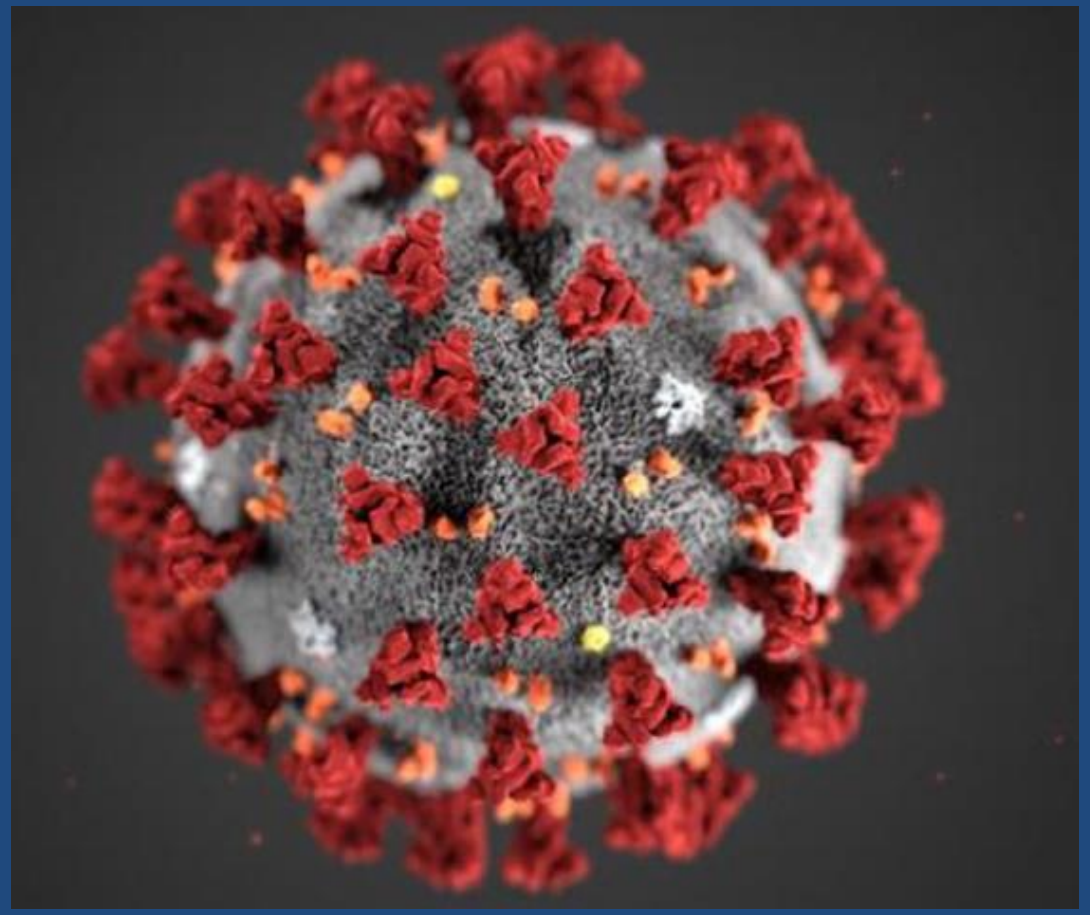
COVID-19 and the Workplace



John Howard, M.D.
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services

California Industrial Hygiene Council Webinar
15 September 2020

NOTE: Information in this power point slide set may have changed since the date of presentation due to new scientific findings.

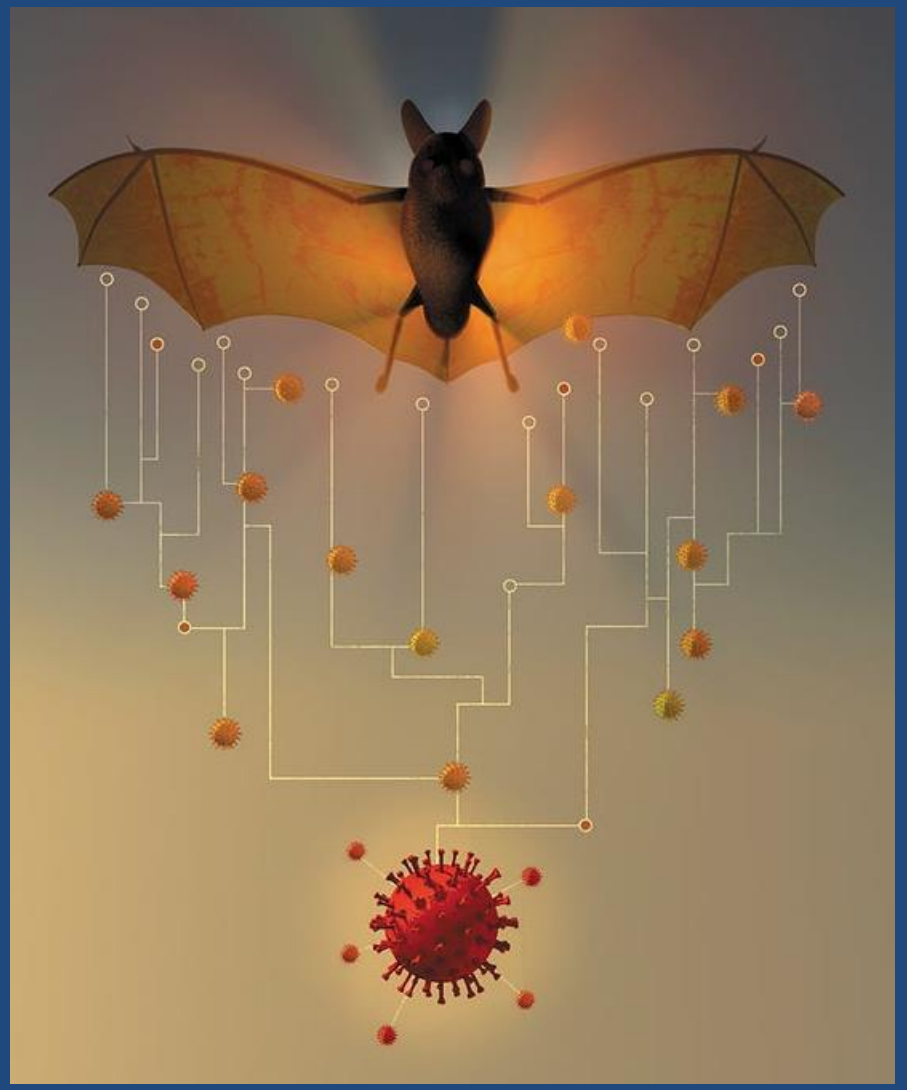
Overview

- COVID-19 Basics
- Transmission
- Testing
- Mitigation
- Vaccines

Nomenclature

- The virus that causes COVID-19 is ***SARS-CoV-2*** which stands for “severe acute respiratory syndrome—coronavirus—two.”
  - Genetic sequence identity
    - 79.6% SARS-CoV-1
    - 96.2% Bat betacoronavirus (BATCoV RaTG13)

- ***COVID-19*** is an abbreviation. ‘CO’ stands for “corona,” ‘VI’ stands for ‘virus,’ ‘D’ stands for ‘disease,’‘ and 19’ refers to 2019 when the viral disease was first identified in December in Wuhan, China.



Coronavirus Family

Coronaviruses	Disease
SARS-CoV-2	COVID-19
SARS-CoV	Severe Acute Respiratory Syndrome (SARS)
MERS-CoV	Middle East Respiratory Syndrome (MERS)
HCoV – 229E	Usually mild respiratory disease (10-15% of common colds caused by HCoVs) but can cause severe disease in vulnerable groups
HCoV – OC43	
HCoV – NL63	
HCoV - HKU1	

Coronaviruses Compared

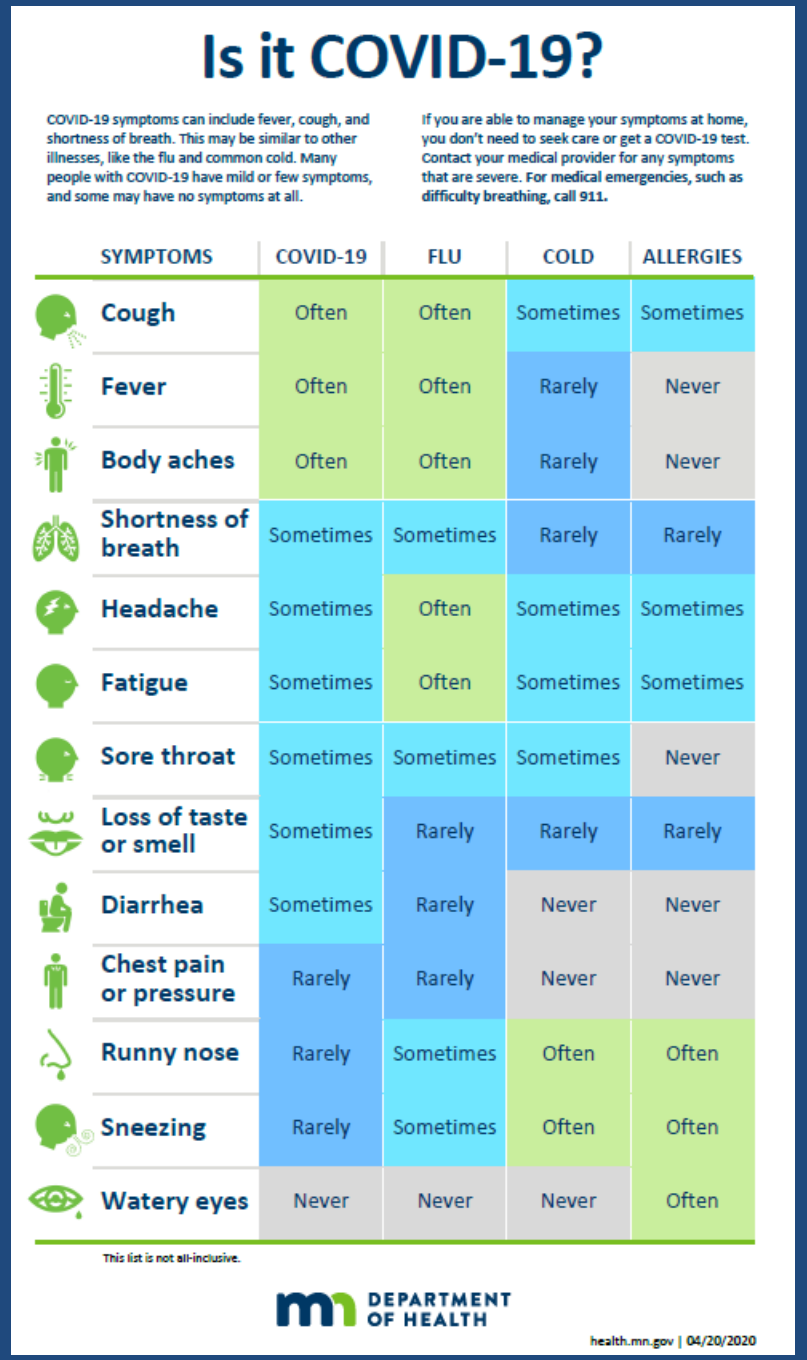
	SARS	MERS	COVID-19	Other coronaviruses (229E, NL63, OC43, HKU1)
Onset	2002, China	2012, Saudi Arabia	**2019, China**	1960s, global
Animal host	Bats	Bats, camels	**Bats**	Bats, domestic animals
Surface S spike GP	+	+	+	+
Symptoms	Fever, cough, SOB, diarrhea	Fever, cough, SOB, GI symptoms, ARF	**Fever, cough, fatigue, muscle aches**	URI: fever, runny nose, sore throat, cough
% hospitalization	100%	100%	**? 15 – 20%**	3 – 11%
Case fatality rate	10%	35%	**? 1 – 3%**	<0.01%
Asymptomatic transmission?	No	No	**Yes**	Yes
Peak viral shedding	Late, >10 days	Late, >10 days	**Early**	Early
R value, or prevalence	R = 2.2 – 3.6	R = 0.4 – 0.9	**? R = 1 – 3 (2.4)**	3 – 26% of global URIs
Super spreaders?	Yes	Yes	**Yes**	No

COVID-19 Basics

- **Presentation**
  - Most cases are mild
  - Some cases involve viral pneumonia
  - Severe cases affect the entire body
    - Lung, liver, kidneys, gut, brain, heart, and blood vessels

- **Acute Symptoms**
  - Cough, fever, trouble breathing
  - New loss of taste or smell

- **Incubation period**
  - 5.2 days on average (range 4—6 days)
  - 99% exhibit symptoms within 12—14 days
    - If they exhibit symptoms at all



Is it COVID-19?

COVID-19 symptoms can include fever, cough, and shortness of breath. This may be similar to other illnesses, like the flu and common cold. Many people with COVID-19 have mild or few symptoms, and some may have no symptoms at all.

If you are able to manage your symptoms at home, you don't need to seek care or get a COVID-19 test. Contact your medical provider for any symptoms that are severe. For medical emergencies, such as difficulty breathing, call 911.

SYMPTOMS	COVID-19	FLU	COLD	ALLERGIES
Cough	Often	Often	Sometimes	Sometimes
Fever	Often	Often	Rarely	Never
Body aches	Often	Often	Rarely	Never
Shortness of breath	Sometimes	Sometimes	Rarely	Rarely
Headache	Sometimes	Often	Sometimes	Sometimes
Fatigue	Sometimes	Often	Sometimes	Sometimes
Sore throat	Sometimes	Sometimes	Sometimes	Never
Loss of taste or smell	Sometimes	Rarely	Rarely	Rarely
Diarrhea	Sometimes	Rarely	Never	Never
Chest pain or pressure	Rarely	Rarely	Never	Never
Runny nose	Rarely	Sometimes	Often	Often
Sneezing	Rarely	Sometimes	Often	Often
Watery eyes	Never	Never	Never	Often

This list is not all-inclusive.

