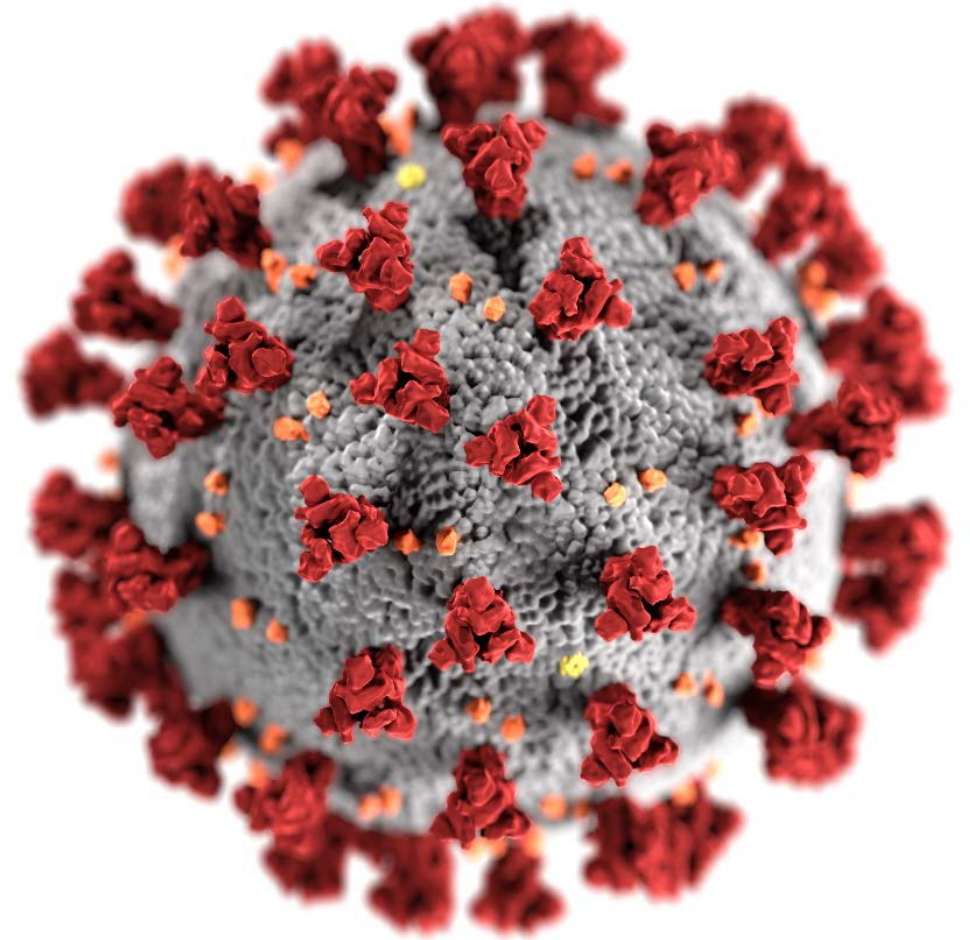


# Epidemiology of COVID-19 in Children Aged 5 – 11 years

**Jefferson Jones, MD, MPH, FAAP**  
**Medical Officer**  
**Epidemiology Task Force**  
**CDC COVID-19 Public Health**  
**Response**

ACIP Meeting  
November 2, 2021



[cdc.gov/coronavirus](https://cdc.gov/coronavirus)

# Overview of COVID-19 in Children Aged 5 – 11 Years

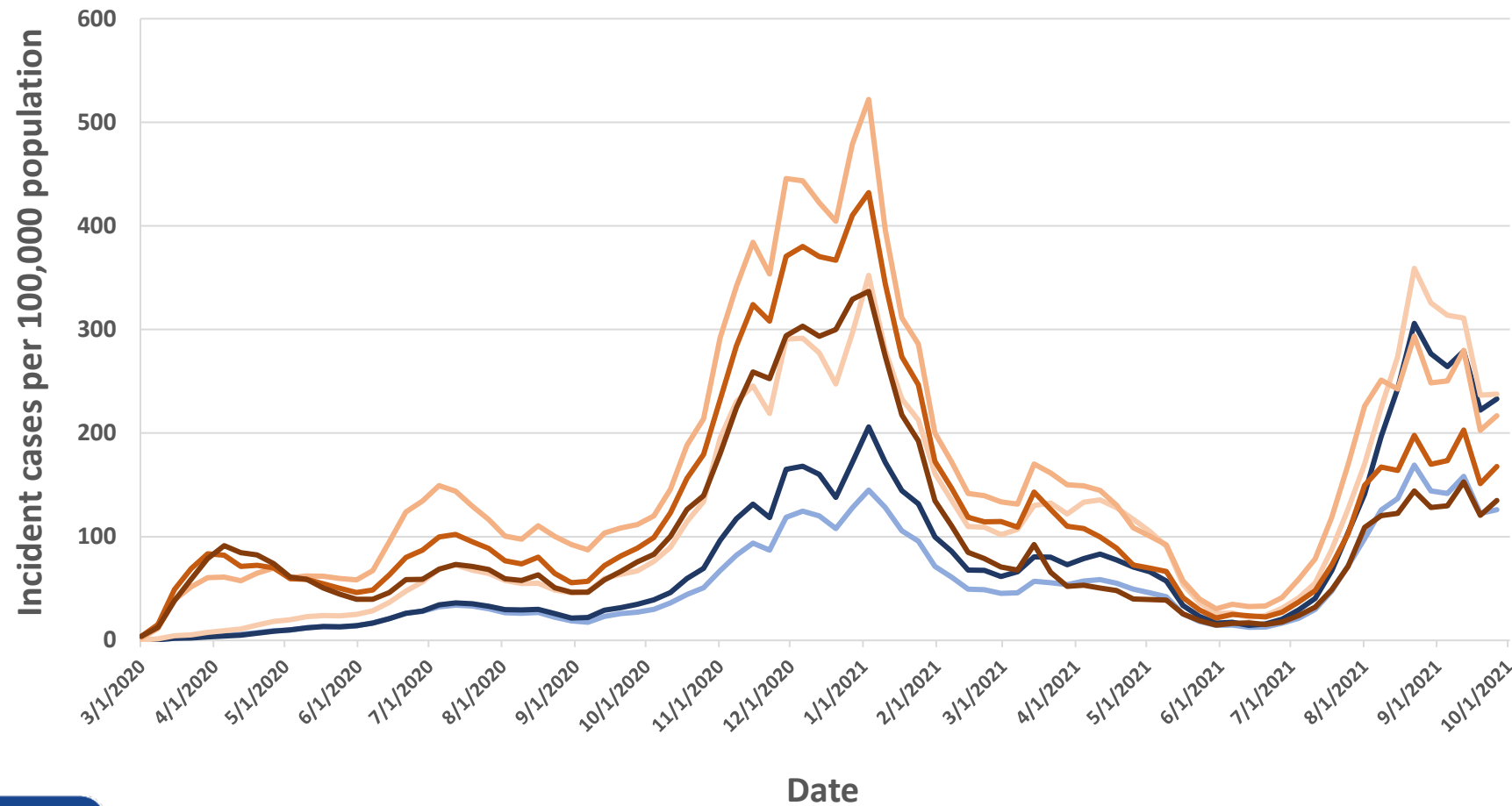
- Incidence and seroprevalence estimates
- COVID-19-associated hospitalization rates and mortality
- Multisystem Inflammatory Syndrome in Children (MIS-C)
- Post-COVID conditions
- Transmission



