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**APPENDIX TO AMICUS BRIEF OF NON-PARTY AMICUS
FRONT LINE COVID-19 CRITICAL CARE ALLIANCE**

Appendix A: MATH+ Protocol FLCCC GUIDE TO MANAGING THE HOSPITALIZED
COVID-19 PATIENT.....APP 0001

Appendix B: Review of the Emerging Evidence Demonstrating the Efficacy of Ivermectin in
the Prophylaxis and Treatment of COVID-19, Pierre Kory, MD, G. Umberto Meduri, MD2, Jose
Iglesias, DO, Joseph Varon, MD, Keith Berkowitz, MD, Howard Kornfeld, MD, Eivind
Vinjevoll, MD, Scott Mitchell, MBChB, Fred Wagshul, MD, Paul E. Marik, MD.APP 0044

Appendix C: FDA Transcript oral argument in *Apter et al v. HHS, FDA, et al.* S. D. Tex. 3:22-
cv-00184 dated November 1, 2022.....APP 0074

MATH+[®]

COVID HOSPITAL TREATMENT

**A GUIDE TO
MANAGING THE
HOSPITALIZED
COVID-19 PATIENT**

September 6, 2022

FLCCC
ALLIANCE

FRONT LINE COVID-19 CRITICAL CARE ALLIANCE
PREVENTION & TREATMENT PROTOCOLS FOR COVID-19

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Disclaimer

The information in this document is our recommended approach to COVID-19 in the hospitalized patient, based on the best (and most recent) literature. It is provided as guidance to healthcare providers worldwide on the prevention and early treatment of COVID-19. Our guidance should only be used by medical professionals in formulating their approach to COVID-19. Patients should always consult with their provider before starting any medical treatment. As this is a highly dynamic topic, we will update these guidelines as new information emerges. Please ensure you are using the latest version of this protocol.

To read more about the safety of the vitamins and nutraceuticals listed on the FLCCC protocols during pregnancy, please review [this document](#).

The Use of “Off-Label” Drugs

Once the FDA approves a prescription medication, federal laws allow any U.S. physician to prescribe the duly approved drug for any reason. [1] In fact, 30 percent of all prescriptions are for off-label uses, written by American doctors exercising their medical judgment.

Many states — including Nebraska, Tennessee, and Missouri — have asserted the right of physicians to prescribe, and pharmacists to dispense, off-label drugs such as ivermectin and hydroxychloroquine for the treatment of COVID-19. For example, Nebraska’s Attorney General, Doug Peterson, released a legal opinion in October 2021 saying he did not see data to justify legal action against healthcare professionals who prescribe ivermectin or hydroxychloroquine. [2] In May 2022, Tennessee approved a standing order allowing ivermectin to be dispensed over the counter.

Overview of MATH+ and Key Concepts

As the pandemic has played out over the last two years, more than six million patients have died worldwide. Most countries across the globe have limited resources to manage this humanitarian crisis. The FLCCC physicians developed the **MATH+ protocol** to provide guidance for the treatment of the pulmonary phase of this devastating disease with the goal of reducing hospital mortality. We are now realizing the relentless malpractice of deliberately withholding effective early COVID treatments and forcing the use of toxic remdesivir in hospitalized patients may have unnecessarily killed up to 800,000 Americans. [3]

The core principle of MATH+ is the use of anti-inflammatory agents to dampen the “cytokine storms,” together with anticoagulation to limit the microvascular and macrovascular clotting, and supplemental oxygen to help overcome the hypoxia.

COVID is an extraordinarily complex, yet treatable, disease; many of its mysteries are still unravelling. However, a few concepts are key to its management.

It is critically important to recognize that infection with SARS-CoV-2, the virus that causes COVID-19, progresses through stages. Treatment approaches are therefore highly stage-specific (see Figures 2-4 and Table 1). Antiviral therapy is likely to be effective only during the viral replicative phase. Anti-inflammatory therapy is expected to be effective during the pulmonary phase and possibly the post-COVID phase.

While there is no “magic bullet” for COVID-19, several therapeutic agents have shown great promise for the treatment of this disease. These include ivermectin, Vitamin D, quercetin, melatonin, fluvoxamine, spironolactone, corticosteroids, curcumin (turmeric), *Nigella sativa* and anti-androgen therapy. A growing body of evidence suggests that many of these agents may act synergistically in various phases of the disease. [4-6] In the midst of a global pandemic, the use of cheap, effective, and safe repurposed drugs has and will continue to have a major role to play. We must focus on the totality of evidence, and not just on randomized controlled trials (RCTs) (see Figure 1).

Ivermectin has emerged as a highly effective drug for the prophylaxis and treatment of COVID-19. Ivermectin inhibits viral replication and has potent anti-inflammatory properties. Emerging data (including RCTs) suggest that ivermectin may have an important clinical benefit across the spectrum of phases of the disease, i.e., pre-exposure prophylaxis, post-exposure prophylaxis, during the symptomatic phase and during the pulmonary phase. [7-29] In the recommended dosages, ivermectin is remarkably safe and effective against SARS-CoV-2. However, as noted below, there is the potential for serious drug-drug interaction.

COVID-19 is essentially a clinical diagnosis supported by laboratory tests. At symptom onset, a PCR test will be positive in approximately 60% of patients; maximal positivity rate is on day 8 (post-infection) when 80% of patients will be positive (see Figure 4). [30] A PCR test remains positive for at least two weeks. Patients who progress to the pulmonary phase are usually PCR-positive, despite cessation of viral replication (and are therefore less likely to be infectious). However, due to the imperfect sensitivity of the PCR test, as many as 20% of patients who progress to the pulmonary phase will be PCR-negative (even on repeat testing).

Symptomatic patients are likely to be infectious during a narrow window starting 2–3 days before the onset of symptoms and to up to 6 days after the onset of symptoms (see Figure 4). [31]

COVID-19 patients present with a variety of phenotypes, likely dependent on inoculum size and viral load, virus variant, genetic heterogeneity mutations and polymorphisms, biotypes, blood type, sex and androgen status, age, race, BMI (obesity), immunological and nutritional status, and comorbidities. [32-43] The phenotype at presentation determines the prognosis and impacts the optimal approach to treatment. It is noteworthy that obesity and increasing BMI are critical prognostic factors. This may be related to the fact that there are more ACE-2 receptors in visceral fat than in the lung. [44]

The pulmonary phase is characterized by prolonged immune dysregulation, [35;45-59] a pulmonary microvascular injury (vasculopathy), [58-62] with activation of clotting and a procoagulant state together with the characteristics of an organizing pneumonia. [63;64] Immune dysregulation may last weeks or even months. The early and abrupt termination of anti-inflammatory agents will likely result in rebound inflammation. [65]

Endothelial damage and an imbalance of both innate and adaptive immune responses, with aberrant macrophage activation, plays a central role in the pathogenesis of the severe COVID-19 disease. [59]

The pulmonary phase of COVID-19 is a treatable disease; it is inappropriate to limit therapy to “supportive care” alone. As patients progress down the pulmonary cascade the disease becomes more difficult to reverse. The implications of this are two-fold:

MATH+: COVID Hospital Treatment Protocol (9/6/2022)

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- Early treatment of the pulmonary phase is ESSENTIAL to a good outcome.
- Treatment in the late pulmonary phase may require escalation of the dose of corticosteroids as well as the use of salvage methods (i.e., plasma exchange). However, patients who present in the late pulmonary phase may have progressed to the irreversible pulmonary fibroproliferative phase.

The radiographic and pathological findings of COVID-19 lung disease are characteristic of a Secondary Organizing Pneumonia (and not ARDS). [63;66;67] The initial pulmonary phase neither looks like, smells like nor is ARDS. [68-70] The ground glass infiltrates are peripheral and patchy, [66] and do not resemble the dependent air space consolidation (sponge/baby lung) seen with "typical ARDS". [71] Extravascular lung water index (EVLWI) is normal or only slightly increased; this, by definition, excludes non-cardiogenic pulmonary edema (ARDS). Lung compliance is normal (this excludes ARDS). Patients are PEEP unresponsive. Treating patients as if they ARDS is an extremely dangerous approach. The hypoxia is due to an organizing pneumonia with severe ventilation/perfusion mismatch likely due to the microvascular narrowing, thrombosis and vasoplegia.

SARS-CoV-2, as compared to all other respiratory viruses, upregulates cytokines and chemokines while at the same time down regulating the expression of Interferon alpha (the hosts primary antiviral defense mechanism). [131,155] Low innate antiviral defenses and high pro-inflammatory mediators contribute to ongoing and progressive lung injury.

An unknown percentage of patients with COVID-19 present with "silent hypoxia" with a blunted respiratory response. This phenomenon may be related to involvement of chemoreceptors of the carotid bodies and/or brain stem dysfunction, [72;73] and necessitates pulse oximetry in symptomatic patients managed at home.

It should be recognized that Low Molecular Weight Heparin (LWMH) has non-anticoagulant properties that are likely beneficial in patients with COVID-19; these include anti-inflammatory effects and inhibition of histones. [74] In addition, in vitro studies demonstrate that heparin inhibits SARS-CoV-2 interaction with the ACE-2 receptor and viral entry, [75;76] as well as viral replication [11;77]. Most importantly LWWH inhibits heparanase (HPSE). [78] HSE destroys the endothelial glycocalyx increasing endothelial leakiness, activating clotting and potentiating endothelialitis. [78] HPSE levels have been reported to be increased in patients with severe COVID-19 infection. [79] Due to the ease of administration, greater anti-Xa activity and better safety profile, we prefer low molecular weight heparin (LMWH) to unfractionated heparin (UFH).

The combination of steroids and ascorbic acid (Vitamin C) is essential. Both have powerful synergistic anti-inflammatory actions. [80;81] Vitamin C protects the endothelium from oxidative injury. [82-85] Furthermore, Vitamin C Increases the expression of interferon-alpha [86] while corticosteroids (alone) decrease expression of this important protein. [87-90] It should be noted that when corticosteroids are used in the pulmonary phase (and not in the viral replicative phase) they do not appear to increase viral shedding or decrease the production of type specific antibodies. [91;92] It is likely that LMWH acts synergistically with corticosteroids and Vitamin C to protect the endothelium and treat the endothelialitis of severe COVID-19 disease.

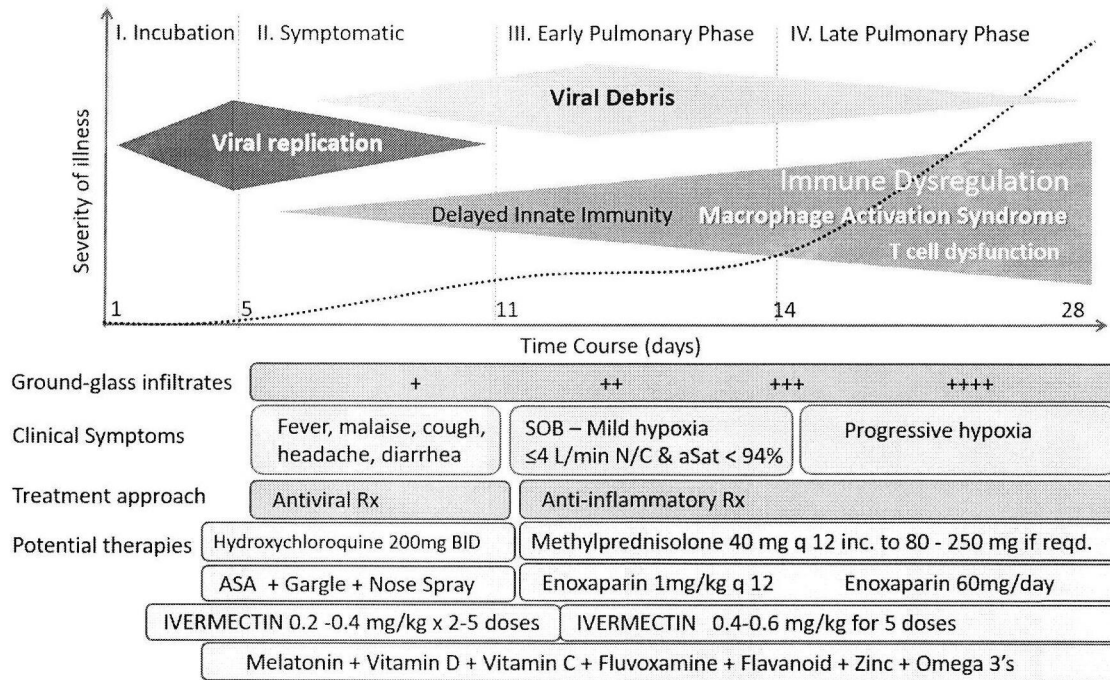
Notwithstanding the particularly important and impressive results of the RECOVERY-Dexamethasone study, methylprednisolone is the corticosteroid of choice for the pulmonary phase of COVID-19. This is based on pharmacokinetic data (better lung penetration), [93] genomic data specific for SARS-CoV-2, [94] and a long track record of successful use in inflammatory lung diseases (see Table 1).

Figure 1. Evaluating the Totality of Evidence



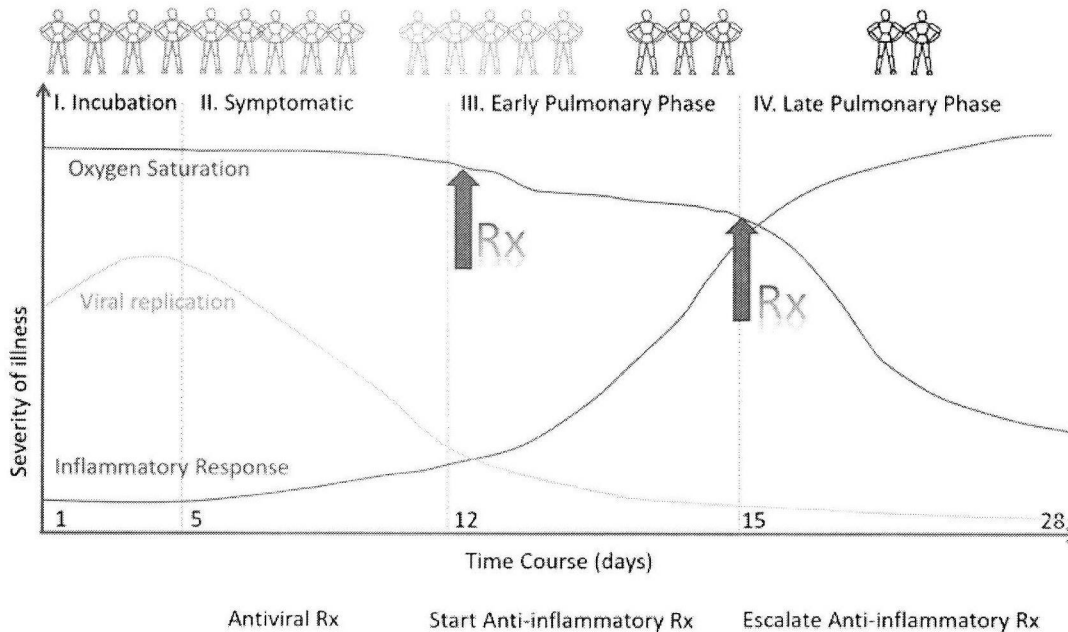
Source: FLCCC

Figure 2. The Course of COVID-19 and General Approach to Treatment



Source: FLCCC

Figure 3. Timing of the Initiation of Anti-Inflammatory Therapy



Source: FLCCC

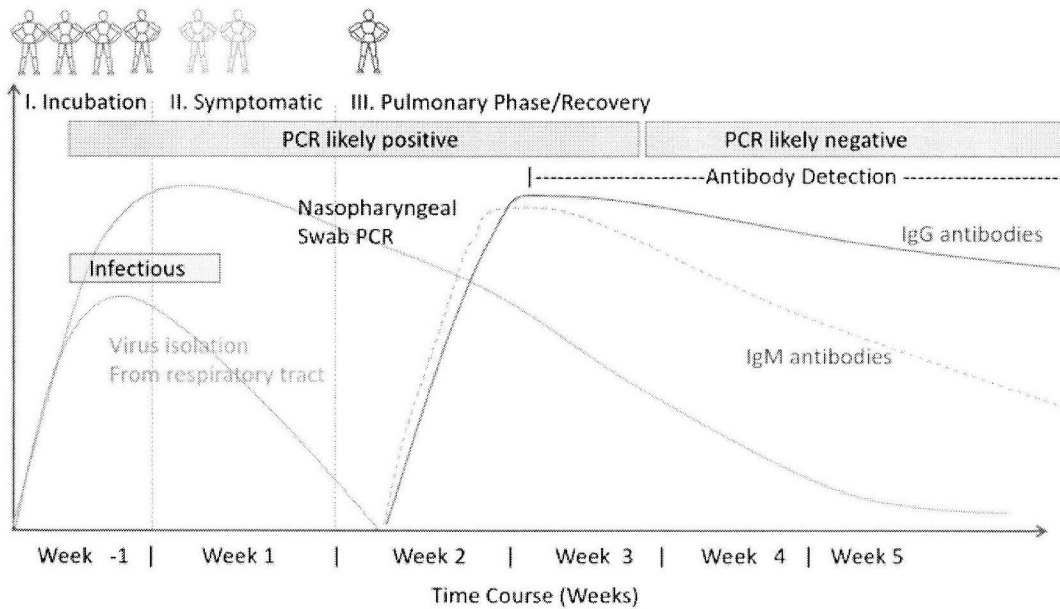
Note: Viral replication in Figures 2 and 3 are typical for the original Wuhan SARS-CoV-2 virus (Alpha strain). The time course of Omicron BA.4 and BA.5 appears to be contracted/shortened compared to the Wuhan (Alpha) strain.

THIS IS A STEROID-RESPONSIVE DISEASE:

HOWEVER, TIMING IS CRITICAL.

Not too early. Not too late.

Figure 4. Time Course of Laboratory Tests for COVID-19



Source: FLCCC

Table 1. Pharmacological Therapy for COVID-19 by Stage of Illness: What has worked and what has failed*

	Pre-exposure/ Post-Exposure/Incubation	Symptomatic Phase	Pulmonary/ inflammatory phase
Ivermectin	BENEFIT	BENEFIT	BENEFIT
Hydroxychloroquine	Benefit**	Benefit**	?Trend to harm
Corticosteroids	n/a	Trend to harm	BENEFIT
Anti-androgen Rx	? Benefit	Benefit	BENEFIT
LMWH	n/a	n/a	BENEFIT
Paxlovid/Molnupiravir	n/a	No Benefit	n/a
Monoclonal Abs	No Benefit	No benefit	HARM
Lopivinar-Ritonavir	n/a	No benefit	No benefit
Tocilizumab	n/a	n/a	Unclear Benefit
Convalescent Serum	n/a	No benefit	Trend to harm
Colchicine	n/a	Unclear benefit	No Benefit

Source: FLCCC

** Due to extensive fraudulent activity around the design and conduct of RCTs, the benefit of HCQ is supported largely by numerous consistently positive observational trials.

Table 2. Drug Interactions with Ivermectin

Patients taking any of these medications should discuss with their treating physicians.

SERIOUS (5) Use Alternative	MONITOR CLOSELY (50)	
erdafitinib	amiodarone	lonafarnib
lasmiditan	atorvastatin	loratadine
quinidine	berotralstat	lovastatin
sotorasib	bosutinib	nefazodone
tepotinib	clarithromycin	nicardipine
	clotrimazole	nifedipine
	dronedarone	nilotinib
	elagolix	phenobarbital
	eliglustat	phenytoin
	erythromycin base	ponatinib
	erythromycin ethylsuccinate	quercetin
	erythromycin lactobionate	ranolazine
	erythromycin stearate	rifampin
	felodipine	ritonavir
	fosphenytoin	sarecycline
	fostamatinib	simvastatin
	glecaprevir/pibrentasvir	sirolimus
	indinavir	St John's Wort
	istradefylline	stiripentol
	itraconazole	tacrolimus
	ivacaftor	tolvaptan
	ketoconazole	trazodone
	lapatinib	tucatinib
	levoketoconazole	verapamil
	lomitapide	warfarin

Source: Medscape

Mildly Symptomatic Patients (On hospital floor/ward)

First Line Therapies (in order of priority)

Ivermectin, low molecular weight heparin (LMWH) and corticosteroids form the foundation of care for the hospitalized patient. Multiple RCTs have demonstrated that these drugs reduce the mortality of patients hospitalized with COVID-19.