DEPARTMENT OF HEALTH

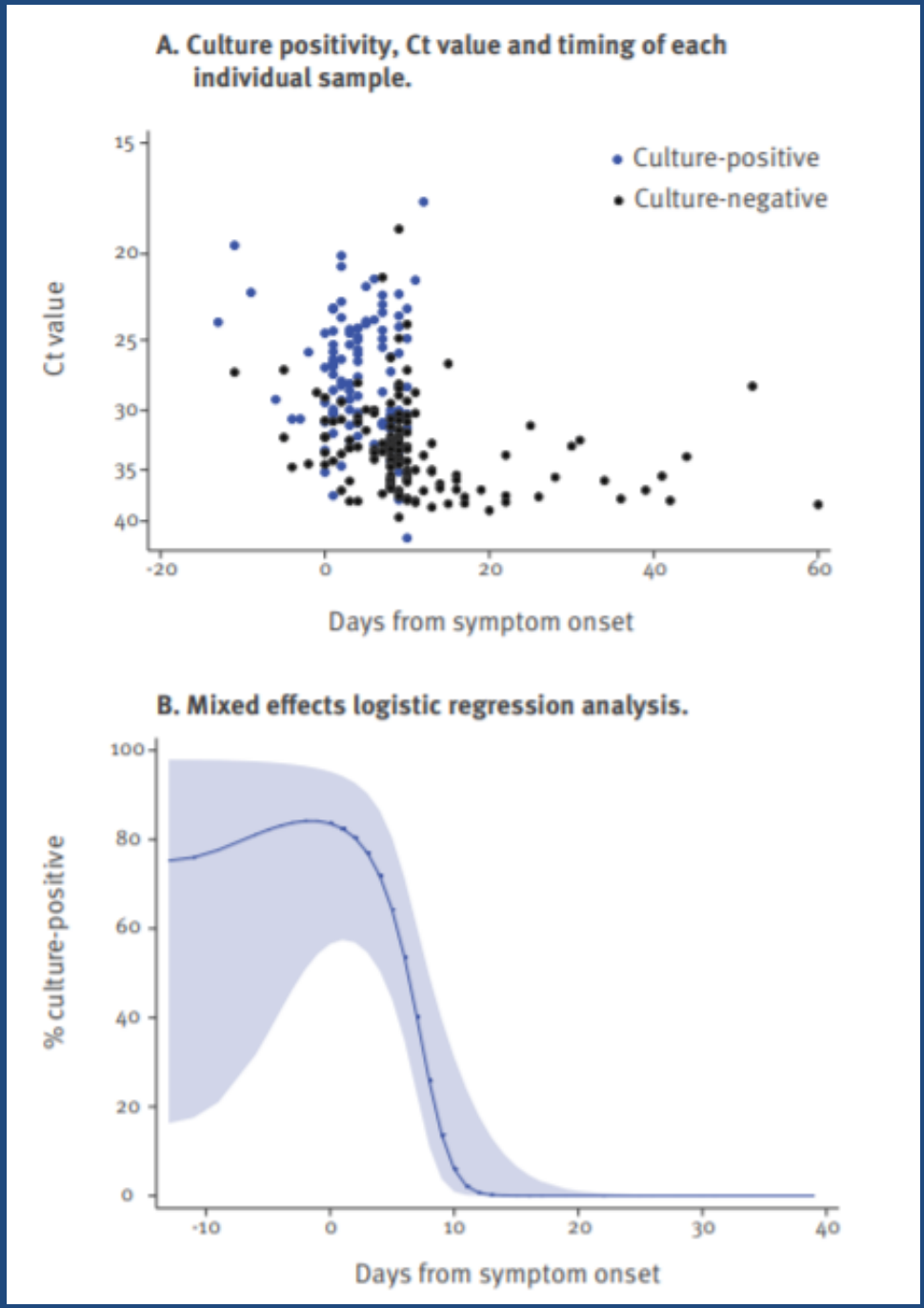
health.mn.gov | 04/20/2020

Period of Infectiousness

Singanayagam et al. *Eurosurveillance* (13 Aug 2020)

- **Onset**
  - 2-3 days **before** to 2-3 days **after** symptom onset
    - Ferretti L et al. *medRxiv* (8 Sep 2020)

- **Duration**
  - 10 days after symptom onset in most people
    - Probability of culturing virus declines to 6% after 10 days, and after 15 days declines to 0.6%
  - 20 days in immunocompromised individuals
    - https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html (16 Aug 2020)



Asymptomatic vs. Pre-Symptomatic

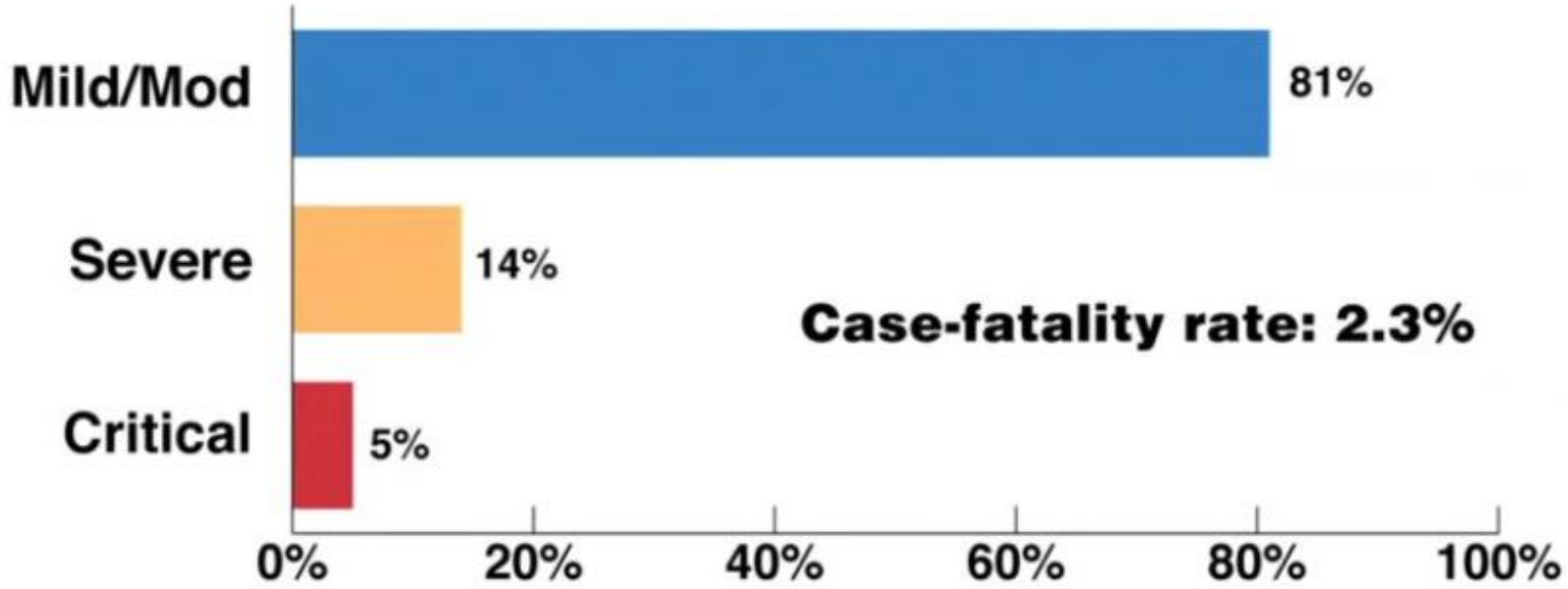
- **Asymptomatic**
  - Definition
    - Viral test positive, without symptoms through entire course of infection
  - Prevalence Surveys
    - Wide range of infections are asymptomatic—6.3 to 96%
    - 40 to 45% across several surveys (Oran & Topol, 2020)
  - Characteristics
    - Viral load similar to symptomatic persons
    - Viral loads tend to decrease more slowly than in symptomatic or pre-symptomatic patients
      - » Lee et al. *JAMA Int Med* (6 August 2020)
- **Pre-symptomatic**
  - Asymptomatic at the time, but only for a short time
  - 2 weeks on average

COHORT	TESTED	PERCENT POSITIVE	SHARE OF INFECTIONS THAT WERE ASYMPTOMATIC
Diamond Princess cruise ship passengers and crew	3,711	19.2%	**46.5%**
Boston homeless shelter occupants	408	36.0	**87.8**
New York City obstetric patients	214	15.4	**87.9**
USS Theodore Roosevelt aircraft carrier crew	4,954	17.3	**58.4**
Japanese citizens evacuated from Wuhan, China	565	2.3	**30.8**
Charles de Gaulle aircraft carrier crew	1,760	59.4	**47.8**
Los Angeles homeless shelter occupants	178	24.2	**62.8**
King County, Wash., nursing facility residents	76	63.2	**6.3**
Arkansas, North Carolina, Ohio and Virginia inmates	4,693	69.8	**96.0**
New Jersey university and hospital employees	829	4.9	**65.9**
Indiana residents	4,611	1.7	**44.8**
Argentine cruise ship passengers and crew	217	59.0	**81.3**
San Francisco residents	4,160	1.8	**52.7**
Tyson Foods Springdale, Ark.	3,748	12.8	**94.6**

Sources: Annals of Internal Medicine, Tyson Foods

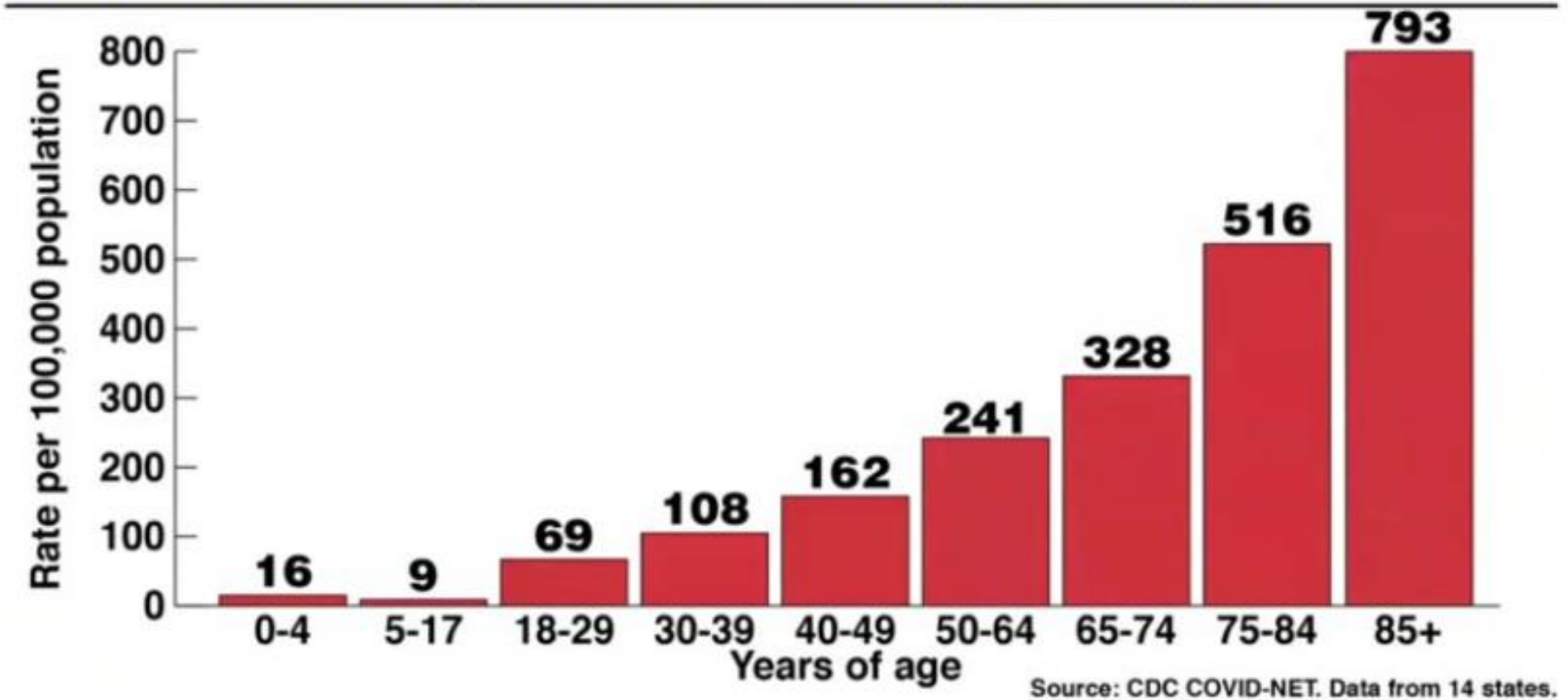
THE WASHINGTON POST

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



Source: Z Wu & JM McGoogan, *JAMA* 323:1239, 2020.

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



Source: CDC COVID-NET. Data from 14 states.

May 11, 2020

JAMA

The Journal of the American Medical Association

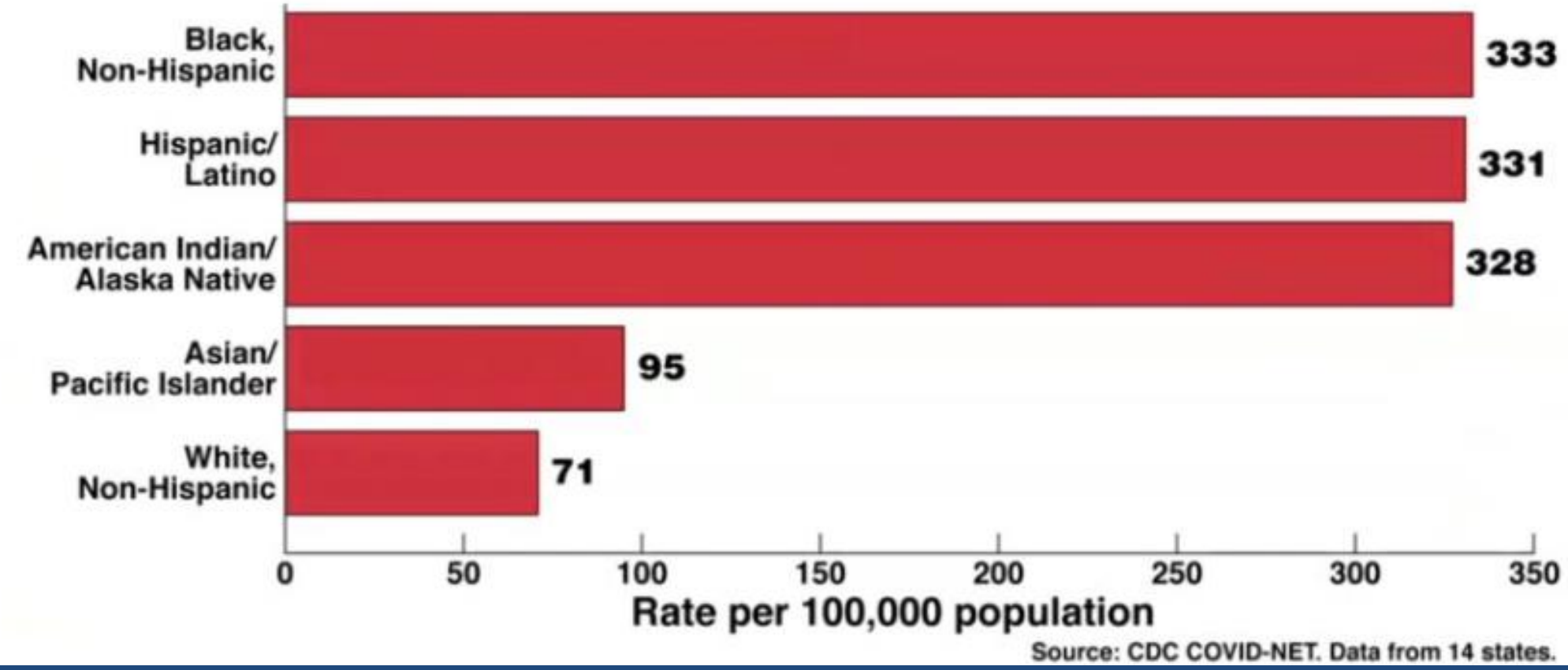
Viewpoint

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."

