

SARS-CoV-2 – A Constantly Evolving Threat: New Challenges and Mitigation Strategies

David J. Weber, MD, MPH, FIDSA, FSHEA, FRSM (London)
Sanders Distinguished Professor of Medicine, Pediatrics and Epidemiology
Associate Chief Medical Officer, UNC Medical Center
Medical Director, Hospital Epidemiology, UNC Medical Center
University of North Carolina at Chapel Hill



UNC
SCHOOL OF MEDICINE

Disclosures: Consultancy; Pfizer, Sanofi, PDI, Germitec, UWinnovators; Merck
All drugs/vaccines issues discussed consistent with FDA approvals or authorizations

COVID-19 UPDATE: EPIDEMIOLOGY

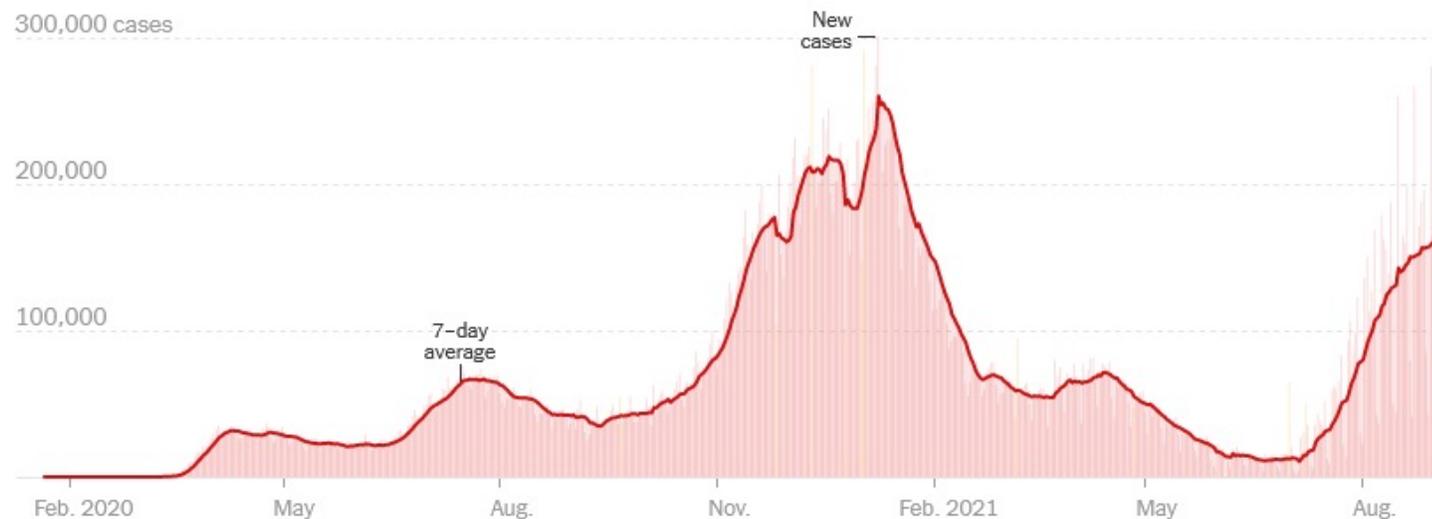


UNC
SCHOOL OF MEDICINE

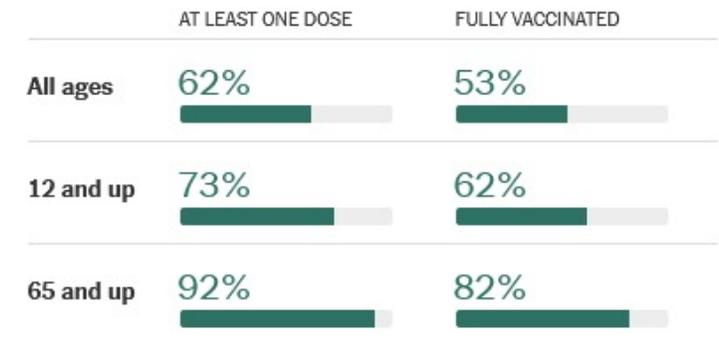
CORONAVIRUS CASES AND VACCINE COVERAGE, US, 6 SEPTEMBER 2021

7 day average = ~164,000 per day; peak in past 7 days = ~280,000

New reported cases



Vaccinations



[See more details >](#)

[About this data](#)

<https://www.nytimes.com/interactive/2021/us/covid-cases.html>

IMPACT OF COVID-19 ON LIFE EXPECTANCY

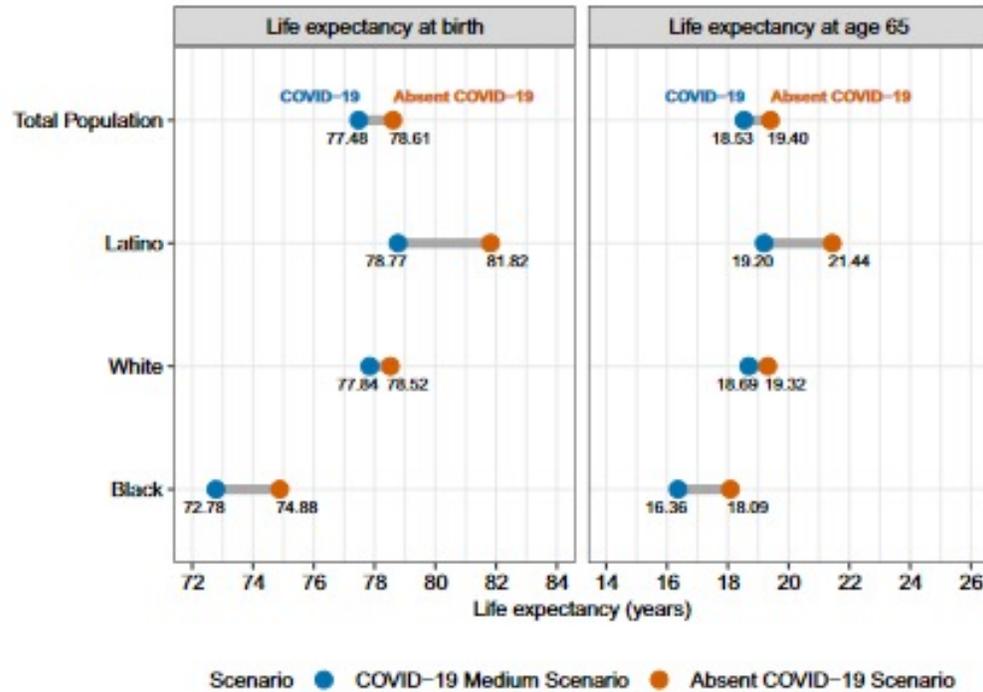


Fig. 1. Life expectancy projections for 2020 by race and ethnicity in the absence of COVID-19 and under the medium scenario. The COVID-19 medium scenario is based on the IHME current projection scenario (October 9, 2020 update).

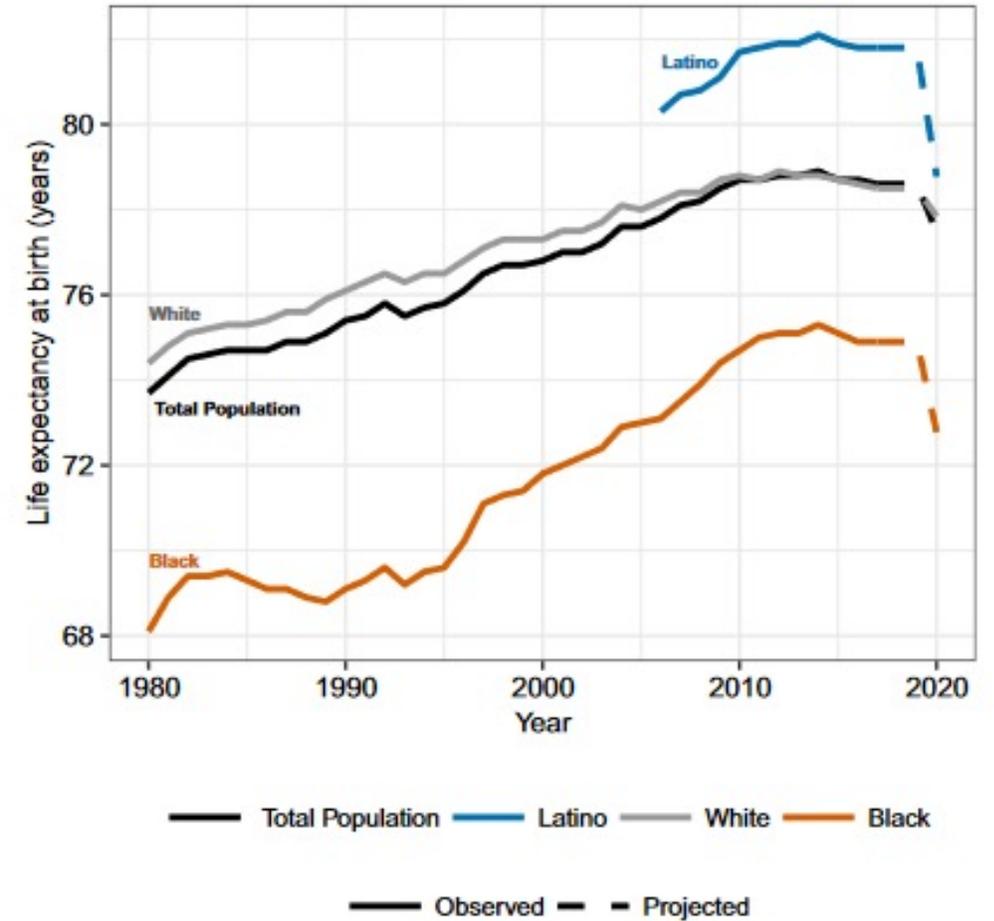
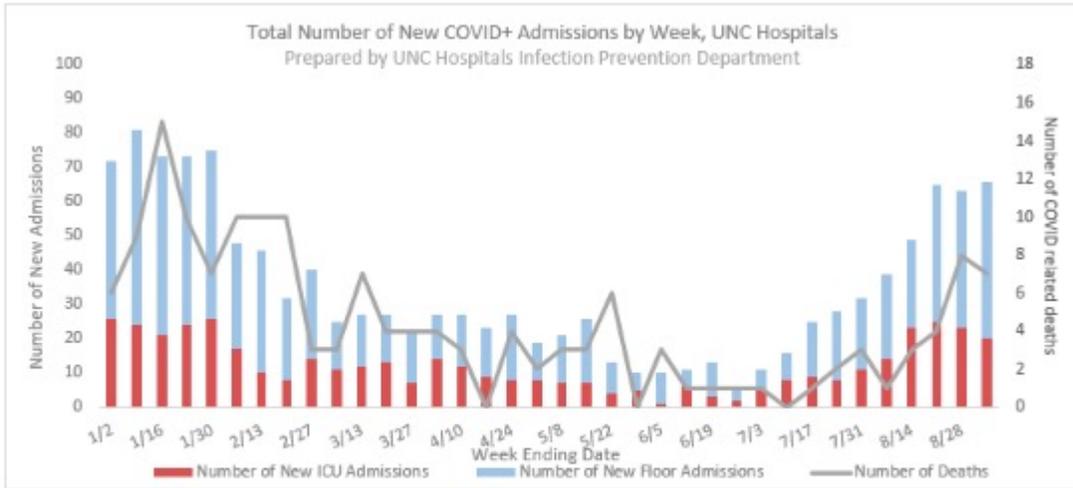