- **Ivermectin** 0.4–0.6 mg/kg daily for 5 days or until symptoms resolve (see Figure 4). A higher dose may be required when treatment is delayed and in patients with more severe disease. [7-12;15-18;20;29;95-102]. Ivermectin retains full efficacy against the Omicron variants (as best we know). Ivermectin is best taken with a meal or just following a meal for greater absorption. It should be noted that ivermectin has potent anti-inflammatory properties apart from its antiviral properties. [13;14;23;103] Ivermectin is a remarkably safe drug with minimal adverse reactions (almost all minor). [29] However, potential drug-drug interactions should be reviewed before prescribing ivermectin (see Table 2). Note that ivermectin should not be administered with quercetin.
- **Methylprednisolone** 80 mg bolus dose followed by 40 mg every 12 hours (alternative: 80 mg bolus followed by 80 mg/240 ml normal saline IV infusion at 10 ml/hr); increase to 80 mg and then 125 mg every 12 hours in patients with progressive symptoms and increasing c-reactive protein (CRP). There is now overwhelming and irrefutable evidence that corticosteroids reduce the risk of death in patients in the pulmonary phase of COVID-19, i.e., those requiring supplemental oxygen or higher levels of support. [37;91;104-114] **We believe that the use of low fixed dose dexamethasone is inappropriate for the treatment of the pulmonary phase of COVID-19.** The role of inhaled corticosteroids (budesonide) is unclear and appears to be rather limited. While methylprednisolone is the corticosteroid of choice, in regions/countries where it is not available the following (in order of preference) may be substituted for methylprednisolone (dose adjusted according to methylprednisolone dosages): prednisolone; prednisone; hydrocortisone; and, LASTLY, dexamethasone.
- **Enoxaparin** 1 mg/kg every 12 hours (see dosage adjustments and Xa monitoring below). The ATTACC, ACTIV-4a & REMAP-CAP trials demonstrated a significant reduction of the primary endpoint (composite of organ support days and hospital mortality) regardless of D-dimer levels. [115]
- **Vitamin C** 500–1000 mg every 6 hours.
- **Quercetin** 250–500 mg twice daily (if available). Note that ivermectin should not be administered with quercetin.
- **Zinc** 75–100 mg/day.
- **Melatonin** 6 mg at night. [116-122]
- **Fluvoxamine** 50 mg twice daily. Fluoxetine 20-40 mg daily is an alternative. [123-126]
NOTE: Some individuals who are prescribed fluvoxamine experience acute anxiety,

which needs to be carefully monitored for and treated by the prescribing clinician to prevent rare escalation to suicidal or violent behavior.

Second Line and Optional Treatments

- **Nitazoxanide (NTZ)** 600 mg twice daily for 7 days. [127] NTZ is considered an alternative to ivermectin, or part of a multi-drug combination that includes ivermectin. It should be noted that while NTZ is relatively cheap in most of the world, it is very expensive in the United States.
- **Vitamin D3/Calcifediol.** For patients hospitalized with COVID-19, the dosing scheme listed in Table 3 is suggested. Vitamin D3 requires hydroxylation in the liver to become 25(OH)D, causing a lag of about 3 to 4 days. [128] This may explain the lack of benefit of Vitamin D3 in patients hospitalized with severe COVID-19. [129] Calcifediol is already 25-hydroxylated, and thus, it bypasses the liver and become available in the circulation within four hours of administration. Among other benefits, it permits boosting the immune system and improving the functions of other systems within a day. Orally administered, a single dose of calcifediol raises serum 25(OH)D concentration within four hours. Therefore, calcifediol is particularly useful in acute infections like COVID-19, and in sepsis. [130-134] The single oral calcifediol dose is calculated as 0.014 mg/kg body weight. To be most effective, a loading dose of Vitamin D3 should be administered with or within the first week of administration of calcifediol. We recommend against the use of **calcitriol** [1,25(OH)2D], which has minimal effect on immune cells. Moreover, the effective dose (ED50) and toxic level overlap at the dose currently suggested for COVID-19. [135]
- **Aspirin/Acetylsalicylic acid (ASA)** 325 mg daily — if not contraindicated. Moderate to severe COVID infection results in profound platelet activation, contributing to the pro-thrombotic state and increasing the inflammatory response. [136-139]
- **B complex** vitamins.
- **N-acetyl cysteine (NAC)** 600-1200 mg by mouth twice daily. [140-144]
- **Anti-androgen therapy** (both men and women). Spironolactone 100 mg twice daily for 10 days. Second line anti-androgen: Dutasteride 2 mg day 1, followed by 1 mg for 10 days. AVOID IN PREGNANCY. [145-147]
- *Optional:* **Famotidine** 40 mg twice daily (20–40 mg/day in renal impairment). [148-154] Famotidine may be useful for its protective effect on gastric mucosa, as well as its antiviral and histamine-blocking properties.
- *Optional:* The anti-serotonin agent, **cypheptadine** 4–8 mg by mouth every 6 hours should be considered in patients with more severe disease. [155;156] Patients with COVID-19 have increased circulating levels of serotonin, which is likely the result of increased platelet activation and decreased removal by the pulmonary circulation due to an extensive microcirculatory vasculopathy. [155;157-159] Increased circulating serotonin is associated with pulmonary, renal, and cerebral vasoconstriction and may partly explain the V/Q mismatch and reduced renal blood flow noted in patients with severe COVID-19 infection. [160-163] Furthermore, serotonin itself enhances platelet

aggregation, creating a propagating immuno-thrombotic cycle. [164] In addition, serotonin receptor blockade may reduce progression to pulmonary fibrosis. [165]

- *Optional: Vascepa* (Ethyl eicosapentaenoic acid) 4 g daily or Lovaza (EPA/DHA) 4 g daily; alternative DHA/EPA 4 g daily. [166] Vascepa and Lovaza tablets **must be swallowed** and cannot be crushed, dissolved, or chewed.
- *Optional: JAK inhibitors* ruxolitinib or baricitinib. JAK inhibitors target JAK1, JAK2, JAK3, and whose inhibition downregulates the JAK/STAT signaling pathway decreasing cytokine concentrations. [167] These drugs have been shown to decrease the use of mechanical ventilation and the risk of death. [168;169] In these studies, low doses of corticosteroids were used. The role of JAK inhibitors with appropriate corticosteroid dosing is unclear. JAK inhibitors should be used with caution in patients with severe renal impairment as well as those with lymphopenia (< 500) and neutropenia (< 1000). The safety of these drugs is uncertain, as they are nephrotoxic and myelosuppressive.
- *Not recommended: Remdesivir*. The SOLIDARITY trial demonstrated no mortality benefit of this agent in the entire treatment cohort or any subgroup. [170] The VA study showed no mortality benefit with remdesivir and a longer length of hospital stay. [171] Most recently, the DisCoVeRy trial reported no outcome benefit from remdesivir. [172] A meta-analysis of the six published RCTS demonstrate no mortality reduction with remdesivir; interestingly enough, the independent studies demonstrate a trend to harm while the two studies conducted by Gilead demonstrate a mortality benefit. (See Figure 6).
- *Not recommended: Colchicine*. Recruitment to the colchicine arm of the RECOVERY trial has been closed as no mortality benefit was noted (Mortality 20% colchicine, 19% standard of care). In addition, potentially serious drug-drug interactions exist with the use of colchicine and CYP 3A4 and p-glycoprotein inhibitors (ivermectin, macrolide antibiotics, cyclosporin, etc.) as well as with the use of statins. [173]

NOTE: Transfer patients to ICU as early as possible if respiratory symptoms worsen, oxygen requirements increase, or arterial desaturation emerges.

Table 3. A Single-Dose Regimen of Calcifediol to Rapidly Raise Serum 25(OH)D above 50 ng/mL

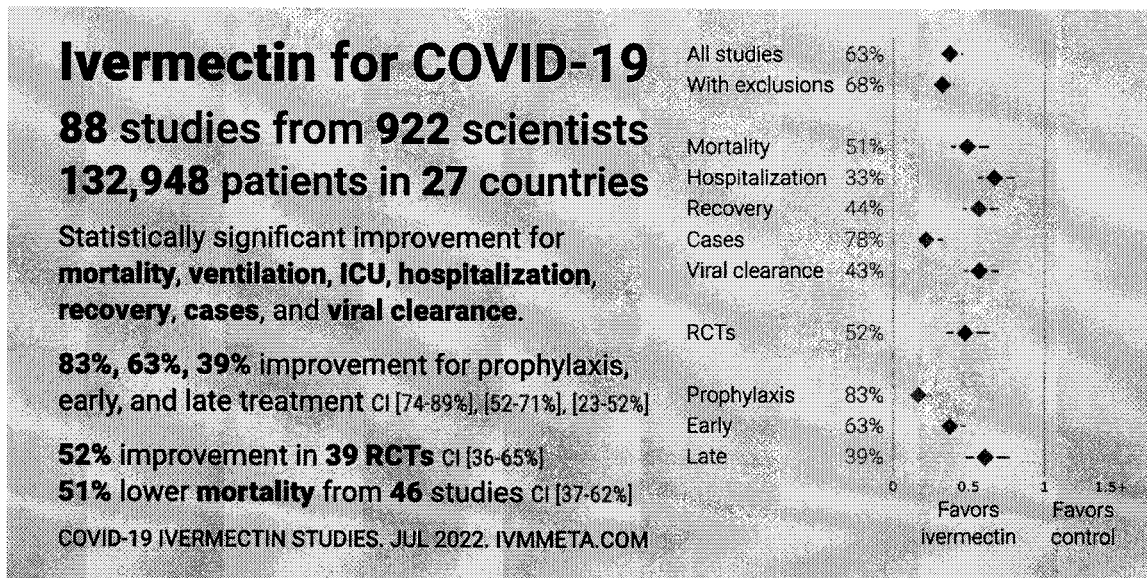
Using a regimen of calcifediol * to rapidly raise serum 25(OH)D concentration above 50 ng/mL (125 nmol/L) in medical emergencies (i.e., to raise serum levels within four hours). ** A single body weight based, oral dose is calculated: 0.014 mg/kg body weight.

Weight (lbs)	Weight (kg)	Calcifediol ~ (mg) #	If Calcifediol Is Not Available: Bolus/Loading Dose of Vitamin D ₃ ##
8–14	4–6	0.05	20,000
15–21	7–10	0.1	40,000
22–30	10–14	0.15	60,000
31–40	15–18	0.2	80,000
41–50	19–23	0.3	100,000
51–60	24–27	0.4	150,000
61–70	28–32	0.5	200,000
71–85	33–39	0.6	240,000
86–100	40–45	0.7	280,000
101–150	46–68	0.8	320,000
151–200	69–90	1.0	400,000
201–300	91–136	1.5	600,000
>300	>137	2.0	800,000

Source: Nutrients'—Special Issue: "Vitamin D—Calcifediol and COVID" [174]

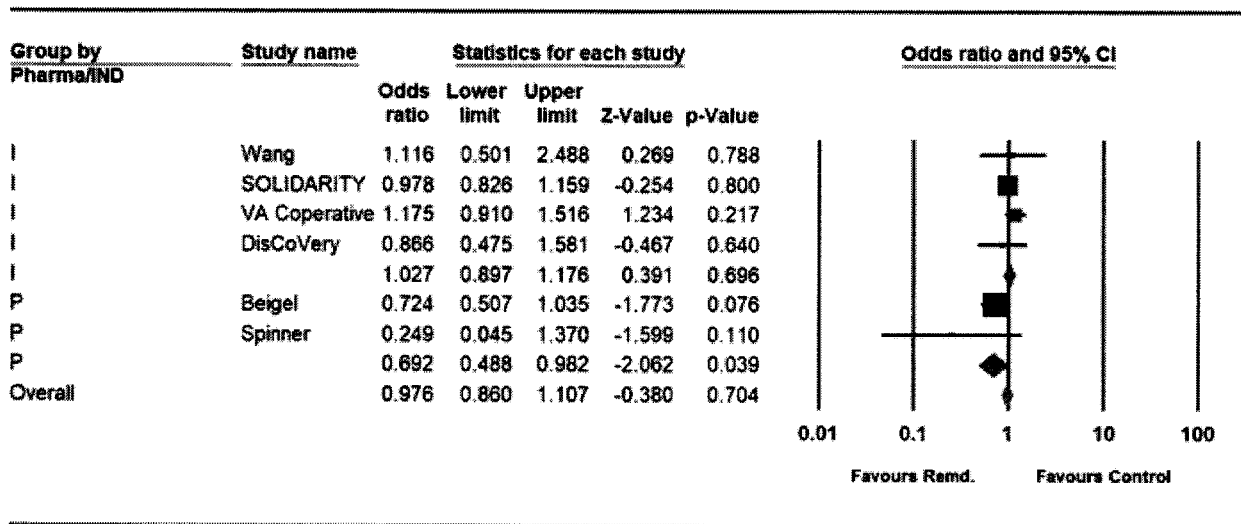
* Calcifediol [partially activated vitamin D₃, 25(OH)D]. ** Use the earliest possible in person with COVID-19, sepsis, Kawasaki disease, multisystem inflammatory syndrome, acute respiratory distress syndrome, burns, and vitamin D deficiency in early pregnancy and other clinical emergencies. # Measurement (or the concentration) of serum 25(OH)D is unnecessary. ## If calcifediol is unavailable, the equivalent dose of vitamin D is administered, as illustrated in Table 2, preferably in divided doses over three to five days. Irrespective of the regimen used, daily or weekly follow-up maintenance vitamin D dose is necessary as described in the text.

Figure 5. Ivermectin for COVID-19: Real-time meta-analysis of 88 studies



Source: c19ivermectin.com

Figure 6. Meta-Analysis of the Remdesivir RCTs Grouped by Independent Studies (I) and Those Done by Gilead™ (P)



Meta Analysis

Treatment for Patients Admitted to ICU

First line treatments

- **Methylprednisolone** 80 mg loading dose followed by 40 mg every 12 hours for at least 7 days and until transferred out of ICU. In patients with an increasing C-reactive protein (CRP) or worsening clinical status increase the dose to 80 mg every 6 hours, then titrate down as appropriate. [37;91;104-114] Pulse methylprednisolone 500-1000 mg/day for 3 days (followed by taper) may be required. [112] We suggest that all patients admitted to the ICU have a chest CT scan on admission to allow risk stratification based on the extent of the disease; those with extensive disease should be initiated on high dose corticosteroids (see section below on severe COVID). As depicted in Table 4, methylprednisolone is the corticosteroid of choice. Observational and randomized studies have clearly demonstrated the superiority of methylprednisolone over low dose dexamethasone. [175;176] These clinical findings are supported by a genomic study. [94] Methylprednisolone should be weaned slowly over two weeks once oxygen is discontinued to prevent relapse/recurrence (20 mg twice daily of oxygen, then 20 mg/day for 5 days, then 10 mg/day for 5 days). While 1) methylprednisolone is the corticosteroid of choice (see below) in those regions/countries where it is not available the following (in order of preference) may be substituted for methylprednisolone (dose adjusted according to methylprednisolone dosages), 2) prednisolone, 3) prednisone, 4) hydrocortisone, and 5) LASTLY dexamethasone.
- **Ascorbic acid (Vitamin C)** 50 mg/kg (or 3000 mg) IV every 6 hours for at least 7 days and/or until transferred out of ICU. [80;81;85;177-187]. *High-dose Vitamin C* should be considered in severely ill patients, those with progressive respiratory failure and as salvage therapy: 25 g Vitamin C in 200-500 cc saline over 4-6 hours every 12 hours for 3-5 days, then 3 g IV every 6 hours for total of 7-10 days of treatment. [188] High-dose Vitamin C appears safe in patients with acute renal failure and end-stage renal disease. In patients with chronic renal failure, a dose of 12.5 g every 12 hours may be suitable. [189] In the study by Lankadeva et al, high-dose Vitamin C increased renal cortical blood flow and renal cortical pO₂; oxalate crystals were not detected. [188] Note caution with POC glucose testing. Oral absorption is limited by saturable transport proteins, and it is difficult to achieve adequate levels with PO administration. However, should IV Vitamin C not be available, it would be acceptable to administer PO Vitamin C at a dose of 1 g every 4–6 hours.
- **Anticoagulation:** The ATTACC, ACTIV-4a & REMAP-CAP trials demonstrated a marginally increased mortality in ICU patients treated with full anti-coagulation (35.3% vs. 32.6%). [115] Critically ill COVID-19 patients frequently have impaired renal function and it is likely that in the absence of Xa monitoring patients were over-anticoagulated. However, full anti-coagulation should be continued on floor patients transitioned to the ICU who have normal renal function. In all other patients, we would suggest intermediate dose enoxaparin i.e 60 mg/day (enhanced thromboprophylaxis) or 0.5 mg/kg every 12 hours. [190] Full anticoagulation (enoxaparin or heparin) may be required in patients with increasing D-dimer or with thrombotic complications. Due to augmented renal clearance

some patients may have reduced anti-Xa activity despite standard dosages of LMWH. [236] We therefore recommend monitoring anti-Xa activity aiming for an anti-Xa activity of 0.5 – 0.9 IU/ml. Heparin is suggested with CrCl < 15 ml/min. It should also be appreciated that Vitamin C is a prerequisite for the synthesis of collagen and Vitamin C deficiency is classically associated with vascular bleeding. [85;179] This is relevant to COVID-19, as Vitamin C levels are undetectable in severely ill COVID-19 patients and this may partly explain the increased risks of anticoagulation in ICU patients (not treated with Vitamin C). [191-193] The use of the novel oral anticoagulants (NOAC/DOAC) is not recommended. [194]

Note: A falling SaO₂ and the requirement for supplemental oxygen should be a trigger to start anti-inflammatory treatment.

Note: Early termination of ascorbic acid and corticosteroids will likely result in a rebound effect with clinical deterioration.

Additional Treatment Components

- **Highly recommended: Ivermectin** 0.6 mg/kg day orally for 5 days or until recovered [7-20;22-29;195]. Note that ivermectin has potent antiviral and anti-inflammatory effects. As noted above, clinical outcomes are superior with multiday as opposed to single day dosing.
- **Nitazoxanide (NTZ)** 600 mg twice daily for 7 days. [127] NTZ should be considered as an alternative to ivermectin, or as part of a multi-drug combination that includes ivermectin. It should be noted that while NTZ is relatively cheap in most of the world, it is very expensive in the USA.
- **Melatonin** 10 mg at night. [117-119]
- **Thiamine** 200 mg IV every 12 hours for 3-5 days, then 200 mg daily [196-201] Thiamine may play a role in dampening the cytokine storm. [197;202]
- **Aspirin/Acetylsalicylic acid (ASA)** 325 mg daily. COVID infection results in profound platelet activation contributing to the severe pro-thrombotic state and increasing the inflammatory response. [136-139] As the risk of significant bleeding is increased in patients receiving both ASA and heparin, ASA should not be used in patients at high risk of bleeding. In addition (as noted below) patients should receive famotidine concurrently.
- The anti-serotonin agent, **cyproheptadine**. Platelet activation results in the release of serotonin, which may contribute to the immune and vascular dysfunction associated with COVID-19. [215-219] Therefore, the serotonin receptor blocker cyproheptadine 4–8 mg by mouth every 6 hours should be considered.
- **Anti-androgen therapy** (both men and women). Spironolactone 100 mg twice daily for 10 days. Second line: Dutasteride 2 mg day 1, followed by 1 mg for 10 days. Finasteride 10 mg is an alternative (dutasteride cannot be crushed). [203;204] **AVOID IN PREGNANCY.** [145;146] Bicalutamide 150 mg daily is also an option.

- **Fluvoxamine** 50 mg twice daily. Fluoxetine 20-40 mg daily is an alternative. NOTE: Some individuals who are prescribed fluvoxamine experience acute anxiety, which needs to be carefully monitored for and treated by the prescribing clinician to prevent rare escalation to suicidal or violent behavior.

Second Line Treatments

- **B complex vitamins.**
- **Calcifediol** [25-hydroxylated vitamin D; 25(OH)D]. Dosing as suggested in Table 3.
- **Vascepa** (Ethyl eicosapentaenoic acid) 4 g daily or Lovaza (EPA/DHA) 4 g daily; alternative DHA/EPA 4 g daily. Vascepa and Lovaza tablets must be swallowed and cannot be crushed, dissolved, or chewed.
- **Magnesium** 2 g stat IV. Keep Mg between 2.0 and 2.2 mmol/l. [205] Prevent hypomagnesemia (which increases the cytokine storm and prolongs Qtc). [206-208]

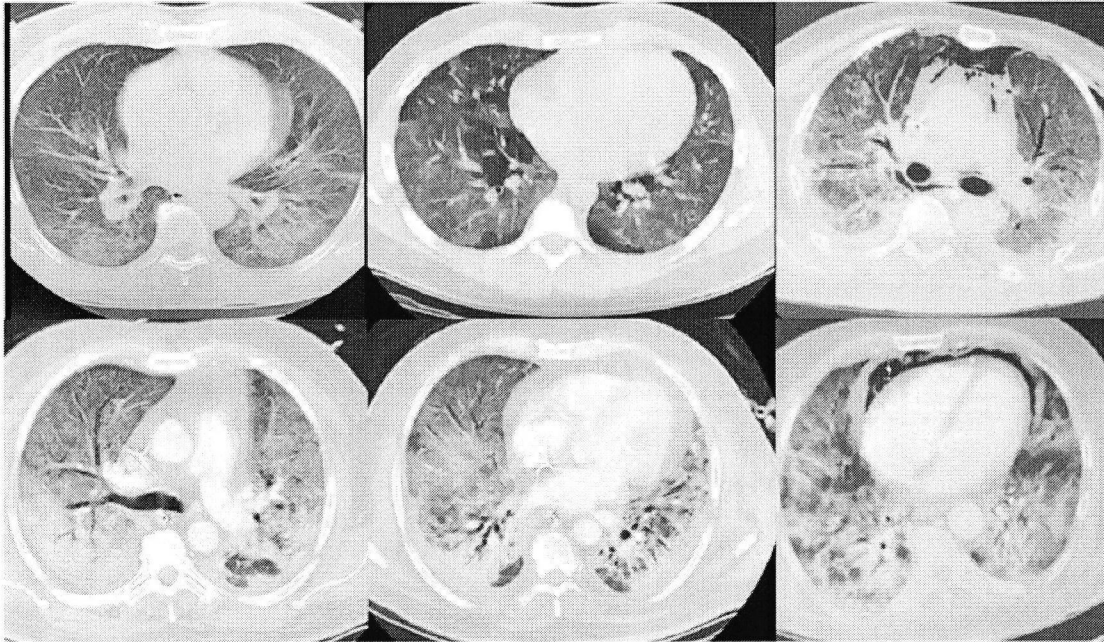
Optional Treatments (and those of uncertain benefit)

- *Optional:* **Famotidine** 40 mg twice daily (20–40 mg/day in renal impairment). [148-154]
- *Optional:* **JAK inhibitors** ruxolitinib or baricitinib.
- *Optional:* **Atorvastatin** 40-80 mg/day (reduce dose to 40 mg if taken with ivermectin due to possible drug-drug interaction. Preliminary data suggests atorvastatin may improve outcome in patients with COVID-19. [238-242] Due to numerous drug-drug interactions, simvastatin should be avoided
- *Unclear benefit.* **Losartan** 50-100 mg/day (reduce to 25-50 mg with impaired renal function) or telmisartan 40-80 mg twice daily (reduce to 40 mg/day or twice daily with impaired renal function). [209-211]
- *Unclear benefit.* **Maraviroc** 300 mg twice daily for 10 days. Maraviroc is a CCR5 antagonist. [212] CCR5 is a chemokine that activates macrophages/monocytes and whose circulating levels are significantly increased in COVID-19. [213;214] Blocking the CCR5 receptor (CCR5R) repolarizes macrophages/monocytes and decreases the production of proinflammatory cytokines.
- *Not recommended:* **Remdesivir.** This drug has no benefit at this stage of the disease.
- *Not recommended.* **Convalescent serum** [215-220] nor **monoclonal antibodies.** [221] However, convalescent serum/monoclonal antibodies may have a role in patients with hematologic malignancies. [222] The role of bebtetovimab requires further evaluation. [223]
- *Not recommended.* **Colchicine** (see above).
- *Not recommended.* **Tocilizumab.** Five RCTs have now failed to demonstrate a clinical benefit from tocilizumab. [224-228] Considering the effect of IL-6 inhibitors on the profile of dysregulated inflammatory mediators this finding is not surprising. [229] Tocilizumab may have benefit in patients receiving an inadequate dose of corticosteroids. [230] In patients who receive an adequate therapeutic dose of corticosteroid the role of this drug appears limited.

