**COVID-19 Bibliography**

March 6, 2021

compiled by S. Todd Stolp MD

**Airborne/aerosol transmission** 1

**Clinical Care** 3

**Communications** 6

**Contact Tracing** 8

**Epidemiology (Including the Great Barrington Declaration)** 9

**Ethics** 12

**Masking and Respirator Use** 13

**Mental Health** 16

**Occupational Health** 19

**Schools** 19

**Social/Physical Distancing and Transmissibility** 23

**Testing, Screening and Diagnosis** 27

**Treatment** 30

**Vaccine and Immunology** 34

**Vaccine Distribution and Demographics** 41

**Vaccines: Individual Products** 38

**Virology of SARS-CoV-2** 42

1. **Airborne/aerosol transmission**
2. Morawska, L., and Milton, D.K. (2020). It is time to address airborne transmission of COVID-

19. Clinical Infectious Diseases, ciaa939. Available: <https://doi.org/10.1093/cid/ciaa939> A commentary on the importance of recognizing the likelihood of airborne spread of SARS-CoV-2 distributed on line on 7/6/2020

1. Lindsle W.G. et al. Viable influenza A virus in airborne particles from human coughs. Journal of Occupational and Environmental Hygiene, 2015; 12: 107-113. Airborne transmission of influenza as a model for SARS-CoV-2
2. Xie, X., Li, Y., Chwang, A., Ho, P. & Seto, W. How far droplets can move in indoor environments--revisiting the Wells evaporation-falling curve. Indoor Air, 2007; 17: 211-225. <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1600-0668.2007.00469.x> Estimates of the distance travelled by exhaled droplets at different velocities before evaporation: normal breathing about 1 meter, coughing about 2 meters and sneezing about 6 meters
3. Morawska, L. et al. Size distribution and sites of origin of droplets expelled from the human respiratory tract during expiratory activities. Journal of Aerosol Science 2009; 40: 256-269. <https://doi.org/10.1016/j.jaerosci.2008.11.002> Similar to the previous study
4. Buonanno et al., PREPRINT Quantitative assessment of the risk of airborne transmission of SARS-CoV-2 infection: perspective and retrospective applications. medRxiv, 2020; doi: <https://doi.org/10.1101/2020.06.01.20118984> (accessed 6/23/2020). Preprint analysis: “…in order to guarantee an acceptable individual risk of 10-3 for exposed subjects in naturally ventilated indoor environments, the exposure time should be shorter than 20 min”
5. Miller, S. et al., Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event. medRxiv, 2020; doi: <https://doi.org/10.1101/2020.06.15.20132027> (accessed 23/06/2020) Analysis of the factors contributing to the Skagit Valley cluster
6. Tang, J. W.; Noakes, C. J.; Nielsen, P. V.; Eames, I.; Nicolle, A.; Li, Y.; Settles, G. S. Observing and Quantifying Airflows in the Infection Control of Aerosol- and Airborne-Transmitted Diseases: An Overview of Approaches. Journal of Hospital Infection 2011, 77 (3), 213–222. <https://doi.org/10.1016/j.jhin.2010.09.037> A look at hospital mitigations and the use of negative pressure rooms
7. Yu, I. T. et al. Evidence of airborne transmission of the severe acute respiratory syndrome virus. New England Journal of Medicine, 2004; 350, 1731-1739. <https://www.nejm.org/doi/full/10.1056/nejmoa032867> Interesting epi investigation of transmission of SARS-1 between buildings in a Hong Kong housing complex.
8. Shen, Y et al Community Outbreak Investigation of SARS-CoV-2 Transmission Among Bus Riders in Eastern China JAMA Internal Med Network Published online September 1, 2020 <https://doi.org/10.1001/jamainternmed.2020.5225> A cohort study of 128 people riding one of two buses provides additional evidence of airborne spread
9. Kang, M et al Probable Evidence of Fecal Aerosol Transmission of SARS-CoV-2 in a High Rise Building An Int Med September 1, 2020 <https://doi.org/10.7326/M20-0928> Epi study of three vertical aligned flats of 9 infected people in 3 families in a high rise building in China and a total of 11 flats in a high rise building were tested to determine likely vehicles of transmission, and potential for transmission via non-sealed trap drains hypothesized
10. Infection Prevention and Control of Epidemic-and Pandemic-prone Acute Respiratory Infections in Health Care. Geneva: World Health Organization; 2014 (available at

<https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf;jsessionid=41AA684FB64571CE8D8A453> WHO guidelines and definitions for contact, droplet, airborne and other forms of agent transmission

1. Stadnytskyi, A The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission Proc Natl Acad Sci U S A. 2020 Jun 2; 117(22): 11875–11877.

Published online 2020 May 13. <https://doi.org/10.1073/pnas.2006874117> A modeling study supporting the hypothesis that airborne droplets generated by normal speech are capable of transmitting COVID-19 disease

1. Fears AC, Klimstra WB, Duprex P, Weaver SC, Plante JA, Aguilar PV, et al. Persistence of Severe Acute Respiratory Syndrome Coronavirus 2 in Aerosol Suspensions. Emerg Infect Dis September 2020;26(9) <https://wwwnc.cdc.gov/eid/article/26/9/20-1806_article>

Viable, cultured SARS-Cov-2 was recovered after 16 hours from artificially produced aerosols

1. Cheng VC-C, Wong S-C, Chan VW-M, So SY-C, Chen JH-K, Yip CC-Y, et al. Air and environmental sampling for SARS-CoV-2 around hospitalized patients with coronavirus disease 2019 (COVID-19). Infect Control Hosp Epidemiol. 2020:1-32 <https://doi.org/10.1017/ice.2020.282> Testing of air samples and environmental samples in and around 6 patients in December 2019 (some with masks and some without) returned only 5% of environmental specimens positive and no positive air samples.
2. Santarpia JL, Rivera DN, Herrera V, Morwitzer MJ, Creager H, Santarpia GW, et al. Transmission potential of SARS-CoV-2 in viral shedding observed at the University of Nebraska Medical Center (pre-print). MedRxiv. June 3, 2020 <https://doi.org/10.1101/2020.03.23.20039446> Recovery of PCR-confirmed RNA from 72.4% of samples taken from surfaces and air in the rooms of 13 patients from the Diamond Princess Cruise Ship; SARS-Cov-2 viral was not definitively recovered from any Vero tissue cultures, so viability of the viral specimens is not confirmed. Highest concentration of viral RNA was from the HVAC intake grate.
3. Khanh, NC et al Transmission of Severe Acute Respiratory Syndrome Coronavirus 2 During Long Flight Volume 26, Number 11 November 2020 <https://wwwnc.cdc.gov/eid/article/26/11/20-3299-f1> An epi investigation into a cluster arising after a 10 hour flight.
4. A thorough video from the Wall Street Journal describing the importance of building ventilation to indoor air quality and viral transmission <https://www.wsj.com/video/ventilation-is-key-to-battling-covid-heres-why/EC6274D1-B4F0-40DF-A8EC-F9BDA7C5D1A1.html>
5. **Clinical Care**
6. Multisystem Inflammatory Syndrome of Children (MIS-C): CDC Tracking site <https://www.cdc.gov/mis-c/cases/index.html>
7. MMWR, Hospitalization Rates and Characteristics of Children Aged <18 YearsHospitalized with Laboratory-Confirmed COVID-19 —COVID-NET, 14 States, March 1–July 25, 2020; Vol 69, August 7, 2020 A review of 576 cases reported to the COVID-19-Associated Hospitalization Surveillance Network https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6932e3-H.pdf
8. MMWR, COVID-19–Associated Multisystem Inflammatory Syndrome in Children — United States, March–July 2020; Vol 69 August 11, 2020 (a Latent Class Analysis) A summary of 570 MIS-C cases reported to the CDC between March and July 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6932e2-H.pdf>
9. Sethuraman, N et al Interpreting Diagnostic Tests for SARS-CoV-2 JAMA. 2020;323(22):2249-2251. doi:10.1001/jama.2020.8259 Includes an excellent chart describing the time-dependent windows for various laboratory tests for SARS-Cov-2
10. Tartof, S et al Obesity and Mortality Among Patients Diagnosed With COVID-19: Results From an Integrated Health Care Organization Ann Int Med On-line August 13, 2020 <https://doi.org/10.7326/M20-3742> Strong correlation between COVID-19 case mortality and obesity established
11. Wilson, N et al Case-Fatality Risk Estimates for COVID-19 Calculated by Using a Lag Time for Fatality EID Vol 26, Number 6, June 2020 <https://wwwnc.cdc.gov/eid/article/26/6/20-0320_article> Case fatality estimates, including data on lag time from diagnosis to death in China
12. Fifi, J COVID-19 related stroke in young individuals Lancet Vol 19 September 2020 <https://www.thelancet.com/action/showPdf?pii=S1474-4422%2820%2930272-6> More suggestion of angiopathic consequences of COVID-19
13. Martines, R et al Pathology and Pathogenesis of SARS-CoV-2 Associated with Fatal Coronavirus Disease, United States EID Vol. 26 No. 9 <https://wwwnc.cdc.gov/eid/article/26/9/20-2095_article?deliveryName=USCDC_353-DM35825> A thorough look at the pathophysiology of COVID-19
14. Killerby ME, Link-Gelles R, Haight SC, et al. Characteristics Associated with Hospitalization Among Patients with COVID-19 — Metropolitan Atlanta, Georgia, March–April 2020. MMWR Morb Mortal Wkly Rep 2020;69:790–794. DOI: <http://dx.doi.org/10.15585/mmwr.mm6925e1> A summary of comorbidities associated with hospitalization for COVID-19
15. Lucas, C et al Longitudinal analyses reveal immunological misfiring in severe COVID-19 Nature, Vol. 584 Issue 7821 463-469 <https://doi.org/10.1038/s41586-020-2588-y> A look at stratifying COVID-19 patients according to inflammatory markers and cytokines (IFNs α/γ/λ, TNFα, interleukins, etc…) to identify patients at risk of severe disease
16. Puelles, V.G. Multiorgan and Renal Tropism of SARS-CoV-2 NEJM 383;6 590-592 August 6, 2020 <https://www.nejm.org/doi/pdf/10.1056/NEJMc2011400> Multiorgan involvement in the pathophysiology of COVID-19
17. Ackermann, M Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19

N Engl J Med 2020; 383:120-128 July 9, 2020 <https://doi.org/10.1056/NEJMoa2015432> Angiopathy described

1. van der Made, C et al Presence of Genetic Variants Among Young Men With Severe COVID-19 JAMA Vol. 324 No. 7 663-673 <https://doi.org/10.1001/jama.2020.13719> Interesting study of two pairs of male twins suffering severe COVID-19 with X-chromosomal mutations related to the functions of Interferon I and II
2. Henderson, W et al , Does prone positioning improve oxygenation and reduce mortality in patients with acute respiratory distress syndrome? Can Respir J. 2014 Jul-Aug; 21(4): 213–215. <https://doi.org/10.1155/2014/472136> Support for the prone position in managing ARDS
3. Delahoy, MJ et al Characteristics and Maternal and Birth Outcomes of Hospitalized Pregnant Women with Laboratory-Confirmed COVID-19 — COVID-NET, 13 States, March 1–August 22, 2020 Vol. 69 September 16, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6938e1-H.pdf> Unsurprising risk factors for hospitalization for COVID-19 during pregnancy included obesity and gestational diabetes
4. Thapa, S et al Clinical Outcomes of In-Hospital Cardiac Arrest in COVID-19 JAMA Int Med Research Letter September 28, 2020 <https://doi.org/10.1001/jamainternmed.2020.4796> Of 54 in-hospital cardiac arrests in COVID-19 patients there was a 2.9% 30 day survival and none of the patients survived to hospital discharge
5. Alexander, GC et al mary Care Office-Based vs Telemedicine Care Visits During the COVID-19 Pandemic in the US . 2020; 3(10):e2021476. <https://doi.org/10.1001/jamanetworkopen.2020.21476> High use of telemedicine during the first two quarters of the 2020 COVID-19 outbreak in California. The percent of visits done via telemedicine were nearly the same for white and black individuals.
6. Ellul, MA et al Neurological associations of COVID-19 The Lancet Vol. 19 Is. 9, July 02, 2020 [https://doi.org/10.1016/S1474-4422(20)30221-0](https://doi.org/10.1016/S1474-4422%2820%2930221-0) A look at the list of recognized neurological conditions associated with COVID-19 infection
7. Patel, A et al New-onset anosmia and ageusia in adult patients diagnosed with SARS-CoV-2 infection Clin Microbiol Infect. 2020 Sep; 26(9): 1236–1241. <https://doi.org/10.1016/j.cmi.2020.05.026> Recommends anosmia and ageusia be used in self-isolation protocols, with over half of their 141 confirmed cases reporting either one or both symptoms
8. Marr KA, Platt A, Tornheim JA, Zhang SX, Datta K, Cardozo C, et al. Aspergillosis complicating severe coronavirus disease. Emerg Infect Dis. 2021 Jan [Oct 21, 2020]. <https://doi.org/10.3201/eid2701.202896> A syndrome described of Coronavirus-associated pulmonary Aspergillosis with risk factors including immunosuppression, hypertension, inhaled or systemic corticosteroids
9. Gupta, S et al Association Between Early Treatment With Tocilizumab and Mortality Among Critically Ill Patients With COVID-19 JAMA Int Med October 20,2020 <https://doi.org/10.1001/jamainternmed.2020.6252> Modest benefit in a non-randomized study of 433 patients out of 3924 treated with tocilizumab, a monoclonal antibody interleukin-6 receptor blocker, with Hazard Ratio of 0.71
10. Lavery, A et al Characteristics of Hospitalized COVID-19 Patients Discharged and Experiencing Same-Hospital Readmission — United States, March–August 2020 MMWR Vol 69, November 9, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6945e2-H.pdf> Among the 106,543 patients discharged from the index admission, 9,504 (9%) were readmitted
11. Garibaldi, B et al, Patient Trajectories Among Persons Hospitalized for COVID-19, Ann of Int Med September 22, 2020 <https://doi.org/10.7326/M20-3905> An updated analysis of cofactors identifying patients at high risk of poor outcomes from COVID-19
12. Gandhi, R et al Mild or Moderate COVID-19, N Engl J Med 2020; 383:1757-1766 October 29, 2020. <https://doi.org/10.1056/NEJMcp2009249> An updated review from an earlier report in April 2020 regarding clinical care and assessment of COVID-19 patients
13. Fajgenbaum, D et al Cytokine Storm December 3, 2020 N Engl J Med 2020; 383:2255-2273 <https://doi.org/10.1056/NEJMra2026131> A review of the elusive definition and wide range of clinical presentations of cytokine storm, with mention of its relationship to COVID-19
14. Carfi, A et al. Persistent Symptoms in Patients After Acute COVID-19 JAMA Volume 324, Number 6 August 11, 2020 <https://doi.org/10.1001/jama.2020.12603> A small study looking at a high rate of persistent symptoms in 149 Italian patients following the first wave of infections in the spring
15. Cheng, L et al. Effect of Recombinant Human Granulocyte Colony–Stimulating Factor for Patients With Coronavirus Disease 2019 (COVID-19) and Lymphopenia JAMA Int Med September 10, 2020 <https://doi.org/10.1001/jamainternmed.2020.5503> “In preliminary findings from a randomized clinical trial, rhG-CSF treatment for patients with COVID-19 with lymphopenia but no comorbidities did not accelerate clinical improvement, but the number of patients developing critical illness or dying may have been reduced”
16. Berlin, DA et al Severe COVID-19. N Engl J Med December 17, 2020;383:2451-60. <https://doi.org/10.1056/NEJMcp2009575> An updated article from a May 2020 review of the clinical management of severe COVID-19
17. Sanders, J.M. et al Pharmacologic Treatments for Coronavirus Disease 2019 (COVID-19): A Review JAMA May 12, 2020 Volume 323, Number 18 <https://doi.org/10.1001/jama.2020.6019> An early review of therapeutic agents under study for COVID-19
18. Rubin, R. Sorting Out Whether Vitamin D Deficiency Raises COVID-19 Risk. JAMA News and Perspectives January 6, 2021 <https://doi.org/10.1001/jama.2020.24127> A quick look at various international articles with poor study designs that leave no clear conclusion about whether low Vitamin D levels increase risk of severe COVID-19
19. Williamson, EJ et al. Factors associated with COVID-19-related death using OpenSAFELY Nature volume 584, pages430–436(2020) <https://www.nature.com/articles/s41586-020-2521-4> A broad look at the relative risk of factors that raise mortality with COVID-19
20. Kaplon, H et al Antibodies to watch in 2021 *mAbs* Volume 13, 2021 - Issue 1 January 17, 2021 <https://doi.org/10.1080/19420862.2020.1860476> Startling descriptions of the array of monoclonal antibodies that are expected to receive FDA authorization or approval in 2021 or that are initiating late phase trials, some of which are to target COVID-19 and others for other conditions
21. Lai, S.K. et al. Learning from past failures: Challenges with monoclonal antibody therapies for COVID-19. Journal of Controlled Release (received 24 September 2020; Received in revised form December 2020)329 (2021) 87–95 <https://doi.org/10.1016/j.jconrel.2020.11.057> Interesting concept of early delivery of monoclonal antibodies via nebulizer
22. Cohen, Myron. Monoclonal Antibodies to Disrupt Progression of Early Covid-19 Infection N Engl J Med EditorialJanuary 21, 2021;384:289-291 <https://doi.org/10.1056/NEJMe2034495> A reiteration of the findings in the Weinreich and Chen studies on Casirivimab-Imdevimab and Bamlanivimab monoclonal antibodies.
23. Anderson, K et al. Reports of Forgone Medical Care Among US Adults During the Initial Phase of the COVID-19 Pandemic JAMA Netw January 21, 2021; 4(1) <https://doi.org/10.1001/jamanetworkopen.2020.34882> This survey study found a high frequency of forgone care among US adults from March to mid-July 2020. Policies to improve health care affordability and to reassure individuals that they can safely seek care may be necessary with surging COVID-19 case rates. As the pandemic begins to subside, people may require encouragement to return to routine health care practices.
24. Oran, DP and Topol, E. The Proportion of SARS-CoV-2 Infections That Are Asymptomatic. An Int Med January 22, 2021 <https://doi.org/10.7326/M20-6976> Consistent with prior studies, at least one third of COVID-19 infections are asymptomatic
25. WHO Solidarity Trial Consortium. Repurposed Antiviral Drugs for Covid-19 — Interim WHO Solidarity Trial Results N Engl J Med 384;6 497-511. February 11, 2021 <https://doi.org/10.1056/NEJMoa2023184> These remdesivir, hydroxychloroquine, lopinavir, and interferon regimens had little or no effect on hospitalized patients with Covid-19, as indicated by overall mortality, initiation of ventilation, and duration of hospital stay
26. Thomas, S et al. Effect of High-Dose Zinc and Ascorbic Acid Supplementation vs Usual Care on Symptom Length and Reduction Among Ambulatory Patients With SARS-CoV-2 Infection The COVID A to Z Randomized Clinical Trial. JAMA Network Downloaded March 3, 2021 <https://doi.org/10.1001/jamanetworkopen.2021.0369> No benefit demonstrated in this study of zinc and ascorbic acid supplementation for COVID-19 symptoms
27. López-Medina et al Effect of Ivermectin on Time to Resolution of Symptoms Among Adults With Mild COVID-19 March 4, 2021.A Randomized Clinical Trial. JAMA. Published online March 4, 2021. <https://doi.org/10.1001/jama.2021.3071> Ivermectin did not shorten symptomatic period when administered in earlier COVID-19 infection
28. **Communications**
29. *Putting the Risk of COVID-19 in Perspective,* by David C. Roberts New York Times May 22, 2020 <https://www.nytimes.com/2020/05/22/well/live/putting-the-risk-of-covid-19-in-perspective.html> Defines the risk of death from COVID-19 during the peak of the outbreak in NYC in relative risk terms, using a metric called the “micromort,” which is a one-in-a-million chance of death roughly equivalent to the risk of death that each U.S. citizen faces each day due to nonnatural causes (car accidents, electrocutions, etc..) The risk of death due to COVID-19 between March 15 and May 9th was about one quarter of the risk of childbirth, ten times the risk of undergoing general anesthesia and equivalent to doing 7 parachute jumps, but in this case you are affecting other people and most people would “think twice about forcing their frail grandmothers, or their neighbors, to jump with them.”
30. Brossard, D et al Encouraging Adoption of Protective Behaviors to Mitigate the Spread of COVID-19, Nat Academies of Science, July 2020 ISBN 978-0-309-68101-8 <https://doi.org/10.17226/25881> Reviews effective science-based communication strategies that work.
31. Rosenbaum, L Tribal Truce — How Can We Bridge the Partisan Divide and Conquer Covid? NEJM September 23, 2020 Tribal Truce — How Can We Bridge the Partisan Divide and Conquer Covid? <https://doi.org/10.1056/NEJMms2027985> An interesting look at the ethics and sociology behind our expressed messaging
32. Kantor, B N et ak Non-pharmaceutical Interventions for Pandemic COVID-19: A Cross-Sectional Investigation of US General Public Beliefs, Attitudes, and Actions *Frontiers in Medicine* July 2020 Vol. 7 Art. 384 <https://doi.org/10.3389/fmed.2020.00384> Results of a cross-sectional online survey of public beliefs (N=1005) regarding non-pharmaceutical interventions (NPI). 90% reported using some sort of NPI.
33. Callender, B et al The art of medicine COVID-19, comics, and the visual culture of contagion Lancet Vol 396, October 10, 2020 [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)32084-5/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2820%2932084-5/fulltext) Interesting view of communication techniques, highlighting comics
34. Wilson, R et al Factors Influencing Risk for COVID-19 Exposure Among Young Adults

