COVID-19 and the Pediatric Population: Risk factors for severe infection and hospitalization

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Disclosures

I have no financial disclosures or conflicts of interest related to this topic.

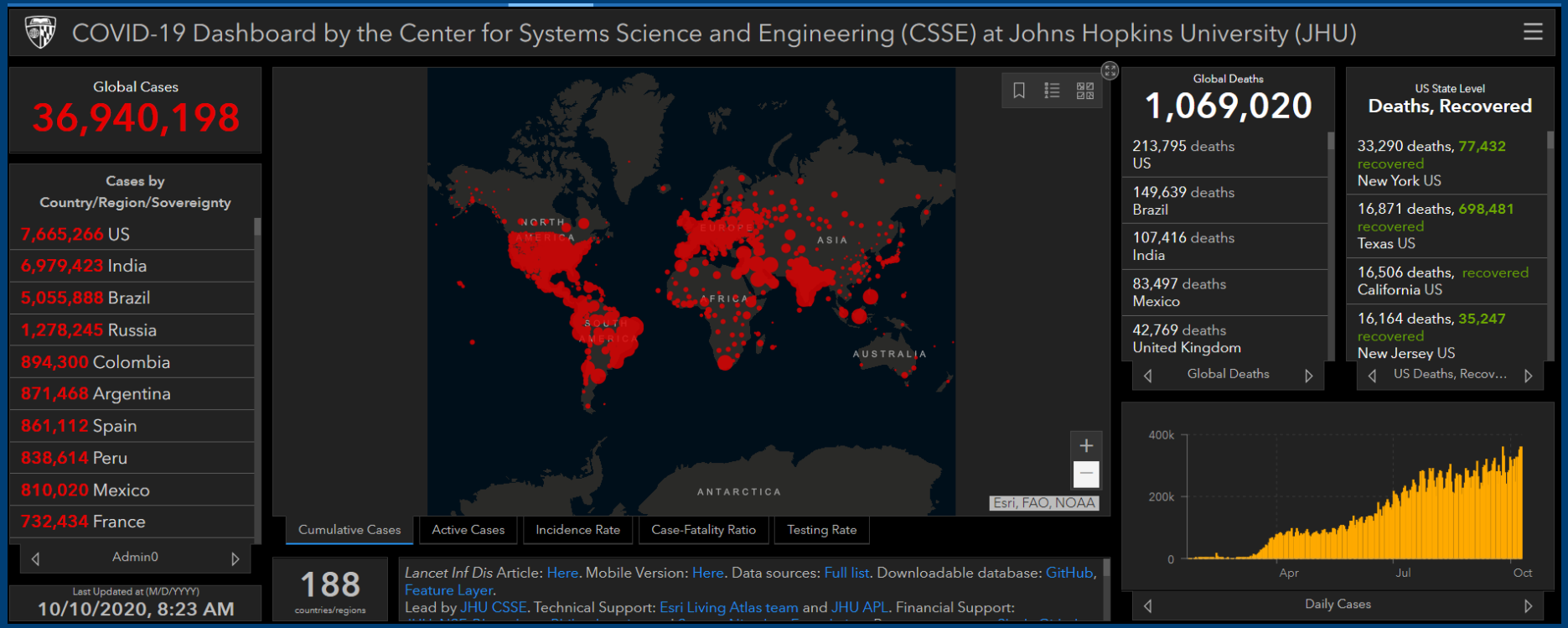
However, my implicit biases remain:

- *Father, pediatrician, and physician scientist*
- *No significant training in epidemiology nor population biostatistics*

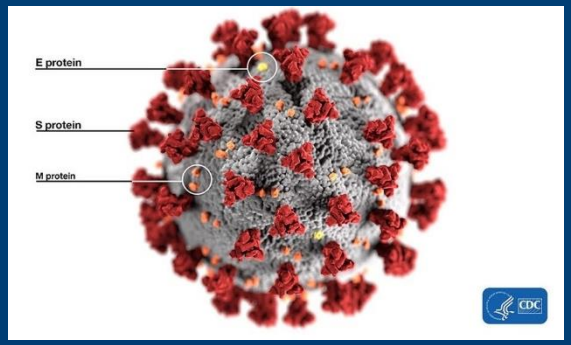
Outline

- Coronaviruses and COVID-19
- COVID-19 in the Pediatric Population
  - Prevalence
  - Transmission
- Susceptibility & Risk Factors in Pediatrics
  - Underlying conditions
  - Racial Disparities

