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Sent via electronic mail

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Dear Physician/Journalist:

I am writing you because you have reported on COVID-19 this year and I think you would find this information of interest. As you know, the introduction of the newest coronavirus, (“COVID-19”), into the United States earlier this year caused one of the most significant public health crises of our lifetime.ⁱ As with any influenza, the risk of respiratory failure is present with COVID-19; however, this flu carries some unique challenges that modern medicine has not been able to reliably meet. Some unique challenges of COVID-19 include, the following: (1) that the virus somehow causes lower blood-oxygen readings in patients than their bodies tend to demonstrate, requiring a more frequent medical recommendation for high-risk intubated mechanical ventilation;ⁱⁱ (2) COVID-19 is believed to have a higher-than-average rate of contagiousness, triggering an additional preference for intubated ventilation as opposed to masked or noninvasive breathing devices that would aerate the virus more;ⁱⁱⁱ and (3) hospitals have had relatively poor success rates with patients who have been treated with intubated ventilation while having COVID-19.^{iv}

With the spread of COVID-19 worldwide, suitable and narrowly tailored ventilation is needed.

Respiratory distress or failure is a common extreme symptom of influenza. Most often, the flu and resulting inflammation triggers acute respiratory disease syndrome, or ARDS, which can be fatal.^v To counter ARDS, many physicians recommend (invasive) intubated mechanical ventilation.^{vi} The pre-COVID-19 *status quo* seems to have favored the use of intubated ventilation with influenza-induced hypoxemic respiratory failure or the same complicated by ARDS. Id.

COVID-19 has yielded a relatively high recommendation for intubated mechanical ventilation. Patients are often recorded as showing conflicting signs of adequate blood-oxygen levels—noted by full sentences, no difficulty breathing, talking on the phone and full consciousness with morbidly low blood-oxygen readings, e.g., 10-70% while anything lower than 93% is considered critical.^{vii} This has encouraged physicians to rush to active ventilation, rather than starting with passive alternatives.

Many standard pulse oximeters measure blood oxygen level through the extremities, commonly sending electromagnetic (light) waves through one side of a patient’s finger that are read by a sensor on the opposing side of the finger.^{viii} See Figure 1 below. As red blood cells—carriers of oxygen in the blood—pass through the veins in a finger they absorb the

light emitted by the pulse oximeter. The quantity of light absorbed by red blood cells typically gives a reliable reading of blood-oxygen level in a patient. *Id.* Severe COVID-19 patients, however, have had strong immune reactions and higher white blood cell counts.^{ix} **Since the white blood cells are in the bloodstream and larger than red blood cells, yet they do not absorb light from the pulse oximeter, it is plausible that a patient's immune reaction to the virus may cause a higher concentration of white blood cells in the blood and the pulse oximeters are not accounting for this phenomenon, misestimating that the blood has fewer red blood cells per volume. Pulse oximeters are known to be unreliable in septic/infected patients.**^x See Figure 2 below.

