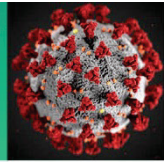


COVID-19 Science Update



From the Office of the Chief Medical Officer, CDC COVID-19 Response, and the CDC Library, Atlanta, GA.
Intended for use by public health professionals responding to the COVID-19 pandemic.

*** Available on-line at <https://www.cdc.gov/library/covid19> ***

Section headings in the COVID-19 Science Update have been changed to align with the [CDC Science Agenda for COVID-19](#).

Detection, Burden, and Impact

PEER-REVIEWED

[Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA](#). Taquet *et al.* *Lancet Psychiatry* (November 9, 2020).

Key findings:

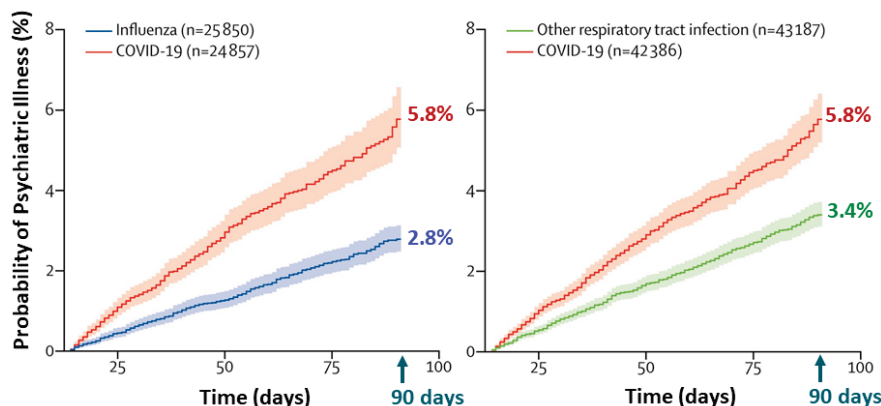
- In patients with no history of psychiatric disorders, the probability of a first psychiatric disorder diagnosed during a window period up to 90 days following a COVID-19 diagnosis was higher (5.8%, 95% CI 5.2%–6.4%) than among patients presenting with flu (2.8%, 95% CI 2.5%–3.1%) or other respiratory infections (3.4%, 95% CI 3.1%–3.7%) (Figure).
- Patients diagnosed with a psychiatric disorder in the previous year had a higher incidence of COVID-19 diagnosis than patients without a past psychiatric diagnosis (RR 1.65, 95% CI 1.59–1.71).

Methods: Data from 62,354 COVID-19 patients diagnosed between January 20 and August 1, 2020 and patients presenting with other medical conditions, including influenza and other respiratory tract infections, were compared regarding incidence of psychiatric disorders during days 14–90 following COVID-19 diagnosis.

Limitations: Potential for other confounding factors not included in the analyses.

Implications: The authors suggest that clinicians caring for COVID-19 patients over time be on the lookout for new onset psychiatric disorders, even in patients with no previous psychiatric diagnoses. Along with the findings of [Yang *et al.*](#) (commented on by [Smith and Gradus](#)), these studies underscore the need for surveillance and care of populations with pre-existing psychiatric disorders during the COVID-19 pandemic.

Figure:



Note: Adapted from Taquet *et al.* Onset of first psychiatric diagnoses after **COVID-19** diagnosis compared with **influenza** and **other respiratory tract infections**. Shaded areas represent 95% CIs. The number of subjects within each cohort corresponds to all who did not have the outcome before the follow-up period. Licensed under CC-BY.

SARS-CoV-2 Reactivity in Pre-Pandemic Specimens and Uninfected Persons

Antibodies provide protection from infection. Serosurveys for the presence of antibodies can be used as a tool to assess previous exposure to SARS-CoV-2 within a population. Antibodies generated in persons exposed to seasonal coronaviruses before the pandemic might offer a level of protection to SARS-CoV-2. However, the presence of these antibodies could make it difficult to interpret population-based serosurveys designed to assess SARS-CoV-2 exposure. Below are three articles that examine potential cross-reactivity between antibodies to SARS-CoV-2 and seasonal coronaviruses.

PEER-REVIEWED

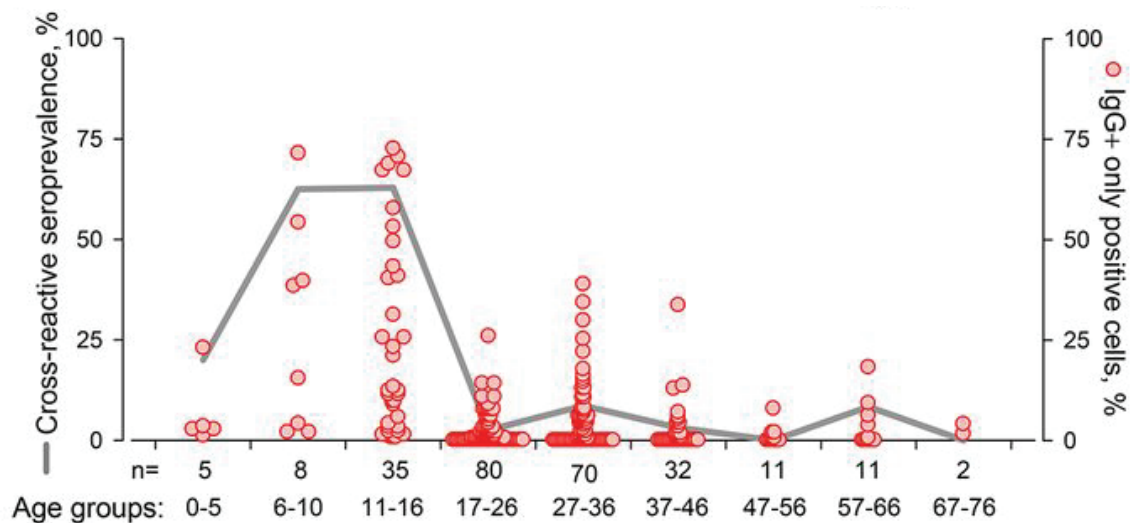
A. [Preexisting and de novo humoral immunity to SARS-CoV-2 in humans](#). Ng *et al.* Science (November 6, 2020).

Key findings:

- SARS-CoV-2 IgG antibodies were detected in persons presumed uninfected with SARS-CoV-2 (Figure 1):
 - 16 (5.3%) of 302 archived specimens from adults.
 - 21 (43.8%) of 48 archived specimens from 1–16-year-olds.
- Unlike samples from SARS-CoV-2-uninfected persons which only had IgG, sera from infected persons was also positive for IgM and IgA.
 - Neutralizing activity was comparable in both groups (Figure 2).