Aged 18–23 Years — Winnebago County, Wisconsin, March–July 2020 MMWR Vol. 69 No. 41

<https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6941e2-H.pdf> Informant interviews were conducted during July 9–22 with 13 young adults, nine owners of business

establishments employing and frequented by young adults (e.g., restaurants and bars), and eight community leaders exploring perceptions and misconceptions of public health guidance and how these correlated with legislative and community leader actions (including Wisc Supreme Court invalidation of the Safe At Home Emergency Order) and spread of COVID-19 in Winnebago, Wisconsin

1. An Online Risk Assessment Resource: CareEvolution, *My COVID-19 Risks* (visited December 1, 2020) <https://safercovid.org/myrisk/> A simple website providing personalized risk stratification for individuals, partially funded by the National Institutes of Health
2. Liu, M et al. Internet Searches for Unproven COVID-19 Therapies in the United States JAMA letter August 2020 Volume 180, Number 8 <https://doi.org/10.1001/jamainternmed.2020.1764> An unsurprising report of the increase in Google searches to purchase Chloroquine and Hydroxychloroquine that followed endorsements by well-known people. A recommendation to counter such unsupported endorsements with organized public messaging is included in the conclusion.
3. Vraga EK, Bode L. Addressing COVID-19 misinformation on social media preemptively and responsively. Emerg Infect Dis. 2021 February 2021 [January 4, 2021]. <https://doi.org/10.3201/eid2701.203139> An interesting experimental design to test the effectiveness of preemptive vs responsive messaging to correct misperceptions promoted by messaging that promotes misinformation. In general, messaging was modestly effective whether preemptive or responsive, although effects were most significant when addressing science principles rather than COVID-19 prevention.
4. Abbasi, Jennifer COVID-19 Conspiracies and Beyond: How Physicians Can Deal With Patients’ Misinformation JAMA News Article (online December 30, 2020) <https://doi.org/10.1001/jama.2020.22018> An interview with a Duke social scientist, Brian Southwell about misinformation in the COVID-19 realm
5. Duplaga, Maiusz. The Determinants of Conspiracy Beliefs Related to the COVID-19 Pandemic in a Nationally Representative Sample of Internet Users. Int J Environ Res Public Health 2020 Oct 26;17(21):7818 <https://doi.org/10.3390/ijerph17217818> The percentage of supporters of particular conspiracy theories in the study sample ranged from 43% to 56%.
6. Druckman, J et al. Affective polarization, local context and public opinion in America, Nature Human Behavior, online November 5, 2020 <https://doi.org/10.1038/s41562-020-01012-5> An in depth look at the influence of political polarization on interpretation of public health messaging and science
7. Sax, Paul E. COVID-19 Frequently Asked Questions NEJM Online (Downloaded January 15, 2021) <https://www.nejm.org/covid-vaccine/faq> Specific answers to FAQs from a Harvard University Infectious Disease specialist, including a number of recommendations regarding public health communications
8. Tyson A﻿, Johnson C﻿, Funk C﻿. US public now divided over whether to get COVID-19 vaccine. Pew Research Center. September 8-13, 2020 <https://www.pewresearch.org/science/2020/09/17/u-s-public-now-divided-over-whether-to-get-covid-19-vaccine/> In this survey vaccine acceptance was lower among Black individuals (32%, 263 of 822); those with lower educational attainment (47%, 676 of 1438 among those with high school or less education) compared with college graduates (56%, 1673 of 2988) or those with a postgraduate education (63%, 1693 of 2668); and among Republican voters (44%, 1817 of 4129)
9. Volpp, K.G. et al. Behaviorally Informed Strategies for a National COVID-19 Vaccine Promotion Program JAMA Network 2021;325(2):125-126. (online December 14, 2020) <https://doi.org/10.1001/jama.2020.24036> Specific recommendations to inform and promote vaccination in a responsible and effective fashion: 1) Make the Vaccine Free and Easily Accessible, 2) Make Access to Valued Settings Conditional on Getting Vaccinated, 3) Use Public Endorsements From Trusted Leaders to Increase Uptake, 4) Provide Priority Access to People Who Sign Up to Get Vaccinated Before Vaccines Are Widely Available, 5) Transform Individual Vaccination Decisions Into a Public Act.
10. Buttenheim, A SARS-CoV-2 Vaccine Acceptance: We May Need to Choose Our Battles Editorial An Int Med September 4, 2020 <https://www.acpjournals.org/doi/10.7326/M20-6206> Selecting the population towards which to focus vaccination messaging
11. Brewer, N.T. et al. Increasing Vaccination: Putting Psychological Science Into Action. Psychol Sci Public Interest. 2017 Dec;18(3):149-207. <https://doi.org/10.1177/1529100618760521> A comprehensive review of the behavioral psychology of antivaccination convictions and messaging strategies to inform such beliefs with vaccine science.
12. Hutchins HJ, Wolff B, Leeb R, et al. COVID-19 mitigation behaviors by age group: United States, April-June 2020. MMWR Morb Mortal Wkly Rep. 2020;69 (43):1584-1590. <https://doi.org/10.15585/mmwr.mm6943e4> The prevalence of reported mitigation behaviors was lowest among younger adults (aged 18–29 years) and highest among older adults (aged ≥60 years).
13. Fisher KA , Bloomstone SJ , Walder J , et al. Attitudes toward a potential SARS-CoV-2 vaccine. A survey of U.S. adults. Ann Intern Med. 2020;173:964-73. <https://doi.org/10.7326/M20-3569> A view of the changing prevalence of vaccine hesitancy
14. Wood, S and Schuman, K. Beyond Politics — Promoting Covid-19 Vaccination in the United States N Eng J Med 384;e23 February 18, 2021 <https://doi.org/10.1056/NEJMms2033790> An excellent review of vaccine messaging emphasizing evidence-based tactics and strategies for countering COVID-19 vaccine misinformation and disinformation
15. **Contact Tracing**
16. Cheng, H-Y et al Contact Tracing Assessment of COVID-19 Transmission Dynamics in Taiwan and Risk at Different Exposure Periods Before and After Symptom Onset JAMA Intern Med. 2020;180(9):1156-1163. <https://doi.org/10.1001/jamainternmed.2020.2020> Identifies transmission risks at different points in disease progression in index cases, with zero transmission from 856 symptomatic index patients 6 days or longer after symptom onset
17. Johns Hopkins University Bloomberg School of Public Health Contact Tracing training site, a comprehensive and free on-line five-hour training for prospective contact tracers <https://coronavirus.jhu.edu/contact-tracing>
18. Sachdev, D et al Outcomes of Contact Tracing in San Francisco, California—Test and Trace During Shelter-in-Place, JAMA Int Med November 2, 2020 <https://doi/org/10.1001/jamainternmed.2020.5670> Among 1214 contacts traced from 1394 interviews with cases in San Francisco between April 13 to June 8, 83.8% were successfully notified, 37.6% were tested, and 9.9% (120) were newly diagnosed with COVID-19 (while city-wide testing positivity was 2.2%)
19. CDC Contact Tracing Informational Video for the Public, *Answer the Call* <https://www.youtube.com/watch?v=u3dLoBj3YLo>
20. CDC Contact Tracing Resources, an extensive page of Contact Tracing resources from the CDC including checklist tools for contact tracers

<https://www.cdc.gov/coronavirus/2019-ncov/php/open-america/contact-tracing-resources.html#communication-resources>

1. Braithwaite, I et al, Automated and partly automated contact tracing: a systematic review to inform the control of COVID-19, Lancet, digital health Vol 2 November 2020 [https://www.thelancet.com/journals/landig/article/PIIS2589-7500(20)30184-9/fulltext](https://www.thelancet.com/journals/landig/article/PIIS2589-7500%2820%2930184-9/fulltext) “Well designed prospective studies are needed given gaps in evidence of effectiveness, and to investigate the integration and relative effects of manual and automated systems. Large-scale manual contact tracing is therefore still key in most contexts.”
2. Hellewell J, Abbott S, Gimma A, Bosse NI, Jarvis CI, Russell TW, et al. Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts. Lancet Glob Health. 2020;8:e488–96. [https://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X(20)30074-7.pdf](https://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X%2820%2930074-7.pdf) Across different initial numbers of cases, the majority of scenarios with an R0 of 1.5 were controllable with less than 50% of contacts successfully traced, but to control the majority of outbreaks for R0 of 2.5 more than 70% of contacts had to be traced, for an R0 of 3·5 more than 90% of contacts had to be traced.
3. **Epidemiology (Including the Great Barrington Declaration)**
4. Wilson NM, Norton A, Young FP, et al. Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: a narrative review. Anaesthesia. 2020. [PMID: 32311771] <https://doi.org/10.1111/anae.15093>
5. Stutt ROJH, Retkute R, Bradley M, Gilligan C, Colvin J. A modelling framework to assess the likely effectiveness of facemasks in combination with ‘lock-down’ in managing the COVID-19 pandemic. Proc. R. Soc. Volume 476, Issue 2238, 2020 <http://doi.org/10.1098/rspa.2020.0376> A look at the effect of masking and lockdowns on mathematical models of the outbreak.
6. Tian, L et al *Calibrated Intervention and Containment of the COVID-19 Pandemic* arXiv.org Submitted March 16, 2020 and last revised April 2, 2020 <https://arxiv.org/abs/2003.07353> Interesting mathematical model projecting the effects of different non-pharmaceutical interventions based upon computer modeling. “…if 70% of the general public wear masks and contact tracing is conducted at 60% efficiency within a 4-day time frame, epidemic growth will be flattened in the hardest hit countries.”
7. Hatfield, K et al *Facility-Wide Testing for SARS-CoV-2 in Nursing Homes — Seven U.S. Jurisdictions, March–June 2020* MMWR Vol69 August 11, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/mm6932e5.htm?s_cid=mm6932e4_e&deliveryName=USCDC_921-DM35136> “…for each additional day before completion of initial facility-wide testing (after a COVID-19 case was identified in a nursing home), an estimated 1.3 additional cases were identified.”
8. Wang et al Impact of Social Distancing Measures on Coronavirus Disease Healthcare Demand, Central Texas, USA EID Volume 26, Number 10—October 2020 <https://wwwnc.cdc.gov/eid/article/26/10/20-1702-f1> School Closures alone had minimal effect on the epidemic curve in mathematical models from U of Texas
9. Wilson, N et al Case-Fatality Risk Estimates for COVID-19 Calculated by Using a Lag Time for Fatality EID Vol 26, Number 6, June 2020 <https://wwwnc.cdc.gov/eid/article/26/6/20-0320_article> Case fatality estimates, including data on lag time from diagnosis to death i
10. Pollan, M Prevalence of SARS-CoV-2 in Spain (ENE-COVID): a nationwide, population-based seroepidemiological study Lancet July 6, 2020 [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31483-5/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2820%2931483-5/fulltext) With a 5% seroprevalence (up to 10% in hotspot urban centers) in Spain, the authors conclude that herd immunity was not yet achieved when non-pharmacologic measures successfully contained the outbreak in Spain.
11. Bilinski, A et al Modeling Contact Tracing Strategies for COVID-19 in the Context of Relaxed Physical Distancing Measures JAMA Netw August 21, 2020 <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2769618> A modeled assessment of the relative benefits of identification of asymptomatic cases, contact tracing and adherence to physical distancing measures.
12. Blackburn, J Infection Fatality Ratios for COVID-19 Among Noninstitutionalized Persons 12 and Older: Results of a Random-Sample Prevalence Study An Int Med, Online September 2, 2020 <https://doi.org/10.7326/M20-5352> An effort to breakdown Infection Fatality Rates for non-institutionalized populations in Indiana showing the expected higher rate of 1.7% IFR for those over 60 and higher rates for racial/ethnic minorities, particularly African Americans, with an overall IFR of 0.26%
13. Bixler, D et al SARS-CoV-2–Associated Deaths Among Persons Aged <21 Years —United States, February 12–July 31, 2020 MMWR data for some variables in case-based surveillance September 18, 2020 Vol. 69 No. 37 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6937e4-H.pdf> “...data on cases and deaths by race/ethnicity are not comparable and case fatality rates by race/ethnicity cannot be calculated.” There were 121 deaths among 391,814 cases in U.S. people under 21 years. A disproportionate percentage of deaths occurred among young adults aged 18–20 years and among Hispanics, Blacks, AI/ANs, and persons with underlying medical conditions.
14. CDC data sets by HHS Region for Tests per 100,000 Population and Test Positivity Rates for School Children <https://stacks.cdc.gov/view/cdc/94151> Variable trends across the U.S. among school children
15. Fineberg, H.V. The Toll of COVID-19 JAMA Editorial October 12, 2020 <https://doi.org/10.1001/jama.2020.20019> A review of the excess death calculations attributable to the COVID-19 pandemic conducted by the NVSS
16. Chau NVV et al Superspreading event of SARS-CoV-2 infection at a bar, Ho Chi Minh City, Vietnam Emerg Infect Dis. downloaded October 15, 20202021 Jan [date cited]. <https://doi.org/10.3201/eid2701.203480> A report of an outbreak in over 200 people at a bar in Vietnam. Crowds in enclosed indoor settings with poor ventilation may be

considered at high risk for transmission.

1. Dominguez, S et al Isolation, propagation, genome analysis and epidemiology of HKU1 betacoronaviruses J Gen Virol. 2014 Apr; 95(Pt 4): 836–848. <https://doi/org/10.1099/vir.0.059832-0> The prevalence of HKU1 betacoronavirus RNA detection, which may have some homology with antigens in SARS-CoV-2, in over 15000 specimens collected between 2009 and 2013 was 0.5%
2. Viner, RM et al Susceptibility to SARS-CoV-2 Infection Among Children and Adolescents Compared With Adults, JAMA Pediatrics online September 25, 2020 <https://doi.org/10.1001/jamapediatrics.2020.4573> “In this meta-analysis, there is preliminary evidence that children and adolescents have lower susceptibility to SARS-CoV-2, with an odds ratio of 0.56 for being an infected contact compared with adults. There is weak evidence that children and adolescents play a lesser role than adults in transmission of SARS-CoV-2 at a population level. This study provides no information on the infectivity of children.”
3. Ng, OT et al SARS-CoV-2 seroprevalence and transmission risk factors among high-risk close contacts: a retrospective cohort study, Lancet (online November 2, 2020) [https://doi.org/10.1016/S1473-3099(20)30833-1](https://doi.org/10.1016/S1473-3099%2820%2930833-1) A retrospective cohort study of close contacts of confirmed COVID-19 cases in Singapore, identified between Jan 23 and April 3, 2020, analyzing transmission risk factors in and outside of households
4. Brown, K et al Association Between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada JAMA Int Med (online November 9, 2020) <https://doi.org/10.1001/jamainternmed.2020.6466> In this cohort of Canadian nursing homes, crowded homes were more likely to experience larger and deadlier COVID-19 outbreaks. Shared bedrooms and bathrooms in nursing homes were associated with larger and deadlier COVID-19 outbreaks.
5. Selden, T and Berdahl, T COVID-19 And Racial/Ethnic Disparities In Health Risk, Employment, And Household Composition *Health Affairs* Vol. 39, No. 9 July 14, 2020 <https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.00897> Racially stratified employment risk factors as an explanation for disparity in incidence and fatality rates, with essential work outside the home accounting for higher incidence for Black and Hispanic populations and higher age group accounting for higher White fatality rates in some areas (although age-controlled fatality rates are higher in Black and Latinx populations)
6. Liotti, F et al Assessment of SARS-CoV-2 RNA Test Results Among Patients Who Recovered From COVID-19 With Prior Negative Results JAMA Internal Med November 12, 2020 <https://doi/org/10.1001/jamainternmed.2020.7570> After a mean (SD) time from COVID-19 diagnosis to follow-up was 48.6 (13.1) days in 32 patients (Table) and 57.7 (16.9) days in 144 patients 0.6% of patients continued to have positive replicable virus
7. Chang, S et al Mobility network models of COVID-19 explain inequities and inform reopening, Nature (Accelerated Article Preview) November 10, 2020 <https://doi.org/10.1038/s41586-020-2923-3> ‘Our model predicts that a small minority of “superspreader” POIs account for a large majority of infections and that restricting maximum occupancy at each POI is more effective than uniformly reducing mobility.’
8. **The “Great Barrington Declaration” and proposals for Herd Immunity**
* Omer, S et al Herd Immunity and Implications for SARS-CoV-2 Control JAMA Network, October 19, 2020 <https://jamanetwork.com/journals/jama/fullarticle/2772167> A review of factors that affect Herd Immunity. Arguments against the “Great Barrington Declaration” proposal
* Barry, John M What Fans of ‘Herd Immunity’ Don’t Tell You *The New York Times*, October 19, 2020 <https://www.nytimes.com/2020/10/19/opinion/coronavirus-herd-immunity.html> An interesting discussion of the ethical and epidemiologic implications of the so-called “Great Barrington Declaration.” (See next item)
* *The Great Barrington Declaration* A public policy proposal by a group of credentialed signatories supporting a strategy called “Focused Protection,” by allowing low risk groups to return to normal activities to seek herd immunity in communities around the world. Ongoing debate addresses exactly how that could be accomplished and the number of deaths that would result (see previous NY Times perspective piece)<https://gbdeclaration.org/>
* You Tube presentation moderated by the Editor of JAMA of the debate regarding the Great Barrington Declaration, clarifying its proposals and risks posed by its recommendations <https://youtu.be/2tsUTAWBJ9M>
1. Cheng, H-Y et al Contact Tracing Assessment of COVID-19 Transmission Dynamics in Taiwan and Risk at Different Exposure Periods Before and After Symptom Onset JAMA Intern Med. 2020;180(9):1156-1163. <https://doi.org/10.1001/jamainternmed.2020.2020> Identifies transmission risks at different points in disease progression in index cases, with zero transmission from 856 symptomatic index patients 6 days or longer after symptom onset
2. Wang, E et al, COVID-19, Decarceration, and the Role of Clinicians, Health Systems, and Payers A Report From the National Academy of Sciences, Engineering, and Medicine JAMA Network, November 16, 2020 <https://doi.org/10.1001/jama.2020.22109> “According to the COVID Prison Project, by August 2020, 90 of the largest 100 cluster outbreaks in the United States have occurred in prisons and jails.”
3. Firestone, M et al COVID-19 Outbreak Associated with a 10-Day Motorcycle Rally in a