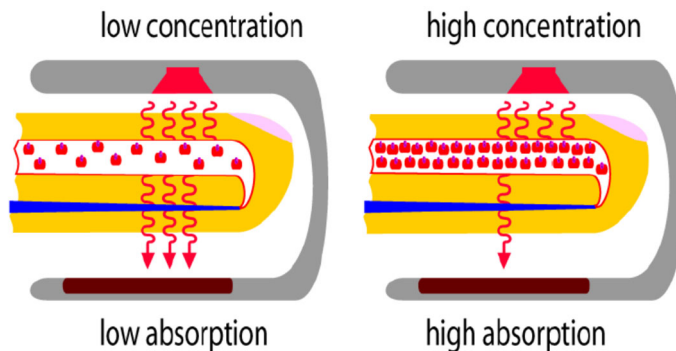


Figure 1: Low vs. High Concentration Red Blood Cells

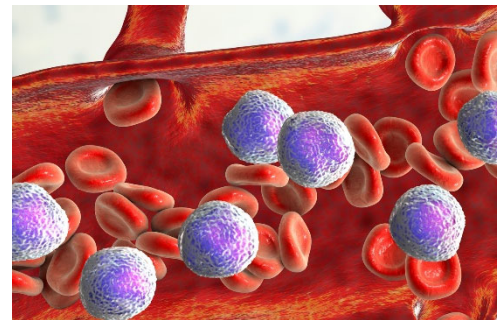


Figure 2: White Blood Cells with Red Blood Cells

The suspiciousness of pulse oximetric blood-oxygen levels is increased when considering how especially ineffective mechanical ventilation has been with COVID-19 patients.^{xi} While blood-oxygen levels show that severe ARDS is likely, mechanical ventilation survival rates *with ARDS* drops from around 60-50% pre-COVID-19 to 20% or less with COVID-19.^{xii} Many COVID-19 patients do not carry traditional symptoms of ARDS.^{xiii} This further suggests that blood-oxygen is not as low as measured and we may be over-ventilating patients.^{xiv} Over ventilating the body can severely damage the lungs and their ability to deliver oxygen to other parts of the body. *Id.* The lungs end with fragile, tissue-paper thin air sacs (alveoli) that engage capillaries when inflated to deliver oxygen to the bloodstream.^{xv}

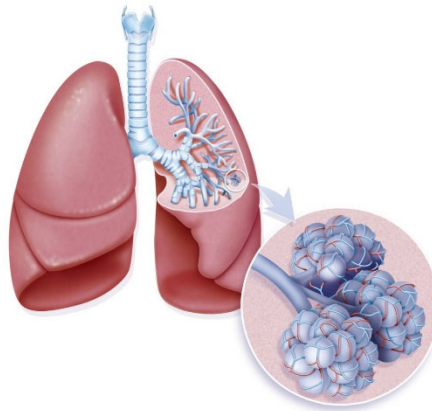


Figure 3: Lungs with Alveoli

The lungs cannot deliver oxygen to the body without them. Many COVID-19 patients are likely suffering unnecessary trauma to the lungs for causes unrelated to the virus' incumbrances on the lungs but linked to the broad and aggressive use of active ventilation.^{xvi}

Indeed, many physicians have already brazenly broken hospital mechanical ventilation protocols; the iconoclasts are (successfully) erring in favor of passive ventilation even though blood-oxygen readings suggest that invasive ventilation is necessary.^{xvii} E.g., where existing protocols for ventilation were not working one doctor designed his own protocol, coining his strategy "passive ventilation." Coffey *supra*. Another medical team out of Chicago felt so strongly about their defiance of MV protocols they created what they believe to be a lifesaving slogan: "prevent the vent!" Bartosch, *supra*, "Avoiding intubation is key," [EM Director Dr. Spiegel] said. 'Most of our colleagues around the city are not doing this, but I sure wish other ERs would take a look at this technique closely.'" Likewise, others felt no less than morally compelled to leave their employing hospitals for other facilities willing to defy MV protocols. Schelden, *supra*, "**'We ran into an impasse where I could not morally, in a patient-doctor relationship, continue the current protocols which, again, are the protocols of the top hospitals in the country. I could not continue those. You can't have one doctor just doing their own protocol. So I had to step down.'**"

In many cases, physicians can oxygenate patients without sedating them and placing them on intubated ventilators by using non-invasive ventilation. This would allow patients to give feedback on the pressure settings. Also, there are other ways of diagnosing acute respiratory distress syndrome (or ARDS) besides low blood oxygen and infection with an influenza including: (1) getting visual confirmation through chest X-rays and (2) measuring blood oxygen through an arterial blood gas test that takes a sample of blood to measure the chemical content of oxygen in the blood. I believe that if we ask physicians to review this information and consider adding secondary confirmations of ARDS to their intubated mechanical ventilation protocols we can save many lives.

Please pass this information on to your physician contacts as well as the manufacturers of the pulse oximeters and mechanical ventilators. Included with this letter are

hyperlinks to the references I am relying upon. If you have any questions please call me at (248) 296-0770 or send an e-mail to: KristyDowning@jhu.edu. Thank you for your attention to these matters!

Sincerely,

s/ Kristy J. Downing /

ⁱ Center for Disease Control and Prevention, Coronavirus Disease 2019 (COVID-19) – Cases in the U.S., <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html> (Assessed 08-03-2020)(reporting 154,471 US deaths this year of 4.65M cases); see also, Johns Hopkins University & Medicine, Coronavirus Resource Center, <https://coronavirus.jhu.edu/> (Assessed 08-03-2020)(reporting 18M global cases, 690,452 global deaths and 154,992 US deaths attributable to COVID-19); UCI Health, Why is COVID-19 so dangerous?, <https://www.ucihealth.org/blog/2020/04/why-is-covid19-so-dangerous> (“But of the many viruses known to infect humans, what makes this one, which has caused the worst pandemic in a century, so dangerous?”).