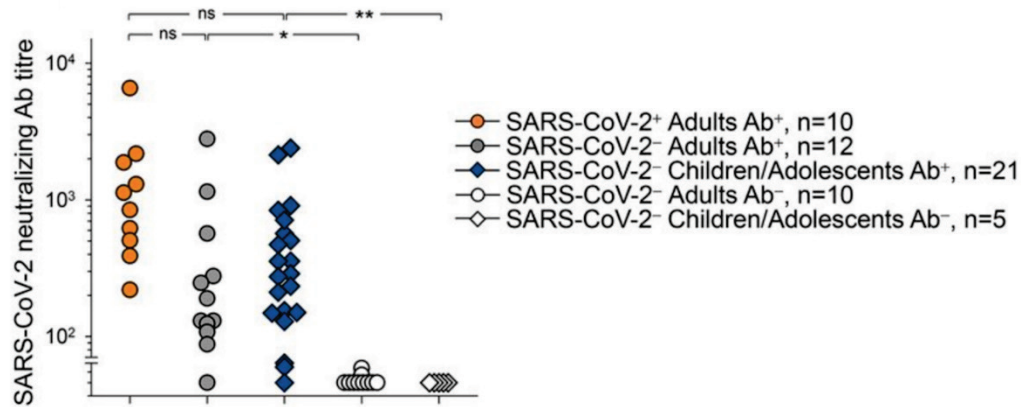
Methods: SARS-CoV-2 spike protein was expressed on cell lines and incubated with sera from 170 COVID-19 patients, archived specimens collected during 2011-2018 from 302 SARS-CoV-2-uninfected adults and 48 SARS-CoV-2-uninfected children and adolescents in the UK. Antibody binding to spike protein and ability of patient sera to neutralize SARS-CoV-2 was assessed. **Limitations:** Small sample size and limited generalizability.

Figure 1



Note: Adapted from Ng *et al.* Prevalence of SARS-CoV-2 S antibodies in age groups (line) and frequency of cells expressing spike protein that stained with IgG (open circles) in samples for which the date of birth was known. Licensed under CC BY.

Figure 2



Note: Adapted from Ng *et al.* Neutralizing antibody (Ab) titer for adults or children stratified by SARS-CoV-2 infection and Ab status. *p = 0.037. ** p = 0.014. ns, not significant. Licensed under CC BY.

B. High prevalence of pre-existing serological cross-reactivity against SARS-CoV-2 in sub-Saharan Africa.

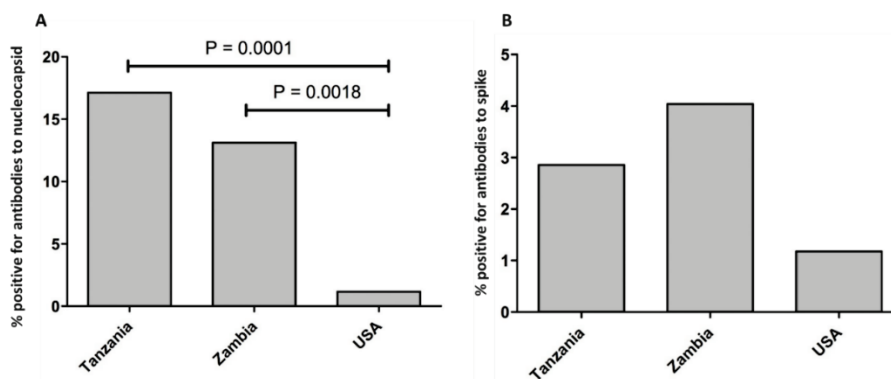
Tso *et al.* International Journal of Infectious Diseases (November 7, 2020).

Key findings:

- There was a higher prevalence of serological cross-reactivity against SARS-CoV-2 in pre-pandemic samples from Tanzania (19%, p = 0.0002) or Zambia (14.1%, p = 0.0069) compared with the US (2.4%).
- The prevalence of anti-SARS-CoV-2 nucleocapsid protein was significantly higher in pre-pandemic Tanzanian (17%, p= 0.0001) and Zambian (13.1%, p = 0.0018) samples compared to samples from the US (1.2%) (Figure).
 - There was no difference in the prevalence of anti-SARS-CoV-2 spike protein antibodies among countries (Figure).
- Most cross-reactive samples strongly reacted to the nucleocapsid proteins of the alphacoronaviruses HCoV-NL63 and HCoV-229E (92% and 50%, respectively).

Methods: A total of 289 pre-COVID-19 pandemic blood donor plasma samples from Tanzania, Zambia, and the US, collected between 2005 and 2019, were examined for cross-reactivity against the spike and nucleocapsid proteins of SARS-CoV-2 and other human coronaviruses (SARS, MERS, HCoVOC43, HCoV-HKU-1, HCoV-NL63 and HCoV-229E). **Limitations:** Small sample size.

Figure:



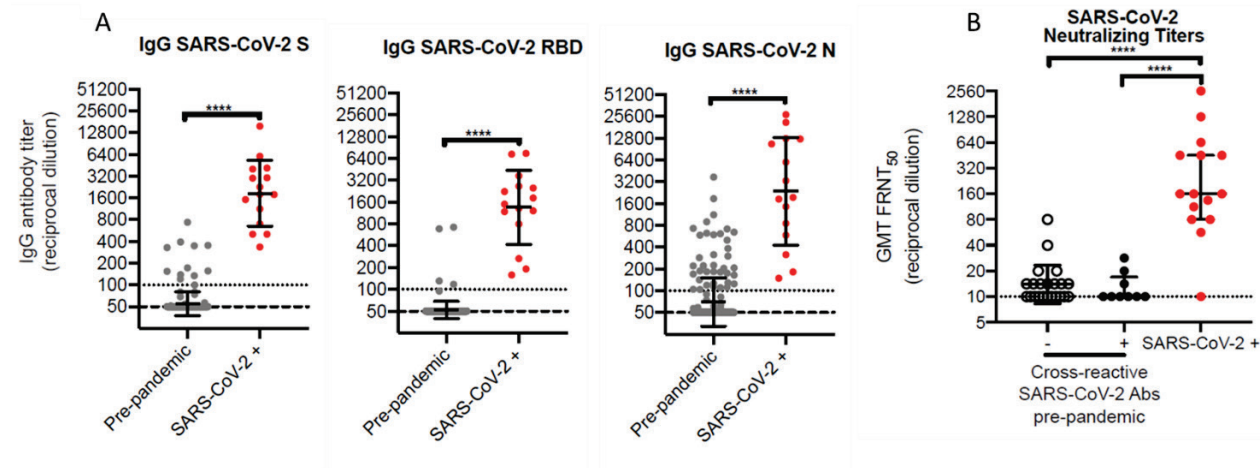
Note: Adapted from Tso *et al.* Prevalence of cross-reactivity against SARS-CoV-2 in Tanzanian, Zambian and US samples. **A:** Percent antibody positive against SARS-CoV-2 nucleocapsid protein. **B:** Percent antibody positive against SARS-CoV-2 spike protein. Licensed under CC-BY-NC-ND.

