COVID-19: an update

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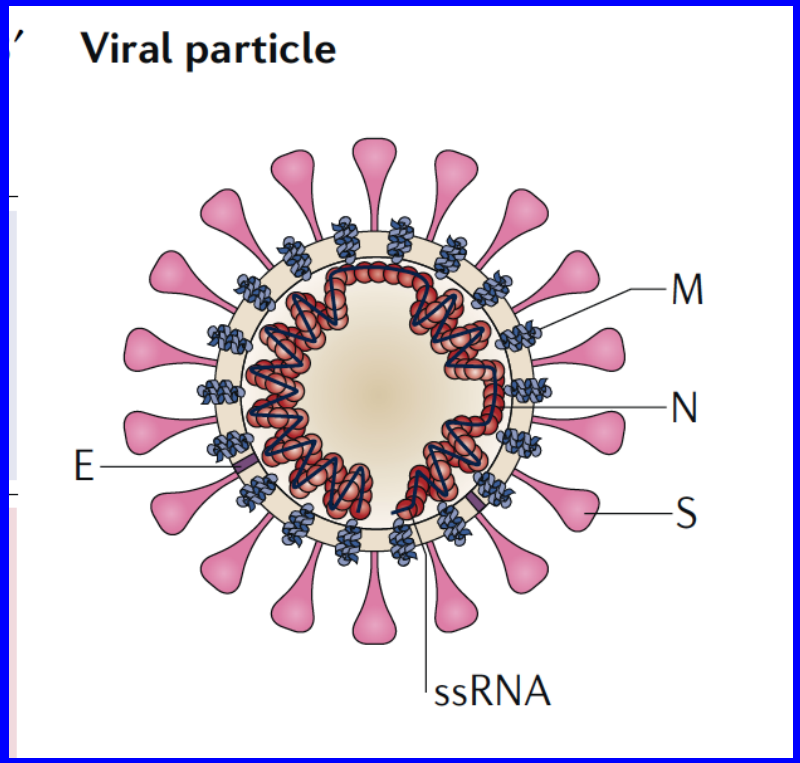
No relevant disclosures

Overview

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

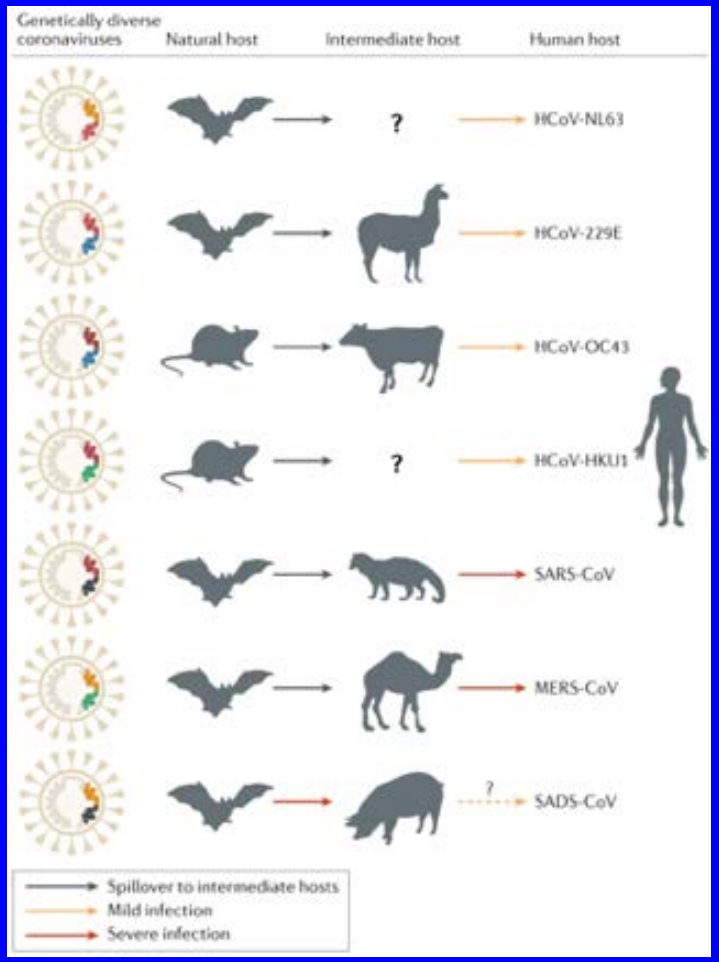
Coronaviruses



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

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

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.

