

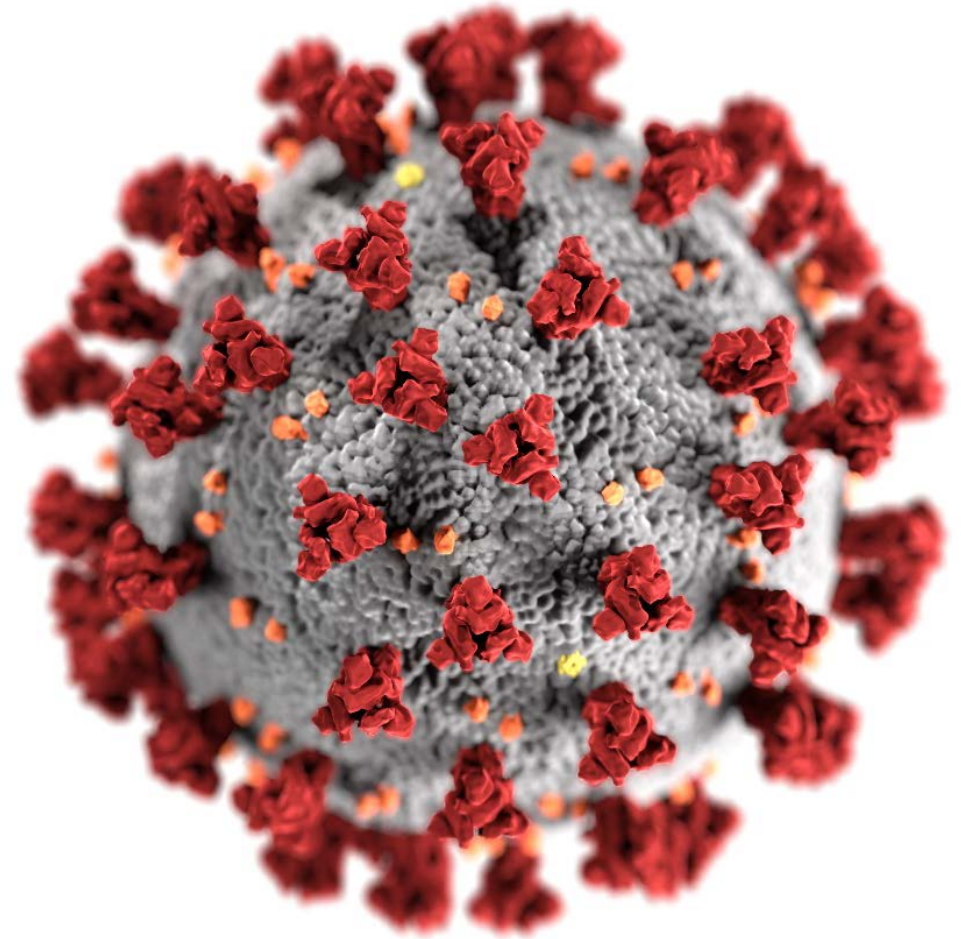
Vaccines and Related Biological Products Advisory Committee Meeting

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

Fiona Havers, MD, MHS, FIDSA
Medical Officer
Epidemiology Task Force
CDC COVID-19 Public Health
Response

VRBPAC Meeting
October 26, 2021



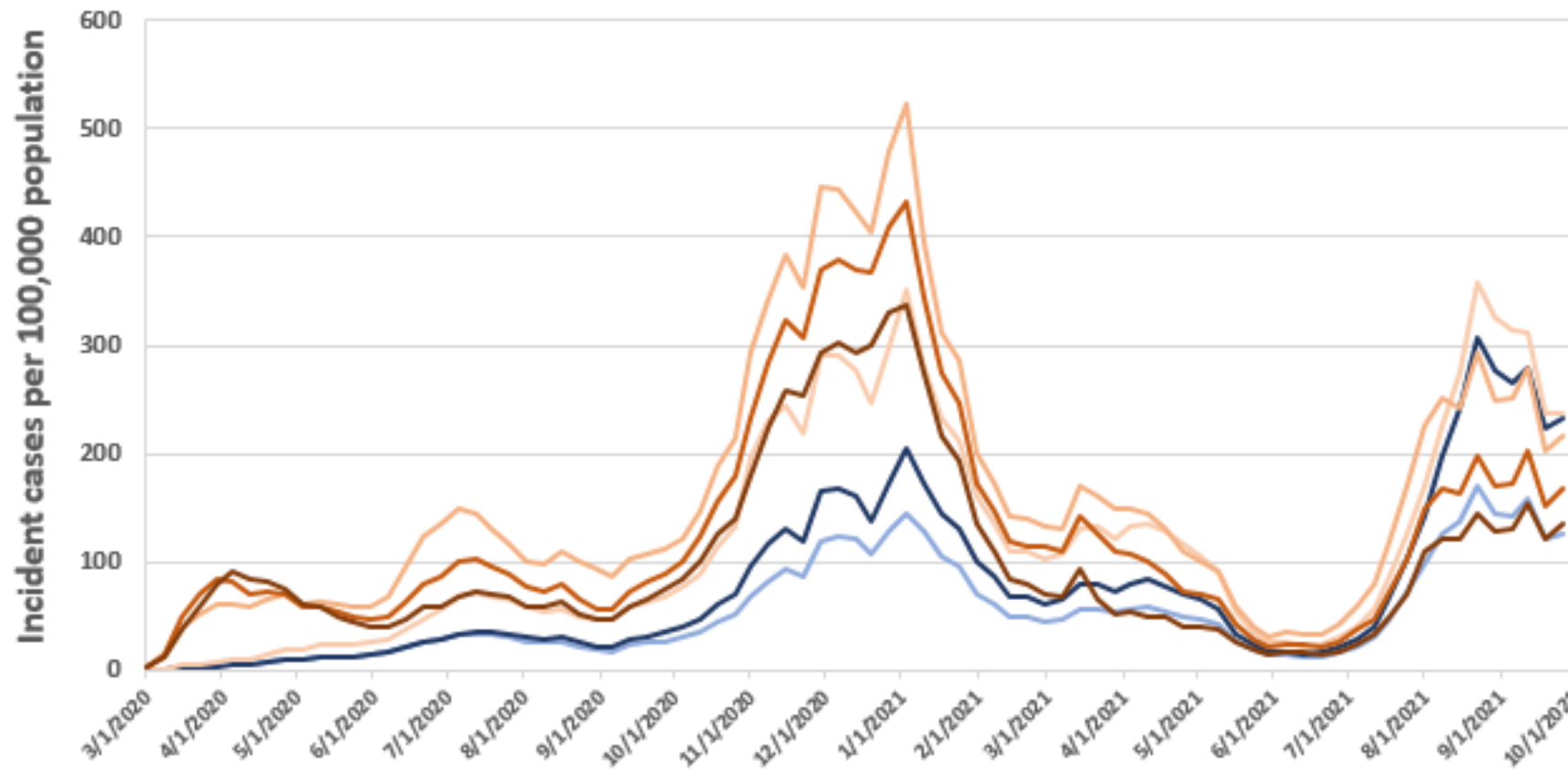
cdc.gov/coronavirus

Overview of COVID-19 in Children Aged 5 – 11 years

- Incidence and burden estimates
- COVID-19-associated hospitalization rates and mortality
- Multisystem Inflammatory Syndrome in Children (MIS-C)
- Post-COVID conditions
- Transmission
- Lost in-person learning and other impacts