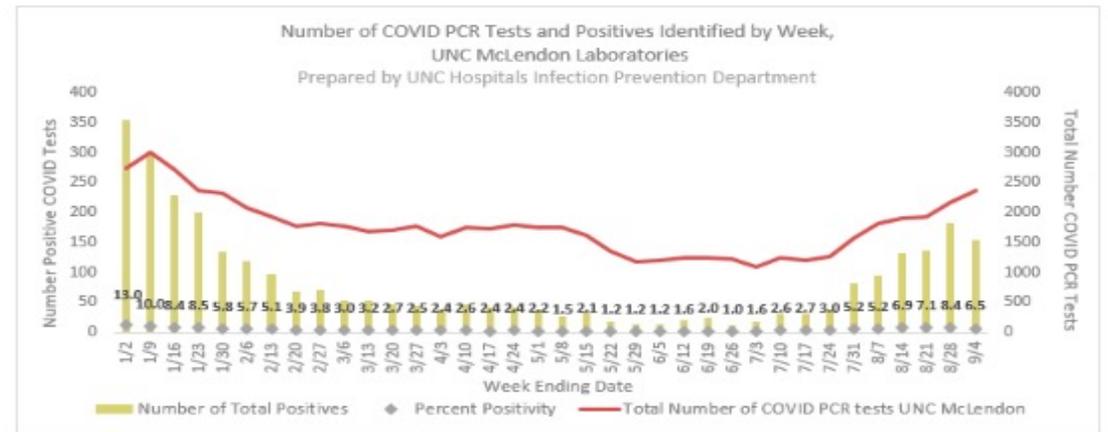
Fig. 2. Trends in life expectancy at birth by race and ethnicity: 1980–2020. Note that the data for the Black and White populations prior to 2006 include Latinos; data for these groups from 2006 onward are for the non-Latino Black and non-Latino White populations. The projections for 2020 are based on the IHME current projection scenario (October 9, 2020 update).

UNC MEDICAL CENTER SURVEILLANCE, 9/4/21



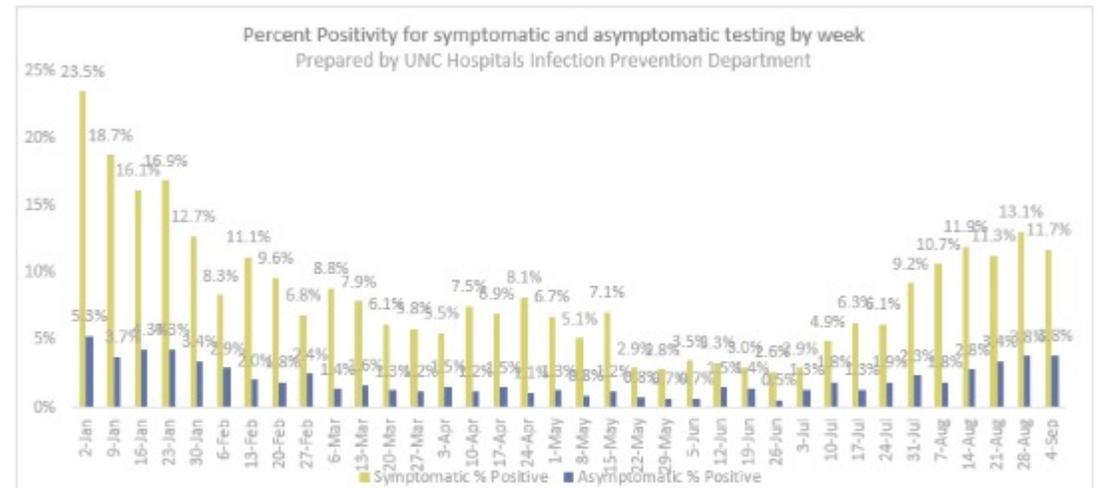
Admissions to UNC Hospitals for patients with COVID-19 broken down by intensive care and floor units. Data includes transfers of patients between intensive care and floor units. Graph also displays number of weekly COVID related deaths.

Surveillance produced by Ms. Lauren DiBiase, Associate Director, UNC-MC Infection Prevention



Data represents COVID-19 tests performed by UNC McLendon labs for UNC Hospitals' facilities and includes re-tests. COVID testing done as part of the RPP with COVID order and the RSV/influenza with COVID order is included.

Note: Testing of asymptomatic persons in certain populations was expanded beginning 5/3. Number of tests and positive results included on the graph are not reflective of all COVID testing done by UNC McLendon Laboratories.



Percent positivity for COVID-19 tests performed by UNC McLendon labs for UNC Hospitals' facilities and includes re-tests. Symptomatic and asymptomatic testing categories determined by answer to question in COVID-19 test order.

IMPACT OF COVID-19 ON LIFE EXPECTANCY

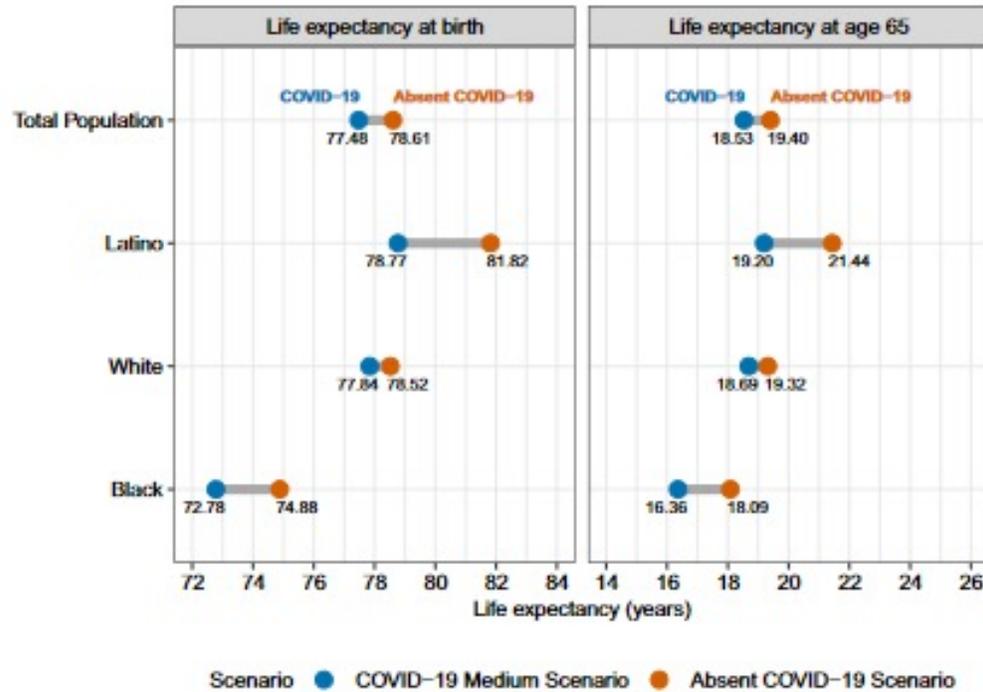


Fig. 1. Life expectancy projections for 2020 by race and ethnicity in the absence of COVID-19 and under the medium scenario. The COVID-19 medium scenario is based on the IHME current projection scenario (October 9, 2020 update).

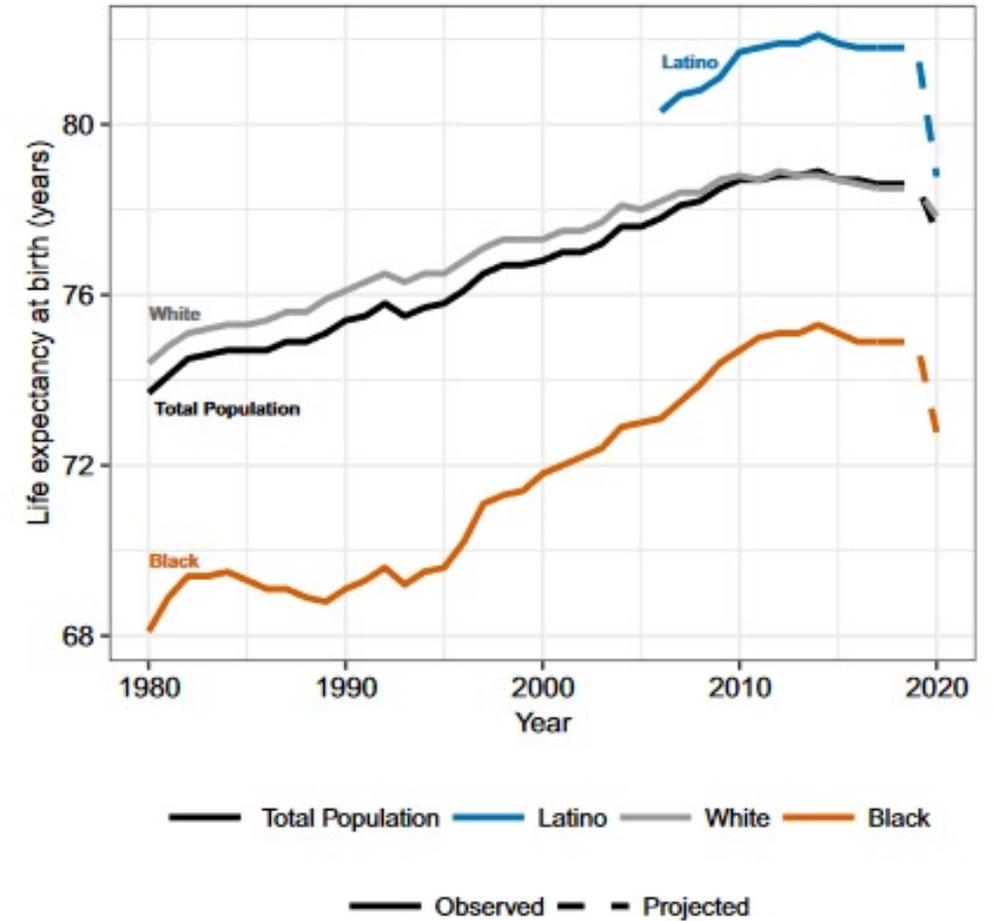


Fig. 2. Trends in life expectancy at birth by race and ethnicity: 1980–2020. Note that the data for the Black and White populations prior to 2006 include Latinos; data for these groups from 2006 onward are for the non-Latino Black and non-Latino White populations. The projections for 2020 are based on the IHME current projection scenario (October 9, 2020 update).