# Incidence and Seroprevalence



# COVID-19 Weekly Cases per 100,000 Population by Age — United States, March 1, 2020–October 10, 2021



**>1.9 million**  
cases among  
children 5-11  
years of age

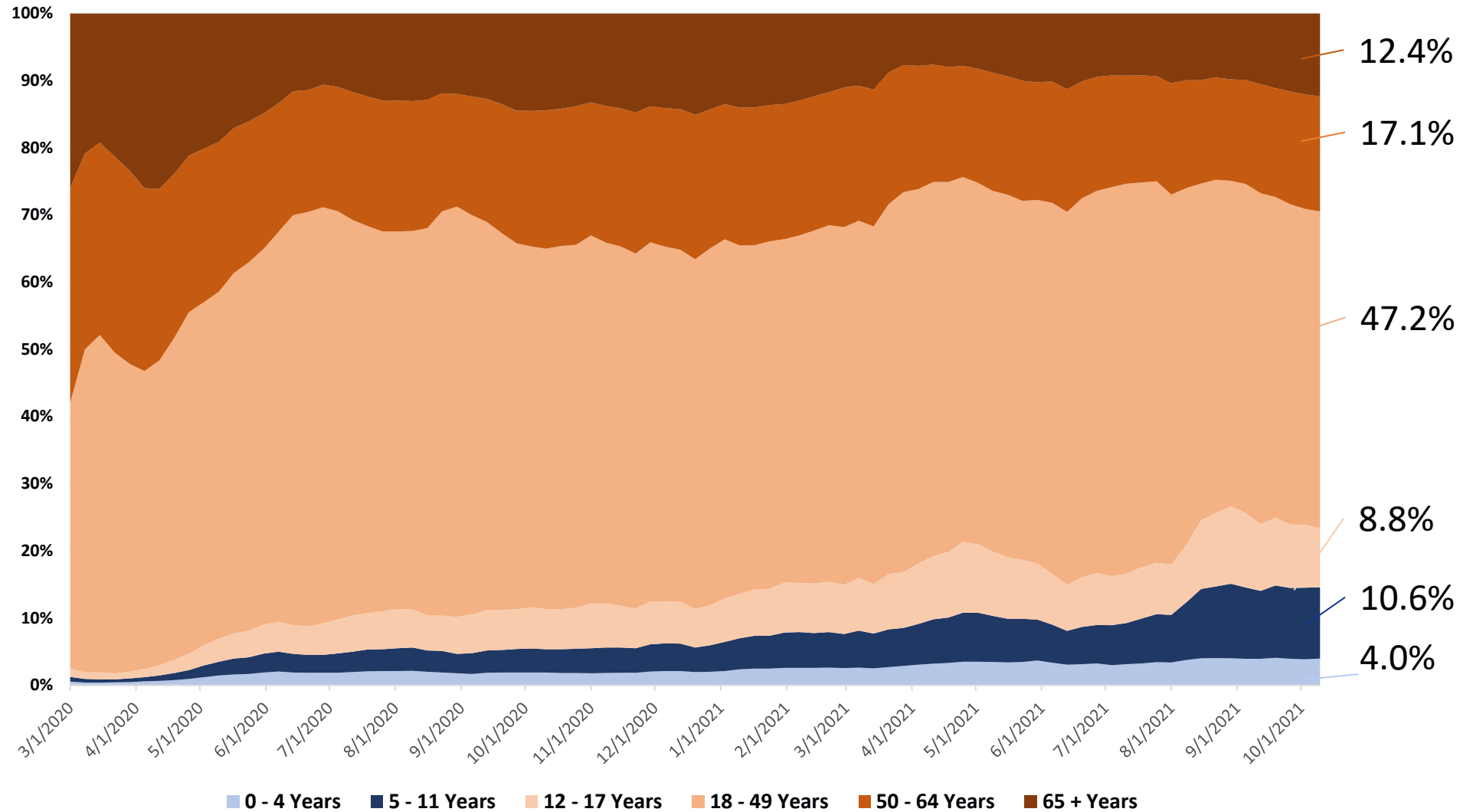


— 0-4 years — 5-11 years — 12-17 years — 18-49 years — 50-64 years — ≥65 years

<https://covid.cdc.gov/covid-data-tracker/#demographicsovertime>

# Proportion of Total COVID-19 Cases by Age Group

## — United States, March 1, 2020–October 10, 2021



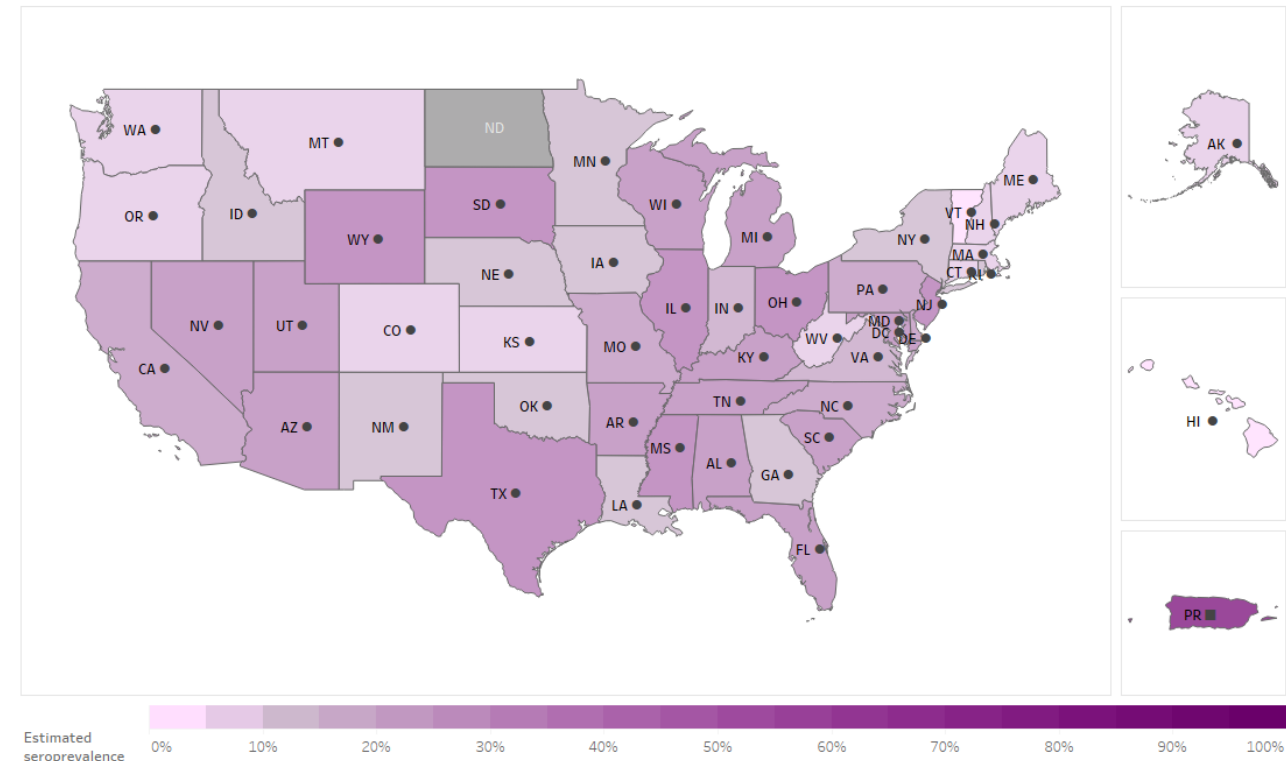
Children 5-11 years are making up a greater proportion of total cases:

**10.6%** of cases the week of October 10, 2021

# Nationwide Commercial Laboratory SARS-CoV-2 Seroprevalence Survey

- Every 2 weeks, ~50,000 specimens tested for SARS-CoV-2 antibodies
- De-identified residual sera collected by commercial laboratories for routine screening or acute clinical care
- Limited pediatric specimens
- Most common reasons for pediatric clinical visits include general examination (e.g., cholesterol screen), obesity, drug monitoring, and fatigue

United States COVID-19 Seroprevalence Estimates



<https://covid.cdc.gov/covid-data-tracker/#national-lab>

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/geographic-seroprevalence-surveys.html>

