Potential dangers associated with COVID-19 injectable products for children aged 12-18

Jessica Rose, PhD, MSc, BSc
May 30, 2021

Neither the *Pfizer/BioNTech* nor the *Moderna* COVID-19 products have been approved or licensed by the U.S. Food and Drug Administration (FDA), having been authorized instead for emergency use by FDA under an Emergency Use Authorization (EUA) to prevent Coronavirus Disease 2019 (COVID-19) for use in individuals 16 years of age and older. [1,2,3]

The precautionary principle promotes transparency and the adoption of preventative measures to address adverse events (AEs) as risks to the public. It is vital that individuals are informed of potential risks before agreeing to participate in any medically-involved treatment program such as the roll-out of the *Pfizer/BioNTech* and *Moderna* products into the U.S. adult population and plans of continuing this roll-out into the juvenile population in May 2021.[1]

1. TOTAL adverse event reports made in the context of COVID-19 products are atypically high

Adverse event reports are currently at 252,523 (U.S. VAERS) and this number is increasing at an exponential rate. There are already FOUR TIMES AS MANY total reports as of May 28th, 2021 (Figure 1, right) than for the ENTIRETY of the VAERS reports collected from last year.

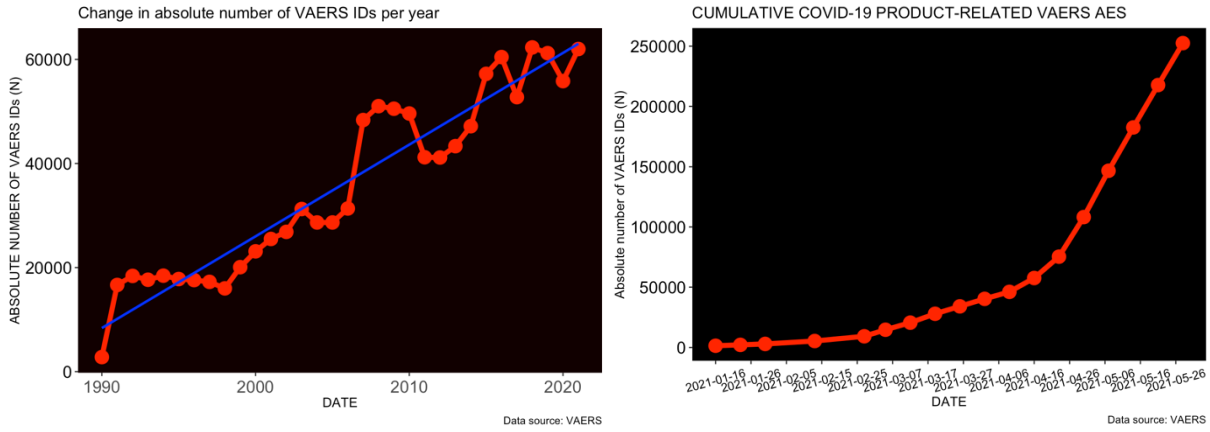

Figure 1: Time series plots showing VAERS reports by year with trendline in blue (left) and showing cumulative VAERS reports associated with the COVID-19 products for the year 2021 (right). Data contains VAERS reports processed as of 5/28/2021.

1.1 Children aged 12-18 are experiencing severe adverse events with CARDIOVASCULAR AEs occuring in 17% of this subpopulation

Children aged 12-18 comprise 3.4% of the total VAERS population with 58% comprising females. Of these 8500 children, 9 (0.1%) have died, 846 (10%) have experienced a severe adverse event resulting in hospitalization or debilitation. 1463 (17%) have experienced cardiovascular AEs, 437 (5.1%) have experienced a neurological AE and 928 (11%) have experienced an immunological AE. 26 (0.3%) of the young women in this subset have experienced female reproductive issues. 18 (0.2%) have succumbed to a breakthrough COVID-19 infection and none have died from a breakthrough infection to date.