ⁱⁱ Jamie Ducharme, Time Magazine, Why Ventilators May Not Be Working as Well for COVID-19 Patient as Doctors Hoped, <https://time.com/5820556/ventilators-covid-19/> (Assessed 06-27-2020)(“Even stranger, some COVID-19 patients who show very low blood oxygen levels still appear to be breathing fairly comfortably, raising even more questions about how much support they need.”); Penka Arsova, LaCorte News, Minnesota doctor and lawmaker slams CDC guidelines on certifying coronavirus deaths, <https://www.lacortenews.com/n/minnesota-doctor-and-lawmaker-slams-cdc-guidelines-on-certifying-coronavirus-deaths> (Assessed 06-27-2020)(discussing financial incentives for mechanical ventilation also).

ⁱⁱⁱ Times Magazine, supra.

^{iv} J. Bacon, Detroit Free Press, A bridge between life and death: Most COVID-19 patients put on ventilators will not survive, <https://www.freep.com/story/news/health/2020/04/08/coronavirus-cases-ventilators-covid-19/2950167001/> (Assessed 04-08-2020) (originally reporting an 80% death rate for patients receiving intubated ventilation); see also, WebMD, Ventilators: Helping or Harming COVID-19 Patients?, <https://www.webmd.com/lung/news/20200415/ventilators-helping-or-harming-covid-19-patients#1> (Assessed 06-27-2020)

Precise measurements needed

These patients also are at risk of ventilator-associated acute lung injury, a condition caused by overinflating the lungs during mechanical ventilation, Khouli said.

Doctors have to precisely calculate the amount of air to push into a person's lungs with every mechanical breath, taking into account the fact that a large part of the lung could be full of fluid and incapable of inflation. "The amount of volume you need to deliver would be usually less," Khouli said.

"If the settings are not managed correctly, it can cause an additional trauma to the lungs," Khouli said.

(further reporting a 40-80% mortality rate with the use of intubated ventilators); see also, Stobbe, AP News, Some doctors moving away from ventilators for virus patients, <https://apnews.com/8ccd325c2be9bf454c2128dcb7bd616d> (April 8, 2020)(Assessed 07-28-2020), pp2-3 and 5 (noting that 3-4% of people with COVID-19 are estimated to need ventilation, an 80% death rate with use of ventilators in New York City, 66% death rate with use of ventilators in the UK, and 86% death rate with use of ventilators in China); Coffey, MedScape, German Physician Explains His Alternative Ventilation Strategy for COVID-19, <https://www.medscape.com/viewarticle/929609> (April 28, 2020)(Assessed 07-29-2020) (reporting 35-50% death rates with MV and UK rates as high as two-thirds); Achenbach et al., The Washington Post, Elderly covid-19 patients on ventilators usually do not survive, New York hospitals report, https://www.washingtonpost.com/health/elderly-covid-19-patients-on-ventilators-usually-do-not-survive-new-york-hospitals-report/2020/05/19/ba20e822-99f8-11ea-89fd-28fb313d1886_story.html (May 19, 2020)(Assessed 07-29-2020)(reporting death rates as high as 80%); Racatte, Richochet, COVID-19 Data: Survival Rates for Patients on Ventilators, <https://ricochet.com/742120/covid-19-data-survival-rates-for-patients-on-ventilators/>

(April 4, 2020) (Assessed 07-29-2020)(death rates for mechanical ventilators span from 27% to 76% depending upon age).

^v Fratzke et al., American Association for Respiratory Care, The Role of ECLS in Influenza-Related ARDS, <https://www.aarc.org/nnl19-ecls-in-influenza-related-ards/> (06-27-2020)(“In the face of severe respiratory failure[] the use of invasive mechanical ventilation is needed to maintain adequate life-sustaining gas exchange.”)(recommending the use of extracorporeal life support in instances where intubated mechanical ventilation prove unsuccessful); see also, Mayo Clinic, ARDS, <https://www.mayoclinic.org/diseases-conditions/ards/symptoms-causes/syc-20355576?p=1> (Assessed 06-27-2020).