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



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



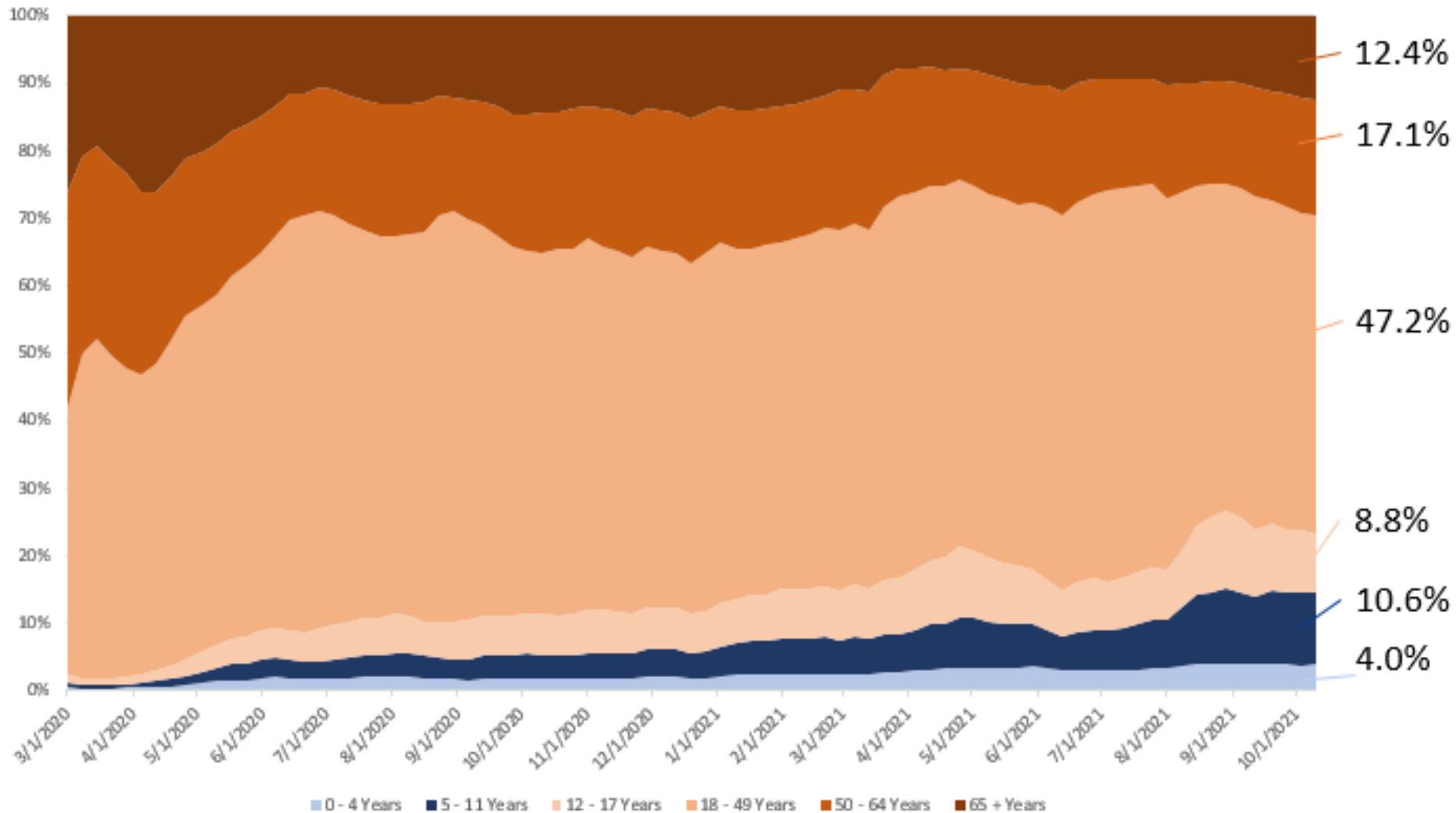
Case earliest date by end of week

— 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

— March 1, 2020–October 10, 2021

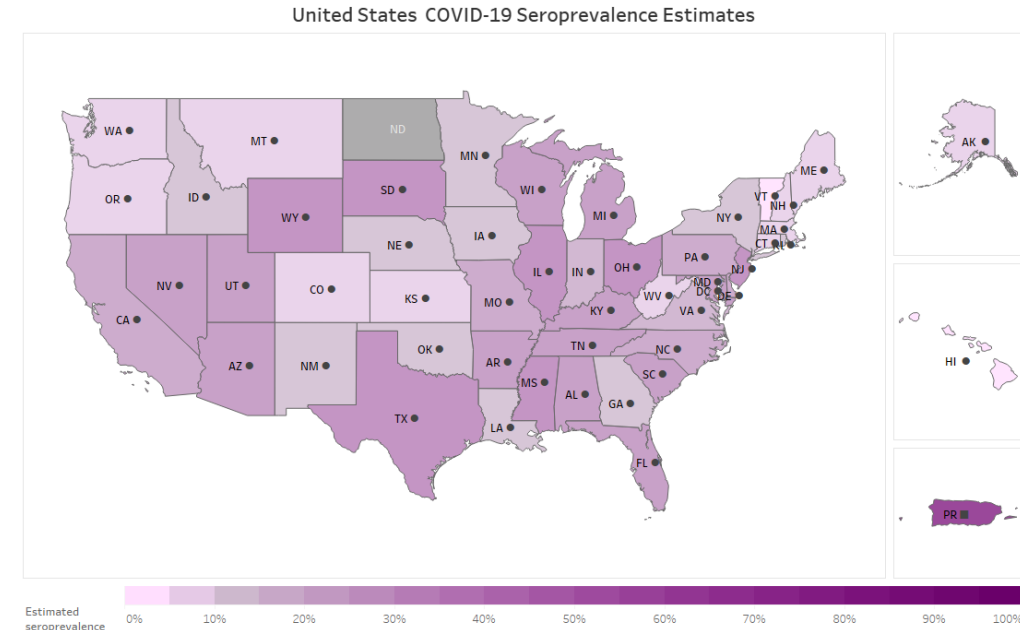


Children 5-11 years are making up a greater proportion of total cases:

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 from commercial laboratories
 - Limited pediatric specimens
- For age-stratified analysis:
 - Restricted to 15 jurisdictions that include ≥ 100 specimens from children aged 5–11 years per 2 months
 - Restricted to a total antibody anti-N assay

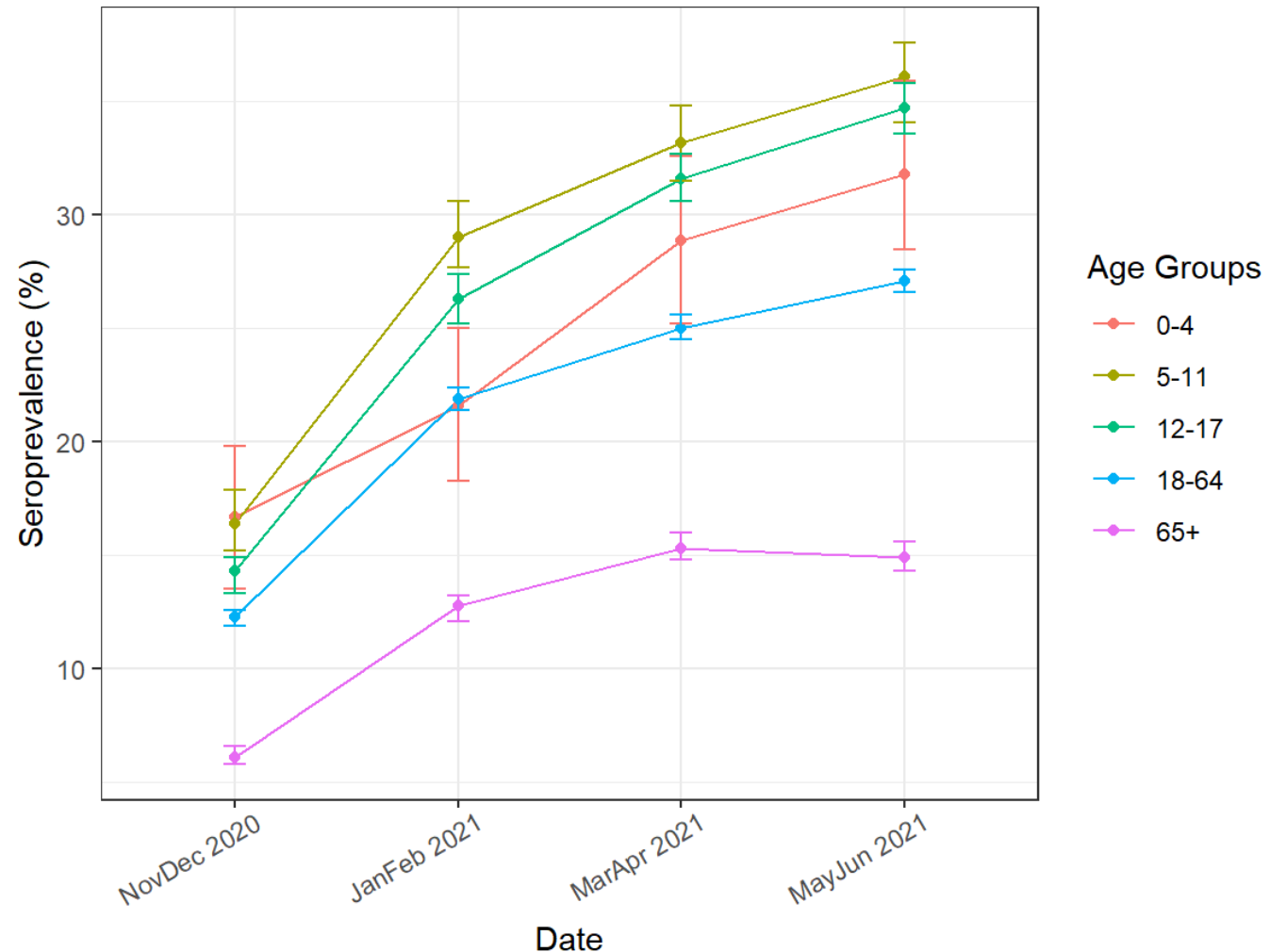


<https://covid.cdc.gov/covid-data-tracker/#national-lab>

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

Weighted SARS-CoV-2 Infection-Induced Seroprevalence: 15 U.S. jurisdictions by Age Group, Nov 2020–Jun 2021

- Children consistently have higher seroprevalence estimates than adults
- Age 5–11 have the highest seroprevalence, but confidence intervals overlap with other pediatric age groups
- Age 5–11 seroprevalence increased from 13% in Nov–Dec 2020 to 42% in May–June 2021
- 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)



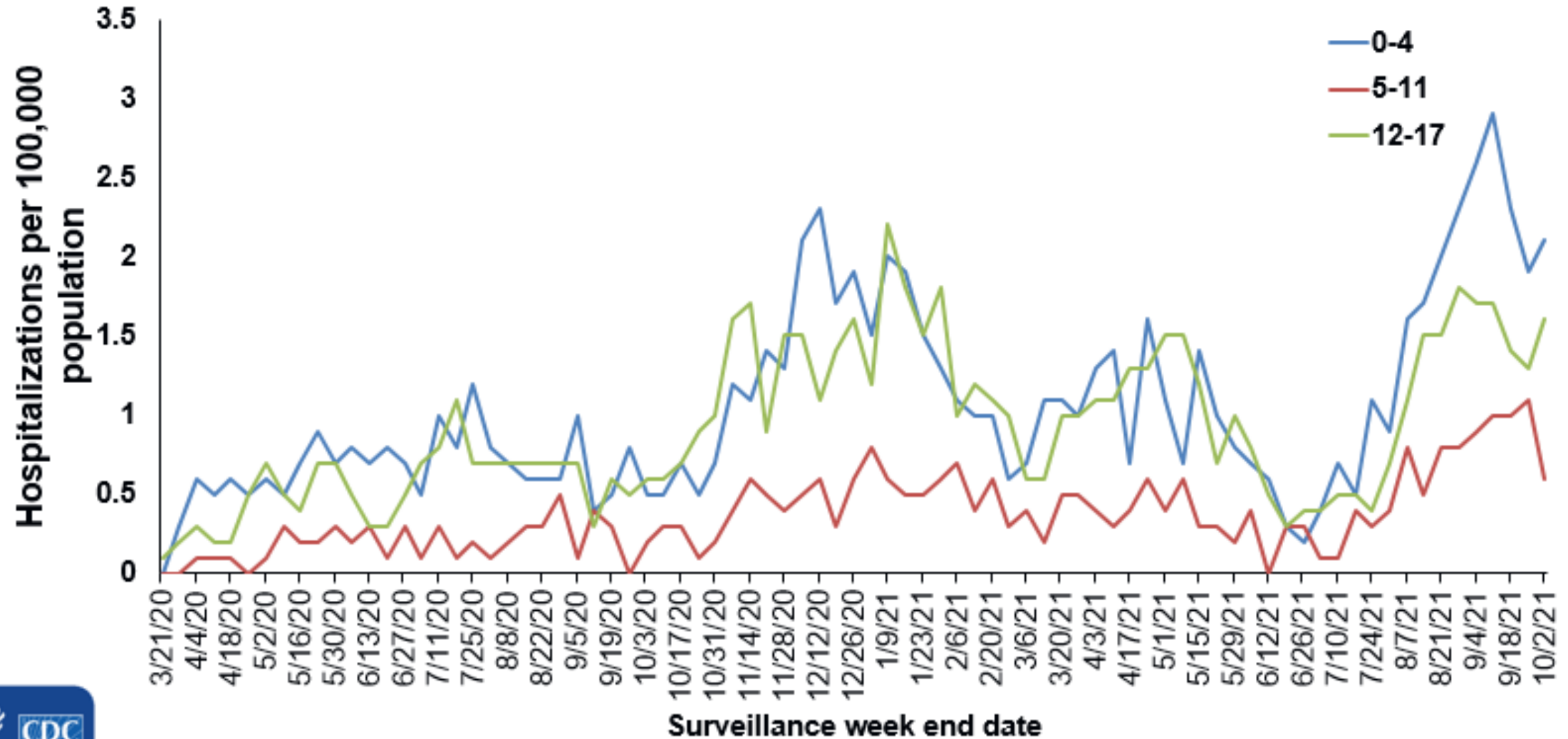
* Restricted to jurisdictions that provided age data for >90% of individual cases: CA, IL, NV, NJ, NC, OH, SC, and TN