[1] The National Childhood Vaccine Injury Act of 1986 (NCVIA) requires health care providers and vaccine manufacturers to report to the DHHS specific adverse events following the administration of those vaccines outlined in the Act.[1]

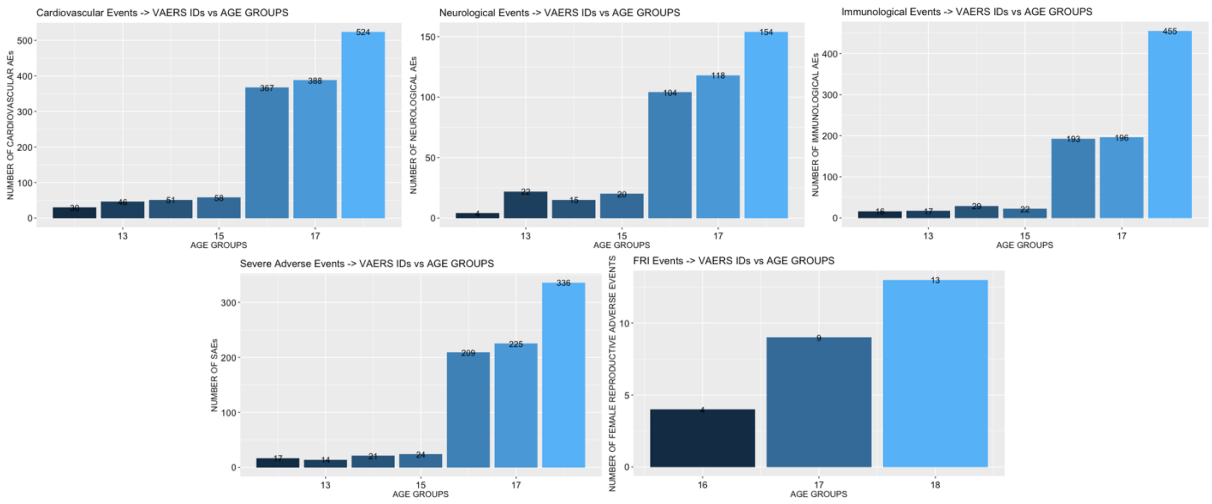

Figure 3: Histograms showing distributions of categorized AEs by age.

Figure 3 shows the distributions of each AE category by age. The data is skewed toward the upper range of the age set and this is statistically significant (I>1). It appears from this data that young people over the age of 15 are experiencing and reporting AEs at significantly higher rates ($p<0.001$) than their younger counterparts. What is truly striking are the high number of reports of cardiovascular AEs. Children are not at high risk for cardiovascular ailments[2], but appear to be at risk in the context of these COVID-19 injections.

1.2 The injections are likely causing the AEs

Reporting AEs that occur in temporal proximity to injection of biological material into humans is critical and serves as an early warning system for adverse events not detected during pre-market testing of such products.[4] It is especially relevant in the context of technologically novel treatments in the experimental phase of development such as the *Pfizer/BioNTech* mRNA injectables.

