COVID-19 Update
September 16

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Incidence of Nosocomial COVID-19 in Patients Hospitalized at a Large US Academic Medical Center

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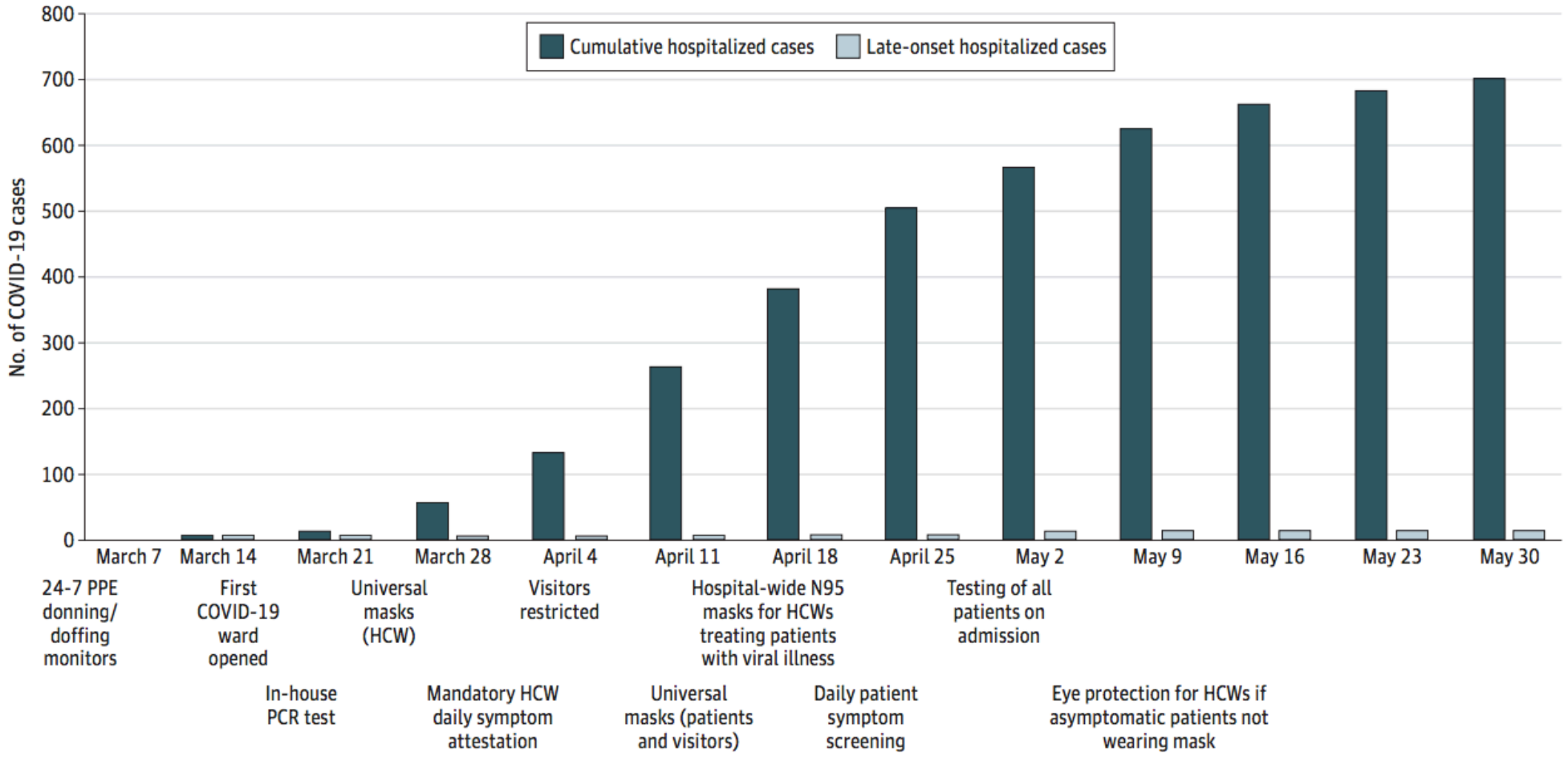
- **The problem**
  - Patients are avoiding essential care for fear of contracting COVID-19 in hospitals.
  - There are few data on this subject in US hospitals.
- **Objective**
  - To assess the incidence of COVID-19 among patients hospitalized at a large US academic medical center in the 12 weeks after the first inpatient case was identified.
- **Exposures**
  - The infection control program included
  - Dedicated COVID-19 units with airborne infection isolation rooms
  - PPE in accordance with CDC standards
  - PPE donning and doffing monitors, universal masking, restriction of visitors
  - Liberal RT-PCR testing of symptomatic and asymptomatic patients.

