Plaintiff's Exhibit 81

PDMJ

Primary Doctor
Medical Journal

Winter 2020

Masks, false safety and real dangers, Part 4:

Proposed mechanisms by which masks increase risk of COVID-19

December 7, 2020.
Completed peer-review and revised, January 8, 2021

https://pdmj.org/papers/masks_false_safety_and_real_dangers_part4/

https://doi.org/10.6084/m9.figshare.14021057

Colleen Huber, NMD [*]

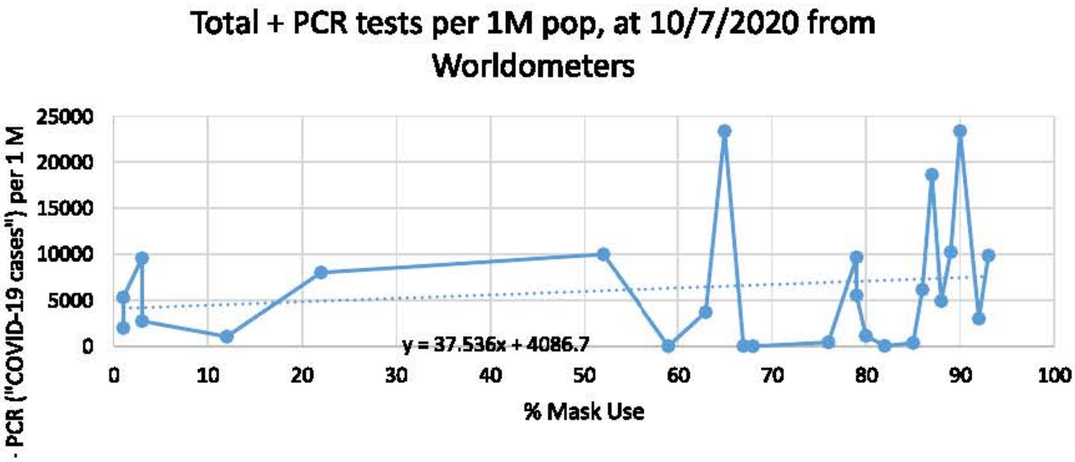
Abstract

Mask "mandates" in 2020 have resulted in no reductions in incidence of COVID-19, as detected by positive polymerase chain reaction (PCR) tests among nations or US states. Increased rates or insignificant change in incidence of SARS-CoV-2 infections, as detected by PCR tests, have followed mask mandates throughout the world and in US states. Masks are therefore a possible risk factor for infection with SARS-CoV-2 and higher incidence of COVID-19 disease. This paper examines the known physical and chemical attributes of respiration through and involving the periphery of and inside of masks that may lead to a better understanding of the reasons for this phenomenon of increased COVID-19 incidence following mask use.

COVID-19 incidence in masked and unmasked populations

The Council of Foreign Relations surveyed the citizens of 25 countries in mid-July, 2020. Their question was: "Have you always worn a face mask outside the home in the last seven days?" [1] Yes responses ranged from the highest of 93% in Singapore to the lowest of 1% in Finland and Denmark. In our team's research, we examined those same countries 3 months later, in early October 2020, regarding COVID-19 deaths and COVID-19 cases. There seemed to be no clear, identifiable pattern with regard to deaths. However, there was a trend of the countries with the least mask use in July 2020 showing generally fewer COVID-19 cases three months later.[2]

[*] Colleen Huber, NMD is a Naturopathic Medical Doctor and Naturopathic Oncologist (FNORI), writing on topics of masks, COVID-19, cancer and nutrition.



