


# THE SCIENCE BEHIND THE SCHOOL OPENING GUIDANCE

July 17, 2020

# Opening Remarks



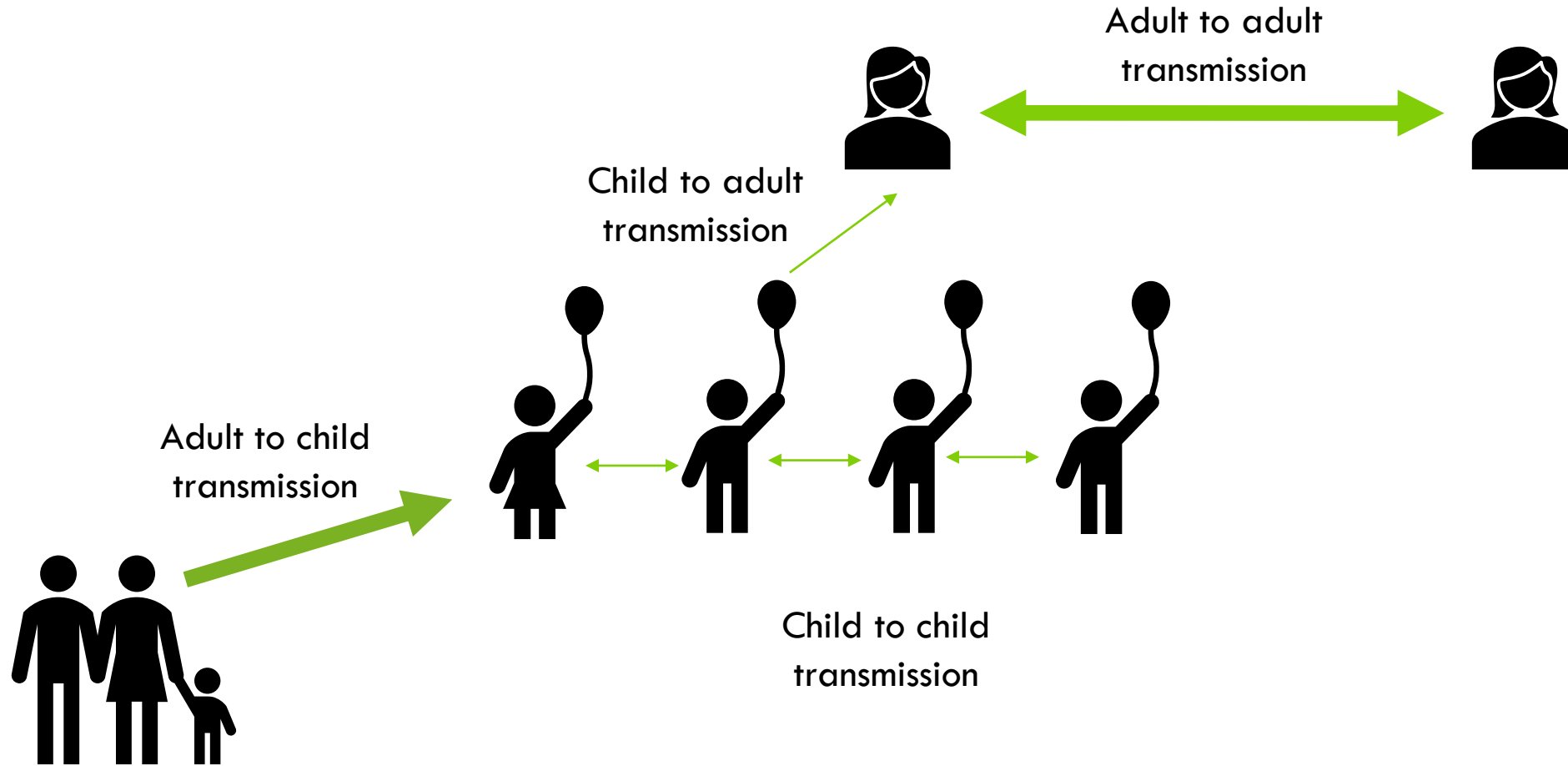
- Aim to provide an overview highlighting current scientific data behind our recent public health recommendations.
  - This overview is not comprehensive, but highlights themes and key articles and reports relevant to school settings.
  - Our understanding of COVID-19 is rapidly evolving. We will continue to monitor emerging research and provide updated information and recommendations as appropriate.
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# DISEASE PREVALENCE AND TRANSMISSION DYNAMICS

# COVID-19 Prevalence and Transmission Dynamics in Children

- Children become infected with COVID-19 less often, and are less ill.
  - Multisystem inflammatory syndrome is rare.
- Children who contract COVID-19 most often get the disease from an adult, often one that lives in their household.
- Children do not seem to be major sources of transmission to each other or to adults.
- Teachers and staff are more likely to transmit COVID-19 to each other.
- Older children transmit more like adults

# Disease transmission patterns between adults and children



# Children get COVID less often than adults

- **CALIFORNIA<sup>1</sup>**: Cases and Deaths Associated with COVID-19 by Age Group in California (7/8/2020)
- **ITALY<sup>2</sup>**: During peak, less than 1% of cases, only 11% hospitalized and none died
- **ICELAND<sup>3</sup>**: Random sample: Zero cases <10yo. High-risk sample: (symptomatic, travel or +contact) case rate in children half that in adults (7% vs. 14%)
- **SPAIN<sup>4</sup>**: Antibody prevalence in community April 27 to May 11. 3.1% of children <10 vs. 5% overall with antibodies

Age Group	No. Cases	Percent Cases	No. Deaths	Percent Deaths	Percent CA Population
<5	5274	1.8	0	0.0	5.8
5-17	18,686	6.5	0	0.0	16.7
18-34	97,289	33.6	76	1.2	24.3
35-49	72,966	25.2	334	5.2	19.3
50-59	42,199	14.6	610	9.4	12.5
60-64	15,818	5.5	459	7.1	5.9
65-69	11,045	3.8	587	9.1	5.0
70-74	7,923	2.7	686	10.6	4.1
75-79	5,746	2.0	768	11.9	2.7
80+	12,197	4.2	2,954	45.6	3.9
missing	325	0.1	1	0.0	0.0
Total	289,468	100.0	6,475	100.0	100.0

1.CDPH: <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/COVID-19-Cases-by-Age-Group.aspx>

2. Italian National Health Institute (Istituto Superiore di Sanità). Coronavirus epidemic: situation report. March 26, 2020. 3. Gudbjartsson et al NEJM April 2020 4. Pollan et al Lancet July 2020

# COVID-19 Cases January – July 11 2020 in Santa Clara County

Age Group	Cases	Rate per 100,000
1-4	115	130
5-9	163	166
10-14	194	190
15-17	139	107
18 - 20	244	310
21 – 49	3410	437
50 – 64	1278	327
65+	947	305

**Rates among school children are lower as compared to adults**

# Children are generally less ill than adults

Centers for Disease Control and Prevention



Early Release / Vol. 69

Morbidity and Mortality Weekly Report

April 6, 2020

## Coronavirus Disease 2019 in Children — United States, February 12–April 2, 2020

CDC COVID-19 Response Team

Classic symptoms (fever, cough, or shortness of breath) less common in children (73%) than in adults (93%)

**TABLE. Signs and symptoms among 291 pediatric (age <18 years) and 10,944 adult (age 18–64 years) patients\* with laboratory-confirmed COVID-19 — United States, February 12–April 2, 2020**

Sign/Symptom	No. (%) with sign/symptom	
	Pediatric	Adult
Fever, cough, or shortness of breath <sup>†</sup>	213 (73)	10,167 (93)
Fever <sup>§</sup>	163 (56)	7,794 (71)
Cough	158 (54)	8,775 (80)
Shortness of breath	39 (13)	4,674 (43)
Myalgia	66 (23)	6,713 (61)
Runny nose <sup>¶</sup>	21 (7.2)	757 (6.9)
Sore throat	71 (24)	3,795 (35)
Headache	81 (28)	6,335 (58)
Nausea/Vomiting	31 (11)	1,746 (16)
Abdominal pain <sup>¶</sup>	17 (5.8)	1,329 (12)
Diarrhea	37 (13)	3,353 (31)

\* Cases were included in the denominator if they had a known symptom status for fever, cough, shortness of breath, nausea/vomiting, and diarrhea. Total number of patients by age group: <18 years (N = 2,572), 18–64 years (N = 113,985).