Neighboring State — Minnesota, August–September 2020 MMWR Vol. 69 November 20, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6947e1-H.pdf> “The impact of gatherings as a source of virus transmission underscores the importance of reducing the number of attendees at gatherings, using face masks, and encouraging physical distancing”

1. James, A et al High COVID-19 Attack Rate Among Attendees at Events at a Church — Arkansas, March 2020, MMWR Vol. 69 No. 20 May 22, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6920e2-H.pdf> Thirty-five confirmed cases, three deaths occurred in attendees at a church, with 26 additional cases in secondary contacts and one additional death. No information available on specific risk behaviors or masking.
2. Pray, I et al COVID-19 Outbreak at an Overnight Summer School Retreat — Wisconsin, July–August 2020 MMWR Vol. 69 No. 43 October 30, 2020 [https://doi.org/https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6943a4-H.pdf](https://doi.org/https%3A//www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6943a4-H.pdf) Assuming that compliance with a “7-day quarantine” was impeccable, this outbreak occurred despite the “7-day quarantine” following a negative SARS-CoV-2 PCR in a Wisconsin camp.
3. Biggerstaff M, Cowling BJ, Cucunubá ZM, Dinh L, Ferguson NM, Gao H, et al., for the WHO COVID-19 Modelling Parameters Group. Early insights from statistical and mathematical modeling of key epidemiologic parameters of COVID-19. Emerg Infect Dis. 2020 [cited November 25]. <https://doi.org/10.3201/eid2611.201074> An excellent article addressing estimated epidemiologic parameters for SARS-CoV-2 through a partial review of various studies (“partial” because the outbreak continues to evolve and peer review of the data in many cases had not been completed at the time of this analysis)
4. Faust, J.S. et al. All-Cause Excess Mortality and COVID-19–Related Mortality Among US Adults Aged 25-44 Years, March-July 2020 JAMA Research Letter December 16, 2020 <https://doi.org/10.1001/jama.2020.24243> From March 1, 2020, to July 31, 2020, a total of 76 088 all-cause deaths occurred among US adults aged 25 to 44 years, which was 11 899 more than the expected 64 189 deaths (incident rate ratio, 1.19 [95% CI, 1.14-1.23], and 38% of these were recorded as due to COVID-19.
5. Woolf, S et al. COVID-19 as the Leading Cause of Death in the United States. JAMA Network Viewpoint December 17, 2020 <https://doi.org/10.1001/jama.2020.24865> A sobering look at the toll of COVID-19 using relative risk figures
6. Chen, Y.H. et al. Excess Mortality in California During the Coronavirus Disease 2019 Pandemic, March to August 2020. JAMA Int Med Published Online: December 21, 2020. <https://doi.org/10.1001/jamainternmed.2020.7578>
7. **Ethics**
8. Powell, t et al COVID in NYC: What We Could Do Better Am Journ of Bioethics 2020, Vol. 20, No. 7, 62-66 <https://doi.org/10.1080/15265161.2020.1764146> A look at the NYC response to the COVID-19 pandemic and ethical dilemmas that emerged
9. Abbott, J et al Ensuring Adequate Palliative and Hospice Care During COVID-19 Surges September 21, 2020 Online <https://doi.org/10.1001/jama.2020.16843> Addressing the importance of palliative end-of-life care during the pandemic surge
10. Rosenbaum, L Tribal Truce — How Can We Bridge the Partisan Divide and Conquer Covid? NEJM September 23, 2020 Tribal Truce — How Can We Bridge the Partisan Divide and Conquer Covid? <https://doi.org/10.1056/NEJMms2027985> An interesting look at the ethics and sociology behind our expressed messaging
11. Lynn, Joanne Playing the Cards We Are Dealt: COVID‐19 and Nursing Homes J. of the Amer. Geriatrics Soc Vol. 68 Iss. 8 May 30, 2020 <https://doi.org/10.1111/jgs.16658> Some questions raised regarding geriatric patients in SNFs in this article early in the outbreak, although speculation about such things as long term immunity and effectiveness of isolation and quarantine are debateable.
12. Barry, John M What Fans of ‘Herd Immunity’ Don’t Tell You *The New York Times*, October 19, 2020 <https://www.nytimes.com/2020/10/19/opinion/coronavirus-herd-immunity.html> An interesting discussion of the ethical and epidemiologic implications of the so-called “Great Barrington Declaration.” (See next item)
13. *The Great Barrington Declaration* A public policy proposal by a group of credentialed signatories supporting a strategy called “Focused Protection,” by allowing low risk groups to return to normal activities to seek herd immunity in communities around the world. Ongoing debate addresses exactly how that could be accomplished and the number of deaths that would result (see previous NY Times perspective piece)<https://gbdeclaration.org/>
14. Becker, Carolyn. Relationships Between Academic Medicine Leaders and Industry—Time for Another Look? November 10, 2020 JAMA. 2020;324(18):1833-1834. <https://doi.org/10.1001/jama.2020.21021> Some important economic conflicts of interest are discussed regarding the interface between public service and personal gain, some of which contribute to loss of public trust in the health care system
15. McClung, N et al, The Advisory Committee on Immunization Practices’ Ethical Principles for Allocating Initial Supplies of COVID-19 Vaccine — United States, 2020, MMWR Vol. 69 November 23, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6947e3-H.pdf> ACIP COVID-19 Vaccines Work Group
16. **Masking and Respirator Use (See related subject of Aerosol/Airborne transmission)**
17. World Health Organization. Shortage of personal protective equipment endangering health workers worldwide. 3 March 2020. Accessed at [www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide](http://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide) on 15 April 2020 Served as argument against the use of surgical masks or N-95 masks for the general public during the early period of the outbreak
18. ECRI. Clinical evidence assessment: safety of extended use and reuse of N95 respirators. March 2020. Accessed at <https://assets.ecri.org/PDF/COVID-19-Resource-Center/COVID-19-Clinical-Care/COVID-ECRI-N95-Respirators-updated.pdf> on 10 April 2020. Reuse of N-95 respirators is feasible
19. Stutt ROJH, Retkute R, Bradley M, Gilligan C, Colvin J. A modelling framework to assess the likely effectiveness of facemasks in combination with ‘lock-down’ in managing the COVID-19 pandemic. Proc. R. Soc. Volume 476, Issue 2238, 2020 <https://royalsocietypublishing.org/doi/10.1098/rspa.2020.0376>
20. Leung, N et al, Respiratory virus shedding in exhaled breath and efficacy of face masks, *Nature Medicine,* Vol 26, May 2020: 676-680 <https://doi.org/10.1038/s41591-020-0843-2>

Frequently quoted study assessing the effectiveness of cloth masks and respirators

1. Abhitejo Konda et al, Aerosol Filtration Efficiency of Cloth Masks, *American Chemical Society*: April 21, 2020 <https://dx.doi.org/10.1021/acsnano.0c03252> Specific look at cloth masks
2. Wilson NM, Norton A, Young FP, et al. Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: a narrative review. Anaesthesia. 2020. [PMID: 32311771] doi:10.1111/anae.15093 Aerosol transmission of SARS-CoV-2 likely, advising airborne precautions for healthcare workers
3. Sickbert-Bennet, E Filtration Efficiency of Hospital Face Mask Alternatives Available for Use During the COVID-19 Pandemic JAMA Int Med Published online August 11, 2020. doi:10.1001/jamainternmed.2020.4221 Reuse of N95 respirators after ethylene oxide and hydrogen peroxide sterilization is acceptable
4. Dugdale CM and Walensky RP. Filtration efficiency, effectiveness, and availability of N95 face masks for COVID-19 prevention. JAMA Intern Med 2020 Aug 11; [e-pub]. <https://doi.org/10.1001/jamainternmed.2020.4218> Surgical masks worn by both caregiver and patient were as effective as N-95 respirators in preventing transmission
5. Ngonghala, C et al Mathematical assessment of the impact of non-pharmaceutical interventions on curtailing the 2019 novel Coronavirus Mathematical Biosciences Volume 325, July 2020, 108364 [https://www.sciencedirect.com/science/article/pii/S0025556420300560#](https://www.sciencedirect.com/science/article/pii/S0025556420300560)! Combining face-masks and social-distancing is more effective in COVID-19 control
6. Eikenberry, S et al To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic Infectious Disease Modelling April 21, 2020 <https://doi.org/10.1016/j.idm.2020.04.001> We therefore estimate that inward mask efficiency could range widely, anywhere from 20 to 80% for cloth masks, with ≥50% possibly more typical (and higher values are possible for well-made, tightly fitting masks made of optimal materials), 70–90% typical for surgical masks, and >95% typical for properly worn N95 masks.
7. Doung-ngern, P et al Case-Control Study of Use of Personal Protective Measures and Risk for Severe Acute Respiratory Syndrome Coronavirus 2 Infection, Thailand Emerg Inf Dis. Volume 26, Number 11 November 2020 <https://doi.org/10.3201/eid2611.203003> An indication that cloth masks may indeed protect the wearer
8. Balazy, A et al Do N95 Respirators provide 95% protection level against airborne viruses, and how adequate are surgical masks? APIC 2006 <https://doi.org/10.1016/j.ajic.2005.08.018> A specific look at the filtering capacity of N95 respirators
9. Dugdale, Caitlin et al Filtration Efficiency, Effectiveness, and Availability of N95 Face Masks for COVID-19 Prevention JAMA Int Med August 11, 2020 <https://doi.org/10.1001/jamainternmed.2020.4218> If both caregiver and patient are wearing surgical masks during encounters, this does not constitute an exposure despite the fact that an N95 respirator was not in use.
10. Gallaway, MS et al Trends in COVID-19 Incidence After Implementation of Mitigation Measures — Arizona, January 22–August 7, 2020 MMWR October 9, 2020 Vol. 69 No. 40 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6940e3-H.pdf> Another study supporting the effectiveness of non-pharmaceutical measures, although relative benefits of each measure remaining difficult to assess
11. Lyu, W and Wehby, L Community Use Of Face Masks And COVID-19: Evidence From A Natural Experiment Of State Mandates In The US Health Affairs 39, No. 8 August 2020 1419–1425 <https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2020.00818> Addressing the correlation between masking mandates and declining COVID-19 incidence
12. Howard, J et alFace Masks Against COVID-19: An Evidence Review, Europe PMC July 11 2020 Preprint <https://doi.org/10.20944/preprints202004.0203.v3> Support for masking in European literature
13. Wang, et al Association Between Universal Masking in a Health Care System and SARS-CoV-2 Positivity Among Health Care Workers (HCW) JAMA Research Letter Vol. 324, No. 7 <https://doi.org/10.1001/jama.2020.12897> Mass General Brigham health care system found a correlation between implementation of testing and masking requirments and declining COVID-19 incidence
14. Sunjaya, AP et al Rational for universal face masks in public against COVID-19 Respirology Asian Pacific Society of Respirology (2020) 25, 678–679 <https://doi.org/10.1111/resp.13834> An early review of masking as a public health intervention to mitigate SARS-CoV-2 spread
15. Leffler, CT et al Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks. Update August 4, 2020. medRxiv preprint

<https://www.medrxiv.org/content/10.1101/2020.05.22.20109231v5> “Societal norms and government policies supporting the wearing of masks by the public, as well as international travel controls, are independently associated with lower per-capita mortality from COVID-19”

1. Snyder, A and O’Reilly, E Where the Science Stands on Using Face Masks Against Coronavirus *Science* June 25, 2020 <https://www.axios.com/coronavirus-face-mask-science-e9df446b-e7fb-447b-a980-67a9cf73556a.html> A news summary report regarding recent research on masking for SARS-CoV-2
2. Chughtai, A et al Effectiveness of Cloth Masks for Protection Against Severe Acute Respiratory Syndrome Coronavirus, EID Vol. 26, No. 10, October 2020 <https://wwwnc.cdc.gov/eid/article/26/10/20-0948_article> Addresses the importance of correct use of cloth masks
3. Wilson, RF et al Factors Influencing Risk for COVID-19 Exposure Among Young Adults Aged 18-23 Years – Winnebago County, Wisconsin, March – July 2020 MMWR Vol 69 early release October 9, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6941e2-H.pdf> Conflicting messages and peer pressure to not wear a mask was influential to youth who became infected
4. Seidelman  J﻿, Lewis  S﻿, Advani  S﻿,  et al.  Universal masking is an effective strategy to flatten the SARS-2-CoV healthcare worker epidemiologic curve. ﻿ *Infect Control Hosp Epidemiol*. Published online June 24, 2020. doi:[10.1017/ice.2020.313](http://dx.doi.org/10.1017/ice.2020.313) Universal masking of all HCWs significantly reduced the rate of healthcare-acquisition of SARS-CoV-2
5. Chan, N et al Peripheral Oxygen Saturation in Older Persons Wearing Nonmedical Face Masks in Community Settings, JAMA Network, October 30, 2020 <https://doi.org/10.1001/jama.2020.21905> Limited study that does not support the concern that three layer cloth masks contribute to oxygen desaturation in otherwise healthy older persons
6. Van Dyke, M et al Trends in County-Level COVID-19 Incidence in Counties With and Without a Mask Mandate — Kansas, June 1–August 23, 2020 MMWR Vol. 69 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6947e2-H.pdf> “Countywide mask mandates appear to have contributed to the mitigation of COVID-19 transmission in mandated counties.”
7. Clapp, P et al. Evaluation of Cloth Masks and Modified Procedure Masks as Personal Protective Equipment for the Public During the COVID-19 Pandemic. JAMA Int Med Published online December 10, 2020 <https://doi.org/10.1001/jamainternmed.2020.8168> The comparative effectiveness of the 7 consumer-grade and 5 medical masks that were tested was essentially the same, based upon the OSHA Fitted Filtration Efficiency (FFE), a measure of how much the masks protect the wearer from airborne particles.
8. Brooks, J et al. Maximizing Fit for Cloth and Medical Procedure Masks to Improve Performance and Reduce SARS-CoV-2 Transmission and Exposure, 2021 MMWR February 19, 2021 Vol 70, No. 7 <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7007e1-H.pdf> There are multiple simple ways to achieve better fit of masks to more effectively slow the spread of COVID-19.
9. Schumm, M et al. Filtering Facepiece Respirator (N95 Respirator) Reprocessing: A Systematic Review. JAMA March 3, 2021 <https://doi.org/10.1001/jama.2021.2531> Ultraviolet germicidal irradiation, moist heat, and microwave-generated steam processing of filtering facepiece respirators are effective means for decontamination and are simple to implement.
10. Guy GP Jr., Lee FC, Sunshine G, et al. Association of State-Issued Mask Mandates and Allowing On-Premises Restaurant Dining with County-Level COVID-19 Case and Death Growth Rates — United States, March 1–December 31, 2020. MMWR Morb Mortal Wkly Rep. ePub: 5 March 2021. DOI: <http://dx.doi.org/10.15585/mmwr.mm7010e3> Reviews the correlation between mask mandates, restaurant lockdowns and distancing measures and decreased SARS-CoV-2 transmission and deaths between March and December 2020.
11. **Mental Health**
12. Czeisler, ME et al Mental Health, Substance Use, and Suicidal Ideation During the COVID-19

Pandemic — United States, June 24–30, 2020 MMWR Vol. 69, No. 32 August 14, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6932a1-H.pdf> A fairly intuitive report about the metrics monitoring mental health during the pandemic, identifying young adults, racial/ethnic minorities, essential workers and unpaid adult caregivers as high risk populations

1. Amsalem, D et al The Coronavirus Disease 2019 (COVID-19) Outbreak and Mental Health — Current Risks and Recommended Actions [COMMENTARY] JAMA June 24, 2020 <https://www.notion.so/The-Coronavirus-Disease-2019-COVID-19-Outbreak-and-Mental-Health-Current-Risks-and-Recommended-A-eadcfab550a84b20a4cb3cc213dd1e3c> Effects on increasing consumption of digital media
2. Serafini, G et al The psychological impact of COVID-19 on the mental health in the general population QJM: An International Journal of Medicine, Volume 113, Issue 8, 30 June 2020August 2020, Pages 531–537, <https://doi.org/10.1093/qjmed/hcaa201> A General review of the psychological impacts of quarantine on the population and sources of resilience
3. Summers-Gabr, N Rural–Urban Mental Health Disparities in the United States During COVID-19 2020, Am Psych Assoc Vol. 12, No. S1, S222–S224 <http://dx.doi.org/10.1037/tra0000871S222> Addressing the urban-rural disparity in access to broadband internet as a specific social distancing risk factor
4. Shim, R Mental Health Inequities in the Context of COVID-19JAMA Netw Open.2020; 3(9):e2020104. doi:10.1001/jamanetworkopen.2020.20104 <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2770142> Addresses disparities in access to mental health resources, considering internet access as a social determinant of health
5. Patrick et al Well-being of Parents and Children During the COVID-19 Pandemic: A National Survey Pediatrics (Prepublication) 2020 <https://doi.org/10.1542/peds.2020-016824> Identifies factors, most of which are intuitive, contributing to worsening measures of mental and behavioral health, with 27% of parents reporting worsening mental health and 14% reporting worsening mental health for their children in June 2020
6. Druss, B Addressing the COVID-19 Pandemic in Populations With Serious Mental Illness JAMA Psychiatry April 3, 2020 <https://doi.org/10.1001/jamapsychiatry.2020.0894> Describes factors that compound COVID-19 risk for people with Serious Mental Illness (SMI)
7. Blanchflower, D and Oswald, A Trends in Extreme Distress in the United States, 1993–2019 American Journal of Public Health October 2020 Vol.110 Iss. 10 1538-1544 <https://doi.org/10.2105/AJPH.2020.305811> An analysis of Behavioral Risk Factor Surveillance System data on 8.1 million adults in the U.S., suggesting rising levels of mental distress between 1993 and 2019, particularly in the low-education midlife (35-54 years) white population
8. Hedegaard H, Curtin SC, Warner M. Suicide rates in the United States continue to increase. NCHS Data Brief, no 309. Hyattsville, MD: National Center for Health Statistics. 2018. <https://www.cdc.gov/nchs/data/databriefs/db309.pdf>
9. Hedegaard H, Curtin SC, Warner M. Increase in suicide mortality in the United States, 1999–2018. NCHS Data Brief, no 362. Hyattsville, MD: National Center for Health Statistics. April 2020 <https://www.cdc.gov/nchs/products/databriefs/db362.htm> Unfortunate 20-year trend toward increasing suicide rates in the U.S. even prior to the COVID-19 pandemic
10. Fond, G et al Disparities in suicide mortality trends between United States of America and 25 European countries: retrospective analysis of WHO mortality database Nature Scientific Reports February 17, 2016 <http://doi.org/10.1038/srep20256> U.S. suicide trend is unique to the U.S. compared to European countries
11. Unützer, J et al. Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial JAMA 2002;288(22):2836-2845 <https://pubmed.ncbi.nlm.nih.gov/12472325/> Research conducted by UCLA supporting Collaborative Care for Behavioral and Mental Health conditions
12. Kroenke, Kurt et al The PHQ-9: Validity of a Brief Depression Severity Measure J Gen Intern Med Vol. 16 September 2001 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495268/pdf/jgi_01114.pdf> A review of the PHQ-9 tool for depression screening in the clinic setting
13. Reger, M et al. Suicide Mortality and Coronavirus Disease 2019—A Perfect Storm? JAMA Psychiatry April 10, 2020. <https://doi.org/10.1001/jamapsychiatry.2020.1060>
14. Wei, E et al Coping With Trauma, Celebrating Life: Reinventing Patient And Staff Support During The COVID-19 Pandemic Health Affairs Vol. 39, No. 9 <https://doi.org/10.1377/hlthaff.2020.00929> A look at mitigations put in place in a New York health care system
15. Blanco, C et al Opportunities for Research on the Treatment of Substance Use Disorders in the Context of COVID-19 JAMA Psychiatry September 1, 2020. <https://doi.org/10.1001/jamapsychiatry.2020.3177>
16. McGinty, E et al Trends In News Media Coverage Of Mental Illness In The United States: 1995–2014 *Health Affairs* Behavioral Health Vol. 35, No. 6 June 2016 1121–1129 <https://doi.org/10.1377/hlthaff.2016.0011>
17. Swanson JW, McGinty EE, Fazel S, Mays VM. Mental illness and reduction of gun violence and suicide: bringing epidemiologic research to policy. Ann Epidemiol. 2015;25(5): 366–76
18. Applebaum, P Violence and Mental Disorders: Data and Public Policy Am J of Psychiatry 163:8, August 2006 <https://ajp.psychiatryonline.org/doi/pdfplus/10.1176/ajp.2006.163.8.1319> An editorial addressing the public misconceptions of violent behavior by those suffering mental health disorders and firearm access
19. Pollard, et al Changes in Adult Alcohol Use and Consequences During the COVID-19 Pandemic in the US JAMA Sept 29 2020;3(9):e2022942. <https://doi.org/10.1001/jamanetworkopen.2020.22942> A representative RAND sample of 1540 people were surveyed for alcohol consumption in 2019 (April 29 to June 9, 2019) and again in 2020 (May 28 to June 16, 2020) On average, alcohol was consumed 1 day more per month by 3 of 4 adults in 2020; for women, the frequency of heavy drinking increased by 41% over baseline, equating to an increase of 1 day per month for 1 in 5 women.
20. The Nielsen Company. Rebalancing the ‘COVID-19 Effect’ on alcohol sales. Published May 7, 2020. Accessed August 27, 2020. <https://www.nielsen.com/us/en/insights/article/2020/rebalancing-the-covid-19-effect-on-alcohol-sales/> 54% increase in national sales of alcohol for the week ending March 21, 2020, compared with 1 year before; online sales increased 262% from 2019
21. Li, L et al Association of a Prior Psychiatric Diagnosis With Mortality Among Hospitalized Patients With Coronavirus Disease 2019 (COVID-19) Infection JAMA Network, Psychiatry September 30, 2020 <https://doi.org/10.1001/jamanetworkopen.2020.23282> Poorer prognosis in patients with prior mental heath diagnoses
22. Evans, ML et al A Pandemic within a Pandemic — Intimate Partner Violence during Covid-19 NEJM Perspective September 16, 2020 <https://doi.org/10.1056/NEJMp2024046> Expectation that the rate of domestic tensions may increase in the U.S. leading to increasing episodes of domestic violence as apparently experienced in China (See next article)
23. Ramaswamy, A et al Finding Policy Responses to Rising Intimate Partner Violence during the Coronavirus Outbreak, Kaiser Family Foundation June 11, 2020 (On-line) <https://www.kff.org/coronavirus-covid-19/issue-brief/finding-policy-responses-to-rising-intimate-partner-violence-during-the-coronavirus-outbreak/> Data suggesting an increase in domestic violence in the U.S. during the COVID-19 outbreak
24. Troyer, E et al Are we facing a crashing wave of neuropsychiatric sequelae of COVID-19? Neuropsychiatric symptoms and potential immunologic mechanisms Brain, Behavior and Immunity, Volume 87, July 2020, Pages 34-39 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7152874/pdf/main.pdf>
25. Greenhalgh, T et al Management of Post-acute COVID-19 in Primary Care The BMJ 2020; 370:m3026 August 11, 2020 <http://dx.doi.org/10.1136/bmj.m3026> Defines “post-acute” COVID-19 as a syndrome extending beyond three weeks from the onset of first symptoms and chronic covid-19 as extending beyond 12 weeks, both syndromes associated with neuropsychiatric findings
26. Institute of Medicine. 2006. Improving the Quality of Health Care for Mental and Substance-Use Conditions. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11470>
27. American Psychiatric Association The Impact of COVID-19 on Incarcerated Persons with Mental Illness, Committee on Psychiatric Dimensions of Disaster and COVID-19 and the Council on Psychiatry and Law, June 2020
28. Stijelja, S et al COVID-19 and Psychological Distress—Changes in Internet Searches for Mental Health Issues in New York During the Pandemic JAMA Int Medicine, October 5, 2020