Population data for countries and US states have shown that declared numbers of COVID-19 cases have more often increased than decreased after government "mandates" to their citizens to wear masks in those jurisdictions. Timelines of seven countries, Israel, Peru, Philippines, Spain, France, Hungary and Argentina, all showed no prompt impact of mask mandates on change in number of cases or hospitalizations from COVID-19.[3] [4] But all seven of those countries showed increases in SARS-CoV-2 cases within 12 weeks following mask mandates. Five US metropolitan areas and six US states were also examined and showed similar patterns of increased reported SARS-CoV-2 cases. The Czech Republic showed sharply increased COVID-19 incidence immediately following that country's second mask mandate. The graphs discussed were prepared using data from the COVID Tracking Project Data Download [5] and from Our World In Data.[6] None except the Czech Republic showed a distinct inflection point from decrease to increase or vice versa of positive PCR tests at the time of, or shortly after, a mask mandate. The trend line of cases and hospitalizations in each jurisdiction generally increased after some weeks following the mandate. All areas showed increases in COVID-19 cases following mask mandates, except for New York City and Mississippi, both of which had already begun a sharp descent in COVID-19 cases for at least two weeks prior to mask mandates and then continued without appreciable change.

The foregoing data from The Covid Tracking Project Data Download, Our World in Data, The Council of Foreign Relations and our research team show higher rates of positive COVID-19 PCR tests in regions that had previous higher mask use.

The largest population-based study of facemasks and COVID-19 outcomes to date, known as the DANMASK-19 or Danish Mask Study, was conducted in April and May, 2020, and was released in mid-November 2020.[7] It enrolled 3030 participants to wear masks, and 2994 to remain unmasked, and for one month followed 4,862 of them who were able to complete the study. For that month, approximately one half of the participants wore masks, and the other half did not, while they went about their daily activities, in a non-lockdown environment. The average amount of time spent outside the home was 4.5 hours per day.

At the end of that month, data was collected on PCR values, IgM and IgG antibodies and / or hospital admission. Missing data and inconclusive results, patient-reported findings on home tests and other variables limited accurate assessment of results. It was found that approximately 2% of each group, 1.8% masked and 2.1% unmasked, were determined to have become infected with SARS-CoV-2. The DANMASK-19 study authors confessed a prior bias in favor of mask use, despite lack of any medical research prior to March 2020 confirming a preventive effect of masks against any viral illnesses. According to the existing research and meta-analyses prior to March 2020, facemasks have never been shown to be effective against transmission of viral infections.[8] [9] [10] Nor have masks been shown to be effective specifically against SARS-CoV-2.[11] The conclusion of the DANMASK-19 study was that masks did not significantly reduce COVID-19 infection rates, and about 0.5% of each group tested positive for other viruses. The DANMASK-19 study found, "A recommendation to wear a surgical mask when outside the home among others did not reduce, at conventional levels of statistical significance, incident SARS-CoV-2 infection compared with no mask recommendation."

The data above show that regions with higher mask use either had higher rates or insignificant change in positive COVID-19 PCR tests. It is the goal of this paper to examine the mechanisms of mask use that may be most likely to give rise to these findings.

Proposed physical mechanisms for increased COVID-19 transmission due to mask use

A 2020 Duke University study included an examination of a cloth masks containment failure. The mesh of certain masks served as a dispersing tool for expired respiratory droplets.[12] Larger exhaled droplets from an unmasked person are known to fall to the ground quickly and at a short distance forward from the mouth.[13] The Duke University study found, however, that the mesh of the mask dispersed larger exhaled respiratory droplets "into a multitude of smaller droplets, . . . which explains the apparent increase in droplet count relative to no mask in that case." Smaller particles were also found to be more likely to stay airborne longer than larger droplets. As a result those particular cloth masks examined in the Duke University study were considered to be "counterproductive."

Aerosolized breath contain particles that can remain airborne for hours. "These time scales vary from many seconds to a few hours in typical indoor settings." [14]

A seldom considered aspect of masking is the nozzle effect. Gaps are present around the edges of all masks except for the most tightly fitted, and therefore possibly most suffocating, respirators. Side gaps and brow gaps around the periphery of a mask are openings by which exhaled and unfiltered aerosol is released into the air. As a stream of fluid (liquid or gas) is forced by exhalation against a constricted opening, both its speed and kinetic energy increase. Bernoulli's equation explains the conservation of energy as a fluid is forced through a narrowed opening:

$$\frac{1}{2}\rho v^2 = \frac{\frac{1}{2}mv^2}{V} = \frac{\mathrm{KE}}{V}.$$

Where ρ is the fluid density, and the kinetic energy per unit volume KE/V is ½ of mass times the square of velocity per total Volume (V). Compression of exhaled gas inside a mask raises fluid density compared to unmasked airspace. According to Bernoulli's equation above, velocity and kinetic energy as air is expelled would therefore be higher in masked than in unmasked airspace.