PREPRINTS (NOT PEER-REVIEWED)

C. Seasonal human coronavirus antibodies are boosted upon SARS-CoV-2 infection but not associated with protection. Anderson *et al.* medRxiv (November 10, 2020).**Key findings:**

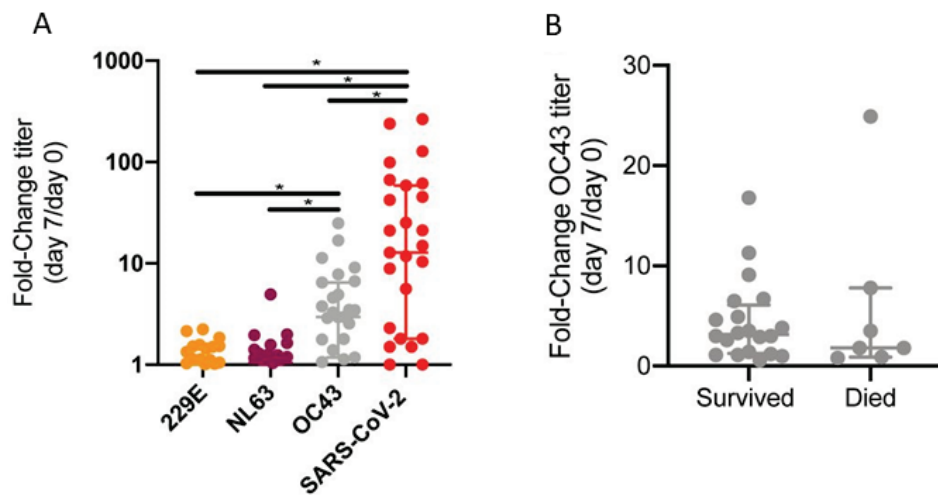
- Of 204 pre-pandemic specimens, 11 (5.4%) had IgG against SARS-CoV-2 spike (S) protein, 4 (2.0%) against S receptor binding domain (S-RBD) and 38 (18.6%) against nucleocapsid (N) protein (Figure 1A).
 - IgG levels in pre-pandemic sera were lower compared with sera from SARS-CoV-2-infected individuals (Figure 1A).
 - Pre-pandemic sera did not neutralize SARS-CoV-2 *in vitro* (Figure 1B).
- There was no difference in SARS-CoV-2- or seasonal betacoronavirus OC43-specific antibodies in archived sera samples from individuals who did or did not subsequently become infected with SARS-CoV-2.
- There was an increase in IgG reactive to the S protein of OC43 and SARS-CoV-2, but not seasonal alphacoronaviruses 229E or NL63, in 27 COVID-19 patients during hospitalization ($p < 0.0001$), but this was not associated with survival ($p < 0.04$) (Figure 2).

Methods: Antibody titers to SARS-CoV-2 and seasonal coronaviruses were measured in 204 specimens collected in 2017, in pre-pandemic specimens from 251 individuals who later became infected with SARS-CoV-2, 251 controls who did not become infected, and 27 hospitalized COVID-19 patients. Antibody titers in pre-pandemic serum samples were compared with those from a subset of individuals who did and did not have a subsequent positive PCR test for SARS-CoV-2. **Limitations:** Small sample size.

Figure 1

Note: Adapted from Anderson *et al.* **A:** IgG antibody titer from **pre-pandemic sera** or from **SARS-CoV-2-positive individuals** for S, S-RBD, or N proteins (right to left). **B:** Serum dilution at which SARS-CoV-2 neutralization is detected for antibody-negative pre-pandemic sera (open circles), antibody-positive pre-pandemic sera (closed circles) or sera from **SARS-CoV-2-positive individuals**. Dashed line, lower limit of detection. **** $p < 0.0001$. GMT FRNT, geometric mean titer focus reduction neutralization titer. Ab, antibody. S, Spike protein. N, nucleocapsid protein. RBD, receptor binding domain. Licensed under CC-BY-NC-ND.

Figure 2



Note: Adapted from Anderson *et al.* **A:** Fold change in IgG titer against S protein from seasonal human coronaviruses **229E**, **NL63**, and **OC43**, and **SARS-CoV-2** from Day 0 to Day 7 after hospitalization (* $p < 0.04$). **B:** Fold change in OC43 S-reactive antibodies in patients who survived or died by day 28 of hospitalization. Horizontal line, mean. Whisker bars, standard deviation. Licensed under CC-BY-NC-ND.

Implications for three studies (Ng *et al.*, Tso *et al.* & Anderson *et al.*): Antibodies to SARS-CoV-2 proteins are not uncommon in pre-pandemic samples, suggesting cross-reactivity from prior infection with seasonal coronaviruses. Ng *et al.* saw high pre-existing SARS-CoV-2 antibodies in children/adolescents with neutralizing activity, whereas Anderson *et al.* did not and showed 2 lines of evidence suggesting no impact of pre-existing immunity on SARS-CoV-2 infection or outcomes. The biological implications of these findings regarding existing protective immunity to SARS-CoV-2 infection remains unclear. Cross-reactivity needs to be considered in designing and conducting serosurveys to assess the extent of SARS-CoV-2 infection in a population.

T Cell Responses to SARS-CoV-2

T cells potentially provide long-lived immunity in the absence of antibody responses. In the presence of SARS-CoV-2 infection, T cell responses are dependent on recognition of short viral peptides bound to human proteins known as HLA antigens on the surface of infected cells. Responses are most effective if there is broad recognition of multiple pathogen peptides. The great diversity of HLA types within individuals and populations may result in large variation and potential gaps in T cell-mediated immune responses. Following are two papers detailing T cell responses to SARS-CoV-2.

PEER-REVIEWED

[Characterization of pre-existing and induced SARS-CoV-2-specific CD8⁺ T cells.](#) Schulien *et al.* Nature Medicine (November 12, 2020).

Key findings:

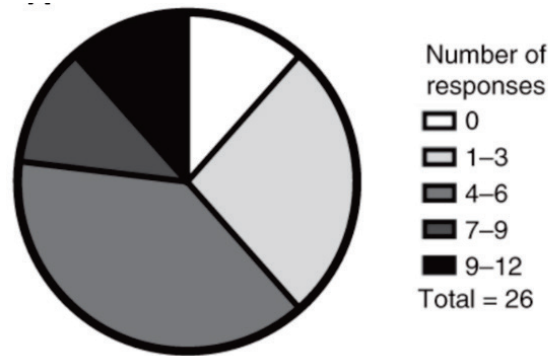
- SARS-CoV-2-reactive CD8⁺ T cells were seen in specimens from 23 (88.5%) of 26 convalescent COVID-19 patients.
 - Reactivity to >4 peptides was seen in most individuals and peptides bound many of the most common human leukocyte antigen (HLA) types (Figure 1).