<sup>†</sup> Includes all cases with one or more of these symptoms.

<sup>§</sup> Patients were included if they had information for either measured or subjective fever variables and were considered to have a fever if “yes” was indicated for either variable.

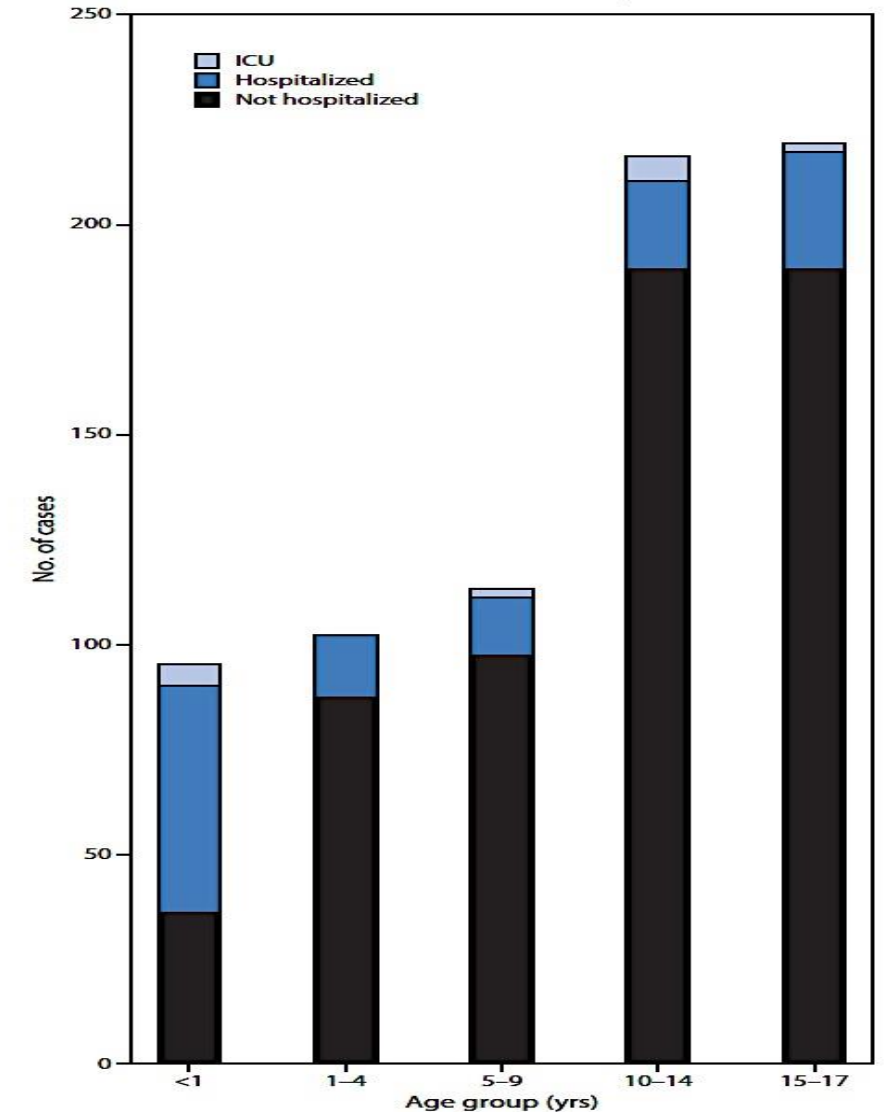
<sup>¶</sup> Runny nose and abdominal pain were less frequently completed than other symptoms; therefore, percentages with these symptoms are likely underestimates.



# Children are generally less ill than adults

- Most cases did not require hospitalization
  - Hospitalization most common among infants

FIGURE 2. COVID-19 cases among children\* aged <18 years, among those with known hospitalization status (N = 745),<sup>†</sup> by age group and hospitalization status — United States, February 12–April 2, 2020



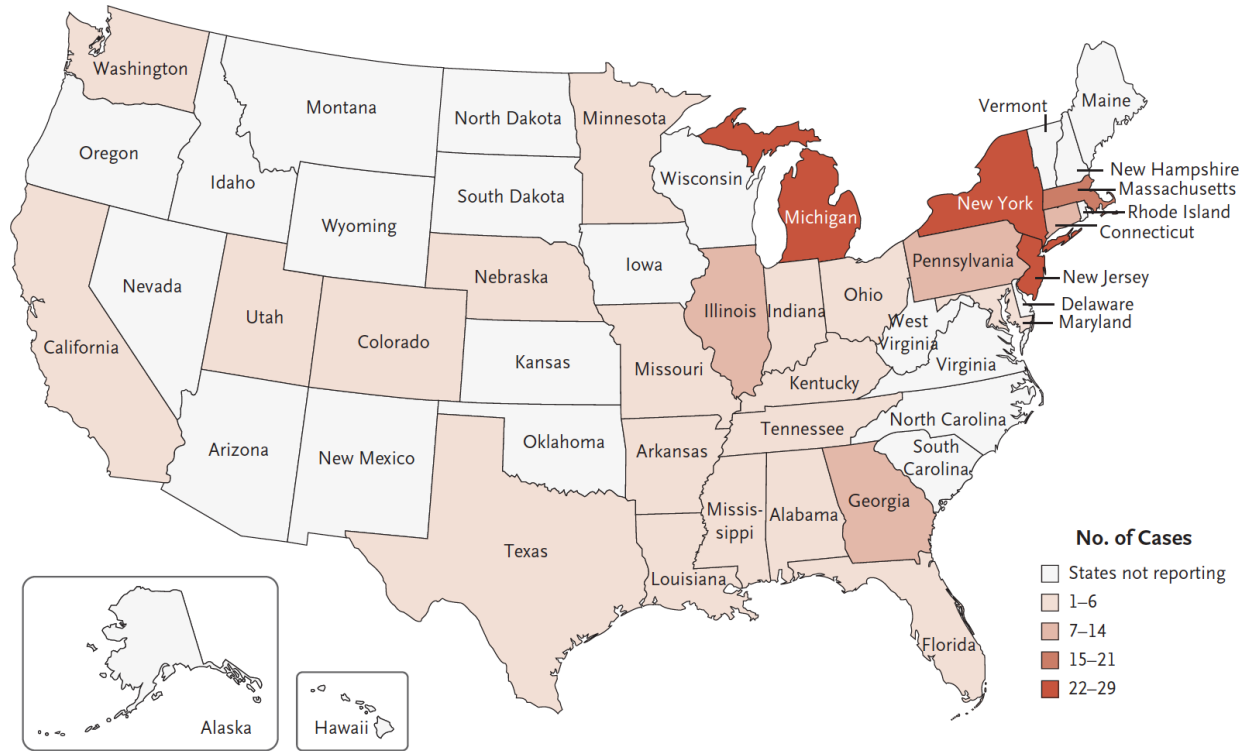
Abbreviation: ICU = intensive care unit.