^{vi} Id.; see also, Ramsey et al., Critical Care Medicine, Ventilator management for hypoxemic respiratory failure attributable to H1N1 novel swine origin influenza virus, https://journals.lww.com/ccmjournal/Fulltext/2010/04001/Ventilator_management_for_hypoxemic_respiratory.8.aspx, 2010 Vol. 38, No. 4 (discussing a study of ventilator management and performance with respect to the H1N1 novel swine flu); Xie et al., World Journal of Emergency Medicine, Ventilator management for acute respiratory distress syndrome associated with avian influenza A (H7N9) virus infection: A case series, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5847497/>, World J Emerg Med, Vol 9, No. 2, 2018 (studying ventilator management and emergency measures for eight patients and making recommendations thereafter).

^{vii} Begley, STAT, With ventilators running out, doctors say the machines are overused for COVID-19, <https://www.statnews.com/2020/04/08/doctors-say-ventilators-overused-for-covid-19/> (April 8, 2020)(Assessed 07-28-2020), pp1-4

Many patients have blood oxygen levels so low they should be dead. But they’re not gasping for air, their hearts aren’t racing, and their brains show no signs of blinking off from lack of oxygen.

...

Those levels often “look beyond awful,” said Scott Weingart, a critical care physician in New York and host of the “EMCrit” podcast. But many can speak in full sentences, don’t report shortness of breath, and have no signs of heart or other organ abnormalities that hypoxia can cause.

“The patients in front of me are unlike any I’ve ever seen,” Kyle-Sidell told Medscape about those he cared for in hard-hit Brooklyn hospital. [*sic*] “They looked a lot more like they had altitude sickness than pneumonia.”

See also, Schelden, MedicineNet, Doctors Suspect Mystery COVID-19 Lung Problems, Pleas for New Approach, <https://www.medicinenet.com/script/main/art.asp?articlekey=230110> (April 9, 2020) (Assessed 07-28-2020)

[T]he doctor noticed disturbing patterns he had never seen before COVID-19 patients on ventilators sometimes showed extremely low blood-oxygen concentrations during ventilation, he said. Despite doctors best efforts, he reported seeing concentrations of oxygen in blood at 10% to 20% and sometimes even lower – a healthy blood oxygen level is above 95 percent, according to the British Lung Foundation.

Not only that, but some COVID-19 patients seem less obviously impaired by their low blood oxygen levels than he expected.

See also, Jamie Ducharme, Time Magazine, Why Ventilators May Not Be Working as Well for COVID-19 Patient as Doctors Hoped, <https://time.com/5820556/ventilators-covid-19/> (Assessed 06-27-2020)(“Even stranger,

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some COVID-19 patients who show very low blood oxygen levels still appear to be breathing fairly comfortably, raising even more questions about how much support they need.”); Dwyer, New York Times, What Doctors on the Front Lines Wish They’d Known a Month Ago, <https://www.nytimes.com/2020/04/14/nyregion/new-york-coronavirus.html> (April 15, 2020)(Assessed 07-28-2020), p2 (“‘Never in my life have I had to ask a patient to get off the telephone because it was time to put in a breathing tube,’ said Dr. Richard Levitan... People who need breathing tubes, which connect to mechanical ventilators that assist to take over respiration, are rarely in any shape to be on the phone because the level of oxygen in their blood has declined precipitously.”)

^{viii} Gotter, Healthline, Pulse Oximetry: Uses, Readings, and How It Works, <https://www.healthline.com/health/pulse-oximetry> (Aug. 2, 2017) (Assessed 07-29-2020); BioOptics World Editors, Biomedicine, Optical sensor-driven device can count white blood cells through the skin, <https://www.bioopticsworld.com/biomedicine/article/16430391/optical-sensordriven-device-can-count-white-blood-cells-through-the-skin> (Oct. 1, 2015)(Assessed 07-29-2020), p3 (discussing tuning a pulse oximeter to measure white blood cell count: “When illuminating at certain frequencies, light is absorbed by the hemoglobin in the red cells, an effect that does not happen with the white cells.”).