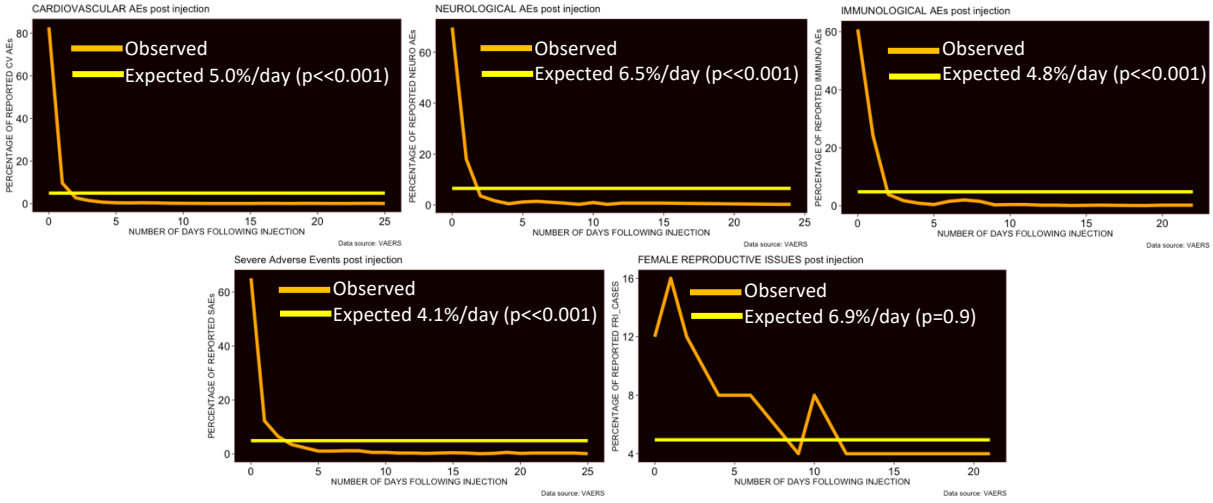

Figure 4: Plots showing percentages of VAERS IDs as per cardiovascular, neurological and immunological AEs and the total SAEs and Female Reproductive Issues against the number of days following injection.

[2] https://www.cdc.gov/heartdisease/heart_attack.htm

Analysis of adverse event data suggests that these products are likely the *cause* of female reproductive issues, the breakthrough infections and the cardiovascular, neurological and **immunological** AEs.[3] What is striking is the extremely high percentages of reports made within 24 hours of the injections in the cardiovascular, neurological and immunological AE categories. In each case, over 80% of events occurred and reports filed on the same day of the injections.

Th be clear, a causal effect means that a change in one variable leads to change in another variable. If the cardiovascular AEs, for example, following COVID-19 injections are not causally-linked, then the reported percentages of these AEs should be equally distributed across days following injection: there should not be an excess of reports on days 0, 1 and 2, yet there are. *Chi-square tests* confirm association for each AE group with p-values less than 0.001 in each case. If risk is not accentuated by some immediate factor temporally, then that risk should necessarily plateau or diminish each day.

The null hypothesis holds that in the absence of causality, the distributions of AE reports should be even about the y-axis: there is an equal chance of the event occurring at any point following, or even before, the injection date. This is not the case and thus the null hypothesis is negated. The evidence for causation in this data is strong and in addition to this evidence, the Bradford Hill Criteria are satisfied.[4]

2. The potential disruption of the Renin-Angiotensin-Aldosterone System

Messenger RNA (mRNA) platforms are new in medical microbiology and have never before been implemented for use in human subjects on a global scale in the context of viruses. mRNA stands for messenger RNA and is the coding template for a protein. All living things use it for production of these building blocks of life. In the context of the *Pfizer/BioNTech* and *Moderna* products, the mRNA encoding the pre-fusion *spike* protein, which is the protein on the surface of the coronavirus that is used for binding and infection of host cells, is wrapped in a lipid-nanoparticle (LNP) shell to enable stable introduction to host cells via intramuscular injection. It is currently not known how long the mRNA remains for the purpose of production and presentation of spike proteins to specialized cells to induce a specific immune response against them. The protein on the surfaces of human cells that the spike protein binds to in order to infect the cell is called Angiotensin Converting Enzyme-2 (ACE-2). ACE-2 is an enzyme that acts to regulate the Renin-Angiotensin Aldosterone System (RAAS) to decrease blood pressure to normal levels are to maintain electrolyte levels at normal-functioning values, and can act in both membrane-bound and soluble forms. This protein is commonly expressed in many cell types distributed all over the body and is primarily associated with enterocytes which are specialized cells in the epithelium.[5] It is an essential component of the RAAS: an essential system in every human being. In the presence of SARS-nCoV-2 virions (viral particles), it is known that the binding sites of ACE-2 proteins are occupied by the SARS-nCoV-2 viral particle via the spike protein. This can result in dysregulation of the RAAS which would clinically manifest as hypertensive disorders, fibrosis or problems with any one of the organs involved with the system and/or the arteries.[56] These problems are matching the AEs that are being reported at record rates.