<https://doi.org/10.1001/jamainternmed.2020.3271> An analysis of trends in internet searches relating to mental health during the COVID-19 lockdown. Searches for “anxiety” significantly increased following March 22, 2020, and remained significantly higher than expected for 3 consecutive weeks. Searches for “panic attack” soared during the first week of the lockdown: search volumes increased 56% (95% PI, 37%-97%)

1. Olson, K et al Pandemic-Driven Posttraumatic Growth for Organizations and Individuals JAMA Online October 8, 2020. <https://doi.org/10.1001/jama.2020.20275> An interesting look at the potential for a flip side to PTSD
2. Simon NM﻿, Saxe GN﻿, Marmar CR﻿. Mental health disorders related to COVID-19–related deaths. ﻿ JAMA. Published online October 12, 2020. <https://doi.org/10.1001/jama.2020.19632> A look at the population consequences of the COVID-19 Pandemic
3. Leeb, R et al Mental Health–Related Emergency Department Visits Among Children Aged <18 Years During the COVID-19 Pandemic — United States, January 1–October 17, 2020 MMWR 69(45);1675–1680 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6945a3-H.pdf> “Beginning in week 12 (March 16) the **number** of mental health–related ED visits among children decreased 43% concurrent with the widespread implementation of COVID-19 mitigation measures; simultaneously, the **proportion** of mental health–related ED visits increased sharply beginning in midMarch 2020 (week 12)” (Bolding added)
4. Valtorta, N et al Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies Heart 2016;102:1009–1016. <https://doi.org/10.1136/heartjnl-2015-308790> UK review of 23 studies of correlation between metrics of loneliness and coronary heart and stroke events.
5. Faust, SJ et al. Suicide Deaths During the COVID-19 Stay-at-Home Advisory in Massachusetts, March to May 2020 JAMA Netw Open. 2021 <https://doi.org/10.1001/jamanetworkopen.2020.34273> Suicide deaths from March to May in Massachusetts were unchanged between 2019 and 2020 during the COVID-19 pandemic stay-at-home advisory, even when cases with unresolved cause of death are considered
6. Ayers, JW et al. Suicide-Related Internet Searches During the Early Stages of the COVID-19 Pandemic in the US. JAMA Netw Open. January 21, 2021;4(1):e2034261. <https://doi.org/10.1001/jamanetworkopen.2020.34261> Internet searches for suicide and related terms, previously found to be associated with population changes in suicidal behavior, decreased during the early stages of the COVID-19 pandemic in the US.
7. **Occupational Health**
8. Sterling, MR et al Experiences of Home Health Care Workers in New York City During the Coronavirus Disease 2019 Pandemic: A Qualitative Analysis JAMA Intern Med. Published online August 4, 2020. <https://doi.org/10.1001/jamainternmed.2020.3930> An overlooked and under-resourced population of in home health care providers and senior care providers were disproportionately affected by the outbreak. Residents and staff at nursing homes and other long-term care setting account for 57000 of the more than 140,000 deaths due to Coronavirus.
9. Louie, J Lessons from Mass-Testing for COVID-19 in Long Term Care Facilities for the Elderly in San Francisco Clin Inf Diseases July 20, 2020 <https://doi.org/10.1093/cid/ciaa1020> High asymptomatic transmission rates in long term care facilities
10. Porru, S Health Surveillance and Response to SARS-CoV-2 Mass Testing in Health Workers of a Large Italian Hospital in Verona, *Veneto International Journal of Environmental Research and Public Health* July 15, 2020 <https://www.mdpi.com/1660-4601/17/14/5104/htm> Highest transmission rates occurred in medical wards, with a cumulative incidence of 4%.
11. Treibel, T COVID-19: PCR Screening of Asymptomatic Healthcare Workers at London Hospital The Lancet, May 7, 2020 [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31100-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2820%2931100-4/fulltext) Transmission to 400 healthcare workers occurred at a rate that paralleled community transmission
12. Tisch, C Camping Alone – Recovering From COVID-19 JAMA *A piece of my mind* September 26, 2020 <https:///doi/org/10.1001/jama.2020.19304> Interesting insight into the challenge of illness during medical training
13. Shimotsu ST, Johnson ARL, Berke EM, Griffin DO. COVID-19 infection control measures in long-term care facility, Pennsylvania, USA. Emerg Infect Dis. 2021 Feb [Nov 19]. <https://doi.org/10.3201/eid2702.204265> After the institution of strict infection precautions a Pennsylvania LTCF was found to have a 17-fold lower incidence of COVDI-19 than neighboring facilities.
14. **Schools**
15. Matrajt et al Evaluating the Effectiveness of Social Distancing Interventions to Delay or Flatten the Epidemic Curve of Coronavirus Disease, EID Vol. 26, No. 8, August 2020 <https://wwwnc.cdc.gov/eid/article/26/8/20-1093_article> Excerpt from authors results statement: “Our models suggest that social distancing can provide crucial time to increase healthcare capacity but must occur in conjunction with testing and contact tracing of all suspected cases to mitigate virus transmission.”
16. Levinson, M *Reopening Primary Schools during the Pandemic* N Eng J Med July 29, 2020 DOI: 10.1056/NEJMms2024920 <https://www.nejm.org/doi/full/10.1056/NEJMms2024920?query=featured_home>

“Even under conditions of moderate transmission (<10 cases per 100,000 people), however, we believe that primary schools should be recognized as essential services…and that school reopening plans should be developed and financed accordingly. The safest way to open schools fully is to reduce or eliminate community transmission…Such measures along with universal mask wearing must be implemented now in the United States if we are to bring case numbers down to safe levels for elementary schools to reopen this fall nationwide.”

1. Auger, K.A. Association Between Statewide School Closure and COVID-19 Incidence and Mortality in the U.S. JAMA July 29, 2020 doi:10.1001/jama.2020.14348 <https://jamanetwork.com/journals/jama/fullarticle/2769034>

Conclusions and Relevance: “Between March 9, 2020, and May 7, 2020, school closure in

the US was temporally associated with decreased COVID-19 incidence and mortality; states

that closed schools earlier, when cumulative incidence of COVID-19 was low, had the largest

relative reduction in incidence and mortality. However, it remains possible that some of the

reduction may have been related to other concurrent nonpharmaceutical interventions.”

1. American Academy of Pediatrics Guidance Statement, June 25, 2020 <https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools/>

After describing principles of flexibility, the AAP states, “AAP strongly advocates that all policy considerations for the coming school year should start with a goal of having students physically present in school.” No scientific citations are included in the Guidance document.

1. AAP State level report: <https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/children-and-covid-19-state-level-data-report/>
2. Michaud, J and Kates, J, Kaiser Family Foundation (KFF) *What Do We Know About Children and Coronavirus Transmission?* <https://www.kff.org/coronavirus-covid-19/issue-brief/what-do-we-know-about-children-and-coronavirus-transmission/>Weekly data report from AAP and AHA: “However, where there is already widespread community transmission, as is the case in many areas in the U.S., there is clearly a risk of spread associated with reopening schools”
3. Kaiser Family Foundation, Health Tracking Poll July 27, 2020 Very strong correlation between political preferences, race, and economic status and perceptions of risks/benefits of school closures, with Democrat voters, people of color and lower socioeconomic groups more concerned with risks of transmission in school. People of color were also more concerned about children falling behind if not in school, economic impact of unemployment and lack of resources to care for children at home; <https://www.kff.org/coronavirus-covid-19/report/kff-health-tracking-poll-july-2020/>
4. Szablewski CM, Chang KT, Brown MM, et al. SARS-CoV-2 Transmission and Infection Among Attendees of an Overnight Camp — Georgia, June 2020. MMWR Morb Mortal Wkly Rep. ePub: 31 July 2020. <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6931e1-H.pdf> With testing results for only 58% of camp attendees, 76% of those tested were positive (for an overall attack rate of 44%, which is surely an underestimate since test results were unavailable for so many). Attack rates for campers a) 6-10 years was 51%; b) 11-17 years was 44%; c) 18-21 years was 33% and d) over 22 years was 29%.
5. The path to zero and schools: achieving pandemic resilient teaching and learning spaces. Cambridge, MA: Harvard GlobalHealth Institute, Edmond J. Safra Center for Ethics at Harvard University, July 19, 2020 An excellent 4-page brief was developed by faculty at Harvard’s Global Health Institute, Graduate School of Education, Chan School of Public Health and Edmund J. Safra Center for Ethics. This proposed tool helps to stratify risk to allow locally specific school reopening thresholds, as determined by local public health officials in partnership with schools, government leaders and members of the public according to status of the outbreak [https://globalepidemics.org/wpcontent/uploads/2020/07/pandemic\_resilient\_schools\_briefing\_7 .19.20.pdf](https://globalepidemics.org/wpcontent/uploads/2020/07/pandemic_resilient_schools_briefing_7%20.19.20.pdf) .
6. Levinson, M COVID-19 White Paper 17: Educational Ethics During a Pandemic White Paper from Edmond Safra Center for Ethics at Harvard, May 16, 2020 <https://ethics.harvard.edu/educational-ethics-pandemic>
* In mid-April 2020, over 1.5 billion students, representing 91% of the global population of enrolled students from preschool through higher education, were prevented from attending school in person due to COVID-19–related school closures
* “School closures due to coronavirus have impacted at least 124,000 U.S. public and private schools and affected at least 55.1 million students” enrolled in grades K through 12.” (*EdWeek*)
* As of March 27, over 80% of public schools were providing meal services to students—almost twice the percentage that were providing any educational services. By mid-April, about 80% of school districts had teaching plans in place, and 57 to 61% of districts had organized to distribute digital devices or Internet access—but a full 94% were distributing meals to students and families.
* “But we should also remember our revealed preferences in the first two months of massive school closures: schools’ essential value is in providing care even when they cannot provide academics; it is not in providing academics in the absence of care.”
1. Zhang J, Litvinova M, Liang Y, et al. Changes in contact patterns shape the dynamics of the COVID-19 outbreak in China. *Science*. 2020;368(6498):1481-1486. doi:10.1126/science.abb8001 Concludes that school closures “can reduce peak incidence by 40 to 60% and delay the epidemic.”
2. Choe et al, Are We Ready for Coronavirus Disease 2019 Arriving at Schools?J Korean Med Sci. 2020 Mar 23;35(11):e127 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7086087/pdf/jkms-35-e127.pdf> Speculative report on school closures as a containment strategy in South Korea
3. Park YJ, Choe YJ, Park O, Park SY, Kim YM, Kim J, et al. Contact tracing during coronavirus disease outbreak, South Korea, 2020. Emerg Infect Dis. 2020 Oct [date cited]. <https://doi.org/10.3201/eid2610.201315> Support for school closures as a mitigation strategy.
4. Heald-Sergeant, T et al Age-related Differences in Nasopharyngeal Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Levels in Patients With Mid to Moderate Coronavirus Disease 2019 (COVID-19) JAMA Pediatrics July 30, 2020 Children under 5 years carried as much or more SARS-CoV-2 viral load as older children and adults.
5. Kroshus, E et al Plans of US Parents Regarding School Attendance for Their Children in the Fall of 2020, JAMA Peds Published Online August 14 doi:10.1001/jamapediatrics.2020.3864

<https://jamanetwork.com/journals/jamapediatrics/fullarticle/2769634> A survey of parents highlighting issues that will affect decisions to return children to school

1. Link-Gelles R et al. Limited secondary transmission of SARS-CoV-2 in child care programs-Rhode Island June 1–July 31, 2020 MMWR Morb Mortal Wkly Rep 2020 Aug 21; [e-pub]. <https://doi.org/10.15585/mmwr.mm6934e2> Limited transmission to 52 children in 666 childcare centers with approximately 19,000 children following CDC guidance
2. Han MS et al Clinical Characteristics and Viral RNA Detection in Children With Coronavirus Disease 2019 in the Republic of Korea JAMA Pediatrics August 28, 2020 <https://doi.org/10.1001/jamapediatrics.2020.3988> Prevalence in pediatric populations, although unclear whether viral detection correlates with infectivity
3. WHO Guidance Statement Advice on the use of masks for children in the community in

the context of COVID-19 August 21, 2020 <https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC_Masks-Children-2020.1> A thorough synopsis of the experience with masking the pediatric population around the world

1. Braunack-Mayer, A et al Understanding the school community's response to school closures during the H1N1 2009 influenza pandemic BMC Public Health 2013 Apr 15;13:344 doi: 10.1186/1471-2458-13-344 <https://pubmed.ncbi.nlm.nih.gov/23587175/> Interesting consideration of the public health successes and shortcomings during the H1N1 outbreak in Australia in 2009
2. Mallapaty, S How schools can reopen safely during the pandemic Nature Vol. 584 Issue 7822 August 18, 2020 <https://www.nature.com/articles/d41586-020-02403-4>

Masks, class sizes and hygiene are important, but low community spread is key.

1. Leeb RT, Price S, Sliwa S, et al. COVID-19 Trends Among School-Aged Children — United States, March 1–September 19, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1410–1415. DOI: <http://dx.doi.org/10.15585/mmwr.mm6939e2> Variable trends in school children across the U.S. (See also #11 under Epidemiology)
2. Esposito, S et al School Closure During the Coronavirus Disease 2019 (COVID-19) Pandemic

An Effective Intervention at the Global Level? JAMA Pediatrics May 13, 2020 <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2766114> Projected impact of school closure on the pandemic

1. Litvinova M﻿, Liu QH﻿, Kulikov ES﻿, Ajelli M﻿. Reactive school closure weakens the network of social interactions and reduces the spread of influenza. ﻿ Proc Natl Acad Sci U S A. 2019;116(27):13174-13181. <https://doi.org/10.1073/pnas.1821298116> School closure in influenza outbreak mitigation
2. Hobbs, C et al Factors Associated with Positive SARS-CoV-2 Test Results in Outpatient Health Facilities and Emergency Departments Among Children and Adolescents Aged <18 Years — Mississippi, September–November 2020 MMWR Vol. 69. December 15, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6950e3-H.pdf> Among children and adolescents aged <18 years in Mississippi, close contact with persons with COVID-19 and gatherings with persons outside the household and lack of consistent mask use in school were associated with SARS-CoV-2 infection, whereas attending school or child care was not associated with receiving positive SARS-CoV-2 test results.
3. Leidner, A et al. Opening of Large Institutions of Higher Education and County-Level COVID-19 Incidence — United States, July 6–September 17, 2020 MMWR January 8, 2021 Vol. 70 No. 1 <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7001a4-H.pdf> “U.S. counties with large colleges or universities with remote instruction (n = 22) experienced a 17.9% decrease in incidence and university counties with in-person instruction (n = 79) experienced a 56% increase in incidence, comparing the 21-day periods before and after classes started.”
4. Honein , M et al. Data and Policy to Guide Opening Schools Safely to Limit the Spread of SARS-CoV-2 Infection. JAMA. Published online January 26, 2021. <https://doi.org/10.1001/jama.2021.0374> A retrospective review of effective mitigations that allowed safe opening of schools and of practices that increased risk of COVID-19 in schools
5. **Social/Physical Distancing, Transmissibility and Environmental Stability of SARS-CoV-2 (See also in Schools)**
6. Matrajt et al Evaluating the Effectiveness of Social Distancing Interventions to Delay or Flatten the Epidemic Curve of Coronavirus Disease, EID Vol. 26, No. 8, August 2020 <https://wwwnc.cdc.gov/eid/article/26/8/20-1093_article> Excerpt from authors results statement: “Our models suggest that social distancing can provide crucial time to increase healthcare capacity but must occur in conjunction with testing and contact tracing of all suspected cases to mitigate virus transmission.”
7. Morawska, L., and Milton, D.K. (2020). It is time to address airborne transmission of COVID-

19. Clinical Infectious Diseases, ciaa939. Available: <https://doi.org/10.1093/cid/ciaa939> Advocating for measures to prevent aerosol transmission the