Figure. Cumulative Number of Total and Late-Onset Hospitalized Coronavirus Disease 2019 (COVID-19) Cases by Week and Associated With Infection Control Policies



Late-onset hospitalized COVID-19 cases were defined as patients who first tested positive for severe acute respiratory syndrome coronavirus 2 by reverse-transcription polymerase chain reaction (PCR) on hospital day 3 or later. Table 2 gives a detailed description of the major infection control policies and interventions. HCW indicates health care worker; PPE, personal protective equipment.

Incidence of Nosocomial COVID-19 in Patients Hospitalized at a Large US Academic Medical Center

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- **During a 12-week period 9149 patients were hospitalized**
  - Mean age, 46.1 (SD 26.4) years; 57.3 % female
  - **7394** SARS-CoV-2 RT-PCR tests were performed

- **697 COVID-19 cases were confirmed**(8656 days of COVID-19–related care)
  - 12 **(1.7%)** of them tested positive on day 3 or later (median, 4 days; range, 3-15 days)
  - **Only 1 case** was deemed to be hospital acquired
    - Most likely from a pre-symptomatic spouse who was visiting daily and diagnosed with COVID-19 before visitor restrictions and masking were implemented

- **8370 patients with non–COVID-19–related hospitalizations**
  - 11 (0.1%) tested positive within 14 days of discharge (median time to diagnosis, 6 days (Range 1-14 days)
  - **Only 1 case** was deemed likely to be hospital acquired, with no known exposures.

Incidence of Nosocomial COVID-19 in Patients Hospitalized at a Large US Academic Medical Center: Conclusions

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These findings suggest that **robust and rigorous infection control practices** may be associated with minimized risk of nosocomial spread of COVID-19 to hospitalized patients. These results, especially if replicated at other US hospitals, should provide reassurance to patients as some health care systems reopen services and others continue to face COVID-19 surges.

Association of Vitamin D Status and Other Clinical Characteristics With COVID-19 Test Results

- **We do know that**
  - Vitamin D treatment has been found to decrease the incidence of viral respiratory tract infection, especially in patients with vitamin D deficiency.
- **We don’t know if**
  - Vitamin D is associated with COVID-19 incidence

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Association of Vitamin D Status and Other Clinical Characteristics With COVID-19 Test Results

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- **OBJECTIVE**
  - To examine whether the last vitamin D status before COVID-19 testing is associated with COVID-19
- **DESIGN**
  - Retrospective cohort study at an urban academic medical center
  - Patients with 25-Hydroxy and 1,25-dihydroxy Vit D measured within 1 year before being tested for COVID-19
- **EXPOSURES**
  - Baseline/ treatment changes of Vit. D were used to categorize the Vit. D status before COVID-19 testing:
    - Likely deficient (last level deficient and treatment not increased)
    - Likely sufficient (last level not deficient and treatment not decreased)
    - Uncertain deficiency (last level deficient and treatment increased, or last level not deficient and treatment decreased).
- **MAIN OUTCOMES AND MEASURES**
  - The outcome was a positive COVID-19 polymerase chain reaction test result

Vitamin D deficiency was defined by the last measurement of 25-hydroxycholecalciferol less than 20 ng/mL or 1,25-dihydroxycholecalciferol less than 18 pg/mL before COVID-19 testing.

Association of Vitamin D Status and Other Clinical Characteristics With COVID-19 Test Results.