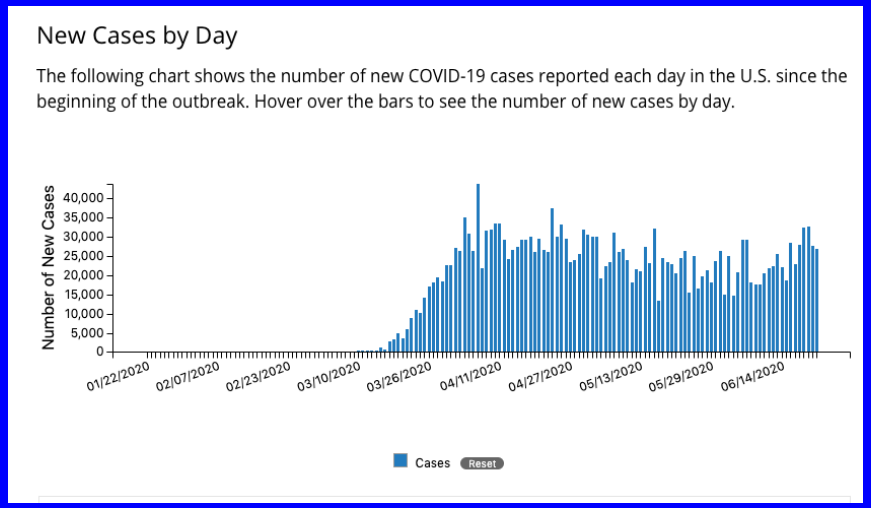
SARS-CoV-2 transmission

- 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.

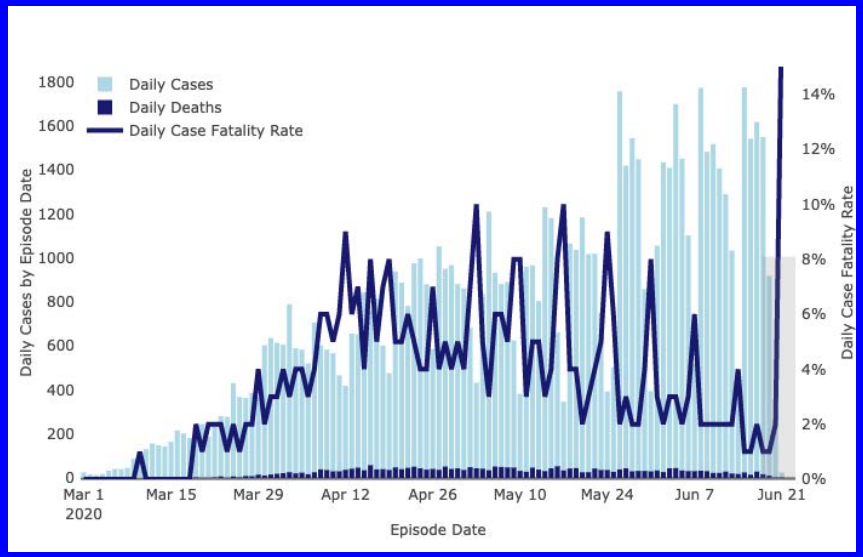
COVID-19 Epidemiology

- 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



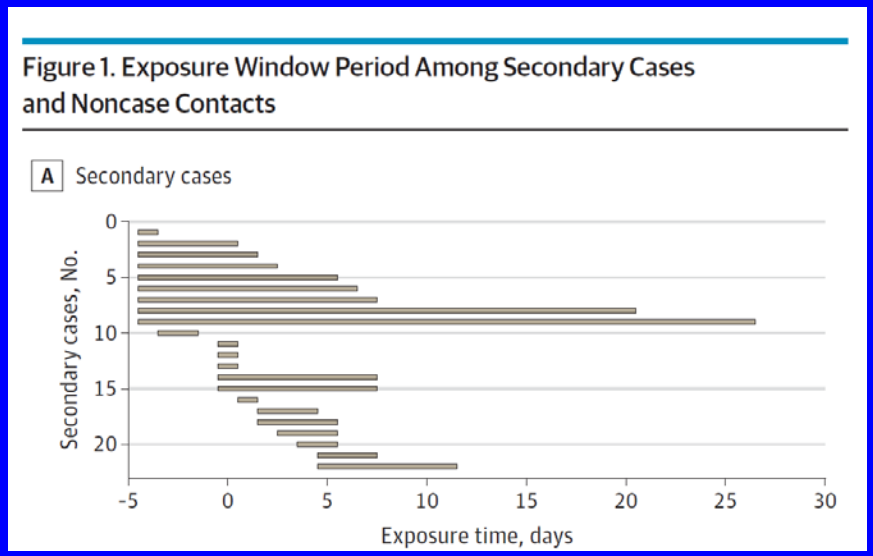
https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html