- **Broad-spectrum antibiotics** added if complicating bacterial pneumonia is suspected based on procalcitonin levels and respiratory culture (no bronchoscopy). Due to the paradox of hyper-inflammation and immune suppression (a major decrease of HLA-DR on CD14 monocytes, T cell dysfunction and decreased CD4 and CD8 counts) secondary bacterial and fungal infections (*Candida* and *Aspergillus* species) and viral reactivation is not uncommon. [231-233] Patients with non-resolving fever, increasing WBC count and progressive pulmonary infiltrates should be screened for COVID-19-associated pulmonary aspergillosis (CAPA). [234] Recommended first-line therapy for CAPA is either voriconazole or isavuconazole (beware drug-drug interactions). While low CD4 counts are typical of severe COVID-19 infection, PJP infections have not been reported; therefore, PJP prophylaxis is not required.
- Maintain **EUVOLEMIA** (this is not non-cardiogenic pulmonary edema). Due to the prolonged “symptomatic phase” with flu-like symptoms (6–8 days) patients may be volume depleted. Cautious rehydration with 500 ml boluses of Lactate Ringers may be warranted, ideally guided by non-invasive hemodynamic monitoring. Diuretics should be avoided unless the patient has obvious intravascular volume overload. Avoid hypovolemia.
- Early **norepinephrine** for hypotension. It should however be appreciated that despite the cytokine storm, vasodilatory shock is distinctly uncommon in uncomplicated COVID-19 (when not complicated by bacterial sepsis). This appears to be due to the fact that TNF- α which is “necessary” for vasodilatory shock is only minimally elevated.
- Escalation of **respiratory support** (steps); **Try to avoid intubation if at all possible.** Intubation is indicated in patients who have failed non-invasive ventilation and in those patients with excessive work of breathing. A subgroup of patients with COVID-19 deteriorates very rapidly. Intubation and mechanical ventilation may be required in these patients.
 - a. Accept “permissive hypoxemia” (keep O₂ Saturation > 84%); follow venous lactate and Central Venous O₂ saturations (ScvO₂) in patents with low arterial O₂ saturations
 - b. N/C 1–6 L/min
 - c. High Flow Nasal canula (HFNC) up to 60–80 L/min [235]
 - d. Trial of inhaled Flolan (epoprostenol)
 - e. Attempt proning (cooperative repositioning-proning) [236-239]
 - f. Intubation ... by Expert intubator; Rapid sequence. No Bagging; Full PPE. Crash/emergency intubations should be avoided.
 - g. Volume protective ventilation; Lowest driving pressure and lowest PEEP as possible. Keep driving pressures < 15 cm H₂O.
 - h. Moderate sedation to prevent self-extubation
 - i. Trial of inhaled Flolan (epoprostenol)
 - j. Prone positioning

There is widespread concern that using HFNC could increase the risk of viral transmission. There is, however, no evidence to support this fear. [240;241] HFNC is a better option for the patient and the healthcare system than intubation and mechanical ventilation. HFNC is preferred over conventional oxygen therapy. [235] Intermittent CPAP/BiPAP may be used in select patients, notably those with COPD exacerbation or heart failure.

Figure 7. "Typical" Progression of Chest CT Findings



Source: FLCCC

Table 4: Comparison of Methylprednisolone, Dexamethasone and Hydrocortisone - Number Needed to Treat

PUBLISHED RCT's/OCT's OF CORTICOSTEROID THERAPY IN COVID-19		ABSOLUTE DIFFERENCE IN MORTALITY	NUMBER NEEDED TO TREAT TO SAVE ONE LIFE
METHYLPREDNISONE – HOSPITAL PATIENTS (Edalatifard et al, Italy) 250mg methylprednisone daily x 3 days		5.9% vs. 42.9%	2.7
METHYLPREDNISONE – ICU PATIENTS (Confalonieri et al, Italy) 80mg methylprednisone daily x 8 days		7.2% vs. 23.3%	6.2
METHYLPREDNISONE- ARDS PATIENTS (OCT - Wu C et al- China) 1-2 mg/kg/day for 3-5 days		46.0% vs. 61.8%	6.3
METHYLPREDNISONE – HOSPITAL PATIENTS, (OCT - Fadel et al, USA) 0.5-1.0mg/kg/day x 3 days		13.6% vs. 26.3%	7.8
METHYLPREDNISONE - Pts on oxygen – (Fernandez-Cruz et al, Spain) 1mg/kg/day		13.9% vs. 23.9%	10.0
METHYLPREDNISONE VS. DEXAMETHASONE (Ranjbar et al, Iran) 2mg/kg/day MP vs. 6mg/day Dexamethasone		18.6% vs 37.5%	5.3
METHYLPREDNISONE VS. DEXAMETHASONE (OCT - Ko et al, UISC) >= 1mg/kg/day MP for min. 3 days vs. 6mg/day Dex for min. 7 days	OVERALL	16.4% vs. 26.5%	10
	PTS ON MV	31% vs. 54%	4.3
HYDROCORTISONE -CAPE-COVID – ICU Patients (Dequin et al France) 200mg/day with taper over 14 days – stopped early		14.7% vs 27.4%	7.9
HYDROCORTISONE –REMAP-CAP – ICU Patients (Angus et al) 200 - 400 mg/day x 7 days – stopped early		28% vs 33% (NS)	20.0
DEXAMETHASONE – CODEX – ICU Patients (Tomazini et al) 20 mg x 5 days, 10 mg x 5 days		56.3% vs 61.5%	19.2
DEXAMETHASONE – RECOVERY (Hornsby et al) 6mg/day x 10 days	PTS ON OXYGEN	23.3% vs. 26.2%	28.6
	PTS ON MV	29.3% vs. 41.4%	8.4

Source: FLCCC

Patients with Severe, Life Threatening COVID-19 Organizing Pneumonia

The first task of the clinician is to determine the reversibility of the pulmonary disease. This is a critical assessment. Aggressive anti-inflammatory treatment is futile in patients with advanced fibrotic lung disease. The horse has already bolted and allowing the patient a “peaceful death” is the most compassionate and humane approach.

The reversibility of the pulmonary disease is dependent on a number of factors superseded by a good deal of clinical judgement; these include:

- a) The length of time that has elapsed since the onset of symptoms. Early aggressive treatment is critical to prevent disease progression. With each day the disease becomes more difficult to reverse. The ‘traditional’ approach of supportive care alone is simply unacceptable.
- b) The level of inflammatory biomarkers, particularly the CRP. In general the CRP tracks the level of pulmonary inflammation. [242] A high CRP is indicative of a hyper-inflammatory state and potentially reversible pulmonary inflammation.
- c) It is likely that advanced age is a moderating factor making the pulmonary disease less reversible.
- d) A chest CT is extremely helpful in determining the reversibility of disease. BEWARE: this is not ARDS but organizing pneumonia. [63] The extent of the pulmonary involvement may be determined qualitatively or preferably quantitatively (see Figure 7). [242-249] The Ichikado CT Score is a useful quantitative score to evaluate the extent of lung involvement with COVID-19. [250;251] The changes in the CT follow a stereotypic progressive pattern:
 - I. Peripheral, patchy, predominantly basal ground glass opacification (GGO). GGO is defined an increase in density of lung with visualization of bronchial and vascular structures through it
 - II. Progressive widespread bilateral GGO
 - I. Crazy-paving (CGO with interlobular and intralobular septal thickening)
 - II. Air space consolidation (air bronchograms)
 - III. Dense airspace consolidation
 - IV. Coalescent consolidation
 - V. Segmental/subsegmental pulmonary vessel dilatation
 - VI. Bronchial wall thickening
 - VII. Linear opacities
 - VIII. Traction bronchiectasis
 - IX. Cavitation
 - X. Fibrotic changes with bullae and reticulation

GGO pattern is significantly more prevalent in early-phase disease compared with late-phase disease while crazy-paving and consolidation patterns are significantly more common in late-phase. [242] Therefore widespread GGO suggests reversibility while widespread consolidation with other features of more advanced disease suggest irreversible lung disease. However, when in doubt (borderline cases) a time-limited therapeutic trial of the aggressive “Full Monty” approach may be warranted.

The “FULL MONTY” for Severe COVID Pulmonary Disease

- I. Methylprednisolone 250-500 mg every 12 hours for at least 3 days, then titrate guided by clinical status and CRP
- II. Ivermectin 1 mg/kg for 5 days
- III. Melatonin 10 mg by mouth at night
- IV. Enoxaparin 60 mg daily; critically ill patients usually have some degree of renal impairment and will require a renally adjusted lower dose. Patients with very high D-dimer and or thrombotic complications may require full anticoagulant doses of Lovenox. It may be prudent to monitor Xa levels aiming for 0.4-0.8 IU/ml (a somewhat lower anti-Xa).
- V. Vitamin C 3 g every 6 hours to 25 g every 12 hours
- VI. Cyproheptadine 4–8 mg by mouth every 6 hours
- VII. Fluvoxamine 50-100 mg twice daily or fluoxetine 20-40 mg daily
- VIII. Spironolactone 100 mg twice daily
- IX. Thiamine 200 mg every 12 hours
- X. NAC 1200 mg by mouth twice daily [142]
- XI. Finasteride 10 mg daily or dutasteride 2 mg day 1 then 1 mg daily or bicalutamide 150 mg daily
- XII. Omega-3 fatty acids 4 g/day
- XIII. Famotidine 40 mg twice daily
- XIV. Calcifediol (0.014 mg/kg) use as a single dose (see Table 3)
- XV. Consider plasma exchange on admission to the ICU

All these drugs have been shown to be safe and independently to improve the outcome of patients with COVID-19. Ultimately it is irrelevant as to the contribution of each element as long as the patient improves and survives his/her ICU stay. In the midst of a pandemic caused by a virus resulting in devastating lung disease, there is no place for “ivory tower medicine.”

Salvage Treatments

- High dose bolus corticosteroids: 500–1000 mg/day methylprednisolone for 3 days then taper. [110;112]
- Plasma exchange [252-258]. Should be considered in patients with progressive oxygenation failure despite corticosteroid therapy as well as in patients with severe MAS. Patients may require up to 5 exchanges. FFP is required for the exchange; giving back “good humors” appears to be more important than taking out “bad humors”.
- Calcifediol (0.014 mg/kg) use as a single dose (see Table 3).
- Mega-dose Vitamin C should be considered in severely ill patients and as salvage therapy: 25 g Vitamin C in 200-500 cc saline over 4-6 hours, 12 hourly for 3-5 days, then 3g IV 6 hourly for total of 7-10 days of treatment. [188;189]
- In patients with a large dead-space ventilation (i.e., high PaCO₂ despite adequate minute ventilation) consider “Half-dose rTPA” to improve pulmonary microvascular blood flow; 25 mg of tPA over 2 hours followed by a 25 mg tPA infusion administered over the subsequent 22 hours, with a dose not to exceed 0.9 mg/kg followed by full anticoagulation. [259;260]
- Combination inhaled nitric oxide (or epoprostenol) and intravenous almitrine (10–16 ug/kg/min). The combination of inhaled nitric oxide, a selective pulmonary vasodilator, and almitrine, a specific pulmonary vasoconstrictor, may improve the severe V/Q mismatch in patients with severe COVID-19 “pneumonia”. [261-264]
- ECMO [265-267]. Unlike “typical ARDS”, COVID-19 patients may not progress into a resolution phase. Rather, patients with COVID-19 with unresolved inflammation may progress to a severe fibro-proliferative phase and ventilator dependency. ECMO in these patients would likely serve little purpose. ECMO however may improve survival in patients with severe single organ failure (lung) if initiated within 7 days of intubation. [268]
- Lung transplantation. [269]

Salvage Treatments of Unproven/No Benefit

- Convalescent serum/monoclonal antibodies: Four RCTs failed to demonstrate a clinical benefit with the use of convalescent serum. [215-217;219;220] Eli Lilly suspended the ACTIV-33 clinical trial as their monoclonal antibody failed to demonstrate a clinical benefit in hospitalized patients.[270] It is noteworthy that the only RCT demonstrating efficacy of convalescent plasma for an infectious disease was conducted more than 40 years ago, for treating Argentine hemorrhagic fever. [211] Furthermore, giving antibodies directed against SARS-CoV-2 appears pointless when the virus is already dead (i.e., pulmonary phase). In addition, IgG is a large protein that penetrates tissues poorly, and is unlikely to achieve submucosal concentrations required for mucosal immunity. [271] Lastly, COVID-19 pulmonary disease is immune mediated, and it would therefore appear paradoxical to enhance the antibody response with convalescent serum. [272]

- In patients with progressive fibrosis, the combination of anti-fibrotic therapy with corticosteroids should be considered. [273-276] It should however be recognized that unlike all the medications in the MATH+ protocol, pirfenidone and nintedanib have complex side-effects and drug interactions and should be prescribed by pulmonary physicians who have experience with these drugs.
- CVVH/D with cytokine absorbing/filtering filters [277;278] This treatment strategy appears to have an extremely limited role.

Monitoring

- On admission: Procalcitonin (PCT), CRP, BNP, Troponins, Ferritin, Neutrophil-Lymphocyte ratio, D-dimer and Mg. CRP and D-dimer are important prognostic markers. [279] A PCT is essential to rule out coexisting bacterial pneumonia. [280]
- As indicated above (corticosteroid section), a chest CT scan on admission to the ICU is very useful for risk stratification and for the initial corticosteroid dosing strategy. The Ichikado Score is a quantitative method to assess the extent of lung involvement on the CT scan. [250;281] Follow-up CXR, CT scan (if indicated) and chest ultrasound as clinically indicated.
- Daily: *CRP, Ferritin, D-Dimer and PCT*. CRP and Ferritin track disease severity closely (although ferritin tends to lag behind CRP). Early high CRP levels are closely associated with the degree of pulmonary involvement and the CT score. [282]
- In patients receiving IV vitamin C, the Accu-Chek™ POC glucose monitor will result in spuriously high blood glucose values. Therefore, a laboratory glucose is recommended to confirm the blood glucose levels. [283;284]
- ECHO as clinically indicated; Patients may develop a severe “septic” cardiomyopathy and/or COVID-19 myocarditis. [285;286]

Post ICU Management

- Enoxaparin 40–60 mg s/c daily
- Methylprednisolone 40 mg day, then wean slowly, follow CRP and oxygen requirements – wean off over two weeks once oxygen is discontinued to prevent relapse/recurrence
- Vitamin C 500 mg PO BID
- Melatonin 3–6 mg at night
- Vascepa, Lovaza or DHA/EPA 4g day
- Atorvastatin 40mg daily

Post Hospital Discharge Management

Patients have an increased risk of thromboembolic events post-discharge. [287;288] Extended thromboprophylaxis (with a DOAC) should be considered in high-risk patients. Risk factors include: [289]

- i. Increased D dimer (> 3 times ULN)
- ii. Increased CRP (> 2 times ULN) [290]
- iii. Age > 60
- iv. Prolonged immobilization
 - a. Patients with unresolved pulmonary infiltrates and/or those who remain dyspneic and/or oxygen dependent should be discharged on a tapering course of corticosteroids (prednisone).
 - b. Patients should continue to receive Vitamin C, melatonin, Omega-3 fatty acids and a statin. These agents may reduce this risk of developing long COVID.
 - c. *Nigella sativa* and Kefir.
 - d. Patients should be followed/monitored for developing long COVID.

References

1. Wittich CM, Burkle CM, Lanier WL. Ten common questions (and their answers) about off-label drug use. *Mayo Clin Proc* 2012; 87:982-990.
2. Peterson DJ. Prescription of ivermectin or hydroxychloroquine as off-label medicines for the prevention and treatment of Covid-19. https://ago.nebraska.gov/sites/ago.nebraska.gov/files/docs/opinions/21-017_0.pdf [2021 [cited 2022 Jan. 14];
3. Kennedy RF. *The Real Anthony Fauci. Bill Gates, Big Pharma, and the Global War on Democracy and Public Health.* New York, NY: Skyhorse Publishing; 2021.
4. Fatima S, Zaidi SS, Alsharidah AS, Alijaser FS, Banu N. Possible prophylactic approach for SARS-CoV-2 infection by combination of melatonin, Vitamin C and Zinc in animals. *Frontiers in Veterinary Science* 2020; 7:585789.
5. Arslan B, Ergun NU, Topuz S, Semerci SY, Suner N. Synergistic effect of quercetin and vitamin C against COVID-19: Is a possible guard for front liners? *ssrn* 2020.
6. Ahmed AK, Albalawi YS, Shora HA, Abelseed HK, Al-Kattan AN. Effects of quadruple therapy: Zinc, Quercetin, Bromelain and Vitamin C on clinical outcomes of patients infected with COVID-19. *Rea Int Jou of End and Dia* 2020; 1:1005.
7. Caly L, Druce JD, Catton MG, Jans DA, Wagstaff KM. The FDA-approved drug Ivermectin inhibits the replication of SARS-CoV-2 in vitro. *Antiviral Res* 2020.
8. Lehrer S, Rheinstein PH. Ivermectin docks to the SARS-CoV-2 spike receptor-binding domain attached to ACE2. *In Vivo* 2020; 34:3023-3026.
9. Maurya DK. A combination of Ivermectin and Doxycycline possibly blocks the viral entry and modulate the innate immune response in COVID-19 patients. *ChemRxiv* 2020.
10. Yang SN, Atkinson SC, Wang C, Lee A. The broad spectrum antiviral ivermectin targets the host nuclear transport importin alpha/beta1 heterodimer. *Antiviral Res* 2020; 177:104760.
11. Dayer MR. Coronavirus (2019-nCoV) deactivation via spike glycoprotein shielding by old drugs, bioinformatic study. *Preprints* 2020.
12. Swargiary A. Ivermectin as a promising RNA-dependent RNA polymerase inhibitor and a therapeutic drug against SARS-CoV2: Evidence from silico studies. *Research Square* 2020.
13. Zhang X, Song Y, Ci X, An N, Ju Y. Ivermectin inhibits LPS-induced production of inflammatory cytokines and improves LPS-induced survival in mice. *Inflamm Res* 2008; 57:524-529.
14. Ci X, Li H, Yu Q, Zhang X, Yu L, Chen N et al. Avermectin exerts anti-inflammatory effect by downregulating the nuclear transcription factor kappa-B and mitogen activated protein kinase pathway. *Fundamental & Clinical Pharmacology* 2009; 23:449-455.
15. Rajter JC, Sherman MS, Fatteh N, Vogel F, Sacks J, Rajter JJ. ICON (Ivermectin in COvid Ninteen) study: Use of ivermectin is associated with lower mortality in hospitalized patients with COVID-19. *Chest* 2020.
16. Gorial FI, Mashhadani S, Sayaly HM, Dakhil BD, AlMashhadani MM. Effectiveness of Ivermectin as add-on therapy in COVID-19 management (Pilot Trial). *medRxiv* 2020.
17. Khan MS, Khan MS, Debnath Cr, Nath PN, Mahtab MA. Ivermectin treatment may improve the prognosis of patients with COVID-19. *Archivos de Bronconeumologia* 2020.