- 8 of 23 patients with SARS-CoV-2-reactive CD8⁺ T cells were negative for antibody to viral nucleocapsid (N) and spike proteins.
- 5 (50%) of 10 pre-pandemic blood cell specimens from donors likely exposed to seasonal coronaviruses had SARS-CoV-2-reactive-CD8⁺ T cells.
 - The frequency of SARS-CoV-2-reactive CD8⁺ T cells in pre-pandemic specimens was approximately 10-fold lower than in specimens from SARS-CoV-2 convalescent patients (Figure 2).

Methods: Blood cells from 26 convalescent COVID-19 patients and from 10 pre-pandemic donors likely exposed to seasonal coronaviruses were tested to detect SARS-CoV-2-specific CD8⁺ T cells. *Limitations:* Small sample size; pre-pandemic specimens not broadly representative of population.

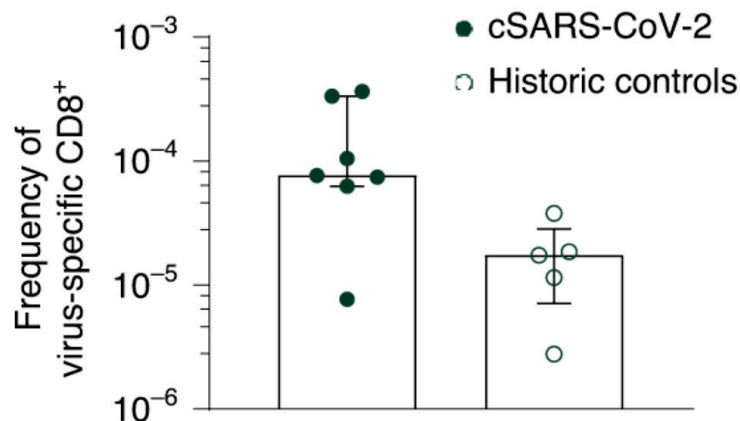
Implications: As summarized in [Karlsson et al.](#), T cells play an important role in the immune response. Pre-existing CD8⁺ T cells that recognize SARS-CoV-2 may be a result of cross-reactivity from prior seasonal coronavirus infections. The level of protective immunity afforded by this pre-existing response needs to be determined.

Figure 1



Note: Adapted from Schulien *et al.* Pie chart illustrating the number of viral peptides recognized per tested individual. Permission request in process.

Figure 2



PREPRINTS (NOT PEER-REVIEWED)

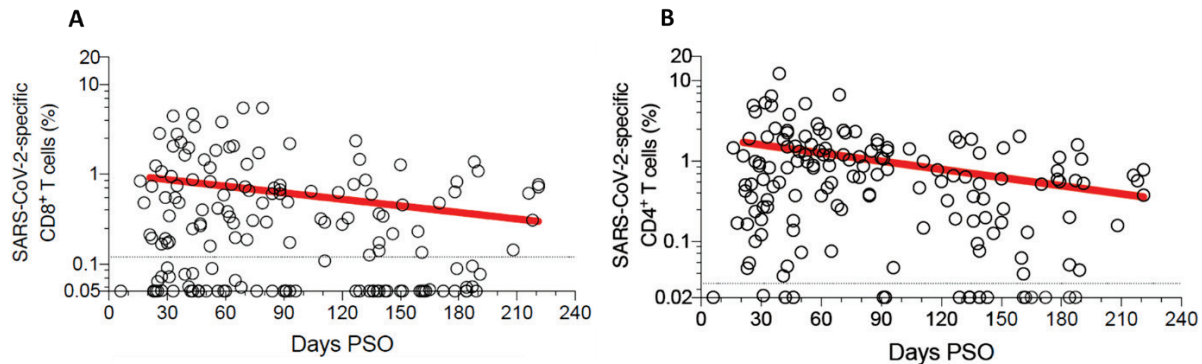
[Immunological memory to SARS-CoV-2 assessed for greater than six months after infection.](#) Dan *et al.* bioRxiv (November 16, 2020).

Key findings:

- Antibodies against SARS-CoV-2 and virus neutralization were detected in samples from COVID-19 patients up to 6 months post-symptom onset (PSO), although antibody levels decreased over time.
- Memory B cells were detected in most patients for up to 6 months PSO.
- 61% (30/49) of patients had detectable circulating SARS-CoV-2 memory CD8⁺ T cells 20-50 days PSO compared with 50% (9/18) at >6 months PSO (Figure).
 - SARS-CoV-2 CD8⁺ T cells declined with an estimated half-life of 166 days.
- 94% (46/49) of patients had SARS-CoV-2 memory CD4⁺ T cells at 20-50 days PSO compared with 89% (16/18) at >6 months PSO (Figure).
 - SARS-CoV-2 memory CD4⁺ T cells declined with an estimated half-life of 96 days.

Methods: Blood samples from 185 individuals with COVID-19 obtained 6 and 240 days PSO were tested for SARS-CoV-2 antibodies and neutralization and evaluated for percentage of SARS-CoV-2-specific CD8⁺ T cells and CD4⁺ T cells. **Limitations:** Measurement at three time points is optimal to understand long-term kinetics of SARS-CoV-2 immune responses, however there was only one sample per patient studied.

Implications: CD8⁺ and CD4⁺ T cells specific for SARS-CoV-2 are generally long-lived, for well over six months, although fewer patients had detectable CD8⁺ T cells compared with CD4⁺ T cells.

Figure

Note: Adapted from Dan *et al.* The percent of CD8⁺ (A) or CD4⁺ (B) T cells binding to SARS-CoV-2 peptides in blood from COVID-19 patients at the indicated days post-symptom onset with **red lines**. Used by permission from author.

Transmission

PEER-REVIEWED

[Secondary attack rate and family clustering of SARS-CoV-2 infection in children of healthcare workers with confirmed COVID-19.](#) Ladhani *et al.* Clinical Infectious Diseases (November 17, 2020).

Key findings:

- Among 126 families of healthcare workers, 21 families (16.7%) reported at least one parent who developed COVID-19 symptoms and tested positive for SARS-CoV-2.
 - Among these 21 families, nine (42.9%) had a least one child positive for SARS-CoV-2 IgG and in these nine families, 20 (95%) of 21 total children were seropositive.
 - The healthcare worker parent was considered the likely index case in all households (based on symptom onset).
- There was no difference in size, ethnicity, source of infection, degree of self-isolation by index case among families with and without seropositive children.
- Estimated overall secondary attack rate was 36.2% (95% CI 9.0%-63.4%).