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

SARS-CoV-2 transmission

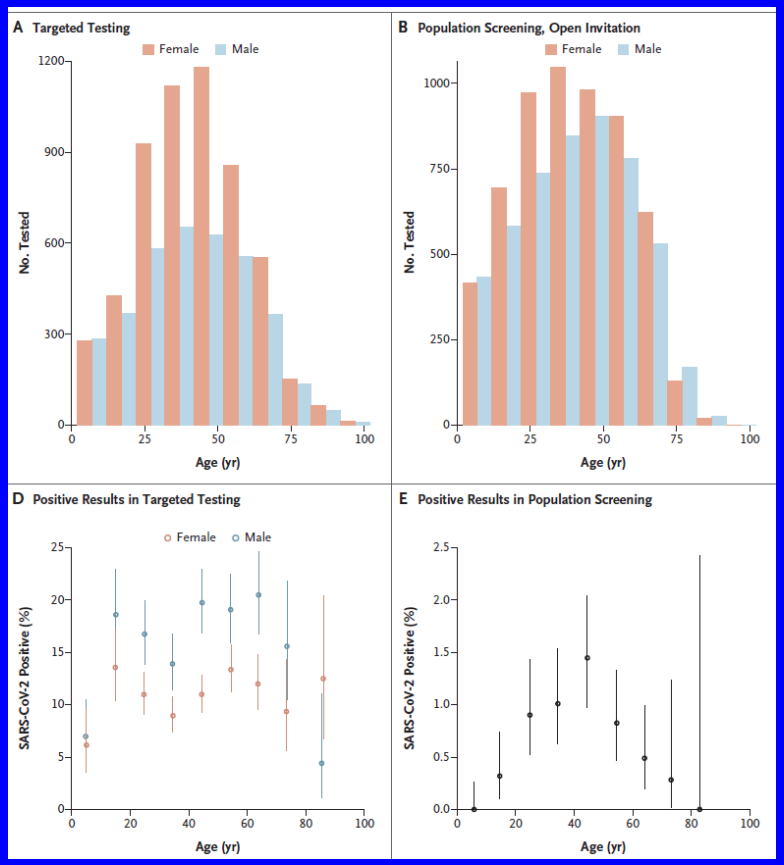
- 2761 close contacts of 100 COVID-19 patients in Taiwan
  - 22 secondary cases
    - 0.7%, 95 CI 0.4-1.0%
  - No cases in 852 contacts occurring ≥ 6 days of symptoms
  - Household contact, severe disease associated with transmission