18. Hashim HA, Maulood MF, rasheed AM, Fatak DF, Kabah KK. Controlled randomized clinical trial on using Ivermectin with Doxycycline for treating COVID-19 patients in Bagdad, Iraq. medRxiv 2020.
19. Murshed MR, Bhiuyan E, Saber S, Alam RF, Robin RF. A case series of 100 COVID-19 positive patients treated with combination of Ivermectin and Doxycycline. Bangladesh Coll Phys Surg 2020; 38:10-15.
20. Chamie J. Real-World evidence: The case of Peru, casuality between Ivermectin and COVID-19 infection fatality rate. ResearchGate 2020.
21. Patel AN, Desai SS, Grainger DW, Mehra MR. Usefulness of ivermectin in COVID-19 illness. medRxiv 2020.
22. Jans DA, Wagstaff KM. Ivermectin as a broad-spectrum host directed anti-viral: The real deal. Cells 2020; 9:2100.
23. DiNicolantonio JJ, Barroso-Arranda J, McCarty M. Ivermectin may be a clinically useful anti-inflammatory agent for late-stage COVID-19. Open Heart 2020; 7:e001350.
24. Sharun K, Dhama K, Patel SK, Pathak M, Tiwari R. Ivermectin, a new candidate therapeutic against SARS-CoV-2/COVID-19. Ann Clin Microbiol Antimicrob 2020; 19:23.
25. Peralta EG, Fimia-Duarte R, Cardenas JW, Dominguez DV, Segura RB. Ivermectin, a drug to be considered for the prevention and treatment of SARS-CoV-2. Brief literature review. EC Veterinary Science 2020; 5:25-29.
26. Al-Jassim KB, Jawad AA, Al-Masoudi EA, Majeed SK. Histopathological and biochemical effects of ivermectin on kidney functions, lung and the ameliorative effects of vitamin C in rabbits. Bas J Vet Res 2016; 14:110-124.
27. Mudatsir M, Yufika A, Nainu F, Frediansyah A, Megawati D. Antiviral activity of ivermectin against SARS-CoV-2: an old-fashioned dog with a new trick- Literature review. Sci Pharm 2020; 88:36.
28. Carvallo H, Hirsch R, Farinella ME. Safety and efficacy of the combined use of Ivermectin, dexamethasone, enoxaparin and aspirin against COVID-19. medRxiv 2020.
29. Kircik LH, Del Rosso JQ, Layton AM, schauber J. Over 25 years of clinical experience with Ivermectin: An overview of safety for an increasing number of indications. J Drugs Dermatol 2016; 15:325-332.
30. Kurcicka L, Lauer SA, Laeyendecker O, Boon D, Lessler J. Variation in false-negative rate of reverse transcriptase polymerase chain reaction-based SARS-CoV-2 tests by time since exposure. Ann Intern Med 2020; 173:262-267.
31. Cheng HY, Jian SW, Liu DP, Huang WT, Lin HH. Contact tracing assessment of COVI-19 transmission dynamics in Taiwan and risk at different exposure periods before and after symptom onset. JAMA Intern Med 2020; 180:1156-1163.
32. Zhao J, Yang Y, Huang H, Li D, Gu D. Relationship between ABO blood group and the COVID-19 susceptibility. medRxiv 2020.
33. Banerjee A, Pasea L, Harris S, Gonzalez-Izquierdo A. Estimating excess 1-year mortality associated with the COVID-19 pandemic according to underlying conditions and age: a population-based cohort study. Lancet 2020; 395:1715-1725.
34. Goren A, Vamo-Galvan S, Wambier CG, McCoy J. A preliminary observation: Male pattern hair loss among hospitalized COVID-19 patients in Spain- A potential clue to the role of androgens in COVID-19 severity. J Cosmetic Dermatol 2020.
35. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020; 395:497-506.

36. Guan W, Ni Z, Hu Y, Liang W, Ou C, He J. Clinical characteristics of Coronavirus disease 2019 in China. *N Engl J Med* 2020.
37. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S. Risk factors associated with acute respiratory distress syndrome and death in patients with Coronavirus disease 2019 pneumonia in Wuhan, China. *JAMA Intern Med* 2020.
38. von der Thüsen J, van der Eerden M. Histopathology and genetic susceptibility in COVID-19 pneumonia. *Eur J Clin Invest* 2020.
39. Sweeney TE, Liesenfeld O, Wacker J, He YD, Rawling D, Rimmel M. Validation of inflammopathic, adaptive, and coagulopathic sepsis endotypes in Coronavirus disease 2019. *Crit Care Med* 2020.
40. Tartof SY, Qian L, Hong V, Wei R, Nadjafi RF, Fischer H. Obesity and mortality among patients diagnosed with COVID-19: Results from an integrated health care organization. *Ann Intern Med* 2020.
41. Pujadas E, Chaudhry F, McBride R, Richter F, Zhao S. SARS-CoV-2 viral load predicts COVID-19 mortality. *Lancet Resp Med* 2020.
42. Akbar AN, Gilroy DW. Aging immunity may exacerbate COVID-19. *Science* 2020; 369.
43. Zhang Q, Bastard P, Liu Z, Le Pen J, Chen J, Korol C. Inborn errors of type I IFN immunity in patients with life-threatening COVID-19. *Science* 2020.
44. Li MY, Li L, Zhang Y, Wang XS. Expression of the SARS-CoV-2 cell receptor gene ACE2 in a wide variety of human tissues. *Infectious Diseases of Poverty* 2020; 9:45.
45. Zhou Y, Fu B, Zheng X, Wang D, Zhao C. Pathogenic T cells and inflammatory monocytes incite inflammatory storm in severe COVID-19 patients. *Natl Sci Rev* 2020; 7:998-1002.
46. Blanco-Melo D, Nilsson-Payant BE, Liu WC, Uhl S. Imbalanced host response to SARS-CoV-2 drives development of COVID-19. *Cell* 2020; 181:1036-1045.
47. Giamarellos-Bourboulis EJ, Netea MG, Rovina N, Akinosoglou K, Antoniadou A, Antonakos N et al. Complex immune dysregulation in COVID-19 patients with severe respiratory failure. *Cell Host & Microbe* 2020.
48. McGonagle D, Sharif K, O'Regan A, Bridgewood C. The role of cytokines including interleukin-6 in COVID-19 induces pneumonia and macrophage activation syndrome-like disease. *Autoimmunity Reviews* 2020; 19:102537.
49. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z. Clinical course and risk factor for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020.
50. Wu D, Yang XO. TH17 responses in cytokine storm of COVID-19: An emerging target of JAK2 inhibitor Febratinib. *J Microbiol Immunol Infect* 2020.
51. Giamarellos-Bourboulis EJ, Netea MG, Rovina N, Akinosoglou K. Complex immune dysregulation in COVID-19 patients with severe respiratory failure. *medRxiv* 2020.
52. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ. COVID-19: consider cytokine storm syndromes and immunosuppression. *Lancet* 2020; 395:1033-1034.
53. Qin C, Zhou L, Hu Z, Zhang S. Dysregulation of the immune response in patients with COVID-19 in Wuhan, China. *Lancet Infect Dis* 2020.
54. Zhang C, Wu Z, Li JW, Zhao H, Wang GQ. The cytokine release syndrome (CRS) of severe COVID-19 and interleukin-6 receptor (IL-6R) antagonist Tocilizumab may be the key to reduce the mortality. *Int J Antimicrob Agents* 2020.
55. Ye Q, Wang B, Mao J. The pathogenesis and treatment of the "Cytokine Storm" in COVID-19. *J Infection* 2020.

56. Moore JB, June CH. Cytokine release syndrome in severe COVID-19. *Science* 2020.
57. Tay MZ, Poh CM, Renia L, MacAry PA. The trinity of COVID-19: immunity, inflammation and intervention. *Nature Reviews* 2020; 20:363-374.
58. Leisman DE, Deutschman CS, Legrand M. Facing COVID-19 in the ICU: vascular dysfunction, thrombosis, and dysregulated inflammation. *Intensive Care Med* 2020; 46:1105-1108.
59. Bryce C, Grimes Z, Pujadas E, Ahuja S, Beasley MB, Albrecht R et al. Pathophysiology of SARS-CoV-2: targeting of endothelial cells renders a complex disease with thrombotic microangiopathy and aberrant immune response. *The Mount Sinai COVID-19 autopsy experience*. medRxiv 2020.
60. Teuwen LA, Geldhof V, Pasut A, Carmeliet P. COVID-19: the vasculature unleashed. *Nature Reviews* 2020.
61. Varga Z, Flammer AJ, Steiger P, Habrecker M, Andermatt R, Zinkernagel AS. Endothelial cell infection and endotheliitis in COVID-19. *Lancet* 2020.
62. Ackermann M, Verleden SE, Kuehnel M, Haverich A, Welte T. Pulmonary vascular endothelialitis, Thrombosis, and Angiogenesis in COVID-19. *N Engl J Med* 2020; 383:120-128.
63. Kory P, Kanne JP. SARS-CoV-2 organizing pneumonia: "Has there been a widespread failure to identify and treat this prevalent condition in COVID-19?". *BMJ Open Res* 2020; 7:e000724.
64. Torrealba JR, Fisher S, Kanne JP, Butt YM, Glazer C, Kershaw C. Pathology-radiology correlation of common and uncommon computed tomographic patterns of organizing pneumonia. *Human Pathology* 2018; 71:30-40.
65. Jeronimo CM, Farias ME, Almeida FF, Sampaio VS, Alexandre MA, Melo GC. Methylprednisolone as adjunctive therapy for patients hospitalized with COVID-19 (Metcovid): A randomised, double-blind, phase IIb, placebo-controlled trial. *Clin Infect Dis* 2020.
66. Kanne JP, Little BP, Chung JH, Elicker BM. Essentials for radiologists on COVID-19: an Update-Radiology Scientific Expert Panel. *Radiology* 2020.
67. Copin MC, Parmentier E, Duburcq T, Poissy J, Mathieu D. Time to consider histologic pattern of lung injury to treat critically ill patients with COVID-19 infection [letter]. *Intensive Care Med* 2020.
68. Gattinoni L, Chiumello D, Caironi P, Busana M, Romitti F, Brazzi L. COVID-19 pneumonia: different respiratory treatment for different phenotypes? *Intensive Care Med* 2020; 46:1099-1102.
69. Chiumello D, Cressoni M, Gattinoni L. Covid-19 does not lead to a "typical" Acute Respiratory Distress syndrome. *Lancet* 2020.
70. Gattinoni L, Chiumello D, Rossi S. COVID-19 pneumonia: ARDS or not? *Crit Care* 2020; 24:154.
71. Gattinoni L, Pesenti A. The concept of "baby lung". *Intensive Care Med* 2005; 31(6):776-784.
72. Tobin MJ, Laghi F, Jubran A. Why COVID-19 silent hypoxemia is baffling to physicians. *Am J Respir Crit Care Med* 2020.
73. Schurink B, Roos E, Radonic T, Barbe E, Bouman CS. Viral presence and immunopathology in patients with lethal COVID-19: a prospective autopsy cohort study. *Lancet Microbe* 2020.

74. Buijssers B, Yanginlar C, Maciej-Hulme ML, de Mast Q. Beneficial non-anticoagulant mechanisms underlying heparin treatment of COVID-19 patients. *EBioMedicine* 2020.
75. Kim SY, Jin W, Sood A, Montgomery DW, Grant OC, Fuster MM. Characterization of heparin and severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2) spike glycoprotein binding interactions. *Antiviral Res* 2020; 181:104873.
76. Clausen TM, Sandoval DR, Spliid CB, PiHI J, Painter CD, Thacker BE et al. SARS-CoV-2 infection depends on cellular heparan sulphate and ACE2. *bioRxiv* 2020.
77. Kwon PS, Oh H, Kwon SJ, Jin W, Zhang F, Fraser K et al. Sulphated polysaccharides effectively inhibit SARS-CoV-2 in vitro. *Cell Discovery* 2020; 6:50.
78. Huang X, Han S, Liu x, Wang T, Xu H. Both UFH and NAH alleviate shedding of endothelial glycocalyx and coagulopathy in LPS-induced sepsis. *Exp Thera Med* 2020; 19:913-922.
79. Buijssers B, Yanginlar C, de Nooijer A, Grondman I, Jonkman I, Rother N. Increased plasma heparanase activity in COVID-19 patients. *medRxiv* 2020.
80. Barabutis N, Khangoora V, Marik PE, Catravas JD. Hydrocortisone and Ascorbic Acid synergistically protect and repair lipopolysaccharide-induced pulmonary endothelial barrier dysfunction. *Chest* 2017; 152:954-962.
81. de Melo AF, Homem-de-Mello M. High-dose intravenous vitamin C may help in cytokine storm in severe SARS-CoV-2 infection. *Crit Care* 2020; 24:500.
82. May JM, Qu ZC. Ascorbic acid prevents oxidant-induced increases in endothelial permeability. *Biofactors* 2011; 37:46-50.
83. Utoguchi N, Ikeda K, Saeki K, Oka N, Mizuguchi H, Kubo K et al. Ascorbic acid stimulates barrier function of cultured endothelial cell monolayer. *Journal of Cellular Physiology* 1995; 163(2):393-399.
84. Han M, Pendem S, Teh SL, Sukumaran DK, Wu F, Wilson JX. Ascorbate protects endothelial barrier function during septic insult: Role of protein phosphatase type 2A. *Free Radic Biol Med* 2010; 48:128-135.
85. Marik PE. Hydrocortisone, Ascorbic Acid and Thiamine (HAT therapy) for the treatment of sepsis. Focus on ascorbic acid. *Nutrients* 2018; 10:1762.
86. Colunga Biancatelli RM, Berrill M, Marik PE. The antiviral properties of vitamin C. *Expert Rev Anti Infect Ther* 2020; 18:99-101.
87. Elenkov IJ. Glucocorticoids and the Th1/Th2 balance. *Ann N Y Acad Sci* 2004; 1024:138-146.
88. Shodell M, Siegal FP. Corticosteroids depress INF-alpha-producing plasmacytoid dendritic cells in human blood. *J Allergy Clin Immunol* 2001; 108:446-448.
89. Thomas BJ, Porritt RA, Hertzog PJ, Bardin PG. Glucocorticosteroids enhance replication of respiratory viruses: effect of adjuvant interferon. *Scientific Reports* 2014; 4:7176.
90. Singanayagam A, Glanville N, Girkin JL, Ching YM, Marcellini A. Corticosteroid suppression of antiviral immunity increases bacterial loads and mucus production in COPD exacerbations. *Nature Communications* 2018; 9:2229.
91. Liu J, Zheng X, Huang Y, Shan H, Huang J. Successful use of methylprednisolone for treating severe COVID-19. *J Allergy Clin Immunol* 2020.
92. Salton F, Confalonieri P, Santus P, Harari S, Scala R, Lanini S et al. Prolonged low-dose methylprednisolone in patients with severe COVID-19 pneumonia. *medRxiv* 2020.
93. Braude AC, Rebeck AS. Prednisone and methylprednisolone disposition in the lung. *Lancet* 1983;995-997.

94. Draghici S, Nguyen TM, Sonna LA, Ziraldo C, Vanciu R, Fadel R et al. COVID-19: disease pathways and gene expression changes predict methylprednisolone can improve outcome in severe cases. *Bioinformatics* 2020.
95. Niae MS, Gheibl N, Namdar P, Allami A, Javadi A. Ivermectin as an adjunct treatment for hospitalized adult COVID-19 patients: A randomized multi-center clinical trial. *Research Square* 2020.
96. Alam MT, Murshed R, Bhiuyan E, Saber S, Alam RF, Robin RC. A case series of 100 COVID-19 positive patients treated with combination of Ivermectin and Doxycycline. *Bangladesh Coll Phys Surg* 2020; 38:10-15.
97. Chowdhury AT, Shahabz M, Karim MR, Islam J, Guo D, He D. A randomized trial of ivermectin-doxycycline and hydrochloroquine-azithromycin therapy on COVID-19 patients. *Research Square* 2020.
98. Kory P, Meduri GU, Iglesias J, Varon J, Berkowitz K, Wagshul F et al. Review of the emerging evidence supporting the use of Ivermectin in the prophylaxis and treatment of COVID-19. *Front Line Covid-19 Critical Care Alliance*. *osf io* 2020.
99. Chamie-Quintero JJ, Hibberd JA, Scheim DE. Ivermectin for COVID-19 in Peru: 14-fold reduction in nationwide excess deaths, $p=0.002$ for effect by state, then 13-fold increase after ivermectin use restricted. *medRxiv* 2021.
100. Hazan S, Dave S, Gunaratne AW, Dolai S, Clancy RL, McCullough PA et al. Effectiveness of ivermectin-based multidrug therapy in severe hypoxic ambulatory COVID-19 patients. *medRxiv* 2021.
101. Bryant A, Lawrie TA, Dowswell T, Fordham E, Mitchell S, Hill SR et al. Ivermectin for the prevention and treatment of COVID-19 infection: a systematic review and meta-analysis. *Lancet* 2021.
102. Hill A, Garratt A, Levi J, Falconer J, Ellis L, McCann K et al. Meta-analysis of randomized trials of ivermectin to treat SARS-CoV-2 infection. *Open Forum Infectious Diseases* 2021.
103. DiNicolantonio JJ, Barroso-Aranda J, McCarty MF. Anti-inflammatory activity of ivermectin in late-stage COVID-19 may reflect activation of systemic glycine receptors. *Open Heart* 2021; 8:e001655.
104. Villar J, Confalonieri M, Pastores SM, Meduri GU. Rationale for prolonged corticosteroid treatment in the acute respiratory distress syndrome (ARDS) caused by COVID-19. *Crit Care Expl* 2020; 2:e0111.
105. Fadel R, Morrison AR, Vahia A, Smith ZR, Chaudry Z, Bhargava P et al. Early course corticosteroids in hospitalized patients with COVID-19. *Clin Infect Dis* 2020; 71:2114-2120.
106. Chroboczek T, Lacoste M, Wackenheim C, Challan-Belval T, Amar B, Boisson T. Beneficial effect of corticosteroids in severe COVID-19 pneumonia: a propensity score matching analysis. *medRxiv* 2020.
107. Cruz AF, Ruiz-Antoran B, Gomez AM, Lopez AS. Impact of glucocorticoid treatment in SARS-CoV-2 infection mortality: A retrospective controlled cohort study. *medRxiv* 2020.
108. Meduri GU, Bridges L, Shih MC, Marik PE, Siemienluk RA, Kocak M. Prolonged glucocorticoid treatment is associated with improved ARDS outcomes: analysis of individual patients' data from four randomized trials and trial-level meta-analysis of the updated literature. *Intensive Care Med* 2016; 42:829-840.
109. Association between administration of systemic corticosteroids and mortality among critically ill patients with COVID-19. A meta-analysis. *JAMA* 2020.

