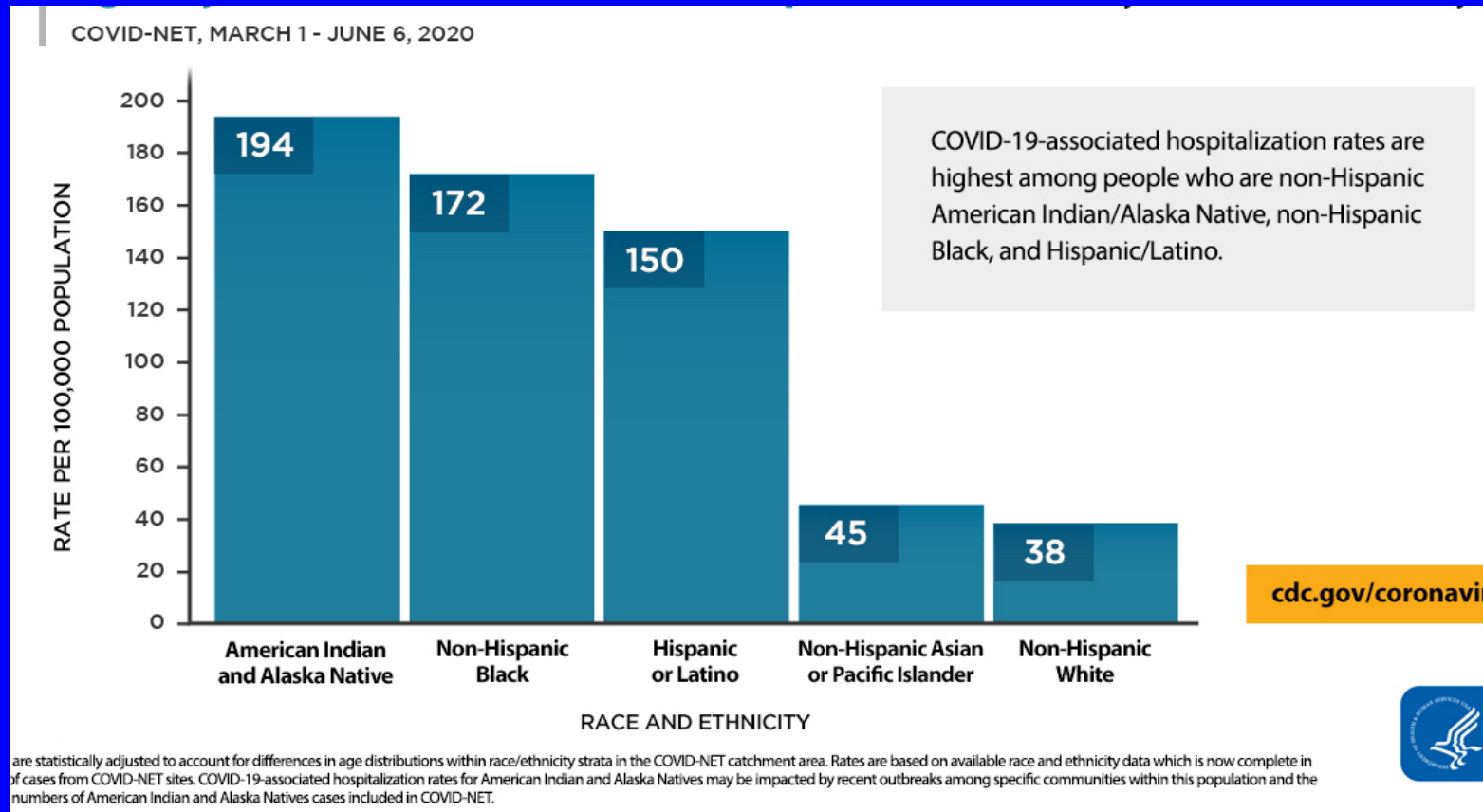


Age as risk factor for serious/critical disease/death

- Laboratory confirmed hospitalization rates (per 100,000 population) as of June 13th
 - ≥ 65 years old 286.9
 - 50-64 years old 143
 - 18-49 years old 56.5
 - 5-17 years old 3.5
 - 0-4 years old 7.4
 - https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html