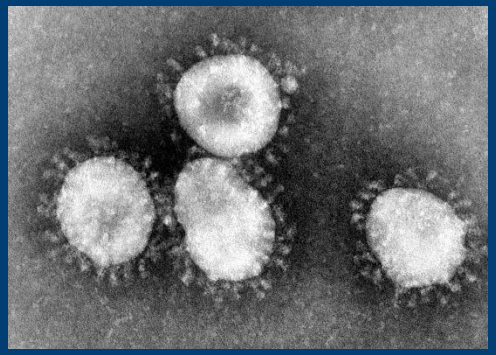
Let's Take a Moment to Pause



John Hopkins University. https://coronavirus.jhu.edu/map.html. Retrieved 10.10.2020

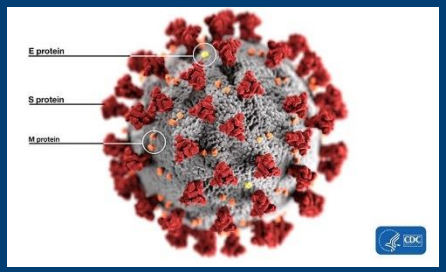


Coronavirus



- Named as spokes look like a crown
- Seven human coronaviruses
- Coronaviruses HKU1 NL63, 229, OC43
  - Most common symptoms – common cold
  - Winter and early spring
  - Outbreak every 2 to 4 years

Coronavirus 2019 (COVID-19)



- Illness: 80% mild, 15% severe, 5% critical
- Mainly adults with symptoms
- Fever, cough, sore throat, shortness of breath
- Strongest risk factor: Age (>65 years of age)
- Overall fatality rate: 2.3%; ~15% > 80 years

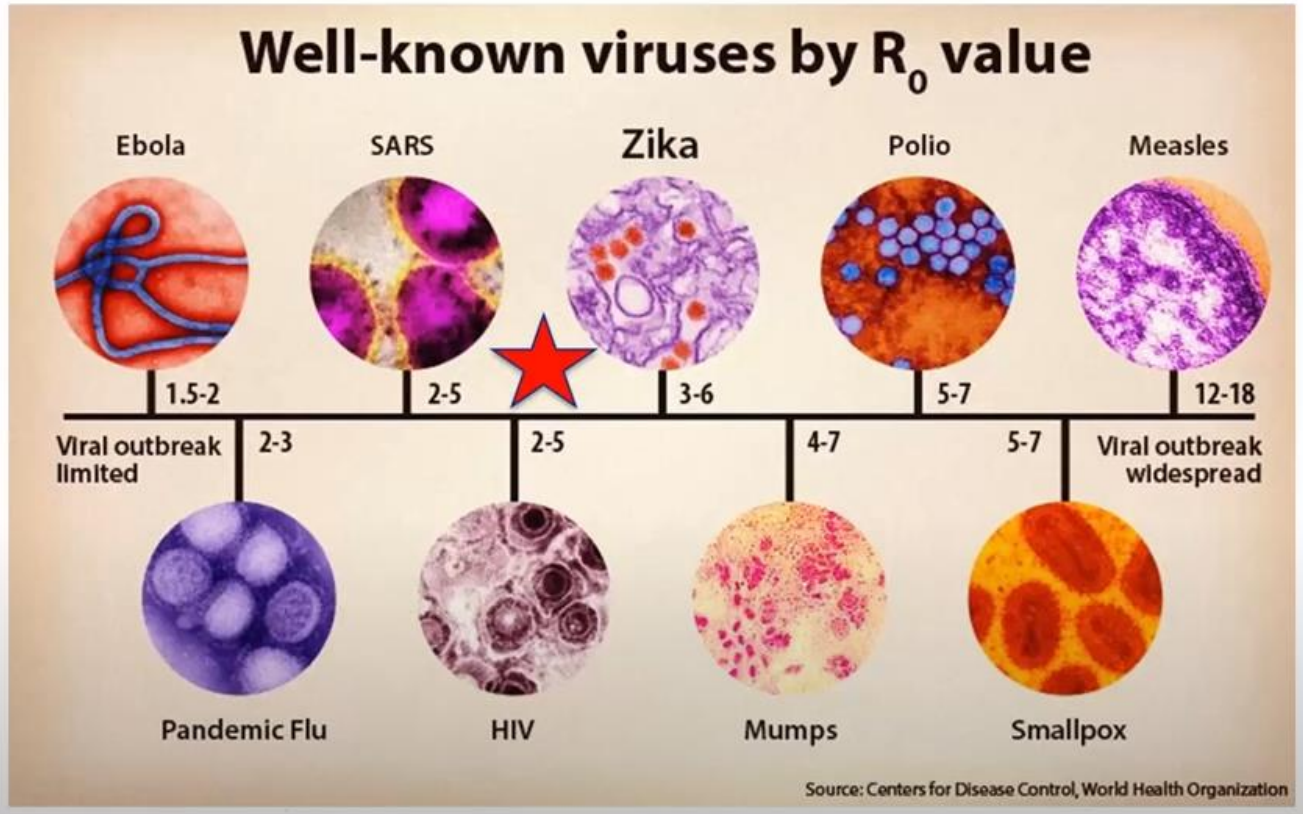
Wu Z *JAMA* Feb 2020; Dong Y *Pediatrics* 2020