110. Ruiz-Irastorza G, Pijoan JI, Berceciatua E, Dunder S, Dominguez J, Garcia-Escudero P. Second week methyl-prednisolone pulses improve prognosis in patients with severe coronavirus disease 2019 pneumonia: An observational comparative study using routine care data. medRxiv 2020.
111. Tomazini BM, Maia IS, Cavalcanti AB, Berwanger O, Rosa RG, Veiga VC. Effect of dexamethasone on days alive and ventilaor-free in patients with moderate or severe acute respiratory distress syndrome and COVID-19. The CoDEX randomized clinical trial. JAMA 2020; 324:1307-1316.
112. Edalatfard M, Akhtari M, Salehi M, Naderi Z, Jamshidi A, Mostafaei S. Intravenous methylprednisolone pulse as a treatment for hospitalized severe COVID-19 patients: results from a randomised controlled clinical trial. Eur Respir J 2020.
113. Effect of hydrocortisone on mortality and organ support in patients with severe COVID-19. The REMAP-CAP COVID-19 Corticosteroid Domain Randomized Clinical Trial. JAMA 2020.
114. Dequin PF, Heming N, Meziani F, Plantefevre G, Voiriot G. Effect of hydrocortisone on 21-day mortality or respiratory support among critically ill patients with COVID-19. A randomized Clinical trial. JAMA 2020.
115. Therapeutic anticoagulation with heparin in noncritically ill patients with Covid-19. N Engl J Med 2021; 389:790-802.
116. Gandolfi JV, Di Bernardo AP, Chanes DA, Martin DF, Joles VB, Amendola CP et al. The effects of melatonin supplementation on sleep quality and assessment of the serum melatonin in ICU patients: A randomized controlled trial. Crit Care Med 2020.
117. Castillo RR, Quizon GR, Juco MJ, Roman AD, de Leon DG, Punzalan FE et al. Melatonin as adjuvant treatment for coronavirus disease 2019 pneumonia patients requiring hospitalization (MAC-19 PRO): a case series. Melatonin Res 2021; 3:297-310.
118. Ramiall V, Zucker J, Tatonetti N. Melatonin is significantly associated with survival of intubated COVID-19 patients. medRxiv 2021.
119. Farnoosh G, Akbaariqomi M, Badri T, Bagheri M, Izadi M. Efficacy of a low dose of melatonin as an adjunctive therapy in hospitalized patients with COVID-19: A randomized, double-blind clinical trial. medRxiv 2021.
120. Hasan ZT, AlAtrakji MQ, Mehuaiden AK. The effect of melatonin on thrombosis, sepsis and mortality rate in COVID-19 patients. International Journal of Infectious Diseases 2022; 114:79-84.
121. Farnoosh G, Akbariqomi M, Badri T, Bagheri M, Izadi M, rezaie E. Efficacy of a low dose of melatonin as an adjunctive therapy in hospitalized patietns with COVID-19: A randomized, double-blind clinical trial. Archives of Medical Research 2021.
122. Darban M, Malek F, Memarian M, Gohari A, Kiani A, Emadi A. Efficacy of high dose vitamin C, melatonin and zinc in Iranian patients with acute respiratory syndrome due to Coronavirus infection: A pilot randomized trial. Journal of Cellular & Molecular Anesthesia 2021; 6:164-167.
123. Calusic M, Marcec R, Luksa L, Jurkovic I, Kovac N, Likic R. Safety and efficacy of flvoxamine in COVID-19 ICU patients: an open label, prospective cohort trial with matched controls. Br J Clin Pharmacol 2021.
124. Reis G, Moreira-Silva EA, Silva DC, Thabane L, Guyatt GH, Mills EJ. Effect of early treatment with flvoxamine on risk of emergency care and hospitalization among

- patients with COVID-19: the TOGETHER randomized, platform clinical trial. *Lancet Glob Health* 2021.
125. Sukhatme VP, Reiersen AM, Vayttaden SJ, Sukhatme VV. Fluvoxamine: A review of its mechanism of action and its role in COVID-19. *Frontiers in Pharmacology* 2021; 12:652688.
 126. Oskotsky T, Maric I, Tang A, Oskotsky B, Wong RJ, Sirota M. Mortality risk among patients with COVID-19 prescribed selective serotonin reuptake inhibitor antidepressants. *JAMA Network Open* 2021; 4:e2133090.
 127. Blum VF, Cimerman S, Huneter JR, Tierno P, Lacerda A, Soeiro A. Nitazoxanide superiority to placebo to treat moderate COVID-19 - A pilot prove of concept randomized double-blind clinical trial. *EClinicalMedicine* 2021; 37:100981.
 128. Heaney RP, Armas LA, Shary JR, Bell NH, Binkley N, Hollis BW. 25-hydroxylation of vitamin D3: relation to circulating vitamin D3 under various input conditions. *Am J Clin Nutr* 2008; 87:1738-1742.
 129. Murai IH, Fernandes AL, Sales LP, Pinto AJ, Goessler KF. Effect of vitamin D3 supplementaion vs placebo on hospital length of stay in patients with severe COVID-19: A multicenter, double-blind, randomized controlled trial. *JAMA* 2020.
 130. Castillo ME, Costa LM, Barrios JM, Diaz JF, Miranda JL, Bouillon R et al. Effect of calcifediol treatment and best available therapy versus best available therapy on intensive care unit admission and mortality among patients hospitalized for COVID-19: a pilot randomized clinical study. *J Steroid Biochem Mol Biol* 2020; 203:105751.
 131. Loucera C, Pena-Chilet M, Esteban-Medina M, Villegas R, Lopez-Miranda J. Real world evidence of calcifediol use and mortality rate of COVID-19 hospitalized in a large cohort of 16,401 Adalusian patients. *medRxiv* 2021.
 132. Nogues X, Overjero D, Pineda-Moncus M, Bouillon R. Calcifediol treatment and COVID-19-related outcomes. *medRxiv* 2021.
 133. Loucera C, Pena-Chilet M, Esteban-Medina M, Villegas R, Tunes I. Real world evidence of calcifediol or vitamin D prescription and mortality rate of COVID-19 in a retrospective cohort of hospitalized Andalusian patients. *Scientific Reports* 2021; 11:23380.
 134. Henriquez MS, de Tejada Romero MJ. Cholecalciferol or calcifediol in the management of vitamin D deficiency. *Nutrients* 2020; 12:1617.
 135. Elamir YM, Amir H, Lim S, Rana Y, Lopez CG, Omar A. A randomized pilot study using calcitriol in hospitalized patients. *Bone* 2022; 154:116175.
 136. Hottz ED, Azevedo-Quintanilha Ig, Palhinha L, Teixeira L, Barreto EA. Platelet activation and platelet-monocyte aggregate formation trigger tissue factor expression in patients with severe COVID-19. *Blood* 2020; 136:1330-1341.
 137. Barrett TJ, Lee AH, Xia Y, Lin LH, Black M, Cotzia P. Platelet and vascular biomarkers associate with thrombosis and death in coronavirus disease. *Circulation Research* 2020; 127:945-947.
 138. Zhang S, Liu Y, Wang X, Yang L, Li H, Wang Y. SARS-CoV-2 binds platelet ACE2 to enhance thrombosis in COVID-19. *Journal of hematology & oncology* 2020; 13:120.
 139. Cloutier N, Allaey I, Marcoux G, Machius KR, Mailhot B. Platelets release pathogenic serotonin and return to circulation after immune complex-mediated sequestration. *PNAS* 2018;E1550-E1559.
 140. De Flora S, Balansky R, La Maestra S. Rationale for the use of N-acetylcysteine in both prevention and adjuvant therapy of COVID-19. *FASEB J* 2020.

141. Shi Z, Puyo CA. N-Acetylcysteine to combat COVID-19: an evidence review. *Therapeutics and Clinical Risk Management* 2020; 16:1047-1055.
142. Assimakopoulos SF, Aretha D, Kominos D, Dimitropoulou D, Lagadinou M. N-acetylcysteine reduces the risk for mechanical ventilation and mortality in patients with COVID-19 pneumonia: a two-center retrospective cohort study. *Infectious Diseases* 2021; 53(11):847-854.
143. Kumar P, Osahon O, Vides DB, Hanania N, Minard CG. Severe glutathione deficiency, oxidative stress and oxidant damage in adults hospitalized with COVID-19: implications for GlyNac (Glycine and N-acetylcysteine) supplementaion. *Antioxidants* 2022; 11(50).
144. Izquierdo JL, Soriano JB, Gonzalez Y, Lumbreras S. Use of N-Acetylcysteine at high doses as an oral treatment for patients with COVID-19. *Science Progress* 2022; 105.
145. McCoy J, Goren A, Cadejani FA, Vano-Galvan S, Kovacevic M, Situm M et al. Proxalutamide reduces the rates of hospitalization for COVID-19 male outpatients: A randomized double-blinded placebo-controlled trial. *Front Med* 2021; 8:668698.
146. Cadejani FA, McCoy J, Zimmerman A, Mirza FN, Barros RN. Efficacy of proxalutamide in hospitalized COVID-19 patients: A randomized, double-blind, placebo-controlled, parallel-design clinical trial. *medRxiv* 2021.
147. Cadejani FA, McCoy J, Wambier CG, Goren A. Early antiandrogen therapy with dutasteride reduces viral shedding, inflammatory responses, and time-to remission in males with COVID-19: A randomized, double-blind, placebo-controlled interventional trial (EAT-DUTA AndroCoV Trial- Biochemical). *Cureus* 2021.
148. Freedberg DE, Conigliaro J, Sobieszczyk ME, Markowitz DD. Famotidine use is associated with improved clinical outcomes in hospitalized COVID-19 patients: A propensity score matched retrospective cohort study. *medRxiv* 2020.
149. Janowitz T, Baglenz E, Pattinson D, Wang TC, Conigliaro J. Famotidine use and quantitative symptom tracking for COVID-19 in non-hospitalized patients: a case series. *Gut* 2020; 69:1592-1597.
150. Mather JF, Seip RL, McKay RG. Impact of famotidine use on clinical outcomes of hospitalized COVID-19 patients. *Am J Gastroenterol* 2020.
151. Malone RW, Tisdall P, Fremont-Smith P, Liu Y, Huang XP, White KM. COVID-19: Famotidine, Histamine, Mast Cells, and mechanisms. *Research Square* 2020.
152. Sethia R, Prasad M, Mahapatra SJ, Nischal N, Soneja M. Efficacy of famotidine for COVID-19: A systematic review and meta-analysis. *medRxiv* 2020.
153. Shoaibi A, Fortin S, Weinstein R, Berlin JA. Comparative effectiveness of famotidine in hospitalized COVID-19 patients. *medRxiv* 2020.
154. Yeramaneni S, Doshi P, Sands K, Cooper M, Kurbegov D, Fromell G. Famotidine use is not associated with 30-day mortality: A coarsened exact match study in 7158 hospitalized COVID-19 patients from a large healthcare system. *medRxiv* 2020.
155. Jalali F, Rezaie S, Rola P, Kyle-Sidell C. COVID-19 pathophysiology: Are platelets and serotonin hiding in plain sight? *ssrn* 2021.
156. Lin OA, Karim ZA, Vemana HP, Espinosa EV, Khasawneh FT. The antidepressant 5-HT_{2a} receptor antagonists Pizotifen and cyproheptadine inhibit serotonin-enhanced platelet function. *PLoS ONE* 2014; 9:e87026.
157. Zaid Y, Guessous F, Puhm F, Elhamdani W, Chentoufi L, Morris AC. Platelet reactivity to thrombin differs between patients with COVID-19 and those with ARDS unrelated to COVID-19. *Blood Advances* 2021; 5:635-639.

158. Zaid Y, Puhm F, Allaeyes I, Naya A, Oudghiri M. Platelets can associate with SARS-CoV-2 RNA and are hyperactivated in COVID-19. *Circ Res* 2020; 127:1404-1418.
159. Dawson C, Christensen CW, Rickaby DA, Linehan JH, Johnston MR. Lung damage and pulmonary uptake of serotonin in intact dogs. *J Appl Physiol* 1985; 58:1761-1766.
160. MacLean MR, Herve P, Eddahibi S, Adnot S. 5-hydroxytryptamine and the pulmonary circulation: receptors, transporters and the relevance to pulmonary arterial hypertension. *Br J Pharmacol* 2000; 131:161-168.
161. Blackshear JL, Orlandi C, Hollenberg NK. Constrictive effect of serotonin on visible renal arteries: a pharmacoangiographic study in anesthetized dogs. *J Cardiovasc Pharmacol* 1991; 17:68-73.
162. Watchorn J, Hang DY, Joslin J, Bramham K, Hutchings SD. Critically ill COVID-19 patients with acute kidney injury have reduced renal blood flow and perfusion despite preserved cardiac function: A case-control study using contrast enhanced ultrasound. *Lancet Resp Med* 2021.
163. McGoon MD, Vanhoutte PM. Aggregating platelets contract isolated canine pulmonary arteries by releasing 5-hydroxytryptamine. *J Clin Invest* 1984; 74:823-833.
164. Almqvist P, Skudder P, Kuenzig M, Schwartz SI. Effect of cyproheptadine on endotoxin-induced pulmonary platelet trapping. *Am Surg* 1984; 50:503-505.
165. Skurikhin EG, Andreeva TV, Khnelevskaya ES, Ermolaeva LA, Pershina OV, Krupin VA. Effect of antiserotonin drug on the development of lung fibrosis and blood system reactions after intratracheal administration of bleomycin. *Bull Exp Biol Med* 2012; 152:519-523.
166. Doaei S, Gholami S, Rastgoo S, Bourbour F, Ghorat F, Joola P. The effect of omega-3 fatty acid supplementation on clinical and biochemical parameters of critically ill patients with COVID-19: a randomized clinical trial. *J Transl Med* 2021; 19:128.
167. Spinelli FR, Conti F, Gadina M. HiJAKing SARS-COV-2? The potential role of JAK inhibitors in the management of COVID-19. *Sci Immunol* 2020; 5:eabc5367.
168. Chen CX, Wang JJ, Li H, Yuan LT, Gale RP. JAK-inhibitors for coronavirus disease-2019 (COVID): a meta-analysis. *Leukemia* 2021.
169. Marconi VC, Ramanan AV, de Bono S, Kartman CE, Krishnan V. Efficacy and safety of baricitinib for the treatment of hospitalized adults with COVID-19 (COV-BARRIER): a randomised, double-blind, parallel-group, placebo-controlled phase 3 trial. *Lancet Resp Med* 2021.
170. Pan H, Peto R, Karim QA, Alejandria M, Henao-Restrepo AM. Repurposed antiviral drugs for COVID-19 - interim WHO SOLIDARITY trial. *medrx* 2020.
171. Ohl ME, Miller DR, Lund BC, Kobayashi T, Miell KR. Association of remdesivir treatment with survival and length of hospital stay among US veterans hospitalized with COVID-19. *JAMA Network Open* 2021; 4:e2114741.
172. Ader F, Hites M, Poissy J, Belhadi D, Diallo A, Staub T. Remdesivir plus standard of care versus standard of care alone for the treatment of patients admitted to hospital with COVID-19 (DisCoVeRy): a phase 3, randomised, controlled, open-label trial. *Lancet Infect Dis* 2021.
173. Finkelstein Y, Aks SE, Hutson JR, Juurlink DN, Nguyen P, Pollak U. Colchicine poisoning: the dark side of an ancient drug. *Clinical Toxicology* 2010; 48:407-414.
174. Wimalawansa SJ. Rapidly increasing serum 25(OH)D boosts immune system, against infections - Sepsis and COVID-19. *Nutrients* 2022; 14:2997.

175. Ranjbar K, Shahriarad R, erfani A, Khodamoradi Z, Saadi MH. Methylprednisolone or dexamethasone, which one is the superior corticosteroid in the treatment of hospitalized COVID-19 patients: A triple-blinded randomized controlled trial. *BMC Infect Dis* 2021; 21:337.
176. Ko JJ, Wu C, Mehta N, Wald-Dickler N, Yang W. A comparison of methylprednisolone and dexamethasone in intensive care patients with COVID-19. *medRxiv* 2021.
177. Fowler AA, Truwit JD, Hite D, Morris PE, DeWilde C, Priday A et al. Vitamin C Infusion for Treatment In Sepsis-Induced Acute Lung Injury- CITRIS-ALI: A Randomized, Placebo Controlled Clinical Trial. *JAMA* 2018; 322:1261-1270.
178. Marik PE, Khangoora V, Rivera R, Hooper MH, Catravas J. Hydrocortisone, Vitamin C and Thiamine for the treatment of severe sepsis and septic shock: A retrospective before-after study. *Chest* 2017; 151:1229-1238.
179. Marik PE. Vitamin C for the treatment of sepsis: The scientific rationale. *Pharmacol Therapeut* 2018; 189:63-70.
180. Cheng RZ. Can early and high-dose vitamin C prevent and treat coronavirus disease 2019 (COVID-19). *Medicine in Drug Discovery* 2020.
181. Wang Y, Lin H, Lin BW, Lin JD. Effects of different ascorbic acid doses on the mortality of critically ill patients: a meta-analysis. *Ann Intensive Care* 2019; 9:58.
182. Boretti A, Banik BK. Intravenous vitamin C for reduction of cytokines storm in acute respiratory distress syndrome. *PharmaNutrition* 2020; 12:100190.
183. Iglesias J, Vassallo AV, Patel V, Sullivan JB, Cavanaugh J, Elbaga Y. Outcomes of metabolic resuscitation using ascorbic acid, thiamine, and glucocorticoids in the early treatment of sepsis. *Chest* 2020; 158:164-173.
184. Hiedra R, Lo KB, Elbashesheh M, Gul F, Wright RM. The use of IV vitamin C for patients with COVID-19: a case series. *Exp Rev Anti Infect Ther* 2020.
185. Zhang J, Rao X, Li Y, Zhu Y, Liu G, Guo G et al. High-dose vitamin C infusion for the treatment of critically ill COVID-19. *Research Square* 2020.
186. Kumari P, Dembra S, Dembra P, Bhawna F, Gul A, Ali B. The role of vitamin C as adjuvant therapy in COVID-19. *Cureus* 2020; 12:e11779.
187. Al Sulaiman K, Al Juhani O, Badreldin HA, Salah KB, Alharbi A, Arabi YM. Adjunctive therapy with ascorbic in critically ill patients with COVID-19: A multicenter propensity score matched study. *Crit Care* 2021.
188. Lankadeva YR, Peiris RM, Okazaki N, Birchall IE, Doenom A, Evans RG et al. Reversal of the pathophysiological responses to Gram-negative sepsis by megadose Vitamin C. *Crit Care Med* 2020.
189. Zhang J, Rao X, Li Y, Zhu Y, Liu G, Guo G et al. Pilot trial of high-dose vitamin C in critically ill COVID-19 patients. *Ann Intensive Care* 2020.
190. Lavinio A, Ercole A, Battaglini D, Magnoni S, Badenes R, Thomas W et al. Safety profile of enhanced thromboprophylaxis strategies for critically ill COVID-19 patients during the first wave of the pandemic: observational report from 28 European intensive care units. *Crit Care* 2021; 25:155.
191. Patterson G, Isales CM, Fulzele S. Low level of vitamin C and dysregulation of vitamin C transporter might be involved in the severity of COVID-19 infection. *Aging and Disease* 2020; 12.
192. Tomassa-Irriguible TM, Lielsa-Berrocalle L. COVID-19: Up to 87% critically ill patients had low vitamin C values. *Research Square* 2020.

193. Arvinte C, Singh M, Marik PE. Serum levels of vitamin C and vitamin D in a cohort of critically ill COVID-19 patients of a North American Community Hospital Intensive Care Unit in May 2020. A pilot study. *Medicine in Drug Discovery* 2020; 8:100064.
194. Lopes RD, Furtado RH, Bronhara B, Damiani LP, Barbosa LM. Therapeutic versus prophylactic anticoagulation for patients admitted to hospital with COVID-19 and elevated D-dimer concentraion (ACTION): an open-label, multicentre, randomised, controlled trial. *Lancet* 2021; 397:2253-2263.
195. Kalfas S, Visvanathan K, Chan K, Drago J. The therapeutic potential of ivermectin for COVID-19: A systematic review of mechanisms and evidence. *medRxiv* 2020.
196. Menezes RR, Godin AM, Rodrigues FF, Coura GM, Melo IS, Brito AM. Thiamine and riboflavin inhibit production of cytokines and increase the anti-inflammatory activity of a corticosteroid in a chronic model of inflammation induced by complete Freund's adjuvant. *Pharmacological Reports* 2020; 69:1036-1043.
197. Vatsalya V, Li F, Frimodig J, Gala KS, Srivastava S, Kong M. Therapeutic prospects for Th-17 cell immune storm syndrome and neurological symptoms in COVID-19: Thiamine efficacy and safety, In-vitro evidence and pharmacokinetic profile. *medRxiv* 2020.
198. Mallat J, Lemyze M, Thevenin D. Do not forget to give thiamine to your septic shock patient! *J Thorac Dis* 2016; 8:1062-1066.
199. Moskowitz A, Donnino MW. Thiamine (vitamin B1) in septic shock: a targeted therapy. *J Thorac Dis* 2020; 12 (suppl 1):S78-S83.
200. Woolum JA, Abner EL, Kelly A, Thompson Bastin ML, Morris PE, Flannery AH. Effect of thiamine administration on lactate clearance and mortality in patients with septic shock. *Crit Care Med* 2018; 46:1747-1752.
201. Marik PE. Thiamine: An essential component of the metabolic resuscitation protocol. *Crit Care Med* 2018; 46:1869-1870.
202. Al Sulaiman K, Aljuhani O, Al Dossari M, Alshahrani A, Alharbi A. Evaluation of thiamine as adjunctive therapy in COVID-19 critically ill patients: A multicenter propensity score matched study. *Research Square* 2021.
203. Zarehoseinzade E, Allami A, Ahmadi M, Bijani B. Finasteride in hospitalized adult males with COVID-19: A risk factor for severity of the disease or an adjunct treatment: A randomized controlled clinical trial. *Medical Journal of the Islamic Republic of Iran* 2021; 35:30.
204. Chen L, Jiang X, Huang L, Lan K, Wang H, Hu L et al. Bioequivalence of a single 10-mg dose of finasteride 5-mg oral disintegrating tablets and standard tablets in healthy adult male Han Chinese volunteers: A randomized sequence, open-label, two-way crossover study. *Clinical Therapeutics* 2009; 31:2242-2248.
205. Tan CW, Ho LP, Kalimuddin S, Cherng BP, Teh YE. Cohort study to evaluate effect of vitamin D, magnesium, and vitamin b12 in combination on severe outcome progression in older patients with coronavirus (COVID-19). *Nutrition* 2020; 80:111017.
206. Lee CY, Jan WC, Tsai PS, Huang CJ. Magnesium sulfate mitigates acute lung injury in endotoxemia rats. *J Trauma* 2011; 70:1177-1185.
207. Salem M, Kasinski N, Munoz R, Chernow B. Progressive magnesium deficiency inceases mortality from endotoxin challenge:Protective effects of acute magnesium replacement therapy [abstract]. *Crit Care Med* 1995;A260.
208. Jiang P. Does hypomagnesemia impact on the outcome of patients admitted to the intensive care unit? A systematic review and meta-analysis. *Shock* 2019; 47:288-295.