\* Includes infants, children, and adolescents.

<sup>†</sup> Number of children missing hospitalization status by age group: <1 year (303 of 398; 76%); 1-4 years (189 of 291; 65%); 5-9 years (275 of 388; 71%); 10-14 years (466 of 682; 68%); 15-17 years (594 of 813; 73%).

# Multisystem inflammatory syndrome rare but serious

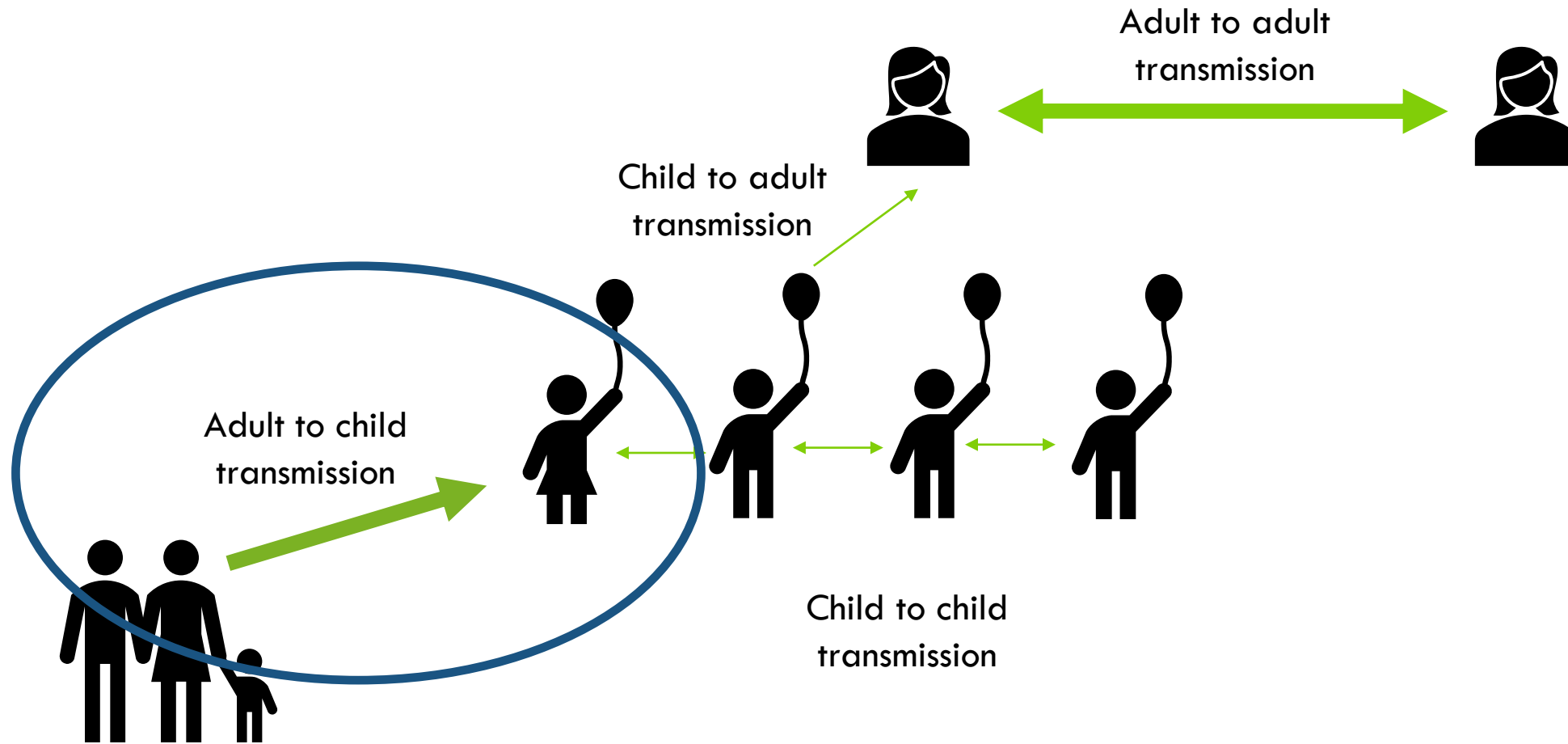
A Cases of MIS-C According to State



- Multisystem inflammatory syndrome in children (MIS-C) is a condition where different body parts can become inflamed due to an overactive immune response
- Don't know what causes MIS-C. However, we know that many children with MIS-C had COVID-19 or had close contact with someone with COVID-19
- MIS-C can be serious but most children who were diagnosed with this condition have gotten better with medical care

Feldstein LR, Rose EB, Horwitz, JP, et al. Multisystem inflammatory syndrome in U.S. children and adolescents. N Engl J Med 2020 Jul 2