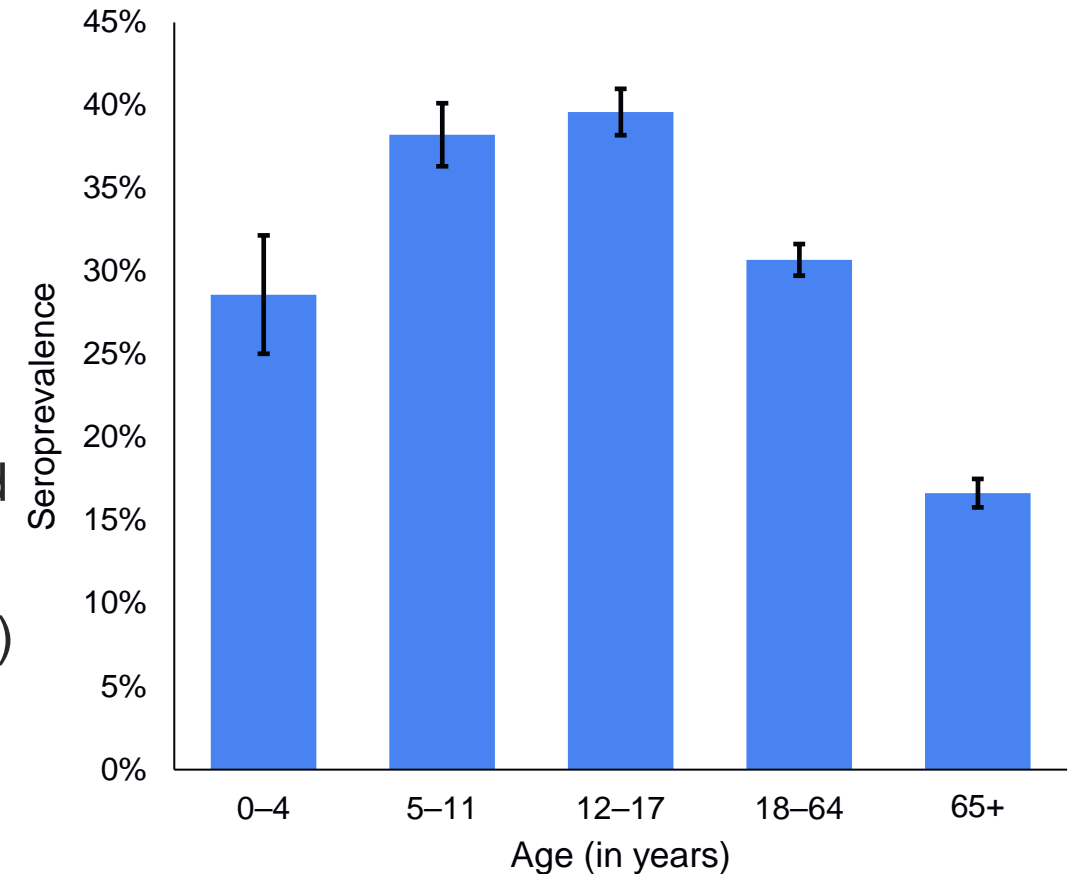
Couture et al. Methods for Estimation of SARS-CoV-2 Seroprevalence and Reported COVID-19 Cases in U.S. Children, August 2020—May 2021. medRxiv. <https://doi.org/10.1101/2021.09.26.2126375>

Bajema et al. Estimated SARS-CoV-2 Seroprevalence in the US as of September 2020. JAMA Intern Med. 2021;181(4):450–460.

\*For Nov 2020–Jun 2021. For Sep 2021, states included even with <100 specimens.

# Weighted Infection-Induced SARS-CoV-2 Seroprevalence By Age Group — 47 U.S. Jurisdictions, Sept 2021

- Seroprevalence in children aged 5–11 years: 38% (95% CI: 36–40%)
  - Higher than estimates among adults
  - Similar to estimates in children aged 12–17 years
- Range for jurisdiction-level estimates for children aged 5–11 years: 11%–61%\*
- Estimates lower than jurisdictions previously presented
- Number of infections per reported case†:
  - General population: Median **2.4** (Range: 2.0–3.9)
  - Ages 0–17 years: Median **6.2** (Range: 4.7–8.9)



Data are preliminary and subject to change

\*Restricted to 23 jurisdictions with  $\geq 75$  specimens from children aged 5–11 years:

†Jurisdiction-level May-June 2021 estimates restricted to jurisdictions that provided age data for  $>90\%$  of individual cases: CA, IL, NV, NJ, NC, OH, SC, and TN

# Infection-Induced Protection From Reinfection

- Based on data in adults, infected individuals have a low risk of reinfection for at least 6 months, but protection is not 100% and likely lower against Delta variant
- Infection-induced antibody response is lower and less consistent compared with mRNA vaccine-induced antibody response
- Antibody titers generated after infection are lower in people with mild or no symptoms
- Vaccination after infection significantly enhances protection and further reduces risk of reinfection
- CDC recommends vaccination regardless of history of infection
  - Serologic testing to assess for prior infection is not recommended for the purpose of vaccine decision-making





# Seroprevalence Summary

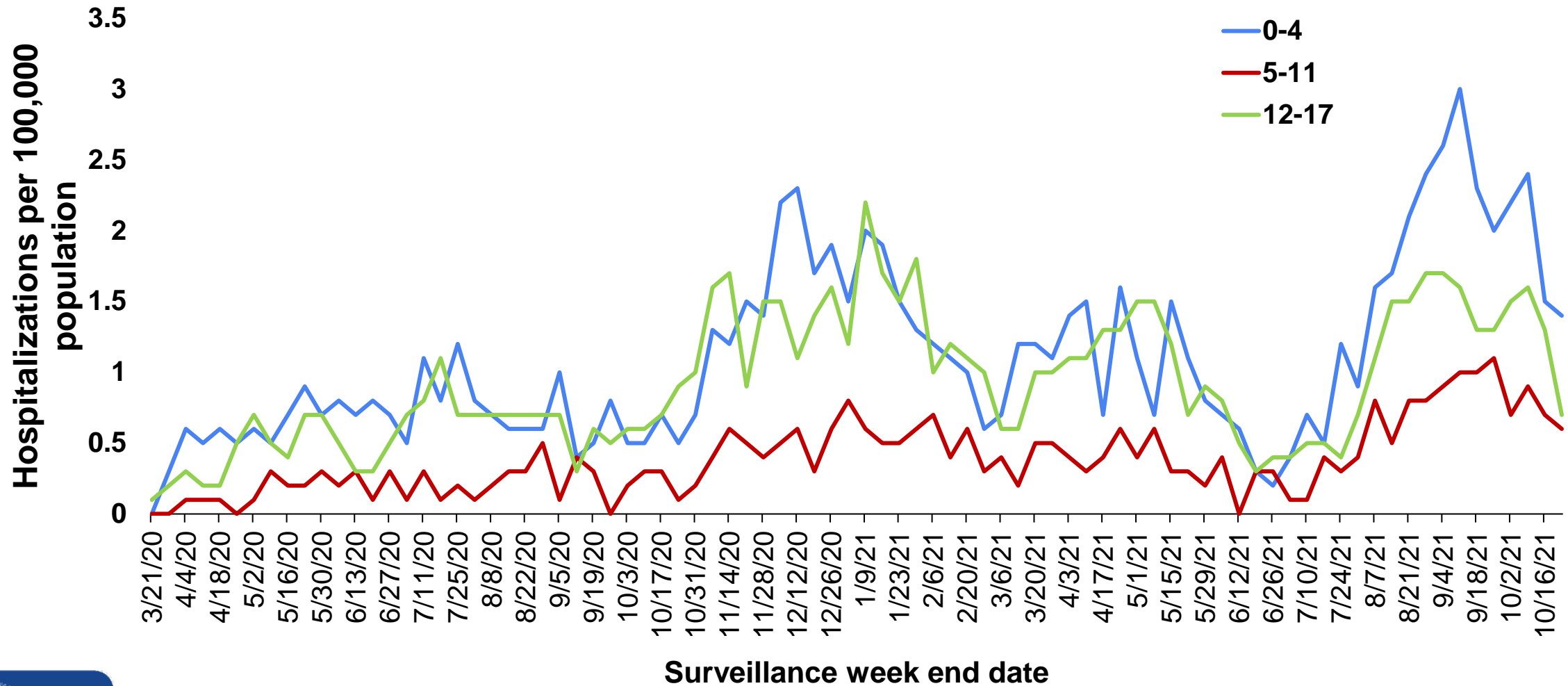
- Seroprevalence data suggest infections in children less likely to be reported compared with adults
- Seroprevalence estimates in children 5–11 years were 38% in September 2021
- Seroprevalence indicates that children are at least as likely as adults to be infected with SARS-CoV-2
- Limitation: Seroprevalence estimates may not be representative of the general pediatric population
  - Antibody tests cannot determine if a person is protected from reinfection or not
  - Assay used for analysis good for detecting previous infection but unlikely to correlate with protection from infection