1. Lindsley, W.G. et al. Viable influenza A virus in airborne particles from human coughs. Journal of Occupational and Environmental Hygiene, 2015; 12: 107-113. <https://ncbi.nlm.nih.gov/pmc/articles/PMC4734406/> Adapting influenza prevention principles to SARS-CoV-2
2. Miller, S. et al., Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event. medRxiv, 2020; doi: <https://doi.org/10.1101/2020.06.15.20132027> (accessed 23/06/2020) The risks of certain activities that can contribute to a so-called “super-spreader” event.
3. Yu, I. T. et al. Evidence of airborne transmission of the severe acute respiratory syndrome virus. New England Journal of Medicine, 2004; 350, 1731-1739. <https://www.nejm.org/doi/full/10.1056/nejmoa032867> Photo of housing complex in China suggesting transmission of SARS-1 through outdoor air currents in a building complex
4. Tang, J. W.; Noakes, C. J.; Nielsen, P. V.; Eames, I.; Nicolle, A.; Li, Y.; Settles, G. S. Observing and Quantifying Airflows in the Infection Control of Aerosol- and Airborne-Transmitted Diseases: An Overview of Approaches. Journal of Hospital Infection 2011, 77 (3), 213–222. <https://doi.org/10.1016/j.jhin.2010.09.037> . Photo of Schlieren image of exhalation with ad without mask
5. Wilson NM, Norton A, Young FP, et al. Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: a narrative review. Anaesthesia. 2020. [PMID: 32311771] <https://doi.org/10.1111/anae.15093> Aerosol transmission of SARS-CoV-2 likely, advising airborne precautions for healthcare workers
6. Buonanno et al., PREPRINT Quantitative assessment of the risk of airborne transmission of SARS-CoV-2 infection: perspective and retrospective applications. medRxiv, 2020;

<https://doi.org/10.1101/2020.06.01.20118984> (accessed 23/06/2020)

1. Pan, L. Liu, C. Wang, H. Guo, X. Hao, Q. Wang, J. Huang, N. He, H. Yu, X. Lin, S. Wei, T. Wu, Association of public health interventions with the epidemiology of the COVID-19 outbreak in Wuhan, China. JAMA <https://doi.org/10.1001/jama.2020.6130> (2020) Temporal association of decreasing disease incidence in China with public health interventions.
2. Lee H-H, Lin S-H. Effects of COVID-19 prevention measures on other common infections, Taiwan. Emerg Infect Dis. 2020 Oct [date cited]. <https://doi.org/10.3201/eid2610.203193> Describes the success of the Taiwan COVID-19 response
3. Vincent Yi-Fong Su, Masks and medical care: Two keys to Taiwan's success in preventing COVID-19 spread Travel Medicine and Infectious Disease, <https://doi.org/10.1016/j.tmaid.2020.101780> Describes the success of the Taiwan COVID-19 response
4. Park, S.W. Potential Role of Social Distancing in Mitigating Spread of Coronavirus

Disease, South Korea EID; Volume 26, Number 11—November 2020 Original Publication Date: August 14, 2020; <https://wwwnc.cdc.gov/eid/article/26/11/20-1099_article>

An analysis of the contribution of social distancing to containing SARS-CoV-2 spread in South Korea

1. Garigliany, M et al SARS-CoV-2 Natural Transmission from Human to Cat, Belgium, March 2020 EID:Volume 26, Number 12—December 2020 <https://wwwnc.cdc.gov/eid/article/26/12/20-2223_article> Transmission to house cats is possible
2. Jiang, FC et al Detection of Severe Acute Respiratory Syndrome Coronavirus 2 RNA on Surfaces in Quarantine Rooms EID Volume 26, Number 9, September 2020 <https://wwwnc.cdc.gov/eid/article/26/9/20-1435_article?deliveryName=USCDC_353-DM35825> While the virus was detected on 8 out of 22 surfaces in a room used for quarantine for 24 hours, there was no testing to determine if it was viable virus
3. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med. 2020;382:1564–7. <https://www.nejm.org/doi/pdf/10.1056/NEJMc2004973> Early look at survivability of SARS-CoV-2 on various surfaces, using TCID50 and comparing to SARS-CoV-1. Indicates SARS-CoV-2 viability for at least 3 hours in airborne aerosols.
4. Pastorino, B et al Prolonged Infectivity of SARS-CoV-2 in Fomites EID Vol. 26, No. 9

<https://wwwnc.cdc.gov/eid/article/26/9/20-1788_article?deliveryName=USCDC_353-DM35825> The presence of a proteinaceous substrate increased environmental stability and viability of the virus on fomites

1. Kang, M et al Probable Evidence of Fecal Aerosol Transmission of SARS-CoV-2 in a High-Rise Building Annals Int Med Online September 1, 2020 <https://doi.org/10.7326/M20-0928> An analysis of temporal and spatial spread of COVID-19 through a housing complex in China in conjunction with airflow raising the possibility of spread through gases in the sewage system. May or may not be applicable to spread through wastewater systems in other countries.
2. Bai, X et al Cities: build networks and share plans to emerge stronger from COVID-19 Nature Comment Vol. 584, Issue 7822 <https://www.nature.com/articles/d41586-020-02459-2> Timeliness of instituting social distancing measures correlates with eventual extent of spread through cities throughout China
3. Kampf G. et al Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents J of Hosp Infect (A Review Study) 104 (2020)246-251 <https://doi.org/10.1016/j.jhin.2020.01.022> Human coronaviruses can remain infectious on inanimate surfaces for up to 9 days. Surface disinfection with 0.1% sodiumhypochlorite or 62 to 71% ethanol significantly reduces corona-virus infectivity on surfaces within 1 min exposure time.
4. Kendig, J COVID-19 Related Environment of Care & Air Exchanges FAQs The Joint Commission <https://www.jointcommission.org/resources/news-and-multimedia/blogs/ambulatory-buzz/2020/08/05/covid-19-related-environment-of-care-and-air-exchanges-faqs/> Joint Commission (for the Accreditation of Hospitals) criteria for AIIRs
5. CDC: Guidance for Workers Handling Human Waste or Sewage <https://cdc.gov/healthywater/global/sanitation/workers_handlingwastewater.html> A description of the recommended PPE for workers in the wastewater industry that provides satisfactory protection against COVID-19
6. Chang L, Zhao L, Gong H, Wang L, Wang L. Severe Acute Respiratory Syndrome Coronavirus 2 RNA Detected in Blood Donations. Emerg Infect Dis. July 2020;26:1631-3. [https://wwwnc.cdc.gov/eid/article/26/7/20-0839\_article SARS-CoV-2](https://wwwnc.cdc.gov/eid/article/26/7/20-0839_article%20SARS-CoV-2) In China, SARS-CoV-2 RNA was found in 4 blood donations out of 2430 asymptomatic donors screened and in one out of 4995 donations retroactively screened between December and January.
7. Cho, H J et al COVID-19 transmission and blood transfusion: A case report J of Infection and Public Health, h (2020), <https://doi.org/10.1016/j.jiph.2020.05.001> A case report of a patient with aplastic anemia who received a transfusion from an infected donor but remained RT-PCR negative for SARS-Cov-2
8. Schwartz, N et al Adolescent with COVID-19 as the Source of an Outbreak at a 3-week Family Gathering – Four States, June-July 2020 MMWR Vol.69 October 5, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6940e2-H.pdf> Transmission through a 3-week household gathering with transmission to 12 of 14 who shared the indoor household without masking but no transmission to family who stayed outside for short visits
9. Okarska-Napierała M, Mańdziuk J, Kuchar E. SARS-CoV-2 cluster in nursery, Poland. Emerg Infect Dis. 2021 Jan [date cited]. <https://doi.org/10.3201/eid2701.203849> Outbreak in a children’s nursery in Poland with transmission to multiple children and family members (29 out of 104 persons tested)
10. Gandhi, M et al Facial Masking for Covid-19 — Potential for “Variolation” as We Await a Vaccine NEJM September 8, 2020 <https://doi.org/10.1056/NEJMp2026913> Presentation of the hypothesis that the size of the SARS-CoV-2 inoculum has a large influence on clinical outcome of infection
11. Hibino, S et al Dynamic Change of COVID-19 Seroprevalence Among Asymptomatic Population in Tokyo during the Second Wave medRxiv September 23, 2020 <https://www.medrxiv.org/content/10.1101/2020.09.21.20198796v1.full.pdf> A look at seroconversions in a Japanese cohort during the summer
12. Belongia, E Osterholm, M COVID-19 and flu, a perfect storm *Science* 12 Jun 2020:
Vol. 368, Issue 6496, pp. 1163 <https://doi.org/10.1126/science.abd2220> Outlines a number of concerns regarding potential synergies between influenza and SARS-CoV-2 outbreaks
13. Gandhi, M et al Masks Do More Than Protect Others During COVID-19: Reducing the Inoculum of SARS-CoV-2 to Protect the Wearer J Gen Intern Med. 2020 Jul 31 : 1–4. <https://doi.org/10.1007/s11606-020-06067-8> [Epub ahead of print] Citations for one small study and several news articles to support the theory that low dose viral exposures may result in asymptomatic infection with immunity
14. Hains DS, Schwaderer AL, Carroll AE, et al. Asymptomatic Seroconversion of Immunoglobulins to SARS-CoV-2 in a Pediatric Dialysis Unit. JAMA. 2020;323(23):2424–2425. <https://doi.org/10.1001/jama.2020.8438> Seroconversion consisted of IgM OR IgG positivity, one symptomatic health care provider seroconverted despite negative PCRs and one symptomatic pediatric patient was PCR positive. Very questionable findings, authors advising further study.
15. Reiner Jr, R et al IHME COVID-19 Forecasting Team, Modeling COVID-19 scenarios for the United States, Nature Medicine, October 6, 2020 <https://doi.org/10.1038/s41591-020-1132-9> Updated projected case numbers for different US states into February 2021 depending upon institution and adherence to different levels of masking and social distancing, prepared by the Institute for Health Metrics and Evaluation at University of Washington, with prior projections having been problematic (see <https://www.statnews.com/2020/10/23/universal-mask-use-could-save-130000-lives-by-the-end-of-february-new-modeling-study-says> )
16. Pringle, J et al COVID-19 in a Correctional Facility Employee Following Multiple Brief Exposures to Persons with COVID-19 — Vermont, July–August 2020 Vol. 69 October 21, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6943e1-H.pdf> Report that an accumulated 15 minutes of unprotected exposure within 6 feet to an infected individual constitutes sufficient criteria for exposure
17. Chang, S et al Mobility network models of COVID-19 explain inequities and inform reopening, Nature (Accelerated Article Preview) November 10, 2020 <https://doi.org/10.1038/s41586-020-2923-3> ‘Our model predicts that a small minority of “superspreader” POIs account for a large majority of infections and that restricting maximum occupancy at each POI is more effective than uniformly reducing mobility.’
18. Kanu, F et al Declines in SARS-CoV-2 Transmission, Hospitalizations, and Mortality After Implementation of Mitigation Measures— Delaware, March–June 2020 November 13, 2020 MMWR 69(45);1691–1694 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6945e1-H.pdf> Draws correlations between prevalence trends in the COVID-19 pandemic in Delaware and the institution of case investigations, stay at home orders, masking mandates and contact tracing.
19. Murphy, N et al A large national outbreak of COVID-19 linked to air travel, Ireland, summer 2020 separator commenting unavailable, Eurosurveillance Volume 25, Issue 42, October 22, 2020 <https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.42.2001624> Thirteen cases were directly linked to an international flight arriving in Ireland which was only at 17% capacity. Nine of the 13 passengers who tested positive reported wearing masks on the flight.
20. Madewell, Z et al. Household Transmission of SARS-CoV-2 A Systematic Review and Meta-analysis. JAMA Global Health December 14, 2020;3(12):e2031756. <https://doi.org/10.1001/jamanetworkopen.2020.31756> A systemic review of studies addressing COVID-19 transmission within households, highlighting risk factors within households and demonstrating considerable heterogeneity. There was higher transmission from symptomatic index cases and from adults
21. Lyu, W et al. Comparison of Estimated Rates of Coronavirus Disease 2019 in Border Counties in Iowa Without a Stay-at-Home Order and Border Counties in Illinois With a Stay-at-Home Order. JAMA Network May 15, 2020 <https://doi.org/10.1001/jamanetworkopen.2020.11102> Illinois border towns’ outbreak control was ahead of Iowa border towns after the Illinois Stay-at-Home order was instituted, although confounding variables are difficult to mediate.
22. Brauner, J et al. Inferring the effectiveness of government interventions against COVID-19

*Science* 15 Dec 2020 <https://doi.org/10.1126/science.abd9338> In this analysis of COVID-19 data from 41 countries school and university closures, limited gatherings to 10 people and shutting businesses substantially cut transmission. Stay-at-home orders were less effective when these other mitigations were in place.

1. Meidan, D., Schulmann, N., Cohen, R. *et al.* Alternating quarantine for sustainable epidemic mitigation. *Nat Commun* **12,**220 (2021). <https://doi.org/10.1038/s41467-020-20324-8> An interesting proposal that projects sustaining socioeconomic continuity at  ~50% capacity by alternating lockdowns of the population: at every instance, half of the population remains under lockdown
2. Fuller, J et al. Mitigation Policies and COVID-19–Associated Mortality — 37 European Countries, January 23–June 30, 2020. MMWR Vol. 70, January 12, 2021 <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7002e4-H.pdf> The earlier that stringent mitigation measures were implemented in Europe, the more limited was COVID-19 spread and lower the number of fatalities.
3. Crane, M et al. Change in Reported Adherence to Nonpharmaceutical Interventions During the COVID-19 Pandemic, April-November 2020. JAMA Published online January 22, 2021. <https://doi.org/10.1001/jama.2021.0286> Reported protective behaviors that had the largest decreases in weighted and adjusted adherence from early April to late November 2020 were remaining in residence except for essential activities or exercise, having no close contact with non–household members, not having visitors over and avoiding eating at restaurants. Mask user increased, perhaps due to public health messaging
4. Lendacki, F et al. COVID-19 Outbreak Among Attendees of an Exercise Facility — Chicago, Illinois, August–September 2020 Vol. 70 February 24, 2021 MMWR <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7009e2-H.pdf> A report of an outbreak among 55 of 81 attendees to an exercise facility in August-September 2020. Mask wearing and social distancing was inconsistent.
5. **Testing, Screening and Diagnosis**
6. **COVID-19 Testing Project.org** A team of researchers and physicians at UCSF, UCBerkeley, Chan Zuckerberg Biohub and Innovative Genomics Institute that compiled head-to-head comparisons of commercially available rapid serology tests and ELISA immunoassays for SARS-CoV-2 and published the data on line. <https://covidtestingproject.org/>
7. **Johns Hopkins Serology-based Testing website** describing different types of serologic assays for COVID-19,including those approved in the U.S. and in other countries and manufacturers sensitivity and specificity data <https://www.centerforhealthsecurity.org/resources/COVID-19/serology/Serology-based-tests-for-COVID-19.html>
8. Clapham H et al Sero-epidemiologic study designs for determining SARS-COV-2 transmission and immunity Emerg Infect Dis. 2020 Sep [date cited]. <https://doi.org/10.3201/eid2609.201840> Overview of study designs for various serologic tests
9. Koczula, KK and Gallotta, A Lateral Flow Assays, *Essays in Biochemistry* (2016) 60 111–120 DOI: 10.1042/EBC20150012 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4986465/pdf/bse0600111.pdf> A description of Lateral Flow immunoassay technology, the same used for most home pregnancy tests
10. Ulhaq, Z et al Interleukin-6 as a potential biomarker of COVID-19 progression Médecine et Maladies Infectieuses Volume 50, Issue 4, June 2020, Pages 382-38 <https://www.sciencedirect.com/science/article/pii/S0399077X20300883?via%3Dihub> Supports the Roche Diagnostics Elecsys IL-6 test EUA to identify SARS-CoV-2 positive patients at risk of severe COVID-19, a debatable clinical management tool
11. Kucirka et al. Variation in False-Negative Rate of Reverse Transcriptase Polymerase Chain Reaction–Based SARSCoV-2 Tests by Time Since Exposure. Annals of Internal Medicine. May 13, 2020 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7240870/> Molecular testing false-negative rate is lowest 3 days after onset of symptoms (approximately 8 days after exposure)
12. Rao et al. A Narrative Systematic Review of the Clinical Utility of Cycle Threshold Values in the Context of COVID-19. Infect Dis Ther. July 2020. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7386165/> Cycle Threshold (Ct) in a PCR assay is not an approved measure of viral burden at this time, even if it may correlate with SARS-CoV-2 RNA in the sample and have value in specific investigational settings.
13. FDA Website listing EUA-approved commercial SARS-CoV-2 Molecular, Serology and Antigen tests *In Vitro Diagnostics EUAs* <https://www.fda.gov/medical-devices/coronavirus-disease-2019-covid-19-emergency-use-authorizations-medical-devices/vitro-diagnostics-euas#individual-serological>
14. FDA Website listing EUA-authorized Serology Test performance, including sensitivities, specificities and PPV/NPVs <https://www.fda.gov/medical-devices/coronavirus-disease-2019-covid-19-emergency-use-authorizations-medical-devices/eua-authorized-serology-test-performance>
15. Pan et al Potential false-negative nucleic acid testing results for Severe Acute Respiratory Syndrome Coronavirus 2 from thermal inactivation of samples with low viral loads *Clinical Chemistry* April 4, 2020 <https://academic.oup.com/clinchem/advance-article/doi/10.1093/clinchem/hvaa091/5815979> Thermal inactivation of specimens at 56°C has been recommended to inactivate severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) before NAT. This study suggests that thermal inactivation adversely affected the efficiency of RT-PCR for SARS-CoV-2 detection, potentially leading to increased false negative results.
16. Lieberman, D Identification of Respiratory Viruses in Adults: Nasopharyngeal versus Oropharyngeal Sampling J of Clin Microbio Sept 2, 2009 <https://jcm.asm.org/content/47/11/3439> Not a SARS-CoV-2 study, but an interesting look at the differential sensitivity of various specimen collection methods in detecting other respiratory viruses. OP/Nasopharyngeal/NP Wash test sensitivities were 54.2%/73.3%/84.9% respectively.
17. Wyllie, A et al Saliva is more sensitive for SARS-CoV-2 detection in COVID-19 patients than nasopharyngeal swabs medRxiv April 22, 2020 (This was subsequently published in NEJM at <https://www.nejm.org/doi/pdf/10.1056/NEJMc2016359?articleTools=true>) <https://www.medrxiv.org/content/10.1101/2020.04.16.20067835v1> A study of 44 inpatients with severe COVID-19 disease, 29 with paired NP swabs and self-collected saliva specimens, suggesting that saliva was at least as effective for screening inpatients with severe disease
18. Abdalhamid, B., et al. 2020. Assessment of Specimen Pooling to Conserve SARS CoV-2 Testing Resources. American Journal of Clinical Pathology, Volume 153. <https://doi.org/10.1093/ajcp/aqaa064>
19. COVID-19 Testing Task Force website <https://testing.covid19.ca.gov/>
20. Gudbjartsson, D Humoral Immune Response to SARS-CoV-2 in Iceland NEJM Vol. 383 No. 10

<https://www.nejm.org/doi/full/10.1056/NEJMoa2026116?query=TOC> Crossectional longitudinal study of the Icelandic population showing that antiviral antibodies did not decline over the 4 months between serological testing campaigns