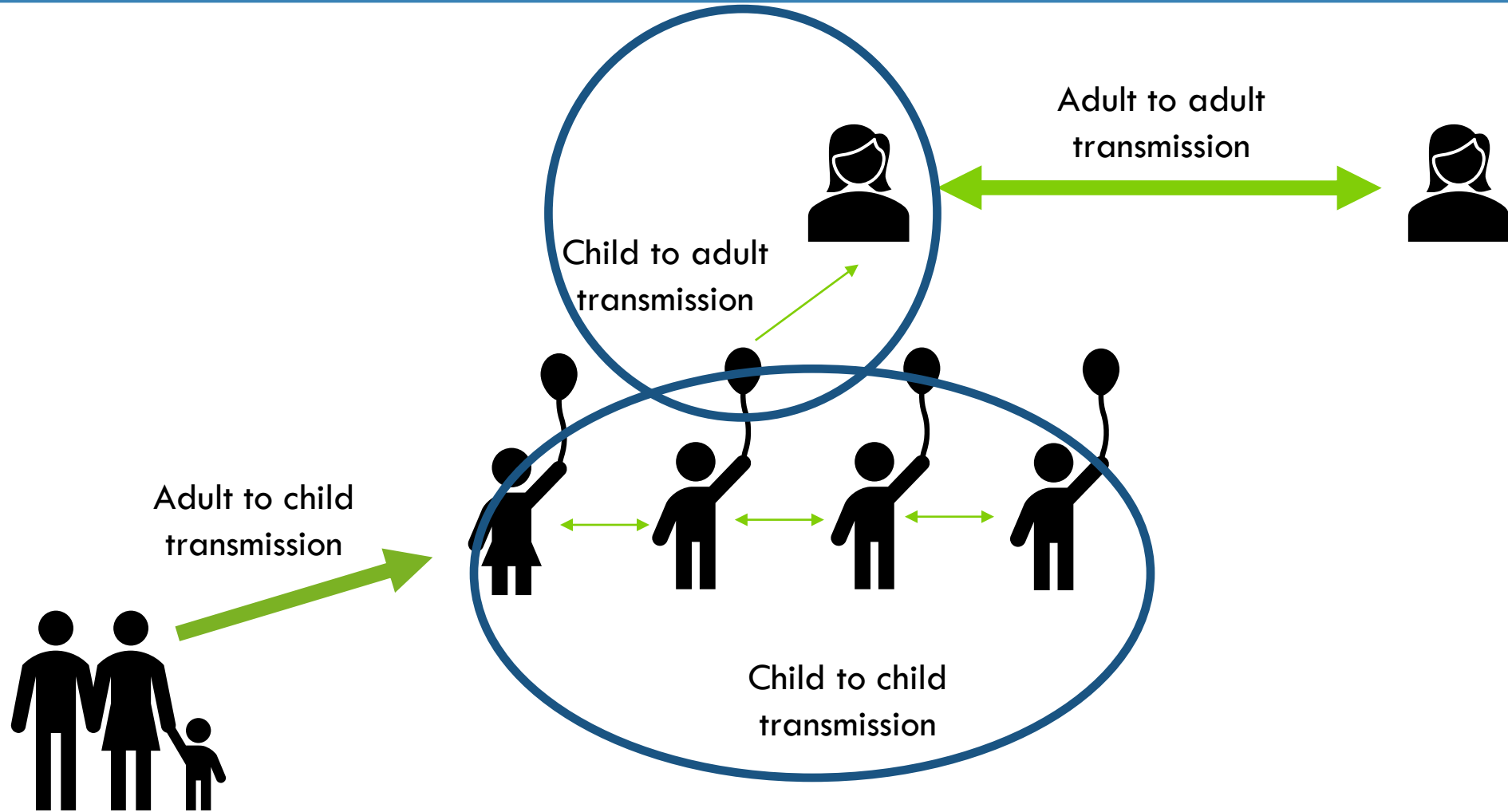
# Adult to child transmission



# Children Generally get COVID-19 From Adult Household Contacts

- **Multi-country** systematic review<sup>1</sup> of 31 household clusters in the USA, China, Singapore, Vietnam and South Korea
  - Index (first) case was a child in less than 10% of household clusters
  - Compared to 54% of household clusters of influenza A
- **Chicago**<sup>2</sup> cohort of 34 households
  - Index case identified as a child in less than 13%
- **China**<sup>3</sup> cohort of 36 children
  - Up to 32 (89%) had been exposed by a family member
- **Switzerland**<sup>4</sup> cohort of 39 hospitalized children <16 years old
  - In 8% of households, the study child developed symptoms prior to any other household member
  - 85% of adult household members developed symptoms vs 43% of children
- **Italy**<sup>5</sup> cohort of 100 children seen in the emergency department
  - Exposure to an unknown source or source outside of the family was 55%
  - In the context of extensive community spread

# Child to child and child to adult transmission



# Child to Child and Child to Adult Transmission Less Common

- **United States**<sup>1</sup>: YMCA emergency childcare (Ages 1-14)
  - Up to 40,000 children in 1,100 sites.
  - Few staff and parent cases, no records of more than 1 case at any site
  - Limitations: not comprehensive, availability of testing varied
- **France**<sup>2</sup>: Case study of 9-year-old child
  - Child had co-occurring influenza and COVID 19
  - 3 schools, 80 contacts, 0 COVID cases, but + Influenza cases
- **Australia**<sup>3</sup>:
  - 18 primary and high school cases (9 students, 9 teachers)
  - Found 2 subsequent cases in students amongst 863 close contacts

# Disease Transmission in Teens & High Schools May Be Different than Elementary Schools


- **France**<sup>1</sup>: retrospective seroprevalence study
  - 40% seropositivity amongst 15-17 year olds where school closed 2-3 weeks after first cases.
  - 11% of household contacts were seropositive suggesting spread amongst high school students first
- **Israel**<sup>2</sup>: media reports
  - High schools with the highest number of cases (one high school in Jerusalem with >100 cases in students and staff).
  - Elementary school cases described were in staff
  - Some schools stopped masking during a heat wave
  - Led to ~80 school closures country-wide (any school with a case)

1. Fontanet et al MedRxiv 2020.

2. <https://www.npr.org/sections/coronavirus-live-updates/2020/06/03/868507524/israel-orders-schools-to-close-when-covid-19-cases-are-discovered>

# In The News....

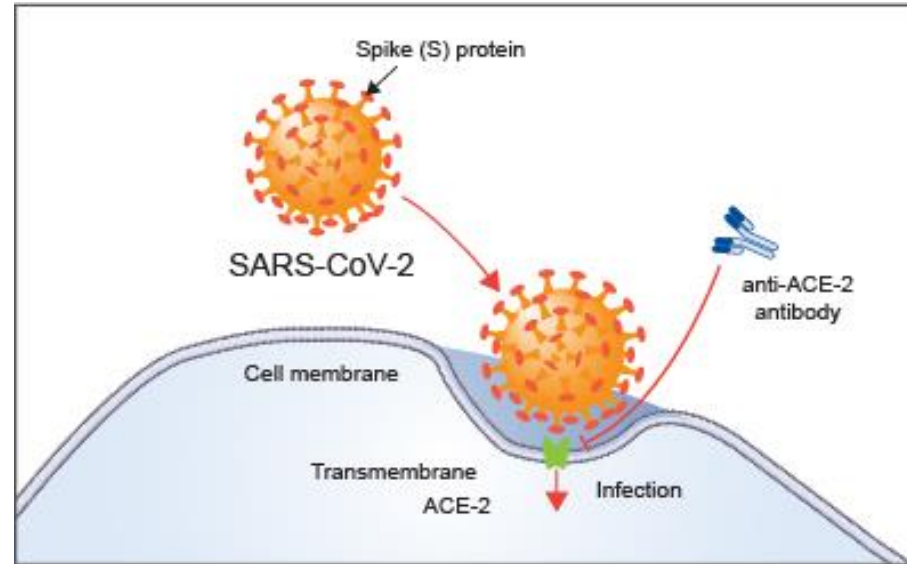


- ▣ Florida pediatric case counts
  - ▣ Arizona teacher death
  - ▣ Missouri summer camp outbreak
  - ▣ Texas day care cases
- 



# Why are children less likely to get infected and to transmit compared to adults?

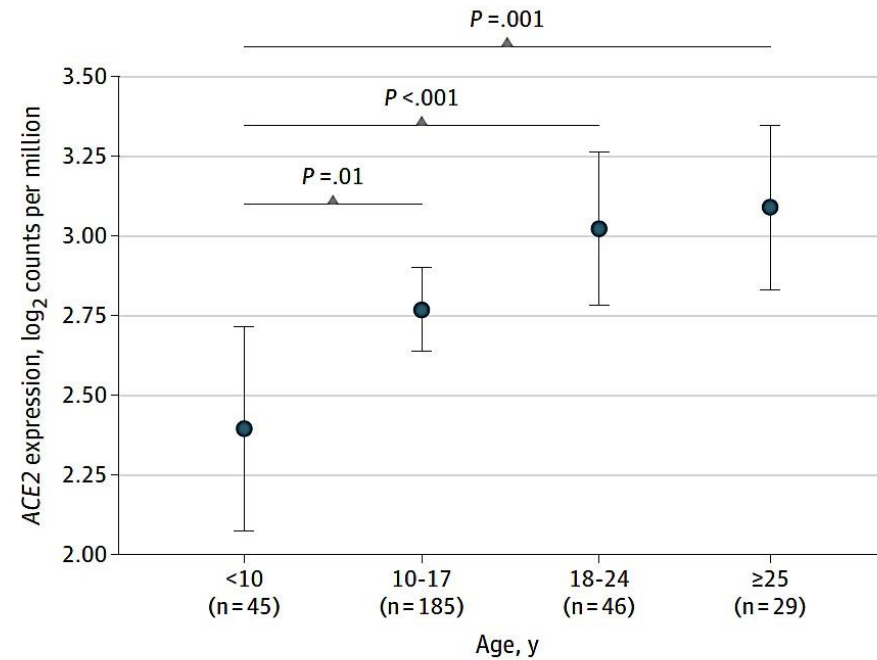
It is hypothesized that the lower risk among children is due to lower expression of angiotensin-converting enzyme 2 (ACE2), a protein that is important for COVID-19 to enter cells



Bunyavanich S, Do A, Vicencio A. Nasal gene expression of angiotensin-converting enzyme 2 in child and adults. JAMA 2020 May 20.