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

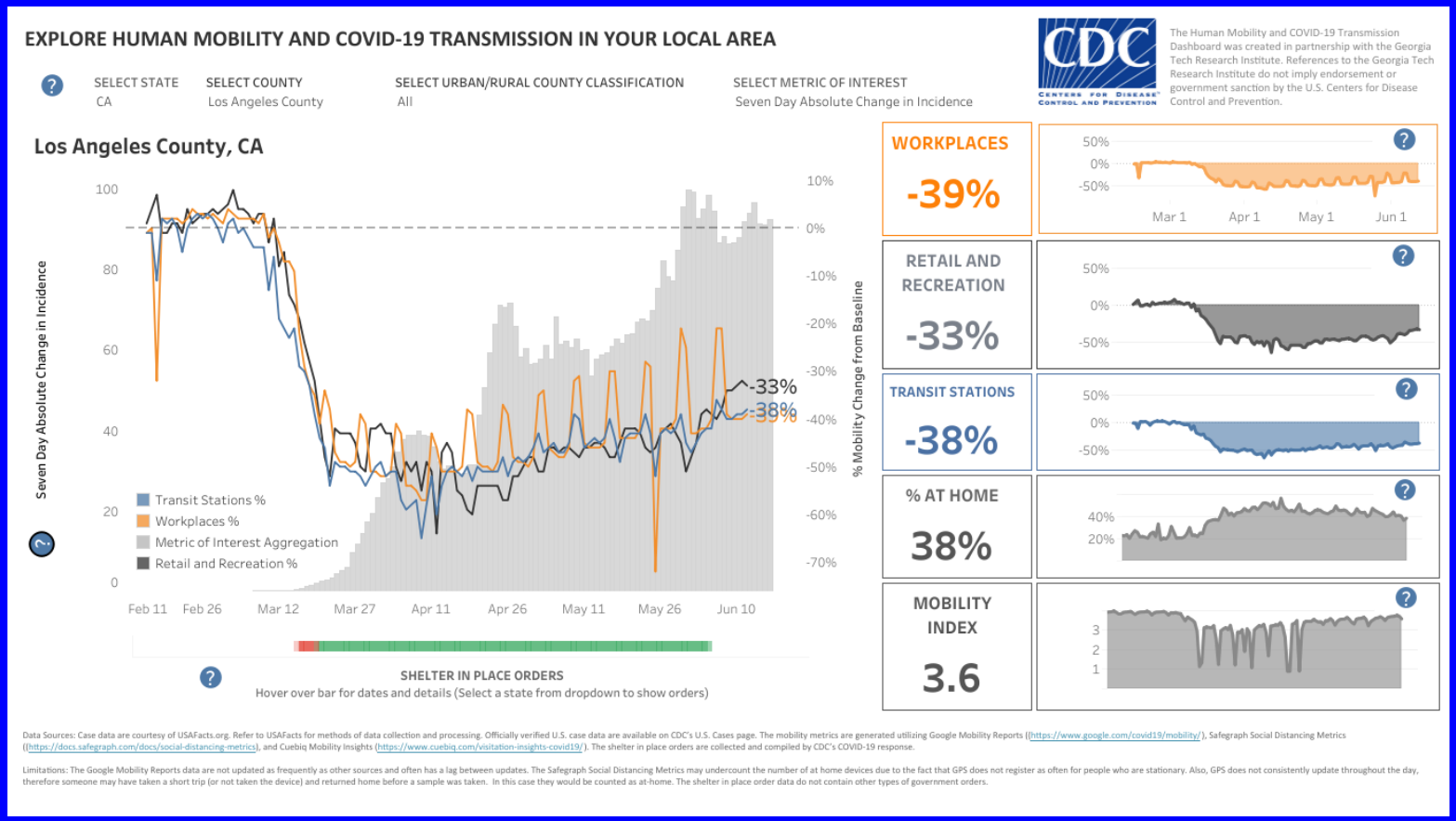
Laboratory-based studies

- 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

Shelter-in-place (Quarantine)



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.