COVID-19 Transmissibility

- Incubation Period
  - 2-14 days (Median: 5 days)

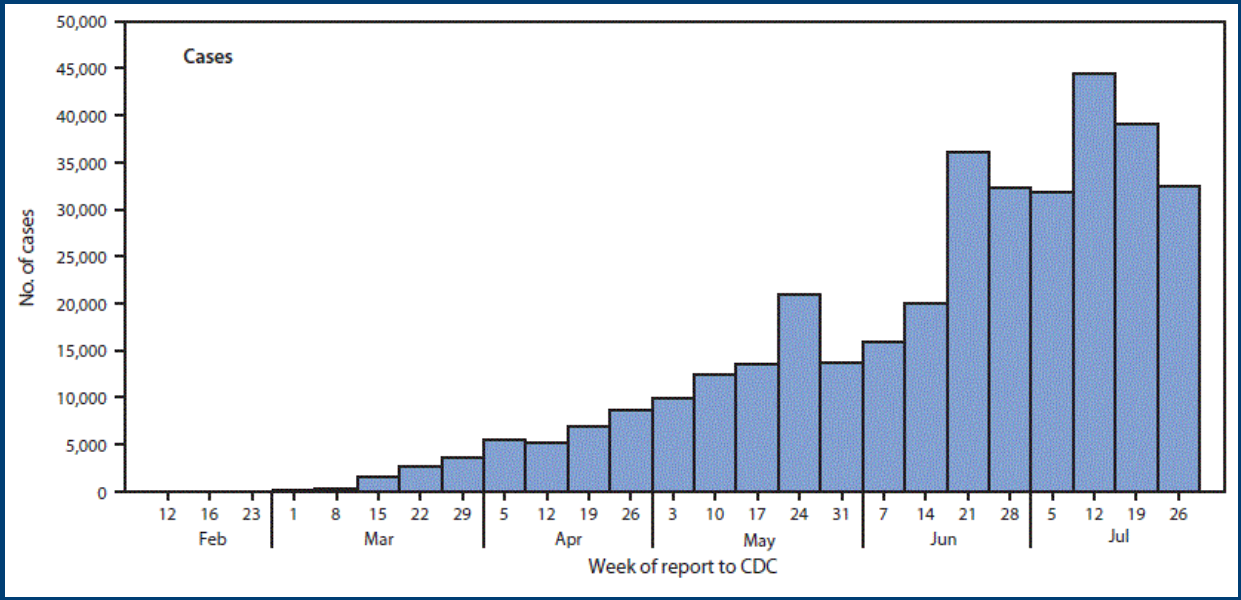
- Basic Reproductive Number (R_0)
  - R_0 = How many secondary cases are infected on average by each person who is infected

How does SAR-CoV-2 R_0 compare to other well-known viruses?