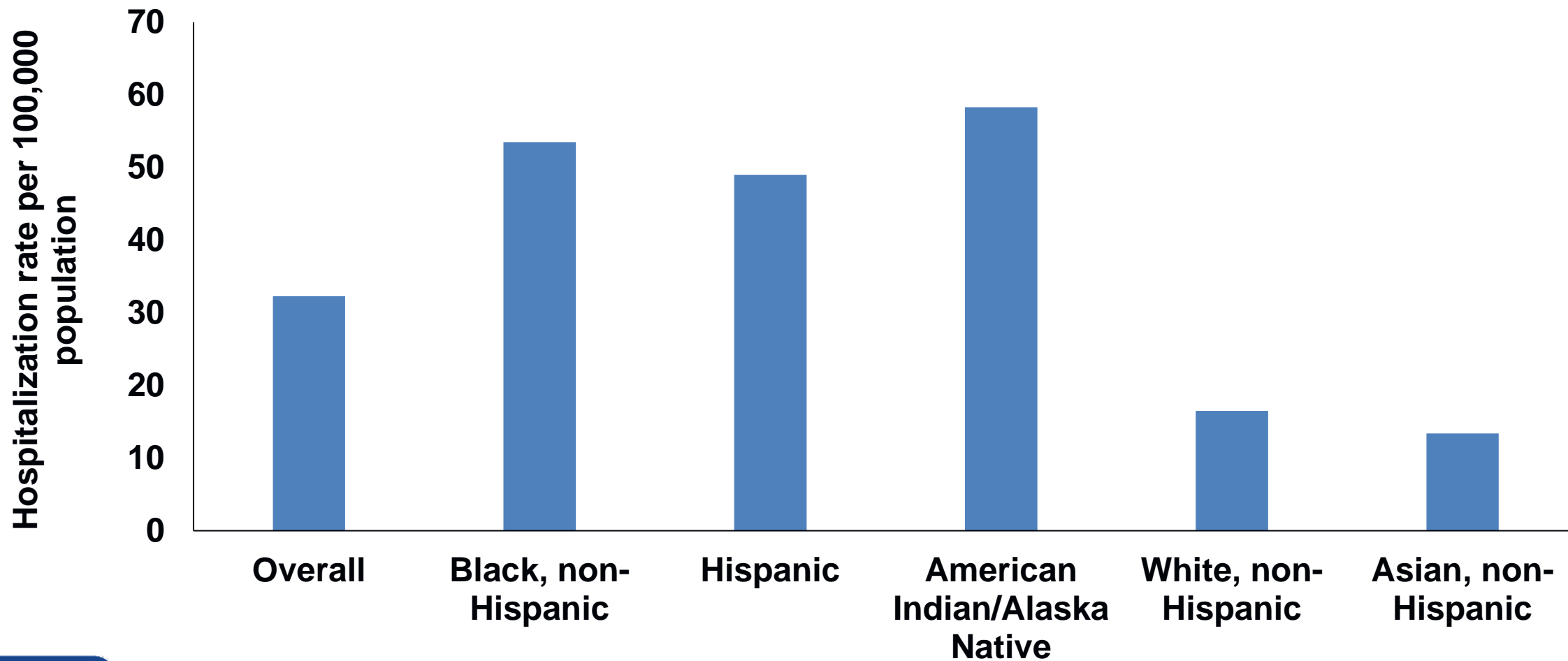
# Hospitalization



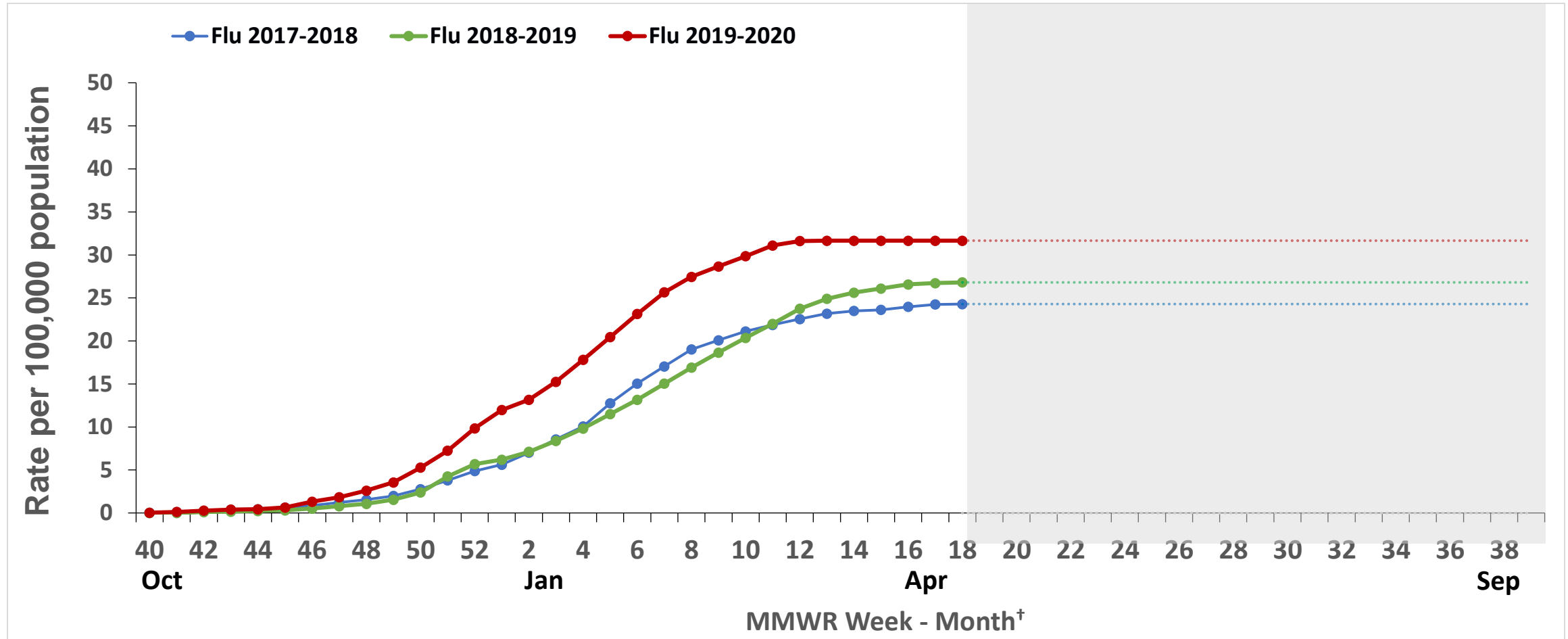
# COVID-19-Associated Weekly Hospitalizations per 100,000 — COVID-NET by Age Group, March 21, 2020–October 23, 2021



# Cumulative COVID-19-Associated Hospitalization Rates by Race and Ethnicity among Children 5-11 Years of Age — COVID-NET, March 1, 2020–October 23, 2021