Methods: 126 healthcare workers and their family members were surveyed. Healthcare workers were tested by RT-PCR and children were tested for IgG. Clustering of cases was assessed using random effects logistic regression with household as random effect. **Limitations:** Retrospective parental recall of self-isolation practices and children's symptoms; potential misclassification of asymptomatic index cases.

Implications: Strong evidence of familial clustering of SARS-CoV-2 infection in children of healthcare workers with confirmed COVID-19 supports household transmission, with a small proportion of cases responsible for most secondary transmission.

[SARS-CoV-2 transmission between mink \(*Neovison vison*\) and humans, Denmark.](#) Hammer *et al.* Emerging Infectious Diseases (November 18, 2020).

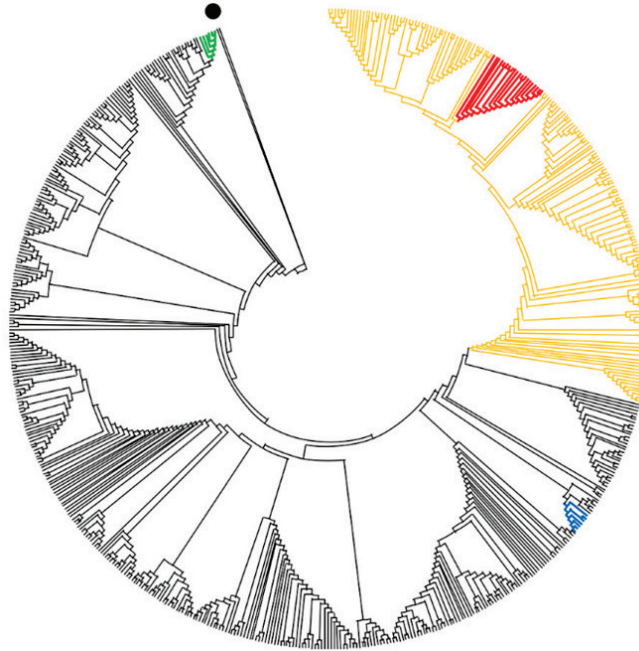
Key findings:

- Seroprevalence among minks during an initial farm visit was 97% (29/30) on farm 1, 3% (1/30) on farm 2, and 67% (20/30) on farm 3. On a follow-up visit 12 days later, seroprevalence on farm 2 was >95%.
 - Mink infections occurred with little clinical disease or death.
- Evidence of linkage between mink and human infections on these farms included:
 - Viral sequences from infected minks and nine humans were closely grouped (Figure).
 - Two viral gene mutations found in linked mink and human cases were not seen in humans prior to June 10, 2020 but were present in >40% of human sequences from the area around the farms from June 10 to July 1, 2020.

Methods: SARS-CoV-2 RNA was assayed from minks and nine human workers at three farms in Denmark between June and July 2020. Thirty adult minks were sampled at each farm at two separate visits to each farm. Positive RNA samples were sequenced, and phylogenetic analysis was performed. Mink serum samples were analyzed for SARS-CoV-2 antibody. **Limitations:** Small sample size; directionality of transmission difficult to establish.

Implications: SARS-CoV-2 can spread rapidly and may be undetected among minks, making mink farms a potential threat to farm workers and persons in surrounding communities. Direct evidence of SARS-CoV-2 transmission from minks to humans is still not definitively shown.

Figure:



Note: Adapted from Hammer *et al.* Global phylogenetic tree showing relationship between genome sequences of SARS-CoV-2 from **minks and humans at 3 mink farms in Denmark, June-July 2020**, and selected full-length genome sequences. Black dot, Wuhan reference sequence NC_045512.2. Genomic sequences from mink farms **NB02, NB01, NB03, NB04** in the Netherlands. European clade **20B**. Open access journal; all content freely available.

Natural History of SARS-CoV-2 Infection

PEER-REVIEWED

[SARS-CoV-2 clinical syndromes and predictors of disease severity in hospitalized children and youth.](#)

Fernandes *et al.* Journal of Pediatrics (November 14, 2020).

Key findings:

- 143 (51%) of 281 hospitalized pediatric patients presented with respiratory disease; multisystem inflammatory syndrome in children (MIS-C) occurred in 69 (25%).
 - 95% of patients recovered and were discharged; all deaths occurred in patients with respiratory disease.
- Obesity (adjusted [a]OR 3.39, 95% CI 1.26-9.10, $p = 0.02$), hypoxia (aOR 4.01, 95% CI 1.14-14.15, $p = 0.03$), and bilateral infiltrates on chest radiograph (aOR 3.69, 95% CI 1.46-9.32, $p = 0.006$) on admission were predictive of severe respiratory disease.
- Lower absolute lymphocyte count (OR 8.33, 95% CI 2.32-33.33, $p = 0.001$) and higher C-reactive protein (OR 1.06, 95% CI 1.01-1.12, $p = 0.017$) were predictive of severe MIS-C.
- Race/ethnicity or socioeconomic status were not predictive of disease severity.

Methods: A cohort study of 281 pediatric patients hospitalized between March 1 and May 22, 2020 with acute SARS-CoV-2 infection or MIS-C in New York, New Jersey, and Connecticut. Data were reviewed to identify characteristics on admission predictive of severe disease. **Limitations:** May not be generalizable.

Implications: Obesity, hypoxia, and bilateral infiltrates on chest radiograph on admission may serve as prognostic indicators of clinical decompensation.

Prevention, Mitigation and Intervention Strategies

PEER-REVIEWED

[Willingness to get the COVID-19 vaccine with and without emergency use authorization.](#) Guidry *et al.* American Journal of Infection Control (November 19, 2020).

Key findings:

- 21.3% of respondents were probably or definitely not planning to receive a COVID-19 vaccine approved under regular conditions, whereas 38.7% were probably or definitely unwilling to receive a vaccine approved under Emergency Use Authorization (EUA).
 - Concerns that vaccine development was rushed factored into hesitation to get the vaccine under EUA.
- Predictors of COVID-19 vaccine uptake intentions overall included high perceived susceptibility to COVID-19, high perceived benefits of the vaccine, and reporting few barriers to obtaining the vaccine.

Methods: A survey of 788 US adults during July 2020 about intention to vaccinate using a 6-point scale.

Limitations: No plans for follow-up to see how intentions translate into actions.

Implications: COVID-19 vaccine-related messages may need to address concerns about the vaccine itself, the EUA approval process, and reinforce benefits and safety of the vaccine.

[Safety, tolerability, and immunogenicity of an inactivated SARS-CoV-2 vaccine in healthy adults aged 18–59 years: a randomised, double-blind, placebo-controlled, phase 1/2 clinical trial.](#) Zhang *et al.* Lancet Infectious Diseases (November 17, 2020).