Epidemiology of COVID-19: Pediatric Population

- 1-8% of laboratory-confirmed cases
- US: 9-11%



Wu Z. *Pediatrics* 2020; Posfay-Barbe KM *Pediatrics* 2020; Docherty AB *BMJ* 2020
(US) Blythe D, CDC COVID-19 Response Team Sept 18 2020

Critical illness is rare, but is disproportionate to <1 year of age

Table 2 Different Severity of Illness by Age Group

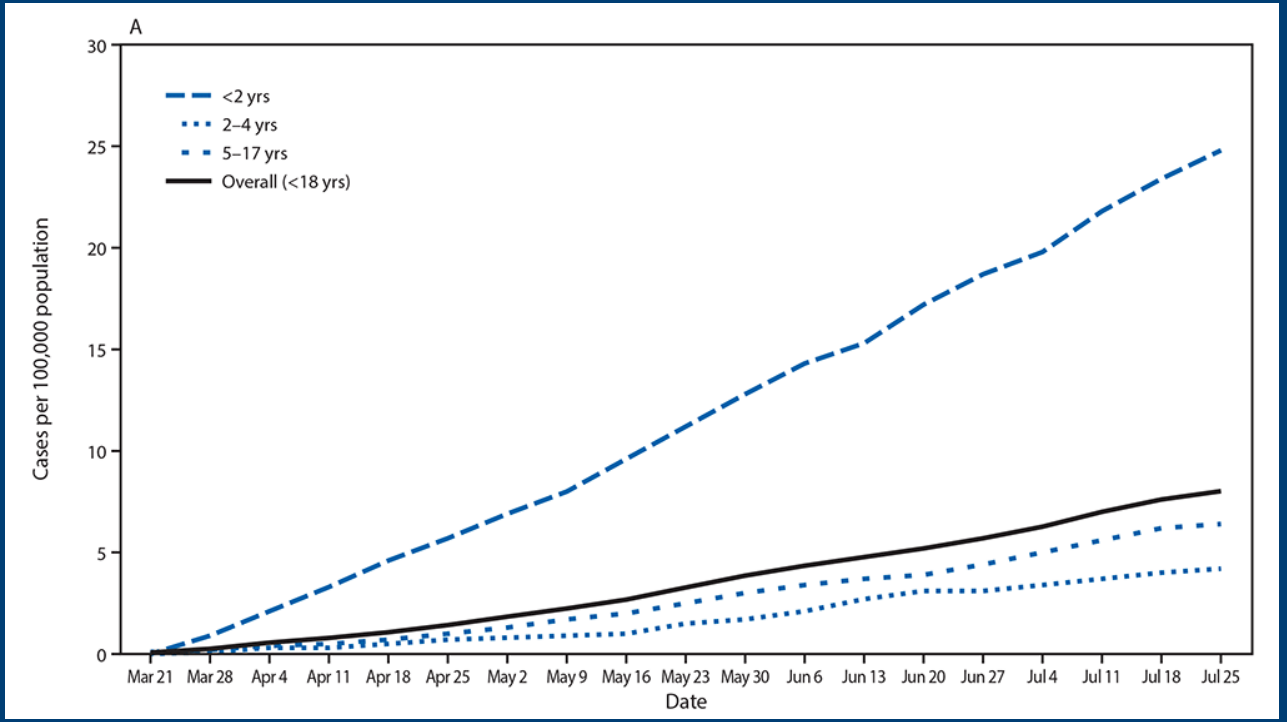
Age group*	Asymptomatic	Mild	Moderate	Severe	Critical	Total
<1	7(7.4)	205(18.8)	127(15.3)	33(29.5)	7(53.8)	379(17.7)
1-5	15(16.0)	245(22.5)	197(23.7)	34(30.4)	2(15.4)	493(23.0)
6-10	30(31.9)	278(25.5)	191(23.0)	22(19.6)	0(0)	521(24.3)
11-15	27(28.7)	199(18.2)	170(20.5)	14(12.5)	3(23.1)	413(19.3)
>15	15(16.0)	164(15.0)	146(17.5)	9(8.0)	1(7.7)	335(15.7)
Total	94	1091	831	112	13	2141(100)

Data were presented with number and percent (%);*Two cases had missing values.