1. Johns Hopkins COVID-19 Molecular Testing page <https://www.centerforhealthsecurity.org/resources/COVID-19/molecular-based-tests/> A thorough treatment and clear description of EUA-approved and available molecular COVID-19 tests, including LOD (Limits of Detection) and PPA (positive percent agreement) as a proxy for sensitivity and NPA (negative percent agreement) as a proxy for specificity.
2. Sung, H et al Nationwide External Quality Assessment of SARS-CoV-2 Molecular Testing, South Korea Vol 26 No 10 October 2020 <https://wwwnc.cdc.gov/eid/article/26/10/20-2551_article> A procedure for testing the sensitivities for commercial testing is presented. This study found there to be a range of sensitivities and specificities for SARS-CoV-2 commercial testing in Korea, from acceptable (PowerCheck 2019 nCoV kit) to less so (AllPlex kit).
3. Joung, J et al Detection of SARS-CoV-2 with SHERLOCK One-Pot Testing NEJM Letter, Sept 16, 2020 <https://doi.org/10.1056/NEJMc2026172> A one-hour CRISPR-based test that combines a the extraction and amplification steps in the assay and provides reasonably acceptable sensitivity (93.1%) and specificity (98.5%) compared to PCR molecular tests.
4. Higgins, T et al SARS-CoV-2 Nasopharyngeal Swab Testing—False-Negative Results From a Pervasive Anatomical Misconception JAMA Network September 17, 2020 <https://doi.org/10.1001/jamaoto.2020.2946> An important reminder regarding proper nasopharyngeal swab collections
5. Morley, G et al Sensitive Detection of SARS-CoV-2–Specific Antibodies in Dried Blood Spot Samples Vol. 26, No. 12, December 2020 <https://doi.org/10.3201/eid2612.203309> Opportunity for a more simple collection procedure for running a highly sensitive and specific serological test
6. Makaronidis J, Mok J, Balogun N, Magee CG, Omar RZ, Carnemolla A, et al. (2020) Seroprevalence of SARS-CoV-2 antibodies in people with an acute loss in their sense of smell and/or taste in a community-based population in London, UK: An observational cohort study. PLoS Med 17(10): e1003358. <https://doi.org/10.1371/journal.pmed.1003358> Anosmia was a more specific screening tool for COVID-19 than ageusia
7. Schwarzkopf, S et al Cellular Immunity in COVID-19 Convalescents with PCR-Confirmed Infection but with Undetectable SARS-CoV-2–Specific IgG Vol. 27, No. 1 January 2021 (On line October 2020) <https://wwwnc.cdc.gov/eid/article/27/1/20-3772_article> 78% of PCR-positive volunteers with undetectable antibodies showed T cell immunity against SARS-CoV-2
8. Larremore, D et al Test sensitivity is secondary to frequency and turnaround time for COVID-19 surveillance medRxiv September 8, 2020 <https://www.medrxiv.org/content/10.1101/2020.06.22.20136309v3.full.pdf> Interesting study supporting that frequency of testing and test turnaround time is more critical than test sensitivity to effective surveillance
9. Wang, H et al Performance of Nucleic Acid Amplification Tests for Detection of Severe Acute Respiratory Syndrome Coronavirus 2 in Prospectively Pooled Specimens, EID Volume 27, Number 1, January 2021 <https://doi.org/10.3201/eid2701.203379> “tested 1,648 prospectively pooled specimens by using 3 nucleic acid amplification tests for severe acute respiratory syndrome coronavirus 2:…Positive percent agreement (PPA) of pooled versus individual testing ranged from 71.7% to 82.6% for pools of 8 and from 82.9% to 100.0% for pools of 4.”
10. Wölfel, R., Corman, V.M., Guggemos, W. et al. Virological assessment of hospitalized patients with COVID-2019. Nature 581, 465–469 (2020). <https://doi.org/10.1038/s41586-020-2196-x> Comparative viral loads and specimen sources are analyzed for SARS-CoV and SARS-CoV-2. A novel technique is used for determining replicative virus by identifying viral mRNA, used to identify persistent active infection in 0.6% of patients in a JAMA article (<https://doi/org/10.1001/jamainternmed.2020.7570>)
11. Jones A, Fialkowski V, Prinzing L, Trites J, Kelso P, Levine M. Assessment of Day-7 Postexposure Testing of Asymptomatic Contacts of COVID-19 Patients to Evaluate Early Release from Quarantine — Vermont, May–November 2020. MMWR Morb Mortal Wkly Rep 2021;70:12–13. <http://dx.doi.org/10.15585/mmwr.mm7001a3> Vermont’s policy to test asymptomatic exposed patients at 7 days and if negative to release from quarantine was successful, with no negative patients at 7 days subsequently testing positive, although there was only a small number (16%) that underwent subsequent testing after a negative test at seven days.
12. Pilarowski, G et al. Field performance and public health response using the BinaxNOWTM Rapid SARS-CoV-2 antigen detection assay during community-based testing . Clin Inf Dis. 26 December 2020 <https://doi.org/10.1093/cid/ciaa1890> Among 3,302 persons tested for SARS-CoV-2 by BinaxNOWTM and RT-PCR in a community setting, rapid assay sensitivity was 100%/98.5%/89% using RT-PCR Ct thresholds of 30, 35 and none. “We returned rapid antigen test results via secure messaging within an hour of testing. Persons with a positive rapid antigen test received a follow-up phone call within 2 hours.”
13. Bastos, M. L. et al The Sensitivity and Costs of Testing for SARS-CoV-2 Infection With Saliva Versus Nasopharyngeal Swabs: A Systematic Review and Meta-analysis. An Int Med, January 12, 2021 <https://doi.org/10.7326/M20-6569> Saliva sampling seems to be a similarly sensitive and less costly alternative that could replace nasopharyngeal swabs for collection of clinical samples for SARS-CoV-2 testing, although this study did not look at test specificity
14. Butler-Laporte, G et al Comparison of Saliva and Nasopharyngeal Swab Nucleic Acid Amplification Testing for Detection of SARS-CoV-2: A Systematic Review and Meta-analysis JAMA Intern Med. Published online January 15, 2021 <https://doi.org/10.1001/jamainternmed.2020.8876> Another study indicating that salivary PCR (NAAT) testing is comparable to nasopharyngeal swab testing sensitivity and specificity
15. Prince-Guerra, J.L. et al. Evaluation of Abbott BinaxNOW Rapid Antigen Test for SARS-CoV-2 Infection at Two Community-Based Testing Sites — Pima County, Arizona, November 3–17, 2020 MMWR Vol 70(3) January 22, 2021 <http://dx.doi.org/10.15585/mmwr.mm7003e3> In this evaluation, using real-time RT-PCR as the standard, the sensitivity of the BinaxNOW antigen test was lower among specimens from asymptomatic persons (35.8%) than among specimens from symptomatic persons (64.2%). Specificity (99.8%–100%) was high in specimens from both asymptomatic and symptomatic groups.
16. Shuren, J and Stenzel, T. The FDA’s Experience with Covid-19 Antibody Tests N Engl J Med February 18, 2021; 384:592-594 <https://doi.org/10.1056/NEJMp2033687> A description of the steps taken to maximize available of serological tests for COVID-19, followed by the removal of a large number of poorly performing tests from the market after the market was flooded with flawed tests that did not adhere to regulations
17. **Treatment**
18. **Bamlanivimab**
19. U.S. FDA News Release, Coronavirus (COVID-19) Update: FDA Authorizes Monoclonal Antibody for Treatment of COVID-19 <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-authorizes-monoclonal-antibody-treatment-covid-19> Studies of bamlanivimab have not yet been published in the refereed literature, but the FDA news release included the following: “While the safety and effectiveness of this investigational therapy continues to be evaluated, bamlanivimab was shown in clinical trials to reduce COVID-19-related hospitalization or emergency room visits”
20. *The Medical Letter* An EUA for Bamlanivimab—A Monoclonal Antibody for COVID-19 JAMA. Published online December 11, 2020. <https://doi.org/10.1001/jama.2020.24415> A monoclonal antibody approved for mild to moderate COVID-19. Bamlanivimab is not authorized for patients who are hospitalized due to COVID-19 or require oxygen therapy due to COVID-19. A benefit of bamlanivimab treatment has not been shown in patients hospitalized due to COVID-19.” Also, “The data supporting this EUA for bamlanivimab are based on an interim analysis from a phase two randomized, double-blind, placebo-controlled clinical trial in 465 non-hospitalized adults with mild to moderate COVID-19 symptoms.” Health Care Provider information on bamlanivimab is available at <https://www.fda.gov/media/143603/download>
21. Center for Drug Evaluation and Research (CDER) Review, Emergency Use Authorization (EUA) for bamlanivimab 700mg IV <https://www.fda.gov/media/144118/download>
22. ACTIV-3/TICO LY-CoV555 (bamlanivimab) Study Group. A Neutralizing Monoclonal Antibody for Hospitalized Patients with Covid-19 N Eng J Med December 22, 2020, <https://doi.org/10.1056/NEJMoa2033130> This monoclonal antibody trial demonstrated no benefit for hospitalized patients compared to placebo.
23. Chen, P et al. SARS-CoV-2 Neutralizing Antibody LY-CoV555 in Outpatients with Covid-19 N Eng J Med October 28, 2020 <https://doi.org/10.1056/NEJMoa2029849>

The BLAZE-1 trial included a primary endpoint of viral load at day 11, a benefit not achieved by the intervention, although a secondary endpoint - progression to hospitalization – did suggest modest benefit (1.6% in intervention group, 6.3% in the placebo group). In a post hoc analysis examining hospitalization among patients who were 65 years of age or older and among those with a BMI of 35 or more, the percentage who were hospitalized was 4% (4 of 95) in the LY-CoV555 group and 15% (7 of 48) in the placebo group.

1. Gottlieb, R et al. Effect of Bamlanivimab as Monotherapy or in Combination With Etesevimab on Viral Load in Patients With Mild to Moderate COVID-19: A Randomized Clinical Trial

JAMA. Published online January 21, 2021. <https://doi.org/10.1001/jama.2021.0202> Treatment with bamlanivimab and etesevimab combination therapy, but not bamlanivimab monotherapy, resulted in a reduction in SARS-CoV-2 log viral load at day 11 in patients with mild to moderate COVID-19. The comparison of the monotherapy groups against the final results for the placebo group led to changes in the effect sizes, and the loss of previously reported statistical significance for decreased viral load in the group that received 2800 mg of bamlanivimab that was reported in the Chen article (see previous report) describing early findings of the BLAZE-1 trial.

1. **Baricitinib**
2. Kalil, A.C. et al. Baricitinib plus Remdesivir for Hospitalized Adults with Covid-19. N Eng J Med December 11, 2020 <https://doi.org/10.1056/NEJMoa2031994> Baricitinib plus remdesivir was superior to remdesivir alone in reducing recovery time and accelerating improvement in clinical status, notably among patients receiving high-flow oxygen or noninvasive mechanical ventilation for which groups the hazard ratios were 0.4 and 0.55 respectively.
3. **Casirivimab-Imdevimab**
4. Weinreich, D et al. REGN-COV2, a Neutralizing Antibody Cocktail, in Outpatients with Covid-19 N Eng J Med December 17, 2020 <https://doi.org/10.1056/NEJMoa2035002> The REGN-COV2 antibody cocktail (AKA Regeneron REGN10933 and REGN10987 AKA Casirivimab-Imdevimab monoclonal antibody to the spike protein) reduced viral load, with a greater effect in patients whose immune response had not yet been initiated.
5. FDA EUA for Casirivimab-Imdevimab, authorized November 21, 2020 <https://www.fda.gov/media/143891/download> To treat mild to moderate COVID-19 in adults and pediatric patients >12 years of age but not adults or pediatric patients who are hospitalized or who require oxygen therapy due to COVID-19
6. Baum A, Ajithdoss D, Copin R, et al. REGN-COV2 antibodies prevent and treat SARS-CoV-2 infection in rhesus macaques and hamsters. Science Nov 27;370(6520):1110-1115 <https://pubmed.ncbi.nlm.nih.gov/33037066/> Initial testing of REGN-CoV cocktail (REGN10933 and REGN10987, AKA Casirivimab-Imdevimab) in macaque monkeys and hamsters suggested a dose-related therapeutic and prophylactic impact on viral replication and lung pathology
7. **Convalescent Plasma**
8. Libster, R et al. Early High-Titer Plasma Therapy to Prevent Severe Covid-19 in Older Adults N Eng J Med Vol. 69 December 17, 2020 <https://doi.org/10.1056/NEJMoa2033700> “Early administration of high-titer convalescent plasma against SARS-CoV-2 to mildly ill infected older adults reduced the progression of Covid-19.”
9. Simonovich, V et al. A Randomized Trial of Convalescent Plasma in Covid-19 Severe Pneumonia N Eng J Med November 24, 2020 <https://doi.org/10.1056/NEJMoa2031304> No significant differences were observed in clinical status or overall mortality between 228 patients with severe pneumonia treated with convalescent plasma and 105 patients who received placebo.
10. **Dexamethasone**
11. Horby, PW et al *Effect of Dexamethasone in Hospitalized Patients with COVID-19 – Preliminary Report* RECOVERY study <https://doi.org/10.1101/2020.06.22.20137273> 33% improvement in mortality with use of dexamethasone in ventilation assisted patients admitted to the hospital with severe COVID-19, 20% improvement in mortality for oxygen supplemented patients without invasive ventilation assistance, but no benefit for randomized admissions with COVID-19
12. **Fluvoxamine**
13. Lenze, E et al, Fluvoxamine vs Placebo and Clinical Deterioration in Outpatients With Symptomatic COVID-19: A Randomized Clinical Trial JAMA Network November 13, 2020 <https://doi.org/10.1001/jama.2020.22760> A weakly powered study suggesting that the SSRI and σ-1 Receptor agonist Fluvoxamine may help symptomatic patients have a lower likelihood of clinical deterioration over 15 days.
14. **Hydroxychloroquine**
15. Horby, PW et al, Effe*ct of Hydroxychloroquine in Hospitalized Patients with COVID-19: Preliminary results from a 5 multi-centre, randomized, controlled trial*, RECOVERY Trial MedRxiv Preprint, June 5, 2020 <https://doi.org/10.1101/2020.07.15.20151852>
* Primary study that concluded that Hydroxychloroquine was ineffective in hospitalized patients with a Covid-19 diagnosis
* Statements of Professor Peter Horby and Professor Martin Landray on June 5, 2020 regarding the decision to cease enrolling patients into the hydroxychloroquine arm of the RECOVERY trial in the UK:

‘A total of 1542 patients were randomised to hydroxychloroquine and compared with 3132 patients randomised to usual care alone. There was no significant difference in the primary endpoint of 28-day mortality (25.7% hydroxychloroquine vs. 23.5% usual care; hazard ratio 1.11 [95% confidence interval 0.98-1.26]; p=0.10). There was also no evidence of beneficial effects on hospital stay duration or other outcomes.’

1. Boulware, D.R. A Randomized Trial of Hydroxychloroquine as Postexposure Prophylaxis for Covid-19, NEJM June 3, 2020 DOI: 10.1056/NEJMoa2016638 <https://www.nejm.org/doi/pdf/10.1056/NEJMoa2016638?articleTools=true>

Hydroxychloroquine did not prevent illness after high-risk or moderate-risk exposure to COVID-19. Strong argument against the Risch argument (below) that Hydroxychloroquine is effective when given early in the course of COVID-19 infection

1. National Institutes of Health. NIH halts clinical trial of hydroxychloroquine: study shows treatment does no harm, but provides no benefit [news release]. 20 June 2020. Accessed at www.nih.gov/news-events/news-releases/nih-halts-clinical-trial-hydroxychloroquine on 6 July 2020.
2. Cavalcanti, AB Hydroxychloroquine with or without Azithromycin in Mild-to-Moderate Covid-19 NEJM July 23, 2020 DOI: 10.1056/NEJMoa2019014 Among patients hospitalized with mild-to-moderate Covid-19, the use of hydroxychloroquine, alone or with azithromycin, did not improve clinical status at 15 days
3. World Health Organization. WHO discontinues hydroxychloroquine and lopinavir/ritonavir treatment arms for COVID-19 [news release]. 4 July 2020. Accessed at [www.who.int/news-room/detail/04-07-2020-who-discontinues-hydroxychloroquine-and-lopinavir-ritonavir-treatment-arms-for-covid-19 on 6 July 2020](http://www.who.int/news-room/detail/04-07-2020-who-discontinues-hydroxychloroquine-and-lopinavir-ritonavir-treatment-arms-for-covid-19%20on%206%20July%202020).
4. Annals of Internal Medicine, Update Alert 2: Should Clinicians Use Chloroquine or Hydroxychloroquine Alone or in Combination With Azithromycin for the Prophylaxis or Treatment of COVID-19? Living Practice Points From the American College of Physicians: “Do not use chloroquine or hydroxychloroquine alone or in combination with azithromycin as prophylaxis against COVID-19 (or)…as a treatment for COVID-19.”
5. Do not use chloroquine or hydroxychloroquine alone or in combination with azithromycin as a treatment of patients with COVID-19.
6. Two published studies were retracted in June 2020 (*The Lancet* retracted the paper titled Hydroxychloroquine or Chloroquine With or Without a Macrolide for Treatment of COVID-19: A Multinational Registry Analysis and The New England Journal of Medicine retracted the paper titled Cardiovascular Disease, Drug Therapy, and Mortality in COVID-19, both due to questions about the data procured from 169 hospitals around the world by Surgisphere, a data compiling company used in the studies).
7. Harvey A. Risch, *Early Outpatient Treatment of Symptomatic, High-Risk Covid-19 Patients Should be Ramped-Up Immediately as Key to the Pandemic Crisis* Oxford University Press on behalf of the Johns Hopkins Bloomberg School of Public Health. Yale epidemiologist supporting the use and further research into Hydroxychloroquine in combination with Azithromycin and Zinc in **outpatients** as prevention and or treatment prior to the first 48 hours of symptoms. Some of the data from the studies upon which he bases his conclusions have been deemed unreliable. These studies include:
* 1450 (405) symptomatic Zelenko Patients, 1045 considered low risk not treated, 405 treated with HCQ+AZ+Zinc X 5 days; COVID diagnosis made based upon clinical symptoms
* 1061 Marseilles patients, tested positive and treated for at least 3 days followed for 9 days; “good clinical outcome and virological cure were seen in 973 patients (92%), 5 died (~0.5%) and remainder in various stages of recovery”
* 42 patients in Marseilles France, Non randomized study with questionable data according to third party analysis
1. Yao, X. et al. In vitro antiviral activity and projection of optimized dosing design of hydroxychloroquine for the treatment of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Clin. Infect. Dis. 2020. Study upon which dosing schedules were designed for a number of observational studies exploring the effectiveness of Hydroxychloroquine and Chloroquine
2. Philippe Gautret et al, Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial, International Journal of Antimicrobial Agents, 56 (2020) 105949 https://doi.org/10.1016/j.ijantimicag.2020.105949 Only 20 cases in the series from France
3. Arnold et al, (from the Center for Emerging and Reemerging Infectious Diseases (CERID) at University of Washington Seattle) Clin Transl Sci (2020) 13, 642–645; March 27, 2020; accepted: April 6, 2020. <http://doi.org/10.1111/cts.12797> Reviews the in vitro studies and concludes “Improved HCQ PK models are needed to increase our confidence in predicting HCQ efficacy”
4. Mitjà, O et al. A Cluster-Randomized Trial of Hydroxychloroquine for Prevention of Covid-19

N Engl J Med February 4, 2021; 384:417-427 <https://doi.org/10.1056/NEJMoa2021801> Postexposure therapy with hydroxychloroquine did not prevent SARS-CoV-2 infection or symptomatic Covid-19 in healthy persons exposed to a PCR-positive case patient