Seroprevalence Findings

- Seroprevalence data suggest infections in children less likely to be reported compared with adults
- Children are at least as likely as adults to be infected with SARS-CoV-2
- Seroprevalence in children continues to increase
 - Estimates in children 5–11 years were >40% in May–June 2021
- Limitation: Seroprevalence estimates may not be representative of the general pediatric population



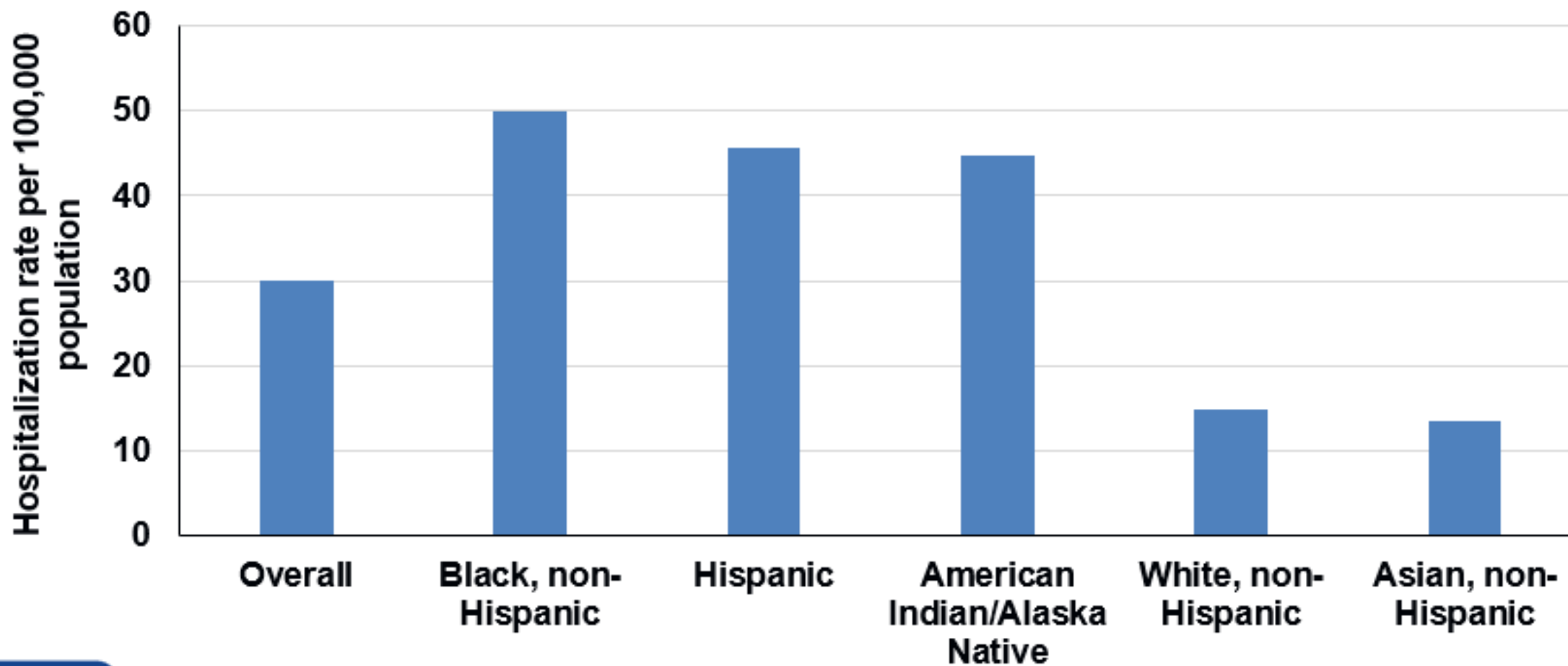
COVID-19-Associated Weekly Hospitalizations per 100,000 — COVID-NET by age group, March 21, 2020–October 2, 2021