Dong Y et al. *Pediatrics* 2020

US: Hospitalization remains low in pediatrics, but is increasing

- Hospitalization Rate: 8 of 100,000 infected



(US) Kim L. *MMWR* August 14 2020

Pediatric Population and COVID-19

(as of November 12th,2020)

- >1 million COVID-19 positive children
  - 49 states, DC, PR, and Guam reporting
- 11.5% of all cases by age
- 11/6-11/12: >112,000 new cases – highest yet!
- Hospitalization rate: 0.5%-6.1%
- Death rate: 0.00%-0.21%

American Academy of Pediatrics

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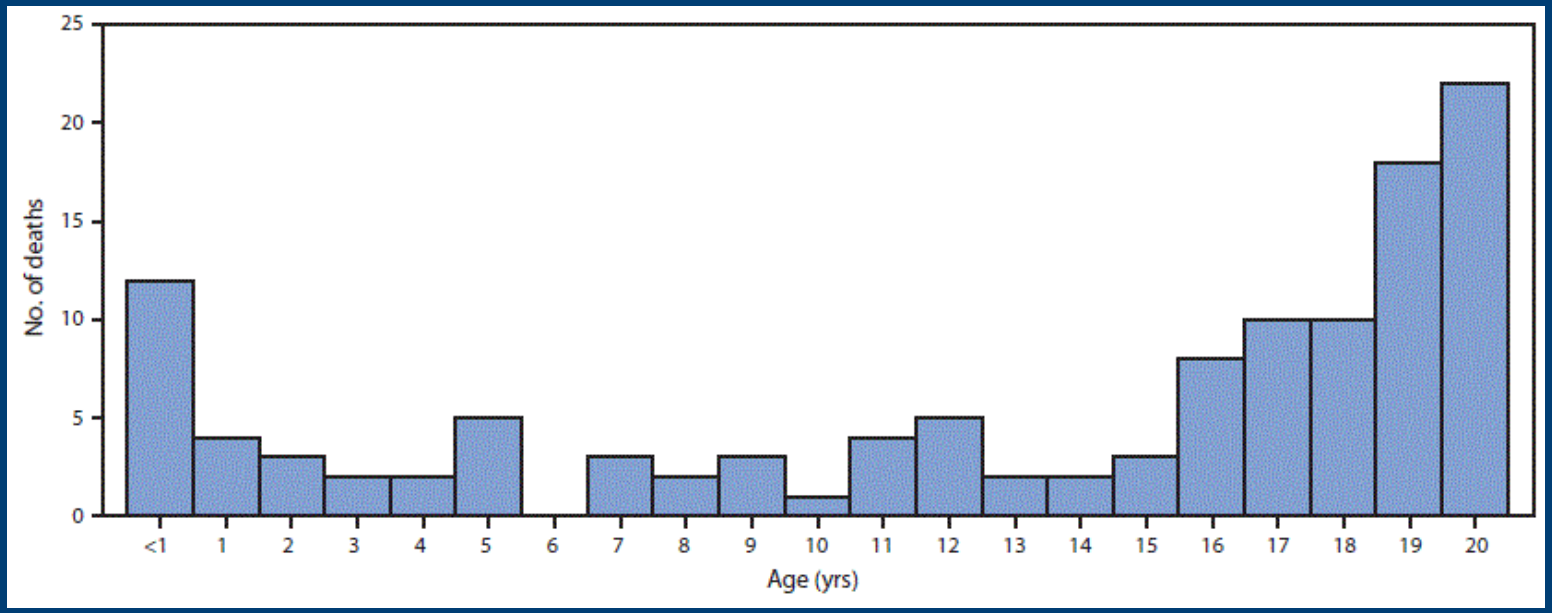
Critical Updates on COVID-19 / Children and COVID-19: State-Level Data Report