1. **Lopinavir–Ritonavir**
2. Cao, b et al A Trial of Lopinavir–Ritonavir in Adults Hospitalized with Severe Covid-19 , N Engl J Med 2020; 382:1787-1799 May 7, 2020 In hospitalized adult patients with severe Covid-19, no benefit was observed with lopinavir–ritonavir treatment beyond standard care
3. **LY-CoV555 – See Bamlanivimab**
4. **Remdesivir**
5. Beigel, JH *Remdesivir for the Treatment of Covid-19— Preliminary Report* NEJM <https://doi/org/10.1056/NEJMoa2007764> Remdesivir was superior to placebo in shortening the time to recovery in adults hospitalized with Covid-19 and evidence of lower respiratory tract infection
6. WHO Solidarity trial consortium, Repurposed antiviral drugs for COVID-19 –interim WHO SOLIDARITY trial results, medRxiv preprint server, October 15, 2020 <https://doi.org/10.1101/2020.10.15.20209817> Lack of overall mortality, initiation of ventilation and duration of hospital stay benefit was demonstrated in hospitalized patients in the SOLIDARITY trial.
7. **Tocilizumab**
8. Hermine, O et al Effect of Tocilizumab vs Usual Care in Adults Hospitalized With COVID-19 and Moderate or Severe Pneumonia A Randomized Clinical Trial, JAMA Internal Medicine October 20, 2020 online, <https://doi/org/10.1001/jamainternmed.2020.6820> A trial of 65 out of 131 patients randomly assigned to Tocilizumab (an interleukin-6 receptor antibody/blocker) did not result in detectable improvement in outcome and death at 28 days, but may have reduced the need for ventilatory support at 14 days
9. Stone, J et al Efficacy of Tocilizumab in Patients Hospitalized with Covid-19, NEJM October 21, 2020 <https://doi/org/10.1056/NEJMoa2028836> Interleukin-6 blockade appeared to be ineffective in preventing intubation or death in patients moderately ill with COVID-19 in patients at high risk for disease progression within 28 days after treatment when compared to placebo.
10. **Vaccine and Immunology**
11. Thompson, K et al Emergency Use Authorizations During the COVID-19 Pandemic JAMA On Line August 31, 2020 <https://doi.org/10.1001/jama.2020.16253> Addresses the risk of loss of credibility arising from EUA authorizations followed by revocation as happened with hydroxychloroquine.
12. Fisher, K et al Attitudes Toward a Potential SARS-CoV-2 Vaccine: A Survey of U.S. Adults An Int Med 4 September 2020 <https://doi.org/10.7326/M20-3569> Survey conducted in April indicates that 57.6% of participants intended to be vaccinated, 31.6% were not sure and 10.8% did not intend to be vaccinated. Reasons giving included vaccine-specific concerns, a need for more information, antivaccine attitudes or beliefs, and a lack of trust
13. Buttenheim, A SARS-CoV-2 Vaccine Acceptance: We May Need to Choose Our Battles Editorial An Int Med September 4, 2020 <https://www.acpjournals.org/doi/10.7326/M20-6206> Selecting the population towards which to focus vaccination messaging
14. Arvin, A et al A perspective on potential antibody-dependent enhancement of SARS-CoV-2 Nature, Vol. 584 Issue 7821 July 13, 2020 <https://doi.org/10.1036/s41586-020-2538-8> Reviews the experience and potential mechanisms of Antibody-Dependent Enhancement (ADE) of viral disease with RSV, influenza and dengue, when infection occurs in the setting of existing antibodies to the viral agent (either due to prior infection or vaccination). Raises concern for the possibility of worsening disease in COVID-19 patients following an undertested vaccine
15. Shin, M et al COVID-19 vaccine development and a potential nanomaterial path forward Nature Nanotechnology Vol 15, July 15, 2020 <https://www.nature.com/articles/s41565-020-0737-y> A review of different vaccine strategies
16. Patel, M et al Change in Antibodies to SARS-CoV-2 Over 60 Days Among Health Care Personnel in Nashville, Tennessee JAMA Network September 17, 2020 <https://doi.org/10.1001/jama.2020.18796> Concerning finding of waning antibodies to the spike protein after 60 days in HCW with a history of confirmed COVID-19
17. Operation Warp Speed and COVID-19 Therapeutics Audio interview with N Engl J Med 2020; 383:e92 September 17, 2020 <https://doi.org/10.1056/NEJMe2029886> An interesting discussion of the challenges of coordinating rapid development and distribution of a safe and effective vaccine between a team consisting of political leaders, private corporations and scientists/public health experts.
18. Opel, D et al Should We Mandate a COVID-19 Vaccine for Children? JAMA Peds September 14, 2020 <https://doi.org/10.1001/jamapediatrics.2020.3019> Editorial regarding vaccination mandates for school attendance
19. Opel DJ﻿, Diekema DS﻿, Marcuse EK﻿. A critique of criteria for evaluating vaccines for inclusion in mandatory school immunization programs. ﻿ Pediatrics. 2008;122(2):e504-e510 <https://doi.org/10.1542/peds.2007-3218> Interesting review of criteria that are critical if a vaccine is mandated for school attendance
20. USDHHS/FDA Vaccines to Prevent COVID-19: Guidelines for Industry <https://www.fda.gov/media/139638/download> “FDA is issuing this guidance to assist sponsors in the clinical development and licensure of vaccines for the prevention of COVID-19” A 21-page document describing the EUA planning for a COVID-19 vaccine
21. Leask, J Vaccines — lessons from three centuries of protest Nature Book Review of the book *Anti-vaxxers: How to Challenge a Misinformed Movement* Jonathan M. Berman MIT Press (2020) September 21, 2020 <https://www.nature.com/articles/d41586-020-02671-0> This book review covers a lot of ground from Jonathan Berman’s book addressing historical and sociological factors contributing to the anti-vaccine movement
22. Reiter, PL et al Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? *Vaccine* Vol. 38 #42, 29 Sept 2020, Pages 6500-6507 <https://www.sciencedirect.com/science/article/pii/S0264410X20310847?via%3Dihub> A thorough survey identifying demographic factors correlating with people who intend to decline COVID-19 vaccination
23. Slaoui, M et al Bridging the Gap at Warp Speed — Delivering Options for Preventing and Treating Covid-19 NEJM Perspective Sept 15, 2020 <https://doi.org/10.1056/NEJMp2028535> A description of the DHHS program *Operation Warp Speed* from one of the committees leaders
24. Jeyanathan, M et al Immunological considerations for COVID-19 strategies Nature Review Immunology October 2020 <https://doi.org/10.1038/S41577-020-00434-6> Interesting cutting edge research on new immunization strategies being applied to COVID-19
25. Bennett, N The Role of the Advisory Committee on Immunization Practices in Ensuring Optimal Use of Vaccines JAMA January 29, 2019 Volume 321, Number 4 <https://doi.org/10.1001/jama.2018.20792> An impressive review of the ACIP procedures
26. Schwarzkopf, S et al Cellular Immunity in COVID-19 Convalescents with PCR-Confirmed Infection but with Undetectable SARS-CoV-2–Specific IgG, EID Vol. 27, No. 1 (Downloaded October 16, 2020) January 2021 <https://wwwnc.cdc.gov/eid/article/27/1/20-3772_article> An interesting discussion of the potential significance of T-cell mediated immunity in SARS-CaV-2 immunopathology, reiterating the tapering of antibody titers over 60 days
27. Dan, J et al Immunological memory to SARS-CoV-2 assessed for greater than six months after infection, bioRxiv open access, November 16, 2020 <https://www.biorxiv.org/content/10.1101/2020.11.15.383323v1> In contrast to some studies suggesting a tapering of anti-SARS-CoV-2 IgG after three months, this study suggests a lingering antibody presence and immunity for at least 6 months
28. Braun, J et al, SARS-CoV-2-reactive T cells in healthy donors and patients with COVID-19. Nature Vol. 587, pages270–274(July 29, 2020) <https://www.nature.com/articles/s41586-020-2598-9> Raises the question whether background T-cell immunity to commonly circulating coronaviruses may provide some protection against SARS-CoV-2
29. Peng, Y et al Broad and strong memory CD4 + and CD8 + T cells induced by SARS-CoV-2 in UK convalescent individuals following COVID-19. Nat Immunol Epub 2020 Sep 4. 21(11):1336-134 <https://doi.org/10.1038/s41590-020-0782-6> Another study highlighting the importance of T-cell mediated immunity in COVID-19
30. Feng, Y et al An adenovirus serotype 2-vectored ebolavirus vaccine generates robust antibody and cell-mediated immune responses in mice and rhesus macaques Emerging Microbes & Infections (2018) 7:101 <https://doi.org/10.1038/s41426-018-0102-5> A trial of an adenovirus-serotype-2-vectored vaccine for Ebola in 2018 as a booster for those with antibodies against the serotype-5 adenovirus used as the vector for the first dose of this Ebola virus vaccine. A similar strategy is being used by the Sputnik-5 COVID-19 vaccine, although no published data has been made available on the latter Russian SARS-CoV-2 vaccine
31. Kennedy, S et al. Phase 2 Placebo-Controlled Trial of Two Vaccines to Prevent Ebola in Liberia N Engl J Med October 12, 2017; 377:1438-1447 <https://doi.org/10.1056/NEJMoa1614067> Two Ebola vaccines, one utilizing the chimpanzee adenovirus 3 as a viral vector and the other a recombinant vesicular stomatitis virus as the vector for the Ebola surface glycoprotein vaccine in Phase 2 trial, with the Phase 3 trial discontinued because the Ebola outbreak subsided. The Astra-Zeneca COVID-19 vaccine also uses a chimpanzee adenovirus vector.
32. Leitner, W et al DNA and RNA-based vaccines: Principles, Progress and Prospects Vaccine. 1999 Dec 10; 18(9-10): 765–777. [https://doi.org/10.1016/S0264-410X(99)00271-6](https://doi.org/10.1016/S0264-410X%2899%2900271-6) An in-depth discussion and comparison between DNA-based, RNA-based and vector-based vaccines from 1999
33. WHO Guidelines for the Clinical and Nonclinical Evaluation of vaccines, including DNA-based Vaccines <https://www.who.int/publications/m/item/guidelines-for-assuring-the-quality-and-non-clinical-safety-evaluation-of-dna-vaccines>:
* Guidelines on clinical evaluation of vaccines: regulatory expectations. In: WHO Expert Committee on Biological Standardization. Fifty-second report. Geneva, World Health Organization, 2004, Annex 1 (WHO Technical Report Series, No. 924).
* Guidelines on nonclinical evaluation of vaccines. In: WHO Expert Committee on Biological Standardization. Fifty-fourth Report. Geneva, World Health Organization, 2005, Annex 1 (WHO Technical Report Series, No. 927)
* Guidelines for assuring the quality of DNA vaccines. In: WHO Expert Committee on Biological Standardization. Forty-seventh report. Geneva, World Health Organization, 1998, Annex 3 (WHO Technical Report Series, No. 878)
1. Maassab, H and Bryant, M The development of live attenuated cold-adapted influenza virus vaccine for humans Rev Med Virol Oct-Dec 1999;9(4):237-44 <https://pubmed.ncbi.nlm.nih.gov/10578119/> A review of the process by which attenuated cold-adapted influenza virus was developed for the Live Attenuated Influenza Vaccine (LAIV)
2. Dooling, K et al The Advisory Committee on Immunization Practices’ Interim Recommendation for Allocating Initial Supplies of COVID-19 Vaccine — United States, 2020 MMWR Vol. 69, December 3, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6949e1-H.pdf> ACIP report describing the deliberations from which the Phase 1 COVID-19 vaccine distribution recommendations were derived
3. Dooling, K et al The Advisory Committee on Immunization Practices’ Interim Recommendation for Allocating Initial Supplies of COVID-19 Vaccine — United States, 2020 MMWR Vol. 69, December22, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm695152e2-H.pdf> On December 20, ACIP updated interim vaccine allocation recommendations. In Phase 1b, COVID-19 vaccine should be offered to persons aged ≥75 years and non–health care frontline essential workers, and in Phase 1c, to persons aged 65–74 years, persons aged 16–64 years with high-risk medical conditions, and essential workers not included in Phase 1b.
4. Du, J et al Use of Deep Learning to Analyze Social Media Discussions About the Human Papillomavirus Vaccine JAMA Network Open. 2020;3(11):e2022025 <https://doi.org/10.1001/jamanetworkopen.2020.22025> An analysis of behavioral change theory as applied to improving vaccination rates for the HPV vaccine
5. Audio file of JAMA editor interview with Paul Offitt MD discussing safety issues of the Moderna and Pfizer mRNA COVID-19 vaccines, conducted December 2, 2020 <https://www.youtube.com/watch?v=V4xClOYM3iE&utm>
6. Abassi, Jennifer. COVID-19 and mRNA Vaccines—First Large Test for a New Approach JAMA Medical News and Perspectives;324(12):1125-1127. September 3, 2020 <https://doi.org/10.1001/jama.2020.16866> A succinct report addressing some of the details of the new mRNA vaccine technology
7. Paltiel, A.D. et al Clinical Outcomes Of A COVID-19 Vaccine: Implementation Over Efficacy Health Affairs, online November 19, 2020 <https://doi.org/10.1377/hlthaff.2020.02054> A detailed study of mathematical models looking at efficacy and temporal parameters that will influence the success of various vaccine strategies
8. Tomáš Hanke (2019) Aiming for protective T-cell responses: a focus on the first generation conserved-region HIVconsv vaccines in preventive and therapeutic clinical trials, Expert Review of Vaccines, 18:10, 1029-1041, <https://doi.org/10.1080/14760584.2019.1675518> A review of HIV-vaccine development over the past 10 years, including the utilization of a recombinant Chimpanzee Adenovirus (ChAdV63) as the vaccine’s viral vector
9. Food and Drug Administration. Development and licensure of vaccines to prevent COVID-19: guidance for industry [Internet]. Silver Spring (MD): FDA; 2020 Jun 30 (Guidance Document) <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/development-and-licensure-vaccines-prevent-covid-19>
10. Pardi, N et al. Nucleoside-modified mRNA immunization elicits influenza virus hemagglutinin stalk-specific antibodies Nature Communications, August 2018 9:3361 <https://doi.org/10.1038/s41467-018-05482-0> A small trial utilizing mRNA vaccine technology to stimulate immunity against the conserved influenza hemagglutinin stalk antigens in mice, rabbits and ferrets
11. King, Anthony. Vector-Based Vaccines Come to the Fore in the COVID-19 Pandemic. The Scientist, Opinion September 8, 2020 <https://www.the-scientist.com/news-opinion/vector-based-vaccines-come-to-the-fore-in-the-covid-19-pandemic-67915> A nice background review of the technology involved in virus-vectored vaccines
12. Choe PG, Kim K-H, Kang CK, Suh HJ, Kang E, Lee SY, et al. Antibody responses 8 months after asymptomatic or mild SARS-CoV-2 infection. Emerg Infect Dis. 2021 Mar [Cited December 23,2020]. <https://doi.org/10.3201/eid2703.204543> Three out of four commercial kits detected antibodies 8 months following asymptomatic or mildly symptomatic COVID-19 in 58 people, although neutralizing activity was detected in just 53.4% of asymptomatic or mildly symptomatic participants. Performance of the anti-nucleocapsid ELISA by Epitope was the least sensitive.
13. S. Wang et al. An antibody-dependent enhancement (ADE) activity eliminated neutralizing antibody with potent prophylactic and therapeutic efficacy against SARS-CoV-2 in rhesus monkeys bioRxiv [Preprint]. 27 July 2020; <https://doi.org/10.1101/2020.07.26.222257> A suggestion that a monoclonal antibody-mediated antibody-enhanced disease phenomenon could be neutralized by an Fc-region mutation in the antibody
14. Lumley, S et al. Antibody Status and Incidence of SARS-CoV-2 Infection in Health Care Workers N Eng J Med December 23, 2020 <https://doi.org/10.1056/NEJMoa2034545> Whereas 223 out of 11,364 health care workers with negative anti-spike/anti-nucleocapsid antibodies developed a positive PCR test for SARS-CoV-2 during 31 week follow up, only 2 out of 1265 with positive anti-spike/anti-nucleocapsid antibodies returned positive PCR tests, suggesting the presence of antibodies conferred significantly reduced risk for new COVID-19 infection.
15. Connors, M et al. SARS-CoV-2 Vaccines: Much Accomplished, Much to Learn An Int Med 19 January 2021 <https://www.acpjournals.org/doi/10.7326/M21-0111> Updated review of currently authorized COVID-19 vaccines and other COVID-19 vaccines in the pipeline.
16. Shimabukuro, T et al Reports of Anaphylaxis After Receipt of mRNA COVID-19 Vaccines

in the US—December 14, 2020-January 18, 2021. JAMA February 12, 2021 <https://doi.org/10.1001/jama.2021.1967> Anaphylaxis was reported in 47 instances following Pfizer-BioNTech vaccine, for a reporting rate of 4.7 cases/million doses administered, and 19 instances following Moderna vaccine, for a reporting rate of 2.5 cases/million doses administered.

1. Gee J, Marquez P, Su J, et al. First Month of COVID-19 Vaccine Safety Monitoring — United States, December 14, 2020–January 13, 2021. MMWR Morb Mortal Wkly Rep. ePub: 19 February 2021. <http://dx.doi.org/10.15585/mmwr.mm7008e3> A review of vaccine reactions according to VAERS and V-safe data, indicating that the two COVID-19 vaccinations currently available have a favorable safety profile
2. Blumenthal, K et al. Delayed Large Local Reactions to mRNA-1273 Vaccine against SARS-CoV-2. NEJM Correspndence; March 6, 2021 <https://doi.org/10.1056/NEJMc2102131> A succinct summary of two forms of local reaction that are fairly common with the Moderna mRNA-1273 vaccine, one that occurs in the first couple of days and the other that is delayed until about 8 days post vaccination.
3. **Vaccines: Individual Products**
4. **Pfizer-BioNTech BNT162b2**
5. Polack, F et al Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med December 10, 2020 <https://doi.org/10.1056/NEJMoa2034577> An encouraging study regarding the safety and efficacy of the new Pfizer/BioNTech COVID vaccine, BNT162b2, published by the NEJM on the same day that the vaccine undergoes scrutiny at a meeting of the FDA Advisory Committee to consider EUA
6. Rubin, Eric and Longo, Dan SARS-CoV-2 Vaccination — An Ounce (Actually, Much Less) of Prevention. *Opinion* N Engl J Med December 10, 2020 <https://doi.org/10.1056/NEJMe2034717> An encouraging opinion article regarding the safety and efficacy of the new Pfizer/BioNTech COVID vaccine, BNT162b2, data having been released to the FDA this week (December 8, 2020)
7. Mulligan, M.J., Lyke, K.E., Kitchin, N. et al. Phase I/II study of COVID-19 RNA vaccine BNT162b1 in adults. Nature 586, 589–593 (2020) <https://doi.org/10.1038/s41586-020-2639-4> The Phase 1 and 2 study of the Pfizer/BioNTech mRNA vaccine in 45 healthy adults
8. Mahase, Elizabeth. Covid-19: UK approves Pfizer and BioNTech vaccine with rollout due to start next week. News Report BMJ 2020;371:m4714 December 2, 2020 <http://dx.doi.org/10.1136/bmj.m4714> Report of data submitted to the UK Medicines and Healthcare Products Regulatory Agency in the UK application for approval of the Pfizer vaccine
9. FDA EUA Letter of Authorization for the Pfizer-BioNTech vaccine, December 18, 2020 <https://www.fda.gov/media/144412/download>
10. FDA EUA Fact Sheet for Health Care Providers for the Pfizer-BioNTech vaccine <https://www.fda.gov/media/144413/download>
11. CDC COVID-19 Response Team. Allergic Reactions Including Anaphylaxis After Receipt of the First Dose of Pfizer-BioNTech COVID-19 Vaccine — United States, December 14–23, 2020 MMWR January 15, 2021 Vol. 70, No. 2 <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7002e1-H.pdf> As of December 23, 2020, a reported 1,893,360 first doses of Pfizer-BioNTech COVID-19 vaccine had been administered in the United States, and reports of 4,393 (0.2%) adverse events after receipt of Pfizer BioNTech COVID-19 vaccine had been submitted to the Vaccine Adverse Event Reporting System (VAERS). Twenty-one cases were determined to be anaphylaxis (a rate of 11.1 per million doses administered), including 17 in persons with a documented history of allergies or allergic reactions
12. Liu et al. Neutralizing Activity of BNT162b2-Elicited Serum — Preliminary Report

NEJM February 17, 2021 <https://doi.org/10.1056/NEJMc2102017> No diminished protection was noted against the B.1.1.7 SARS-CoV-2 variant, but a 2/3 reduction in antibody titer was noted against the B.1.351 variant for the Pfizer vaccine