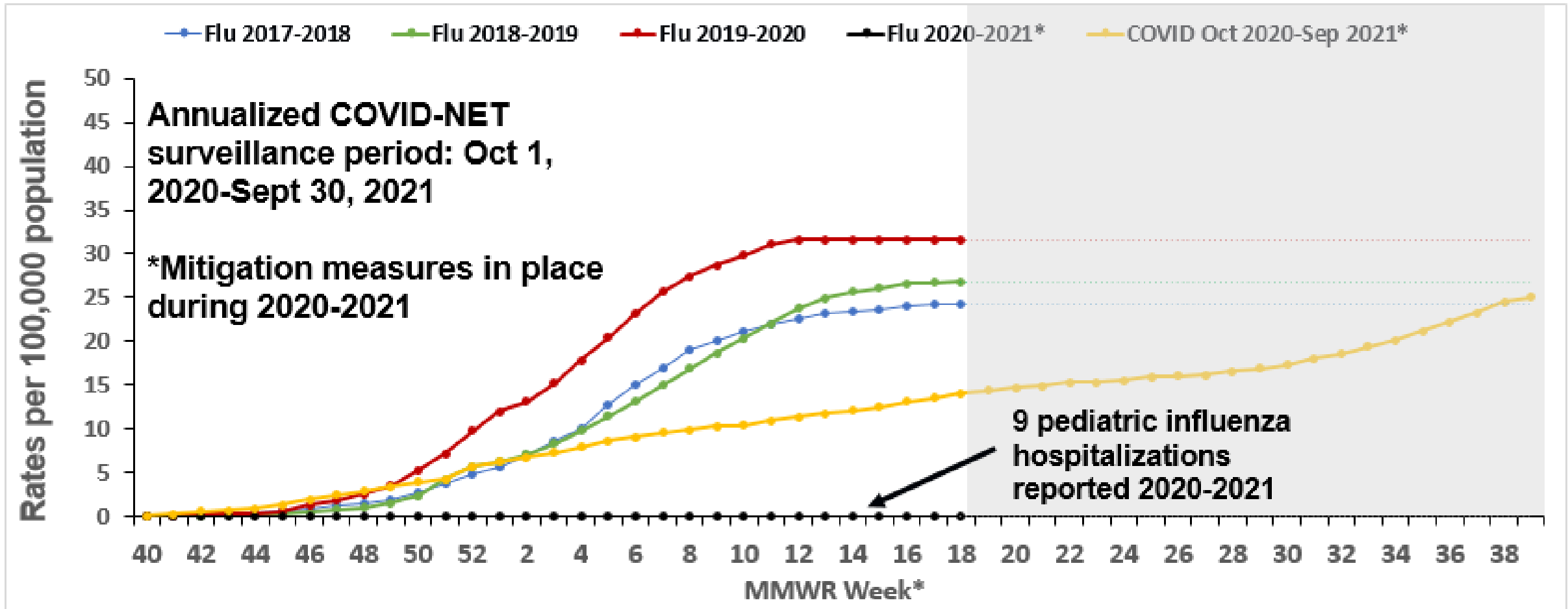
<https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html>



Cumulative COVID-19-Associated Hospitalization Rates by Race and Ethnicity among Children 5-11 Years of Age — COVID-NET, March 1, 2020–October 2, 2021



Cumulative Influenza- and COVID-19-Associated Hospitalizations, Ages 5-11



Notes: 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.

Clinical Interventions and Outcomes of Children Aged 5-11 years with COVID-19 or Influenza-Associated Hospitalizations, COVID-NET¹ and FluSurv-NET²

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

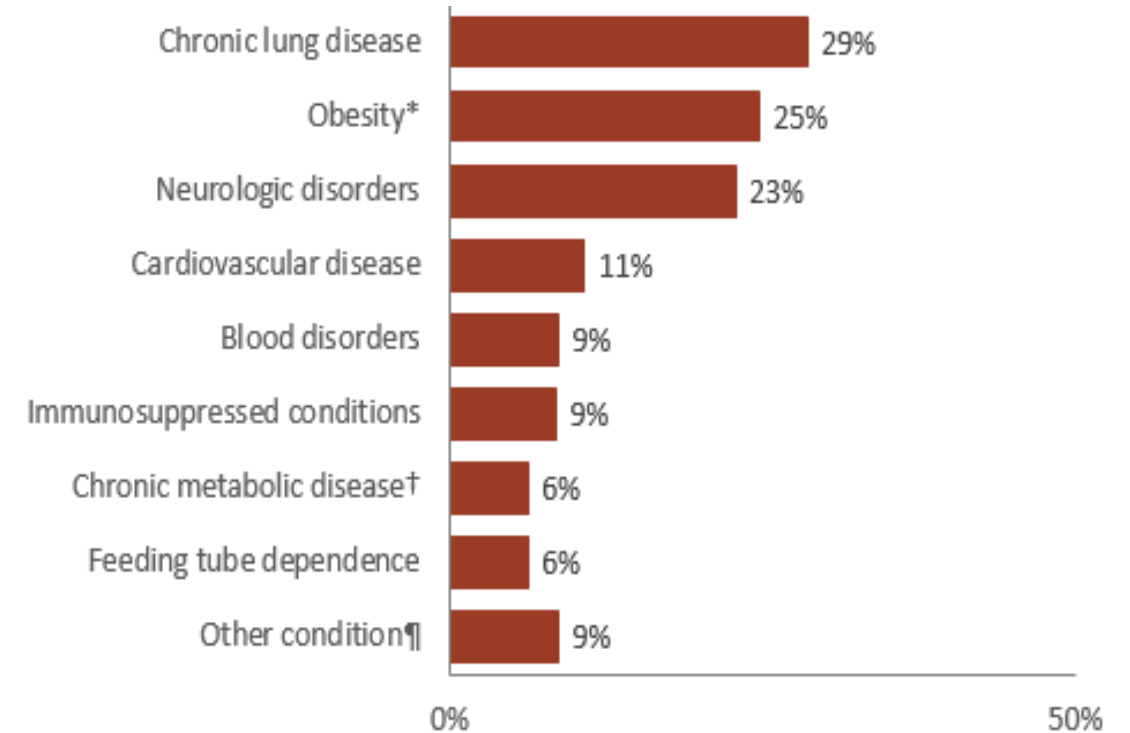


Children Aged 5–11 Years Hospitalized with COVID-19— COVID-NET, March 2020–August 2021

Demographic and clinical characteristics

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

Prevalence of underlying medical conditions



[§]Requiring intensive care unit admission or mechanical ventilation

*BMI (kg/m²) ≥95th percentile for age and sex based on CDC growth charts, ICD-10 codes for obesity, or obesity selected on case report form

†Includes type I and type II diabetes mellitus

¶Includes gastrointestinal or liver disease; renal disease; rheumatologic, autoimmune, inflammatory conditions; abnormality of the airway