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

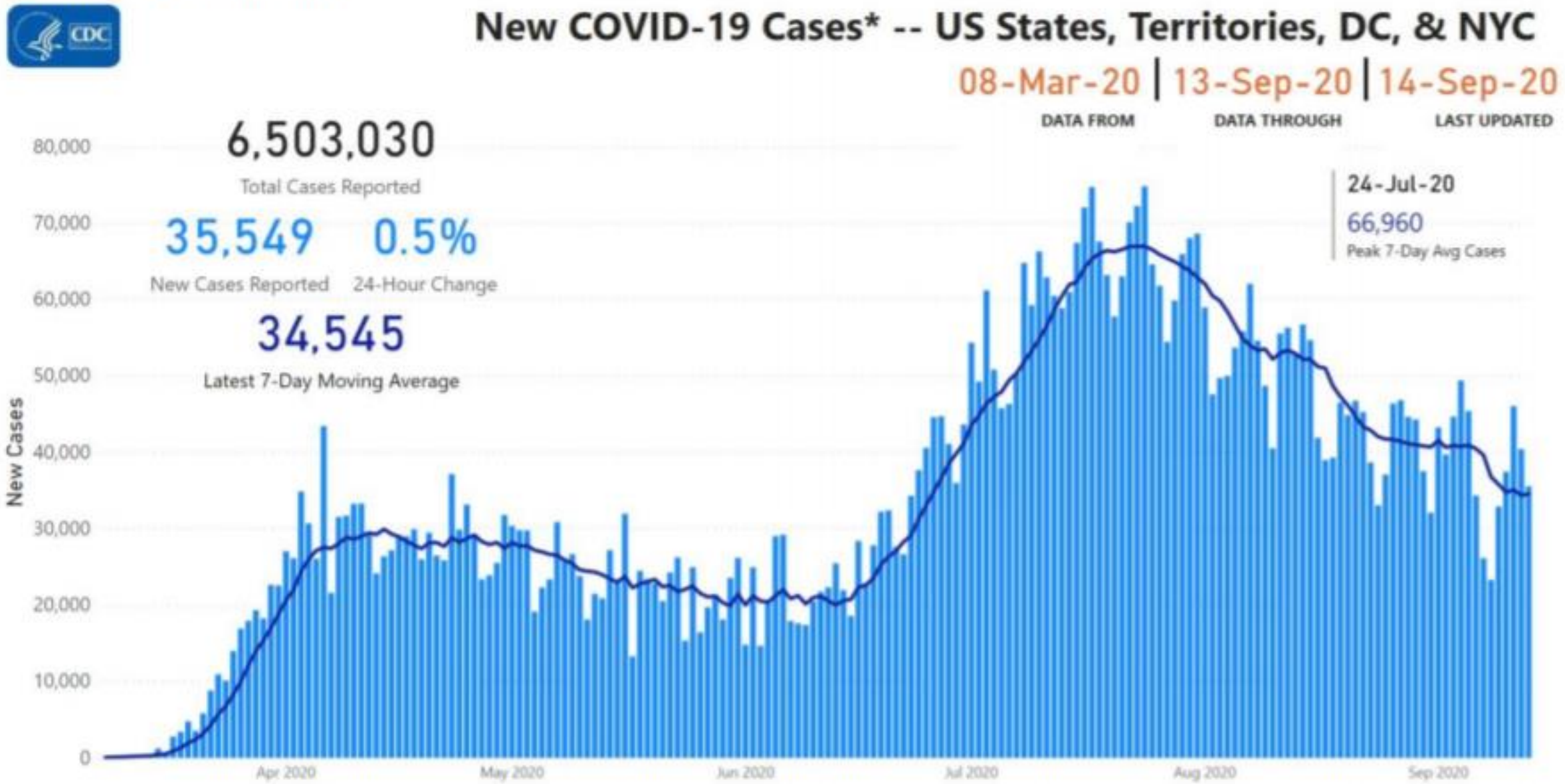


Source: CDC COVID-NET. Data from 14 states.

New COVID-19 Cases by Date

Data 08 Mar 2020 through 13 Sep 2020 *Last Update: 14 Sep 2020, 11:30*

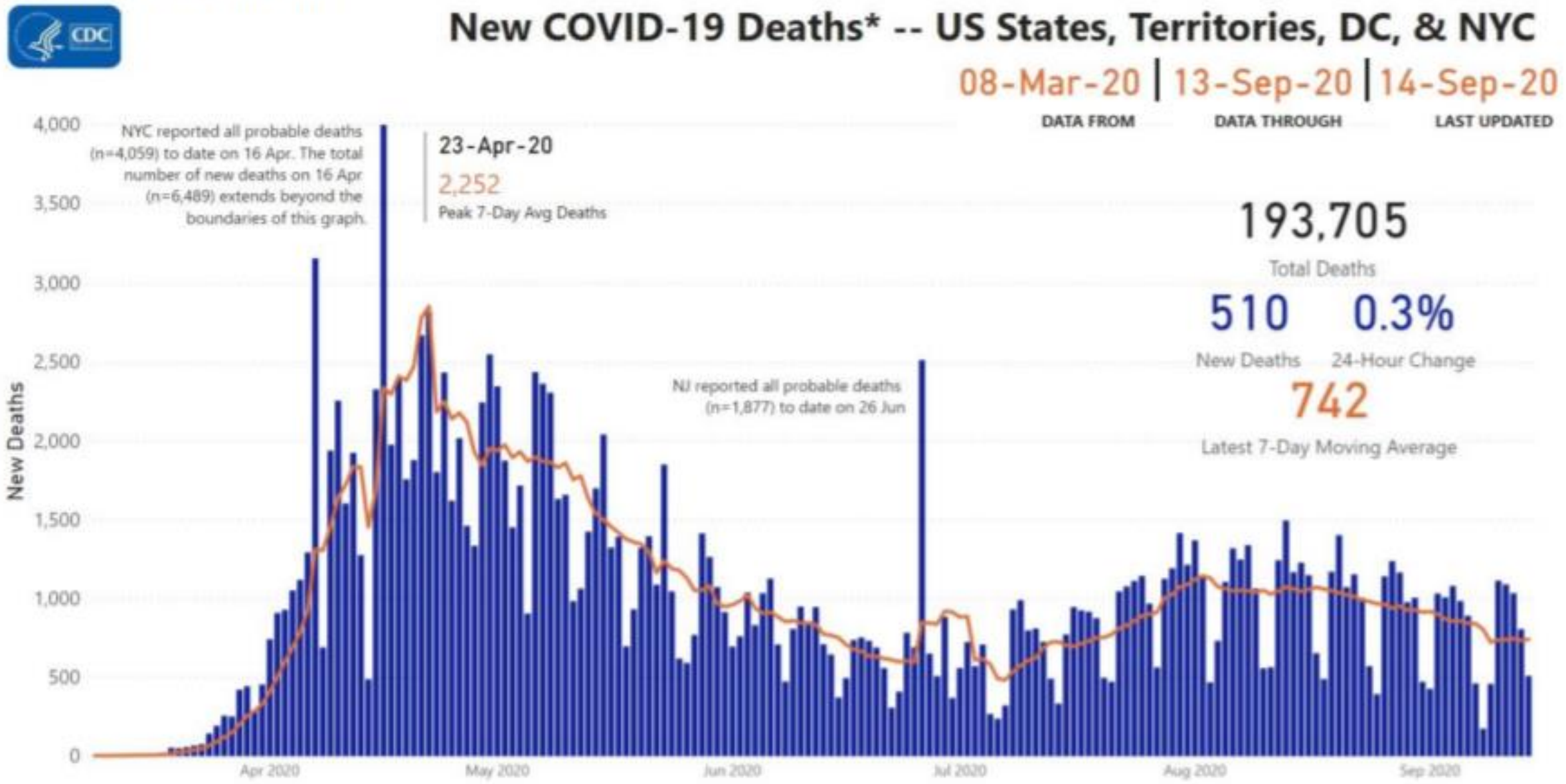
Source: CDC DCIPHER



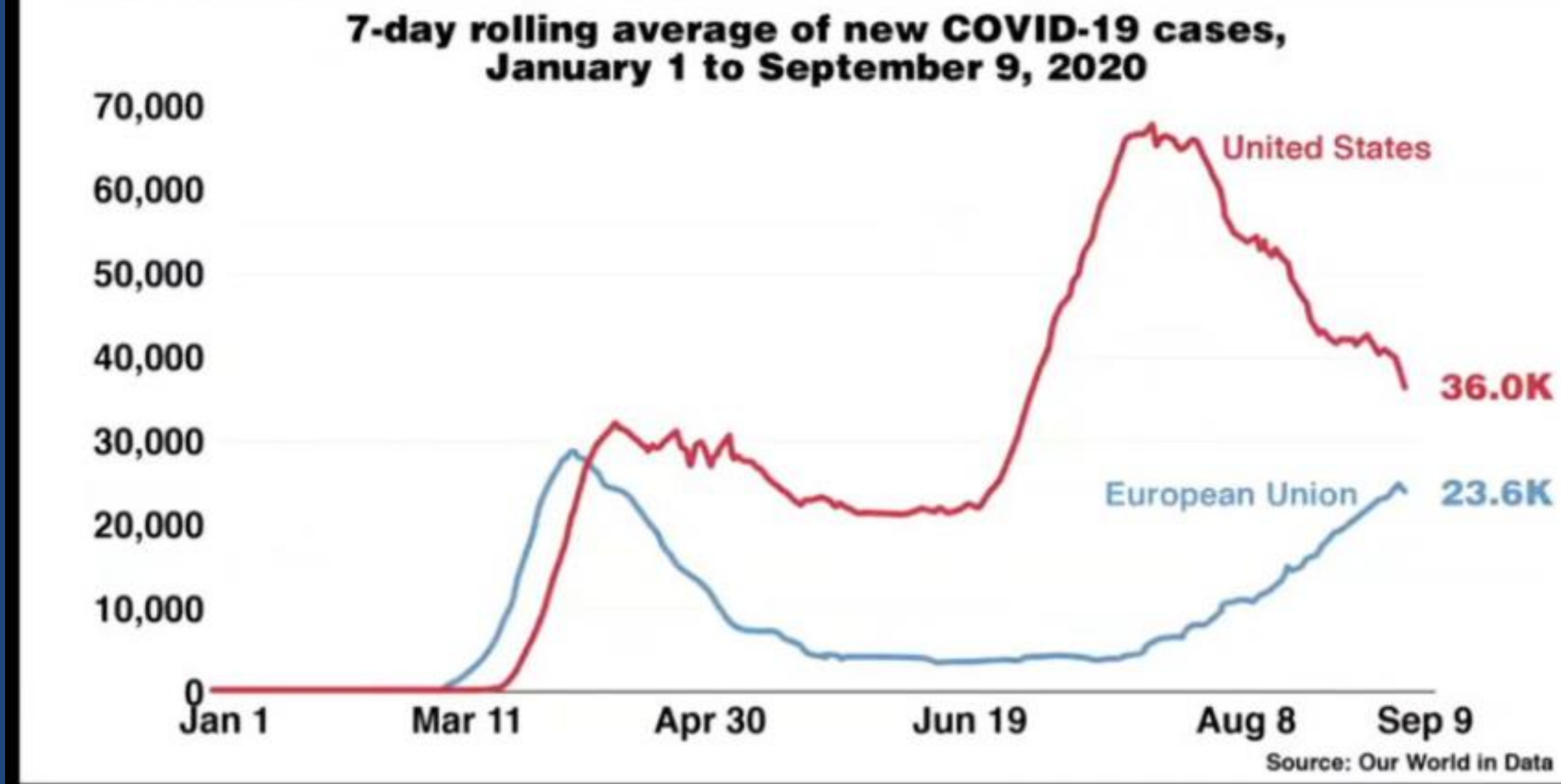
New COVID-19 Deaths by Date

Data 08 Mar 2020 through 13 Sep 2020 *Last Update: 14 Sep 2020, 11:30*

Source: CDC DCIPHER



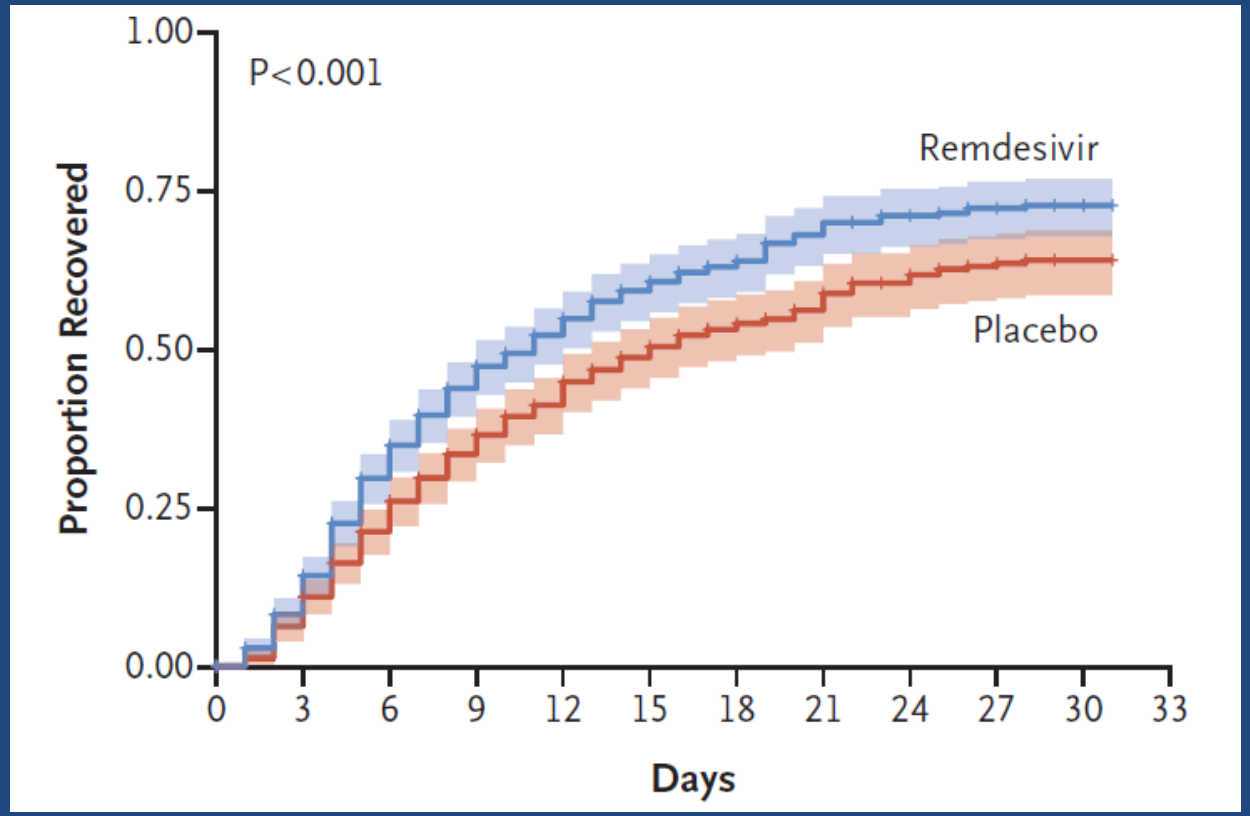
New COVID-19 Cases: US vs. EU



Therapeutics

- No proven medications to treat COVID-19 or for prevention, but several medications are undergoing clinical evaluation for both purposes.
  - https://clinicaltrials.gov/

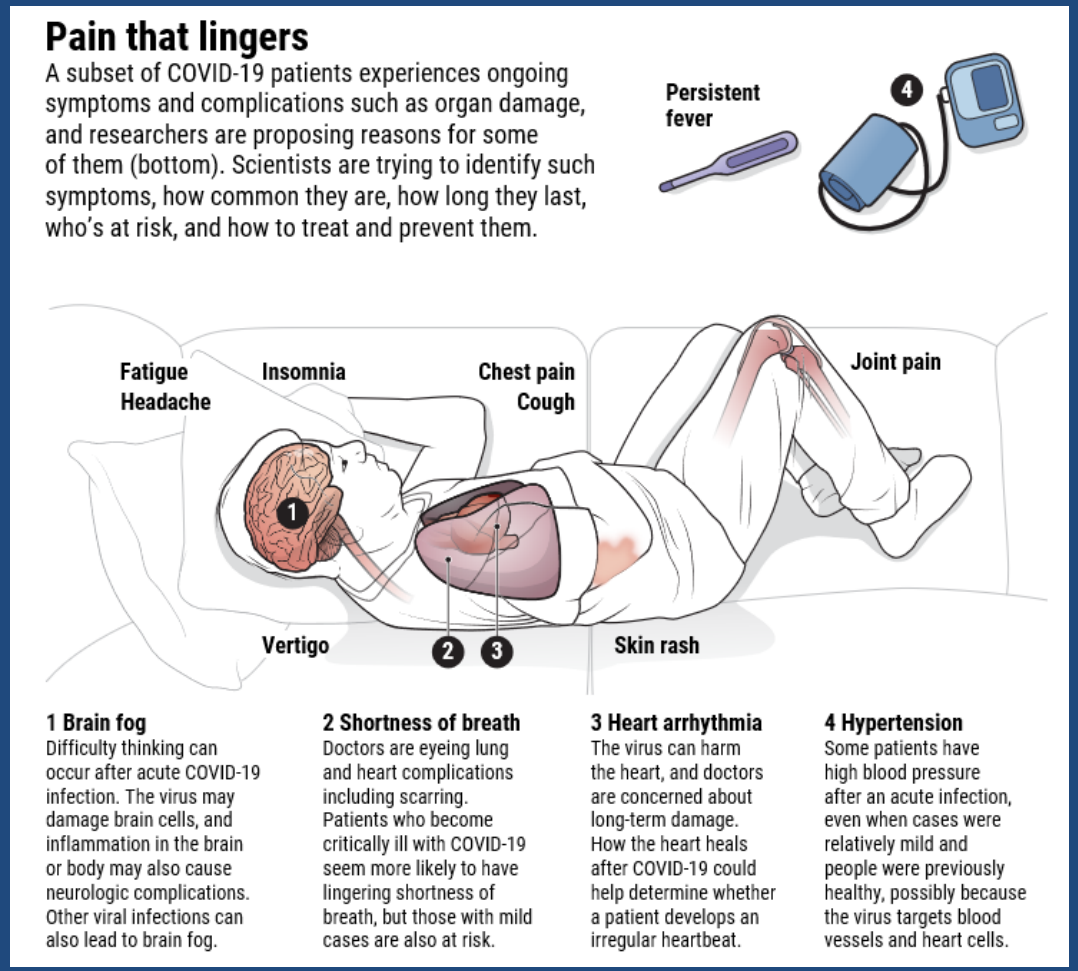
- **Therapeutic Categories:**
  - Antivirals (Remdesivir)
  - Corticosteroids
  - Anti-parasitic agents
    - Hydroxychloroquine
  - Anti-inflammatory agents
  - Antibodies
    - Natural (convalescent plasma)
    - Cloned (laboratory produced)



Survival Without Recovery?