There is increased activity of the RAAS in infancy and childhood.[6] The effects of both SARS-nCoV-2 and the spike protein as an injectable immune system stimulant, on the RAAS, are currently being investigated. It has been shown that the presence of SARS-nCoV-2 and the spike protein on its own induce ACE-2 expression downregulation and cause damage to vascular endothelial cells.[56] This means ACE-2 is less prominent on the surfaces of cells and subsequently, less prominent in soluble form. This downregulation of ACE-2 naturally means is that there are fewer binding sites to occupy with respect to ACE-2, both in membrane-bound and soluble forms of the protein. In the presence of a protein, like the spike protein, that binds ACE-2 with high affinity (very strongly), it is easy to envision competitive inhibition for binding sites arising. Thus, in the presence of high levels of spike proteins, even fewer ACE-

[3] A study of the U.S. Vaccine Adverse Events Reporting System (VAERS) of the COVID-19 Messenger ribonucleic acid (mRNA) biologicals. Dr. Jessica Rose. Science, Public Health Policy, and The Law. Volume 2:59–80, May, 2021, Clinical and Translational Research

[4] The Bradford Hill criteria, otherwise known as Hill's criteria for causation, are a group of nine principles that can be useful in establishing epidemiologic evidence of a causal relationship between a presumed cause and an observed effect and have been widely used in public health research. They were established in 1965 by the English epidemiologist Sir Austin Bradford Hill.

[5] A thin, continuous, protective layer of cells that line the outer surfaces of organs and blood vessels throughout the body, as well as the inner surfaces of cavities in many internal organs. Wikipedia reference.

2 binding sites would be available to exert their inherent purpose and subsequently, an overactive RAAS would ensue accompanied by fibrosis in many sites. In individuals who already have an overactive RAAS, such as many of our elderly with clinical manifestations of hypertension, the obese and pregnant women and children [6,57,58,59], this would result in an even more overactive RAAS due to the enhanced lack of readily-available ACE-2 to close the RAAS loop. The spike protein alone can also impair Nitric Oxide (NO) bioavailability and inhibit mitochondrial function.[56]

It is interesting that children are not suffering serious pathologies or death and this is likely due to robust and healthy innate immune responses as part of a balanced and fully-functioning immune system. This would result in a low viral burden and thus less ACE-2 binding due to infrequency of SARS-nCoV-2 spike protein and thus no serious clinical complications both in the context of the infection and in the context of the RAAS. The take home message on this point is that further studies are required prior to further experimentation in the human population. We simply do not know enough on this particular subject yet.

3. We inherently have effective natural host defenses!!

Effective antiviral responses against the SARS-nCoV-2 virus in the form of both cellular and humoral immune responses have been reported in peer-reviewed studies.[39-44] Because of the combination of a low Infection Fatality Rate (IFR) of 0.15% indicating effective and robust immune responses, it remains unclear why multiple experimental mRNA vaccines have been fast-tracked through conventional testing protocols and are currently being fast-tracked through production and administration into the public. What is even more unclear is why these products are being pushed into young demographics since these demographics do not suffer serious pathologies from COVID-19, as a general rule. The mortality rate from COVID-19 in children 17 and under is 0.06%, as per the CDC reports. With repurposed drugs like Chloroquine and Ivermectin showing extremely positive results in patients [20-30], it is also unclear why these drugs are not being more extensively promoted as effective tools in the fight against this virus. One looming possibility is that EUA is not permissible if FDA-recognized effective treatments exist. Newer to the market of COVID-19 treatments are Nitric Oxide products shown to be 100% effective at reducing viral burden.[6][54, 55]

A healthy immune system is the best weapon we have against pathogenic organisms. It is vital that the public is made aware that the immune system cannot function optimally in the context of Vitamin D deficiency so it is recommended to check Vitamin D levels regularly, especially if you live in sun-deprived climate, and to supplement when necessary. A vitamin D level of 20 ng/mL or higher is considered to be a non-deficient level.[7]