COVID-19 UPDATE: VARIANTS AND VACCINES



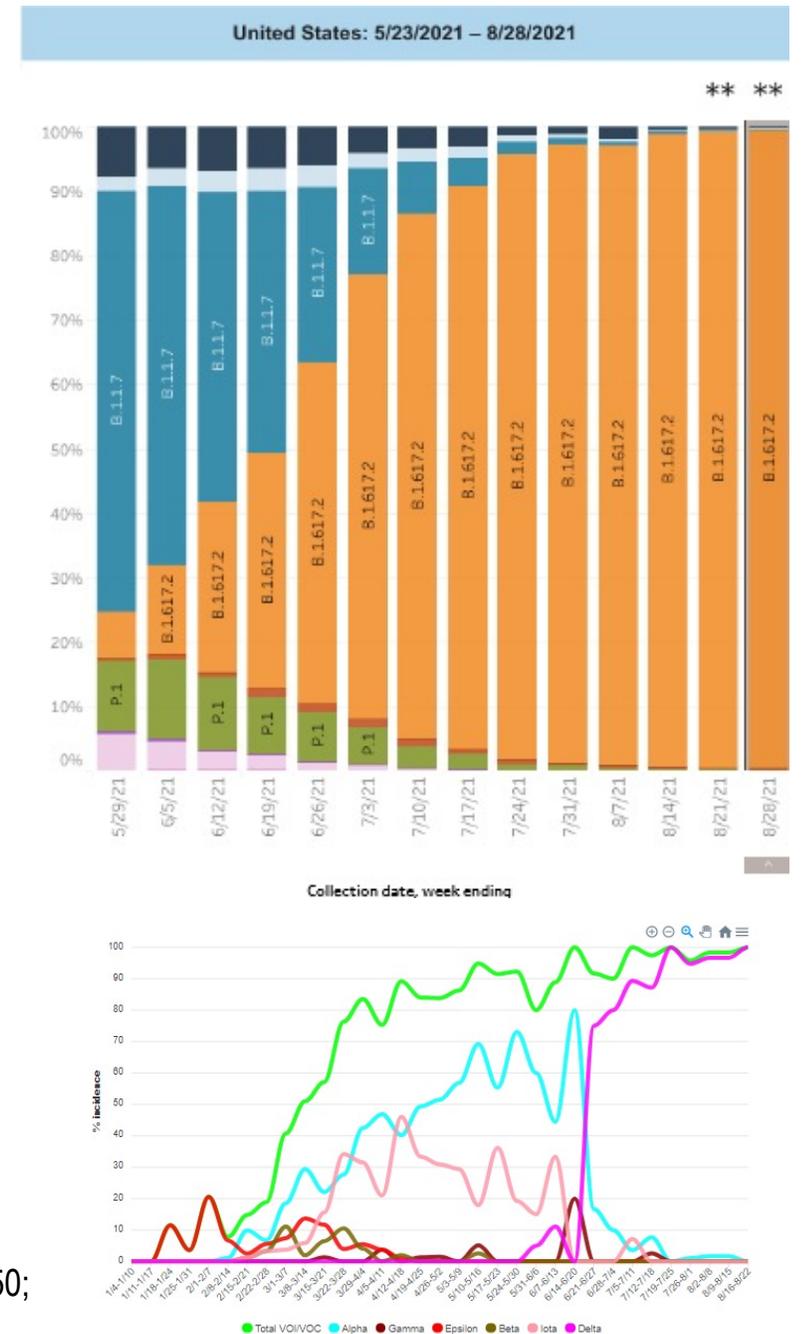
UNC
SCHOOL OF MEDICINE

WHAT'S DRIVING THE INCREASE IN COVID-19

- Exponential increase in Delta variant (per CDC, now accounts for >98% of cases)
- Delta: Increased transmissibility, likely increased virulence, decreased protection from vaccines for symptomatic infection (but continued good protection against severe disease)
- Elimination of mask mandates in most locales
- Vaccine hesitancy and resistance
- Holidays (Memorial Day, 4th of July) and summer activities
- Breakthrough infections in fully vaccinated persons also playing a role in the increase in COVID-19 cases
- Delta variant may also cause more severe disease
 - Canada: Higher odds of hospitalization [aOR 2.20 (CI 1.93-2.53)], ICU admission [aOR 3.87 (CI 2.98-4.99)], and death [aOR 2.37 (CI 1.50-3.30)]¹
 - Singapore: Higher odds of oxygen requirement, ICU admission, or death [aOR 4.90 (CI 1.43-30.78)] and pneumonia [aOR 1.88 (CI 0.95-3.76)]²
 - Scotland: Higher odds of hospitalization [HR 1.85 (CI 1.39-2.47)]³

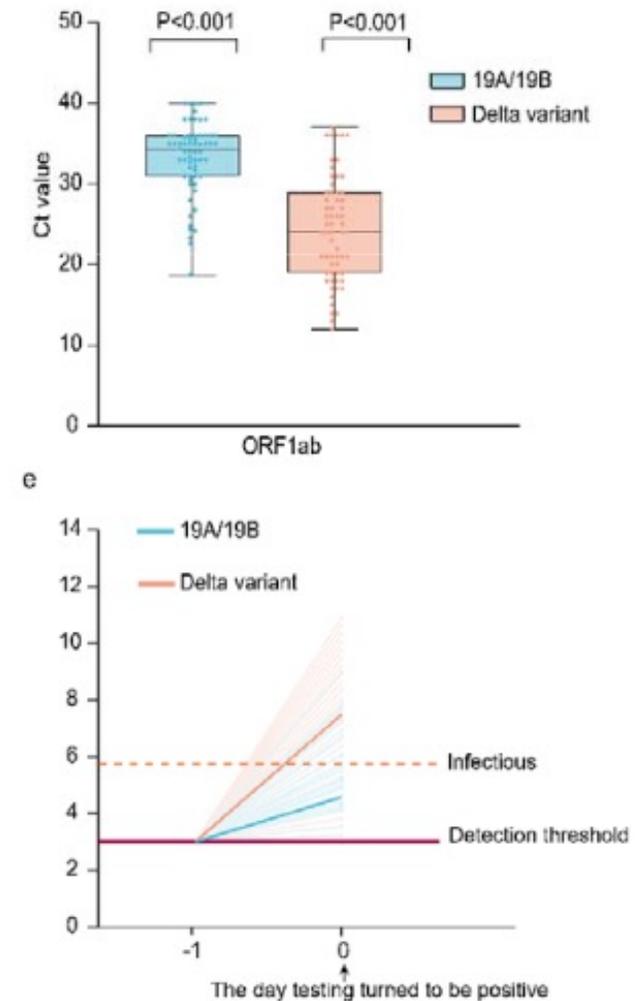
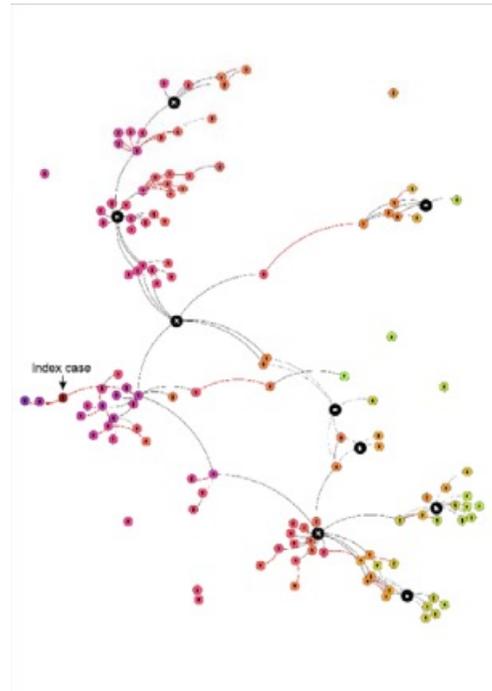
UNC Medical Center data on variants 1,695 genomes sampled through 17 August

<https://covid.cdc.gov/covid-data-tracker/#variant-proportions>; 1. Fisman and Tuite, doi:10.1101/2021.07.05.21260050; 2. Ong et al. doi:10.2139/ssrn.3861566; 3. Sheikh et al. doi:10.1016/S0140-6736(21)01358-1

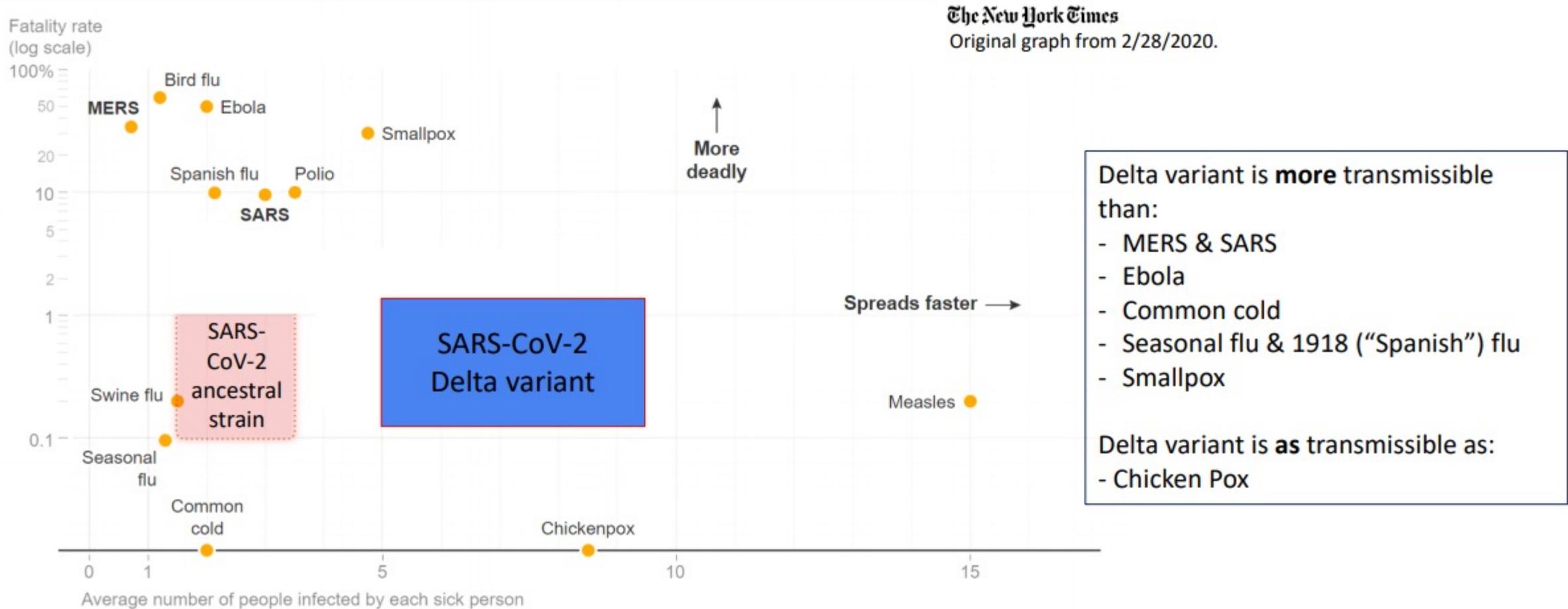


Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant

- Background: One notable epidemiologic feature of the Delta variant is a shorter serial interval compared with to infection with early Wuhan-like strains or other VOC variants
- First Delta outbreak in China: 167 infections traced back to 1 index case.
- Daily sequential PCR testing of the quarantined subjects indicated that the **viral loads** of Delta infections, when they first become PCR+, were on average **~1000 (1,260) times greater** compared to A/B lineage infections during initial epidemic wave in China in early 2020, suggesting potentially faster viral replication and greater infectiousness of Delta during early infection.