Persistent Symptoms

- Common longer-term effects
  - Fatigue (55%), dyspnea (42%), memory loss (34%)
- Duration
  - Unknown
- Prevalence of “long haulers”
  - Unknown
- Return to work issues
  - Not likely infectious
  - Return to work and reasonable accommodations
  - Rehabilitation and disability management
- Survivor studies are just beginning
  - *Mount Sinai Center for Post-COVID Care*
    - https://www.mountsinai.org/about/covid19/center-post-covid-care



Reinfection

- **Animal**
  - Rhesus macaques re-challenged with identical SARS-COV-2 strain:
    - Experienced a boosted immune response, but no detectable viral dissemination or clinical manifestations of viral disease
      - Deng et al. DOI: 10.1126/science.abc5343 (July 2, 2020)

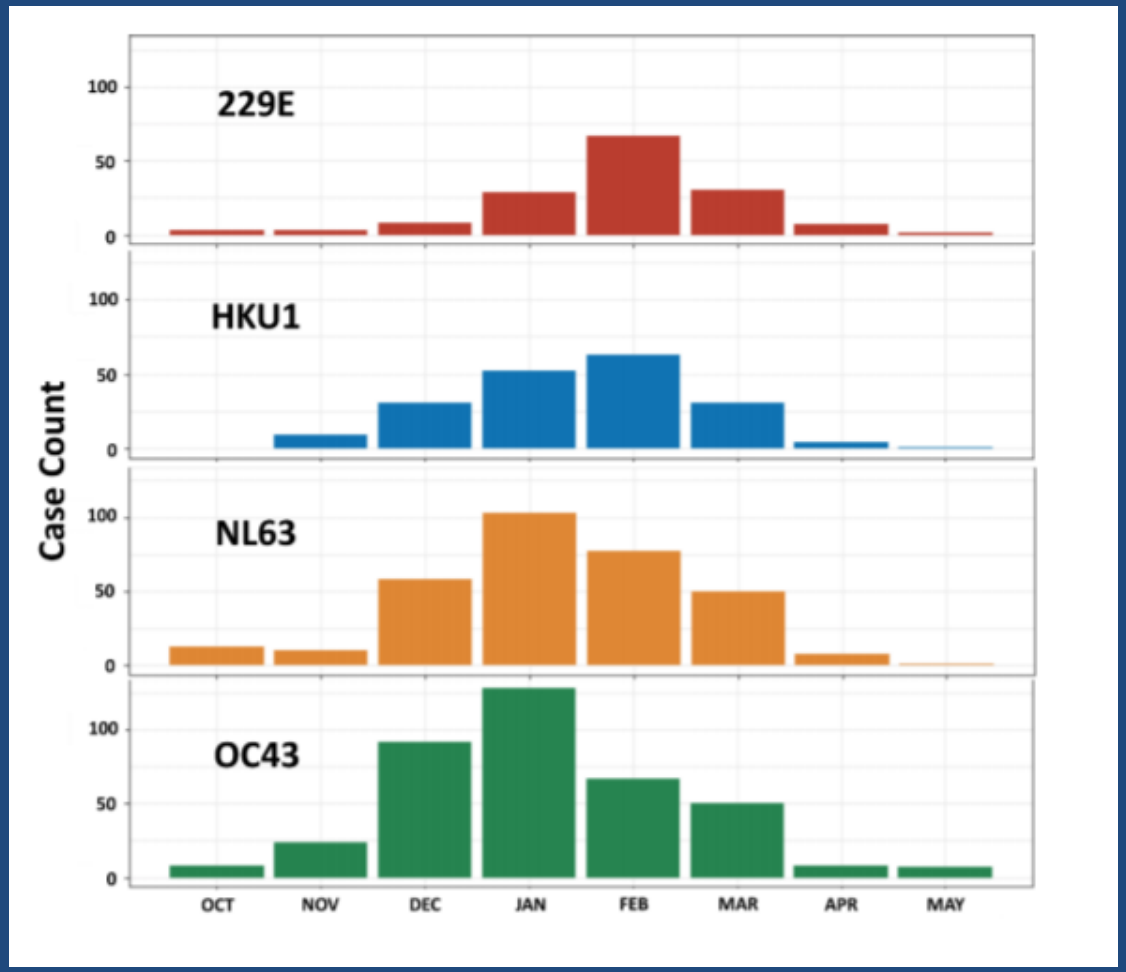
- **Human**
  - One reinfection case reported in Hong Kong and one in Reno, Nevada
    - 33-year-old male in Hong Kong with COVID-19 in March, discharged after 2 negative PCR tests. Tested PCR+ during arrival screening, but asymptomatic. Genomic analysis found virus samples belonged to 2 distinct lineages/clades.
      - To KK-W et al. *Clin Infectious Dis* (24 August 2020)

    - 25-year-old male in Nevada tested negative twice in April after COVID-19, and then in August was hospitalized, but with different virus.
      - Tillett R. *Lancet* (27 August 2020)

  - Majority of cases:
    - Recovered COVID-19 individuals who subsequently developed new symptoms and retested positive had no replication-competent virus detected.
      - Korea CDC, 2020; Lu et al., 2020.

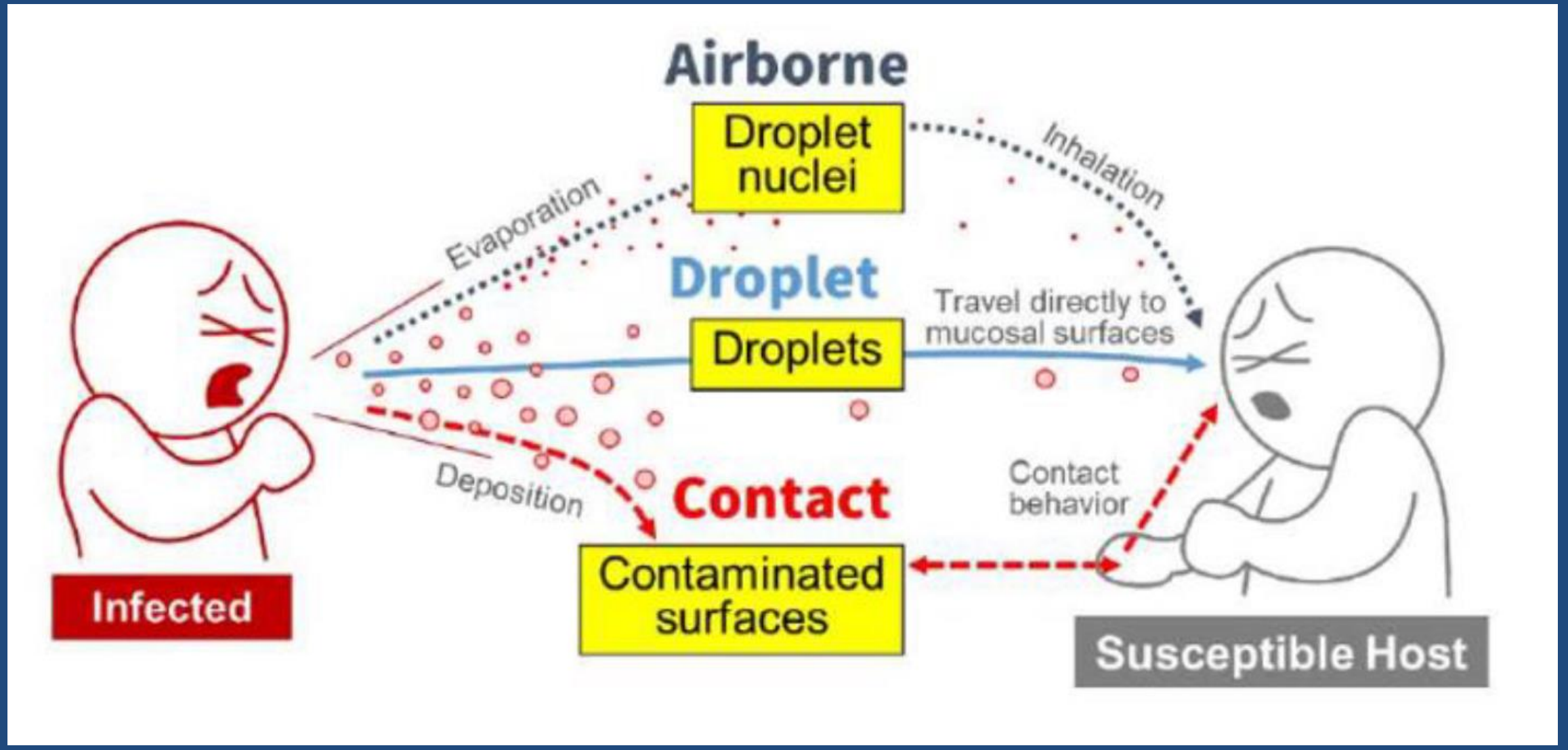
Seasonality

- Coronaviruses producing the common cold are very seasonal
  - Decline in spring and summer and increase in fall and winter
    - Monto AS et al. *J Infect Dis* DOI: 10.1093/infdis/jiaa161
- Seasonality Theory
  - SARS-CoV-2 transmissibility and viability may be affected by temperature and humidity.
  - These factors could drive seasonal variation in COVID-19.
- SARS-CoV-2 is probably not going away anytime soon



Virus Transmission

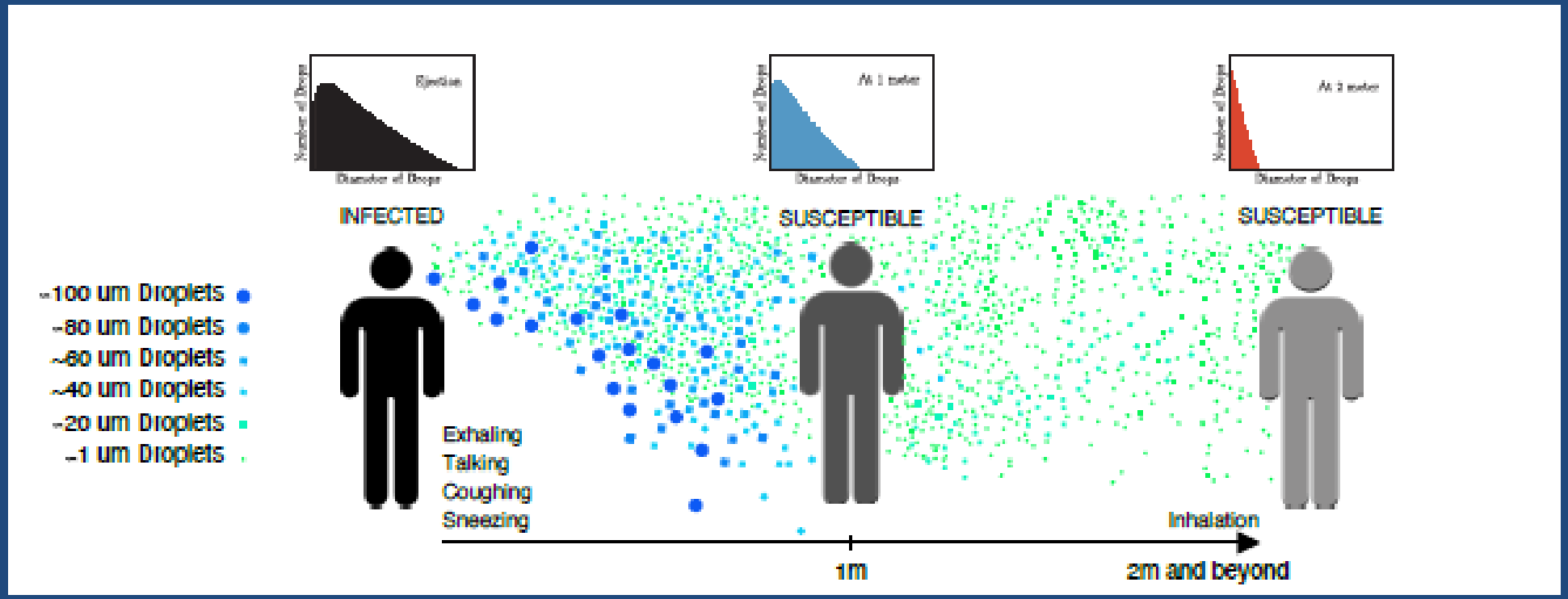
- Airborne
- Droplet
- Contact


Airborne
Droplet nuclei
Inhalation
Evaporation
Droplet
Travel directly to mucosal surfaces
Droplets
Deposition
Contact
Contact behavior
Contaminated surfaces
Infected
Susceptible Host

Two Dominant Routes: Droplet and Airborne

Balachandar et al. *medRxiv* (1 Sep 2020)

- **Generation**: sneezing, coughing, singing, speaking, breathing
- **Transport:**
  - Large (droplets)—undergo **gravitational settling** faster than they evaporate because of size
  - Smaller particles (droplet nuclei or aerosols) **evaporate** faster than they settle, affected by air currents, may travel longer distances