# Cumulative Influenza- and COVID-19-Associated Hospitalizations Among Children Ages 5–11 Years



\*Mitigation measure in place during 2020–2021

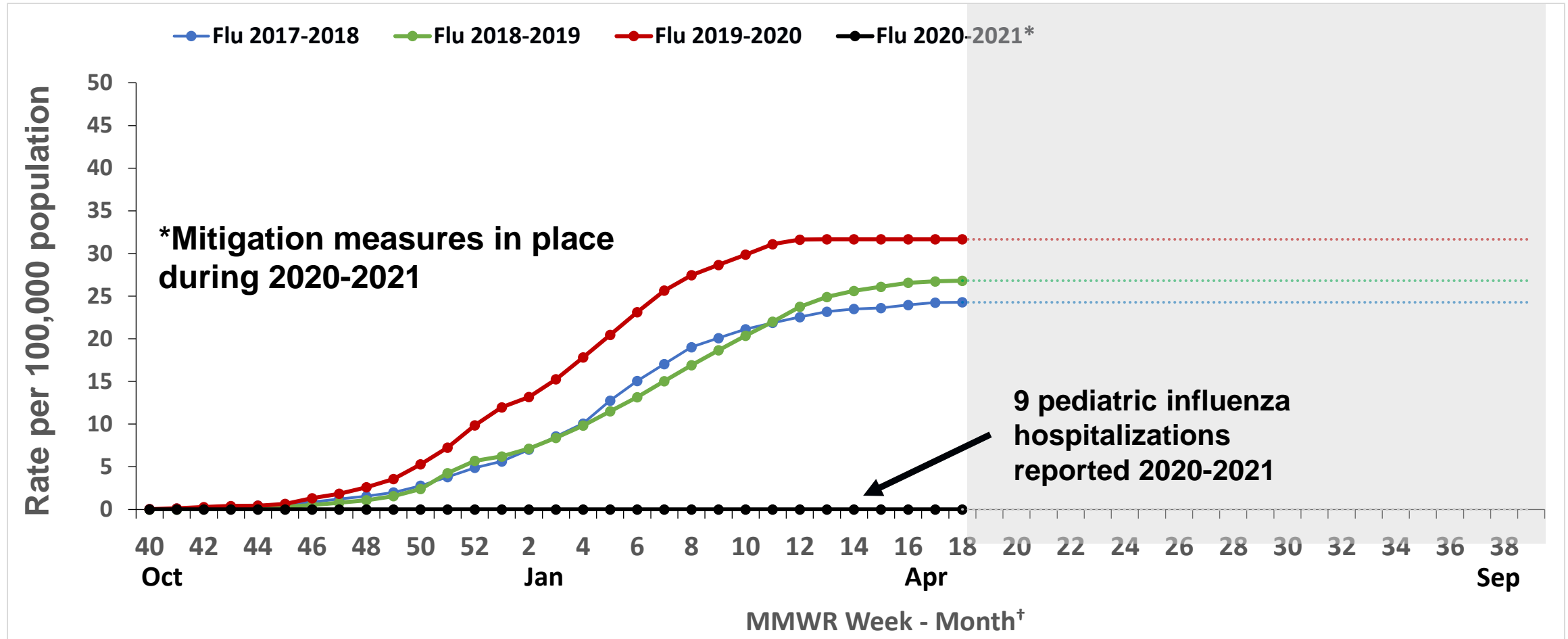
<sup>†</sup>Influenza seasons: MMWR week 40 of the earlier year to MMWR week 18 of the later year. The COVID period: Oct 2020-Sep 2021 goes from MMWR week 40 of year 2020 to MMWR week 39 of year 2021. MMWR Week 53 for MMWR Year 2020 is combined with MMWR Week 52 for consistency with other years.

COVID-NET-California, Colorado, Connecticut, Georgia, Iowa, Maryland (entire state), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

FluSurv-NET: California, Colorado, Connecticut, Georgia, Maryland (Baltimore Metropolitan Area), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.



# Cumulative Influenza- and COVID-19-Associated Hospitalizations Among Children Ages 5–11 Years



**\*Mitigation measure in place during 2020–2021**

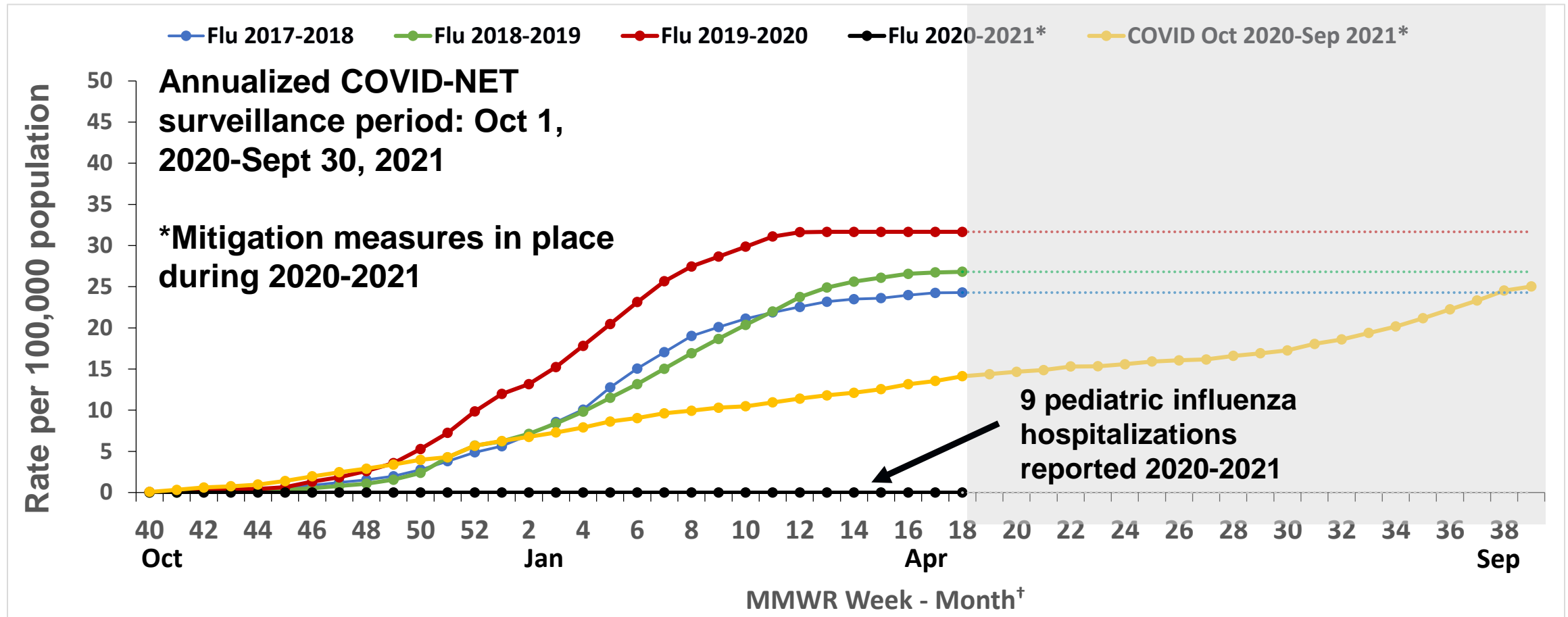
<sup>†</sup>Influenza seasons: MMWR week 40 of the earlier year to MMWR week 18 of the later year. The COVID period: Oct 2020-Sep 2021 goes from MMWR week 40 of year 2020 to MMWR week 39 of year 2021. MMWR Week 53 for MMWR Year 2020 is combined with MMWR Week 52 for consistency with other years.

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# Cumulative Influenza- and COVID-19-Associated Hospitalizations Among Children Ages 5–11 Years



\*Mitigation measure in place during 2020–2021

**Annualized COVID-NET surveillance period: Oct 1, 2020–Sept 30, 2021**

†Influenza seasons: MMWR week 40 of the earlier year to MMWR week 18 of the later year. The COVID period: Oct 2020-Sep 2021 goes from MMWR week 40 of year 2020 to MMWR week 39 of year 2021. MMWR Week 53 for MMWR Year 2020 is combined with MMWR Week 52 for consistency with other years.

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# Clinical Interventions and Outcomes of Children Aged 5-11 Years with COVID-19 or Influenza-Associated Hospitalizations, COVID-NET<sup>1</sup> and FluSurv-NET<sup>2</sup>

	FluSurv-NET 2017-2018, 2018-2019, and 2019-2020 (N = 1,874), <sup>3</sup> n (%)	COVID-NET March 1, 2020–August 31, 2021 (N = 696), <sup>4</sup> n (%)
<b>Hospital length of stay (median, IQR)</b>	2 (1-4)	3 (2-6)
<b>ICU admission</b>	398 (21.2)	222 (31.9)
<b>Invasive mechanical ventilation</b>	87 (4.6)	50 (7.2)
<b>Died during hospitalization</b>	11 (0.6)	4 (0.6)

1 COVID-NET-California, Colorado, Connecticut, Georgia, Iowa, Maryland (entire state), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

2 FluSurv-NET: California, Colorado, Connecticut, Georgia, Maryland (Baltimore Metropolitan Area), Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. Surveillance conducted from October 1-April 30 each season

3 Includes those with complete clinical data (~97% of pediatric cases) on hospital length of stay, ICU admission, invasive mechanical ventilation, and disposition discharge (i.e., discharged alive or died in-hospital).