Pressure inside masked airspace is also higher, because there is obstruction to release of exhaled air by the mask mesh. Pressure and volume remain inversely proportional in a closed system with no other variables. This is explained by Boyle's Law, which is as follows: P = k/V, where P = pressure, k is a constant and V = volume.

The formula for gas pressure, PV = nRT, where n = the number of moles of gas, R is the universal gas constant and T is Kelvin temperature, also shows why pressure increases inside masked airspace on exhalation. R and T and V all stay fairly constant, but the number of moles of gas increase as the exhaled air, and its principal components (79% nitrogen, 16% oxygen and 4% carbon dioxide) emerge from the lungs. With all other variables held constant in PV = nRT, pressure can be expected to increase inside masked airspace on exhalation as n increases.

These mechanical considerations are applicable to masks in that a mask wraps around the sides of the face, back toward the ears, where only small gaps remain for the unimpeded release of exhaled breath. Similarly, gaps at the contours of the sides of the nose and under the chin leave only narrowed gaps for unfiltered, unobstructed exhalation above and below the mask respectively.

As a result, there are side jets, back jets, a crown jet, brow jets and a downward jet that emerge from the mask in each of those directions. Farther transmission of virus-laden fluid particles have been found from masked individuals than from unmasked individuals, by means of "several leakage jets, including intense backward and downwards jets that may present major hazards," and a "potentially dangerous leakage jet of up to several meters." These masks "have the potential to disperse virus-laden fluid particles by several meters." [15] Backward airflow was found to be strong with all masks and faceshields studied, compared to not masking. Schlieren imaging revealed farther brow jets (upward flow) in surgical masks and cloth masks, 182 mm and 203 mm respectively versus none discernible at all with no mask. With regard to side jets and back jets, the authors found:

> "It is important to be aware of this jet, to avoid a false sense of security that may arise when standing to the side of, or behind, a person wearing a surgical, or handmade mask or shield."

These jets were shown to contain viral particles measuring from 0.03 to 1 microns when expelled through the side gaps of both N-95 and surgical masks.[16]

Unmasked individuals on the other hand are unlikely to transmit viral particles anywhere near the distance that a masked individual can unwittingly contaminate. Oral microbial flora dispersed by unmasked healthcare workers standing one meter from the workspace failed to contaminate exposed plates on that surface.[17]

A concern arises then regarding the exposure of people who are positioned next to or behind or standing over a masked individual. Whereas unmasked individuals have been shown to have no or short-distance viral transmission, a leakage jet of up to several meters is a condition that makes a masked person a considerably greater risk for aerosol dispersion toward those in the vicinity who may be concerned about their own exposure to SARS-CoV-2 or other respiratory pathogens.

Proposed chemical mechanisms for increased COVID-19 susceptibility due to mask use

Low oxygen has been measured in the airspace inside a variety of masks. Available oxygen as a percentage of available air volume decreased to less than the US Occupational Safety and Health Administration (OSHA) required minimum of 19.5% [18] in less than 10 seconds of wear, and stayed below that threshold.[19] A study of 53 surgeons found a decrease in saturation of arterial pulsations (SpO2) when performing surgery while masked. Oxygen saturation decreased significantly after the operations.[20]

During a state of hypoxia, the body produces hypoxia-inducible factor-1 (HIF-1). HIF-1 is known to lower T-cell function.[21] CD-4 T-cells have been observed to decline in this process. However, it is essential to understand that CD-4 T-cells are known to fight viral infections.[22] This raises concerns that masked persons might more easily acquire, incubate and subsequently transmit a virus that has been the focus of intense attention, fear and concern throughout the world in 2020.