# Why are children less likely to get infected and to transmit compared to adults?

Figure. Nasal Gene Expression of *ACE2* in Different Age Groups



Data are means (data points) and 95% confidence intervals (error bars) for angiotensin-converting enzyme 2 (*ACE2*) gene expression in younger children (aged <10 years), older children (aged 10-17 years), young adults (aged 18-24 years), and adults (aged ≥25 years). Gene counts are shown as logarithmic (log<sub>2</sub>) counts per million. *P* values are from linear regression modeling in which *ACE2* gene expression in log<sub>2</sub> counts per million was the dependent variable and age group was the independent variable.

# Key Points: Disease Transmission in Children

- Children become infected with COVID-19 less often, and are less ill.
  - Multisystem inflammatory syndrome is rare.
- Children who contract COVID-19 most often get the disease from an adult, often one that lives in their household.
- Children do not seem to be major sources of transmission to each other or to adults.
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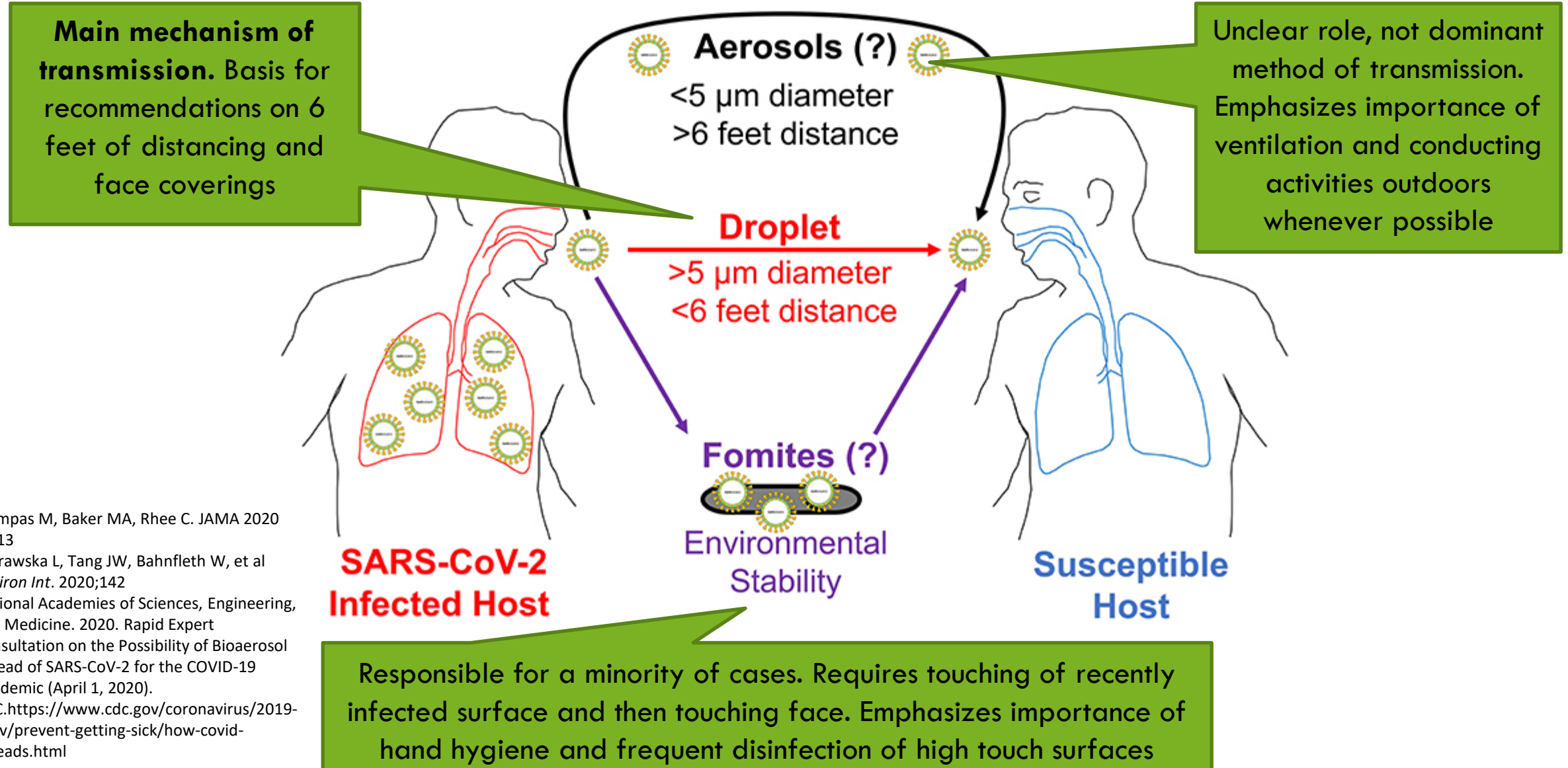
# Impact on Santa Clara County Public Health School Guidance

- Emphasizes the importance of adults remaining 6 feet apart from other adults and from children in all settings
- Requires face covering use in all adults and middle school/high school students at all times and in elementary schools when outside of the classroom
- Encourages but does not require in-classroom face covering use in elementary school children in whom unintended harms (challenges with adherence leading to punitive action, improper use increasing risk, etc) may outweigh benefits (in setting of lower risk of disease transmission)