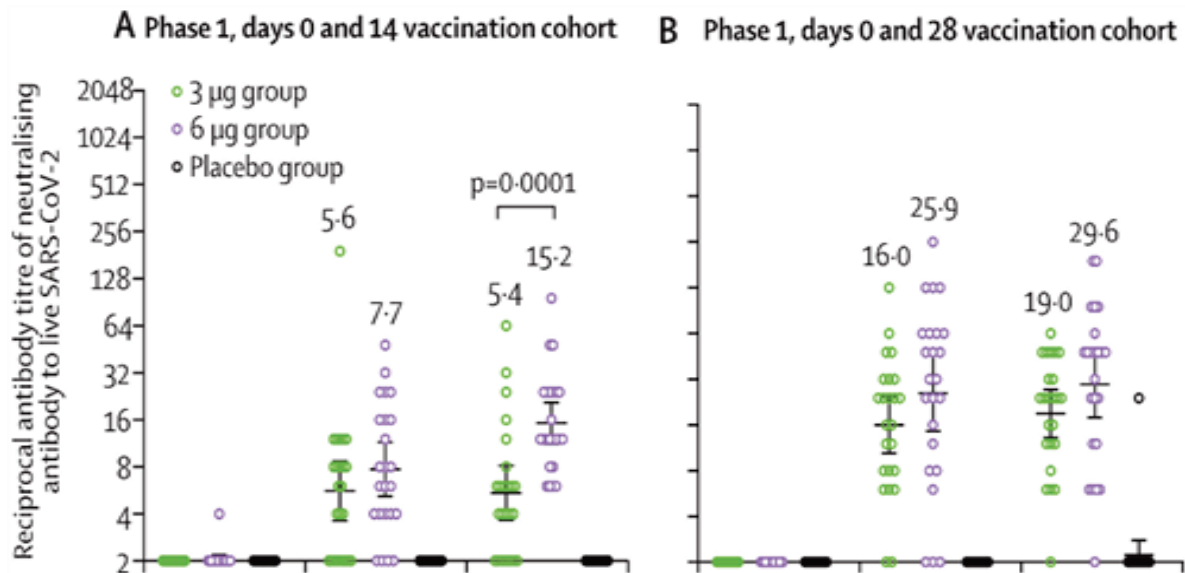
Key findings:

- A 3 µg dose vaccine had fewer adverse events (AEs) than a 6 µg dose:
 - In the 0 and 14 day vaccination cohort, 8% (2/24) of the placebo group, 29% (7/24) of 3 µg group, and 38% (9/24) of 6 µg group had AEs.
 - In the 0 and 28 day vaccination cohort, 13% (3/23) placebo group, 13% (3/24) of 3 µg group, and 17% (4/24) of 6 µg group had AEs.
 - The most common AE was injection site pain.
- SARS-CoV-2 neutralizing antibodies were detected at day 28 in: (Figure)
 - 18% (11/60) of the placebo group, 92% (109/118) of the 3 µg group, and 98% (117/119) of the 6 µg group for the 0 and 14 day vaccination cohort.
 - 0% (0/59) of the placebo group, 97% (114/117) of the 3 µg group, and 100% (118/118) of the 6 µg group for the 0 and 28 day vaccination cohort.
- Levels of virus neutralization and antibodies to SARS-CoV-2 receptor binding domain (RBD) were higher in the 6 µg group compared with 3 µg dose in all cohorts (Figure).

Methods: Randomized, double-blind, placebo-controlled Phase1/2 study of dosing regimens for the CoronaVac inactivated vaccine in adults aged 18–59 years in Jiangsu Province, China. Phase 1 (n = 142) examined AEs in groups given placebo, 3 µg, or 6 µg doses either 14 (0 and 14-day vaccination cohort) or 28 days (0 and 28 day vaccination cohort) after the initial dose. IgG and SARS-CoV-2 neutralization in the placebo, 3 µg, or 6 µg doses given 14 or 28 days apart were assessed in Phase 1 and Phase 2 (n = 600) participants. **Limitations:** Different processes were used to prepare the vaccines in phase 1 vs phase 2.

Implications: This study looked at inactivated coronavirus as a vaccine candidate and balancing AEs and immunogenicity, Phase 3 trials are using two doses of 3 µg given either 14 or 28 days apart.

Figure:



Note: Adapted from Zhang *et al.* Titers of neutralizing antibodies after 3 µg or 6 µg doses of CoronaVac or placebo given on days 0 and 14 and days 0 and 28 in the phase 1 trial. Error bars indicate 95% CI of the GMT and the spots indicate individual antibody titers, with GMT estimates above the spots. Only p values for significant differences are shown. GMT, geometric mean titer. Reprinted from The Lancet Infectious Diseases, Zhang *et al.*, Safety, tolerability, and immunogenicity of an inactivated SARS-CoV-2 vaccine in healthy adults aged 18–59 years: a randomised, double-blind, placebo-controlled, phase 1/2 clinical trial, Copyright 2020, with permission from Elsevier.

Health Disparities

PEER-REVIEWED

[A. Racial and ethnic differences in presentation and outcomes for patients hospitalized with COVID-19: Findings from the American Heart Association's COVID-19 cardiovascular disease registry.](#)

Rodriguez *et al.* *Circulation* (November 17, 2020).

Key findings:

- Among patients hospitalized with COVID-19, Black and Hispanic patients accounted for over 50% of hospitalizations and were significantly younger compared with non-Hispanic White patients.
- After adjusting for demographic and clinical characteristics, no racial/ethnic differences were observed for in-hospital mortality and major adverse cardiovascular events (MACE).
 - Asian patients had the highest COVID-19 cardiorespiratory severity (adjusted OR 1.48, 95% CI 1.16-1.90).

Methods: Retrospective observational study of 7,868 adult COVID-19 patients from the [American Heart Association COVID-19 Cardiovascular Disease Registry](#) treated in 88 hospitals in the US between January 17 and July 22, 2020. Demographic and clinical information were used to assess in-hospital all-cause mortality and MACE (composite of death, myocardial infarction, stroke, new onset heart failure, or cardiogenic shock and COVID-19 cardiorespiratory disease) adapted from [WHO ordinal outcomes scale](#). **Limitations:** Only hospitalized patients and overrepresentation of certain geographic locations; results not generalizable to overall US population.

B. Racial disparities in COVID-19 mortality are driven by unequal infection risks. Zelner *et al.* Clinical Infectious Diseases (November 21, 2020).