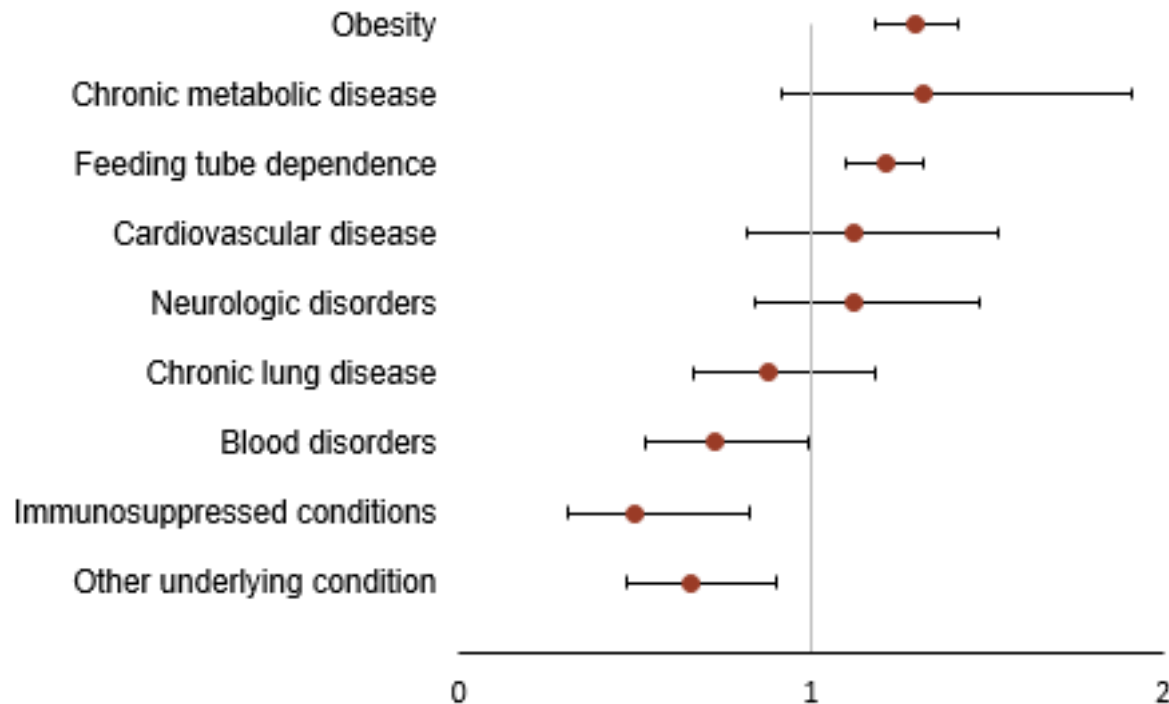
COVID-NET is a population-based surveillance system that collects data on laboratory-confirmed COVID-19-associated hospitalizations among children and adults through a network of over 250 acute-care hospitals in 14 states. Methods described in: Woodruff RC, et al. Risk factors for Severe COVID-19 in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



Underlying Conditions as Risk Factors in Hospitalized Children 5–11 Years—COVID-NET, March 2020–August 2021

Underlying medical conditions associated with severe disease:

Adjusted risk ratio and 95% confidence interval for select underlying medical conditions:



Obesity*

aRR=1.3 (95% CI: 1.2–1.4)

Feeding tube dependence

aRR=1.2 (95% CI: 1.1–1.3)

*BMI (kg/m²) ≥95th percentile for age and sex based on CDC growth charts, ICD-10 codes for obesity, or obesity selected on case report form

†Includes type I and type II diabetes mellitus

‡Includes gastrointestinal or liver disease; renal disease; rheumatologic, autoimmune, inflammatory conditions; abnormality of the airway

Methods described in: Woodruff RC, et al. Risk factors for Severe COVID-19 in Children. *Pediatrics*. ePub October 2021.



Clinical Interventions and Outcomes of Children Aged 5-11 Years with COVID-19–Associated Hospitalizations – COVID-NET, 14 states,* March 1, 2020–June 19, 2021 and June 20–August 31, 2021

Characteristics	March 1, 2020–June 19, 2021 (N = 565) [†] n (%)	June 20–August 31, 2021 (N = 131) [†] n (%)	p-value
Hospital length of stay (median, IQR)	3 (2–6)	3 (1–6)	0.66
ICU admission	182 (32.2)	40 (30.5)	0.71
Vasopressor support	79 (14.0)	12 (9.2)	0.14
Died during hospitalization	4 (0.7)		
Highest level of respiratory support required			
High flow nasal cannula [§]	42 (7.4)	8 (6.1)	0.60
BIPAP/CPAP [§]	29 (5.1)	9 (6.9)	0.43
Invasive mechanical ventilation [§]	35 (6.2)	15 (11.5)	0.04

Abbreviations: ICU = intensive care unit; IQR = interquartile range; BIPAP = bilevel positive airway pressure; CPAP = continuous positive airway pressure

*California, Colorado, Connecticut, Georgia, Iowa, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

[†]Includes those with complete clinical data on hospital length of stay, ICU admission, highest level of respiratory support (invasive mechanical ventilation, BIPAP/CPAP, or high flow nasal cannula), vasopressor support, and disposition discharge (i.e., discharged alive or died in-hospital).

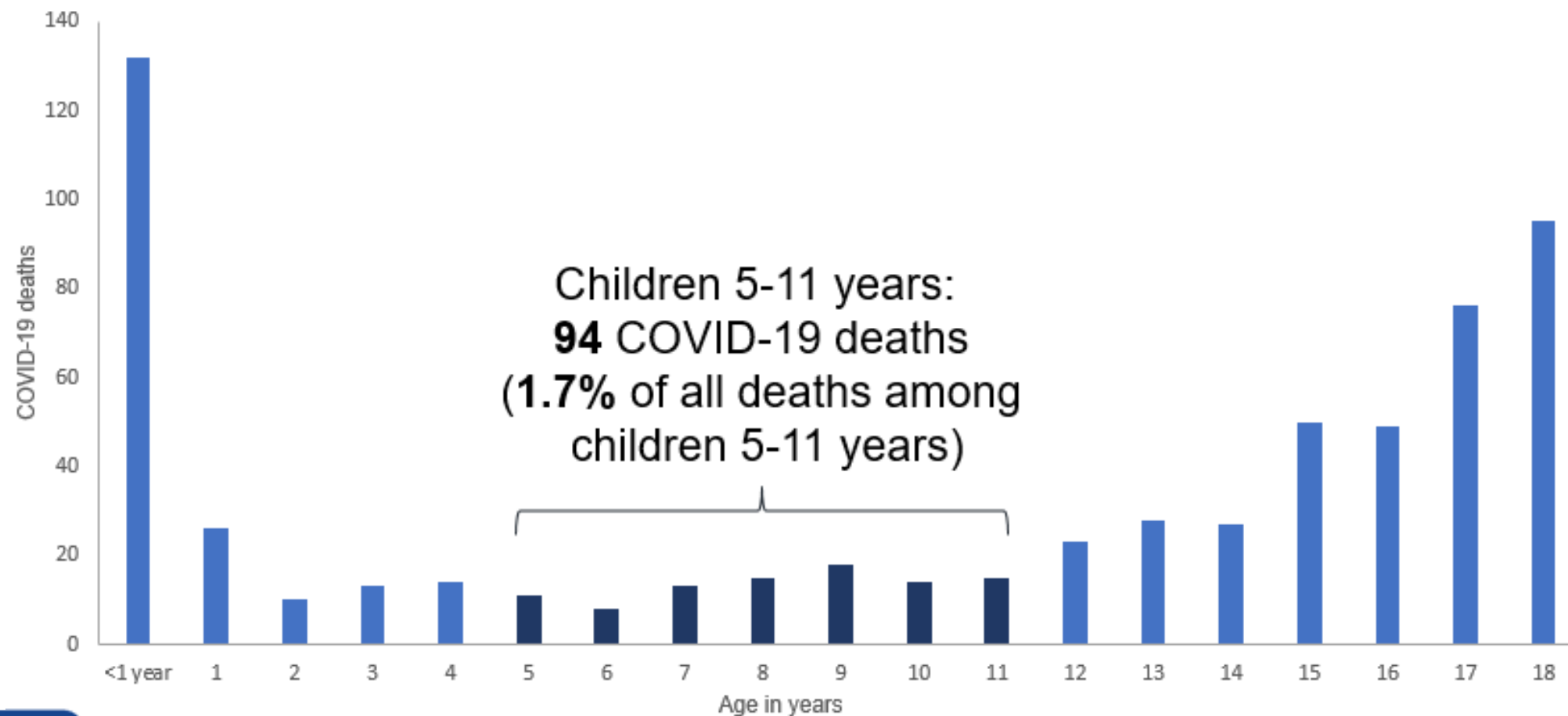
[§]Highest level of respiratory support for each patient that needed respiratory support.