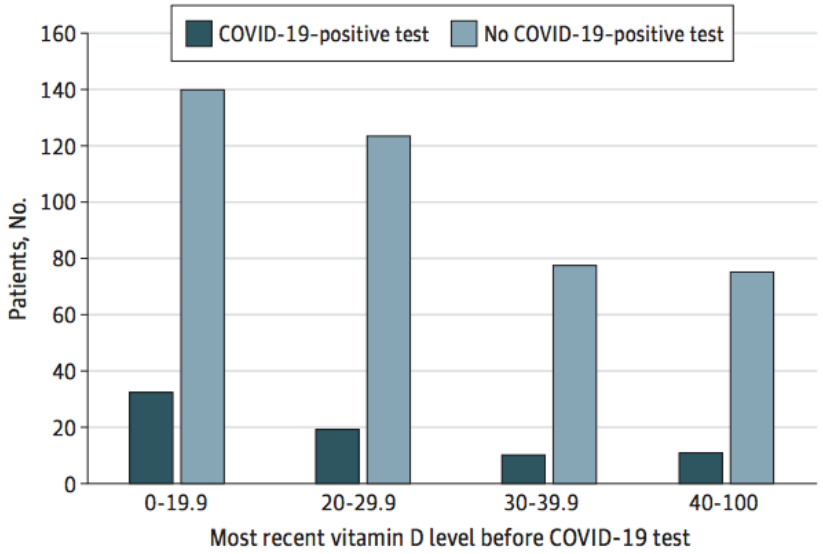
JAMA Network Open. 2020;3(9):e2019722. doi:10.1001/jamanetworkopen.2020.19722

- **A total of 489 patients met inclusion criteria**
- Mean age, 49.2 (SD 18.4) years; 75% women; and 68% race other than White)

- Vitamin D status was categorized as:
  - likely deficient 124 **(25%)**, likely sufficient 287 **(59%)**, Uncertain 78 **(16%)**

- A total 71 participants (15%) tested positive for COVID-19 and was associated with
  - Increasing age up to age 50 years (relative risk, 1.06; 95% CI, 1.01-1.09; P = .02)
  - Non-White race (relative risk, 2.54; 95% CI, 1.26-5.12; P = .009)
  - **Likely deficient vitamin D status** (relative risk, 1.77; 95% CI, 1.12-2.81; P = .02) compared with likely sufficient vitamin D status.

Figure. Most Recent Vitamin D Levels Before COVID-19 Test



Association of Vitamin D Status and Other Clinical Characteristics With COVID-19 Test Results
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- Predicted COVID-19 rates in the deficient group were 21.6% (95% CI, 14.0%-29.2%) vs 12.2% (95% CI, 8.9%-15.4%) in the sufficient group