Transmission of Delta variant vs. ancestral strain and other infectious diseases



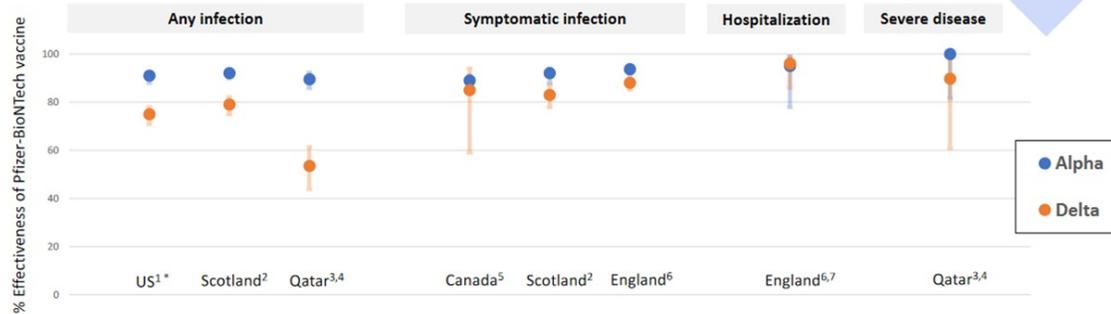
Note: Average case-fatality rates and transmission numbers are shown. Estimates of case-fatality rates can vary, and numbers for the new coronavirus are preliminary estimates.

COVID-19 VACCINES: UPDATE

- Current state of COVID-19 vaccines (US)
 - The Pfizer vaccine FDA approved, ages 16 and over
 - 3rd dose of Pfizer (age ≥ 12 years) or Moderna (age ≥ 18 years) vaccine FDA authorized for persons with moderate to severe immunocompromise
 - No change in FDA authorization or CDC recommendations for the J&J vaccine
- CDC and professional societies (i.e., ACOG and SMFM) now explicitly recommend that all pregnant women receive a COVID-19 vaccine
- Booster doses for non-immunocompromised persons to be considered by FDA and CDC later this month
- COVID-19 vaccines for younger children (i.e., 3-5 to 11 years) not expected to be reviewed by FDA till later Fall (FDA required companies to increase their study sizes because of concerns about myocarditis/pericarditis)
- COVID-19 vaccines for youngest children (i.e., 6 months to 3-5 years) not expected to be reviewed by FDA till Spring
- COVID-19 vaccines continue to be effective in prevent infection from Delta and highly protective in preventing hospitalization and death from Delta

VACCINE EFFECTIVENESS, WORLDWIDE

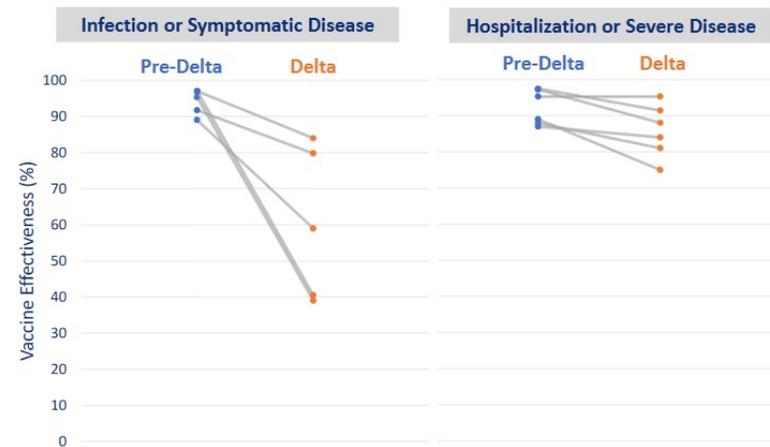
Booster doses of COVID-19 vaccines: Is effectiveness reduced because of the Delta variant?



- Globally, among studies assessing infections with Alpha vs Delta: mild decrease in Delta VE¹⁻⁷
- Other factors may include study methods, **interval** between doses, and **timing** with vaccination and variant increases

References: 1. Tartof et al. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3909743 2. Sheikh A, et al. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)01358-1/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01358-1/fulltext) 3. Tang et al. <https://www.medrxiv.org/content/10.1101/2021.08.11.21261885v1> 4. Abu-Raddad et al. <https://www.nejm.org/doi/full/10.1056/NEJM2104974> 5. Nasreen S, et al. <https://www.medrxiv.org/content/10.1101/2021.06.28.21259420v2> 6. Bernal Lopez et al. <https://www.medrxiv.org/content/10.1101/2021.05.22.21257658v1> 7. Stowe et al. https://khub.net/web/phenational/public-library/-/document_library/v2WsrK3ZIEig/view/479607266 *Included other variants

Vaccine effectiveness in the Pre-Delta and Delta Periods

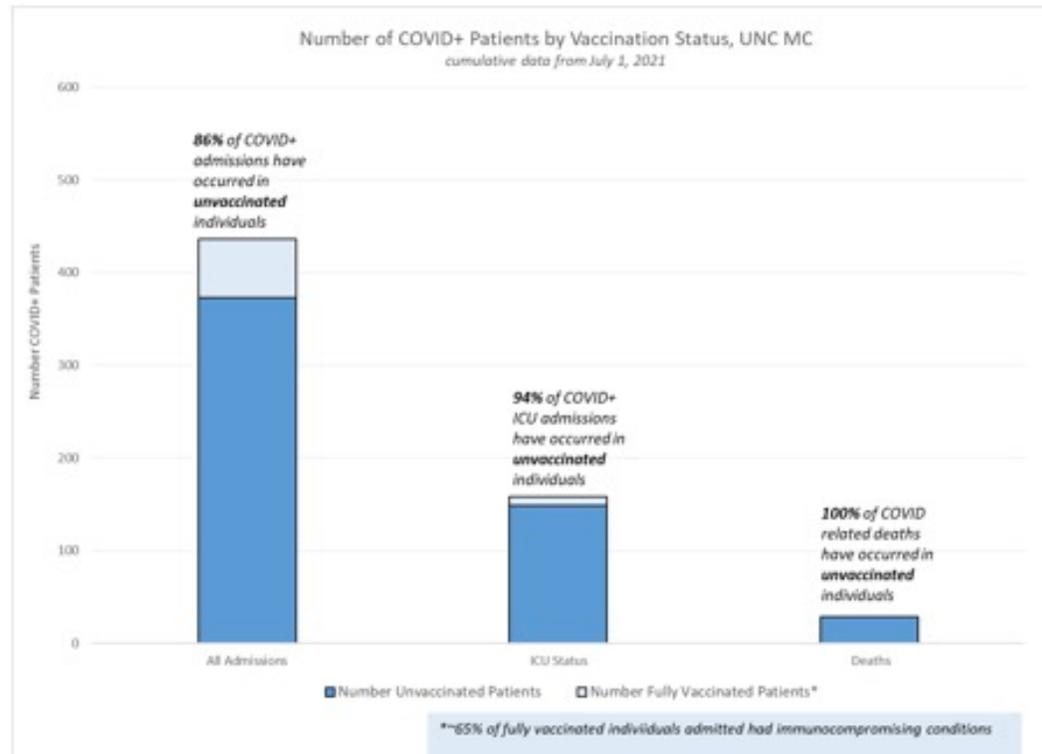


In studies comparing the 'Pre-Delta' and 'Delta' periods:

- Pre-Delta vaccine effectiveness estimates high (**87% or higher**)
- Since the introduction of the Delta variant (varies by region)
 - VE against **infection** ranges from **39–84%**
 - VE against **hospitalization** ranges from **75–95%**

References: 1. Israel Ministry of Health (committee/he/files_publications_corona_two-dose-vaccination-data.pdf) 2. Haas et al. (Israel) [https://doi.org/10.1016/S0140-6736\(21\)00947-8](https://doi.org/10.1016/S0140-6736(21)00947-8) 3. Pouwels et al. (UK) [survey/finalfinalcombinedve20210816.pdf](https://www.medrxiv.org/content/10.1101/2021.08.06.21261707v2) 4. Puranik <https://www.medrxiv.org/content/10.1101/2021.08.06.21261707v2> 5. Rosenberg (US) <https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e1.htm> 6. Tenforde (US) <https://www.cdc.gov/mmwr/volumes/70/wr/mm7034e2.htm>

UNC MEDICAL CENTER SURVEILLANCE, 9/4/21



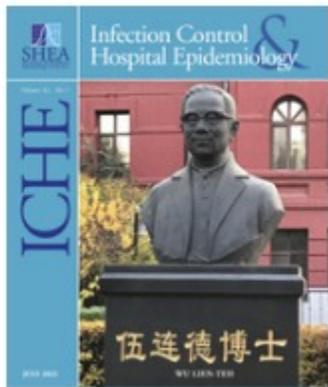
Among vaccinated persons, 66% were on cancer chemotherapy, had an solid organ transplant, or were on high dose steroids

94% of patients who died had a comorbidity

COVID-19 positive admissions to UNC Hospitals and deaths broken down by vaccination status. Vaccination status is captured in Epic and may be an underrepresentation of the true number of vaccinated patients. Patients are considered fully vaccinated 14 days after their second dose or 14 days after receipt of J&J vaccine.

MULTISOCIETY POSITION STATEMENT

- This consensus statement by the Society for Healthcare Epidemiology of America (**SHEA**) and The Society for Post-Acute and Long-Term Care Medicine (**AMDA**), The Association for Professionals in Epidemiology and Infection Control (**APIC**), the HIV Medicine Association (**HIVMA**), the Infectious Diseases Society of America (**IDSA**), the Pediatric Infectious Diseases Society (**PIDS**), and the Society of Infectious Diseases Pharmacists (**SIDP**), **recommends that COVID-19 vaccination should be a condition of employment for all healthcare personnel.** Exemptions from this policy apply to those with medical contraindications to all COVID-19 vaccines available in the United States and other exemptions as specified by federal or state law. **The consensus statement also supports COVID-19 vaccination of non-employees functioning at a healthcare facility (for example, students, contract workers, volunteers, etc.)**



Multisociety Statement on COVID-19 Vaccination as a Condition of Employment for Healthcare Personnel

Published online by Cambridge University Press: 13 July 2021

David J. Weber, Jaffar Al-Tawfiq, Hilary Babcock, Kristina Bryant, Marci Drees, Ramy Elshaboury, Katharine Essick, Mohamad Fakh, David Henderson, Waleed Javaid ...Show all authors ▾

Show author details ▾

Adopted by 1,500 hospitals, 9 Aug, CNN

Health System Vaccine Mandates



BASIS FOR MULTISOCIETY POSITION STATEMENT

- The COVID-19 vaccines available in the United States (US) under the Food and Drug Administration (FDA) emergency use authorization (EUA) have **high efficacy to prevent symptomatic COVID-19, even higher efficacy to prevent serious COVID-19** (i.e., hospitalizations and deaths), and **high effectiveness** against symptomatic and asymptomatic COVID-19 infection.
- The COVID-19 vaccines under FDA EUA (Moderna, J&J) and FDA approval (Pfizer) **have similar safety profiles to vaccines that are currently fully FDA-approved**, shown by efficacy trials and effectiveness studies.
- **Full vaccination against COVID-19 offers several advantages to patient and healthcare personnel (HCP) safety: individual protection against COVID-19 infection; further protection for patients and HCP who are unable to receive COVID-19 vaccination or are not able to mount an adequate immune response; reduced risk of asymptomatic or pre-symptomatic transmission of SARSCoV-2 between HCP, and from HCP to patients or patients to HCP; reduced risk of transmitting infection to household members and community contacts; increased protection for the healthcare workforce in the community setting**
- The COVID-19 vaccines appear to **retain good effectiveness against currently circulating SARS-CoV-2 variants** against symptomatic illness and even higher effectiveness against severe disease.