^{ix} Jin et al., Clinical characteristics of patients diagnosed with COVID-19 in Beijing, Biosafety and Health 2 (13 Mar 2020), pp104-111, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7217107/> (Assessed 07-29-2020), p107 & Table 3 (white blood cell counts average $5.1 \times 10^9/L$, but more severe patients average $6.3 \times 10^9/L$, 24% higher than the infected group’s WBC mean).

^x Schramm et al., Effect of local limb temperature on pulse oximetry and the plethysmographic pulse wave, <https://pubmed.ncbi.nlm.nih.gov/9127780/>, 14 Int. J Clin Monit. Comput. 17-22 (Dec. 11, 1996), p21 (“[T]he obtained SpO2 in septic patients could be expected to be too low due to a low peripheral resistance.”)(also reporting a slight decrease in blood oxygen with increase in temperature); see also, University of Leeds, The Histology Guide, White blood cells, https://www.histology.leeds.ac.uk/blood/blood_wbc.php (Assessed 08-03-2020)(reporting white blood cell types at least three times the size of red blood cells); Peace Health, Complete Blood Count (CBC), [https://www.peacehealth.org/medical-topics/id/hw4260#:~:text=White%20blood%20cell%20\(WBC%2C%20leukocyte,cells%20but%20fewer%20in%20number](https://www.peacehealth.org/medical-topics/id/hw4260#:~:text=White%20blood%20cell%20(WBC%2C%20leukocyte,cells%20but%20fewer%20in%20number), (Dec. 9, 2019)(Assessed 08-03-2020) (reporting that white blood cells are larger in volume than red blood cells).

^{xi} See endnote iv.

^{xii} Modern Healthcare, Some doctors moving away from ventilators for virus patients, <https://www.modernhealthcare.com/safety-quality/some-doctors-moving-away-ventilators-virus-patients> (April 08, 2020) (Assessed 07-28-2020), p1 (“Generally speaking, 40%-50% of patients with severe respiratory distress die while on ventilators, experts say. But 80% or more of coronavirus patients placed on the machines in New York City have died.”).

^{xiii} See e.g., Cressoni et al., COVID-19 Does Not Lead to a “Typical” Acute Respiratory Distress Syndrome, 201 Am Journal of Respiratory and Crit. Care Medicine, 10 (May 15, 2020); Chen, ProPublica, Ventilators Aren’t Going to Cure COVID-19, Here’s What They Can Do, <https://www.propublica.org/article/ventilators-arent-going-to-cure-covid-19-heres-what-they-can-do> (April 15, 2020) (Assessed 07-29-2020), pp2-3 (“COVID-19 behaves differently than other respiratory diseases.”); Sable-Smith, Wisconsin Public Radio, ‘Almost a Death Sentence’: How Wisconsin Doctors, Peers Are Rethinking Ventilators for Coronavirus, <https://www.wpr.org/almost-death-sentence-how-wisconsin-doctors-peers-are-rethinking-ventilators-coronavirus> (May 5, 2020) (Assessed 07-29-2020), pp2-3; Begley, STAT, With ventilators running out, doctors say the machines are overused for COVID-19, <https://www.statnews.com/2020/04/08/doctors-say-ventilators-overused-for-covid-19/> (April 8, 2020)(Assessed 07-28-2020), pp3-4.

^{xiv} Sable-Smith, Wisconsin Public Radio, ‘Almost a Death Sentence’: How Wisconsin Doctors, Peers Are Rethinking Ventilators for Coronavirus, <https://www.wpr.org/almost-death-sentence-how-wisconsin-doctors-peers-are-rethinking-ventilators-coronavirus> (May 5, 2020) (Assessed 07-29-2020), pp2-3.

[Dr.] Gattinoni wrote that about 20 percent to 30 percent of the patients examined had severe symptoms, with stiff and heavy lungs that should be treated with ventilators under ARDS protocols to alleviate dangerous fluid buildup. But more than half of the patients whose records Gattinoni examined showed less severe symptoms, with thin, elastic lungs that did not fit the ARDS profile. Treating those symptoms with a ventilator could prove deadly, Gattinoni said in an interview.

...

At Bellin Health, pulmonologist Dr. John Koszuta likened the risk of using too much pressure with ventilators to overfilling a balloon with air. ‘What happens (to a balloon)? It pops. And if you over distend the lungs, you may get this injury called barotrauma,’ said Koszuta, describing lung damage caused by pressure changes.