Bimodal Distribution of Death in Pediatric Patients with COVID-19

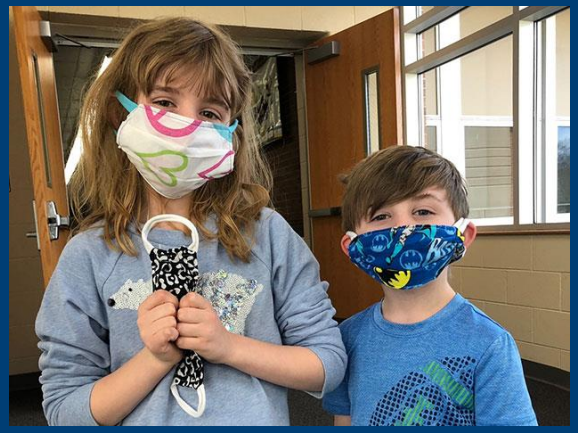
391,814 cases in the US – Feb – July 2020
121 deaths; 15 met criteria for MIS-C



(US) Blythe D, CDC COVID-19 Response Team *Sept 18 2020*

How do children acquire COVID-19?

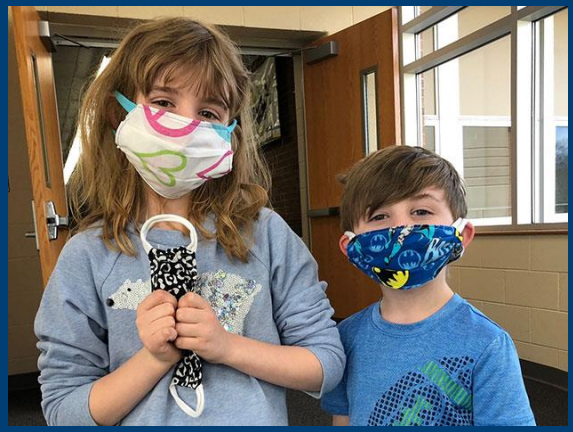
- Household exposure, usually from an adult
- Secondary: teachers and school staff



Brown NE *Emerg Infect Dis* 2020
McCartney K *Lancet Child Adol* 2020

Do children transmit to each other?

- Household transmission: limited
  - More common: adult to family
  - Adolescent>>Pre-school
- Child care settings: uncommon



However, common for adolescent and college-age students to transmit!

Which pediatric patients are at risk for hospitalization?

Hospitalization Rates and Characteristics of Children Aged <18 Years Hospitalized with Laboratory-Confirmed COVID-19 — COVID-NET, 14 States, March 1–July 25, 2020

Lindsay Kim, MD[1,2]; Michael Whitaker, MPH[1,3]; Alissa O'Halloran, MSPH[1]; Anita Kambhampati, MPH[1,4]; Shua J. Chai, MD[1,5]; Arthur Reingold, MD[5,6]; Isaac Armistead, MD[7]; Breanna Kawasaki, MPH[8]; James Meek, MPH[9]; Kimberly Yousey-Hindes, MPH[9]; Evan J. Anderson, MD[10,11]; Kyle P. Openo, DrPH[11]; Andy Weigel, MSW[12]; Patricia Ryan, MSc[13]; Maya L. Monroe, MPH[13]; Kimberly Fox, MPH[14]; Sue Kim, MPH[14]; Ruth Lynfield, MD[15]; Erica Bye, MPH[15]; Sarah Shrum Davis, MPH[16]; Chad Smelser, MD[17]; Grant Barney, MPH[18]; Nancy L. Spina, MPH[18]; Nancy M. Bennett, MD[19]; Christina B. Felsen, MPH[19]; Laurie M. Billing, MPH[20]; Jessica Shiltz, MPH[20]; Melissa Sutton, MD[21]; Nicole West, MPH[21]; H. Keipp Talbot, MD[22]; William Schaffner, MD[22]; Ilene Risk, MPA[23]; Andrea Price[23]; Lynnette Brammer, MPH[1]; Alicia M. Fry, MD[1,2]; Aron J. Hall, DVM[1]; Gayle E. Langley, MD[1]; Shikha Garg, MD[1,2]; COVID-NET Surveillance Team

Who are at risk for severe illness in pediatrics?