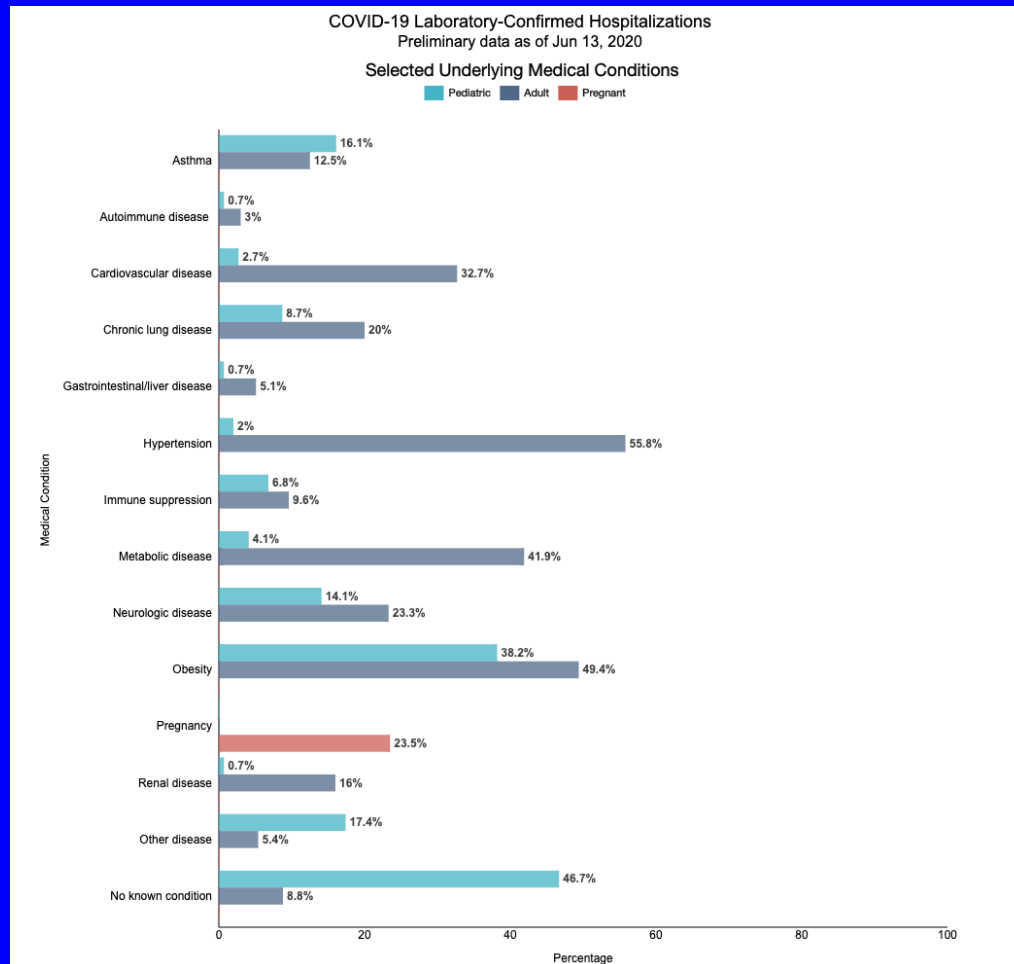
Age-adjusted COVID-19 hospitalizations by race and ethnicity



https://www.cdc.gov/coronavirus/2019-ncov/covid-data/images/Age_Adj_Hosp_Rates_Jun11_1200x675_Site.jpg