# MECHANISMS OF DISEASE TRANSMISSION

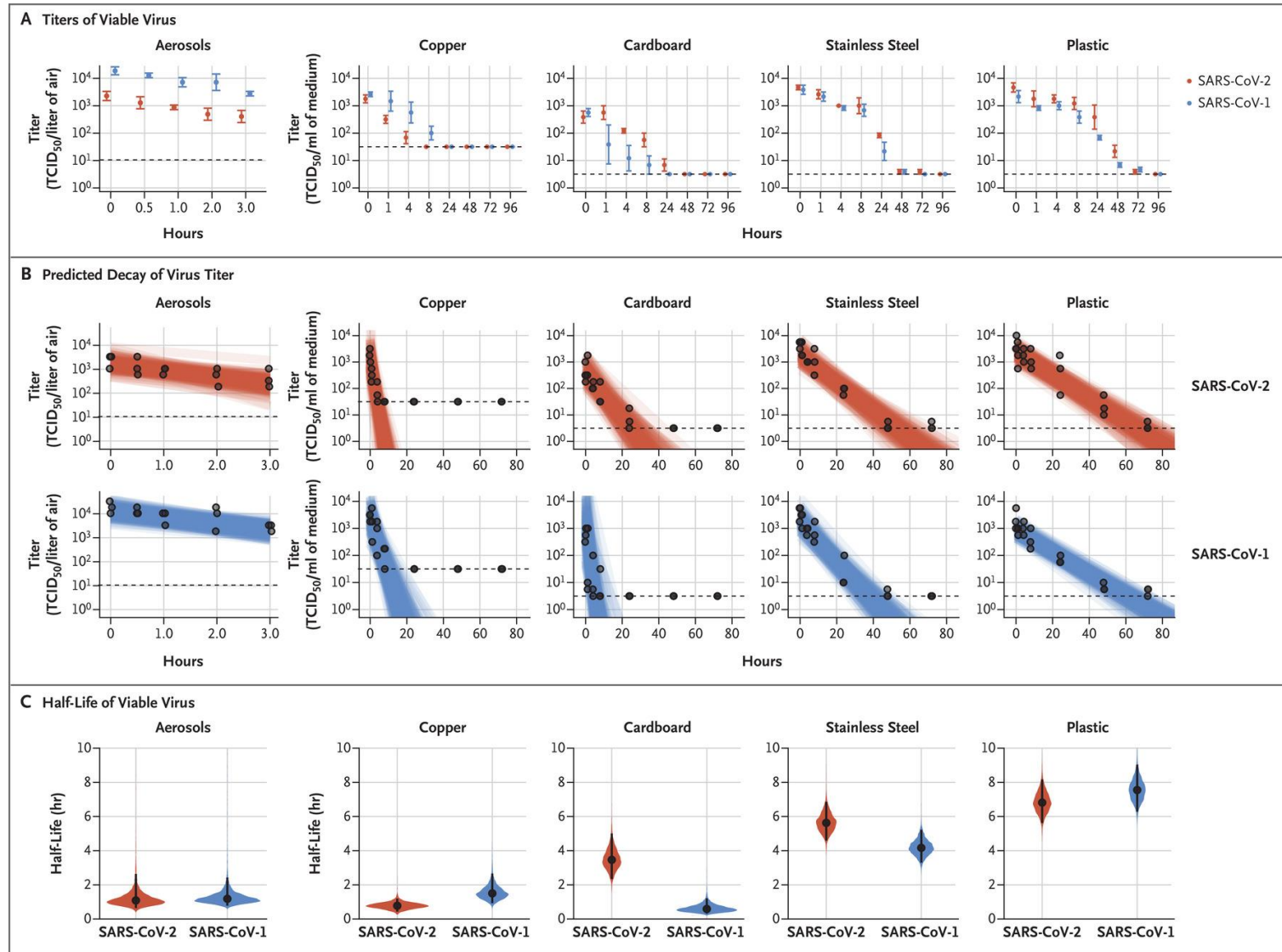
Respiratory, Aerosol, and Surface Transmission

# How is COVID-19 Transmitted?



1. Klompas M, Baker MA, Rhee C. JAMA 2020 Jul 13
2. Morawska L, Tang JW, Bahnfleth W, et al *Environ Int.* 2020;142
3. National Academies of Sciences, Engineering, and Medicine. 2020. Rapid Expert Consultation on the Possibility of Bioaerosol Spread of SARS-CoV-2 for the COVID-19 Pandemic (April 1, 2020).
4. CDC. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html>

# Limited Viable Virus After 24 Hours on Most Surfaces



# CDC Guidance on Cleaning and Disinfection

- ❑ Elimination of high-touch surfaces is preferable to frequent cleaning.
- ❑ When elimination not possible, surfaces that are used frequently should be cleaned and disinfected at least daily and as often as possible.
- ❑ Surfaces that are not high touch require only routine cleaning practices
- ❑ Hand washing should be promoted before and after touching shared equipment.
- ❑ Outdoor playgrounds/natural play areas only need routine maintenance + hand hygiene before and after use of these spaces.
- ❑ Outdoor play equipment with high-touch surfaces, such as railings, handles, etc, should be cleaned and disinfected regularly if used continuously.
- ❑ UV light kills viruses and bacteria. However, UV light-emitting devices not recommended in school settings due to safety concerns

<https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html>



# EFFECTIVENESS OF PUBLIC HEALTH INTERVENTIONS

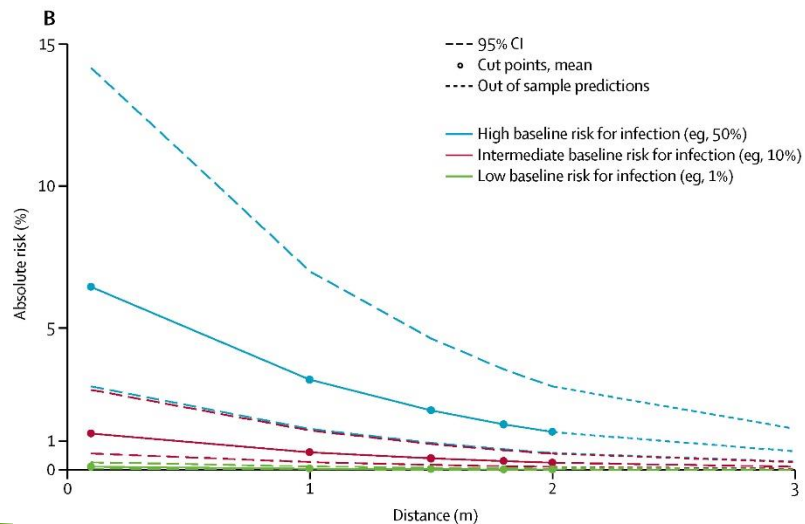
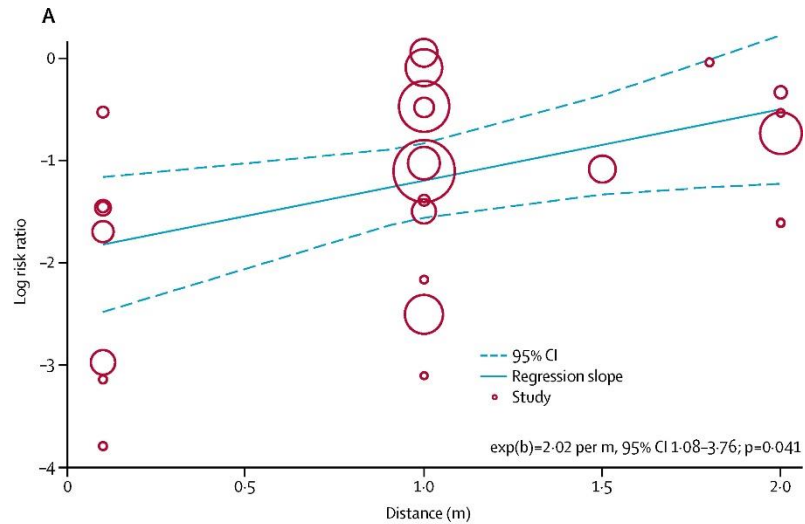
Physical Distancing and Face Coverings

# Public Health Interventions

- ▣ Physical distancing
- ▣ Face covering use
- ▣ Ventilation/outdoors
- ▣ Hand hygiene and cough/sneeze etiquette
- ▣ Cleaning and disinfection

Relative impact of each of these not well understood.  
Goal is to use them collectively.