See also, Schelden, MedicineNet, Doctors Suspect Mystery COVID-19 Lung Problems, Pleas for New Approach, <https://www.medicinenet.com/script/main/art.asp?articlekey=230110> (April 9, 2020) (Assessed 07-28-2020), p3.

“If you think of the lungs as a balloon, typically when people have ARDS or pneumonia, the balloon gets thicker,” Dr. Kyle-Sidell told Medscape. “So not only do you lack oxygen, but the pressure and the work to blow up the balloon becomes greater. So one's respiratory muscles become tired as they struggle to breathe. And patients need pressure. What Gattinoni is saying is that there are essentially two different phenotypes, one in which the balloon is thicker. (But) imagine if the balloon is not actually thicker but thinner, so they'd suffer from a lack of oxygen. But it is not that they suffer from too much work to blow up the balloon.”

In other words, some COVID-19 patients have little trouble “blowing up the balloon” of their lungs, yet still suffer from low oxygen.

See also, WebMD, Ventilators: Helping or Harming COVID-19 Patients?, <https://www.webmd.com/lung/news/20200415/ventilators-helping-or-harming-covid-19-patients#1> (Assessed 06-27-2020)

Precise measurements needed

These patients also are at risk of ventilator-associated acute lung injury, a condition caused by overinflating the lungs during mechanical ventilation, Khouli said.

Doctors have to precisely calculate the amount of air to push into a person's lungs with every mechanical breath, taking into account the fact that a large part of the lung could be full of fluid and incapable of inflation. "The amount of volume you need to deliver would be usually less," Khouli said.

"If the settings are not managed correctly, it can cause an additional trauma to the lungs," Khouli said.

^{xv} See also, Chen, ProPublica, Ventilators Aren't Going to Cure COVID-19, Here's What They Can Do, <https://www.propublica.org/article/ventilators-arent-going-to-cure-covid-19-heres-what-they-can-do> (April 15, 2020) (Assessed 07-29-2020), p2 (discussing the fragile “tissue paper” thin design of the air sacs).

^{xvi} See endnotes xii-xiv.

^{xvii} Coffey, MedScape, German Physician Explains His Alternative Ventilation Strategy for COVID-19, <https://www.medscape.com/viewarticle/929609> (April 28, 2020)(Assessed 07-29-2020), p1 (discussing the use of masks and passive (invasive) ventilation)

He ordered that positive end-expiratory pressure (PEEP) be set to zero, inspiratory time to 1.4 seconds, pCO₂ to less than 35 mmHg, and that tidal volume be increased to at least 800 mL. The regime runs in direct contrast with widely held ventilation strategies and current guidance on COVID-19 treatment.

Within 20 hours of passive ventilation, one of the French patients, a woman who had been intubated for 14 days, was able to be extubated. Another was extubated on the second day. The remaining six are doing well in the ICU but are too weak to breathe on their own for more than a few hours, owing to the fact that they arrived under such heavy sedation...

“The importance of limiting tidal volumes in mechanical ventilated patients,” Checkley said, “is to avoid creating volume trauma – same goes with pressure. The risk of liberalizing the amount of tidal volume delivered could be problematic in the sense that you could induce injury.” For patients with adequate respiratory system compliance, Checkley doesn’t think physicians should increase tidal volumes above 8 mL/kg of predicted body weight.

(Emphasis given); see also, Megan Williams, CBC News, Ventilators are being overused on COVID-19 patients, world-renowned critical care specialist says, <https://www.cbc.ca/news/world/ventilators-covid-overuse-1.5534097> (April 17, 2020)(Assessed 07-28-2020), p3 (physicians are delaying MV as much as possible); see also, Bartosch, At the Forefront U of Chicago Medicine, UChicago Medicine doctors see ‘truly remarkable’ success using ventilator alternatives to treat COVID-19, <https://www.uchicagomedicine.org/forefront/coronavirus-disease-covid-19/uchicago-medicine-doctors-see-truly-remarkable-success-using-ventilator-alternatives-to-treat-covid19> (April 22, 2020)(Assessed 07-27-2020), p1 (adopting the following oxygenation strategy: “prevent the vent” – the medical team avoided ventilation and intubation at all costs. “Avoiding intubation is key,” [EM Director Dr. Spiegel] said. ‘Most of our colleagues around the city are not doing this, but I sure wish other ERs would take a look at this technique closely.’”); see also, WebMD, Ventilators: Helping or Harming COVID-19 Patients?, <https://www.webmd.com/lung/news/20200415/ventilators-helping-or-harming-covid-19-patients#1> (Assessed 06-27-2020)(“ICUs are becoming more cautious in their use of ventilation, using oxygen and breathing dilators like nitric oxide to keep people drawing their own breath for as long as possible.”).