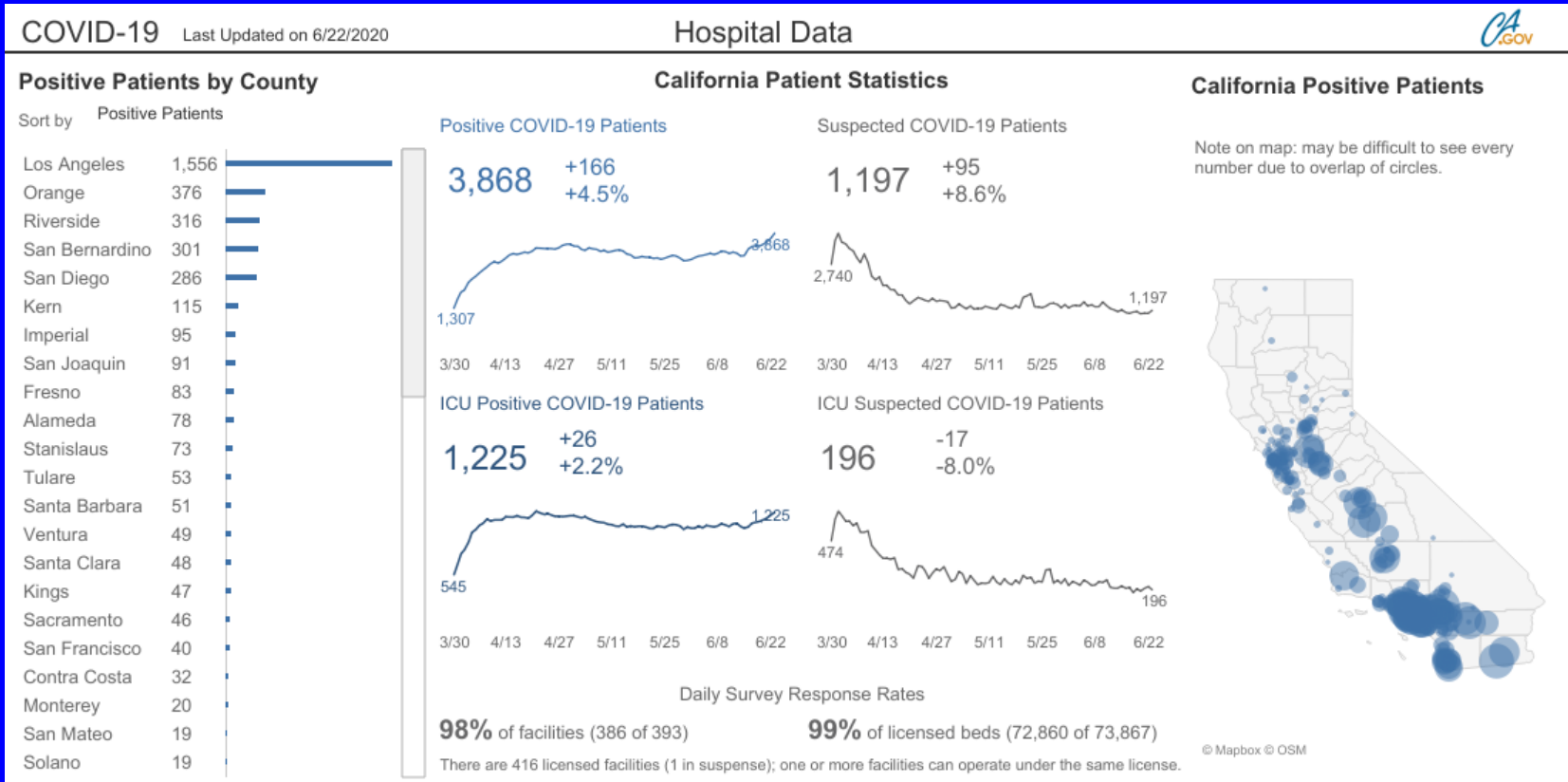
Additional risk factors in hospitalized patients



https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html



California hospital trends



https://public.tableau.com/views/COVID-19PublicDashboard/Covid-19Hospitals?%3Aembed=y&%3Adisplay_count=no&%3AshowVizHome=no



Clinical course for hospitalized patients

- 13 day median onset to dyspnea
- 20 days median viral shedding
- 22 days median illness onset to hospital discharge
- 18.5 days median time to death
 - Zhou. Lancet 2020;395:1054.



Viral Diagnostics

- SARS-CoV-2 nucleic acid amplification test (NAAT)
 - nasopharyngeal, or mid-turbinate, or nasal swabs rather than oropharyngeal swabs or saliva
 - 97% sensitive, 100% specific
 - Rapid tests 74-96% sensitive
 - Hanson. Clin Infect Dis June 16, 2020