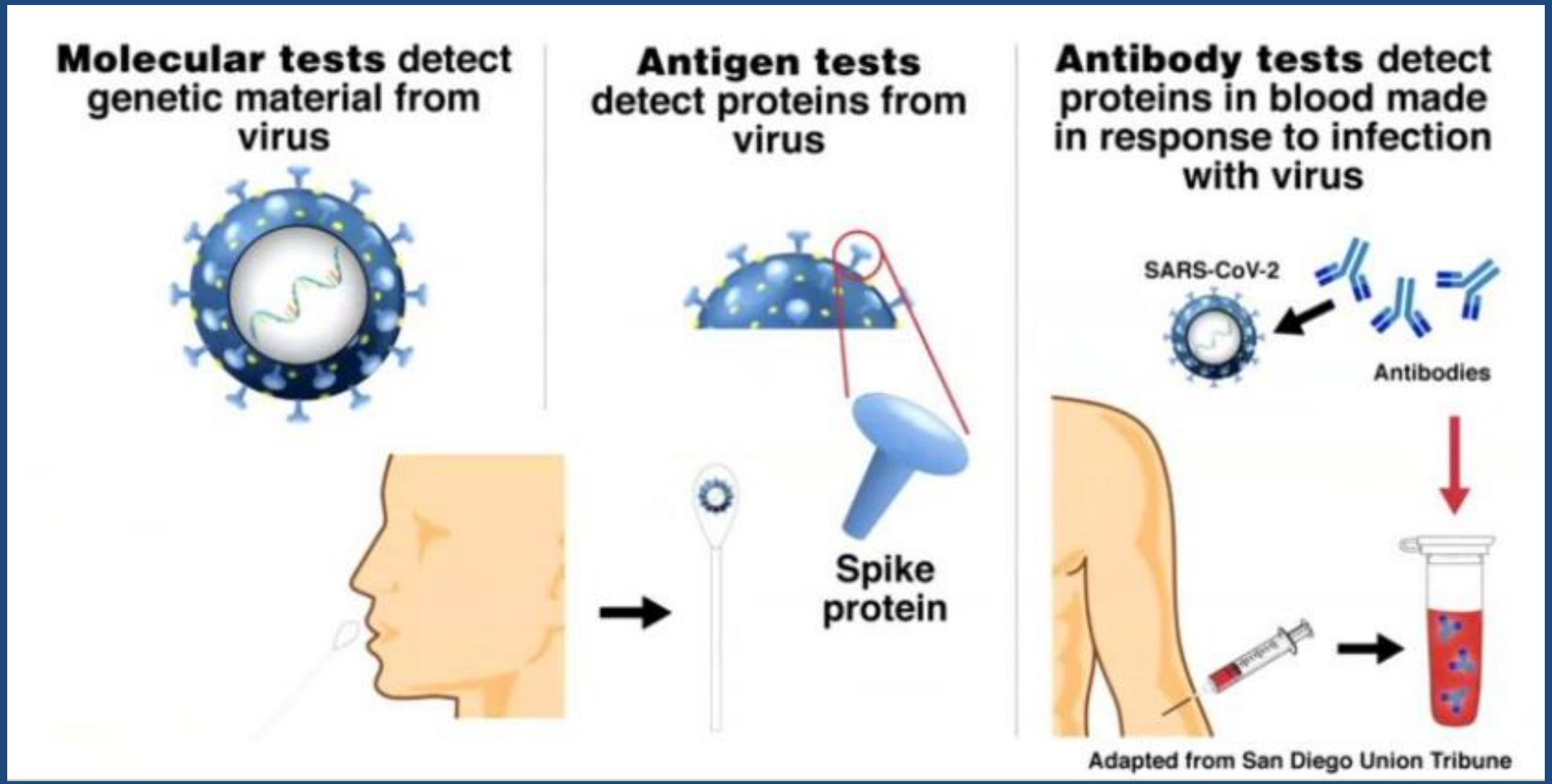
Contact Transmission

- **Direct Contact**
  - Virus transferred from infected person to susceptible person directly.
    - Droplet transmission is a type of direct contact

- **Indirect Contact**
  - Virus moves to a susceptible person by way of an object or surface
  - Susceptible person touches a surface or object that has viable virus on it
  - Then touches their own eyes, nose or mouth
  - Transfers the virus from the object or surface to their body

Testing

Types of Testing

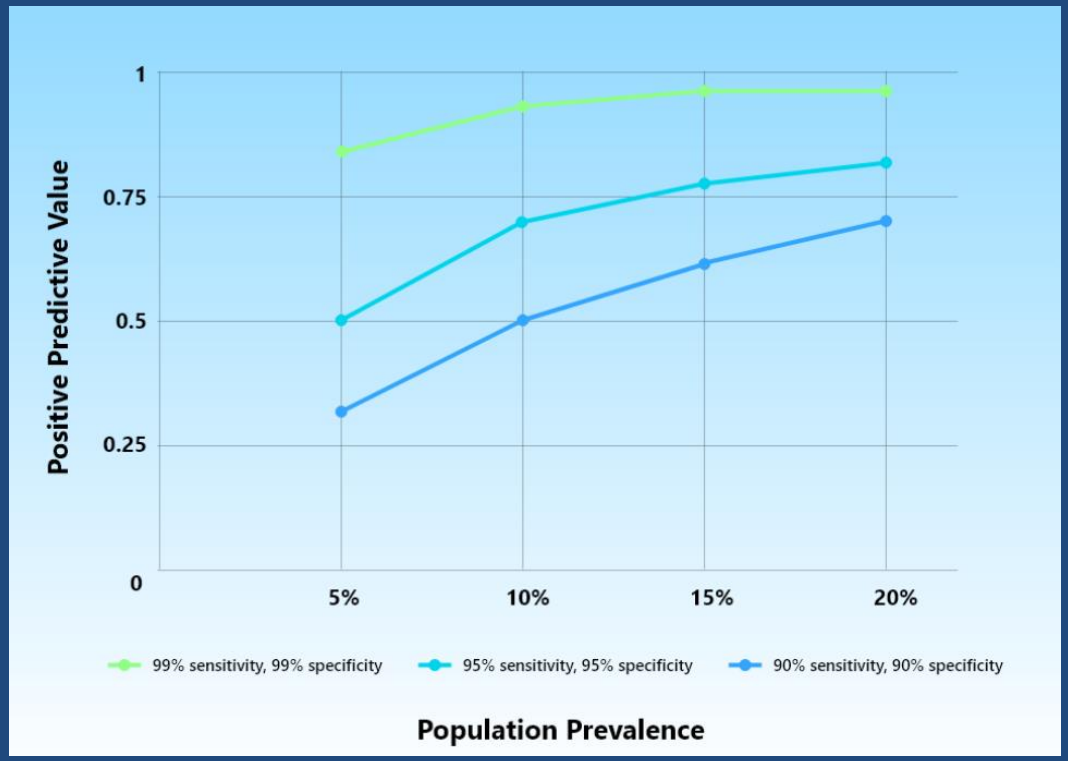


Test Performance—It's Complicated

- **No test is 100% accurate and performance can vary within populations.**

- **Performance Characteristics**
  - Sensitivity—how well test identifies **infected**
    - Low sensitivity produces more false-negative results
  - Specificity—how well test identified **uninfected**
    - Low specificity produces more false-positive results

- **Interpretation Results**
  - Positive predictive value (PPV)
    - Likelihood a positive test result means person is **truly infected**
    - High prevalence setting—PPV increases (true positives ↑)
    - Low prevalence setting—PPV (↑ false-positives)
  - Negative predictive value
    - Likelihood a negative-test result means person is **truly uninfected**
    - High prevalence setting—NPV drops (true negatives ↑)
    - Low prevalence setting—NPV increases (↓ false-negatives)



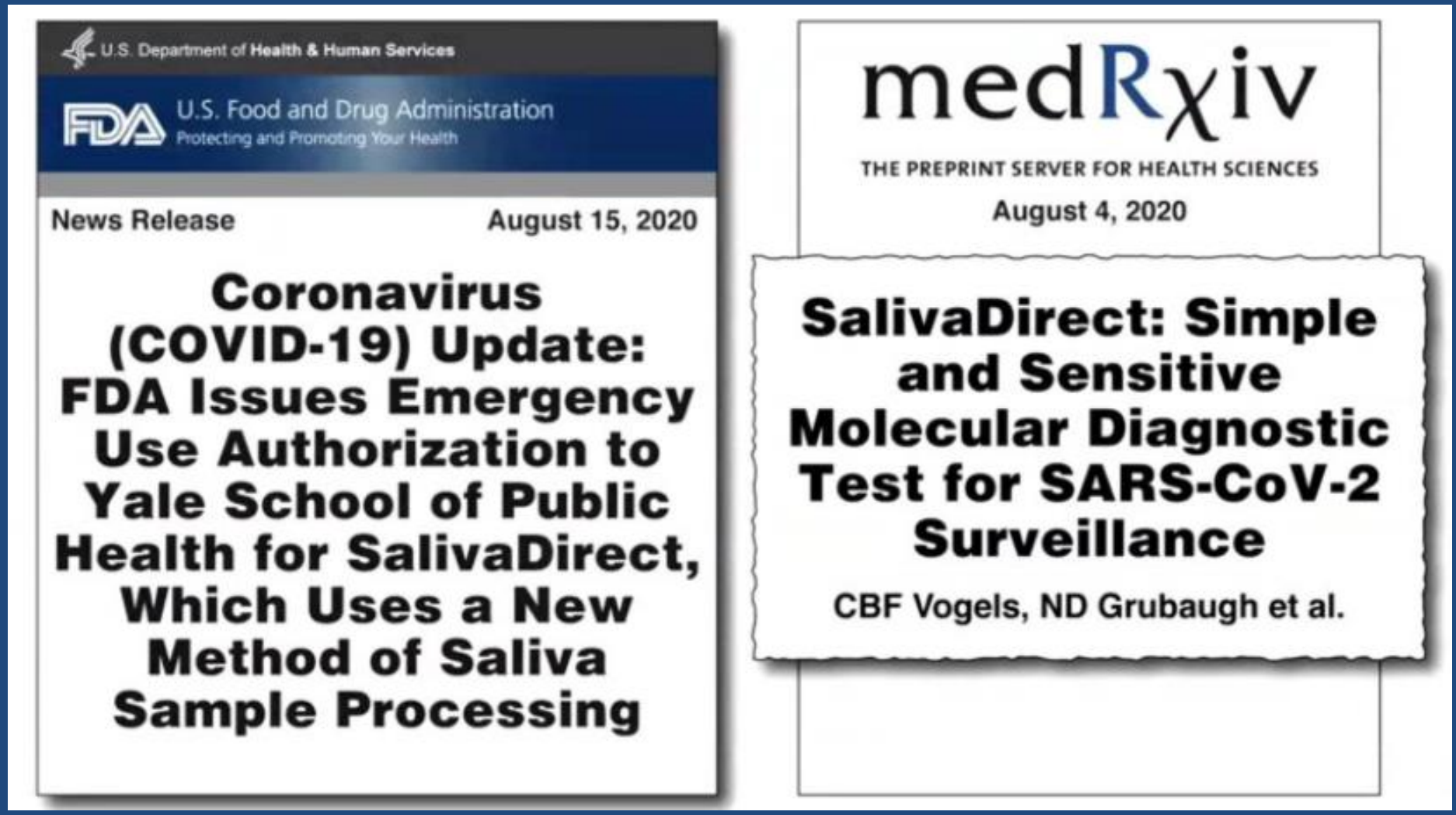
Testing: SARS-CoV-2 Dynamics

- Infected ≠ Infectious
- Following exposure, there is a 5-day window of maximum transmissibility
- Timing of testing matters relative to exposure or presence of symptoms
- Infectiousness depends on viral burden which rises steeply between 3-8 days following exposure
- After that viral shedding and infectiousness steadily decline

Molecular Testing Using RT-PCR

- Reverse transcription polymerase chain reaction (RT-PCR) is the gold standard to detect infection. RT-PCR test is highly sensitive—prevents false negatives.
- Does not depend on viral shedding.
- Poor job determining who is an infectious ("spreader"), *unless* PCR test is done during the window of maximum transmissibility. PCR positive in people who are not infectious and pose no infectious risk.
- RT-PCR turns positive as early as Day 2 after exposure, may stay positive up to 12 weeks after exposure!
- RTPCR may have a role in testing workers who are symptomatic at entry into the workplace

Saliva Tests Using RT-PCR: Simplifies Sample Collection



U.S. Department of Health & Human Services

FDA U.S. Food and Drug Administration
Protecting and Promoting Your Health

News Release August 15, 2020

Coronavirus (COVID-19) Update: FDA Issues Emergency Use Authorization to Yale School of Public Health for SalivaDirect, Which Uses a New Method of Saliva Sample Processing

medRxiv

THE PREPRINT SERVER FOR HEALTH SCIENCES

August 4, 2020

SalivaDirect: Simple and Sensitive Molecular Diagnostic Test for SARS-CoV-2 Surveillance

CBF Vogels, ND Grubaugh et al.

Antigen Testing

https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html

- Antigen tests are relatively inexpensive, can be used at the point-of-care, and can return results in approximately 15 minutes.
- Have a 30% false negative rate—not as sensitive as molecular tests like RT-PCR.
- Unlike RT-PCR, antigen tests do not detect faint signals of viral RNA outside the period of infectiousness.
- Perform best when the person is tested in the early stages of infection when viral load is generally the highest and the person is maximally infectious.

August 27,2020

Science

NEWS

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

RF Service

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

Antigen Testing—BinaxNOW

- Abbott's BinaxNOW COVID-19 Ag Card does not require a separate instrument to analyze its result.
- Uses plain nasal swab
- Shows a positive result as a pair of colored lines on a test strip and takes about 15 minutes!
- EUA specifies use for "diagnosing COVID-19"
  - https://www.fda.gov/media/141567/download
- U.S. government has bought 150 million of the Abbot tests ($750M)
- Initially to be deployed for schools, nursing homes, and other areas at high risk of COVID-19 transmission.
- Abbot is studying its use for asymptomatic screening

Workplace Testing

https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/testing-non-healthcare-workplaces.html

Preventing Entry

Returning Safely

Preventing Entry Into Work

- **Test Platform**
  - Point-of-Care Antigen tests
    - https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html
- **Hazard Elimination**
  - When preventing entry of SARS-CoV-2 into a workplace, it is the infectious, but asymptomatic, workers you want to identify
  - Antigen testing is maximally sensitive when people are maximally infectious
- **Serial Testing**
  - Time between exposure and a positive viral test should determine test frequency
    - Test interval of 3 to 8 days for periodic screening results in lowest rate of false-negative antigen tests—coincides with the maximal period of infectiousness
  - Frequency and turnaround time more important than test sensitivity (Larremore et al. 2020)

Preventing Spread at Work

https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/testing-non-healthcare-workplaces.html

- Workers who are a close contact to a confirmed or suspected COVID-19 case
  - Should be identified and quarantined for 14 days
  - Testing **may be** considered when contact is identified, even if asymptomatic
    - https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html

- Serial testing, may be more likely to detect infection among close contacts of a COVID-19 case than testing done at a single point in time—interval 3 to 8 days.

- Critical Infrastructure Sector Workers Who Are Close Contacts
  - Quarantine for 14 days at home like regular workers
  - Bring worker back sooner than 14 days, if asymptomatic, with infection controls
  - Workers may be permitted to remain at work if asymptomatic & with infection controls
    - https://www.cdc.gov/coronavirus/2019-ncov/community/worker-safety-support/hd-testing.html

What about a Post-COVID Worker
Who becomes a Close Contact to a COVID-19 Case?

- **General Quarantine Rule**
  - For a worker who has had close contact with someone with COVID-19 should isolate for 14 days **after their last exposure** to that person.