4 Includes those with complete clinical data (~90% of pediatric cases) on hospital length of stay, ICU admission, invasive mechanical ventilation, and disposition discharge (i.e., discharged alive or died in-hospital).





# Children Aged 5–11 Years Hospitalized with COVID-19— COVID-NET, March 2020–August 2021

- 68% were Black, non-Hispanic or Hispanic
- 32% had no underlying conditions
- Most common underlying medical conditions were chronic lung disease (primarily asthma) and obesity

## Demographic and clinical characteristics

	N	(%)
<b>Total</b>	562	(100)
<b>Age (yrs) – median (IQR)*</b>	8	(6–10)
<b>Sex – Male</b>	320	(57)
<b>Race/ethnicity</b>		
Black, non-Hispanic	207	(37)
Hispanic	177	(31)
White, non-Hispanic	124	(22)
Asian, non-Hispanic	23	(4)
Other, non-Hispanic	31	(6)
<b>Severe disease<sup>†</sup></b>	<b>200</b>	<b>(36)</b>
<b>≥1 underlying condition</b>	<b>381</b>	<b>(68)</b>



\*Interquartile range; †Requiring intensive care unit admission or mechanical ventilation

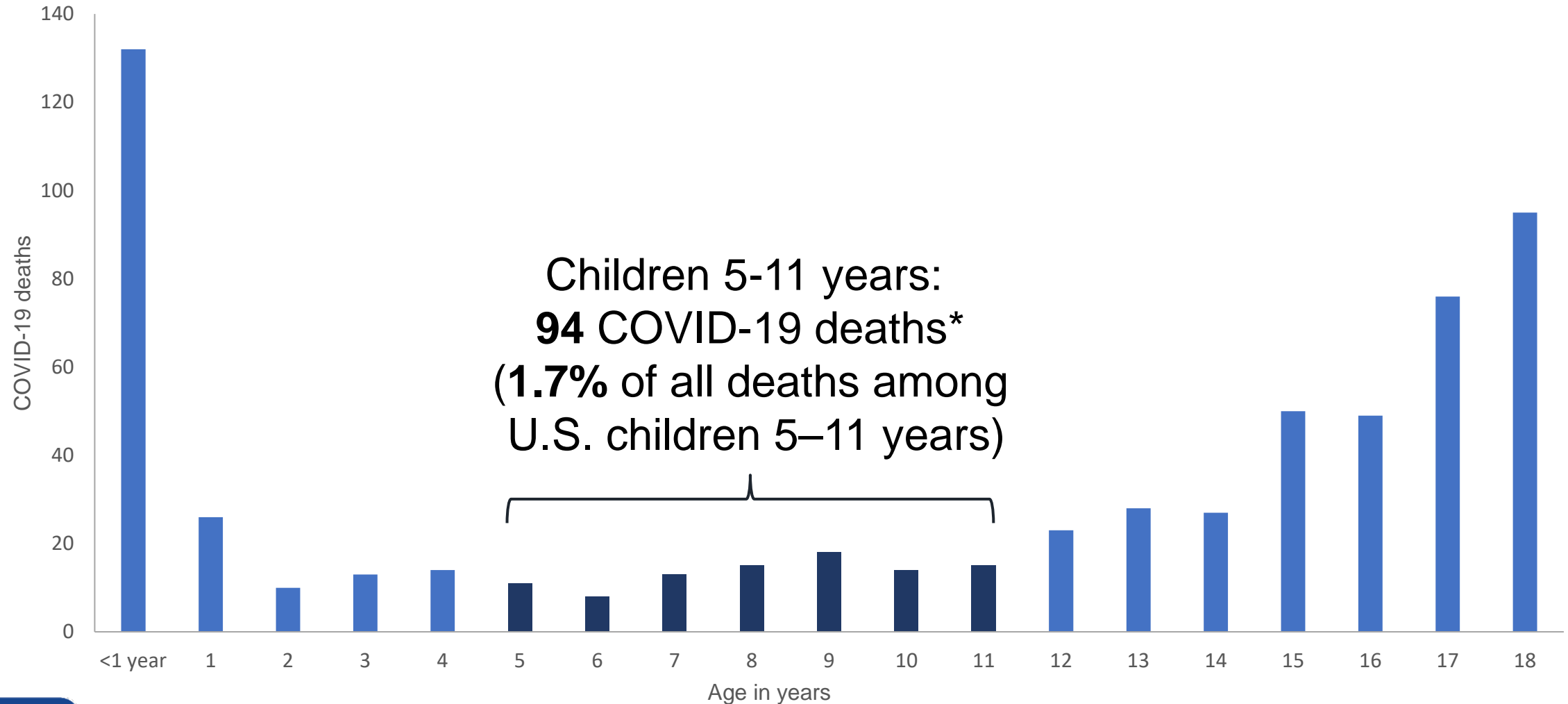
COVID-NET is a population-based surveillance system that collects data on laboratory-confirmed COVID-19-associated hospitalizations among children and adults through a network of over 250 acute-care hospitals in 14 states. Methods described in: Woodruff RC, et al. Risk factors for Severe COVID-19 in Children. *Pediatrics*. ePub October 2021.

# Mortality



# COVID-19 Deaths by Age Group, NCHS

## — United States. January 1, 2020–October 16, 2021



\*Lag in reporting of deaths might result in underestimate  
<https://data.cdc.gov/NCHS/Provisional-COVID-19-Deaths-Counts-by-Age-in-Years/3apk-4u4f/data>

# Leading Causes of Death in Children 5-11 Years of Age, NCHS, 2019

Causes of Death	Death (n)	Crude rate per 100,000
Accidents (unintentional injuries)	969	3.4
Malignant neoplasms	525	1.8
Congenital malformations, deformations and chromosomal abnormalities	274	1.0
Assault (homicide)	207	0.7
Diseases of the heart	115	0.4
Chronic lower respiratory diseases	107	0.4
Influenza and pneumonia	84	0.3
Intentional self-harm (suicide)	66	0.2
Cerebrovascular diseases	56	0.2
Septicemia	48	0.2