Functioning and balanced systems are essential to health and this should be **highly promoted** by governing agencies, both as a rule of thumb, and especially in the context of a pathogen that we know uses the ACE-2 protein as receptor to bind and enter host cells to infect them. In the context of a balanced and functioning immune system and RAAS system, SARS-nCoV-2 does not impose a threat to the majority of humans. One way to ensure a disease state is to maintain a chronic imbalance in any one of these essential systems. One way to potentially induce an imbalance in the RAAS is by saturating it with a protein that binds one of its essential components. It is very concerning to me that millions of individuals have already had the coding material for the SARS-nCoV-2 spike protein injected into their bodies. The implications for the RAAS, even in individuals with functioning and balanced RAAS, are potentially serious and unknown at this point in time. It is imperative that further studies on the relationship between the spike protein and the RAAS are completed before any further roll-outs continue. The implications in the context of pathogenic priming are also serious and this also requires further study prior to advancement of any roll-out of these products. Safety is always a point of relevance with regards to new biological agents. Considering that no long-term studies were completed prior to the global-roll of these products, **and the exponential rise of AEs**, safety is certainly being called into question.

Also considering the fact that children are not in a high-risk group with regards to mortality, epidemiological and immunological evidence, there is absolutely no reason to put children at risk. These data clearly point to risk and again, this is VERY early data.

[6] See Bellerophon Therapeutics and Vero Biotech

References

1. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html
2. Temporary_Authorisation_Patient_Information_BNT162_7_0_UK.pdf
3. Fact Sheet for Vaccination Providers-Full EUA PI_Final_2.25.2021.pdf
4. VAERSDataUseGuide_November2020
5. Lyons-Weiler J. Pathogenic priming likely contributes to serious and critical illness and mortality in COVID-19 via autoimmunity. J Transl Autoimmun. 2020 Apr 9;3:100051. doi: 10.1016/j.jtauto.2020.100051. PMID: 32292901; PMCID: PMC7142689.
6. Dillon MJ. Renin-angiotensin-aldosterone system. Eur J Clin Pharmacol. 1980 Jul;18(1):105-8. doi: 10.1007/BF00561486. PMID: 6249611.
7. JoAnn E. Manson, M.D., Dr.P.H., Patsy M. Brannon, Ph.D., R.D., Clifford J. Rosen, M.D., and Christine L. Taylor, Ph.D. Vitamin D Deficiency — Is There Really a Pandemic? *New England Journal of Medicine*
8. Noa Dagan, M.D., *et al.* BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Mass Vaccination Setting. New England Journal of Medicine. February 24, 2021, DOI: 10.1056/NEJMoa2101765
9. Zimmermann P, Curtis N. Factors That Influence the Immune Response to Vaccination. Clin Microbiol Rev. 2019 Mar 13;32(2):e00084-18. doi: 10.1128/CMR.00084-18. PMID: 30867162; PMCID: PMC6431125.