- **Post-COVID-19 Workers**
  - A worker who has had close contact with a confirmed or suspected COVID-19 case, and who had developed and recovered from COVID-19 illness within the previous 3 months, **does not** need to quarantine at home.
    - https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html

Returning Safely to Work

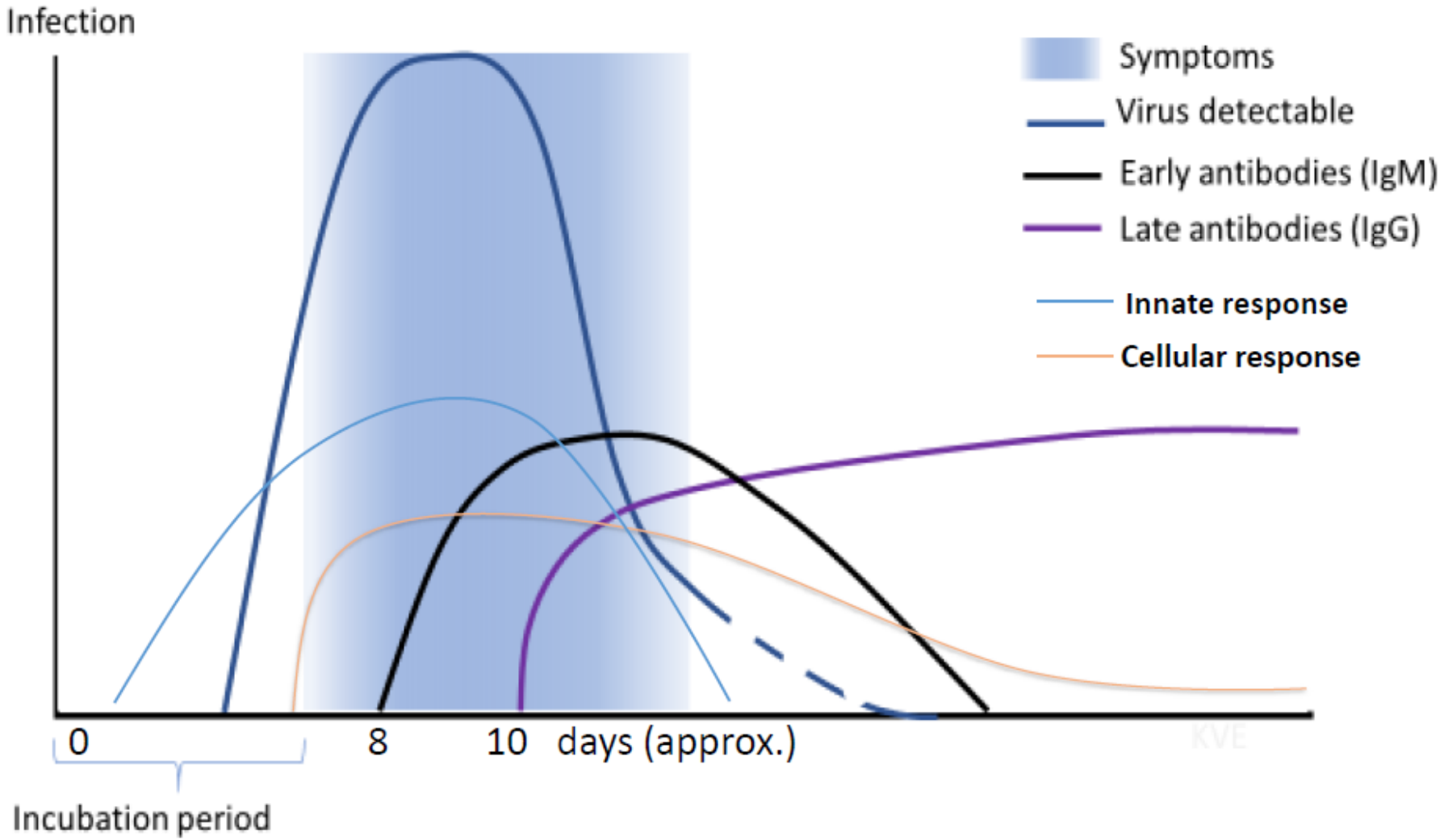
https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html
https://www.cdc.gov/coronavirus/2019-ncov/hcp/return-to-work.html
https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/returning-to-work.html

- **Symptom Strategy**
  - Viral RNA may be detectable up to 3 months after diagnosis and long after the end of the infectious period
    - Korea CDC, 2020; Li et al., 2020; Xiao et al, 2020
  - A test-based strategy is no longer recommended for determining reentry, but popular with employers.

- **Duration of Isolation**
  - COVID-19 Case with symptoms
    - Discontinue 10 days after 24 hours without fever (or fever-reducing meds), and improvement in any other symptoms
      - Severe illness extends isolation up to 20 days after symptom onset.
  - COVID-19 Case without symptoms)
    - Discontinue 10 days after the date of their first positive viral test.

- **Duration of Quarantine**
  - Contact to COVID-19 Case (no symptoms)
    - Discontinue after 14 days of quarantine (based on range of incubation period)
      - Exception—to preserve the function of critical infrastructure and protect public health and safety

The immune response to viral infections



Antibody Testing

https://www.cdc.gov/coronavirus/2019-nov/lab/resources/antibody-tests-guidelines.html
https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html

- **Pre-Existing Immunity**
  - SARS-CoV-2-reactive T cells and antibodies detected in blood donors from 2018.
    - Braun et al. *Nature* (29 July 2020), Mateus et al. *Science* (4 August 2020), Ng et al. *medRxiv* (23 July 2020)

- **Duration**
  - Other CoVs
    - Immunity to HCoV-OC43 and HCoV-HKU1 wanes within a year
    - Immunity to SARS-CoV-1 can generate longer lasting immunity
  - Mild COVID-19
    - Demonstrates rapid decay of antibodies
      - Ibarrondo FJ et al. NEJM (10 Sep 2020)
  - Antibodies correlate with short-term protection from infection on a fishing vessel outbreak
      - Addetia et al. *medRxiv* (13 August 2020)

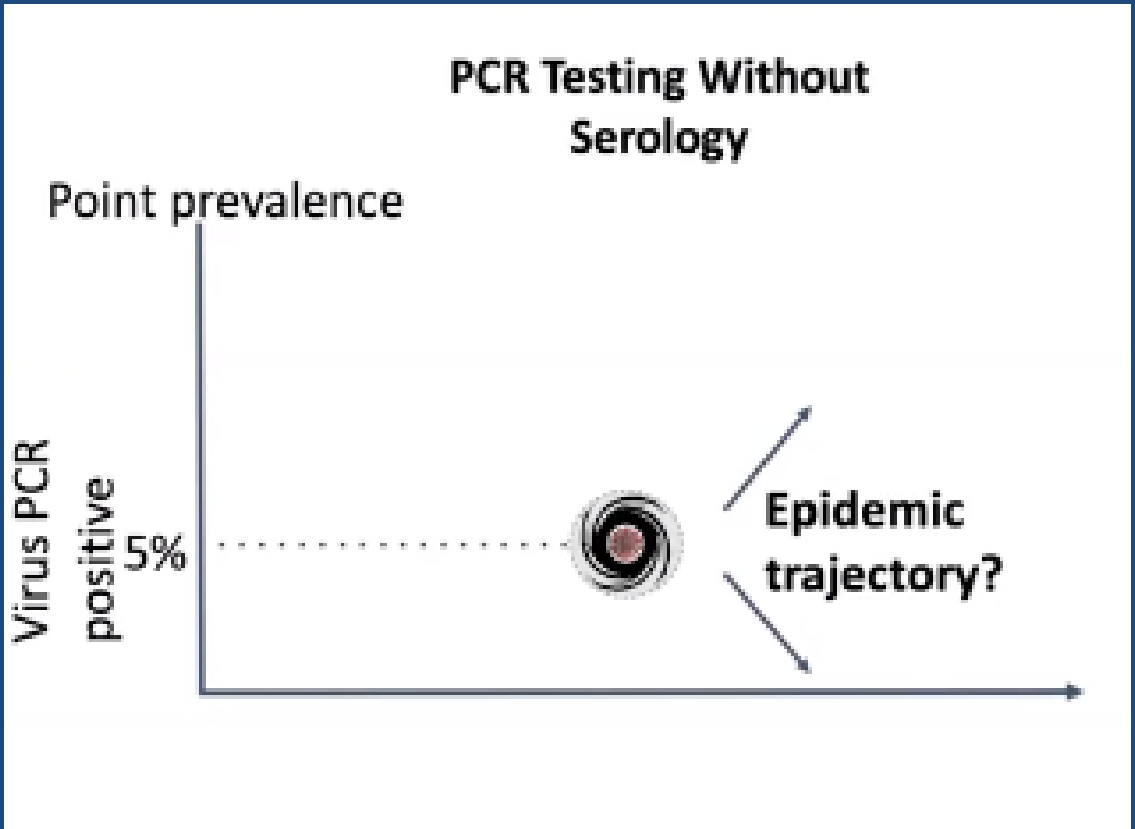
- **Immune status**
  - Presence of antibodies cannot be equated with long-term immunity from ***re-infection***
  - More studies needed to assess the magnitude, durability, and protection of SARS-CoV-2 antibodies

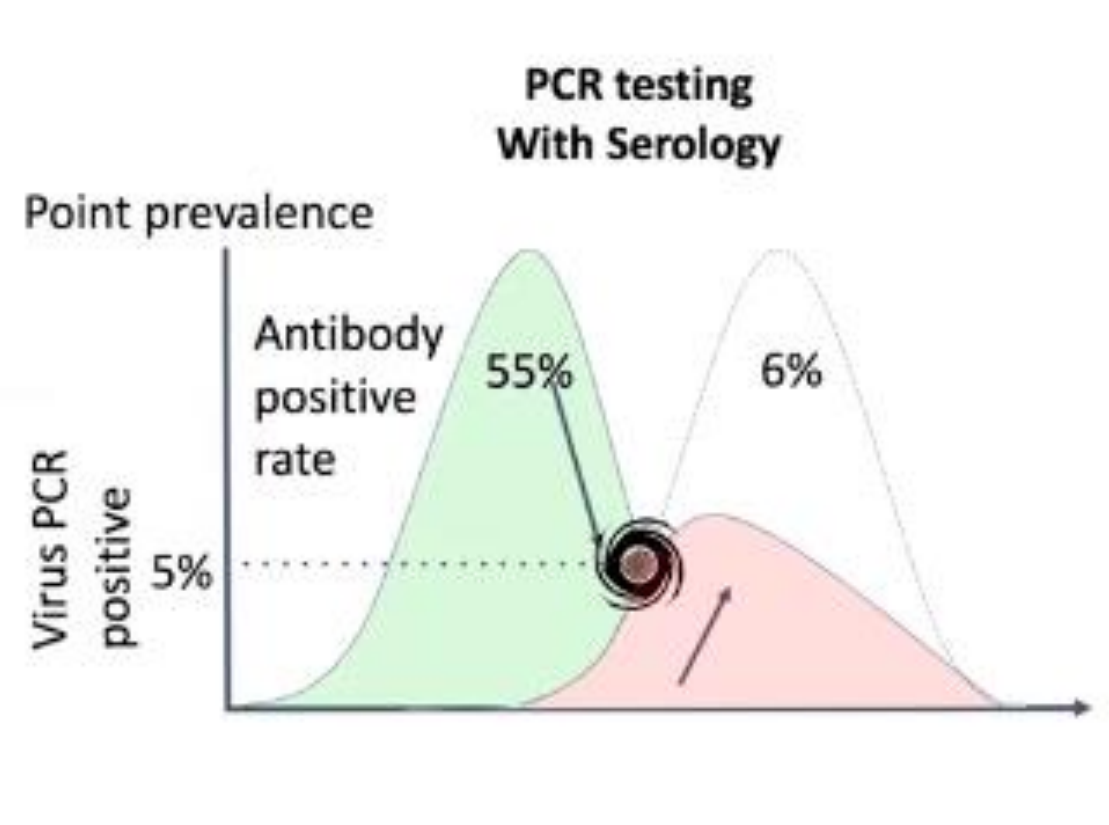
Diagnostic Viral and Antibody Testing:

Can help tell whether the outbreak on its way down or up

Michael Mins (Harvard School of Public Health and Harvard Medical School)

- For persons who present late—9 to 14 days after symptom onset the sensitivity of viral test decreasing while sensitivity of antibody increasing





Mitigation

Distancing

Face Covering

Disinfection

Ventilation

Hierarchy of Controls—Layered Interventions

Workplace Infection Control Coordinator

Hazard Elimination

- Prevent viral entry by symptom/temp check & viral testing
- Encourage symptom reporting at entry into workplace
- Telework
- Contact tracing within workplace and co-ordinate with local health authorities for community contact tracing

Engineering Controls

- Restructuring physical spaces to ensure physical distancing
- Use partitions or barriers if workers cannot physically distance
- Improve ventilation through:
  - Dilution
  - Filtration
  - Disinfection

Administrative Controls

- De-densify by reorganizing workflow
- Use staggered shifts
- Infection control practices including face coverings
- Perform cleaning and disinfection
- Flexible sick leave
- Train employees in hazards and controls

PPE

- Use N95s, gloves, face shields, gowns as per hazard assessment
- Consider alternatives to N95s
- Fit-testing and respirator maintenance procedures

Physical Distancing

- **Principle**
  - Keep possibly infected individuals physically separated from uninfected (susceptible) individuals.

- **Application**
  - Maintain *at least* 6-foot distance between people
    - May not feasible in all workplace
    - The more distance people can maintain, the less the risk

- **Effectiveness**
  - Transmission lower with distancing of one meter or more; protection was increased *as distance was lengthened*
    - Chu et al. *Lancet.* DOI:10.1016/S0140-6736(20)31142-9
  - Distancing appeared to have the most substantial association with a reduction in SARS-CoV-2 transmission
    - Rubin et al. *JAMA Network.* DOI:10.1001/jamanetworkopen.2020.16099

Physical Distancing Guidance

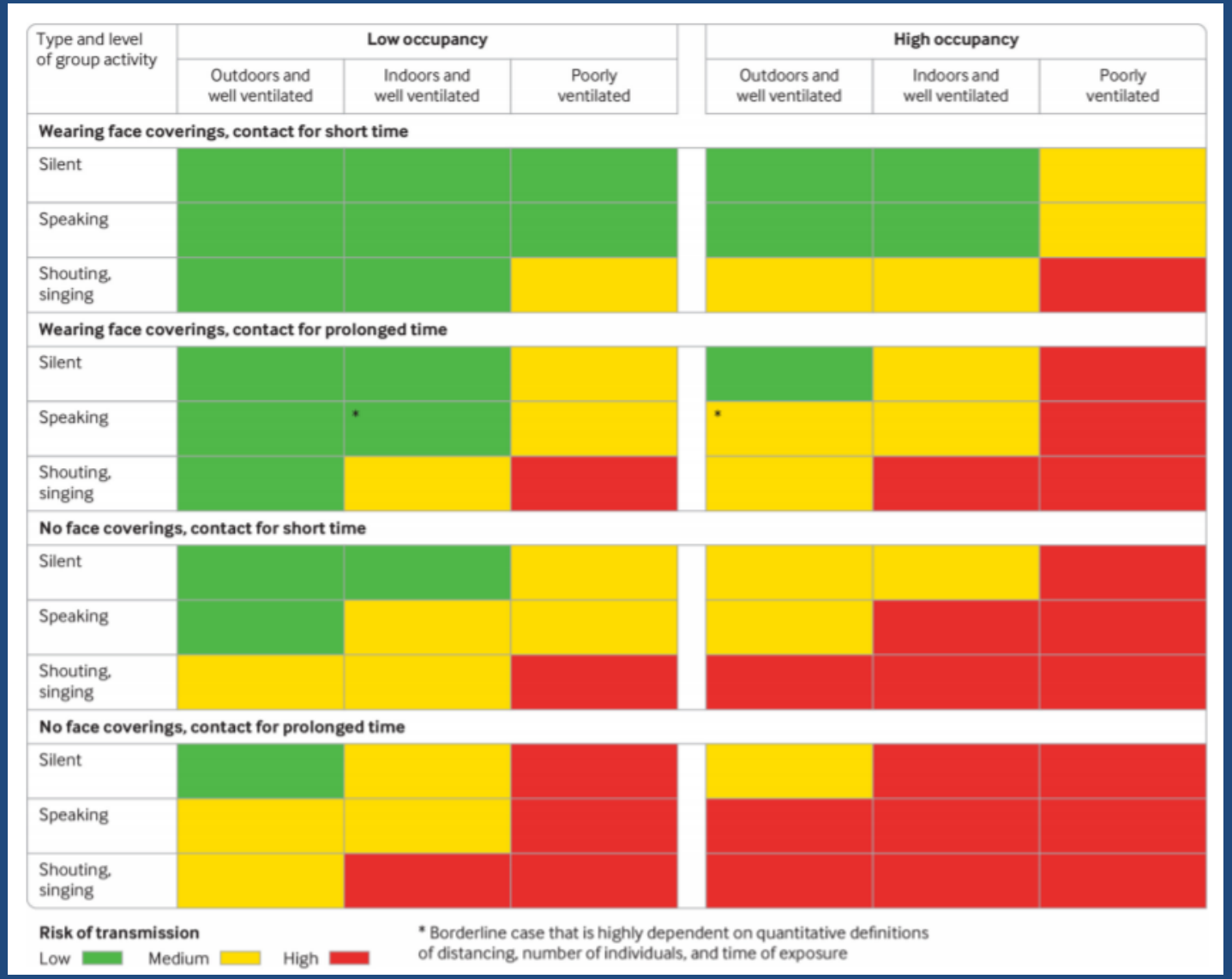
Meters	Inches	Feet	Countries
1	39.37	3.28	World Health Organization Singapore, Hong Kong
1.5	59.05	5	Australia
1.8	70.86	5.9	USA
2.0	78.74	6.5	UK, Ireland, New Zealand

- How are these guides generated?
  - Modelling, simulation, lessons from outbreaks
- Caution:
  - 6-foot or 1-meter recommendations may not sufficiently decrease transmission risk in *all* scenarios
  - Treat as recommendation not as a rule

Advanced Physical Distancing: What a Close Contact?