Reference: Delahoy et al. Hospitalizations Associated with COVID-19 Among Children and Adolescents — COVID-NET, 14 States, March 1, 2020–August 14, 2021; MMWR. September 10, 2021 / 70(36):1255–1260.



COVID-19 Deaths by Age Group, NCHS

— January 1, 2020–October 16, 2021



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

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 manifestations and complications
 - **60-70%** of patients are admitted to intensive care, 1-2% die^{1,2}
- **5,217 MIS-C cases** have been reported to national surveillance as of October 4, 2021³
 - Median age of **9 years**, 39% of cases occurred in children 6-11 years
 - **61%** occurred in children who are Hispanic/Latino or Black, Non-Hispanic
 - Adjusted incidence estimates ~100-600 cases per million SARS-Cov-2 infections⁴

1. 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
2. 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
3. <https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance>
4. 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



Post-COVID Conditions in Children

- **Post-COVID conditions do occur in children**
 - Appears 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 diagnosis¹
 - Can appear after mild to severe infections, and after MIS-C
- **Most common symptoms:** Similar to adults and include fatigue, headache, insomnia, trouble concentrating, muscle and joint pain, and cough^{2,3}
- **Impact on quality of life:** Limitations of physical activity, feeling distressed about symptoms, mental health challenges, decreased school attendance/participation²

¹Office 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/prevalenceofongoingsymptomsfollowingcoronaviruscovid19infectionintheuk/1april2021>

²Buonsenso 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.

³Molteni 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>



Children and Transmission of SARS-CoV-2

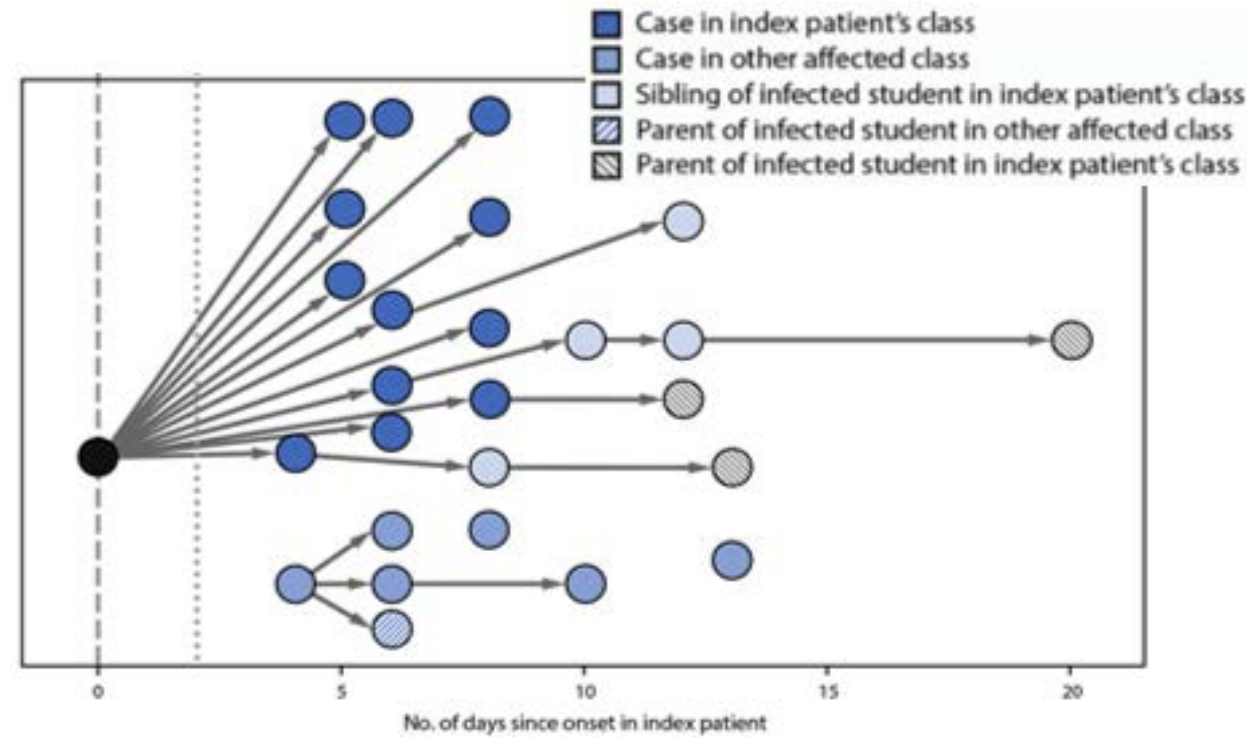
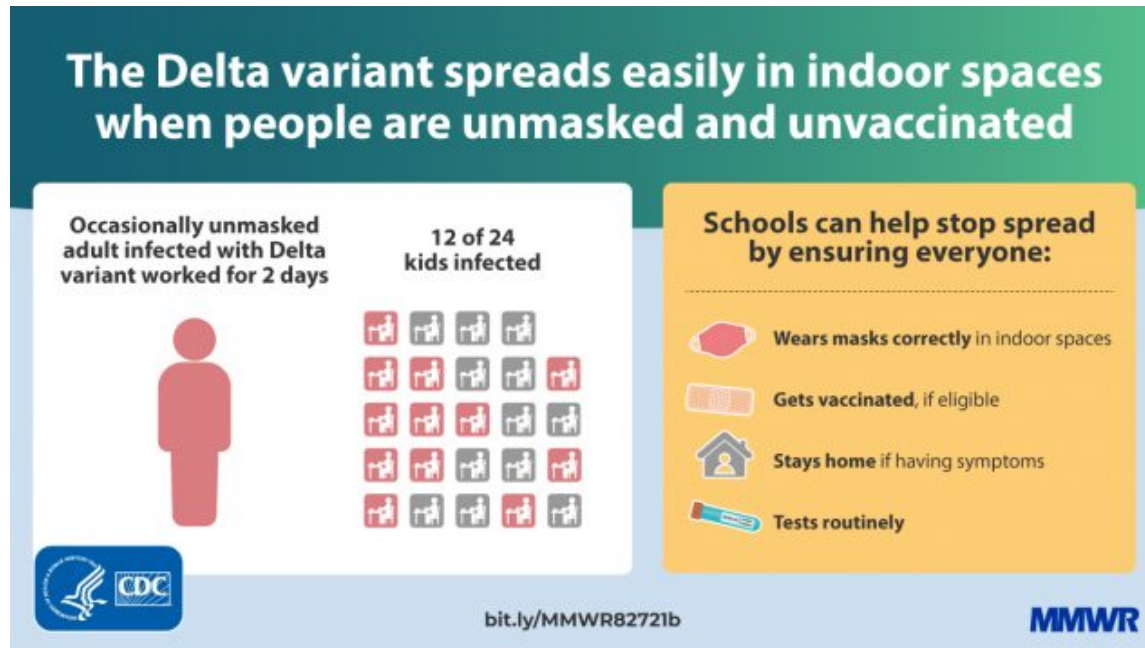
- Transmission of SARS-CoV-2 virus is influenced by presence and type of symptoms, type and timing of exposure, viral load, and variant
- Some studies observed similar infection rates between children, adolescents and adults, while others found lower infection rates among children and adolescents compared with adults^{1,2}
- Secondary transmission from children can and does occur in both household³ and school settings^{2,4,5}