# More physical distancing provides more protection



- Systematic Review combining studies from MERS, SARS, and COVID-19
- Key findings
  - Less disease transmission at distances > 1m (3.3. ft) compared to < 1m
  - Protection increased as distance lengthened (i.e. the more distance the better)
  - A physical distance of more than 1 m probably results in a large reduction in virus infection
  - For every 1 m further away in distancing, the relative effect might increase 2.02 times
- Study limitations: non-COVID studies, other inventions and populations, baseline risk for infection not clearly defined

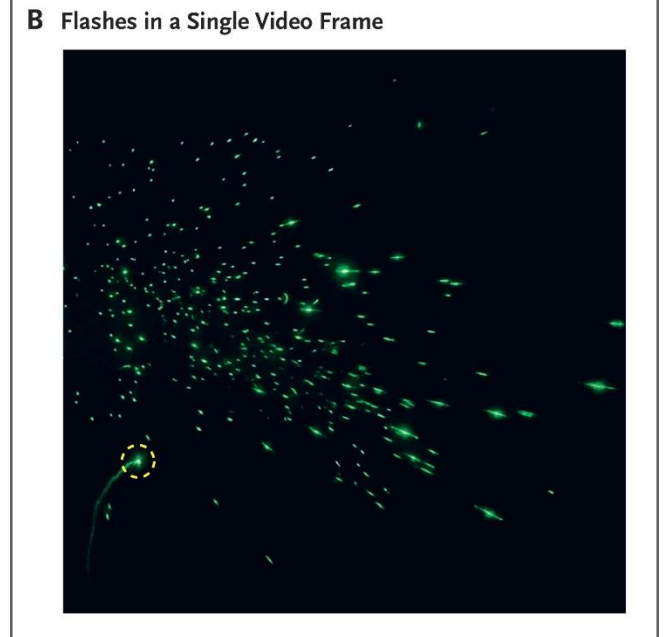
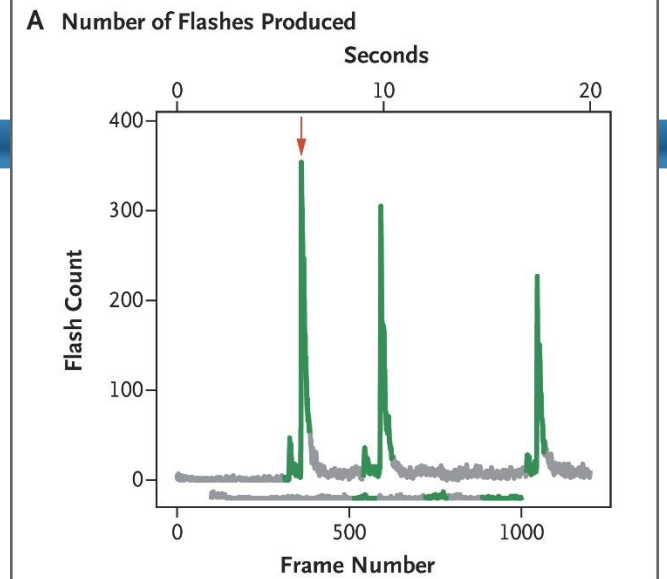
**More distance = less disease risk; No clear cutoff**

# Face Coverings Reduce Disease Transmission

- Experiment using high-speed video
  - Found that hundreds of droplets were generated when saying a simple phrase
  - Nearly all these droplets were blocked when the mouth was covered by a damp washcloth

## LIVE VIDEO DEMONSTRATION

<https://www.nejm.org/doi/full/10.1056/NEJMc2007800>



# Face Coverings Reduce Disease Transmission

- **US<sup>1</sup>:** Study compared the COVID-19 growth rate before and after mask mandates in 15 states and the District of Columbia.
  - It found that mask mandates led to a slowdown in daily COVID-19 growth rate, which became more apparent over time.
  - The first five days after a mandate, the daily growth rate slowed by 0.9 percentage-points compared to the five days prior to the mandate; at three weeks, the daily growth rate had slowed by 2 percentage-points.
- **Globally<sup>2</sup>:** A study of coronavirus deaths across 198 countries; countries with cultural norms or government policies favoring mask-wearing had lower death rates

1. Lyu Wei & Wehby George. Community Use Of Face Masks And COVID-19: Evidence From A Natural Experiment Of State Mandates In The US. Health Affairs June 2020.

2. Leffler et al. Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks. MedRxiv. July 2020

# Do face coverings protect the wearers or others?

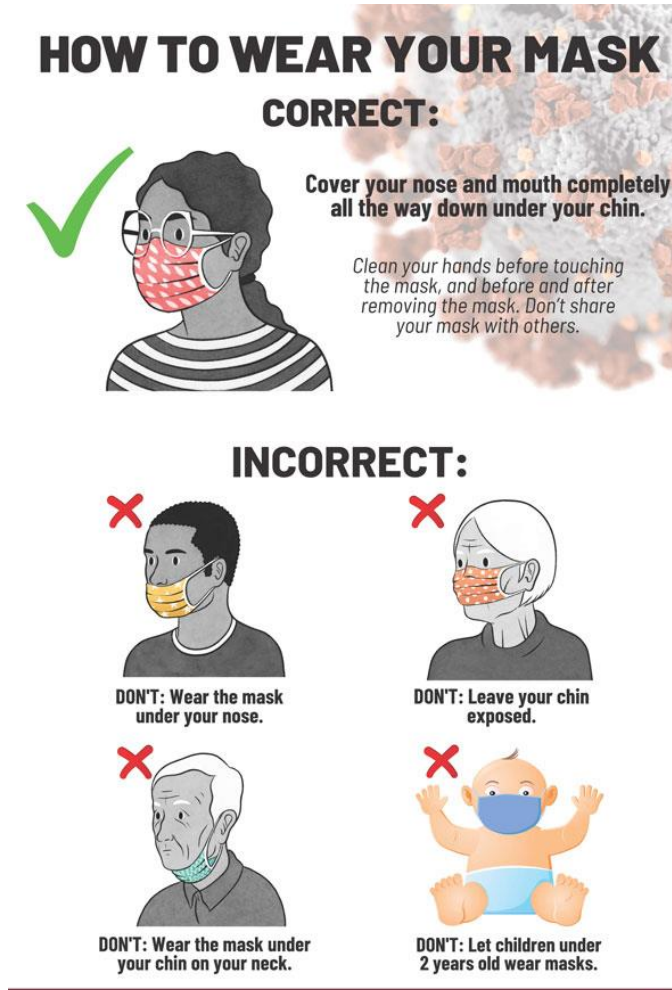
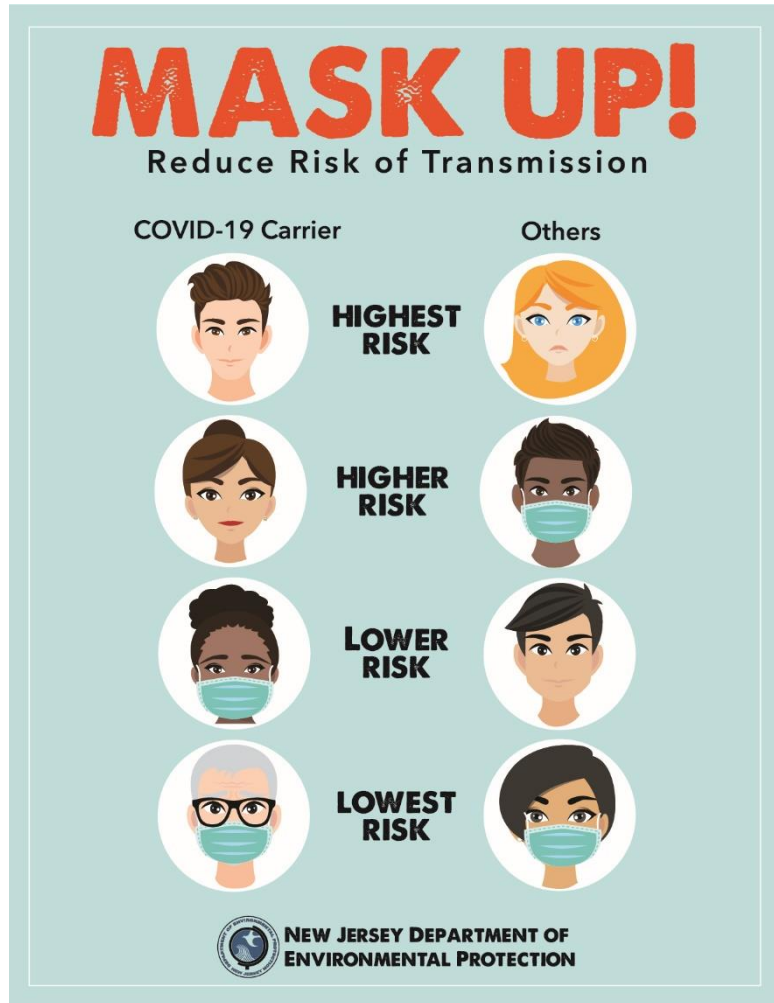


Image credit: [communitycare.com/COVID](https://communitycare.com/COVID)



# The outbreak that didn't happen: Masks credited with preventing coronavirus spread inside Missouri hair salon

+ Add to li

See also Hendrix MJ, Walde C, Findley K, Trotman R. Absence of apparent transmission of SARS-CoV-2 from two stylists after exposure at a hair salon with a universal face covering policy – Springfield, Missouri, May 2020. MMWR 2020 Jul 14; 69.