10. Nath TR, Malaviya AN, Kumar R, Balakrishnan K, Singh BP. A study of the efficacy of typhoid vaccine in inducing humoral and cell-mediated immune responses in human volunteers. *Clin Exp Immunol*. 1977;30(1):38-43.
11. Orenstein WA, Bernier RH, Dondero TJ, Hinman AR, Marks JS, Bart KJ, Sirotkin B. Field evaluation of vaccine efficacy. Bull World Health Organ. 1985;63(6):1055-68. PMID: 3879673; PMCID: PMC2536484.
12. Furman D, Davis MM. New approaches to understanding the immune response to vaccination and infection. Vaccine. 2015 Sep 29;33(40):5271-81. doi: 10.1016/j.vaccine.2015.06.117. Epub 2015 Jul 29. PMID: 26232539; PMCID: PMC4581990.
13. Demeure CE, Derbise A, Guillas C, Gerke C, Cauchemez S, Carniel E, Pizarro-Cerdá J. Humoral and cellular immune correlates of protection against bubonic plague by a live Yersinia pseudotuberculosis vaccine. Vaccine. 2019 Jan 3;37(1):123-129. doi: 10.1016/j.vaccine.2018.11.022. Epub 2018 Nov 19. PMID: 30467064.
14. Walsh EE, Frenck RW Jr, Falsey AR, Kitchin N, Absalon J, Gurtman A, Lockhart S, Neuzil K, Mulligan MJ, Bailey R, Swanson KA, Li P, Koury K, Kalina W, Cooper D, Fontes-Garfias C, Shi PY, Türeci Ö, Tompkins KR, Lyke KE, Raabe V, Dormitzer PR, Jansen KU, Şahin U, Gruber WC. Safety and Immunogenicity of Two RNA-Based Covid-19 Vaccine Candidates. N Engl J Med. 2020 Dec 17;383(25):2439-2450. doi: 10.1056/NEJMoa2027906. Epub 2020 Oct 14. PMID: 33053279; PMCID: PMC7583697.
15. Polack FP, *et al*. C4591001 Clinical Trial Group. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med. 2020 Dec 31;383(27):2603-2615. doi: 10.1056/NEJMoa2034577. Epub 2020 Dec 10. PMID: 33301246; PMCID: PMC7745181.
16. Johns Hopkins University Coronavirus Resource Center. COVID-19 dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. 2020, CDC, WHO, Khan T, Agnihotri K, Tripathi A, Mukherjee S, Agnihotri N, Gupta G. COVID-19: A Worldwide, Zoonotic, Pandemic Outbreak. Altern Ther Health Med. 2020 Aug;26(S2):56-64. PMID: 32412918
17. https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov
18. https://ourworldindata.org
19. https://www.statista.com/statistics/1105914/coronavirus-death-rates-worldwide/
20. Colson P, Rolain JM, Lagier JC, Brouqui P, Raoult D. Chloroquine and hydroxychloroquine as available weapons to fight COVID-19. Int J Antimicrob Agents. 2020 Apr;55(4):105932. doi: 10.1016/j.ijantimicag.2020.105932. Epub 2020 Mar 4. PMID: 32145363; PMCID: PMC7135139.
21. Meo SA, Klonoff DC, Akram J. Efficacy of chloroquine and hydroxychloroquine in the treatment of COVID-19. Eur Rev Med Pharmacol Sci. 2020 Apr;24(8):4539-4547. doi: 10.26355/eurrev_202004_21038. PMID: 32373993.
22. Ibáñez S, Martínez O, Valenzuela F, Silva F, Valenzuela O. Hydroxychloroquine and chloroquine in COVID-19: should they be used as standard therapy? Clin Rheumatol. 2020 Aug;39(8):2461-2465. doi: 10.1007/s10067-020-05202-4. Epub 2020 Jun 3. PMID: 32495226; PMCID: PMC7267470.