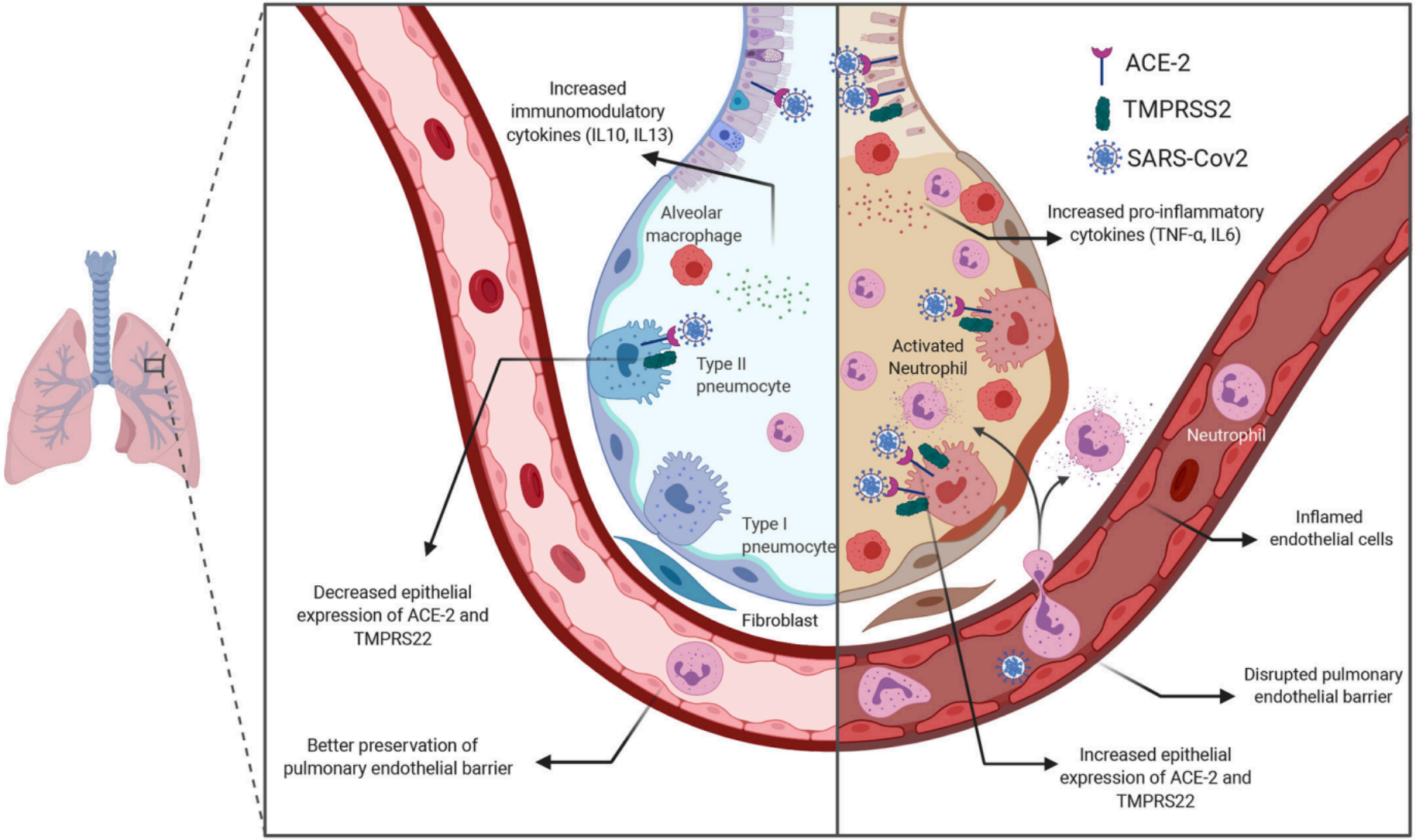

Fig. 2. Mechanisms mediating differential susceptibility of adults and children to COVID-19. Increased expression of mediators essential for viral entry into airway epithelial cells (ACE-2 and TMPRSS2) in adults combined with the proinflammatory milieu in adults may predispose the adult lung to serious pulmonary injury and progression to acute respiratory distress syndrome (ARDS). The pediatric lung has greater expression of immunomodulatory cytokines and possibly a decreased expression of viral entry mediators.

Racial/Ethnic Variation in Nasal Gene Expression of Transmembrane Serine Protease 2 (TMPRSS2)

JAMA Published online September 10, 2020

- **What do we Know about COVID-19**
  - It has disproportionately affected communities of color in the US
  - Infection and death rates in the Unite States are 2 to 3 times higher in Black individuals than their proportion of the population
  - SARS-CoV-2 is spread by airway and uses transmembrane serine protease 2 (TMPRSS2) to facilitate viral entry
  - Host-expressed TMPRSS2 on nasal and bronchial epithelium activates the SARS-CoV-2 spike protein and cleaves the angiotensin-converting enzyme 2 receptor to which the virus binds, enabling SARS-CoV-2 to enter the body
  - Racial/ethnic differences in TMPRSS2 gene–related activity in prostate tissue have been associated with higher incidence of prostate cancer in Blackmen vs White men

Racial/Ethnic Variation in Nasal Gene Expression of Transmembrane Serine Protease 2 (TMPRSS2)

JAMA Published online September 10, 2020

- **What was investigated in this study**
  - The TMPRSS2 nasal gene expression in a racially/ethnically diverse cohort

- **Methods**
  - Cross-sectional study used nasal epithelium collected during 2015-2018 from individuals within the Mount Sinai Health System
  - Healthy individuals and individuals with asthma aged 4 to 60 years underwent nasal brushing for research on asthma biomarkers.
  - RNA isolation of brushings were performed to quantify TRMPRSS2 expression