Confirmed List

- Underlying medical condition (≥1)
  - Obesity
  - Prematurity
  - Chronic lung disease

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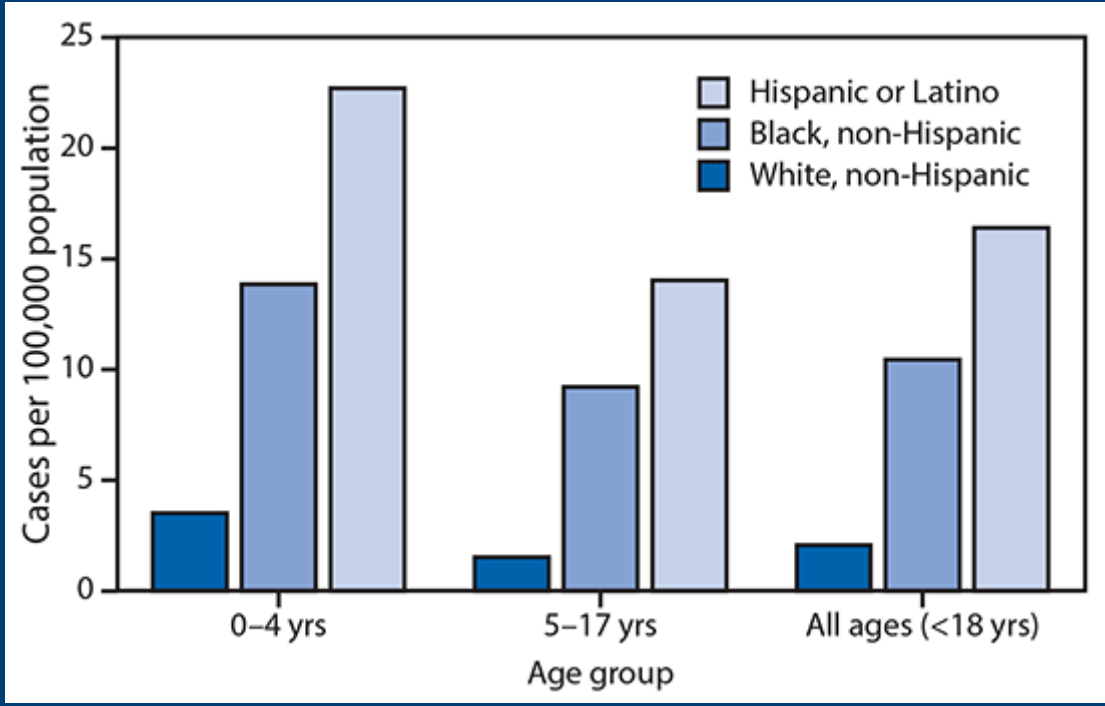
Significant Racial Disparities: Higher prevalence of severe disease in the Hispanic and Black populations



(US) Kim L. *MMWR* August 14 2020

Why is COVID-19 less common and less severe in children than adults?

- Remains unclear
- Proposed mechanisms:
  - Less intense immune response?
  - Viral interference in the respiratory tract?
  - Lower viral load?
  - Different expression of ACE2 with age?
  - Healthier blood vessels?

COVID-19
Resources and References

- CDC: COVID-19 Information for healthcare professionals
- World Health Organization: Coronavirus
- AAP home page: AAP COVID-19
- HealthyChildren.org: 2019 Novel Coronavirus (COVID-19)

- Brown NE *Emerg Infect Dis* 2020
- McCartney K *Lancet Child Adol* 2020
- Kim L. *MMWR* August 14 2020
- Blythe D, CDC COVID-19 Response Team Sept 18 2020
- Dong Y et al. *Pediatrics* 2020
- Wu Z. *Pediatrics* 2020;
- Posfay-Barbe KM *Pediatrics* 2020; Docherty AB *BMJ* 2020

Multisystemic Inflammatory Syndrome in Childhood (MIS-C)

- Mean age: 10-11 years
- GI, Nephrology, Musculoskeletal
- Increased NT-pro-BNP, troponin (muscle)
- + prior (2-4 weeks) SAR-CoV2 infection
- > in Non-Hispanic Black