23. N, Esposito S. Chloroquine or hydroxychloroquine for prophylaxis of COVID-19. Lancet Infect Dis. 2020 Oct;20(10):1118. doi: 10.1016/S1473-3099(20)30296-6. Epub 2020 Apr 17. PMID: 32311322; PMCID: PMC7164862.
24. Ferner RE, Aronson JK. Chloroquine and hydroxychloroquine in covid-19. BMJ. 2020 Apr 8;369:m1432. doi: 10.1136/bmj.m1432. PMID: 32269046.; Hernandez AV, Roman YM, Pasupuleti V, Barboza JJ, White CM. Hydroxychloroquine or Chloroquine for Treatment or Prophylaxis of COVID-19: A Living Systematic Review. Ann Intern Med. 2020 Aug 18;173(4):287-296. doi: 10.7326/M20-2496. Epub 2020 May 27. PMID: 32459529.;
25. Shah S, Das S, Jain A, Misra DP, Negi VS. A systematic review of the prophylactic role of chloroquine and hydroxychloroquine in coronavirus disease-19 (COVID-19). Int J Rheum Dis. 2020 May;23(5):613-619. doi: 10.1111/1756-185X.13842. Epub 2020 Apr 27. PMID: 32281213; PMCID: PMC7262257.
26. Rizzo E. Ivermectin, antiviral properties and COVID-19: a possible new mechanism of action. Naunyn Schmiedebergs Arch Pharmacol. 2020 Jul;393(7):1153-1156. doi: 10.1007/s00210-020-01902-5. Epub 2020 May 27. PMID: 32462282; PMCID: PMC7251046.
27. Heidary F, Gharebaghi R. Ivermectin: a systematic review from antiviral effects to COVID-19 complementary regimen. J Antibiot (Tokyo). 2020 Sep;73(9):593-602. doi: 10.1038/s41429-020-0336-z. Epub 2020 Jun 12. PMID: 32533071; PMCID: PMC7290143.
28. Sharun K, Dhama K, Patel SK, Pathak M, Tiwari R, Singh BR, Sah R, Bonilla-Aldana DK, Rodriguez-Morales AJ, Leblebicioglu H. Ivermectin, a new candidate therapeutic against SARS-CoV-2/COVID-19. Ann Clin Microbiol Antimicrob. 2020 May 30;19(1):23. doi: 10.1186/s12941-020-00368-w. PMID: 32473642; PMCID: PMC7261036.
29. Shih RD, Johnson HM, Maki DG, Hennekens CH. Hydroxychloroquine for Coronavirus: The Urgent Need for a Moratorium on Prescriptions. Am J Med. 2020 Sep;133(9):1007-1008. doi: 10.1016/j.amjmed.2020.05.005. Epub 2020 Jun 2. PMID: 32502485; PMCID: PMC7265864.
30. Lam S, Lombardi A, Ouanounou A. COVID-19: A review of the proposed pharmacological treatments. Eur J Pharmacol. 2020 Nov 5;886:173451. doi: 10.1016/j.ejphar.2020.173451. Epub 2020 Aug 6. PMID: 32768505; PMCID: PMC7406477.
31. Poon, L.L.M., Peiris, M. Emergence of a novel human coronavirus threatening human health. *Nat Med* **26,** 317–319 (2020). https://doi.org/10.1038/s41591-020-0796-5
32. Galloway SE, Paul P, MacCannell DR, et al. Emergence of SARS-CoV-2 B.1.1.7 Lineage — United States, December 29, 2020–January 12, 2021. MMWR Morb Mortal Wkly Rep 2021;70:95–99.
33. Harcourt J, Tamin A, Lu X, et al. Severe Acute Respiratory Syndrome Coronavirus 2 from Patient with Coronavirus Disease, United States. *Emerging Infectious Diseases*. 2020;26(6):1266-1273. doi:10.3201/eid2606.200516.
34. https://www.pfizer.com
35. IPAK Report 2021-1. 2021. Post-vaccination Death Causality Likely Given Temporal Distribution of Deaths Following COVID19 Vaccinations. Interim results.
36. Tinari S. The EMA covid-19 data leak, and what it tells us about mRNA instability BMJ 2021; 372 :n627 doi:10.1136/bmj.n627
37. Ioannidis, J.P. (2021), Reconciling estimates of global spread and infection fatality rates of COVID-19: an overview of systematic evaluations. Eur J Clin Invest. Accepted Author Manuscript e13554. https://doi.org/10.1111/eci.13554
38. S1182_SPI-M-O_Summary_of_modelling_of_easing_roadmap_step_2_restrictions.pdf
39. Toor SM, Saleh R, Sasidharan Nair V, Taha RZ, Elkord E. T-cell responses and therapies against SARS-CoV-2 infection. Immunology. 2021 Jan;162(1):30-43. doi: 10.1111/imm.13262. Epub 2020 Oct 27. PMID: 32935333; PMCID: PMC7730020.
40. Robbiani DF, *et al*. Convergent antibody responses to SARS-CoV-2 in convalescent individuals. Nature. 2020 Aug;584(7821):437-442. doi: 10.1038/s41586-020-2456-9. Epub 2020 Jun 18. PMID: 32555388; PMCID: PMC7442695.
41. Sun B, *et al*. Kinetics of SARS-CoV-2 specific IgM and IgG responses in COVID-19 patients. Emerg Microbes Infect. 2020 Dec;9(1):940-948. doi: 10.1080/22221751.2020.1762515. PMID: 32357808; PMCID: PMC7273175.