Racial/Ethnic Variation in Nasal Gene Expression of Transmembrane Serine Protease 2 (TMPRSS

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Table. β Coefficients for Race/Ethnicity From Linear Regression Modeling[a]

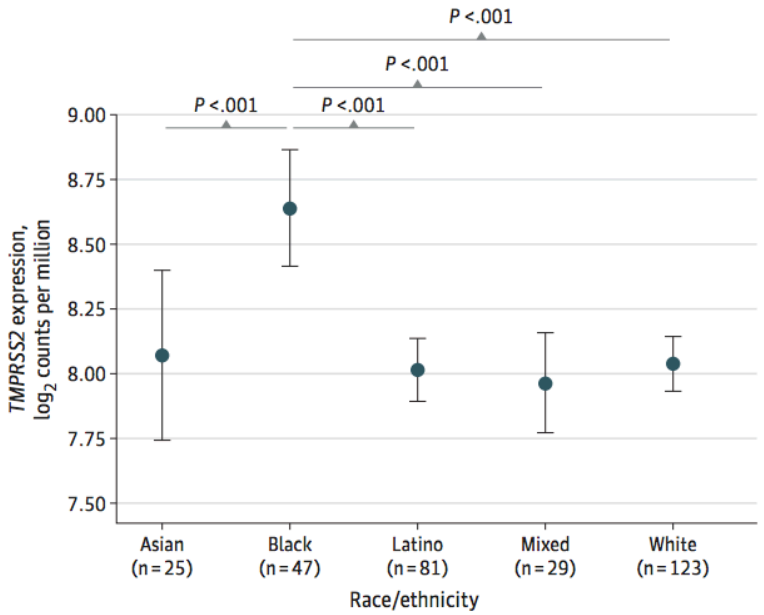
Race/ethnicity	Unadjusted β coefficient (95% CI)[b]	*P* value	Adjusted β coefficient (95% CI)[b,c]	*P* value
Black	[Reference]		[Reference]	
Asian	−0.57 (−0.87 to −0.27)	<.001	−0.63 (−0.94 to −0.32)	<.001
Latino	−0.62 (−0.85 to −0.40)	<.001	−0.64 (−0.86 to −0.42)	<.001
Mixed race	−0.67 (−0.96 to −0.39)	<.001	−0.66 (−0.95 to −0.37)	<.001
White	−0.60 (−0.81 to −0.39)	<.001	−0.60 (−0.81 to −0.39)	<.001

[a] *TMPRSS2* expression was the dependent variable and self-identified race/ethnicity was the independent variable.

[b] β coefficients indicate the difference in *TMPRSS2* expression in $\log_2$ counts per million between a given race/ethnicity and Black individuals.

[c] Adjusted for age, sex, and asthma.

Figure. Nasal Gene Expression of *TMPRSS2* in Self-Identified Racial/Ethnic Groups



The data points indicate means and the error bars indicate 95% CIs for transmembrane serine protease 2 (*TMPRSS2*) gene expression in self-identified racial/ethnic groups. The *P* values were calculated using linear regression modeling in which *TMPRSS2* gene expression was the dependent variable and race/ethnicity was the independent variable.

Racial/Ethnic Variation in Nasal Gene Expression of Transmembrane Serine Protease 2 (TMPRSS2)

JAMA Published online September 10, 2020

- **Results**
  - The cohort (n = 305)was 8.2% Asian individuals, 15.4% Black individuals, 26.6% Latino individuals, 9.5% individuals of mixed race/ethnicity, and 40.3% White individuals.
  - Of the participants, 48.9% were male and 49.8% had asthma.
  - Among the racial/ethnic groups, **nasal gene expression of TMPRSS2 expression was significantly higher in Black individuals** compared with Asian, Latino, mixed race/ethnicity, and White individuals (all $P < .001$)
  - There were no significant associations between TMPRSS2 expression and sex, age, or asthma.
- **Conclusion:**
  - Given the essential role of TMPRSS2 in SARS-CoV-2 entry,3 higher nasal expression of TMPRSS2 may contribute to the higher burden of COVID-19 among Black individuals.
  - TMPRSS2 inhibitors such as camostat mesylate3 are undergoing clinical trials to test their utility for COVID-19 treatment.