**66** COVID-19 associated deaths in children 5–11 10/3/20-10/2/2021



Total population 5-17 years, 2019: 52,715,248

# MIS-C and Additional Post-COVID Conditions



# Multisystem Inflammatory Syndrome in Children (MIS-C)

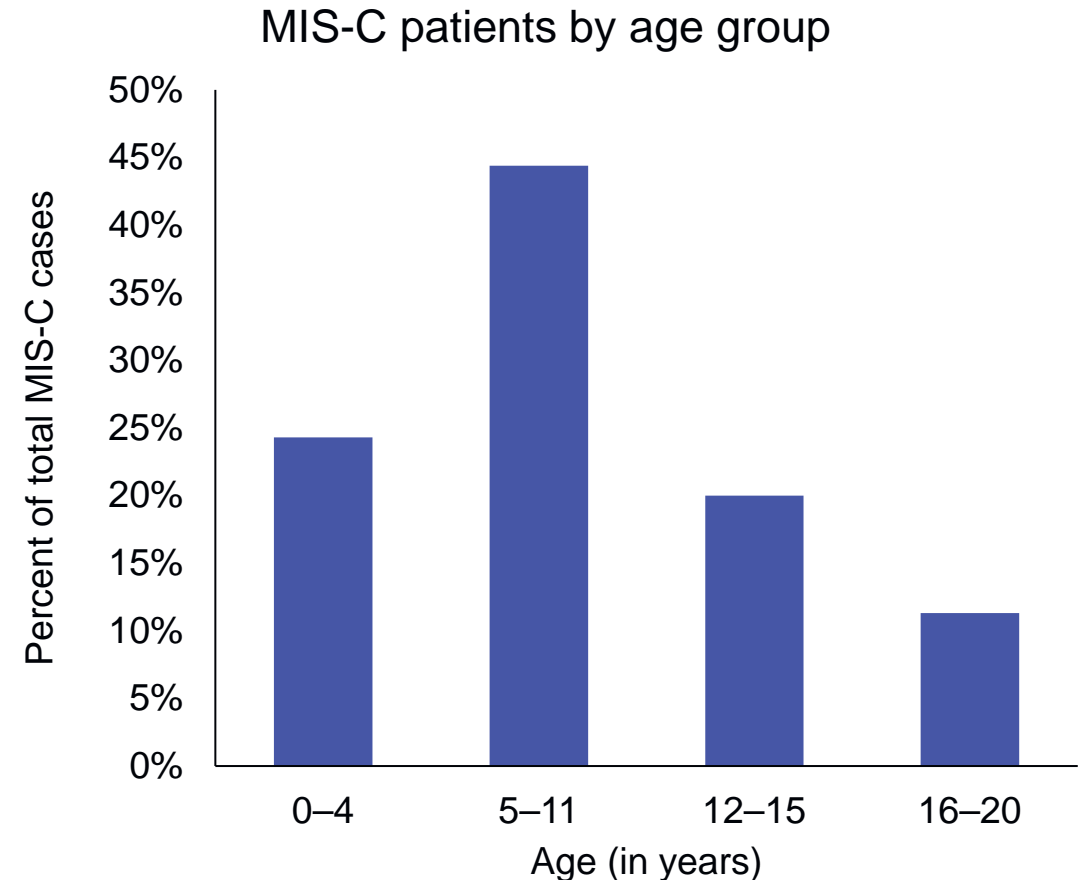
- Severe hyperinflammatory syndrome occurring 2-6 weeks after acute SARS-CoV-2 infection, resulting in a wide range of clinical manifestations and complications
- Incidence has been estimated as 1 MIS-C case in approximately 3,200 SARS-CoV-2 infections
- 60-70% of patients are admitted to intensive care, 1-2% die

- Bowen, et al. Demographic and Clinical Factors Associated With Death Among Persons <21 Years Old With Multisystem Inflammatory Syndrome in Children—United States, February 2020–March 2021, *Open Forum Infectious Diseases*, Volume 8, Issue 8, August 2021,, <https://doi.org/10.1093/ofid/ofab388>
- Payne AB, et al. Incidence of Multisystem Inflammatory Syndrome in Children Among US Persons Infected With SARS-CoV-2. *JAMA Netw Open*. 2021;4(6):e2116420. Published 2021 Jun 1. doi:10.1001/jamanetworkopen.2021.16420
- Feldstein LR, et al. Characteristics and Outcomes of US Children and Adolescents With Multisystem Inflammatory Syndrome in Children (MIS-C) Compared With Severe Acute COVID-19. *JAMA*. 2021;325(11):1074-1087. doi:10.1001/jama.2021.2091
- Belay ED, et al. Trends in Geographic and Temporal Distribution of US Children With Multisystem Inflammatory Syndrome During the COVID-19 Pandemic [published online ahead of print, 2021 Apr 6]. *JAMA Pediatr*. 2021;e210630. doi:10.1001/jamapediatrics.2021.0630
- <https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance>



# MIS-C in Children

- 5,217 MIS-C cases reported to national surveillance with date of onset between February 19, 2020–September 23, 2021
  - Median age of **9** years
  - **2,316 (44%)** of these cases occurred in children aged 5–11 years
- **61%** occurred in children who are Hispanic/Latino or Black, Non-Hispanic
- Among children aged 5–11 years, 9 died (**20%** of MIS-C deaths)



# Additional Post-COVID Conditions in Children

- **Post-COVID conditions occur in children**
  - Appear to be less common in children than in adults
  - A national survey in the UK found 7-8% of children with COVID-19 reported continued symptoms >12 weeks after diagnosis<sup>1</sup>
  - May appear after mild or severe infections, or after MIS-C
- **Most common symptoms:** Similar to adults, and include fatigue, headache, insomnia, trouble concentrating, muscle and joint pain, and cough<sup>2,3</sup>
- **Impact on quality of life:** Limitations of physical activity, feeling distressed about symptoms, mental health challenges, decreased school attendance/participation<sup>2</sup>

<sup>1</sup>Office for National Statistics United Kingdom. (2021) Prevalence of ongoing symptoms following coronavirus (COVID-19) infection in the UK. Retrieved on September 17, 2021 from Office for National Statistics' website. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/prevalenceofongoingsymptomsfollowingcoronavirus/covid19infectionintheuk/1april2021>

<sup>2</sup>Buonsenso D, Munblit D, De Rose C, et al. Preliminary evidence on long COVID in children. *Acta Paediatr.* 2021;110(7):2208-2211. doi:10.1111/apa.15870.

<sup>3</sup>Molteni E, Sudre CH, Canas LS, et al. Illness duration and symptom profile in symptomatic UK school-aged children tested for SARS-CoV-2. *Lancet Child Adolesc Health* 2021; 5: 708–18. <https://www.thelancet.com/action/showPdf?pii=S2352-4642%2821%2900198-X>





# SARS-CoV-2 Transmission



# Children and Transmission of SARS-CoV-2

- Transmission of SARS-CoV-2 virus is influenced by presence and type of symptoms, type and timing of exposure, viral load, and variant
- Some studies reported similar rates of transmission from infected children as from adults, while others observed lower rates of transmission from infected children compared with rates from infected adults<sup>1,2,3</sup>
- Secondary transmission from children occurs in both household<sup>3</sup> and school settings<sup>2,4,5,6</sup>
- Studies have shown that vaccination decreases transmission<sup>7</sup>

1. Bi Q et al. *Lancet Infect Dis.* 2020;20(8):911-919

2. CDC Science Brief: Transmission of SARS-CoV-2 in K-12 schools. [https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission\\_k\\_12\\_schools.html](https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission_k_12_schools.html)

3. McLean, et al. Household Transmission and Clinical Features of SARS-CoV-2 Infections by Age in 2 US Communities. *medRxiv.* <https://doi.org/10.1101/2021.08.16.21262121>

4. Chu VT, Yousaf AR, Chang K, et al. Household Transmission of SARS-CoV-2 from Children and Adolescents. *N Engl J Med.* 2021;NEJMc2031915.

5. Goldstein E et al. On the Effect of Age on the Transmission of SARS-CoV-2 in Households, Schools, and the Community. *J Infect Dis.* 2021 Feb 13;223(3):362-369.

6. Larosa E et al. Secondary transmission of COVID-19 in preschool and school settings in northern Italy after their reopening in September 2020. *Euro Surveill.* 2020;25(49):2001911.

7. CDC Science Brief. COVID-19 Vaccines and Vaccination. <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html>



# Children and Transmission of SARS-CoV-2

- Outbreak investigations have demonstrated efficient transmission among children and adults