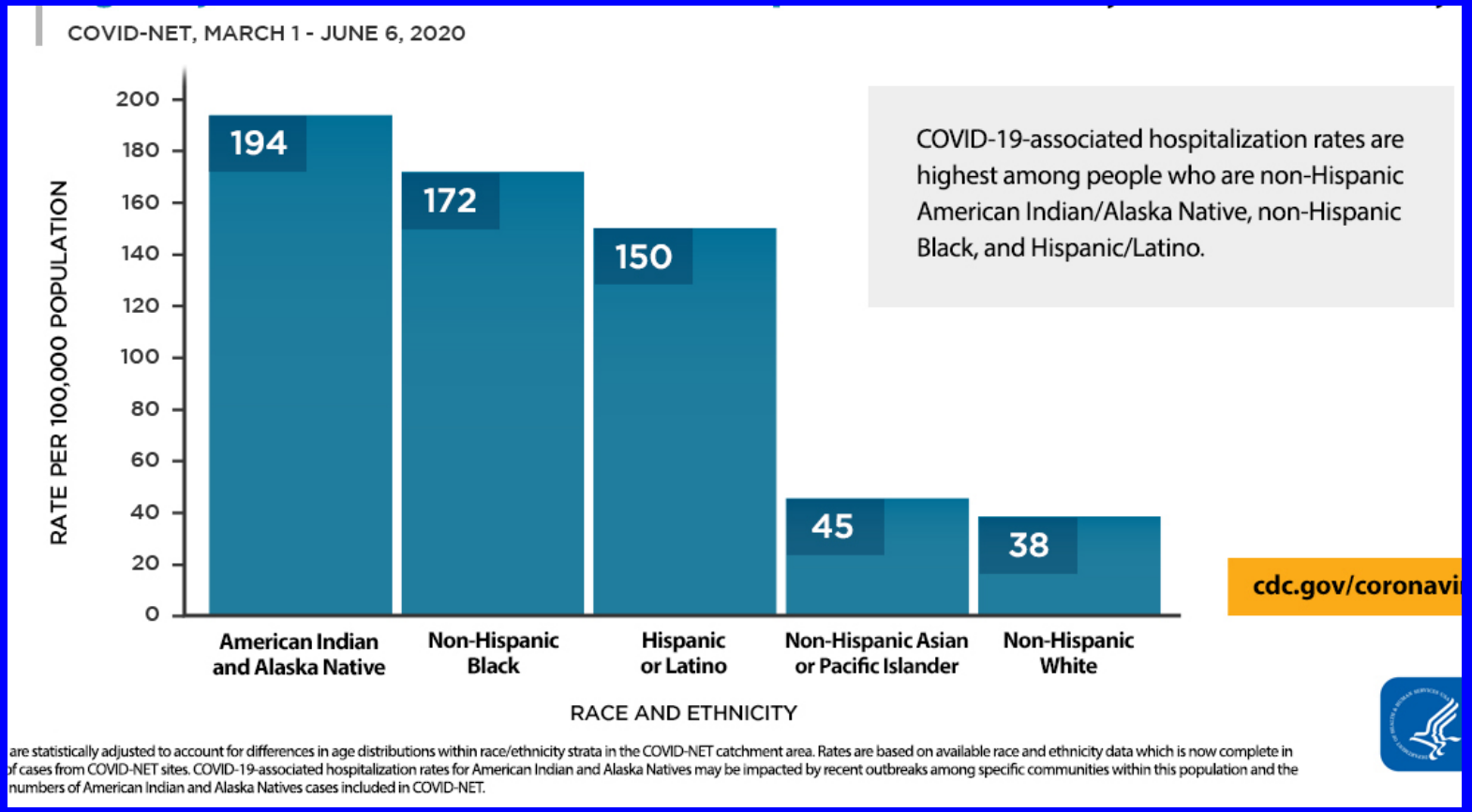
COVID-19 Clinical Course

- 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

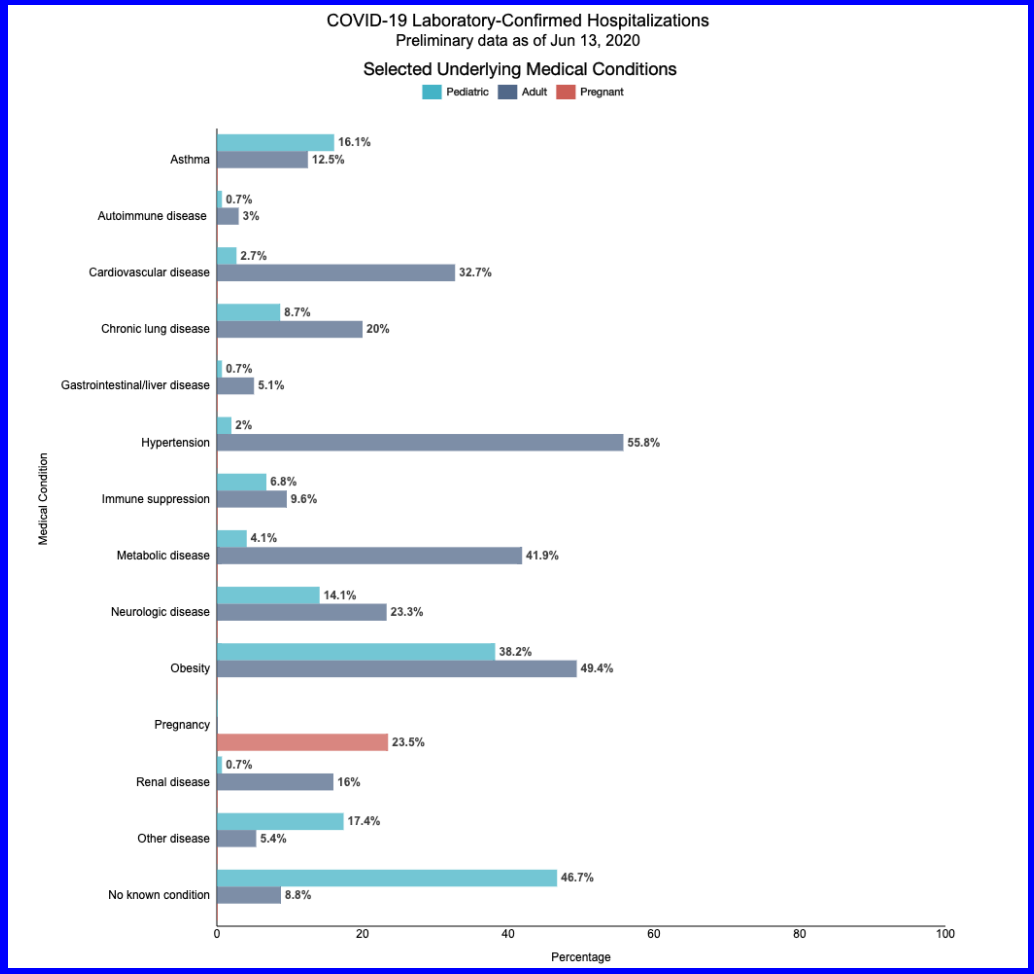
- Laboratory confirmed hospitalization rates (per 100,000 population) as of June 13th
  - ≥ 65 years old 286.9
  - 50-64 years old 143
  - 18-49 years old 56.5
  - 5-17 years old 3.5
  - 0-4 years old 7.4
    - https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html