SARS-CoV-2–Associated Deaths Among Persons Aged <21 Years United States, February 12–July 31, 2020

MMWR Morb Mortal Wkly Rep. ePub: 15 September 2020.

- **What do we know**
  - Since February 12, 2020 approximately:
    - 6.5 million cases of SARS-CoV-2 infection have been reported in the US
    - 190,000 SARS-CoV-2–associated deaths have been reported in the US
  - Symptoms associated are milder in children compared with adults
  - Persons aged < 21 comprise 26% of the US population

- **What does this report describe?**
  - Characteristics of U.S. persons aged < 21 who died in association with SARS-CoV-2 infection, as reported by public health jurisdictions.
  - Forty seven out of fifty-five health jurisdictions responded
  - 20 reported no deaths and 27 identified 121 deaths

Jurisdictions reporting no deaths included Alaska, Delaware, District of Columbia, Guam, Hawaii, Idaho, Kentucky, Massachusetts, Missouri, Montana, New Mexico, Oregon, South Dakota, Vermont, Virginia, U.S. Virgin Islands, Washington, West Virginia, Wisconsin, and Wyoming.
Jurisdictions reporting one or more deaths included: Alabama, Arizona, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Kansas, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Nevada, New Jersey, New York City, New York State, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Utah.

Demographics and Clinical Characteristics of the 121 Reported Deaths

MMWR Morb Mortal Wkly Rep. ePub: 15 September 2020.

Demographics

- The majority (63%) were males
- Age distribution of the
  - 70% were in those aged 10 through 20 years
  - 20% were in children aged 1 through 9
  - 10% occurred in those under 1 year.
- Race/Ethnicity
  - Hispanic persons 45%
  - Non-Hispanic Black (Black) persons 29%
  - American Indian or Alaska Native (AI/AN) 4%.

Clinical Characteristics

- Three quarters of SARS-CoV-2-related occurred among those with underlying health conditions
- Most common underlying conditions were:
  - Chronic lung disease (mostly asthma)
  - Obesity, neurologic/developmental conditions, and cardiovascular conditions.
- Deaths occurred
  - In the hospital ~65
  - Emergency Department 19%
  - Home 13%

SARS-CoV-2–Associated Deaths Among Persons Aged <21 Years United States, February 12–July 31, 2020

MMWR Morb Mortal Wkly Rep. ePub: 15 September 2020.

FIGURE 1. SARS-CoV-2–associated cases,*,† by week of case report to CDC, and deaths,§,¶ by week of death, among persons aged <21 years — United States, February 12–July 31, 2020**