209. Duarte M, Pelorosso F, Nicolosi L, Salgado V, Vetulli H. Telmisartan for treatment of COVID-19 patients: an open multicenter randomized clinical trial. *EClinicalMedicine* 2021; 37:100962.
210. Rothlin RP, Vetulli HM, Duarte M, Pelorosso FG. Telmisartan as tentative angiotensin receptor blocker therapeutic for COVID-19. *Drug Dev Res* 2020; 81:768-770.
211. Nejat R, Sadr AS, Freitas BT, Murray J, Pegan SD. Losartan inhibits SARS-CoV-2 replication in vitro. *J Pharm Pharm Sci* 2021; 24:390-399.
212. Patterson BK, seethamraju H, Dhody K, Corley MJ, Kazempour K, Lalezari J et al. CCR5 inhibition in critical COVID-19 patients decreases inflammatory cytokines, increases CD8 T-cells, and decreases SARS-CoV2 RNA in plasma by day 14. *International Journal of Infectious Diseases* 2021; 103:25-32.
213. Patterson BK, Guevara-Coto J, Yogendra R, Francisco E, Long E, Pise A. Immune-based prediction of COVID-19 severity and chronicity decoded using machine learning. *Front Immunol* 2021.
214. Li S, Jiang L, Li X, Lin F, Wang Y, Li B. Clinical and pathological investigation of patients with severe COVID-19. *JCI Insight* 2020; 5:e138070.
215. Agarwal A, Mukherjee A, Kumar G, Chatterjee P, Bhatnager T. Convalescent plasma in the management of moderate covid-19 in adults in India: open label phase II multicentre randomised controlled trial (PLACID Trial). *BMJ* 2020; 371:m3939.
216. Simonovich VA, Pratz LD, Scibona P, Beruto MV, Vallone MG. A randomized trial of convalescent plasma in COVID-19 severe pneumonia. *N Engl J Med* 2020.
217. Avendano-Sola C, Ramos-Martinez A, Munez-Rubio E, Ruiz-Antoran B, de Molina RM. Convalescent plasma for COVID-19: A multicenter, randomized clinical trial. *medRxiv* 2020.
218. Balcells ME, Rojas L, Le Corre N, Ceballos ME, Ferres M, Chang M. Early versus deferred anti-SARS-CoV-2 convalescent plasma in patients admitted for COVID-19: A randomized phase II clinical trial. *PLOS Med* 2021; 18:e1003415.
219. Janiaud P, Axfors C, Schmitt AM, Glory V, Moher D. Association of convalescent plasma treatment with clinical outcomes in patients with COVID-19. A systematic review and meta-analysis. *JAMA* 2021.
220. Li L, Zhang W, Hu Y, Tong X, Zeng S, Yang J. Effect of convalescent plasma therapy on time to clinical improvement in patients with severe and life-threatening COVID-19. A randomized clinical trial. *JAMA* 2020; 324:460-470.
221. Edwards G. Ivermectin: does P-glycoprotein play a role in neurotoxicity? *Filaria Jurnal* 2003; 3 (Suppl I):S8.
222. Thompson MA, Henderson JP, Shah PK, Rubenstein SM, Joyner MJ, Flora DB. Convalescent plasma and improved survival in patients with hematologic malignancies and COVID-19. *medRxiv* 2021.
223. Westendorf K, Zentelis S, Wang L, Foster D, Wiggin M, Lovett E. LY-CoV1404 (bebtelovimab) potently neutralizes SARS-CoV-2 variants. *bioRxiv* 2022.
224. Rosas IO, Brau N, Waters M, Go R, Hunter BD, Bhagani S et al. Tocilizumab in hospitalized patients with COVID-19 pneumonia. *medRxiv* 2020.
225. Hermine O, Mariette X, Tharaux PL, Resche-Rignon M, Porcher R. Effect of tocilizumab vs usual care in adults hospitalized with COVID-19 and moderate or severe pneumonia. A randomized Clinical Trial. *JAMA Intern Med* 2020.

226. Stone JH, Frigault MJ, Sterling-Boyd NJ, Fernandes AD, Harvey FL. Efficacy of tocilizumab in patients hospitalized with Covid-19. *N Engl J Med* 2020.
227. Salvarani C, Dolci G, Massari M, Merlo DF, Cavuto S. Effect of tocilizumab vs standard care on clinical worsening in patients hospitalized with COVID-19 pneumonia. A randomized clinical trial. *JAMA Intern Med* 2020.
228. Salama C, Han J, Yau L, Reiss WG, Kramer B. Tocilizumab in patients hospitalized with Covid-19 pneumonia. *N Engl J Med* 2020.
229. Jeffreys L, Pennington SH, Duggan J, Breen A, Jinks J. Remdesivir-Ivermectin combination displays synergistic interactions with improved in vitro antiviral activity against SARS-CoV-2. *bioRxiv* 2020.
230. Gordon AC, Mouncey PR, Rowan KM, Nichol AD, Arabi YM, Annane D. Interleukin-6 receptor antagonists in critically ill patients with COVID-19 - Preliminary report. *medRxiv* 2021.
231. Bassetti M, Kollef MH, Timsit JF. Bacterial and fungal superinfections in critically ill patients with COVID-19. *Intensive Care Med* 2020.
232. Rawson TM, Wilson RC, Holmes A. Understanding the role of bacterial and fungal infection in COVID-19. *Clinical Microbiology & Infection* 2021; 27:9-11.
233. Le Balc'h P, Pinceaux K, Pronier C, Seguin P, Reizine F. Herpes simplex virus and cytomegalovirus reactivations among severe COVID-19 patients. *Crit Care* 2020; 24:530.
234. Koehler P, Bassetti M, Chen SC, Colombo AL, Perfect JR. Defining and managing COVID-19-associated pulmonary aspergillosis: the 2020 ECMM/ISHAM consensus criteria for research and clinical guidance. *Lancet Infect Dis* 2021.
235. Ospina-Tascon GA, Calderon-Tapia LE, Garcia AF, Zarama V, Vargas MP, Vaaron J. Effect of high-flow oxygen therapy vs conventional oxygen therapy on invasive mechanical ventilation and clinical recovery in patients with severe COVID-19. A randomized clinical trial. *JAMA* 2021; 326:2161-2171.
236. Xu Q, Wang T, Quin X, Zha L. Early awake prone position combined with high-flow nasal oxygen therapy in severe COVID-19; a case series. *Crit Care* 2020; 24:250.
237. Elharrar X, Trigui Y, Dois AM, Touchon F. Use of prone positioning in nonintubated patients with COVID-19 and hypoxemic acute respiratory failure. *JAMA* 2020.
238. Reddy MP, Subramaniam A, Afroz A, Billah B, Lim ZJ, Wong SN. Prone positioning of nonintubated patients with Coronavirus Disease 2019- A systematic review and meta-analysis. *Crit Care Med* 2021.
239. Xin Y, Martin K, Morais CC, Gerard SE, Abate N, Sidhu U et al. Diminishing efficacy of prone positioning with late application in evolving lung injury. *Crit Care Med* 2021.
240. Haymet A, Bassi GL, Fraser JF. Airborne spread of SARS-CoV-2 while using high-flow nasal cannula oxygen therapy: myth or reality. *Intensive Care Med* 2020; 46:2248-2251.
241. Winslow RL, Zhou J, Windle EF, Nur I, Lall R, Ji C. SARS-CoV-2 environmental contamination from hospitalized patients with COVID-19 receiving aerosol-generating procedures. *Thorax* 2021.
242. Francone M, Lafrate F, Masci GM, Coco S, Cilia F, Manganaro L et al. Chest CT score in COVID-19 patients: correlation with disease severity and short-term prognosis. *European Radiology* 2020; 30:6808-6817.
243. Parry AH, Wani AH, Shah NN, Yaseen M, Jehangir M. Chest CT features of coronavirus disease-19 (COVID-19) pneumonia: which findings on initial CT can predict an adverse short-term outcome? *BJR Open* 2020; 2:20200016.

244. Zhang J, Meng G, Li W, Shi B, Dong H, Su Z. Relationship of chest CT score with clinical characteristics of 108 patients hospitalized with COVID-19 in Wuhan, China. *Respiratory Research* 2020; 21:180.
245. Yang R, Li X, Liu H, Zhen Y, Zhang X, Xiong Q et al. Chest CT severity score: An imaging tool for assessing severe COVID-19. *Radiology: Cardiothoracic Imaging* 2020; 2:e2000047.
246. Li K, Wu J, Wu F, Guo D, Cen L, Fang Z et al. The clinical and chest CT features associated with severe and critical COVID-19 pneumonia. *Investigative Radiology* 2020; 55:1-5.
247. Pan F, Ye T, Sun P, Gui S, Liang B, Li L. Time course of lung changes at Chest CT during recovery from Coronavirus Disease 2019 (COVID-19). *Radiology* 2021; 295:715-721.
248. Ding X, Xu J, Zhou J, Long Q. Chest CT findings of COVID-19 pneumonia by duration of symptoms. *European Journal of Radiology* 2020; 127:109009.
249. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N et al. Chest CT findings in Coronavirus disease 2019 (COVID-19): relationship to duration of infection. *Radiology* 2020; 295:685-691.
250. Ichikado K, Suga M, Muranka H, Gushima Y, Miyakawa H. Prediction of prognosis for acute respiratory distress syndrome with thin-section CT: Validation in 44 cases. *Radiology* 2006; 238:321-329.
251. Ichikado K, Suga M, Muller NL, Tangiguchi H, Kondoh Y, akira M. Acute interstitial pneumonia. Comparison of high-resolution computed tomography findings between survivors and nonsurvivors. *Am J Respir Crit Care Med* 2002; 165:1551-1556.
252. Keith P, Day M, Perkins L, Moyer L, Hewitt K, Wells A. A novel treatment approach to the novel coronavirus: an argument for the use of therapeutic plasma exchange for fulminant COVID-19. *Crit Care* 2020; 24:128.
253. Keith P, Wells AH, Hodges J, Fast SH. The therapeutic efficacy of adjunct therapeutic plasma exchange for septic shock with multiple organ failure: A single center experience. *Crit Care* 2020; 24:518.
254. Busund R, Koukline V, Utrobin U, Nedashkovsky E. Plasmapheresis in severe sepsis and septic shock: a prospective, randomised, controlled trial. *Intensive Care Med* 2002; 28:1434-1439.
255. Morath C, Weigand MA, Zeier M, Speer C, Tiwari-Heckler S. Plasma exchange in critically ill COVID-19 patients. *Crit Care* 2020; 24:481.
256. Khamis F, Al-Zakwani I, Al Hashmi S, Al Dowaiqi S, Al Bahrani M. Therapeutic plasma exchange in adults with severe COVID-19 infection. *Int J Infect Dis* 2020; 99:214-218.
257. Fernandez J, Gratacos-Gines J, Olivas P, Costa M, Nieto S, Mateo D. Plasma exchange: An effective rescue therapy in critically ill patients with Coronavirus Disease 2019 infection. *Crit Care Med* 2020.
258. Gucyetmez B, Atalan HK, Sertdemir I, Cakir U, Telci L. Therapeutic plasma exchange in patients with COVID-19 pneumonia in intensive care unit: a retrospective study. *Crit Care* 2020; 24:492.
259. Poor HD, Ventetuolo CE, Tolbert T, Chun G, Serrao G. COVID-19 critical illness pathophysiology driven by diffuse pulmonary thrombi and pulmonary endothelial dysfunction responsive to thrombolysis. *medRxiv* 2020.
260. Wang J, Najizadeh N, Moore EE, McIntyre RC, Moore PK, Veress LA. Tissue plasminogen activator (tPA) treatment for COVID-19 associated respiratory distress syndrome (ARDS): A case series. *J Thromb Haemost* 2020.

261. Abou-Arab O, Huette P, Debouvries F, Dupont H, Jounieaux V. Inhaled nitric oxide for critically ill Covid-19 patients: a prospective study. *Crit Care* 2020; 24:645.
262. Bagate F, Tuffet S, Masi P, Perier F, Razazi K. Rescue therapy with inhaled nitric oxide and almitrine in COVID-19 patients with severe acute respiratory distress syndrome. *Ann Intensive Care* 2020.
263. Caplan M, Goutay J, Bignon A, Jaillette E, Favory R. Almitrine infusion in severe acute respiratory syndrome coronavirus-2 induced acute respiratory distress syndrome: A single-center observational study. *Crit Care Med* 2020.
264. Payen D. Coronavirus disease 2019 acute respiratory failure: Almitrine drug resuscitation or resuscitating patients by almitrine? *Crit Care Med* 2020.
265. Henry MB, Lippi G. Poor survival with extracorporeal membrane oxygenation in acute respiratory distress syndrome (ARDS) due to coronavirus disease 2019 (COVID-19): Pooled analysis of early reports. *J Crit Care* 2020; 58:27-28.
266. Abrams D, Lorusso R, Vincent JL, Brodie D. ECMO during the COVID-19 pandemic: when is it unjustified. *Crit Care* 2020; 24:507.
267. Supady A, Taccone FS, Lepper PM, Ziegeler S, Staudacher DL. Survival after extracorporeal membrane oxygenation in severe COVID-19 ARDS: results from an international multicenter registry. *Crit Care Med* 2021; 25:90.
268. Barbaro RP, MacLaren G, Boonstra PS, Iwashyna TJ, Slutsky AS. Extracorporeal membrane oxygenation support in COVID-19: an international cohort study of the Extracorporeal Life Support Organization registry. *Lancet* 2020.
269. Cypel M, Keshavjee S. When to consider lung transplantation for COVID-19. *Lancet Resp Med* 2021; 8:944-946.
270. A neutralizing monoclonal antibody for hospitalized patients with Covid-19. *N Engl J Med* 2020.
271. Cerutti A, Chen K, Chorny A. Immunoglobulin responses at the mucosal interface. *Annu Rev Immunol* 2011; 29:273-293.
272. Jacobs JJ. Neutralizing antibodies mediate virus-immune pathology of COVID-19. *Med Hypotheses* 2020; 143:109884.
273. Seifirad S. Pirfenidone: A novel hypothetical treatment for COVID-19. *Medical Hypotheses* 2020; 144:11005.
274. Saba A, Vaidya PJ, Chavhan VB, Achlerkar A, Leuppi J. Combined pirfenidone, azithromycin and prednisolone in post-H1N1 ARDS pulmonary fibrosis. *Sarcoidosis Vasc Diffuse Lung Dis* 2018; 35:85-90.
275. Spagnolo P, Balestro E, Aliberti S, Cocconcilli E, Biondini D, Casa GD. Pulmonary fibrosis secondary to COVID-19: a call to arms? *Lancet Resp Med* 2020; 8:750-752.
276. George PM, Wells AU, Jenkins RG. Pulmonary fibrosis and COVID-19: the potential role for antifibrotic therapy. *Lancet Resp Med* 2020; 8:807-815.
277. Brouwer WP, Duran S, Kuijper M, Inc C. Hemoadsorption with CytoSorb shows a decreased observed versus expected 28-day all-cause mortality in ICU patients with septic shock: a propensity-score-weighted retrospective study. *Crit Care* 2019; 23:317.
278. Villa G, Romagnoli S, De Rosa S, Greco M, Resta M. Blood purification therapy with a hemodiafilter featuring enhanced adsorptive properties for cytokine removal in patients presenting COVID-19: a pilot study. *Crit Care* 2020; 24:605.

279. Ahmad Q, DePerrior SE, Dodani S, Edwards JF, Marik PE. Role of inflammatory biomarkers in the prediction of ICU admission and mortality in patients with COVID-19. *Medical Research Archives* 2020; 8:1-10.
280. Marik PE, Stephenson E. The ability of procalcitonin, lactate, white blood cell count and neutrophil-lymphocyte count ratio to predict blood stream infection. Analysis of a large database. *J Crit Care* 2020; 60:135-139.
281. Ichikado K, Muranaka H, Gushima Y, Kotani T, Nader HM, Fujimoto K et al. Fibroproliferative changes on high-resolution CT in the acute respiratory distress syndrome predict mortality and ventilator dependency: a prospective observational cohort study. *BMJ Open* 2012; 2:e000545.
282. Tan C, Huang Y, Shi F, Tan K, Ma Q, Chen Y. C-reactive protein correlates with computed tomographic findings and predicts severe COVID-19 early. *J Med Virol* 2020; 92:856-862.
283. Howell AP, Parrett JL, Malcom DR. Impact of high-dose intravenous vitamin C for treatment of sepsis on point-of-care blood glucose readings. *J Diabetes Sci Technol* 2019.
284. Stephenson E, Hooper MH, Marik PE. Vitamin C and Point of Care glucose measurements: A retrospective, Observational study [Abstract]. *Chest* 2018; 154 (suppl.):255a.
285. Hekimian G, Kerneis M, Zeitouni M, Cohen-Aubart F, Chommeloux J. COVID-19 acute myocarditis and multisystem inflammatory syndrome in Adult Intensive and cardiac Care Units. *Chest* 2020.
286. Ma KL, Liu ZH, Cao CF, Liu MK, Liao J. COVID-19 myocarditis and severity factors: An adult cohort study. *medRxiv* 2020.
287. Brosnahan SB, Bhatt A, Berger JS, Yuriditsky E, Iturrate E. COVID-19 pneumonia hospitalizations followed by re-presentation for presumed thrombotic event. *Chest* 2020.
288. Giannis D, allen SL, Tsang J, Flint S, Pinhasov T, Williams S. Post-discharge thromboembolic outcomes and mortality of hospitalized COVID-19 patients: The CORE-19 registry. *Blood* 2021.
289. Spyropoulos AC, Lipardi C, Xu J, Peluso C, Spiro TE. Modified IMPROVE VTE Risk Score and elevated D-Dimer identify a high venous thromboembolism risk in acutely ill medical population for extended thromboprophylaxis. *TH Open* 2020; 4:e59-e65.
290. Kunutsor SK, Seidu S, Blom AW, Khunti K. Serum C-reactive protein increases the risk of venous thromboembolism: a prospective study and meta-analysis of published prospective evidence. *Eur J Epidemiol* 2017; 32:657-667.

Review of the Emerging Evidence Demonstrating the Efficacy of Ivermectin in the Prophylaxis and Treatment of COVID-19

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Keywords

Ivermectin, COVID-19, infectious disease, pulmonary infection, respiratory failure

Abstract

In March 2020, the Front Line COVID-19 Critical Care Alliance (FLCCC) was created and led by Professor Paul E. Marik to continuously review the rapidly emerging basic science, translational, and clinical data to develop a treatment protocol for COVID-19. The FLCCC then recently discovered that ivermectin, an anti-parasitic medicine, has highly potent anti-viral and anti-inflammatory properties against COVID-19. They then identified repeated, consistent, large magnitude improvements in clinical outcomes in multiple, large, randomized and observational controlled trials in both prophylaxis and treatment of COVID-19. Further, data showing impacts on population wide health outcomes have

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resulted from multiple, large “natural experiments” that occurred when various city mayors and regional health ministries within South American countries initiated “ivermectin distribution” campaigns to their citizen populations in the hopes the drug would prove effective. The tight, reproducible, temporally associated decreases in case counts and case fatality rates in each of those regions compared to nearby regions without such campaigns, suggest that ivermectin may prove to be a global solution to the pandemic. This was further evidenced by the recent incorporation of ivermectin as a prophylaxis and treatment agent for COVID-19 in the national treatment guidelines of Belize, Macedonia, and the state of Uttar Pradesh in Northern India, populated by 210 million people. To our knowledge, the current review is the earliest to compile sufficient clinical data to demonstrate the strong signal of therapeutic efficacy as it is based on numerous clinical trials in multiple disease phases. One limitation is that half the controlled trials have been published in peer-reviewed publications, with the remainder taken from manuscripts uploaded to medicine pre-print servers. Although it is now standard practice for trials data from pre-print servers to immediately influence therapeutic practices during the pandemic, given the controversial therapeutics adopted as a result of this practice, the FLCCC argues that it is imperative that our major national and international health care agencies devote the necessary resources to more quickly validate these studies and confirm the major, positive epidemiological impacts that have been recorded when ivermectin is widely distributed among populations with a high incidence of COVID-19 infections.

Introduction

In March 2020, an expert panel called the Front Line COVID-19 Critical Care Alliance (FLCCC) was created and led by Professor Paul E. Marik.¹ The group of expert critical care physicians and thought leaders immediately began continuously reviewing the rapidly emerging basic science, translational, and clinical data in COVID-19 which then led to the early creation of a treatment protocol for hospitalized patients based on the core therapeutic interventions of methylprednisolone, ascorbic acid, thiamine and heparin (MATH+), with the “+” referring to multiple, optional adjunctive treatments. The MATH+ protocol was based on the collective expertise of the group in both the research and treatment of multiple other severe infections causing lung injury.

Two manuscripts reviewing different aspects of both the scientific rationale and evolving published clinical evidence in support of the MATH+ protocol were published in major medical journals at two different time points in the pandemic (Kory et al., 2020; Marik et al., 2020). The most recent paper reported a 6.1% hospital mortality rate in COVID-19 patients measured in the two U.S. hospitals that systematically adopted the MATH+ protocol (Kory et al., 2020). This was a markedly decreased mortality rate compared to the 23.0% hospital mortality rate calculated from a review of 45 studies including over 230,000 patients (unpublished data; available on request).