Jones NR et al. *BMJ.* DOI: 10.1136/bmj.m3223

- Levels of risk depends on:
  - Outdoor/Indoor
  - Occupancy
  - Type of activity
  - Duration
  - Face coverings
- Advantages over single physical distance rule
  - Greater protection in the highest risk settings
  - Greater freedom in the lower risk settings
- Does not include
  - Shedding level from emitter
  - Indoor air patterns
  - Where susceptibles are in relationship to the emitter(s)



Face Coverings

Konda et al. *ACS Nano*. https://dx.doi.prg/10.1021/acsnano.0c03252

- **Purposes**
  - Source control (yes)
  - Personal protection (less certain)
    - Reduces the minimum effective dose? (Gandhi et al. 2020)

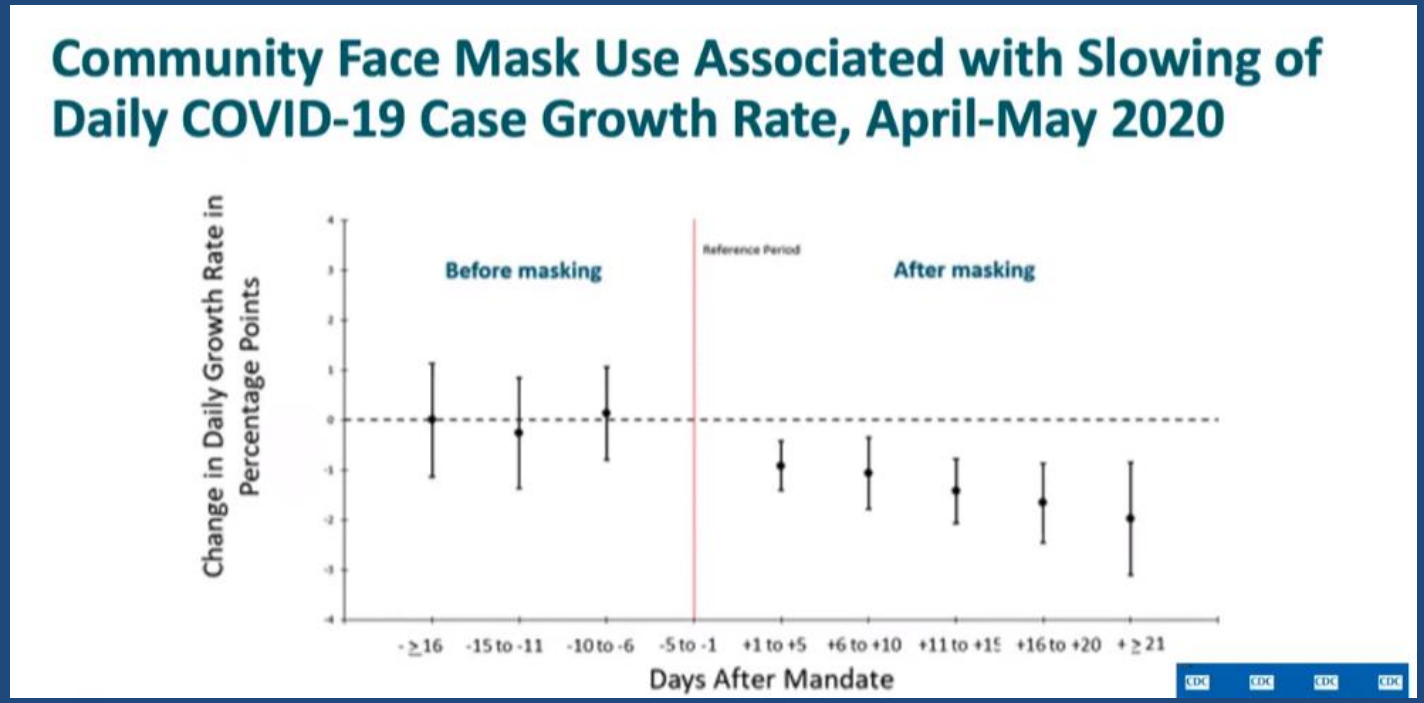
- **Characteristics**
  - **Fabric type**
    - Cotton better than synthetics
    - Weave—cotton performs better at higher thread count
    - Multiple Layers—3 to 4 better
      - Filtration efficiency was > 80% for particles < 300nm
  - **Fit**—head straps better than ear loops
    - Poor fit can result in over a 60% decrease in the filtration efficiency

Face Coverings Effectiveness

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

- Hair Salon (Springfield, Missouri)
  - Hendrix MJ et al. *MMWR* (2020)
  - Two stylists with COVID-19 spent at least 15 minutes with 139 clients, but no client tested positive nor became symptomatic

- Healthcare System Hospital (MA)
  - Wang X et al., *JAMA* (2020)
  - Universal masking of health care workers and patients reduced viral positive tests in HCWs from 14.7% to 11.5%.



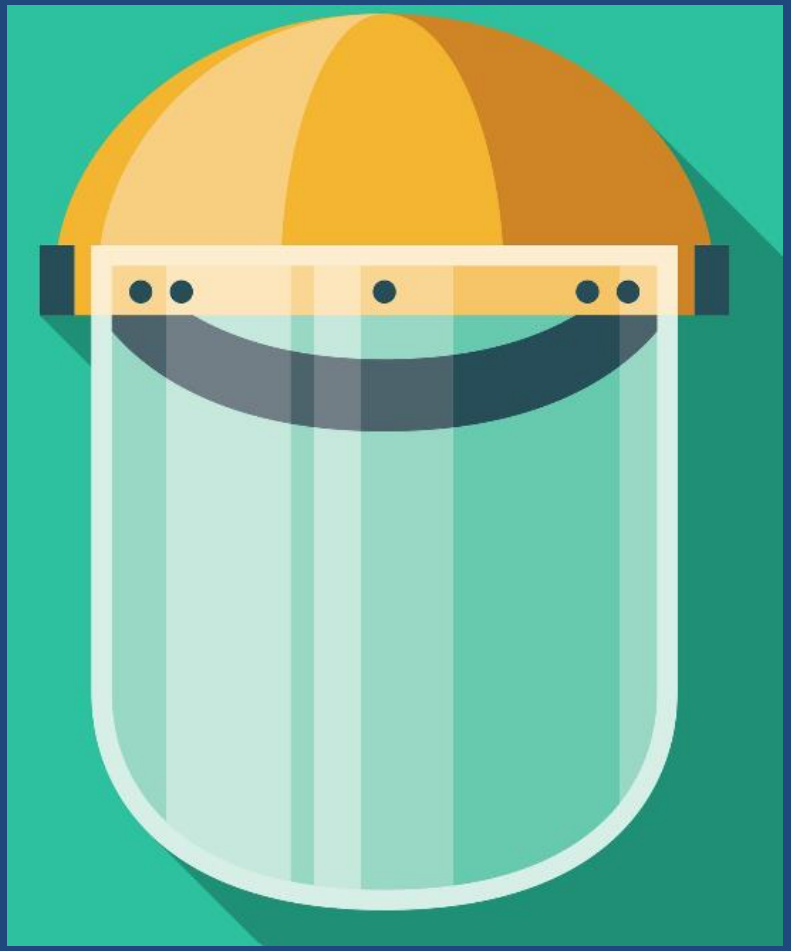
Adjunctive Protection—Face Shields

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html

- **Advantages:**
  - Require no special materials for fabrication
  - Can be used indefinitely and easily cleaned with soap and water
  - Comfortable to wear and easier to communicate
  - Reduces potential for auto-inoculation by blocking finger touching
  - Offers eye protection more than face covering

- CDC does not recommend face shields as a substitute for face coverings, but they may serve as an adjunctive

- When used, face shields must extend below the chin and wrap around the wearer's face to the ears, and have no gap between forehead and the headpiece.



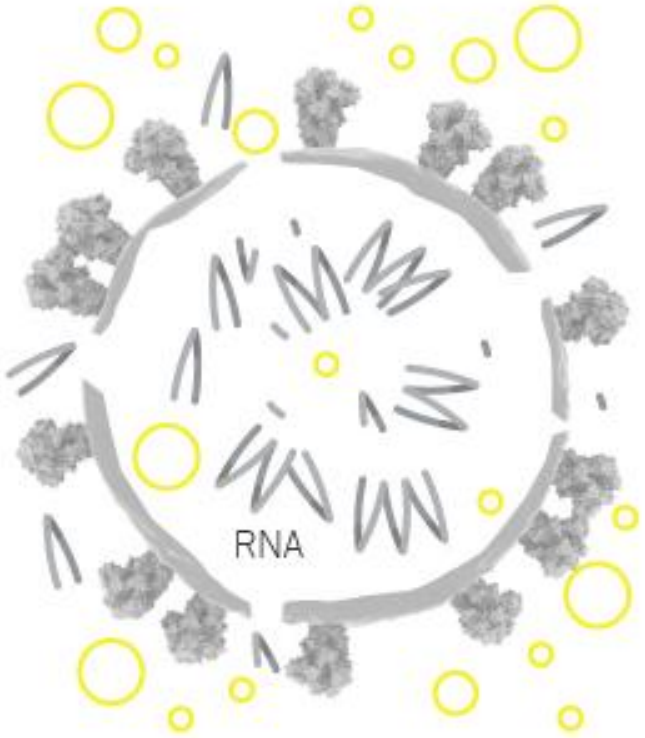
Disinfection

Hand Hygiene

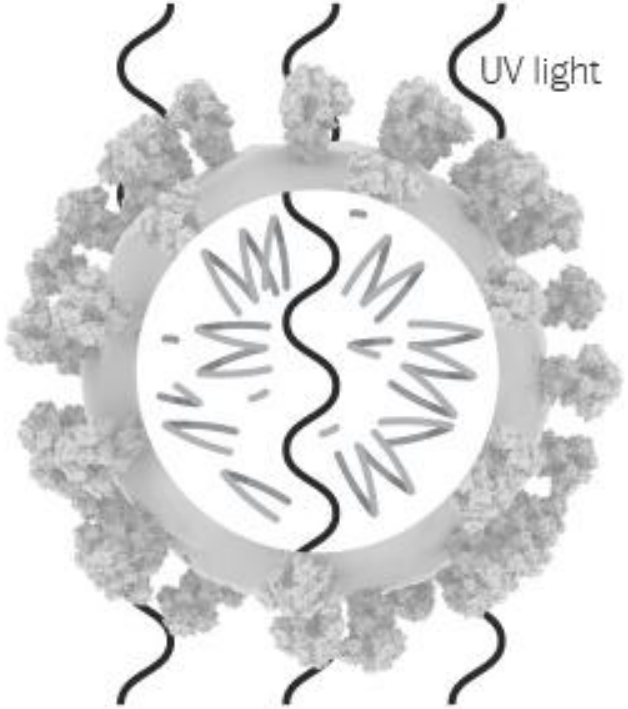
Environmental

Hand Hygiene

Soap and water break the virus membrane.



Ultraviolet light disrupts the genetic material.



Heat breaks the structure of spike.

Environmental Disinfection

- **Environmental persistence of SARS-CoV-2**
  - Viral survival is driven by temperature, relative humidity and matrix (bodily fluids)
    - Limited studies have led to concerns about the persistence of SARS-CoV-2 on environmental surfaces.
    - For example, viral RNA could be detected:
      - Surface Materials
        - » Up to 4 hours on copper
        - » Up to 24 hours on cardboard
        - » Up to 2-3 days on non-porous surfaces: stainless steel & plastic
          - Van Doremalen et al. doi: 10.1056/NEJMc2004973

- RNA detection ≠ presence *viable* SARS-CoV-2
  - Binder RA et al. Environmental and Aerosolized SARS-C0V-2 among hospitalized COVID-19 patients. *Inf Dis* (10 Sep 2020)

Environmental Disinfection

- Currently, over 420 products are registered with the EPA that can be used for SARS-CoV-2. See the EPA List N: Disinfectants for Use Against SARS-CoV-2
    - https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19

- CDC Cleaning & Disinfection Guidance
    - https://www.cdc.gov/coronavirus/2019-ncov/community/cleaning-disinfecting-decision-tool.html
    - https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html

- AIHA Guide to COVID-19 Cleaning & Disinfection in Non-Healthcare Workplaces
    - https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Guidance-Documents/Employers-Guide-to-COVID-Cleaning-and-Disinfection-in-Non-Healthcare-Workplaces-Guidance-Document.pdf

- High-touch surfaces and objects can be commonly disinfected using:
  - 70% ethanol-containing solution
  - 0.5% sodium hypochlorite-containing products (1/3 cup bleach in gallon of water)
    - Contact time with the surface or object should be at least 20 seconds.

Ventilation

Ventilation

- **Evidence**
  - Live virus collected 7-16 feet from SARS-CoV-2 patient (74 virions/liter of air)
    - Lednicky et al. *medRxiv.* DOI: 10.1101/2020.08.03.20167395
  - Hospital air samples contaminated with viral RNA with observation of replication
    - Santarpia et al. *medRxiv* DOI:10.1101/2020.03.23.20039446

- **Role of mechanical ventilation in the airborne viral transmission in indoor spaces**
  - "Plume and room" concept
    - Plume scale—distancing, mask-wearing, cough etiquette
    - Room scale—ventilation
  - Significant knowledge gaps still exist
    - Luongo et al. *Indoor Air*. 2016. doi: 10.1111/ina.12267

- Epidemiologic evidence that HVAC conditions may have contributed to transmission:
  - Restaurant in Guangzhou, China. Lu et al., *Emerg Infect Dis (*2020)
  - Choir Practice in Skagit County, WA—53/61 choir members became ill and 2 died of COVID-19. Hammer et al. *MMWR* (2020)
  - Call Center in South Korea. Park et al. *Emerg Infect Dis* (2020).

Ventilation

- **ASHRAE**
  - "SARS-CoV-2 transmission through the air is *sufficiently likely* that airborne exposure to the virus should be controlled." Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures.
    - https://www.ashrae.org/file%20library/about/position%20documents/pd_infectiousaerosols_2020.pdf
  - Building Readiness Guide
    - https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-building-readiness.pdf
  - Risk reduction methods
    - Dilution
    - Filtration
    - Disinfection
  - Filtration and Disinfection FAQs
    - https://www.ashrae.org/technical-resources/filtration-and-disinfection-faq

Recommended Filters

- ASHRAE's current recommendation is to use a filter with a Minimum Efficiency Reporting Value (MERV) of 13, but a MERV 14 (or better) filter is preferred.

- Ultimate choice depends on the capabilities of the HVAC system.
- Increasing filter efficiency leads to increased pressure drop, which can lead to reduced air flow, more energy use for the fan to compensate for the increased resistance.

- If a MERV 13 filter cannot be used, then use the highest MERV rating you can.