Age-adjusted COVID-19 hospitalizations by race and ethnicity



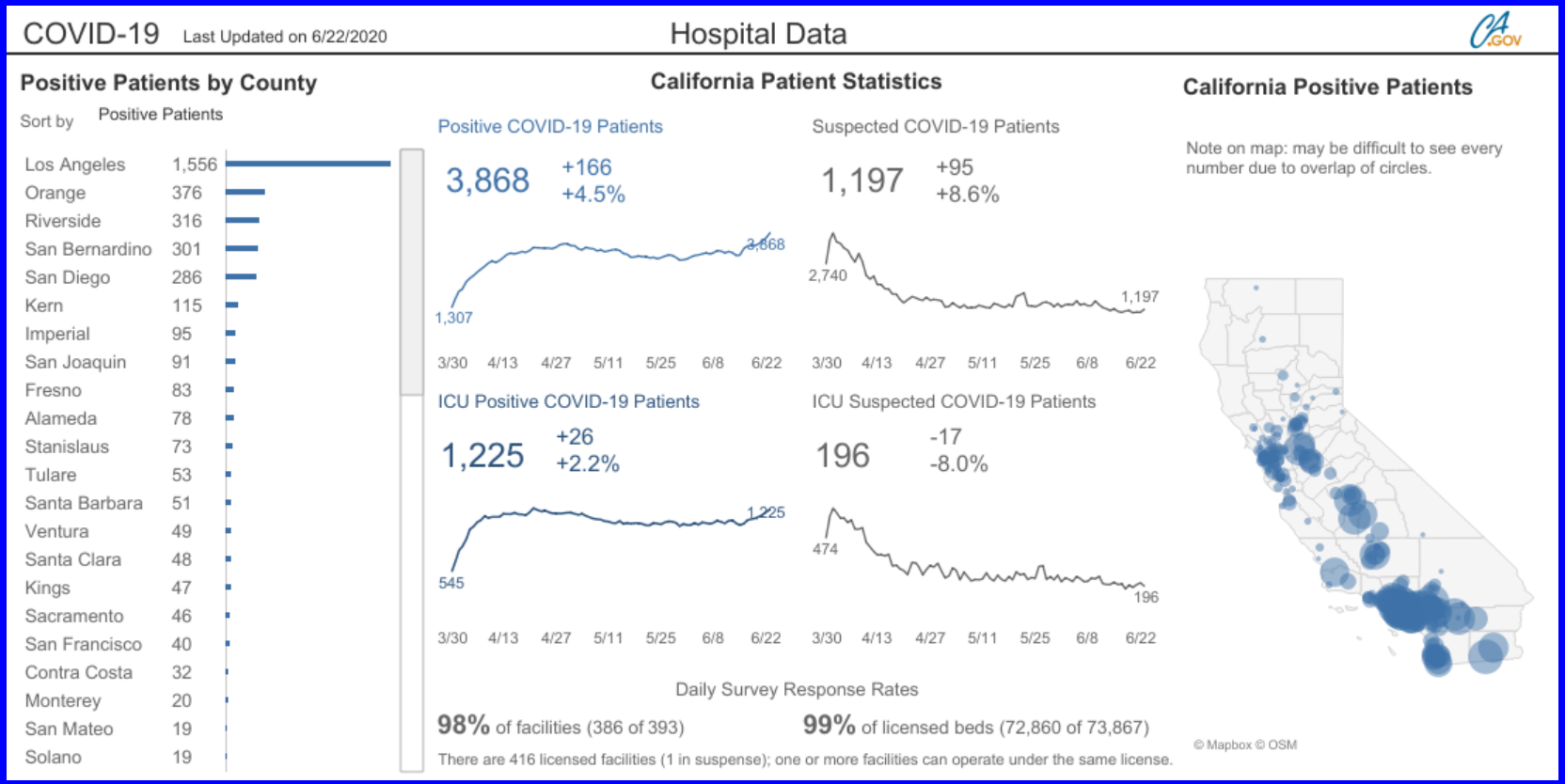
https://www.cdc.gov/coronavirus/2019-ncov/covid-data/images/Age_Adj_Hosp_Rates_Jun11_1200x675_Site.jpg