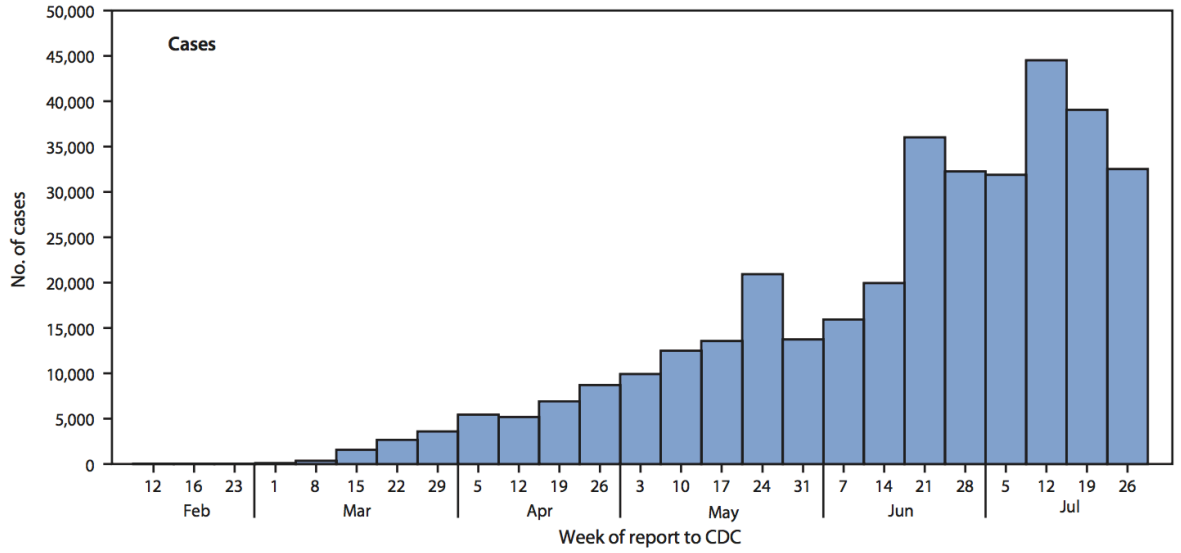
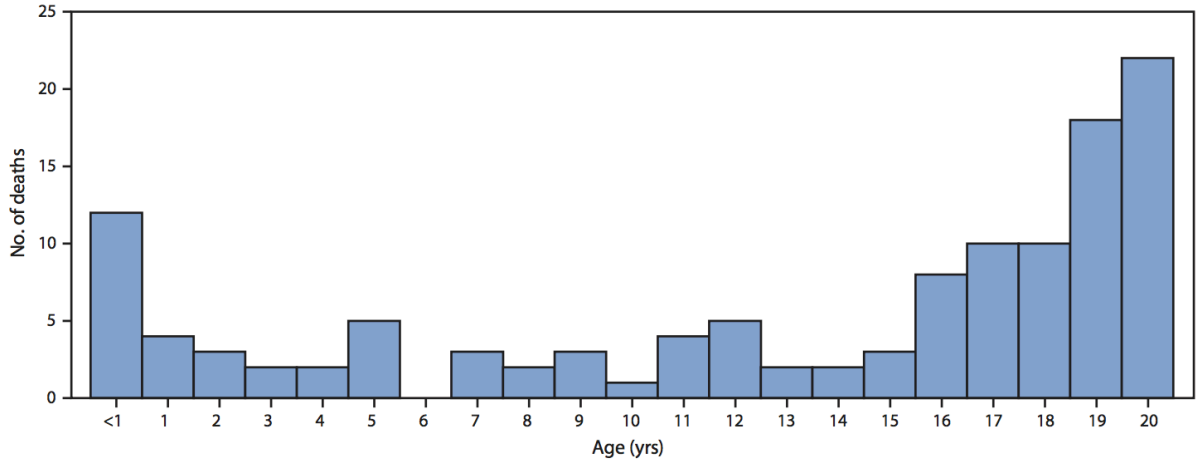


FIGURE 2. Age at death among persons aged <21 years with SARS-CoV-2–associated deaths*,† — United States, February 12–July 31, 2020§



* https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/.
† https://www.cdc.gov/mis-c/hcp/.
§ Includes 121 total decedents, 120 persons who met the case definition for coronavirus disease 2019, 15 who met the case definition for multisystem inflammatory syndrome in children, and 14 persons who met both case definitions.

SARS-CoV-2–Associated Deaths Among Persons Aged <21 Years United States, February 12–July 31, 2020

MMWR Morb Mortal Wkly Rep. ePub: 15 September 2020

- Adolescents and young adults, Hispanic, Black, and AI/AN persons, and persons with underlying medical conditions are disproportionately represented among deaths associated with SARS-CoV-2

- Infants, children, adolescents, and young adults, particularly those from racial and ethnic minority groups at higher risk, those with underlying medical conditions, and their caregivers, need clear, consistent, and developmentally, linguistically, and culturally appropriate COVID-19 prevention messages
  - (e.g., related to mask wearing, physical distancing, hand hygiene).

- To ensure accurate surveillance, it is important that health care providers and health departments assure follow-up for infants, children, adolescents, and young adults infected with or exposed to SARS-CoV-2

SARS-CoV-2–Associated Deaths Among Persons Aged <21 Years United States, February 12–July 31, 2020

MMWR Morb Mortal Wkly Rep. ePub: 15 September 2020

- Health departments, in collaboration with school districts and the communities they serve, can evaluate and improve health promotion, health access, and health equity for all infants, children, adolescents, and young adults. Ultimately, they can mobilize to remove systemic barriers that contribute to health disparities.