Another effect of HIF-1 is that it reduces angiotensin converting enzyme 2 (ACE2).[23] This enzyme plays key roles in maintaining blood pressure and electrolytes and controlling inflammation. Cells throughout the body carry receptors for ACE2, and they are especially concentrated in lung and bronchial epithelial cells, and also present in oral and nasal mucosa. ACE2 receptors are also the initial portal by which SARS-CoV-2 enter cells of the upper respiratory tract. An effect of SARS-CoV-2 is that it down-regulates ACE2 receptors.[24] A masked person with a new SARS-CoV-2 infection then would lose both ACE2 and ACE2 receptors. ACE2 is helpful to counteract damaging effects of Angiotensin II, such as inflammation and vasoconstriction. But as ACE2 effects on the body plummet from both loss of ACE2 and loss of receptors, the masked person with a new SARS-CoV-2 infection is especially at risk of marked inflammation and accompanying disease severity. So pathogenic effects of SARS-CoV-2 would be augmented by a hypoxic influence, such as masking, and therefore, would be contraindicated in one who could become infected with this coronavirus. Therefore, mask-induced hypoxia may make the difference between an asymptomatic or lightly symptomatic interaction with SARS-CoV-2 in a normoxic individual, compared with a severe case of COVID-19 in a hypoxic individual.

Carbon dioxide has also been found to rise within 30 seconds of donning a mask and remains at high levels in masked airspace, above OSHA requirements.[25] Masked individuals have been found to manifest evidence of hypercapnia,[26] which affects multiple body systems.[27] [28]

Hypercapnia immobilizes cilia, the hair-like structures we rely on to clear pathogens from the upper airways. This leads to predisposing mask wearers to respiratory tract infections and vulnerability to deep entry of pathogens.[29] The lower respiratory system is usually sterile because of the action of the cilia that escalate debris and microorganisms up toward the mouth and nose. Impairment of this process, such as in hypercapnia, is a risk factor for pathogenesis and severity of respiratory infections.

Hypercapnia was found to downregulate genes related to immune response. It was found that "hypercapnia would suppress airway epithelial innate immune response to microbial pathogens and other inflammatory stimuli."[30] Suppressive effects of hypercapnia were found on macrophage, neutrophil and alveolar epithelial cell functions.

Another effect of masks that may have direct impact on vulnerability to COVID-19 infection is that a mask covers some of the small portion of body surface area that would otherwise be exposed to sunlight in winter, when seasonal coronaviruses are most prevalent. Skin exposure to the sun is the initial mechanism for bodily production of vitamin D. Vitamin D is known to interfere with viral replication,[31] [32] and has been particularly essential as prophylaxis against COVID-19 severity.[33]

Conclusion

Population studies show that the use of masks either resulted in an increased incidence of COVID-19 or had no impact. None of the examined jurisdictions experienced decreased incidence of COVID-19 after the introduction of mask mandates, except two that had already begun a sharp descent in COVID-19 cases weeks earlier. Two physical mechanisms are proposed to directly contribute to this finding, based on current available research. The first is scatter mechanics of dispersed respiratory droplets becoming aerosolized on collision with the mesh of a mask on outward exhalation and then lingering in air. The second is the pressurized and distant peripheral jets of unfiltered exhaled aerosol from the nozzled edges of a mask. These phenomena result in viral particles lingering longer and traveling farther in airspace from a masked person than exhaled respiratory droplets falling close to the body from the orifices of an unmasked person. There are also chemical mechanisms for increased COVID-19 cases in masked populations. This is likely due to immune suppression caused by hypoxic and hypercapnic conditions, as well as acidotic, immobilized cilia in the lungs, and reduced skin surface available to sunlight for Vitamin D production. Caution is therefore urged against use of masks among those who wish to reduce the risk, either for themselves or others, of infection with SARS-CoV-2 or COVID-19 disease.