Rational for Immunocompromised Persons Receiving a Booster Dose of a COVID-19 Vaccine

Impact of COVID-19 on Immunocompromised Persons

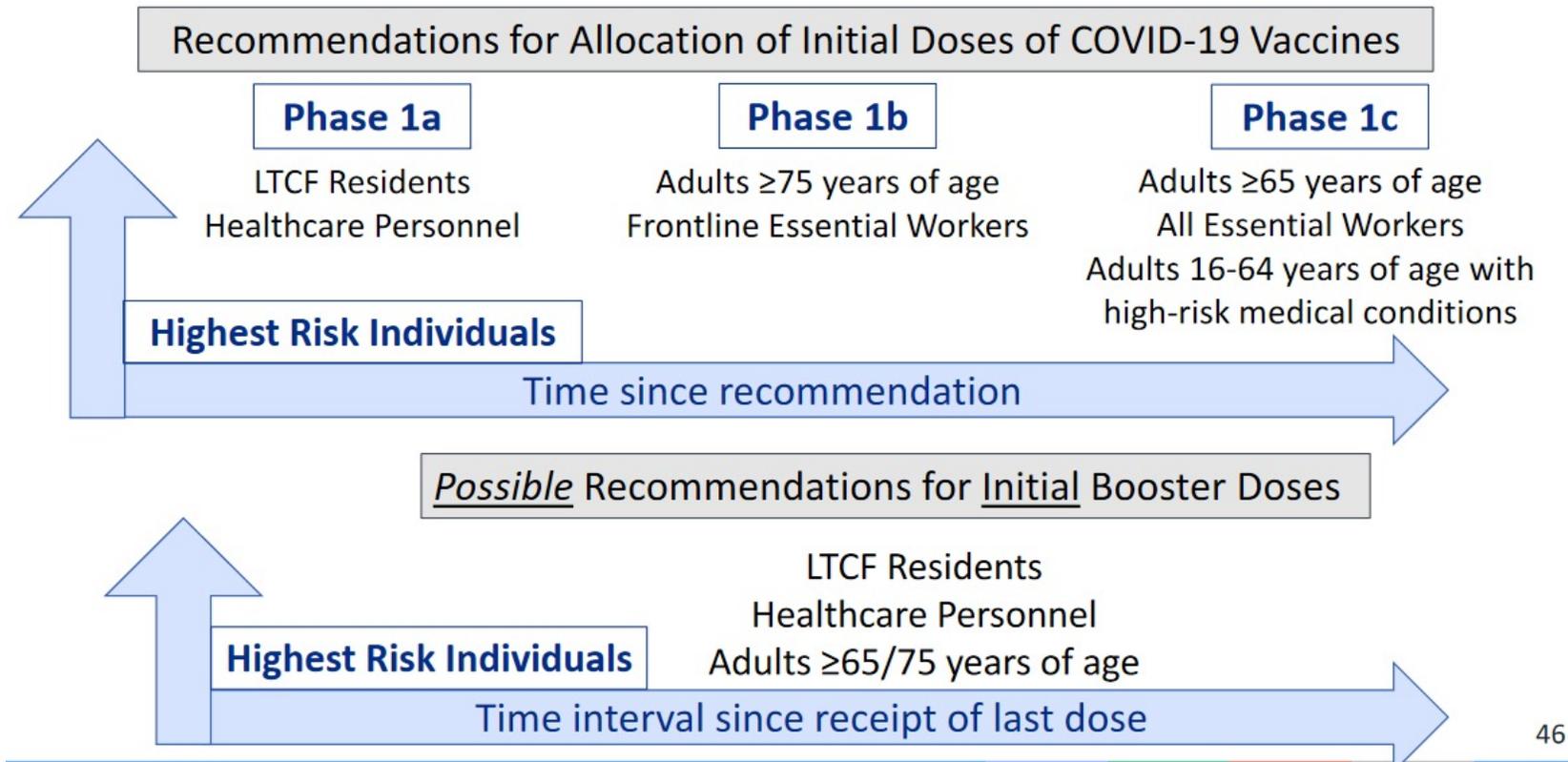
- More likely to get severely ill from COVID-19
- Higher risk for:
 - Prolonged SARS-CoV-2 infection and shedding
 - Viral evolution during infection and treatment (hospitalized patients)
- Low antibody/neutralization titers to SARS-CoV-2 variants
- More likely to transmit SARS-CoV-2 to household contacts
- More likely to have breakthrough infection:
 - 44% of hospitalized breakthrough cases are immunocompromised people in US study
 - 40% of hospitalized breakthrough cases are immunocompromised people in Israeli study

mRNA Vaccine Effectiveness Among Immunocompromised

- VE: 7-27 days after 2nd dose of Pfizer-BioNTech vaccine
 - 71% (CI 37-87%) among immunosuppressed* people vs. 90% (CI 83-96%) overall: SARS-CoV-2 infection
 - 75% (CI 44-88%) among immunosuppressed people vs. 94% (CI 87-97%) overall: symptomatic COVID-19
- VE: ≥ 7 days after 2nd dose of mRNA vaccine
 - 80% among people with inflammatory bowel disease on immunosuppressive meds: SARS-CoV-2 infection
 - VE of 25% was noted after 1st dose of mRNA vaccine for SARS-CoV-2 infection
- VE: ≥ 14 days after 2nd dose of mRNA vaccine
 - 59% (CI 12-81%) among immunocompromised people vs. 91% (CI 86-95%) without immunocompromise: COVID-19 hospitalization

PROPOSED ROLL OUT OF BOOSTER DOSES, CDC, 30 AUGUST

Booster doses of COVID-19 vaccines



BNT162b2 vaccine booster dose protection: A nationwide study from Israel

- Goal: Estimate the reduction in RR for confirmed infection and severe COVID-19 provided by the booster dose (booster dose initiated 6/30/21)
- Methods: 1,144,690 individuals aged 60y and older who were eligible for a booster dose were followed between July 30 and August 22, 2021. Outcomes per person-days at risk were compared between the cohorts using Poisson regression, adjusting for possible confounding factors.
- Results: Twelve days or more after the booster dose we found an 11.4-fold (95% CI: [10.0, 12.9]) decrease in the relative risk of confirmed infection, and a >10-fold decrease in the relative risk of severe illness. Under a conservative sensitivity analysis, we find ≈5-fold protection against confirmed infection.

Table 2. Summary of the results of the Poisson regression analysis for different cohorts: people who received only two vaccine doses and people for whom 12 days or more have passed since their booster dose. For each group, we provide the total number of person-days at risk for each cohort, the number of confirmed infections and severe COVID-19 in each cohort, and the estimated protection of the booster against confirmed infection and severe illness, given as a fold change in relative risk.

Cohort	Person-days at risk	Confirmed infections	Severe COVID-19	Estimated booster protection (95% CI)	
				Against confirmed infection	Against severe illness
2 doses only ("no-booster" cohort)	4,018,929	3,473	330	1	1
12+ days from 3 rd dose ("booster" cohort)	3,351,598	313	32	11.4 [10, 12.9]	15.5 [10.5, 22.8]

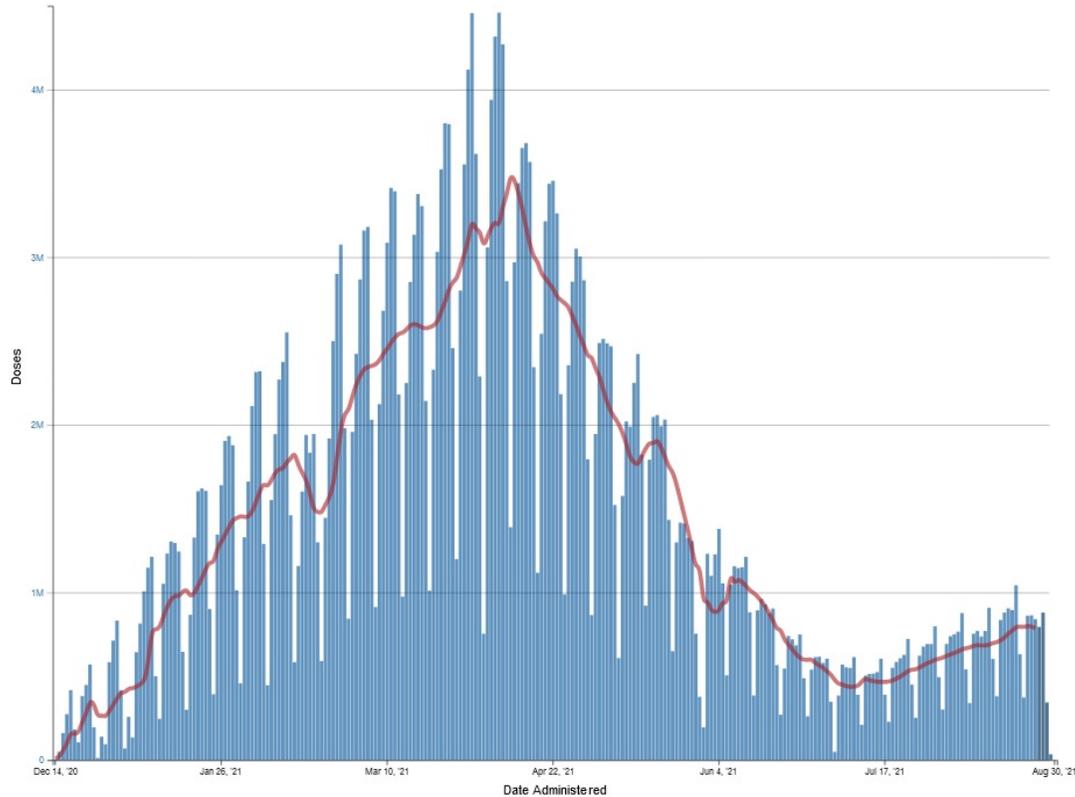
COVID-19 UPDATE: VACCINE HESITANCY, COVI-19 MITIGATION, MENTAL HEALTH, AND PROJECTIONS FOR THE FUTURE



UNC
SCHOOL OF MEDICINE

COVID-19 VACCINATION, US

Daily Count of Total Doses Administered and Reported to CDC by Date Administered, United States