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

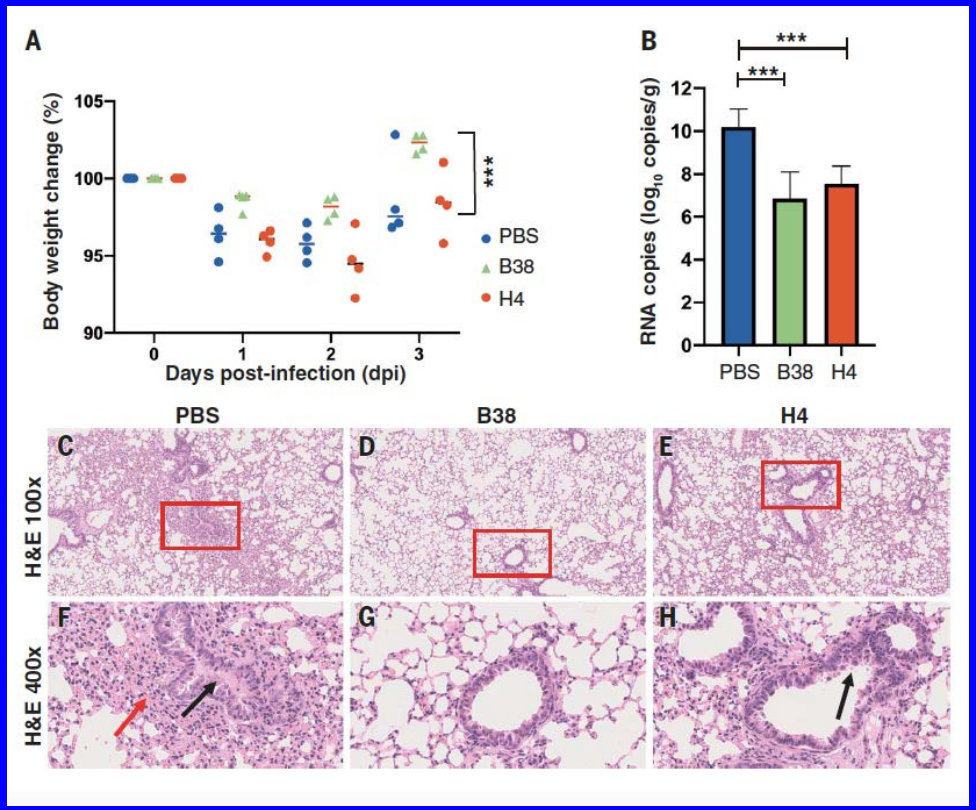
- SARS-CoV-2 nucleic acid amplification test (NAAT)
  - nasopharyngeal, or mid-turbinate, or nasal swabs rather than oropharyngeal swabs or saliva
  - 97% sensitive, 100% specific
  - Rapid tests 74-96% sensitive
    - Hanson. Clin Infect Dis June 16, 2020

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