Although the adoption of MATH+ has been considerable, it largely occurred only after the treatment efficacy of the majority of the protocol components (corticosteroids, ascorbic acid, heparin, statins, Vitamin D, melatonin) were either validated in subsequent randomized controlled trials or more strongly supported with large observational data sets in COVID-19 (Entrenas Castillo et al., 2020; Horby et al., 2020; Jehi et al., 2020; Nadkarni et al., 2020; Rodriguez-Nava et al., 2020; Zhang et al., 2020a; Zhang et al., 2020b). Despite the plethora of supportive evidence, the MATH+ protocol for hospitalized patients has not yet become widespread. Further, the world is in a worsening crisis with

¹ <https://www.flccc.net>

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the potential of again overwhelming hospitals and ICU's. As of December 31st, 2020, the number of deaths attributed to COVID-19 in the United States reached 351,695 with over 7.9 million active cases, the highest number to date.² Multiple European countries have now begun to impose new rounds of restrictions and lockdowns.³

Further compounding these alarming developments was a wave of recently published results from therapeutic trials done on medicines thought effective for COVID-19 which found a lack of impact on mortality with use of remdesivir, hydroxychloroquine, lopinavir/ritonavir, interferon, convalescent plasma, tocilizumab, and mono-clonal antibody therapy (Agarwal et al., 2020; Consortium, 2020; Hermine et al., 2020; Salvarani et al., 2020).⁴ One year into the pandemic, the only therapy considered "proven" as a life-saving treatment in COVID-19 is the use of corticosteroids in patients with moderate to severe illness (Horby et al., 2020). Similarly, most concerning is the fact that little has proven effective to prevent disease progression to prevent hospitalization.

Fortunately, it now appears that ivermectin, a widely used anti-parasitic medicine with known anti-viral and anti-inflammatory properties is proving a highly potent and multi-phase effective treatment against COVID-19. Although growing numbers of the studies supporting this conclusion have passed through peer review, approximately half of the remaining trials data are from manuscripts uploaded to medical pre-print servers, a now standard practice for both rapid dissemination and adoption of new therapeutics throughout the pandemic. The FLCCC expert panel, in their prolonged and continued commitment to reviewing the emerging medical evidence base, and considering the impact of the recent surge, has now reached a consensus in recommending that ivermectin for both prophylaxis and treatment of COVID-19 should be systematically and globally adopted.

The FLCCC recommendation is based on the following set of conclusions derived from the existing data, which will be comprehensively reviewed below:

- 1) Since 2012, multiple *in vitro* studies have demonstrated that Ivermectin inhibits the replication of many viruses, including influenza, Zika, Dengue and others (Mastrangelo et al., 2012; Wagstaff et al., 2012; Tay et al., 2013; Götz et al., 2016; Varghese et al., 2016; Atkinson et al., 2018; Lv et al., 2018; King et al., 2020; Yang et al., 2020).
- 2) Ivermectin inhibits SARS-CoV-2 replication and binding to host tissue via several observed and proposed mechanisms (Caly et al., 2020a).
- 3) Ivermectin has potent anti-inflammatory properties with *in vitro* data demonstrating profound inhibition of both cytokine production and transcription of nuclear factor- κ B (NF- κ B), the most potent mediator of inflammation (Zhang et al., 2008; Ci et al., 2009; Zhang et al., 2009).
- 4) Ivermectin significantly diminishes viral load and protects against organ damage in multiple animal models when infected with SARS-CoV-2 or similar coronaviruses (Arevalo et al., 2020; de Melo et al., 2020).
- 5) Ivermectin prevents transmission and development of COVID-19 disease in those exposed to infected patients (Behera et al., 2020; Bernigaud et al., 2020; Carvallo et al., 2020b; Elgazzar et al., 2020; Hellwig and Maia, 2020; Shouman, 2020).

² <https://www.worldometers.info/coronavirus/country/us/>

³ <https://www.npr.org/sections/coronavirus-live-updates/2020/12/15/946644132/some-european-countries-batten-down-for-the-holidays-with-new-coronavirus-lockdo>

⁴ <https://www.lilly.com/news/stories/statement-activ3-clinical-trial-nih-covid19>

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- 6) Ivermectin hastens recovery and prevents deterioration in patients with mild to moderate disease treated early after symptoms (Carvalho et al., 2020a;Elgazzar et al., 2020;Gorial et al., 2020;Khan et al., 2020;Mahmud, 2020;Morgenstern et al., 2020;Robin et al., 2020).
- 7) Ivermectin hastens recovery and avoidance of ICU admission and death in hospitalized patients (Elgazzar et al., 2020;Hashim et al., 2020;Khan et al., 2020;Niaee et al., 2020;Portmann-Baracco et al., 2020;Rajter et al., 2020;Spoorthi V, 2020).
- 8) Ivermectin reduces mortality in critically ill patients with COVID-19 (Elgazzar et al., 2020;Hashim et al., 2020;Rajter et al., 2020).
- 9) Ivermectin leads to striking reductions in case-fatality rates in regions with widespread use (Chamie, 2020).⁵
- 10) The safety, availability, and cost of ivermectin is nearly unparalleled given its near nil drug interactions along with only mild and rare side effects observed in almost 40 years of use and billions of doses administered (Kircik et al., 2016).
- 11) The World Health Organization has long included ivermectin on its “List of Essential Medicines”.⁶

Following is a comprehensive review of the available efficacy data as of December 12, 2020, taken from *in vitro*, animal, clinical, and real-world studies all showing the above impacts of ivermectin in COVID-19.

History of ivermectin

In 1975, Professor Satoshi Omura at the Kitasato institute in Japan isolated an unusual *Streptomyces* bacteria from the soil near a golf course along the south east coast of Honshu, Japan. Omura, along with William Campbell, found that the bacterial culture could cure mice infected with the round-worm *Heligmosomoides polygyrus*. Campbell isolated the active compounds from the bacterial culture, naming them "avermectins" and the bacterium *Streptomyces avermitilis* for the compounds' ability to clear mice of worms (Crump and Omura, 2011). Despite decades of searching around the world, the Japanese microorganism remains the only source of avermectin ever found. Ivermectin, a derivative of avermectin, then proved revolutionary. Originally introduced as a veterinary drug, it soon after made historic impacts in human health, improving the nutrition, general health and well-being of billions of people worldwide ever since it was first used to treat Onchocerciasis (river blindness) in humans in 1988. It proved ideal in many ways, given that it was highly effective, broad-spectrum, safe, well tolerated and could be easily administered (Crump and Omura, 2011). Although it was used to treat a variety of internal nematode infections, it was most known as the essential mainstay of two global disease elimination campaigns that has nearly eliminated the world of two of its most disfiguring and devastating diseases. The unprecedented partnership between Merck & Co. Inc., and the Kitasato Institute combined with the aid of international health care organizations has been recognized by many experts as one of the greatest medical accomplishments of the 20th century. One example was the decision by Merck & Co to donate ivermectin doses to support the Meztican Donation Program which then provided over 570 million treatments in its first 20 years alone (Tambo et al.). Ivermectins' impacts in controlling Onchocerciasis and Lymphatic filariasis, diseases which

⁵ <https://trialsitenews.com/an-old-drug-tackles-new-tricks-ivermectin-treatment-in-three-brazilian-towns/>

⁶ <https://www.who.int/publications/i/item/WHOMVPEMPIAU201907>

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blighted the lives of billions of the poor and disadvantaged throughout the tropics, is why its discoverers were awarded the Nobel Prize in Medicine in 2015 and the reason for its inclusion on the WHO's "List of Essential Medicines." Further, it has also been used to successfully overcome several other human diseases and new uses for it are continually being found (Crump and Omura, 2011).

Pre-Clinical Studies of Ivermectin's activity against SARS-CoV-2

Since 2012, a growing number of cellular studies have demonstrated that ivermectin has anti-viral properties against an increasing number of RNA viruses, including influenza, Zika, HIV, Dengue, and most importantly, SARS-CoV-2 (Mastrangelo et al., 2012;Wagstaff et al., 2012;Tay et al., 2013;Götz et al., 2016;Varghese et al., 2016;Atkinson et al., 2018;Lv et al., 2018;King et al., 2020;Yang et al., 2020). Insights into the mechanisms of action by which ivermectin both interferes with the entrance and replication of SARS-CoV-2 within human cells are mounting. Caly et al first reported that ivermectin significantly inhibits SARS-CoV-2 replication in a cell culture model, observing the near absence of all viral material 48h after exposure to ivermectin (Caly et al., 2020b). However, some questioned whether this observation is generalizable clinically given the inability to achieve similar tissue concentrations employed in their experimental model using standard or even massive doses of ivermectin (Bray et al., 2020;Schmith et al., 2020). It should be noted that the concentrations required for effect in cell culture models bear little resemblance to human physiology given the absence of an active immune system working synergistically with a therapeutic agent such as ivermectin. Further, prolonged durations of exposure to a drug likely would require a fraction of the dosing in short term cell model exposure. Further, multiple co-existing or alternate mechanisms of action likely explain the clinical effects observed, such as the competitive binding of ivermectin with the host receptor-binding region of SARS-CoV-2 spike protein, as proposed in six molecular modeling studies (Dayer, 2020; Hussien and Abdelaziz, 2020;Lehrer and Rheinstein, 2020;Maurya, 2020;Nallusamy et al., 2020; Suravajhala et al., 2020). In four of the studies, ivermectin was identified as having the highest or among the highest of binding affinities to spike protein S1 binding domains of SARS-CoV-2 among hundreds of molecules collectively examined, with ivermectin not being the particular focus of study in four of these studies (Schein, 2020). This is the same mechanism by which viral antibodies, in particular, those generated by the Pfizer and Moderna vaccines, contain the SARS-CoV-2 virus. The high binding activity of ivermectin to the SARS-CoV-2 spike protein could limit binding to either the ACE-2 receptor or sialic acid receptors, respectively either preventing cellular entry of the virus or preventing hemagglutination, a recently proposed pathologic mechanism in COVID-19 (Dasgupta J, 2020;Dayer, 2020;Lehrer and Rheinstein, 2020;Maurya, 2020;Schein, 2020). Ivermectin has also been shown to bind to or interfere with multiple essential structural and non-structural proteins required by the virus in order to replicate (Lehrer and Rheinstein, 2020;Sen Gupta et al., 2020). Finally, ivermectin also binds to the SARS-CoV-2 RNA-dependent RNA polymerase (RdRp), thereby inhibiting viral replication (Swargiary, 2020).

Arevalo et al investigated in a murine model infected with a type 2 family RNA coronavirus similar to SARS-CoV-2, (mouse hepatitis virus), the response to 500 mcg/kg of ivermectin vs. placebo (Arevalo et al., 2020). The study included 40 infected mice, with 20 treated with ivermectin, 20 with phosphate buffered saline, and then 16 uninfected control mice that were also given phosphate buffered saline. At day 5, all the mice were euthanized to obtain tissues for examination and viral load assessment. The 20 non-ivermectin treated infected mice all showed severe hepatocellular necrosis surrounded by a severe lymphoplasmacytic inflammatory infiltration associated with a high hepatic

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viral load (52,158 AU), while in the ivermectin treated mice a much lower viral load was measured (23,192 AU; $p < 0.05$), with only few livers in the ivermectin treated mice showing histopathological damage such that the differences between the livers from the uninfected control mice were not statistically significant.

Dias De Melo and colleagues recently posted the results of a study they did with golden hamsters that were intranasally inoculated with SARS-CoV-2 virus, and at the time of the infection, the animals also received a single subcutaneous injection of ivermectin at a dose of 0.4mg/kg on day 1 (de Melo et al., 2020). Control animals received only the physiologic solution. They found the following among the ivermectin treated hamsters; a dramatic reduction in anosmia (33.3% vs 83.3%, $p = .03$) which was also sex-dependent in that the male hamsters exhibited a reduction in clinical score while the treated female hamsters failed to show any sign of anosmia. They also found significant reductions in cytokine concentrations in the nasal turbinate's and lungs of the treated animals despite the lack of apparent differences in viral titers.

Despite these mounting insights into the existing and potential mechanisms of action of ivermectin both as a prophylactic and treatment agent, it must be emphasized that significant research gaps remain and that many further *in vitro* and animal studies should be undertaken to better define not only these mechanisms but also to further support ivermectin's role as a prophylactic agent, especially in terms of the optimal dose and frequency required.

Pre-Clinical studies of ivermectin's anti-inflammatory properties

Given that little viral replication occurs in the later phases of COVID-19, nor can virus be cultured, and only in a minority of autopsies can viral cytopathic changes be found (Perera et al., 2020; Polak et al., 2020; Young et al., 2020), the most likely pathophysiologic mechanism is that identified by Li et al. where they showed that the non-viable RNA fragments of SARS-CoV-2 leads to a high mortality and morbidity in COVID-19 via the provocation of an overwhelming and injurious inflammatory response (Li et al., 2013). Based on these insights and the clinical benefits of ivermectin in late phase disease to be reviewed below, it appears that the increasingly well described *in vitro* properties of ivermectin as an inhibitor of inflammation are far more clinically potent than previously recognized. The growing list of studies demonstrating the anti-inflammatory properties of ivermectin include its ability to; inhibit cytokine production after lipopolysaccharide exposure, downregulate transcription of NF-kB, and limit the production of both nitric oxide and prostaglandin E₂ (Zhang et al., 2008; Ci et al., 2009; Zhang et al., 2009).

Exposure prophylaxis studies of ivermectin's ability to prevent transmission of COVID-19

Data is also now available showing large and statistically significant decreases in the transmission of COVID-19 among human subjects based on data from three randomized controlled trials (RCT) and five observational controlled trials (OCT) with four of the eight (two of them RCT's) published in peer-reviewed journals (Behera et al., 2020; Bernigaud et al., 2020; Carvallo et al., 2020b; Chala, 2020; Elgazzar et al., 2020; Hellwig and Maia, 2020; Shouman, 2020).

Elgazzar and colleagues at Benha University in Egypt randomized 200 health care and household contacts of COVID-19 patients where the intervention group consisted of 100 patients given a high dose of 0.4mg/kg on day 1 and a second dose on day 7 in addition to wearing personal

protective equipment (PPE), while the control group of 100 contacts wore PPE only (Elgazzar et al., 2020). They reported a large and statistically significant reduction in contacts testing positive by RT-PCR when treated with ivermectin vs. controls, 2% vs 10%, $p < .05$.

Shouman conducted an RCT at Zagazig University in Egypt, including 340 (228 treated, 112 control) family members of patients positive for SARS-CoV-2 via PCR (Shouman, 2020). Ivermectin, (approximately 0.25mg/kg) was administered twice, on the day of the positive test and 72 hours later. After a two-week follow up, a large and statistically significant decrease in COVID-19 symptoms among household members treated with ivermectin was found, 7.4% vs. 58.4%, $p < .001$.

Recently Alam et al from Bangladesh performed a prospective observational study of 118 patients that were evenly split into those that volunteered for either the treatment or control arms, described as a persuasive approach. Although this method, along with the study being unblinded likely led to confounders, the differences between the two groups were so large (6.7% vs. 73.3%, $p < .001$) and similar to the other prophylaxis trial results that confounders alone are unlikely to explain such a result (Alam et al., 2020). Carvallo et al also performed a prospective observational trial where they gave healthy volunteers ivermectin and carrageenan daily for 28 days and matched them to similarly healthy controls who did not take the medicines (Carvallo et al., 2020b). Of the 229 study subjects, 131 were treated with 0.2mg of ivermectin drops taken by mouth five times per day. After 28 days, none of those receiving ivermectin prophylaxis group had tested positive for SARS-COV-2 versus 11.2% of patients in the control arm ($p < .001$). In a much larger follow-up observational controlled trial by the same group that included 1,195 health care workers, they found that over a 3-month period, there were no infections recorded among the 788 workers that took weekly ivermectin prophylaxis while 58% of the 407 controls had become ill with COVID-19. This study demonstrates that protection against transmission can be achieved among high-risk health care workers by taking 12mg once weekly (Carvallo et al., 2020b). The Carvallo IVERCAR protocol was also separately tested in a prospective RCT by the Health Ministry of Tucuman, Argentina where they found that among 234 health care workers, the intervention group that took 12 mg once weekly, only 3.4% contracted COVID-19 vs. 21.4% of controls, $p < .0001$ (Chala, 2020).

The need for weekly dosing in the Carvallo study over a 4 month period may not have been necessary given that, in a recent RCT from Dhaka, Bangladesh, the intervention group ($n=58$) took 12mg only once monthly for a similar 4 month period and also reported a large and statistically significant decrease in infections compared to controls, 6.9% vs. 73.3%, $p < .05$ (Alam et al., 2020). Then, in a large retrospective observational case-control study from India, Behera et al. reported that among 186 case-control pairs ($n=372$) of health care workers, they identified 169 participants that had taken some form of prophylaxis, with 115 that had taken ivermectin prophylaxis (Behera et al., 2020). After matched pair analysis, they reported that in the workers who had taken two dose ivermectin prophylaxis, the odds ratio for contracting COVID-19 was markedly decreased (0.27, 95% CI, 0.15–0.51). Notably, one dose prophylaxis was not found to be protective in this study. Based on both their study finding and the Egyptian prophylaxis study, the All-India Institute of Medical Sciences instituted a prophylaxis protocol for their health care workers where they now take two 0.3mg/kg doses of ivermectin 72 hours apart and repeat the dose monthly.

Data which further illuminates the protective role of ivermectin against COVID-19 comes from a study of nursing home residents in France which reported that in a facility that suffered a scabies outbreak where all 69 residents and 52 staff were treated with ivermectin (Behera et al., 2020), they found that during the time period surrounding this event, 7/69 residents fell ill with COVID-19 (10.1%). In this group with an average age of 90 years, only one resident required oxygen support and

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no resident died. In a matched control group of residents from surrounding facilities, they found 22.6% of residents fell ill and 4.9% died.

Likely the most definitive evidence supporting the efficacy of ivermectin as a prophylaxis agent was published recently in the International Journal of Anti-Microbial agents where a group of researchers analyzed data using the prophylactic chemotherapy databank administered by the WHO along with case counts obtained by Worldometers, a public data aggregation site used by among others, the Johns Hopkins University (Hellwig and Maia, 2020). When they compared the data from countries with active ivermectin mass drug administration programs for the prevention of parasite infections, they discovered that the COVID-19 case counts were significantly lower in the countries with recently active programs, to a high degree of statistical significance, $p < .001$.

Figure 1 below presents a meta-analysis performed by the study authors of the controlled ivermectin prophylaxis trials in COVID-19.

Figure 1. Meta-analysis of ivermectin prophylaxis trials in COVID-19

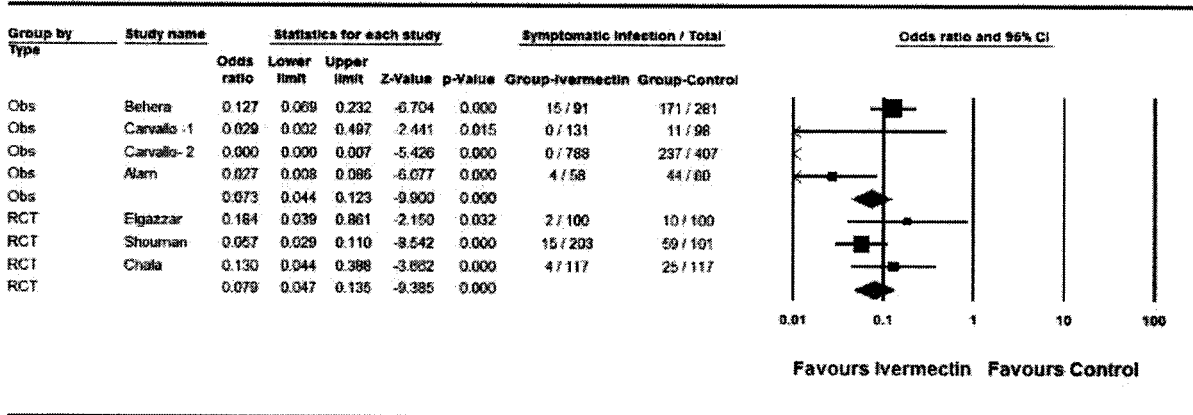


Figure 1 legend – OBS: Observational study, RCT: Randomized Controlled Trial

Symbols – Squares: indicate treatment effect of an individual study. Large diamond: reflect summary of study design immediately above. Small diamond: sum effect of all trial designs. Size of each symbol correlates with the size of the confidence interval around the point estimate of treatment effect with larger sizes indicating a more precise confidence interval.

Further data supporting a role for ivermectin in decreasing transmission rates can be found from South American countries where, in retrospect, large “natural experiments” appear to have occurred. For instance, beginning as early as May, various regional health ministries and governmental authorities within Peru, Brazil, and Paraguay initiated “ivermectin distribution” campaigns to their citizen populations (Chamie, 2020). In one such example from Brazil, the cities of Itajai, Macapa, and Natal distributed massive amounts of ivermectin doses to their city’s population, where, in the case of Natal, 1 million doses were distributed.⁷ The distribution campaign of Itajai began in mid-July, and in Natal they began on June 30th, and in Macapa, the capital city of Amapa and others nearby incorporated ivermectin into their treatment protocols in late May after they were particularly hard hit in April. The data in Table 1 below was obtained from the official Brazilian government site and the national press

⁷ <https://trialsitenews.com/an-old-drug-tackles-new-tricks-ivermectin-treatment-in-three-brazilian-towns/>

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consortium and show large decreases in case counts in the three cities soon after distribution began compared to their neighboring cities without such campaigns.

The decreases in case counts among the three Brazilian cities shown in Table 1 was also associated with reduced mortality rates as seen in Table 2 below.