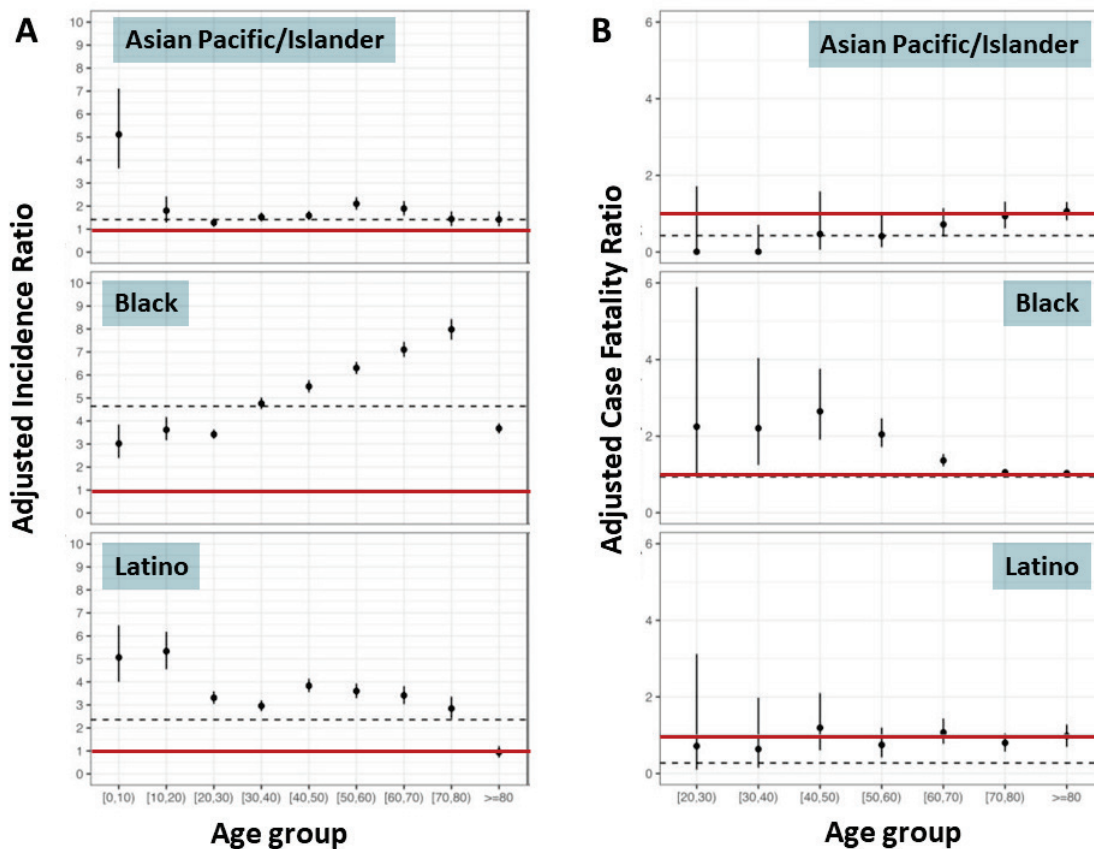
Key findings:

- The overall incidence rate ratios (IRR) for all racial and ethnic minority groups were significantly higher than for White persons.
 - This was most pronounced among older ages for Black persons and younger ages for Hispanic or Latino persons (Figure A).
- Black persons 30 to 70 years had higher case-fatality rates (CFRs) than White persons, with the largest disparity among those 40-49 years of age (Figure B).
 - There were no significant differences in age-specific CFRs for Hispanic or Latino persons and Asian/Pacific Islander persons compared with White persons.
- The higher mortality rate for Black persons was driven by higher rates of COVID-19 infection across all age groups, particularly among older adults, rather than age-specific variation in CFRs.

Methods: Retrospective analysis of 49,701 persons in Michigan with confirmed or probable SARS-CoV-2 infection between March 8 and July 5, 2020 to estimate age-specific incidence and mortality rates by race/ethnicity. Hierarchical Bayesian regression models were used to calculate IRRs, age-specific CFRs, and mortality disparities.

Limitations: Data from one state; asymptomatic and less-severe infections were not included.

Figure:



Note: Adapted from Zelner *et al.* **A:** Adjusted incidence ratios by age and race/ethnic group compared with incidence among White persons. **B:** Adjusted CFR by age and race/ethnic group compared with CFR among White persons. Dashed lines indicate the ratio of the crude overall rate for each group; the **solid red line** is the rate ratio of 1.0 (no association). Vertical lines, 95% posterior credible interval. CFR, case-fatality ratio. Licensed under CC-BY-NC-ND.

PREPRINTS (NOT PEER-REVIEWED)

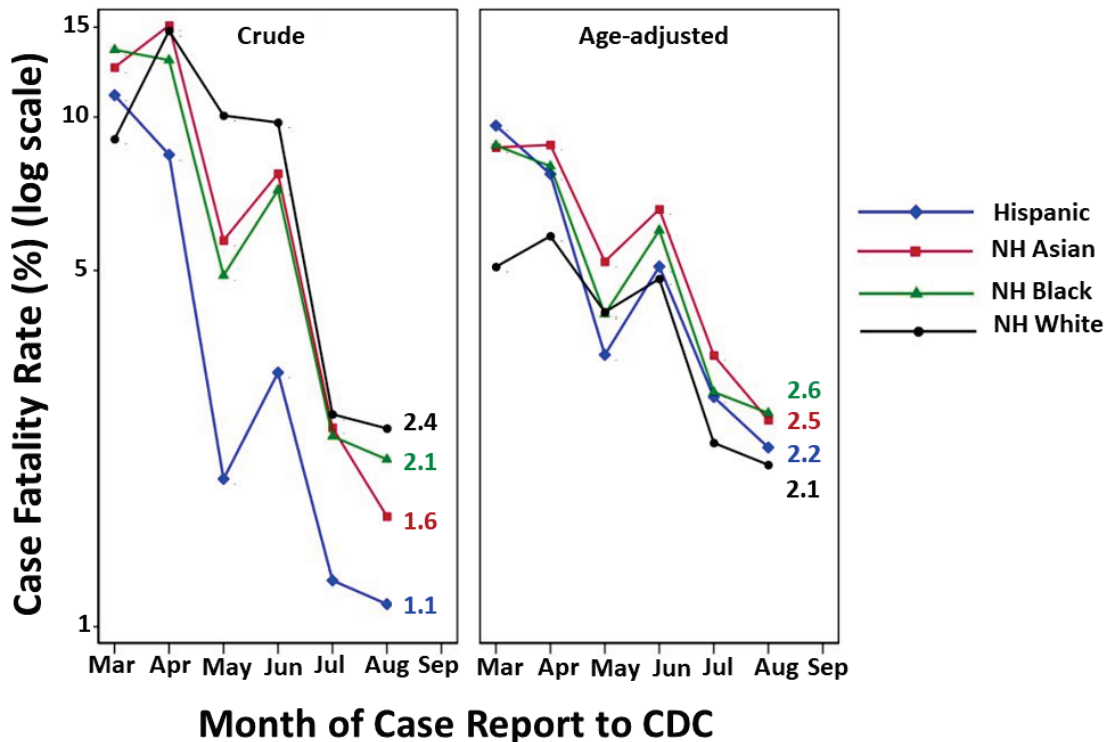
C. Deaths among COVID cases in the United States: Racial and ethnic disparities persist. Short Fabic *et al.* medRxiv (November 17, 2020).