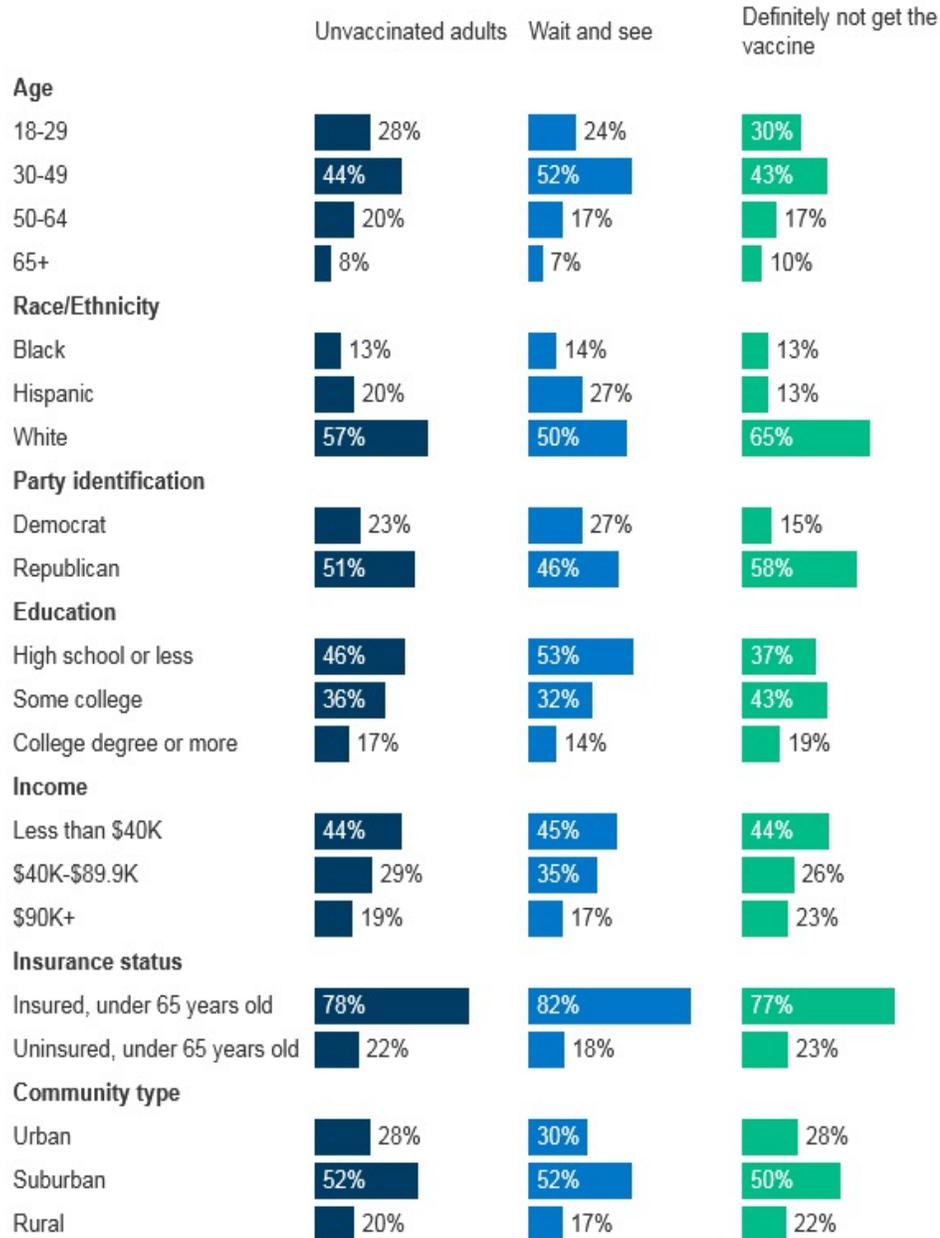


Total Vaccine Doses	People Vaccinated	
	At Least One Dose	Fully Vaccinated
Delivered 440,026,945	Total 204,742,648	173,832,202
Administered 369,556,911	% of Total Population 61.7%	52.4%
Learn more about the distribution of vaccines.	Population ≥ 12 Years of Age 204,514,420	173,700,607
	% of Population ≥ 12 Years of Age 72.1%	61.3%
	Population ≥ 18 Years of Age 191,367,513	163,650,079
	% of Population ≥ 18 Years of Age 74.1%	63.4%
	Population ≥ 65 Years of Age 50,286,364	44,664,225
	% of Population ≥ 65 Years of Age 91.9%	81.7%

173.8M
People fully vaccinated

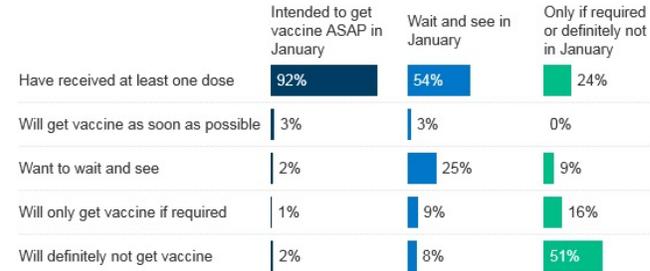
955k
People received an additional dose since August 13th, 2021

As you may know, an FDA-authorized vaccine for COVID-19 is now available for free to all adults in the U.S. Do you think you will...?



Who Wanted To Get Vaccinated ASAP Have Received Vaccine, As Have Slightly More Than Half Of Those Who Wanted To "Wait And See"

Have you personally received at least one dose of the COVID-19 vaccine, or not? As you may know, an FDA-authorized vaccine for COVID-19 is now available for free to all adults in the U.S. Do you think you will...?

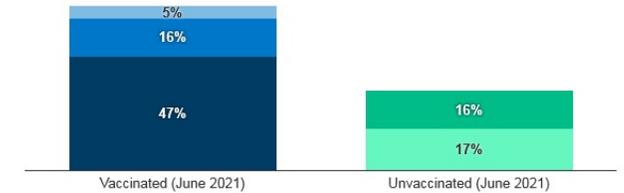


NOTE: See topline for full question wording. SOURCE: KFF COVID-19 Vaccine Monitor (Jan. 14-18, 2021 and June 15-23, 2021) • KFF COVID-19 Vaccine Monitor Download PNG

Match What People Planned To Do Six Months Ago; One In Five Were Either Vaccine Hesitant Or Resistant And Have Gotten Vaccinated

Vaccine intentions six months ago matched with reported vaccine behaviors

■ Vaccinated/ASAP in January and now vaccinated
■ Wait and see in January and now vaccinated
■ Only if required/Definitely not in January and now vaccinated
■ ASAP/Wait and see in January and not vaccinated
■ Only if required/Definitely not in January and not vaccinated



NOTE: See topline for full question wording. SOURCE: KFF COVID-19 Vaccine Monitor (Jan. 14-18, 2021 and June 15-23, 2021) • KFF COVID-19 Vaccine Monitor Download PNG

KFF COVID-19 Vaccine Monitor
<https://www.kff.org/coronavirus-covid-19/dashboard/kff-covid-19-vaccine-monitor-dashboard/>

Reasons for vaccine hesitancy and solutions

In the United States overall...

8% are **Watchful**. They're waiting to see what happens next.



9% are **Cost-Anxious**. They want the vaccine but can't afford the time or cost.



4% are **System Distrusters**. They feel the health care system doesn't treat them fairly.



14% are **Covid Sceptics**. They don't believe the threat.



Breakdown by state Click legend to sort

■ Covid Sceptics ■ System Distruster ■ Cost Anxious ■ Watchful

North Carolina 

- The **Watchful** are holding out to see what kind of experience their friends or neighbors have with the vaccine before committing themselves. **Solution=Allow for a “vaccinate later” option**
- The **Cost-Anxious** worry about the time and potential expense of getting vaccinated (even if it is actually free). **Solution=stress that vaccine is free and encourage businesses to provide paid time off for both vaccines**
- The **System Distrusters** believe that the health care system doesn't treat them fairly. Most, but not all, members of this group are people of color. **Solution=engage trusted member of their own communities to air concerns and be transparent**
- **Covid Sceptics** are at the far end of the spectrum as the least likely to get vaccinated. The primary barrier for people in this group are their specific, deeply held beliefs about Covid-19. Everyone in this group believes at least one conspiracy theory related to the pandemic. **Solution=avoid trying to debunk person's beliefs; listen to concerns and emphasize that vaccination is their own personal choice – and it protects friends and family members**

<https://www.nytimes.com/interactive/2021/05/18/opinion/covid-19-vaccine-hesitancy.html>

COVID-19 Mitigation Strategies

- Mitigation strategies developed specifically for COVID-19 prevention: Supported by high-quality scientific studies
 - COVID-19 vaccines: Supported by efficacy and safety RCTs, and effectiveness trials (cohort, case-control)*^
 - Universal pandemic precautions: Supported by laboratory studies, and cohort and case-control studies (plus meta-analyses)*
 - Masking while in the facility
 - N95 respiratory when providing care for known or suspected COVID-19 patients or for aerosol generating procedures
 - Eye protection with direct patient contact (and for AGPs)
 - Physical distancing (ideally, >6 feet; minimally, >3 feet) – especially important when not masked*^
 - PPE monitors to aid in appropriate donning and doffing of PPE*
 - Monoclonal antibodies for pre- and post-exposure prophylaxis (PEP)*^
- Mitigation strategies standard in healthcare facilities; especially important for communicable diseases*^
 - Hand hygiene and surface disinfection: Supported by experience with viral respiratory pathogens, survival of SARS-CoV-2 on hands and environmental surfaces, and antiseptic/disinfectant susceptibility
 - Contact tracing with isolation and quarantine as indicated
 - Wellness self-checks (prior to coming to work) with evaluation by occupational health if positive

*Healthcare facilities, ^Community

RCT OF BAMLANIVIMAB FOR PRE- AND POST-EXPOSURE PROPHYLAXIS, NURSING HOMES & ASSISTED LIVING

- Goal: To determine the effect of bamlanivimab on the incidence of COVID-19 among residents and staff of skilled nursing and assisted living facilities.
- Methods: RCT, single-dose (4200 mg), phase 3 trial, of residents and staff of 74 skilled nursing and assisted living facilities in the US with at least 1 confirmed SARS-CoV-2 index case; 1175 participants enrolled 8/2 to 11/20/20
- Results: The prevention population comprised a total of 966 participants (666 staff and 300 residents) who were negative at baseline for SARS-CoV-2 infection and serology (mean age, 53.0 [range, 18-104] years; 722 [74.7%] women). **Bamlanivimab significantly reduced the incidence of COVID-19 in the prevention population compared with placebo (8.5% vs 15.2%; odds ratio, 0.43 [95% CI, 0.28-0.68]; $P < .001$; absolute risk difference, -6.6 [95% CI, -10.7 to -2.6] percentage points).** Five deaths attributed to COVID-19 were reported by day 57; all occurred in the placebo group. Rates of AEs: Bam = 20.1%, Placebo = 18.9%.
- Conclusion: Among residents and staff in skilled nursing and assisted living facilities, treatment during August-November 2020 with bamlanivimab monotherapy reduced the incidence of COVID-19 infection.