References

[1] C Felter, N Bussemaker. Which countries are requiring face masks? Council on Foreign Relations. Aug 4, 2020. https://www.cfr.org/in-brief/which-countries-are-requiring-face-masks

[2] B Borovoy, C Huber, M Crisler. Masks, false safety and real dangers, Part 2: Microbial challenges from masks. Primary Doctor Med J. Nov 2020. https://pdmj.org/Mask_Risks_Part2.pdf

[3] I Miller. Mask charts. Rational Ground. https://rationalground.com/mask-charts/

[4] I Miller. More mask charts. Rational Ground. https://rationalground.com/more-mask-charts/

[5] The COVID Tracking Project. Data download. The Atlantic. https://covidtracking.com/data/download

[6] https://github.com/owid/covid-19-data/tree/master/public/data

[7] H Bundgaard, J Bundgaard, et al. Effectiveness of adding a mask recommendation to other public health measures to prevent SARS-CoV-2 infection in Danish mask wearers: A randomized controlled trial. Ann Int Med. Nov 18 2020. https://doi.org/10.7326/M20-6817. https://www.acpjournals.org/doi/10.7326/M20-6817

[8] J Xiao, E Shiu, et al. Nonpharmaceutical measures for pandemic influenza in non-healthcare settings – personal protective and environmental measures. Centers for Disease Control. 26(5); 2020 May. https://wwwnc.cdc.gov/eid/article/26/5/19-0994_article

[9] T Jefferson, M Jones, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. MedRxiv. 2020 Apr 7. https://www.medrxiv.org/content/10.1101/2020.03.30.20047217v2

[10] C Huber. Masks are neither effective nor safe: A summary of the science. PDMJ.org. Dec 2020. https://pdmj.org/Mask_Risks_Part4.pdf

[11] J Brainard, N Jones, et al. Facemasks and similar barriers to prevent respiratory illness such as COVID19: A rapid systematic review. MedRxiv. 2020 Apr 1. https://www.medrxiv.org/content/10.1101/2020.04.01.20049528v1.full.pdf

[12] E Fischer, M Fischer, et al. Low-cost measurement of face mask efficacy for filtering expelled droplets during speech. Science Advances. Sep 2 2020. 6 (36). https://advances.sciencemag.org/content/6/36/eabd3083?fbclid=IwAR0TPVIfIF_sUEiSdad6oM1NVQGO5w2S7WfstCIKaIJ15JJaKaDMzBkD5YY

[13] N Mitchell, S Hunt. Surgical face masks in modern operating rooms – a costly and unnecessary ritual? J Hosp Inf. Jul 1991. 18 (3): 239-242. https://doi.org/10.1016/0195-6701(91)90148-2 https://www.sciencedirect.com/science/article/abs/pii/0195670191901482

[14] M Nicas, W Nazaroff, et al. Toward understanding the risk of secondary airborne infection: Emission of respirable pathogens. J Occup and Env Hygiene. Aug 2010. 143-154.

https://doi.org/10.1080/15459620590918466
https://www.tandfonline.com/doi/full/10.1080/15459620590918466

[15] M Viola, B Peterson, et al. Face coverings, aerosol dispersion and mitigation of virus transmission risk. https://arxiv.org/abs/2005.10720, https://arxiv.org/ftp/arxiv/papers/2005/2005.10720.pdf

[16] S Grinshpun, H Haruta, et al. Performance of an N95 filtering facepiece particular respirator and a surgical mask during human breathing: two pathways for particle penetration. J Occup Env Hygiene. 2009; 6(10):593-603. https://www.tandfonline.com/doi/pdf/10.1080/15459620903120086

[17] N Mitchell, S Hunt. Surgical face masks in modern operating rooms – a costly and unnecessary ritual? J Hosp Inf. Jul 1991. 18 (3): 239-242. https://doi.org/10.1016/0195-6701(91)90148-2 https://www.sciencedirect.com/science/article/abs/pii/0195670191901482

[18] US Department of Labor, Occupational Safety & Health Administration. Confined or enclosed spaces and other dangerous atmospheres >> Oxygen deficient or oxygen enriched atmospheres. https://www.osha.gov/SLTC/etools/shipyard/shiprepair/confinedspace/oxygendeficient.html