42. Le Bert N, *et al*. SARS-CoV-2-specific T cell immunity in cases of COVID-19 and SARS, and uninfected controls. Nature. 2020 Aug;584(7821):457-462. doi: 10.1038/s41586-020-2550-z. Epub 2020 Jul 15. PMID: 32668444.
43. Mateus J, *et al*. Selective and cross-reactive SARS-CoV-2 T cell epitopes in unexposed humans. Science. 2020 Oct 2;370(6512):89-94. doi: 10.1126/science.abd3871. Epub 2020 Aug 4. PMID: 32753554; PMCID: PMC7574914.
44. Lipsitch M, Grad YH, Sette A, Crotty S. Cross-reactive memory T cells and herd immunity to SARS-CoV-2. Nat Rev Immunol. 2020 Nov;20(11):709-713. doi: 10.1038/s41577-020-00460-4. Epub 2020 Oct 6. PMID: 33024281; PMCID: PMC7537578.
45. Poorolajal J, Hooshmand E. Booster dose vaccination for preventing hepatitis B. Cochrane Database Syst Rev. 2016 Jun 7;2016(6):CD008256. doi: 10.1002/14651858.CD008256.pub3. PMID: 27271960; PMCID: PMC7154826.
46. Corbett, K.S., Edwards, D.K., Leist, S.R. *et al.* SARS-CoV-2 mRNA vaccine design enabled by prototype pathogen preparedness. *Nature* **586,** 567–571 (2020). https://doi.org/10.1038/s41586-020-2622-0.
47. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/specific-groups/allergies.html
48. Noh J, Danuser G (2021) Estimation of the fraction of COVID-19 infected people in U.S. states and countries worldwide. PLoS ONE 16(2): e0246772. https://doi.org/10.1371/journal.pone.0246772
49. Correlation Between 3790 Quantitative Polymerase Chain Reaction–Positives Samples and Positive Cell Cultures, Including 1941 Severe Acute Respiratory Syndrome Coronavirus 2 Isolates Clinical Infectious Diseases, ciaa1491, https://doi.org/10.1093/cid/ciaa1491
50. Glenn D. Braunstein, Lori Schwartz, Pamela Hymel, Jonathan Fielding. False Positive Results With SARS-CoV-2 RT-PCR Tests and How to Evaluate a RT-PCR-Positive Test for the Possibility of a False Positive Result. Journal of Occupational & Environmental Medicine, Volume Publish Ahead of Print, 1 January 2021
51. Karen A Alroy, *et al.*, Population-Based Estimates of Coronavirus Disease 2019 (COVID-19)–like Illness, COVID-19 Illness, and Rates of Case Ascertainment, Hospitalizations, and Deaths—Noninstitutionalized New York City Residents, March–April 2020, Clinical Infectious Diseases, 2021; ciab038, https://doi.org/10.1093/cid/ciab038
52. https://github.com/dancarmoz/israel_moh_covid_dashboard_data
53. https://www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/reactogenicity
54. Chen L, Liu P, Gao H, Sun B, Chao D, Wang F, Zhu Y, Hedenstierna G, Wang CG. Inhalation of nitric oxide in the treatment of severe acute respiratory syndrome: a rescue trial in Beijing. Clin Infect Dis. 2004 Nov 15;39(10):1531-5. doi: 10.1086/425357. Epub 2004 Oct 22. PMID: 15546092; PMCID: PMC7107896.
55. https://clinicaltrials.gov/ct2/show/NCT04358588
56. Yuyang Lei *et al*., SARS-CoV-2 Spike Protein Impairs Endothelial Function via Downregulation of ACE 2 Originally published 31 Mar 2021 in Circulation Research https://doi.org/10.1161/CIRCRESAHA.121.318902
57. Irani RA, Xia Y. Renin angiotensin signaling in normal pregnancy and preeclampsia. Semin Nephrol. 2011 Jan;31(1):47-58. doi: 10.1016/j.semnephrol.2010.10.005. PMID: 21266264; PMCID: PMC3275085.]
58. Line Malha *et al.*, Renin-Angiotensin-Aldosterone Profiles in Pregnant Women with Chronic Hypertension. Hypertension. Originally published 25 Jun 2018. https://doi.org/10.1161/HYPERTENSION AHA.118.10854Hypertension. 2018;72:417–424
59. Rasha F, Ramalingam L, Gollahon L, Rahman RL, Rahman SM, Menikdiwela K, Moustaid-Moussa N. Mechanisms linking the renin-angiotensin system, obesity, and breast cancer. Endocr Relat Cancer. 2019 Dec 1;26(12):R653-R672. doi: 10.1530/ERC-19-0314. PMID: 31525726.