Springfield, Mo., health officials braced for an outbreak. Now they say face coverings prevented one.

- 2 PCR-positive hairdressers in Springfield, Mo.
  - Worked 8 and 5 days, respectively
  - Both symptomatic
  - 139 customers exposed
- Posted sign “a mask is required to enter salon”
- Both hairdressers and all customers wore masks
- **No** secondary cases detected



Public health officials braced for a coronavirus outbreak after two stylists at this Great Clips hair salon in Springfield, Mo., tested positive for the virus last month. (USA Today Network/Reuters)

# Can Face Shields Be Used in Place of Face Coverings?

- Most studies of face shields occur in health care workers<sup>1-4</sup>
  - Assess protection from sick patient exposures
  - Usually studied in conjunction with surgical mask use
- Concern about face shields without mask:
  - Inability to prevent dispersion of droplets to others
  - May also be insufficient for wearer
- Potential benefit in reducing touching of face





# Impact on Santa Clara County Public Health School Guidance

- Recommend maximal distancing between students (6 feet if practicable)
- Encourages increased ventilation and use of outdoors settings whenever possible
- Requires face covering use in all adults and middle school/high school students at all times and in elementary schools when outside of the classroom
- Limits use of face shields (instead of masks) to phonological instruction and instruction of children with hearing or other disabilities

# TEMPERATURE SCREENING

# Temperature Screening May Be Ineffective


- ❑ Airport screening procedures during prior epidemics involving millions of screened persons including the SARS 2003, H1N1 2009, and Ebola epidemics have found no evidence that temperature screening reduced the risk of spread of infectious disease
- ❑ Many COVID-cases with symptoms do not have a fever (or can be masked with antipyretics)
- ❑ Does not address pre-symptomatic or asymptomatic transmission
- ❑ Can be inaccurate and fluctuate with ambient temperature and wind conditions

# Potential Harms of Temperature Screening

- A false sense of security
- May increase the infection risk of the screener. The screener may have to reduce recommended physical distancing protocols to get close enough to measure the screened person's temperature.
- May increase the infection risk among screened if distancing not maintained while awaiting screening
- May require additional PPE which may be in short supply

# Impact on Santa Clara County Public Health School Guidance



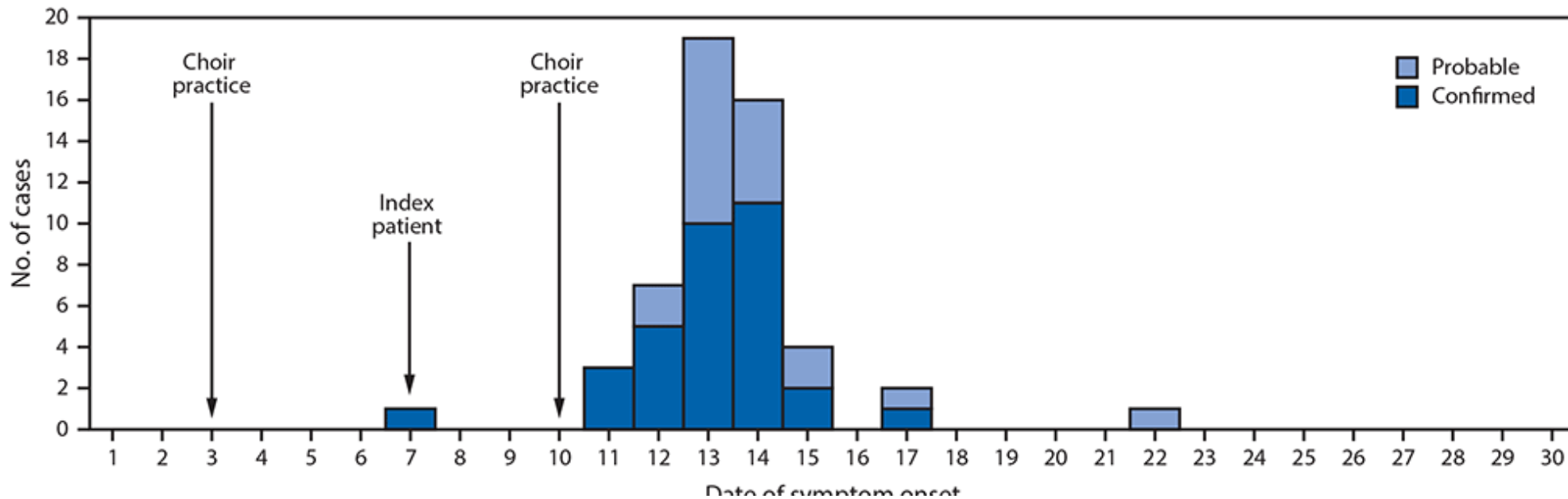
- ▣ Prioritize symptom screening over temperature screening
  - ▣ Temperature screening not required
- 

# HIGH RISK ACTIVITIES: PERFORMING ARTS

# Widespread transmission during choir singing event

- Single case led to 87% of choir infected after a single 2.5-hour choir practice

FIGURE. Confirmed\* and probable† cases of COVID-19 associated with two choir practices, by date of symptom onset (N = 53)  
County, Washington, March 2020



# Ongoing study evaluating droplet dispersal in performing arts

- Ongoing study (Univ of Colorado) on COVID-19 transmission risk in performing arts settings that will:
  - Examine aerosol rates produced by wind instrumentalists, vocalists, and actors
  - Evaluate measures to remediate aerosols in performance arts settings
- Preliminary results from first week of exploratory testing suggest:
  - Playing wind and band instruments and singing may cause greater condensation particle concentration
  - Potential mitigation measures, such as face coverings and nylon bell instrument coverings, may reduce particle transmission and will be tested further

Univ of Colorado Performing Arts Aerosol Study: <https://www.nfhs.org/media/4029958/preliminary-testing-report-7-13-20.pdf>




# Impact on Santa Clara County Public Health School Guidance

- Recommends specific avoidance of choir, band, and vocal cheerleading activities with increased risk of droplet dispersion
- Does not preclude participation in non-aerosol generating activities (i.e. rhythm study, music theory, music history, composition, and analysis)

# Acknowledgements



- UCSF: Dr. George Rutherford, Dr. Naomi Bardach
  - Bay Area Health Officers and Schools Teams
  - County of Santa Clara County Counsel
  - County of Santa Clara Office of Education
- 



Santa Clara County  
**PUBLIC**  
**HEALTH**

BETTER HEALTH FOR ALL