[19] B Borovoy, C Huber, M Crisler. Masks, false safety and real dangers, Part 3: Hypoxia, hypercapnia and physiological effects. PDMJ. Nov 2020. https://pdmj.org/Mask_Risks_Part3.pdf

[20] A Beder, U Buyukkocak, et al. Preliminary report on surgical mask induced deoxygenation during major surgery. Neurocirugia 2008. 19. 121-126. http://scielo.isciii.es/pdf/neuro/v19n2/3.pdf

[21] D Lukashev, B Klebanov. Cutting edge: Hypoxia-inducible factor 1alpha and its activation- inducible short isoform I.1 negatively regulate functions of CD4+ and CD8+ T lymphocytes. J Immun. Oct 15 2006. 177 (8). 4962 – 4965. DOI: https://doi.org/10.4049/jimmunol.177.8.4962 https://www.jimmunol.org/content/177/8/4962

[22] A Sant, A McMichael. Revealing the role of CD-4+ T cells in viral immunity. J Exp Med. Jul 30 2012. 209 (8). https://dx.doi.org/10.1084%2Fjem.20121517 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3420330/

[23] R Zhang, H Su, et al. MiRNA let-7b promotes the development of hypoxic pulmonary hypertension by targeting ACE2. Am J Physiol Lung Cell Mol Physiol. Mar 2019. 1; 316 (3): L547-L557. doi: 10.1152/ajplung.00387.2018 https://pubmed.ncbi.nlm.nih.gov/30628484/

[24] P Verdecchia, C Cavallini et al. The pivotal link between ACE2 deficiency and SARS-CoV-2 infection. Eur J Intern Med. Jun 2020. 76: 14-20. doi: 10.1016/j.ejim.2020.04.037 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7167588/

[25] B Borovoy, C Huber, M Crisler. Masks, false safety and real dangers, Part 3: Hypoxia, hypercapnia and physiological effects. PDMJ. Nov 2020. https://pdmj.org/Mask_Risks_Part3.pdf

[26] T Jacobson, J Kler, et al. Direct human health risks of increased atmospheric carbon dioxide. Nat Sustain. 2019. 2 (8). 691-701. https://www.nature.com/articles/s41893-019-0323-1

[27] B Chandrasekaran, S Fernandes. Exercise with facemask; Are we handling a devil's sword? – A physiological hypothesis. Nov 2020. 144 (110002). doi: 10.1016/j.mehy.2020.110002 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7306735/#b0135

[28] M Joyner, D Casey. Regulation of increased blood flow (hyperemia) to muscles during exercise: a hierarchy of competing physiological needs. Physiol Rev. Apr 2015. 95 (2). 549-601. doi: 10.1152/physrev.00035.2013. https://pubmed.ncbi.nlm.nih.gov/25834232/

[29] C Kempeneers, C Seaton, et al. Ciliary functional analysis: beating a path towards standardization. Pediatr Pulmonol. Oct 2019. 54 (10). 1627-1638. https://doi.org/10.1002/ppul.24439 https://pubmed.ncbi.nlm.nih.gov/31313529/

[30] S Casalino-Matsuda, N Wang, et al. Hypercapnia alters expression of immune response, nucleosome assembly and lipid metabolism genes in differentiated human bronchial epithelial cells. Sep 10 2018. Sci Rep. 13508. https://www.nature.com/articles/s41598-018-32008-x

[31] A Schogler, R Muster, et al. Vitamin D represses rhinovirus replication in cystic fibrosis cells by inducing LL-37. Eur Resp J 2016. 47: 520-530. DOI: 10.1183/13993003.00665-2015 https://erj.ersjournals.com/content/47/2/520

[32] C Gunville, P Mourani, et al. The role of vitamin D in the prevention and treatment of infection. Inflamm Allergy Drug Targets. Jul 2013. 12 (4): 239-245. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3756814/

[33] P Ilie et al. The role of vitamin D in the prevention of coronavirus disease2019 infection and mortality. Aging Clin Exper Res. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7202265/pdf/40520_2020_Article_1570.pdf