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
3. Chu VT, Yousaf AR, Chang K, et al. Household Transmission of SARS-CoV-2 from Children and Adolescents. *N Engl J Med*. 2021;NEJMc2031915.
4. 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.
5. 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.



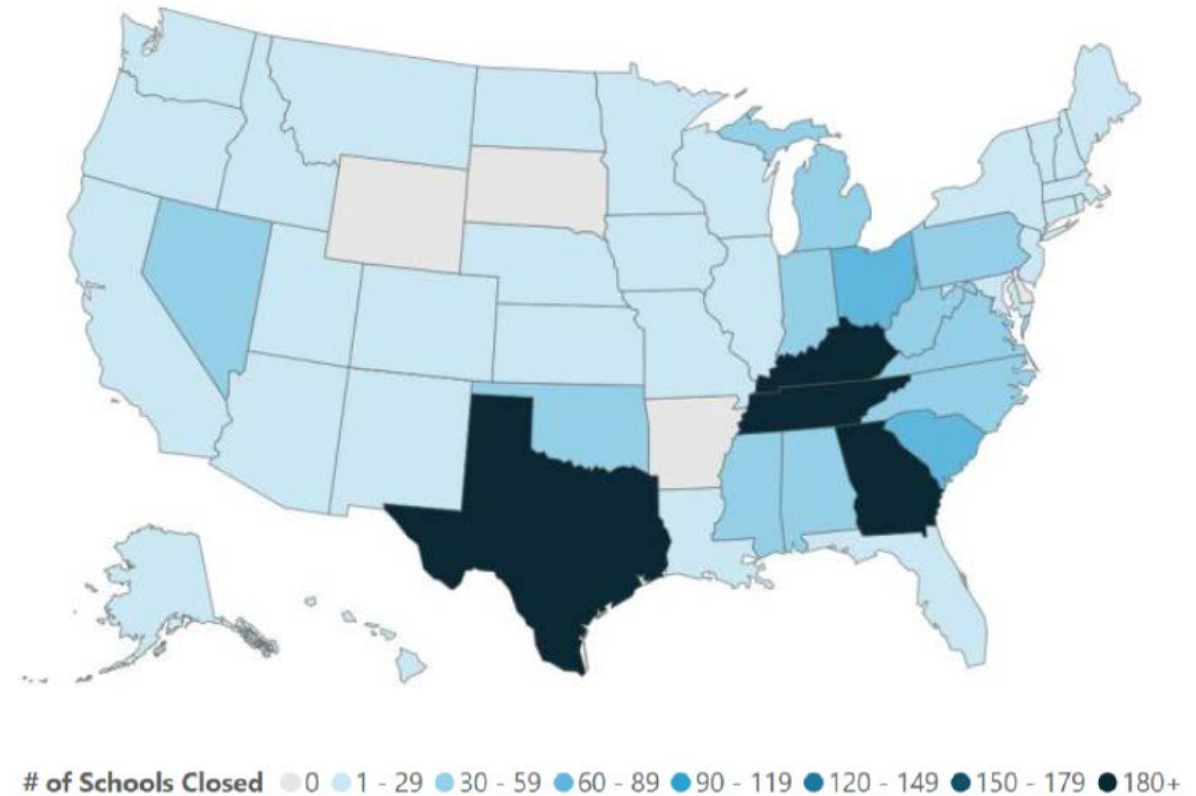
Children and Transmission of SARS-CoV-2

- Outbreak investigations have demonstrated efficient transmission among children and adults



COVID-19 Related K-12 School Closures by State, August 2, 2021 – October 8, 2021

School districts closed	Total # schools closed*	Estimated # students affected*	Estimated # teachers affected*
272	2,074	1,069,116	68,718



Data from the Unplanned School Closure Monitoring Project (DGMQ/CDC), ongoing research that uses systematic daily media searches (methods explained in <https://doi.org/10.1371/journal.pone.0248925>).

* Number of schools closed in district-wide closures, total number of students, and total number of teachers are estimated by matching the public school district ID or school ID with the district/school data for school year 2019/20 and private school ID with school data for year 2017/18 as obtained from the National Center for Education Statistics (<https://nces.ed.gov/ccd/elsi/tableGenerator.aspx>, accessed on Apr 20, 2021). Due to missing information in 2019/20 data, the total number of public school teachers in California is estimated using 2018/19 NCES data.



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

- **Children 5-11 years of age are at least as likely to be infected with SARS-CoV-2 as adults**
 - Over 1.9 million reported cases; seroprevalence estimates of >40% in May – June 2021
 - Seroprevalence data suggests that children less likely to be reported as cases than adults
- **Children 5-11 years of age are at risk of severe illness from COVID-19**
 - >8,300 hospitalizations to date
 - Hospitalization rates 3x times as high for non-Hispanic Black, non-Hispanic American Indian/Alaska Native, and Hispanic children as for non-Hispanic White children
 - Cumulative hospitalization rates similar to pre-pandemic influenza-associated hospitalization rates, despite mitigation measures
 - Severity comparable among children hospitalized with influenza and COVID-19
 - Approximately 1/3 of hospitalized children 5-11 years require ICU admission
 - MIS-C most frequent among children 5-11 years
 - Post-COVID conditions have been seen in children
- **Secondary transmission from young school age children can and does occur in both household and school settings**
- **COVID-19 in children leads to lost in-person learning and other adverse outcomes**



Acknowledgements

■ CDC

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