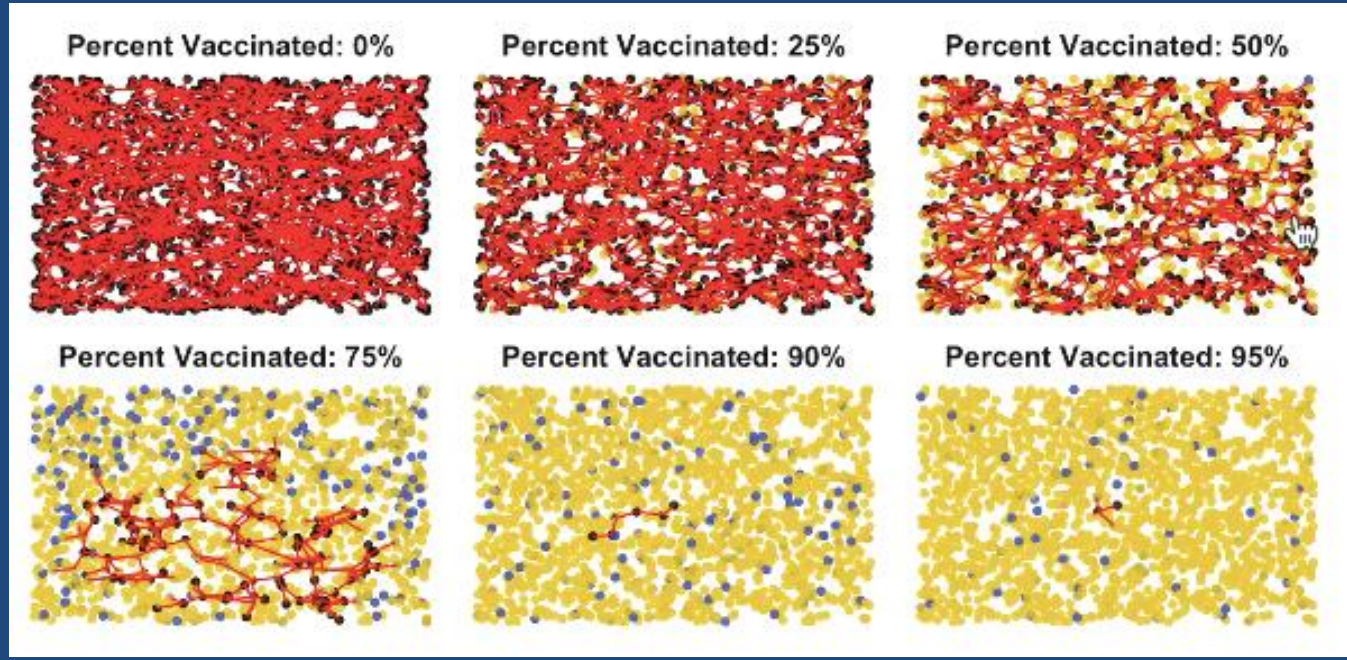
ASHRAE Standard 52.2				ASHRAE Standard 52.1	Application Guidelines		
MERV	Particle Size Removal Efficiency, Percent in Particle Size Range, µm			Dust-Spot Efficiency Percent	Particle Size and Typical Controlled Contaminant	Typical Applications	Typical Air Filter/Cleaner Type
	0.3 to 1	1 to 3	3 to 10				
20	≥ 99.999	in 0.1 – 0.2 µm particle size		—	**< 0.3 µm** Virus (unattached) Carbon dust Sea salt All combustion smoke	Electronics manufacturing Pharmaceutical manufacturing Carcinogenic materials	HEPA/ULPA Filters*
19	≥ 99.999	in 0.3 µm particle size		—			
18	≥ 99.99			—			
17	≥ 99.97			—			
16	> 95	> 95	> 95	—	**0.3-1 µm** All bacteria Droplet nuclei (sneeze) Cooking oil Most smoke Insecticide dust Most face powder Most paint pigments	Superior commercial buildings Hospital inpatient care General surgery	**Bag Filters** – Nonsupported (flexible) microfine fiberglass or synthetic media, 12 to 36 inches deep. **Box Filters** – Rigid style cartridge, 6 to 12 inches deep.
15	85-95	> 90	> 90	> 95			
14	75-85	> 90	> 90	90-95			
13	< 75	> 90	> 90	80-90			
12	—	> 80	> 90	70-75	**1-3 µm** Legionella Humidifier dust Lead dust Milled flour Auto emission particles Nebulizer drops	Superior residential Better commercial buildings Hospital laboratories	**Pleated filters** –Extended surface with cotton or polyester media or both, 1 to 6 inches thick. **Box Filters** – Rigid style cartridge, 6 to 12 inches deep.
11	—	65-80	> 85	60-65			
10	—	50-65	> 85	50-55			
9	—	< 50	> 85	40-45			
8	—	—	> 70	30-35	**3-10 µm** Mold Spores Dust mite body parts and droppings Cat and dog dander Hair spray Fabric protector Dusting aids Pudding mix Powdered milk	Better residential Commercial buildings Industrial workplaces	**Pleated filters** –Extended surface with cotton or polyester media or both, 1 to 6 inches thick. **Cartridge filters** –Viscous cube or pocket filters **Throwaway** –Synthetic media panel filters
7	—	—	50-70	25-30			
6**	—	—	35-50	< 20			
5	—	—	20-35	< 20			
4	—	—	< 20	< 20	**> 10 µm** Pollen Dust mites Cockroach body parts and droppings Spanish moss Sanding dust Spray paint dust Textile fibers Carpet fibers	Minimum filtration Residential window air conditioners	**Throwaway** – Fiberglass or synthetic media panel, 1 inch thick. **Washable** – Aluminum mesh, foam rubber panel **Electrostatic** – Self-charging (passive) woven polycarbonate panel
3	—	—	< 20	< 20			
2	—	—	< 20	< 20			
1	—	—	< 20	< 20			

Vaccines

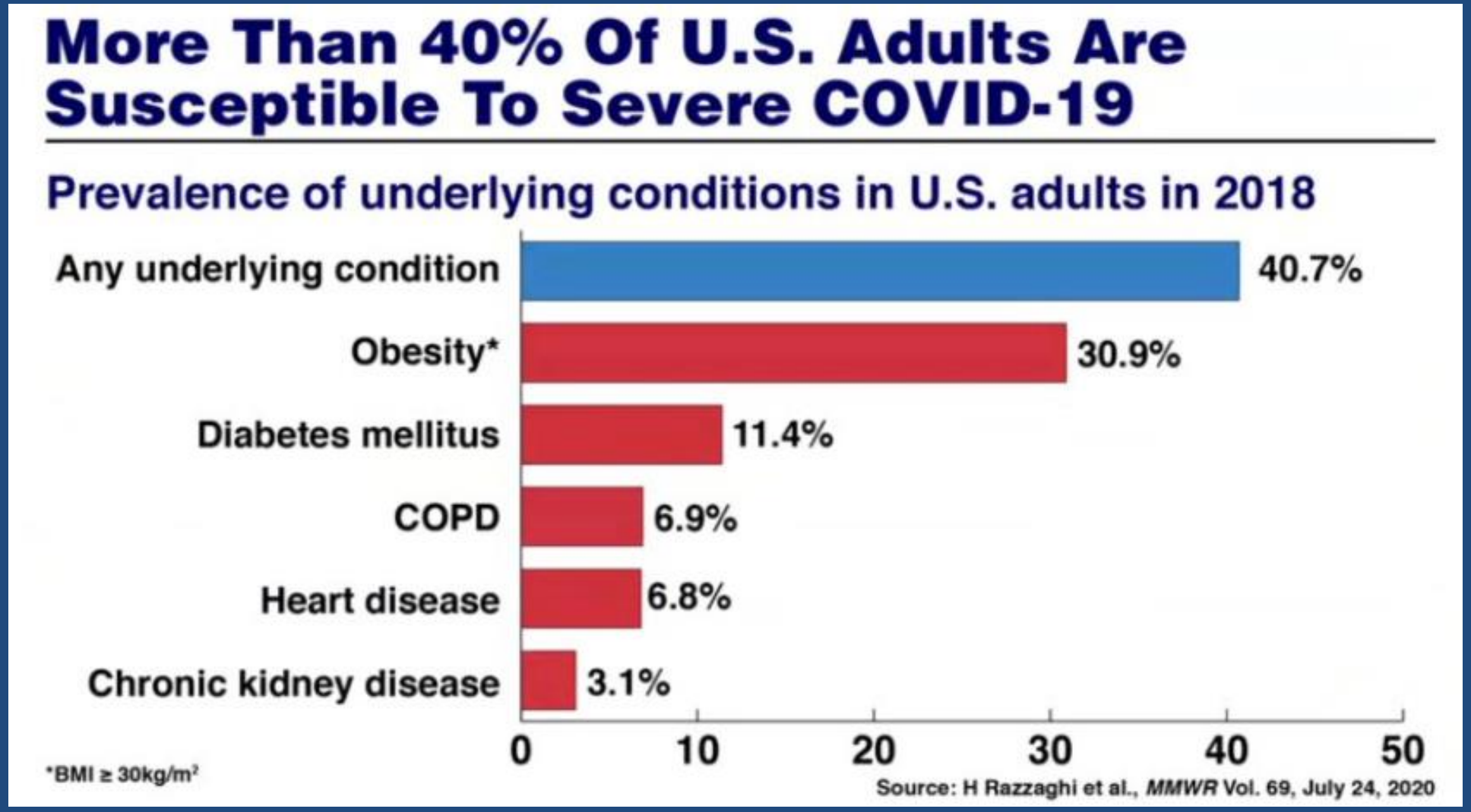
Community (Herd) Immunity

- When enough people in a community have had COVID-19 and develop “natural immunity,” then the rest of the population becomes a lot less *susceptible* to becoming infected because the virus cannot easily jump to a susceptible person—there are less of them.

- The “herd effect” is the decrease in infection rate among “*susceptibles*.”
  - Given SARS-CoV-2 transmissibility, 70 to 90% of the population would need to be infected and recover before community immunity becomes probable.
  - Resulting in healthcare system stress and increased deaths.



Why Just Protecting the Elderly Will Not Work



Safest Way to Community Immunity—Vaccine

Operation Warp Speed

Slaoui & Hepburn. *New Eng J Med.* (26 August 2020)

Selected COVID-19 Vaccine Candidates

Platform	Developer	Phase 1/2	Phase 2/3
Nucleic acid	moderna	Completed	Ongoing
	BIONTECH Pfizer	Completed	Ongoing
Viral vector	UNIVERSITY OF OXFORD AstraZeneca	Completed	Ongoing
	Janssen Johnson & Johnson	Ongoing	--
	MERCK	TBD	--
Protein subunit	NOVAVAX Creating Tomorrow's Vaccines Today	Ongoing	--
	gsk SANOFI	Ongoing	--

Proposed Vaccination Allocation Framework

https://www.nationalacademies.org/news/2020/09/national-academies-release-draft-framework-for-equitable-allocation-of-a-covid-19-vaccine-seek-public-comment

- **Phase 1**
  - 1a—High risk workers in health care facilities" and first responders
  - 1b—Individuals at the highest risk for infection and severe disease or death
    - Older individuals living in congregate settings and those with serious underlying health conditions

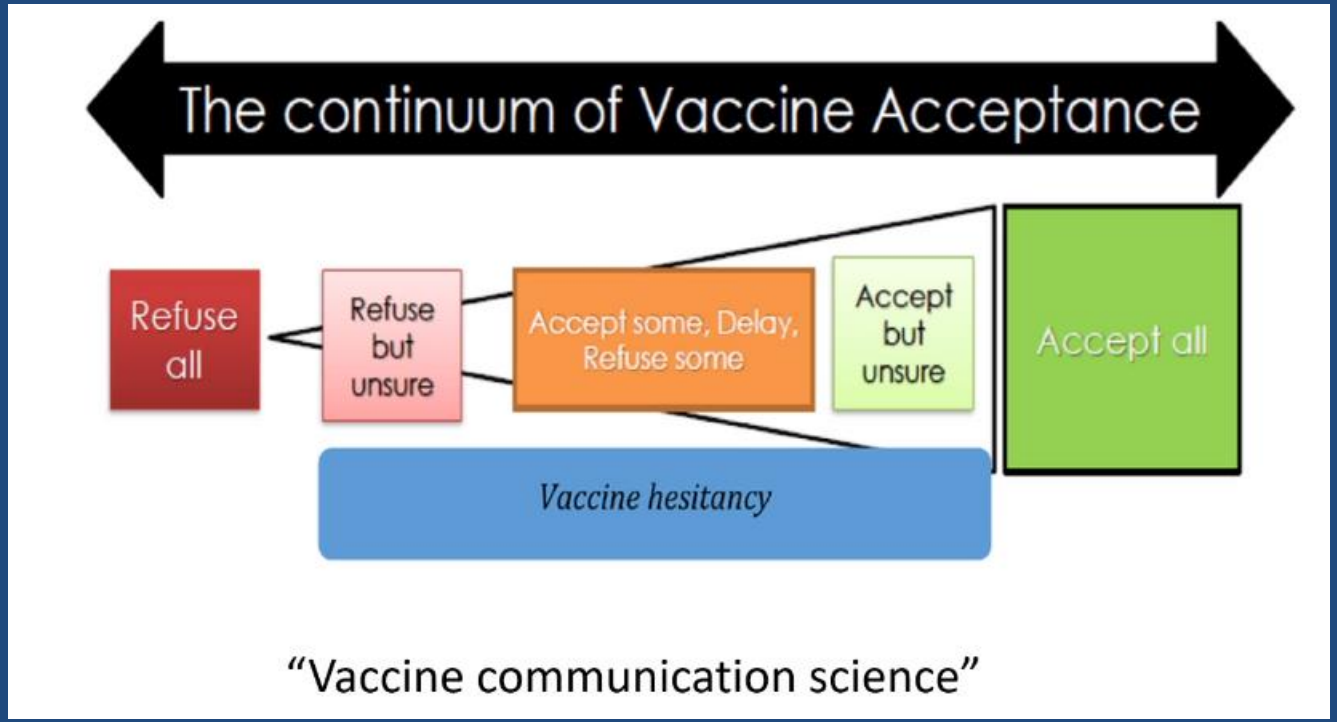
- **Phase 2**
  - Other higher-risk essential workers, all older adults, those with less severe comorbidities
  - Individuals living in other congregate settings, e.g., incarcerated populations, homeless shelters.

- **Phase 3**
  - Remaining essential workers, young adults, and children.

- **Phase 4**
  - Access broadly to remaining portions of the public.

Continuum of Vaccine Acceptance

- Effective way to achieve herd (community) immunity for a population if enough people take the vaccine *and* the vaccine has a high efficacy rate.
- BUT
- You need high vaccine acceptance
- Barriers
  - Vaccine Hesitancy
  - Vaccine Refusal



THE WALL STREET JOURNAL

September 4, 2020

Covid-19 Vaccine Developers Prepare Joint Pledge on Safety, Standards

Industry rivals come together to reassure public that urgency to develop coronavirus vaccine won't compromise scientific, regulatory rigor

Equal Employment Opportunity Commission

https://www.eeoc.gov/coronavirus

- **Vaccination**
  - Mandating or Encouraging?
    - "Generally, ADA-covered employers should consider simply encouraging employees to get the influenza vaccine rather than requiring them to take it." October 9, 2009.
  - Recognized exemptions for medical conditions, religious objections, or pregnancy
    - Reasonable accommodations under ADA, Title VII, and Title VII as amended by the Pregnancy Discrimination Act

- **EEOC Resources**
  - What you should know about COVID-19 and the ADA, the Rehabilitation Act, and Other EEO Laws (June 17, 2020)
    - https://www.eeoc.gov/wysk/what-you-should-know-about-covid-19-and-ada-rehabilitation-act-and-other-eeo-laws
  - Pandemic Preparedness in the Workplace and the ADA (Updated March 19, 2020)
    - https://www.eeoc.gov/sites/default/files/2020-04/pandemic_flu.pdf

Near Future Issues

- Keeping up with CDC Guidance
  - https://www.cdc.gov/coronavirus/2019-ncov/whats-new-all.html
- Workplace Testing Strategies
- Duration of Immunity
- Managing reinfection risks and case & contact spikes
- Achieving community immunity through vaccination

Thank You!

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