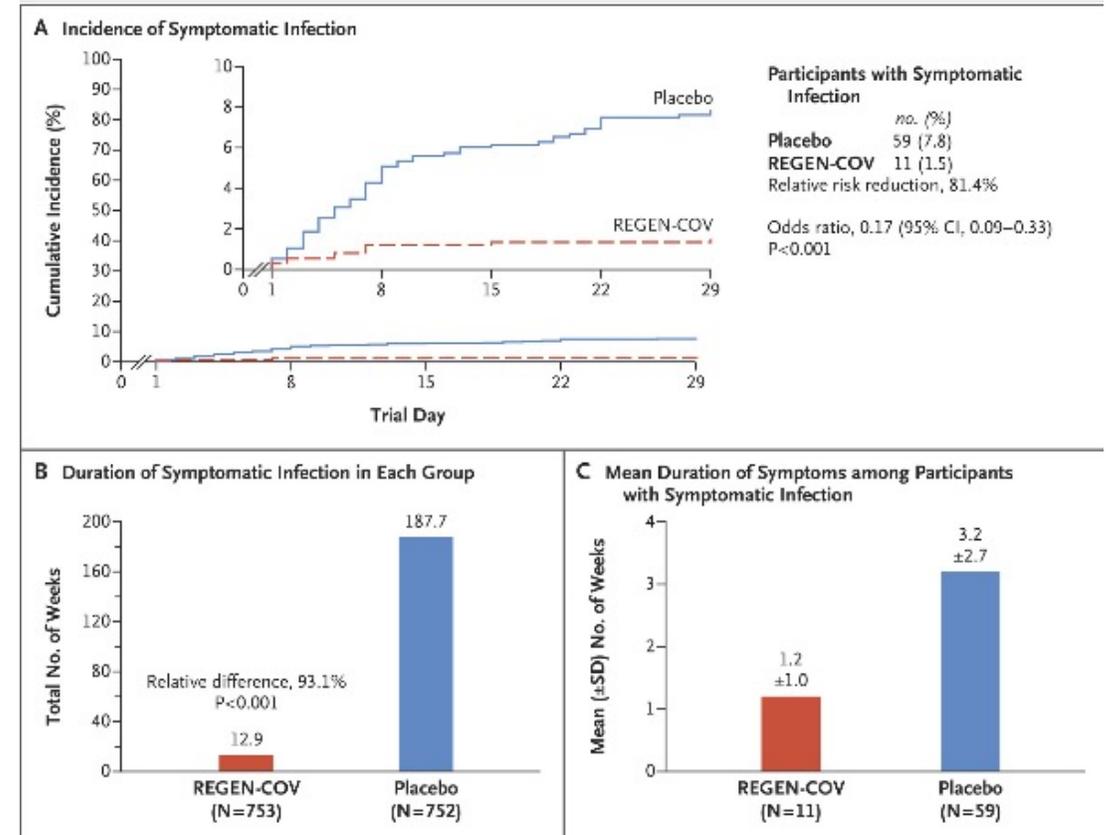
SQ Cas/Imd ANTIBODY COMBINATION TO PREVENT COVID-19, PEP

- Methods:

- RCT (1:1 ratio mAB to placebo), >12 years of age, household study, enrolled within 96 hours after a household contact had received a diagnosis of COVID-19
- Outcome = development of symptomatic infection by day 28

- Results

- Symptomatic SARS-CoV-2 infection developed in 11 of 753 participants in the REGEN-COV group (1.5%) and in 59 of 752 participants in the placebo group (7.8%) (relative risk reduction [1 minus the relative risk], **81.4%**; $P < 0.001$)
- In weeks 2 to 4, a total of 2 of 753 participants in the REGEN-COV group (0.3%) and 27 of 752 participants in the placebo group (3.6%) had symptomatic SARS-CoV-2 infection (relative risk reduction, **92.6%**). REGEN-COV also prevented symptomatic and asymptomatic infections overall (relative risk reduction, 66.4%).
- No dose-limiting toxic effects of REGEN-COV were noted



O'Brien MP, et al. NEJM 2021;4 August

Incidence and Secondary Transmission of SARS-CoV-2 Infections in Schools, NC

- Background: This study describes secondary transmission of SARS-CoV-2 within participating school districts during the first 9 weeks of in-person instruction in the 2020-2021 academic year, NC.
- Methods: From August 15, 2020 to October 23, 2020, 11 of 56 school districts participating in ABCs were open for in-person instruction for all 9 weeks of the first quarter and agreed to track incidence and secondary transmission of SARS-CoV-2.
- Results: Over 9 weeks, 11 participating school districts had >90 000 students and staff attend school in person. Among these students and staff, 773 community-acquired SARS-CoV-2 infections were documented by molecular testing. Through contact tracing, health department staff determined an additional 32 infections were acquired within schools. No instances of child-to-adult transmission of SARS-CoV-2 were reported within schools.
- Conclusions: In the first 9 weeks of in-person instruction in North Carolina schools, extremely limited within-school secondary transmission of SARS-CoV-2, as determined by contact tracing was found.

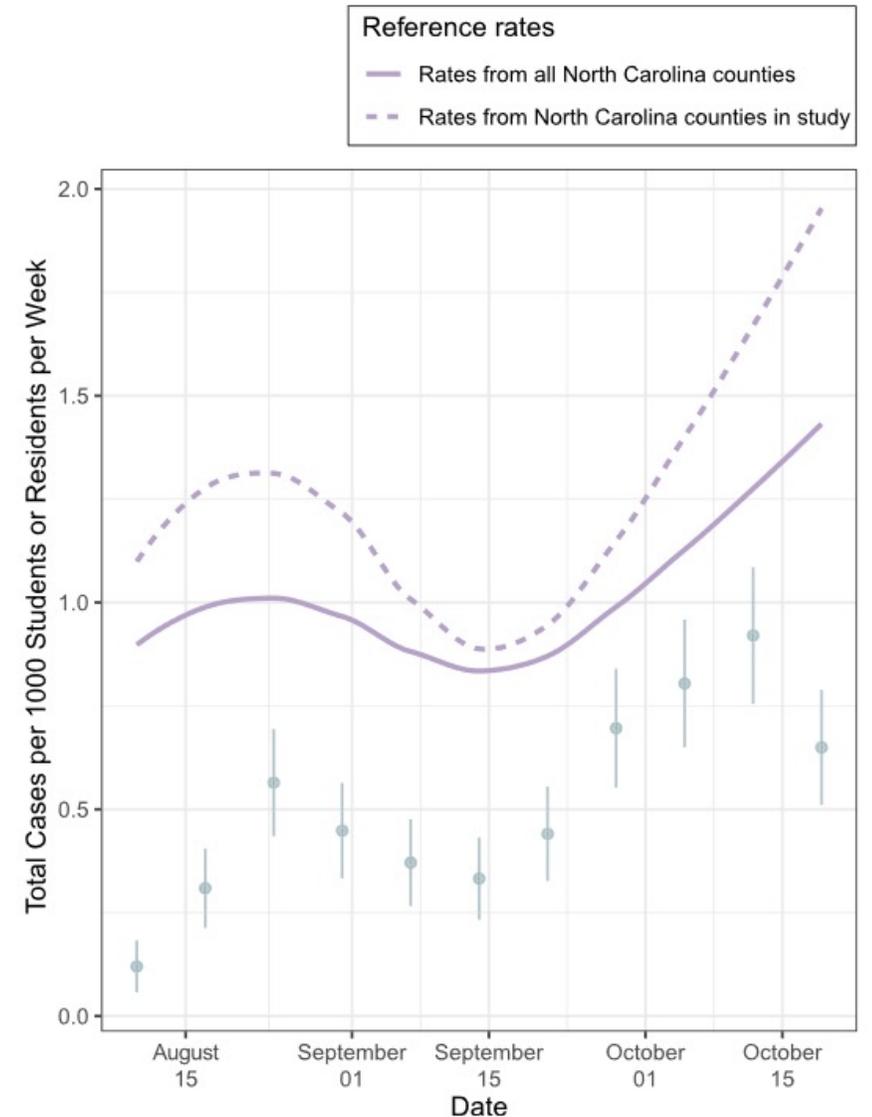


FIGURE 2
Rates of infection: rate of infection across North Carolina (solid line) and in the ABCs 11 districts (dashed line). Dots denote the rates of community-acquired infection within the schools.

Community SARS-CoV-2 Surge and Within-School Transmission

Kanecia O. Zimmerman, MD, MPH; M. Alan Brookhart, PhD; Ibukunoluwa C. Kalu, MD; Angelique E. Boutzoukas, MD; Kathleen A. McGann, MD; Michael J. Smith, MD, MSCE; Gabriela M. Maradiaga Panayotti, MD; Sarah C. Armstrong, MD; David J. Weber, MD, MPH; Ganga S. Moorthy, MD; Daniel K. Benjamin, Jr., MD, PhD; for The ABC Science Collaborative

- Results: More than 100,000 students and staff from 13 school districts attended school in-person; of these, 4,969 community-acquired SARS-CoV-2 infections were documented by molecular testing. Through contact tracing, NC local health department staff identified an additional 209 infections among >26,000 school close contacts (secondary attack rate <1%). Most within-school transmissions in high schools (75%) were linked to school-sponsored sports. School-acquired cases slightly increased during the surge; however, within-school transmission rates remained constant, from pre-surge to surge, with approximately 1 school-acquired case for every 20 primary cases.

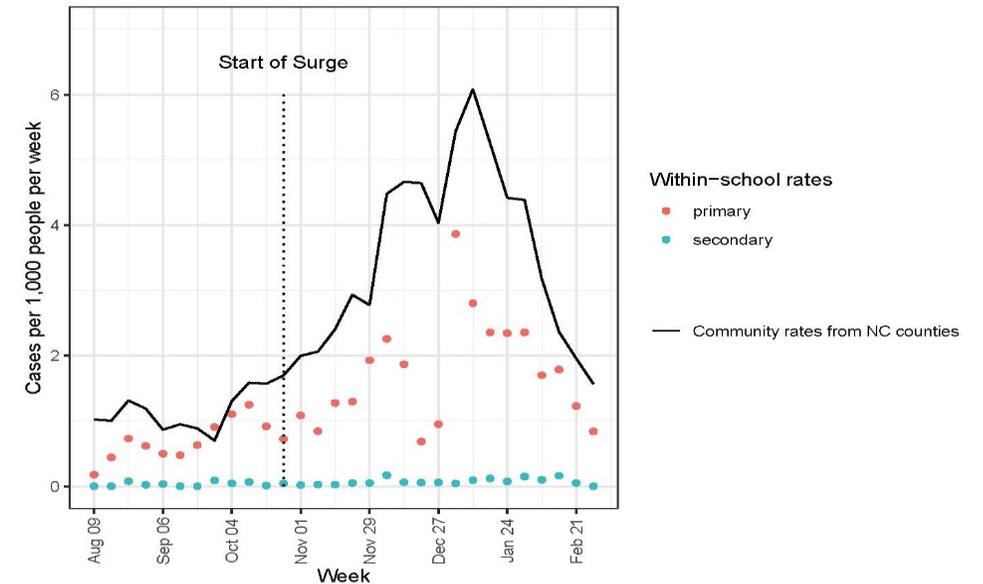


Figure 1. Community Rates vs. Community- and School-acquired Infections
Community rates of infection vs. community-acquired (primary) and school-acquired (secondary) infections in school buildings.