1. **Moderna mRNA-1273**
2. Widge AT, Rouphael NG, Jackson LA, et al. Durability of responses after SARS-CoV-2 mRNA1273 vaccination. N Engl J Med. <https://doi.org/10.1056/NEJMc2032195> A follow up report (See earlier NEJM report, Jackson et al) extending the monitoring period for immunogenicity of the Moderna mRNA-1273 vaccine from 57 days to 119 days
3. Anderson EJ, Rouphael NG, Widge AT, et al. Safety and immunogenicity of SARS-CoV-2 mRNA-1273 vaccine in older adults. N Engl J Med. <https://doi.org/10.1056/NEJMoa2028436> A look at immunogenicity and side effect profile of the 25 and 100 μg two-dose regimen for the Moderna mRNA-1273 vaccine in 40 older adults, 50 to 70 and over 70 years of age. Side effects were mostly mild or moderate and antibody titers were higher for the 100 μg dose.
4. Jackson, L.A. et al An mRNA Vaccine against SARS-CoV-2 – Preliminary Report NEJM published on July 14, 2020, and updated on August 25, 2020, published November 12, 2020 N Engl J Med 2020; 383:1920-1931 <https://doi.org/10.1056/NEJMoa2022483> A description of the Phase 1-2 trials of the Moderna mRNA vaccine
5. FDA EUA Letter of Authorization for the Moderna mRNA 1273 vaccine, December 18, 2020 <https://www.fda.gov/media/144636/download>
6. FDA EUA Fact Sheet for Health Care Providers for the Moderna mRNA 1273 vaccine, December 18, 2020 <https://www.fda.gov/media/144637/download>
7. Oliver, S.E. et al. The Advisory Committee on Immunization Practices’ Interim Recommendation for Use of Moderna COVID-19 Vaccine — United States, Vol. 69 December 20, 2020 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm695152e1-H.pdf> A summary of the Phase 3 data regarding the Moderna mRNA=1273 COVID-19 Vaccine, showing a 94.1% efficacy in randomized, double-blind, placebo-controlled Phase III clinical trial that enrolled approximately 30,000 participants aged 18–95 years
8. Vaccines and Related Biological Products Advisory Committee. Vaccines and Related Biological Products Advisory Committee December 17, 2020, meeting: sponsor briefing document. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2020. <https://www.fda.gov/media/144452/download> Data provided to the VRBPAC
9. Vaccines and Related Biological Products Advisory Committee. Vaccines and Related Biological Products Advisory Committee December 17, 2020, meeting: sponsor briefing document addendum. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2020. <https://www.fda.gov/media/144453/download> Supplemental data provided to the VRBPAC
10. Baden, L et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine N Eng J Med December 30, 2020 <https://doi.org/10.1056/NEJMoa2035389> Summary of the Phase 3 Trial data published in NEJM
11. CDC COVID-19 Response Team. Allergic Reactions Including Anaphylaxis After Receipt of the First Dose of Moderna COVID-19 Vaccine — United States, December 21, 2020–January 10, 2021 MMWR Vol. 70 January 22, 2021; <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7004e1-H.pdf> As of January 10, 2021, a reported 4,041,396 first doses of Moderna COVID-19 vaccine had been administered in the United States, and reports of 1,266 (0.03%) adverse events after receipt of Moderna COVID-19 vaccine were submitted to the Vaccine Adverse Event Reporting System (VAERS), 10 cases determined to be anaphylaxis for a rate of 2.5 cases of anaphylaxis per million Moderna COVID-19 vaccine doses
12. Wu et al. Serum Neutralizing Activity Elicited by mRNA-1273 Vaccine — Preliminary Report

NEJM February 17, 2021 <https://doi.org/10.1056/NEJMc2102179>

While no reduction in neutralizing effect against the B.1.1.7 variant was noted by using a pseudovirus model, there was a 2.7 fold reduction in neutralization against the B.1.351 variant and a 6.5 fold reduction in neutralization of a combination of all mutations with the Moderna mRNA-1273 vaccine.

1. **Astra-Zeneca/Oxford ChAdOx1**
2. Antrobus , R et al Clinical Assessment of a Novel Recombinant Simian Adenovirus ChAdOx1 as a Vectored Vaccine Expressing Conserved Influenza A March 2014 Molecular Therapy Volume 22, Issue 3, March 2014, Pages 668-674 <https://www.sciencedirect.com/science/article/pii/S152500161631190X> A study of the efficacy of the recombinant Chimpanzee Adenovirus as a viral vector for a conserved influenza antigen vaccine in 15 volunteers in 2014
3. Folegatti, P.M. et al Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial Lancet, July 20, 2020 396: 467–78 <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2931604-4> Initial safety and efficacy report on 1077 participants in a Phase1/2 trial
4. Voysey, M et al Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK Lancet, December 08, 2020 [https://doi.org/10.1016/S0140-6736(20)32661-1](https://doi.org/10.1016/S0140-6736%2820%2932661-1) “ChAdOx1 nCoV-19 has an acceptable safety profile and has been found to be efficacious against symptomatic COVID-19 in this interim analysis of ongoing clinical trials.” Subsequent Phase 2/3 report adding 11636 patients (5807 of whom received the vaccine) to the Phase 1/2 Folegatti report in Lancet above.
5. **Janssen/Johnson and Johnson JNJ-78436725 (AKA Ad.26.COV2.S)**
6. Sadoff, J et al. Safety and immunogenicity of the Ad26.COV2.S COVID-19 vaccine candidate: interim results of a phase 1/2a, double-blind, randomized, placebo-controlled trial. medRxiv preprint downloaded December 20, 2020 <https://doi.org/10.1101/2020.09.23.20199604> An adenovirus 26-vectored vaccine meets safety requirements to proceed to Phase 3 large population trial. Seroconversion of 92% occurred at 29 days.
7. NIH News release regarding the launch of the Johnson and Johnson Ad26-vectored vaccine, September 23, 2020 <https://www.nih.gov/news-events/news-releases/fourth-large-scale-covid-19-vaccine-trial-begins-united-states>
8. Sadoff, J et al. Interim Results of a Phase 1–2a Trial of Ad26.COV2.S Covid-19 Vaccine N Eng J Med Vol 70 January 13, 2021 <https://doi.org/10.1056/NEJMoa2034201> Assigned adults between the ages of 18 and 55 years (cohort 1) and those 65 years of age or older (cohort 3) to receive the Ad26.COV2.S vaccine at a dose of 5×1010 viral particles (low dose) or 1×1011 viral particles (high dose) per milliliter or placebo in a single-dose or two-dose schedule. Neutralizing-antibody titers against wild-type virus were detected in 90% or more of all participants on day 29 after the first vaccine dose, regardless of vaccine dose or age group, and reached 100% by day 57
9. FDA Vaccine and Related Biological Products Advisory Committee (VRBPAC). FDA Briefing Document Janssen Ad26.COV2.S Vaccine for the Prevention of COVID-19. February 26, 2021

<https://www.fda.gov/media/146217/download> The FDA analysis of the safety and effectiveness of the Johnson and Johnson Adenovirus-26-mediated COVID-19 vaccine

1. Oliver, s et al. The Advisory Committee on Immunization Practices’ Interim Recommendation for Use of Janssen COVID-19 Vaccine — United States, February 2021. MMWR Vol. 70; March 2, 2021 <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7009e4-H.pdf> The ACIP summary of the Johnson and Johnson Adenovirus 26 COVID-19 vaccine recommendations at the time of authorization.
2. **Novavax NVX-CoV2373**
3. Keech, C et al Phase 1–2 Trial of a SARS-CoV-2 Recombinant Spike Protein Nanoparticle Vaccine NEJM Vol. 383 No. 10 September 2, 2020 <https://doi.org/10.1056/NEJMoa2026920> Robust viral IgG by ELISA and neutralizing antibody response to the Recombinant Spike Protein Nanoparticle vaccine after two doses 21 days apart
4. **Vaccine Distribution and Demographics**
5. Handley, S. C. et al. Changes in Preterm Birth Phenotypes and Stillbirth at 2 Philadelphia Hospitals During the SARS-CoV-2 Pandemic, March-June 2020 JAMA. Published online December 7, 2020. <https://doi.org/10.1001/jama.2020.20991> As a first consideration of the risks of inadvertent vaccination of pregnant women during vaccine distribution, stillbirths appear not to have increased significantly during the COVID-19 pandemic based upon this report
6. Khoury, R et al. Characteristics and Outcomes of 241 Births to Women With Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection at Five New York City Medical Centers Obstet Gynecol 2020 Aug;136(2):273-282. <https://doi.org/10.1097/AOG.0000000000004025> Complications during management of 241 pregnant patients infected with SARS-CoV-2 during pregnancy correlated with known risk factors such as obesity and social determinants
7. National Institutes of Health. Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) [Internet]. Bethesda (MD): NIH; 2020 <https://www.nih.gov/research-training/medical-research-initiatives/>
8. Pharmacy Partnership for Long-term Care <https://www.cdc.gov/vaccines/covid-19/long-term-care/pharmacy-partnerships.html> A public-private partnership that includes the participation of Walgreens and CVC pharmacies to partner with local LTCFs and SNFs to provide COVID-19 vaccinations to staff and residents
9. Warren, N et al. Maximizing the Uptake of a COVID-19 Vaccine in People With Severe Mental Illness: A Public Health Priority. JAMA Psychiatrty Published online December 15, 2020 <https://doi.org/10.1001/jamapsychiatry.2020.4396> Addressing the disproportionately low vaccination rates among people with serious mental illness and proposing methods to improve COVID-19 vaccination rates in this high risk population
10. Parmet, Wendy. Roman Catholic Diocese of Brooklyn v. Cuomo — The Supreme Court and Pandemic Controls N Eng J Med December 16, 2020 <https://doi.org/10.1056/NEJMp2034280> The Supreme Court ruling allowing the assembly of worshipers in New York contrary to the public health-based limits placed upon in-person worship by Governor Cuomo represents a challenge to the long respected precedent set by *Jacobsen v. Massachusetts* and may ultimately influence future decisions regarding vaccination mandates.
11. Largent, E. et al. US Public Attitudes Toward COVID-19 Vaccine Mandates JAMA Network December 18, 2020;3(12):e2033324. <https://doi.org/10.1001/jamanetworkopen.2020.33324> Overall, 61.4% (95% CI, 60.0%-63.0%) of respondents indicated they would likely get a COVID-19 vaccine. Nearly one-half of respondents regarded requiring COVID-19 vaccination for children attending school as acceptable or very acceptable and 38.4% regarded it as unacceptable or very unacceptable. Political party affiliation influenced willingness (Republicans, 44.3%, Independents, 58.4% Democrats, 76.6% and Black respondents were significantly less likely than non-Black respondents to get vaccinated (43.6% vs 63.7%).
12. Vardeny, O et al Effect of High-Dose Trivalent vs Standard-Dose Quadrivalent Influenza

Vaccine on Mortality or Cardiopulmonary Hospitalization in Patients With High-risk Cardiovascular Disease: A Randomized Clinical Trial JAMA December 4, 2020 <https://doi.org/10.1001/jama.2020.23649> In 5260 randomized participants, high-dose

trivalent inactivated influenza vaccine, compared with standard-dose quadrivalent

inactivated influenza vaccine, did not significantly reduce all-cause mortality or

cardiopulmonary hospitalizations. Influenza vaccination remains strongly recommended

in this population.

1. **Virology of SARS-CoV-2**
2. Fehr, A and Perlman, S Coronaviruses: An Overview of Their Replication and Pathogenesis

in Coronaviruses: Methods and Protocols, Methods in Molecular Biology, vol. 1282, DOI 10.1007/978-1-4939-2438-7\_1 A thorough genomic study of the Coronavirus family <https://pubmed.ncbi.nlm.nih.gov/25720466/>

1. Heald-Sargent, T et al Age-Related Differences in Nasopharyngeal Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Levels in Patients With Mild to Moderate Coronavirus Disease 2019 (COVID-19) JAMA Pediatrics July 30, 2020 doi:10.1001/jamapediatrics.2020.3651 Raises concern that the pediatric population carries viral loads at least as heavy as adults. <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2768952>
2. Lauer, S.A. et al The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application Annals of Int Med, May 5, 2020 Volume 172, Issue 9: 577-582 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7081172/pdf/aim-olf-M200504.pdf> Confirms a mean incubation period of about 5 days, with almost all active infections developing within 12 days
3. Zhu N, Zhang D, Wang W, et al; China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020;382:727-733. [PMID:31978945] January 24, 2020 <https://www.nejm.org/doi/full/10.1056/nejmoa2001017> One of the earliest reports from the initial investigators in Wuhan, China
4. Ranawaka A.P.M, Virus Culture and Subgenomic RNA for Respiratory Specimens from Patients with Mild Coronavirus Disease, EID Vol 26, No.11 Early release August 4,2020

<https://wwwnc.cdc.gov/eid/article/26/11/20-3219_article?deliveryName=USCDC_333-DM34649>

1. Bunyavanich, S et al *Nasal Gene Expression of Angiotensin-Converting Enzyme 2 in Children and Adults* JAMA Research Letter June 16, 2020 Volume 323, Number 23 <https://jamanetwork.com/journals/jama/fullarticle/2766524> ACE2 gene expression in nasal mucosa is age dependent. Because the ACE2 receptor is a binding point for SARS-CoV-2, this may explain different clinical courses and transmissibility of SARSS-CoV-2 in children and adults.
2. Zwart, M.P. An experimental test of the independent action hypothesis in virus–insect pathosystems Proc Biol Sci. 2009 Jun 22; 276(1665): 2233–2242.Published online 2009 Mar 11 <https://doi.org/10.1098/rspb.2009.0064> Suggests that the independent action hypothesis (that any given pathogen individual has a non-zero chance of causing infection in the host and that each pathogen acts independently) is supported for pathogens to which the host is highly susceptible.
3. Calloway, E Making Sense of Coronavirus Mutations Nature News Feature Vol 585 10 September 2020 <https://media.nature.com/original/magazine-assets/d41586-020-02544-6/d41586-020-02544-6.pdf> Interesting review of researchers following the chain of mutations being identified in the virus as it spreads
4. Food and Drug Administration. Development and licensure of vaccines to prevent Covid-19: guidance for industry. June 30, 2020 <https://www.fda.gov/media/139638/download>
5. Reed, L and Muench, H A Simple Method of Estimating Fifty Per Cent Endpoints

American Journal of Epidemiology, Volume 27, Issue 3, May 1938, Pages 493–497, <https://doi.org/10.1093/oxfordjournals.aje.a118408> A historical article cited as early evidence that there is a dose-response curve for viral inoculate

1. Florindo, HF et al Immune Mediated approaches against COVID-19, Nature Nanotechnology 15, 630-645 July 13, 2020 <https://www.nature.com/articles/s41565-020-0732-3> Biochemical components of the virus in the context of potential targets for immunity
2. Cevik, M et al SARS-CoV-2, SARS-CoV, and MERS-CoV viral load dynamics, duration of viral shedding, and infectiousness: a systematic review and meta-analysis. Lancet Microbe, November 19, 2020 [https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247(20)30172-5/fulltext](https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247%2820%2930172-5/fulltext) A systematic review of viral shedding in symptomatic and asymptomatic patients
3. Moreno, G.K., Braun, K.M., Riemersma, K.K. et al. Revealing fine-scale spatiotemporal differences in SARS-CoV-2 introduction and spread. Nat Commun 11, 5558 (2020). <https://doi.org/10.1038/s41467-020-19346-z> The researchers “analyze 247 full-genome SARS-CoV-2 sequences from two nearby communities in Wisconsin, USA, and find surprisingly distinct patterns of viral spread… We present evidence for reduced viral spread in both counties following the statewide ‘Safer at Home’ order”
4. New COVID-19 variant in the UK identified: <https://www.cdc.gov/coronavirus/2019-ncov/transmission/variant.html> No research reports are yet formally published regarding the new SARS-CoV-2 variant identified in the UK, “SARS-CoV-2 VOC 202012/01”, but this CDC site update provides some current insight (December 23, 2020)
5. Kemp, SA et al Recurrent emergence and transmission n of a SARS-CoV-2 Spike deletion ΔH69/ΔV70 bioRxiv preprint December 15, 2020, downloaded 12/30/2020 <https://doi.org/10.1101/2020.12.14.422555> A preprint report describing the genome mutations in the new SARS-CoV-2 strain spreading in the UK
6. Volz, E et al. Transmission of SARS-CoV-2 Lineage B.1.1.7 in England: Insights from linking epidemiological and genetic data Imperial College of London Preprint December 312, 2020 <https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-12-31-COVID19-Report-42-Preprint-VOC.pdf> A preprint suggesting that the SARS-CoV-2 VOC 202012/01 variant may be associated with other amino acid substitutions that may alter susceptibility to monoclonal antibodies and a Spike target for testing with the ThermoFisher TaqPath probe test. The negative ThermoFisher test Spike protein test with an otherwise positive PCR appears highly specific.
7. Harrington, D et al. Confirmed Reinfection with SARS-CoV-2 Variant VOC-202012/01. Clin. Inf. Dis. January 9, 2021 <https://doi.org/10.1093/cid/ciab014> A report of a single case of reinfection with the Variant Of Concern strain 202012/01 after an initial mild infection with an earlier strain. The VOC infection was severe.
8. Lauring, A and Hodcraft, E. Genetic Variants of SARS-CoV-2—What Do They Mean? JAMA Network Viewpoint e: January 6, 2021. <https://doi.org/10.1001/jama.2020.27124> An excellent description of the risks posed by the capacity for SARS-CoV-2 to mutate and implications for various therapeutics
9. Weissman, D et al. D614G Spike Mutation Increases SARS CoV-2 Susceptibility to Neutralization Cell Host Microbe 2020 Dec 1;S1931-3128(20)30634-X. <https://doi.org/10.1016/j.chom.2020.11.012> A G614 pseudovirus was moderately more susceptible to neutralization than the D614 pseudovirus. The G614 pseudovirus also was more susceptible to neutralization by receptor-binding domain (RBD) monoclonal antibodies and convalescent sera from people infected with either form of the virus.
10. Galloway, S.E. et al Emergence of SARS-CoV-2 B.1.1.7 Lineage — United States, December 29, 2020–January 12, 2021 MMWR Vol 70 January 15, 2021 Online as Early Release <http://dx.doi.org/10.15585/mmwr.mm7003e2> The emergence of variant B.1.1.7 is described.
11. Zhuoming Liu and Others. Identification of SARS-CoV-2 spike mutations that attenuate monoclonal and serum antibody neutralization. Cell Host & Microbe 2021; 205. [https://www.cell.com/cell-host-microbe/pdf/S1931-3128(21)00044-5.pdf](https://www.cell.com/cell-host-microbe/pdf/S1931-3128%2821%2900044-5.pdf) Using a chimeric vesicular stomatitis virus with the SARS-CoV-2 spike protein to determine if it could escape neutralization by various monoclonal and poly clonal antibodies, it appeared that some degree of resistance was conferred by some of the mutations. The study is limited by the artificiality of the chimeric virus.
12. Mwenda M, Saasa N, Sinyange N, et al. Detection of B.1.351 SARS-CoV-2 Variant Strain — Zambia, December 2020. MMWR Morb Mortal Wkly Rep. ePub: 17 February 2021. <http://dx.doi.org/10.15585/mmwr.mm7008e2> A description of the emergence of the South African lineage of the SARS-CoV-2 variant
13. Vasques Nonaka CK, Franco MM, Gräf T, de Lorenzo Barcia CA, de Ávila Mendonça RN, de Sousa KAF, et al. Genomic evidence of SARS-CoV-2 reinfection involving E484K spike mutation, Brazil. Emerg Infect Dis. 2021 May [February 20, 2021]. <https://doi.org/10.3201/eid2705.210191> A case report of a patient suffering reinfection with SARS-CoV-2, the second infection with a new variant, suggesting escape from native immunity
14. Emma C. Thomson and Others. Circulating SARS-CoV-2 spike N439K variants maintain fitness while evading antibody-mediated immunity. Cell 2021; 369. <https://doi.org/10.1016/j.cell.2021.01.037> The N439K mutation in the SARS-CoV-2 spike receptor binding motif results in similar viral fitness compared to wild-type while conferring resistance against some neutralizing monoclonal antibodies and reducing the activity of some polyclonal antibody responses.
15. Zhang, W et al. Emergence of a Novel SARS-CoV-2 Variant in Southern California February 11, 2021 JAMA. Published online February 11, 2021. <https://doi.org/10.1001/jama.2021.1612> A description of a new SARS-CoV-2 variant found circulating in Southern California, designated CAL.20C.