Key findings:

- Crude and age-adjusted case fatality rates (CFRs) declined for all racial/ethnic groups from March to August, 2020 (Figure).
 - Non-Hispanic (NH) White patients had the lowest age-adjusted CFR (2.1%) and the NH Black patients had the highest (2.6%) age-adjusted CFRs (Figure).
 - For age-specific CFRs, NH Black patients had higher CFRs among patients 30-79 years of age and NH Asian patients had higher CFRs among patients 80 years and older.

Methods: Retrospective analysis using the [CDC COVID-9 case surveillance public use data](#) estimating monthly age-adjusted CFR by race/ethnicity between March 1 and August 31, 2020. A direct standardized age-adjusted CFR was used to compare by race/ethnicity. **Limitations:** Large proportion (41%) of race/ethnicity information was missing; no information on geographic variables.

Figure:



Note: Adapted from Short Fabic *et al.* Crude and age-adjusted monthly CFRs among COVID-19 cases by race/ethnicity. US Government work not subject to copyright.

Implications for three studies (Rodriguez *et al.*, Zelner *et al.* & Short Fabic *et al.*): Previous studies have shown racial/ethnic inequalities in health risk and outcome for various diseases in the US and this has been further exposed during the COVID-19 pandemic. These three studies show that although COVID-19 mortality has decreased overall, there is persistence in these disparities.

Social, Behavioral, and Communication Science

PEER-REVIEWED

[The effects of agency assignment and reference point on responses to COVID-19 messages.](#) Ma *et al.* Health Communication (November 16, 2020).

Key findings:

- Messages framed with SARS CoV-2 as an active agent, e.g., “The virus is likely to prey on more people...” led to more negative reactions than messages framed with humans in a more active role, e.g., “People are more likely to contract the virus...”
- Perceptions of threat or susceptibility to infection did not differ based on whether SARS-CoV-2 or humans were the active agent (“agency assignment”) in the message.

Methods: Participants (n = 207) were randomly assigned to receive one of four versions of a COVID-19 warning message during an online survey. Analyses were conducted to examine the effects of the message’s agency assignment (SARS-CoV-2 vs human) and reference point (self vs other) on risk perceptions associated with SARS-CoV-2, and responses to messages, e.g., perceived threats to freedom, anger, and counterarguing. *Limitations:* A single study using an online research sample that may not be representative of the general population.

Implications: There is a need for effective COVID-19 messages to educate people of the risks of infection and encourage them to follow COVID-19 guidance. Framing messages effectively may require careful development and testing to avoid triggering unintended negative reactions and to ensure the intended effects are achieved.

In Brief

Detection, Prevention and Response

- Park *et al.* [Application of testing-tracing-treatment strategy in response to the COVID-19 outbreak in Seoul, Korea.](#) Journal of Korean Medical Science. A robust public health response in the first 100 days of the COVID-19 pandemic was shown to increase the positive test rate, reduce reproduction number (R_0) and keep the fatality rate low.
- Niccolai *et al.* [Community Trace: Rapid establishment of a volunteer contact tracing program for COVID-19.](#) American Journal of Public Health. Describes successes and challenges faced in developing and implementing a volunteer contact tracing program to supplement state and local health departments.
- Basavaraju *et al.* [Serologic testing of US blood donations to identify SARS-CoV-2-reactive antibodies: December 2019-January 2020.](#) Clinical Infectious Diseases. SARS-CoV-2-reactive antibodies were detected in 106 archived serum specimens from routine donations from California, Oregon, and Washington as early as December 13, 2019.
- Karp *et al.* [A serological assay to detect SARS-CoV-2 antibodies in at-home collected finger-prick dried blood spots.](#) Scientific Reports. An at-home finger-prick dried blood spot collection method has demonstrated 100% sensitivity and specificity, which may be useful in pandemic monitoring and reduce sample collection burden for individuals and health care systems.

Transmission

- Yekta *et al.* [Food products as potential carriers of SARS-CoV-2.](#) Food Control. Reviews the risk of various food products as potential carriers of SARS-CoV-2 either via carry-through (e.g., meat from infected animals) or carry-over (e.g., spread by handling) contamination.

Natural History of SARS-Cov-2 Infection: Spectrum and Clinical Course

- Fiacchini *et al.* [Evaluation of the incidence and potential mechanisms of tracheal complications in patients with COVID-19](#). JAMA Otolaryngology–Head & Neck Surgery. Nearly half of patients with COVID-19 and with prolonged invasive mechanical ventilation suffered tracheal damage.
- Kennedy *et al.* [Delirium in older patients with COVID-19 presenting to the emergency department](#). JAMA. A high proportion (28%) of older patients with COVID-19 presented at emergency department with delirium, and in many cases (37%), exhibited no other typical COVID-19 symptoms.
- Watson *et al.* [COVID-19 and psychosis risk: Real or delusional concern?](#) Neuroscience Letters. Reviews 42 case reports of psychosis associated with COVID-19 and describes possible neurobiological and psychosocial mechanisms, as well as the numerous challenges in clearly identifying causal pathways.

Protection in Healthcare and Non-Healthcare Work Settings

- Zhang *et al.* [Electrospun ultrafine fibers for advanced face masks](#). Materials Science and Engineering. Presents an in-depth review of current face masks and respirators, including the filtering mechanism, structure, fabrication method, and filtering performance of ultrafine fibers.

Prevention, Mitigation, and Intervention Strategies: Vaccines

- Weintraub *et al.* [COVID-19 vaccine to vaccination: Why leaders must invest in delivery strategies now](#). Health Affairs. Applies lessons learned from past pandemics and vaccine campaigns to support successful COVID-19 vaccine delivery, including the need to invest in evidence-based strategies that generate demand, distribute vaccines, and verify coverage.
- Cyranoski D. [Why emergency COVID-vaccine approvals pose a dilemma for scientists](#). Nature. Describes research challenges to understanding long-term effects once a vaccine is granted emergency approval, such as safety, how long protection lasts, and whether it prevents infection or just the disease.

Disclaimer: The purpose of the CDC COVID-19 Science Update is to share public health articles with public health agencies and departments for informational and educational purposes. Materials listed in this Science Update are selected to provide awareness of relevant public health literature. A material's inclusion and the material itself provided here in full or in part, does not necessarily represent the views of the U.S. Department of Health and Human Services or the CDC, nor does it necessarily imply endorsement of methods or findings. While much of the COVID-19 literature is open access or otherwise freely available, it is the responsibility of the third-party user to determine whether any intellectual property rights govern the use of materials in this Science Update prior to use or distribution. Findings are based on research available at the time of this publication and may be subject to change.



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