## The Delta variant spreads easily in indoor spaces when people are unmasked and unvaccinated

Occasionally unmasked adult infected with Delta variant worked for 2 days

12 of 24 kids infected

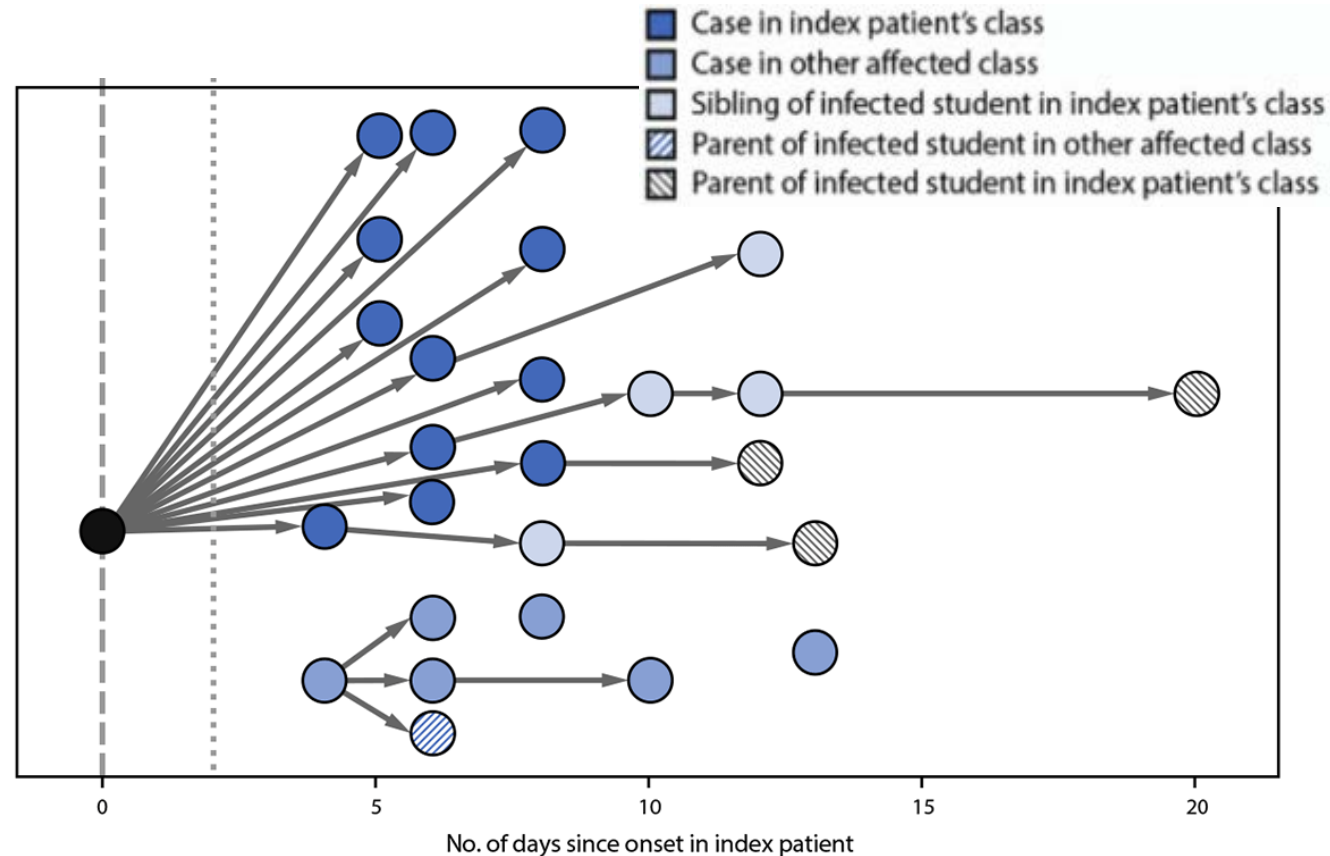


### Schools can help stop spread by ensuring everyone:

- Wears masks correctly in indoor spaces
- Gets vaccinated, if eligible
- Stays home if having symptoms
- Tests routinely

[bit.ly/MMWR82721b](https://bit.ly/MMWR82721b)

MMWR



# Summary: COVID-19 Epidemiology in Children Aged 5–11 years

- **Children aged 5–11 years are at least as likely to be infected with SARS-CoV-2 as adults**
  - Over 1.9 million reported cases; seroprevalence estimated to be ~38% in September 2021
  - Seroprevalence data suggests that infections in children less likely to be reported as cases than infections in adults
- **Children aged 5–11 years are at risk of severe illness from COVID-19**
  - >8,300 hospitalizations to date
    - Hospitalization rates are 3x times higher for non-Hispanic Black, non-Hispanic American Indian/Alaska Native, and Hispanic children compared with non-Hispanic White children
    - Hospitalization rates are similar to pre-pandemic influenza-associated hospitalization rates
    - Severity was comparable among children hospitalized with influenza and COVID-19
    - Approximately 1/3 of hospitalized children aged 5–11 years require ICU admission
  - At least 94 COVID-19-associated deaths occurred in children aged 5–11 years
  - MIS-C was most frequent among children aged 5–11 years
  - Post-COVID conditions have been reported in children
  - All might have been more numerous had pandemic mitigation measures not been implemented
- **Secondary transmission from young school-aged children occurs in household and school settings**



# Acknowledgements

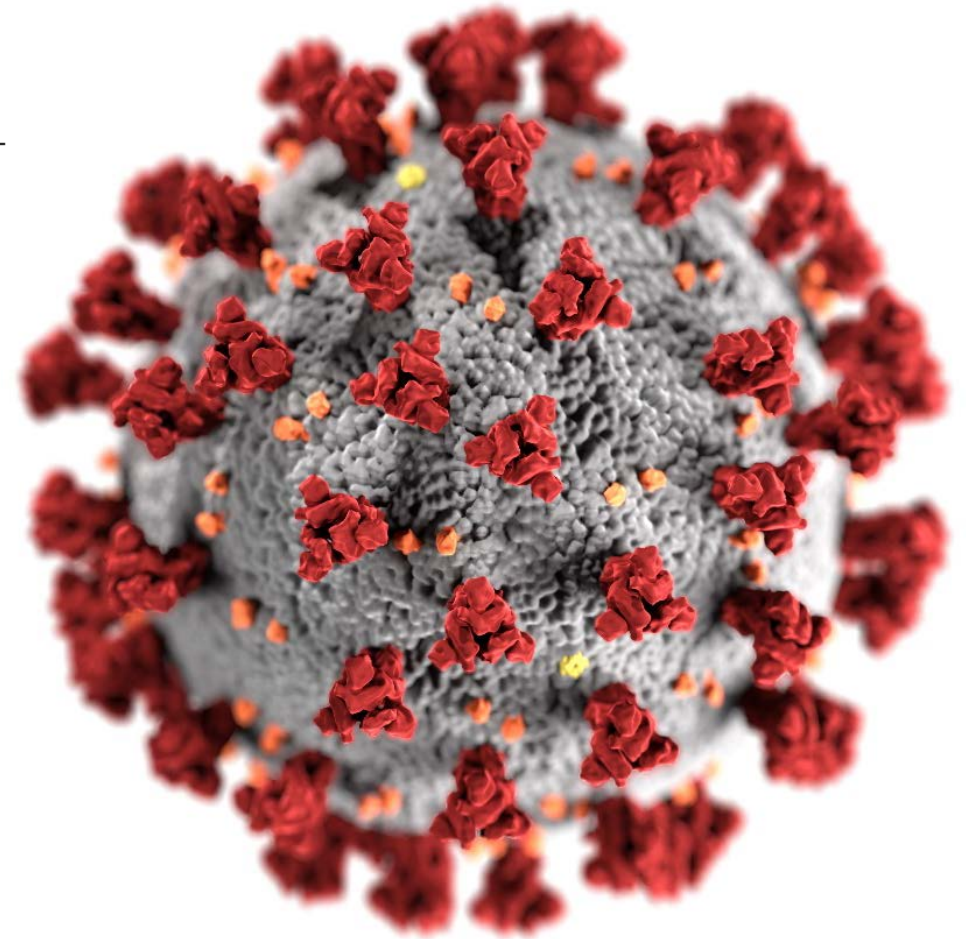
- CDC
  - Kate Woodworth
  - Alexia Couture
  - Hannah Kirking
  - Melissa Rolfes
  - Angela Campbell
  - Melissa Briggs-Hagen
  - Sara Oliver
  - Kristie Clarke
  - Tina Benoit
  - Myrna Charles
  - Brendan Flannery
  - Carrie Reed
  - Casey Lyons
  - Farida Ahmad
  - Nicole Zviedrite
  - Laura Zambrano
- Laboratories and state health departments participating in seroprevalence surveys
- Site PIs and staff for COVID-NET and FluSurv-NET
- Many others

## CDC COVID-NET team

- Fiona Havers
- Christopher Taylor
- Huong Pham
- Michael Whitaker
- Kadam Patel
- Jenny Milucky
- Rebecca Woodruff
- Anita Kambhampati

## CDC FluSurv-NET Team:

- Shikha Garg
- Dawud Ujamaa
- Alissa O'Halloran
- Charisse Cummings
- Rachel Holstein



For more information, contact CDC  
1-800-CDC-INFO (232-4636)  
TTY: 1-888-232-6348 [www.cdc.gov](http://www.cdc.gov)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.