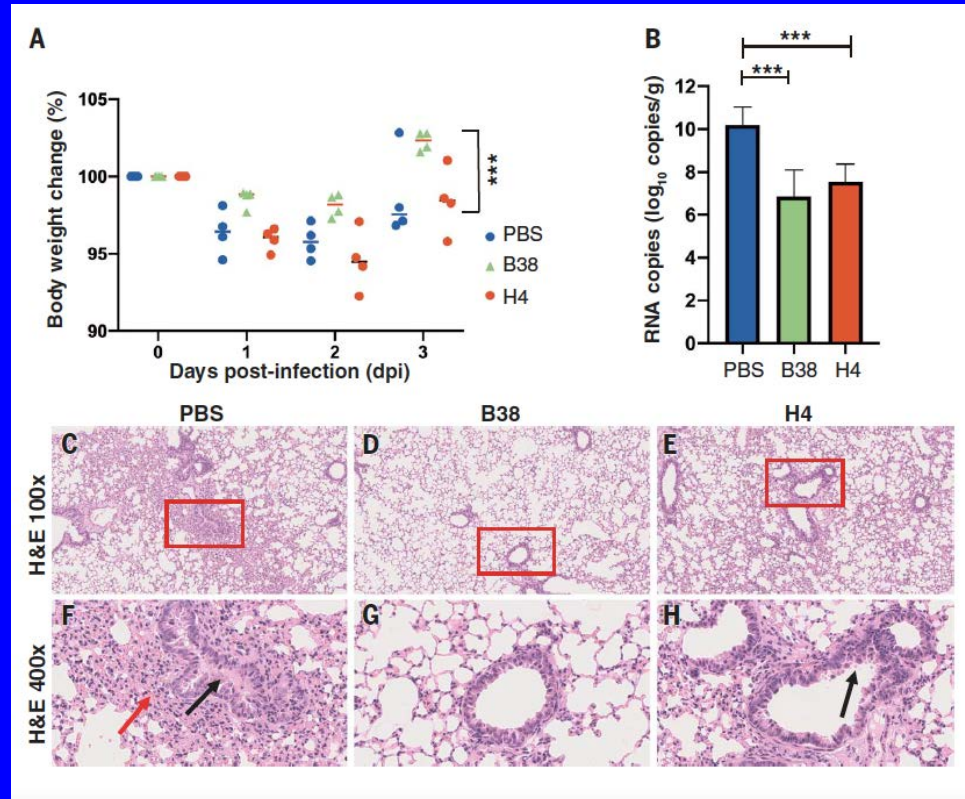
Some testing issues

- 1,343 persons with COVID-19 symptoms in New York
 - 113/624 with PCR confirmed COVID-19 were weakly antibody positive or negative on initial testing
 - Optimal time for testing at least 3-4 weeks after symptom onset
 - 249 (19%) tested positive for nasopharyngeal SARS-CoV-2 RNA 3 to 14 days after symptom resolution (longest 28 days)
 - Wajnberg. MedRxiv preprint 2020
<https://doi.org/10.1101/2020.04.30.20085613>



Some patients make neutralizing antibodies

- Outbreak on USS Theodore Roosevelt
 - 228/382 (59.7%) surveyed crew members has positive antibodies
 - 135/228 (59.2%) had neutralizing antibodies
 - Payne. MMWR 2020 / 69(23);714–721.



Wu et al., Science 368,
1274–1278 (2020)



Antiviral Treatments

- Remdesivir only FDA approved treatment under EUA
 - Shortens duration of symptoms and hospitalization
- Non FDA approved treatments under study
 - Hydroxychloroquine, lopinavir/ritonavir, selinexor, favipravir, ribavirin
 - Convalescent serum



Hydroxychloroquine

- Recovery Trial (UK) 28 day mortality
 - 27.5% of 1542 hospitalized patients with COVID-19 died
 - 23.5% of 3132 hospitalized patients on standard care died
 - Kupferschmidt. Science 2020:368 (6496):1166-67
- 821 asymptomatic exposed individuals
 - 49/414 (11.8%) receiving hydroxychloroquine had COVID like illness
 - 58/407 (14.3%) on placebo (95% CI -7 to 2.2)
 - Boulware. New Engl J Med June 3, 2020



Immune modulating treatments

- Recovery trial of dexamethasone for 10 days, 2104 patients received treatment; 4321 standard care
 - RR 0.65 (95% CI 0.48 – 0.88) for ventilated patients
 - 0.80 (95% CI 0.67 – 0.96) for patients receiving oxygen
 - <https://www.recoverytrial.net/news/low-cost-dexamethasone-reduces-death-by-up-to-one-third-in-hospitalised-patients-with-severe-respiratory-complications-of-covid-19>
- IL-6 blockers, Janus associated kinase (JAK) inhibitors, CCR5 trafficking inhibitor



Vaccines

- Viral vector-based vaccines
- Subunit vaccines
- virus-like particle (VLP)-based vaccines
- live-attenuated vaccines
- DNA-based vaccines
 - Conte. Vaccines. June 17, 2020



Thank you

Questions