- Summary: During the 2020–2021 winter surge of SARS-CoV-2 in North Carolina, K–12 within-school transmission remained extremely low among districts implementing basic mitigation strategies.
- Add: Demonstrates that mitigation strategies of masking and physical distancing work (AAP recommended masking in schools regardless of vaccination status; CDC adopted this recommendation)

Rate of Expected Secondary Infections /100 Primary Cases (95% CI), by Grade Level

Grade Level	Pre-surge Secondary Infections/100 Primary Cases (95% CI)	Post-surge	Post-surge without Sports
Elementary	6.51 (3.70, 11.5)	4.43 (2.82, 6.96)	4.43 (2.91, 6.75)
Middle	4.48 (1.73, 11.6)	2.68 (1.25, 5.75)	2.68 (1.31, 5.47)
High	1.57 (0.49, 5.06)	3.92 (2.36, 6.51)	1.05 (0.42, 2.63)

CI, confidence interval

MENTAL HEALTH ISSUES DUE TO COVID-19

- **Methods:** To evaluate mental health conditions among these workers, a nonprobability–based online survey was conducted during 3/29-4/6/21, among UA public health workers
- **Results:** Among 26,174 respondents, 53.0% reported symptoms of at least one mental health condition in the preceding 2 weeks, including depression (32.0%), anxiety (30.3%), PTSD (36.8%), or suicidal ideation (8.4%). Severity of symptoms increased with increasing weekly work hours and percentage of work time dedicated to COVID-19 response activities.
- **Conclusion:** Implementing prevention and control practices that eliminate, reduce, and manage factors that cause or contribute to public health workers’ poor mental health might improve mental health outcomes during emergencies.

TABLE 2. Traumatic events or stressors reported by 26,174 state, tribal, local, and territorial public health workers and comparisons* of symptoms of post-traumatic stress disorder† — United States, March–April 2021

Traumatic event or stressor/Response	No. [‡]	PTSD prevalence, %	PTSD PR (95% CI)
Personal-related			
Had COVID-19			
Yes [‡]	2,834	36.7	1.03 (0.98–1.09)
Maybe**	3,310	42.4	1.19 (1.14–1.25)
No	16,266	35.6	Ref
Got divorced or separated			
Yes	747	49.6	1.36 (1.27–1.47)
No	22,084	36.3	Ref
Experienced death of a loved one			
Yes	7,580	42.3	1.24 (1.20–1.29)
No	15,403	34.0	Ref
Worried about the health of family and loved ones			
Yes	20,857	39.4	3.11 (2.77–3.48)
No	2,203	12.7	Ref
Felt isolated and alone			
Yes	12,944	49.8	2.49 (2.38–2.60)
No	10,080	20.0	Ref
Work-related			
Felt overwhelmed by workload or family/work balance			
Yes	16,563	45.4	3.10 (2.91–3.30)
No	6,451	14.7	Ref
Felt disconnected from family and friends because of workload			
Yes	14,051	49.0	2.77 (2.64–2.91)
No	8,964	17.7	Ref
Felt inadequately compensated for work			
Yes	13,703	45.2	1.85 (1.78–1.93)
No	9,101	24.4	Ref
Felt unappreciated at work			
Yes	12,362	46.5	1.82 (1.76–1.90)
No	10,551	25.5	Ref
Experienced stigma or discrimination because of work			
Yes	5,962	56.2	1.88 (1.82–1.94)
No	16,944	29.9	Ref
Received job-related threats because of work			
Yes	2,699	61.8	1.85 (1.78–1.92)
No	20,262	33.4	Ref
Felt bullied, threatened, or harassed because of work			
Yes	5,376	59.0	1.97 (1.91–2.03)
No	17,594	30.0	Ref
Interacted often with the public			
Yes	11,143	41.1	1.23 (1.19–1.28)
No	13,318	33.3	Ref
Worried about workplace exposure to COVID-19			
Yes	11,197	42.6	1.36 (1.31–1.41)
No	11,805	31.3	Ref

Abbreviations: IES-6 = 6-item Impact of Event Scale; PR = prevalence ratio; PTSD = post-traumatic stress disorder; Ref = referent group.

* Referent group for all prevalence ratio calculations was not experiencing the traumatic event/stressor (i.e., “No” category).

† Experienced symptoms of post-traumatic stress disorder in the 2 weeks preceding survey, defined as having an IES-6 score ≥ 1.75 out of 4.

‡ Some categories might not sum to 26,174; only those respondents who completed IES-6 questions (N = 22,248) are included in analysis.

§ Positive COVID-19 test or diagnosis by medical professional.

** Had symptoms compatible with COVID-19 but not tested or test inconclusive.

Mental health among healthcare personnel during COVID-19 in Asia: A systematic review

- The COVID-19 pandemic has been associated with an insidious wave of psychological stress among healthcare personnel (HCP) in Asia. Mental exhaustion, burnout, fear, depression, anxiety, insomnia, and psychological stress among HCPs have intensified a daunting challenge during the COVID-19 pandemic. The consequences of such stress may negatively impact patient and HCP safety.
- Methods of mitigating stress: Recognition of staff efforts, access to psychological interventions, increased support and stay connected from family and friends (avoid isolation), encouragement among peers, staff “buddy” system, self-care and sufficient rest and time off, training to deal with identification of and responses to psychological problems, and opportunities for reflection on the effects of stress and ask for help

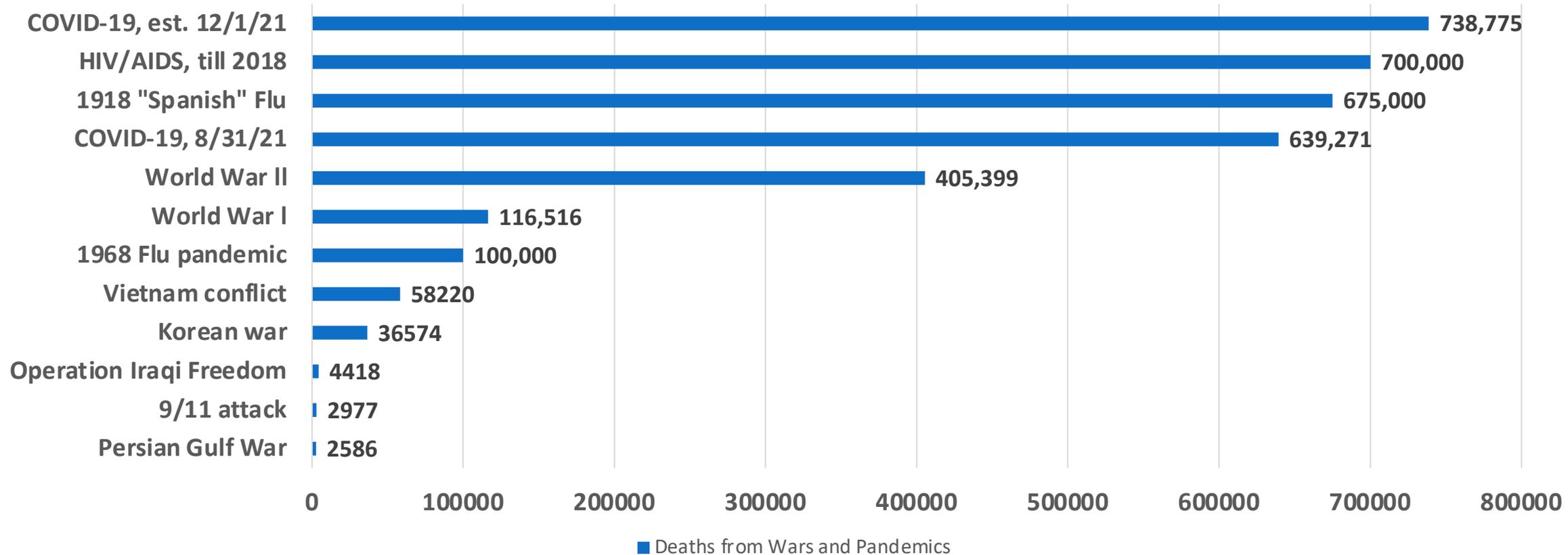
Table 2 Type and risk factors for mental health status disorders among Chinese and non-Chinese healthcare personnel (HCP).

	Depression	Anxiety	Insomnia	Fear	Risk factors
Chinese HCP	27.8% (9519/34,229)	25.9% (5307/20,456)	35.0% (2072/5919)	70.6% (1623/2299)	Frontline HCP, female, older age, nurse, divorced, direct contact treating infected patients, worked for fewer years, longer daily work time.
non-Chinese HCP	23.0% (1098/4785)	12.5% (395/3172)	Not available	91.2% (538/590)	Younger age, female, divorced, lower income, fewer knowledge about COVID-19

NOTE: The number represent pooled mean (total cases/total number of HCP); HCP = healthcare personnel.

DEATHS FROM COVID-19 AND OTHER PANDEMICS AND WARS, US

Deaths from Wars and Pandemics



THE COVID-19 PANDEMIC: LOOKING BACK AND LOOKING FORWARD

Missteps and Misinformation in US Pandemic Response

- Lack of a centralized, coordinated Federal response
- Executive Branch consistently minimized and trivialized risk of COVID-19
- US Public Health infrastructure woefully inadequate
- Slow development and scale-up of rapid, accurate, and widely available testing
- Inaccurate initial assumptions about transmission: Failure to focus on aerosol transmission; failure to recognize the importance of asymptomatic and pre-symptomatic spread
- Inadequate stockpiles of PPE and failure to rapidly ramp up production
- Initial failure to recommend masking by the public as a mitigation strategy
- Failure to initially focus on transmission in nursing homes

Major Remaining Pandemic Concerns

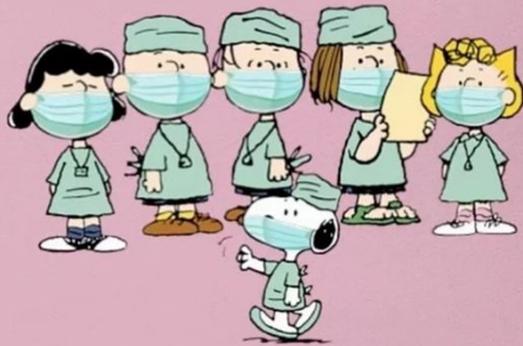
- Science denialism
- Politicization of pandemic response
- Vaccine hesitancy and resistance
- Vaccinations for children
- Evolution and spread of more highly transmissible and/or virulent variants
- Post-COVID-19 clinical issues
- Lack of public support for public health interventions (e.g., mask mandates) if /when another wave or new agent arrives
- Need for recurring boosters
- Unanticipated challenges
- Pandemic fatigue

A SUGGESTION FOR ALL THOSE MEDALS THE OLYMPICS WON'T BE NEEDING THIS YEAR...



STAR TRIBUNE

To All The Wonderful
Healthcare Workers



Thank You! Thank you!
THANK YOU!



from an original by Theo Moudakis



CHARLOTTE OBSERVER
© 2020