See also, Jamie Ducharme, Time Magazine, Why Ventilators May Not Be Working as Well for COVID-19 Patient as Doctors Hoped, <https://time.com/5820556/ventilators-covid-19/> (Assessed 06-27-2020)

[D]octors continue to spark impassioned debate within the medical community, with some doctors moving away from the use of ventilators and others defending the current standard of care. ...

A group of European physicians submitted a letter [hyperlink] to the American Journal of Respiratory and Critical Care Medicine, published March 30, detailing COVID-19’s discrepancies from typical ARDS and calling on doctors to avoid jumping to unnecessary mechanical ventilation. Other physicians say mechanical ventilation can help some patients, but doctors are jumping to it too quickly, potentially subjecting patients to unnecessary traumatic treatment when they could use less-invasive respiratory supports like breathing masks and nasal tubes.

See also, Stobbe, AP News, Some doctors moving away from ventilators for virus patients, <https://apnews.com/8ccd325c2be9bf454c2128dcb7bd616d> (April 8, 2020)(Assessed 07-28-2020)(“increasingly, physicians are trying other measures first.”); Modern Healthcare, Some doctors moving away from ventilators for virus patients, <https://www.modernhealthcare.com/safety-quality/some-doctors-moving-away-ventilators-virus-patients> (April 08, 2020) (Assessed 07-28-2020), p1 (“some doctors are moving away from using the breathing machines when they can.”); Dwyer, New York Times, What Doctors on the Front Lines Wish They’d Known a Month Ago, <https://www.nytimes.com/2020/04/14/nyregion/new-york-coronavirus.html> (April 15, 2020)(Assessed 07-28-2020), p1 (“Instead of quickly sedating people who had shockingly low levels of oxygen

and then putting them on mechanical ventilators, many doctors are now keeping patients conscious, having them roll over in the bed, recline in chairs and continue to breathe on their own – with additional oxygen – for as long as possible.”); Chen, ProPublica, [Ventilators Aren’t Going to Cure COVID-19, Here’s What They Can Do](https://www.propublica.org/article/ventilators-arent-going-to-cure-covid-19-heres-what-they-can-do), <https://www.propublica.org/article/ventilators-arent-going-to-cure-covid-19-heres-what-they-can-do> (April 15, 2020) (Assessed 07-29-2020), p2 (“ventilators are a last resort”); Schelden, MedicineNet, [Doctors Suspect Mystery COVID-19 Lung Problems, Pleas for New Approach](https://www.medicinenet.com/script/main/art.asp?articlekey=230110), <https://www.medicinenet.com/script/main/art.asp?articlekey=230110> (April 9, 2020) (Assessed 07-28-2020), p3; Sable-Smith, Wisconsin Public Radio, [‘Almost a Death Sentence’: How Wisconsin Doctors, Peers Are Rethinking Ventilators for Coronavirus](https://www.wpr.org/almost-death-sentence-how-wisconsin-doctors-peers-are-rethinking-ventilators-coronavirus), <https://www.wpr.org/almost-death-sentence-how-wisconsin-doctors-peers-are-rethinking-ventilators-coronavirus> (May 5, 2020) (Assessed 07-29-2020), pp2-3; Begley, STAT, [With ventilators running out, doctors say the machines are overused for COVID-19](https://www.statnews.com/2020/04/08/doctors-say-ventilators-overused-for-covid-19/), <https://www.statnews.com/2020/04/08/doctors-say-ventilators-overused-for-covid-19/> (April 8, 2020)(Assessed 07-28-2020), p4

[I]n Annals of Intensive Care, physicians who treated Covid-19 patients at two hospitals in China found that the majority of patients needed no more than a nasal cannula. Among the 41% who needed more intense breathing support, none was put on a ventilator right away. Instead, they were given noninvasive devices such as BiPAP; their blood oxygen levels ‘significantly improved’ after an hour or two.