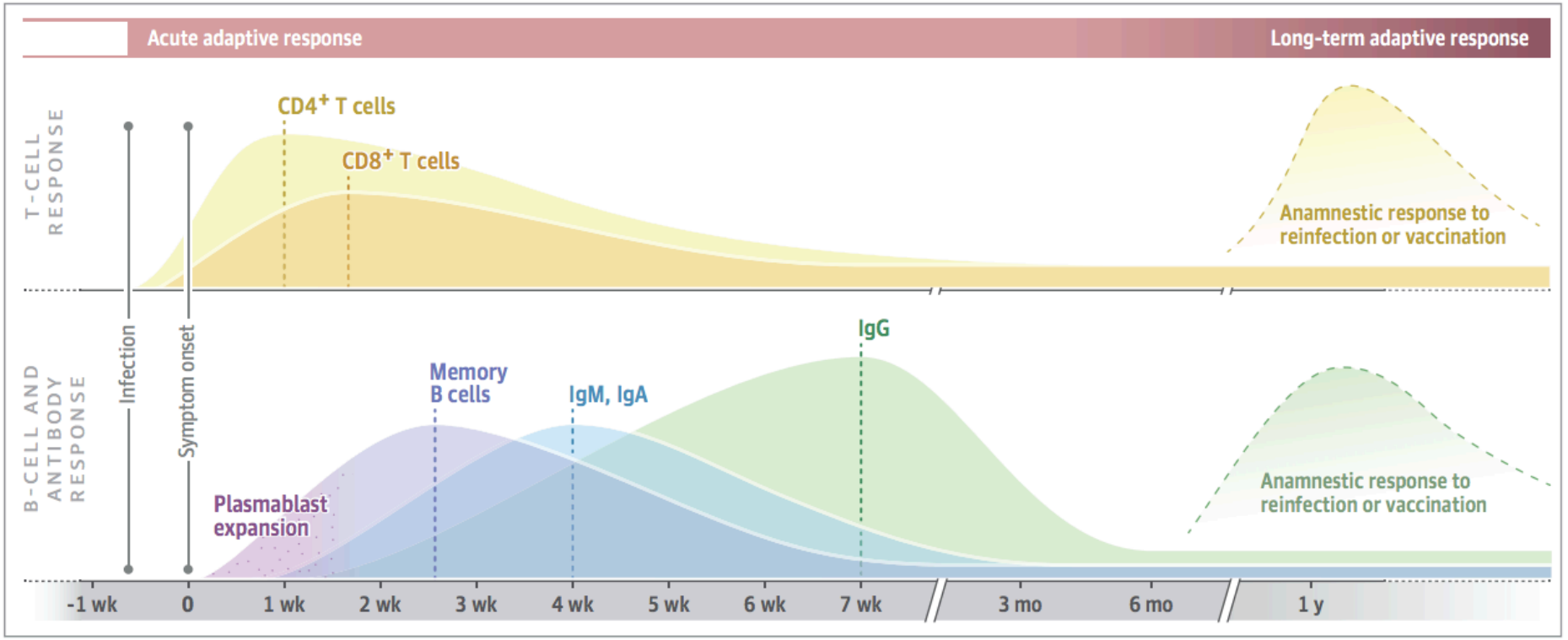
- Persons aged <21 years exposed to SARS-CoV-2 should be monitored for complications

- Ongoing surveillance for SARS-CoV-2–associated infection, hospitalization, and death among persons aged <21 years should be continued as schools reopen in the United States.

COVID-19 and the Path to Immunity

David S. Stephens, M. Juliana McElrath JAMA Published online September 11, 2020 (Reprinted)

Figure. Adaptive Immunity to Coronavirus Disease 2019



Generalized model of T-cell and B-cell (plasmablast, antibody) responses to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection projected over 1 year following infection. Neutralizing antibodies, memory 4 B cells, and CD4+ and CD8+ memory T cells to SARS-CoV-2, which are generated by infection, vaccination, or after reexposure, are key to the path to immunity. The dotted lines represent peak B-cell, T-cell, and antibody responses following infection.