Table 1. Comparison of case count decreases among Brazilian cities with and without ivermectin distribution campaigns (bolded cities distributed ivermectin, neighboring regional city below did not)

REGION	NEW CASES	JUNE	JULY	AUGUST	POPULATION 2020 (1000)	% DECLINE IN NEW CASES BETWEEN JUNE AND AUGUST 2020
South	Itajaí	2123	2854	998	223	- 53 %
	Chapecó	1760	1754	1405	224	- 20 %
North	Macapá	7966	2481	2370	503	- 70 %
	Ananindeua	1520	1521	1014	535	- 30 %
North East	Natal	9009	7554	1590	890	- 82 %
	João Pessoa	9437	7963	5384	817	- 43 %

Table 2. Change in death rates among neighboring regions in Brazil (bolded regions contained a major city that distributed Ivermectin to its citizens, the other regions did not)

REGION	STATE	% CHANGE IN AVERAGE DEATHS/ WEEK COMPARED TO 2 WEEKS PRIOR
South	Santa Catarina	- 36 %
	PARANÁ	- 3 %
	Rio Grande do Sul	- 5 %
North	Amapá	- 75 %
	AMAZONAS	- 42 %
	Pará	+ 13 %
North East	Rio Grande do Norte	- 65 %
	CEARÁ	+ 62 %
	Paraíba	- 30 %

Clinical studies on the efficacy of ivermectin in treating mildly ill outpatients

Currently, seven trials which include a total of over 3,000 patients with mild outpatient illness have been completed, a set comprised of 7 RCT's and four case series (Babalola et al., 2020; Cadegiani et al., 2020; Carvalho et al., 2020a; Chaccour et al., 2020; Chowdhury et al., 2020; Espitia-Hernandez et al., 2020; Gorial et al., 2020; Hashim et al., 2020; Khan et al., 2020; Mahmud, 2020; Podder et al., 2020; Ravikirti et al., 2021).

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The largest, a double blinded RCT by Mahmud et al. was conducted in Dhaka, Bangladesh and targeted 400 patients with 363 patients completing the study (Mahmud, 2020). In this study, as in many other of the clinical studies to be reviewed, either a tetracycline (doxycycline) or macrolide antibiotic (azithromycin) was included as part of the treatment. The importance of including antibiotics such as doxycycline or azithromycin is unclear, however, both tetracycline and macrolide antibiotics have recognized anti-inflammatory, immunomodulatory, and even antiviral effects (58-61). Although the posted data from this study does not specify the amount of mildly ill outpatients vs. hospitalized patients treated, important clinical outcomes were profoundly impacted, with increased rates of early improvement (60.7% vs. 44.4% $p < .03$) and decreased rates of clinical deterioration (8.7% vs 17.8%, $p < .02$). Given that mildly ill outpatients mainly comprised the study cohort, only two deaths were observed (both in the control group).

Ravikirti performed a double-blind RCT of 115 patients, and although the primary outcome of PCR positivity on Day 6 was no different, the secondary outcome of mortality was 0% vs. 6.9%, $p = .019$ (Ravikirti et al., 2021). Babalola in Nigeria also performed a double blind-RCT of 62 patients, and, in contrast to Ravikirti, they found a significant difference in viral clearance between both the low and high dose treatment groups and controls in a dose dependent fashion, $p = .006$ (Babalola et al.).

Another RCT by Hashim et al. in Baghdad, Iraq included 140 patients equally divided; the control group received standard care, the treated group included a combination of both outpatient and hospitalized patients (Hashim et al., 2020). In the 96 patients with mild-to-moderate outpatient illness, they treated 48 patients with a combination of ivermectin/doxycycline and standard of care and compared outcomes to the 48 patients treated with standard of care alone. The standard of care in this trial included many elements of the MATH+ protocol, such as dexamethasone 6mg/day or methylprednisolone 40mg twice per day if needed, Vitamin C 1000mg twice/day, Zinc 75–125mg/day, Vitamin D3 5000 IU/day, azithromycin 250mg/day for 5 days, and acetaminophen 500mg as needed. Although no patients in either group progressed or died, the time to recovery was significantly shorter in the ivermectin treated group (6.3 days vs 13.7 days, $p < .0001$).

Chaccour et al conducted a small, double-blinded RCT in Spain where they randomized 24 patients to ivermectin vs placebo and although they found no difference in PCR positivity at day 7, they did find statistically significant decreases in viral loads, patient days of anosmia (76 vs 158, $p < .05$), and patient days with cough (68 vs 98, $p < .05$) (Chaccour et al., 2020).

Another RCT of ivermectin treatment in 116 outpatients was performed by Chowdhury et al. in Bangladesh where they compared a group of 60 patients treated with the combination of ivermectin/doxycycline to a group of 60 patients treated with hydroxychloroquine/doxycycline with a primary outcome of time to negative PCR (Chowdhury et al., 2020). Although they found no difference in this outcome, in the treatment group, the time to symptomatic recovery approached statistical significance (5.9 days vs. 7.0 days, $p = .07$). In another smaller RCT of 62 patients by Podder et al., they also found a shorter time to symptomatic recovery that approached statistical significance (10.1 days vs 11.5 days, $p > .05$, 95% CI, 0.86–3.67) (Podder et al., 2020).

A medical group in the Dominican Republic reported a case series of 2,688 consecutive symptomatic outpatients seeking treatment in the emergency room, the majority of whom were diagnosed using a clinical algorithm. The patients were treated with high dose ivermectin of 0.4mg/kg for one dose along with five days of azithromycin. Only 16 of the 2,688 patients (0.59%) required subsequent hospitalization with one death recorded (Morgenstern et al., 2020).

In another case series of 100 patients in Bangladesh, all treated with a combination of 0.2mg/kg ivermectin and doxycycline, they found that no patient required hospitalization nor died, and all patients' symptoms improved within 72 hours (Robin et al., 2020).

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A case series from Argentina reported on a combination protocol which used ivermectin, aspirin, dexamethasone and enoxaparin. In the 135 mild illness patients, all survived (Carvalho et al., 2020a). Similarly, a case series from Mexico of 28 consecutively treated patients with ivermectin, all were reported to have recovered with an average time to full recovery of only 3.6 days (Espitia-Hernandez et al., 2020).

Clinical studies of the efficacy of ivermectin in hospitalized patients

Studies of ivermectin amongst more severely ill hospitalized patients include 6 RCT's, 5 OCTs, and a database analysis study (Ahmed et al., 2020; Budhiraja et al., 2020; Camprubi et al., 2020; Chachar et al., 2020; Elgazzar et al., 2020; Gorial et al., 2020; Hashim et al., 2020; Khan et al., 2020; Niaee et al., 2020; Portmann-Baracco et al., 2020; Rajter et al., 2020; Soto-Becerra et al., 2020; Spoorthi V, 2020).

The largest RCT in hospitalized patients was performed concurrent with the prophylaxis study reviewed above by Elgazzar et al (Elgazzar et al., 2020). 400 patients were randomized amongst 4 treatment groups of 100 patients each. Groups 1 and 2 included mild/moderate illness patients only, with Group 1 treated with one dose 0.4mg/kg ivermectin plus standard of care (SOC) and Group 2 received hydroxychloroquine (HCQ) 400mg twice on day 1 then 200mg twice daily for 5 days plus standard of care. There was a statistically significant lower rate of progression in the ivermectin treated group (1% vs. 22%, $p < .001$) with no deaths and 4 deaths respectively. Groups 3 and 4 all included only severely ill patients, with group 3 again treated with single dose of 0.4mg/kg plus SOC while Group 4 received HCQ plus SOC. In this severely ill subgroup, the differences in outcomes were even larger, with lower rates of progression 4% vs. 30%, and mortality 2% vs 20% ($p < .001$).

The one largely outpatient RCT done by Hashim reviewed above also included 22 hospitalized patients in each group. In the ivermectin/doxycycline treated group, there were 11 severely ill patients and 11 critically ill patients while in the standard care group, only severely ill patients ($n=22$) were included due to their ethical concerns of including critically ill patients in the control group (45). This decision led to a marked imbalance in the severity of illness between these hospitalized patient groups. However, despite the mismatched severity of illness between groups and the small number of patients included, beneficial differences in outcomes were seen, but not all reached statistical significance. For instance, there was a large reduction in the rate of progression of illness (9% vs. 31.8%, $p=0.15$) and, most importantly, there was a large difference in mortality amongst the severely ill groups which reached a borderline statistical significance, (0% vs 27.3%, $p=.052$). Another important finding was the surprisingly low mortality rate of 18% found among the subset of critically ill patients, all of whom were treated with ivermectin.

A recent RCT from Iran found a dramatic reduction in mortality with ivermectin use (Niaee et al., 2020). Among multiple ivermectin treatment arms (different ivermectin dosing strategies were used in the intervention arms), the average mortality was reported as 3.3% while the average mortality within the standard care and placebo arms was 18.8%, with an OR of 0.18 (95% CI 0.06-0.55, $p < .05$).

Spoorthi and Sasanak performed a prospective RCT of 100 hospitalized patients whereby they treated 50 with ivermectin and doxycycline while the 50 controls were given a placebo consisting of Vitamin B6 (Spoorthi V, 2020). Although no deaths were reported in either group, the ivermectin treatment group had a shorter hospital LOS 3.7 days vs 4.7 days, $p=.03$, and a shorter time to complete resolution of symptoms, 6.7 days vs 7.9 days, $p=.01$.

The largest OCT ($n=280$) in hospitalized patients was done by Rajter et al. at Broward Health Hospitals in Florida and was recently published in the major medical journal *Chest* (43). They

performed a retrospective OCT with a propensity matched design on 280 consecutive treated patients and compared those treated with ivermectin to those without. 173 patients were treated with ivermectin (160 received a single dose, 13 received a 2nd dose at day 7) while 107 were not (Rajter et al., 2020). In both unmatched and propensity matched cohort comparisons, similar, large, and statistically significant lower mortality was found amongst ivermectin treated patients (15.0% vs. 25.2%, $p=.03$). Further, in the subgroup of patients with severe pulmonary involvement, mortality was profoundly reduced when treated with ivermectin (38.8% vs. 80.7%, $p=.001$).

Another large OCT in Bangladesh compared 115 pts treated with ivermectin to a standard care cohort consisting of 133 patients (Khan et al., 2020). Despite a significantly higher proportion of patients in the ivermectin group being male (i.e., with well-described, lower survival rates in COVID), the groups were otherwise well matched, yet the mortality decrease was statistically significant (0.9% vs. 6.8%, $p<.05$). The largest OCT is a study from Brazil which included almost 1,500 patients (Portmann-Baracco et al., 2020). Although the primary data was not provided, they reported that in 704 hospitalized patients treated with a single dose of 0.15mg/kg ivermectin compared to 704 controls, overall mortality was reduced (1.4% vs. 8.5%, HR 0.2, 95% CI 0.12-0.37, $p<.0001$). Similarly, in the patients on mechanical ventilation, mortality was also reduced (1.3% vs. 7.3%). A small study from Baghdad, Iraq compared 16 ivermectin treated patients to 71 controls (Gorial et al., 2020). This study also reported a significant reduction in length of hospital stay (7.6 days vs. 13.2 days, $p<.001$) in the ivermectin group. In a study reporting on the first 1000 patients treated in a hospital in India, they found that in the 34 patients treated with ivermectin alone, all recovered and were discharged, while in the over 900 patients treated with other agents, there was an overall mortality of 11.1% (Budhiraja et al., 2020).

One retrospective analysis of a database of hospitalized patients compared responses in patients receiving ivermectin, azithromycin, hydroxychloroquine or combinations of these medicines. In this study, no benefit for ivermectin was found, however the treatment groups in this analysis all included a number of patients who died on day 2, while in the control groups no early deaths occurred, thus the comparison appears limited (Soto-Becerra et al., 2020).

Meta-analyses of the above controlled treatment trials were performed by the study authors focused on the two important clinical outcomes: time to clinical recovery and mortality (Figures 2 and 3). The consistent and reproducible signals leading to large overall statistically significant benefits from within both study designs is remarkable, especially given that in several of the studies treatment was initiated late in the disease course.

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Figure 2. Meta-analysis of the outcome of time to clinical recovery from controlled trials of ivermectin treatment in COVID-19

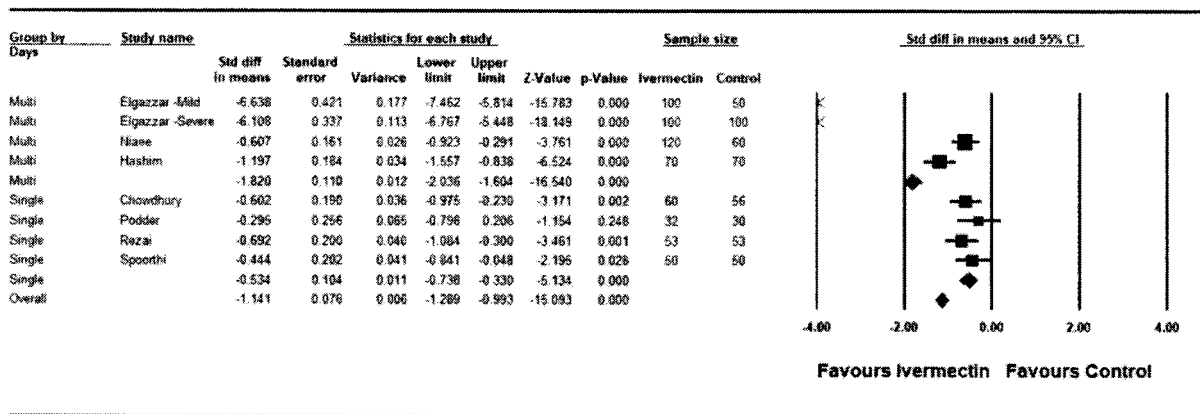


Figure 2 legend — Multi: multiple day dosing regimen. Single: single dose regimen.

Symbols — Squares: indicate treatment effect of an individual study. Large diamond: reflect summary of study design immediately above. Small diamond: sum effect of all trial designs. Size of each symbol correlates with the size of the confidence interval around the point estimate of treatment effect with larger sizes indicating a more precise confidence interval.

Figure 3. Meta-analysis of the outcome of mortality from controlled trials of ivermectin treatment in COVID-19

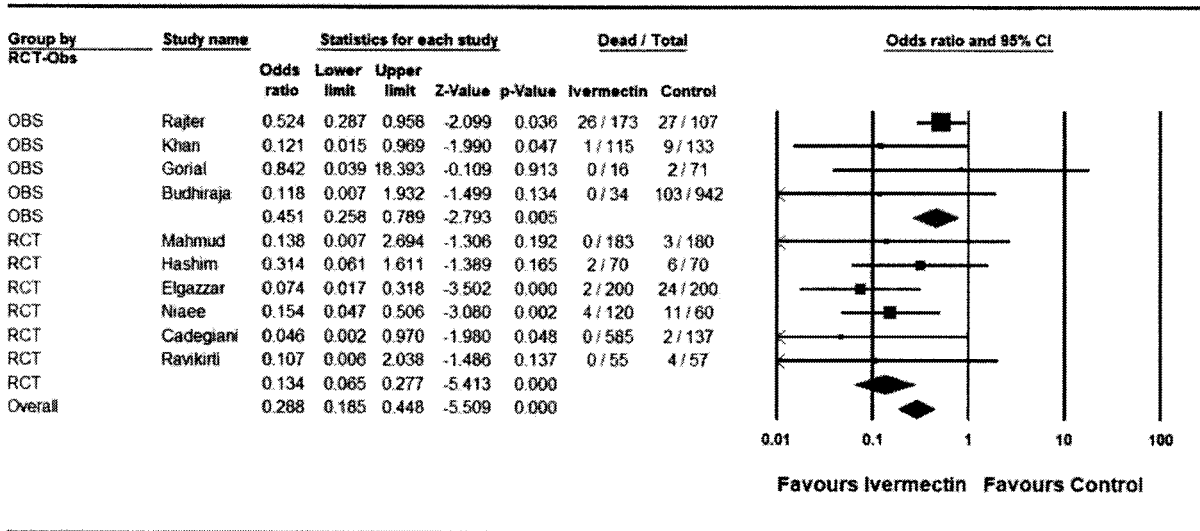


Figure 3 legend — OBS: Observational study, RCT: Randomized Controlled Trial.

Symbols — Squares: indicate treatment effect of an individual study. Large diamond: reflect summary of study design immediately above. Small diamond: sum effect of all trial designs. Size of each symbol correlates with the size of the confidence interval around the point estimate of treatment effect with larger sizes indicating a more precise confidence interval.

Details of the prophylaxis, early, and late treatment trials of ivermectin in COVID-19 can be found in Table 3 below.

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Table 3. Clinical studies assessing the efficacy of ivermectin in the prophylaxis and treatment of COVID-19

Prophylaxis Trials					
AUTHOR, COUNTRY, SOURCE	STUDY DESIGN, SIZE	STUDY SUBJECTS	IVERMECTIN DOSE	DOSE FREQUENCY	CLINICAL OUTCOMES REPORTED
Shouman W, Egypt <i>www.clinicaltrials.gov</i> NCT04422561	RCT N=340	Household members of pts with +COVID-19 PCR test	40–60kg: 15mg 60–80kg: 18mg > 80kg: 24mg	Two doses, 72 hours apart	7.4% vs. 58.4% developed COVID-19 symptoms, p<.001
Elgazzar A, Egypt ResearchSquare doi.org/10.21203/rs.3.rs-100956/v1	RCT N=200	Health care and Household contacts of pts with +COVID-19 PCR test	0.4mg/kg	Two doses, Day 1 and Day 7	2% vs. 10% tested positive for COVID-19 p<.05
Chala R. Argentina NCT04701710 <i>Clinicaltrials.gov</i>	RCT N=234	Health Care Workers	12mg	Every 7 days	3.4% vs. 21.4%, p=.0001.
Carvalho H, Argentina <i>Journal of Biochemical Research and Investigation</i> doi.org/10.31546/2633-8653.1007	OCT N=229	Healthy patients negative for COVID-19 PCR	0.2mg drops	1 drop five times a day x 28 days	0.0% vs. 11.2% contracted COVID-19 p<.001
Alam MT. Bangladesh <i>European J Med Hlth Sciences</i> 10.24018/ejmed.2020.2.6.599	OCT N=118	Health Care Workers	12mg	Monthly	6.9% vs. 73.3%, p<.05
Carvalho H. Argentina <i>Journal of Biochemical Research and Investigation</i> doi.org/10.31546/2633-8653.1007	OCT N=1,195	Health Care Workers	12 mg	Once weekly for up to ten weeks	0.0% of the 788 workers taking ivermectin vs. 58% of the 407 controls contracted COVID-19.
Behera P, India <i>medRxiv</i> doi.org/10.1101/2020.10.29.20222661	OCT N=186 case control pairs	Health Care Workers	0.3 mg/kg	Day 1 and Day 4	2 doses reduced odds of contracting COVID-19 (OR 0.27 95% CI 0.16–0.53)
Bernigaud C. France <i>Annales de Dermatologie et de Venereologie</i> doi.org/10.1016/j.annder.2020.09.231	OCT N=69 case control pairs	Nursing Home Residents	0.2 mg/kg	Once	10.1% vs. 22.6% residents contracted COVID-19 0.0% vs 4.9% mortality
Hellwig M. USA <i>J Antimicrobial Agents</i> doi.org/10.1016/j.ijantimicag.2020.106248	OCT N=52 countries	Countries with and without IVM prophylaxis programs	Unknown	Variable	Significantly lower-case incidence of COVID-19 in African countries with IVM prophylaxis programs p<.001
Clinical Trials – Outpatients					% Ivermectin vs. % Controls
AUTHOR, COUNTRY, SOURCE	STUDY DESIGN, SIZE	STUDY SUBJECTS	IVERMECTIN DOSE	DOSE FREQUENCY	CLINICAL OUTCOMES REPORTED
Mahmud R, Bangladesh <i>www.clinicaltrials.gov</i> NCT0452383	DB-RCT N=363	Outpatients and hospitalized	12mg + doxycycline	Once, within 3 days of PCR+ test	Early improvement 60.7% vs. 44.4%, p<.03, deterioration 8.7% vs 17.8%, p<.02
Chowdhury A, Bangladesh <i>Research Square</i> doi.org/10.21203/rs.3.rs-38896/v1	DB-RCT N=116	Outpatients	0.2 mg//kg + doxycycline	Once	Recovery time 5.9 vs 9.3 days (p=.07)

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Ravikirti, India <i>medRxiv</i> doi.org/10.1101/2021.01.05.21249310	DB-RCT N=115	Mild-moderate illness	12mg	Daily for 2 days	No diff in day 6 PCR+ 0% vs 6.9% mortality, p=.019
Babalola OE, Nigeria <i>medRxiv</i> doi.org/10.1101/2021.01.05.21249131	DB-RCT N=62	Mild-moderate illness	6mg and 12 mg	Every 48h x 2 weeks	Time to viral clearance: 4.6 days high dose vs 6.0 days low dose vs 9.1 days control (p=.006)
Podder CS, Bangladesh <i>IMC J Med Sci 2020;14(2)</i>	RCT N=62	Outpatients	0.2 mg/kg	Once	Recovery time 10.1 vs 11.5 days (NS), average time 5.3 vs 6.3 (NS)
Chaccour C. Spain <i>Research Square</i> doi.org/10.21203/rs.3.rs-116547/v1	RCT N=24	Outpatients	0.4mg/kg	Once	No diff in PCR+ Day 7, lower viral load days 4 and 7, (p<.05), 76 vs 158 pt. days of anosmia (p<.05), 68 vs 98 pt. days of cough (p<.05)
Morgenstern J, Dominican Republic <i>medRxiv</i> doi.org/10.1101/2020.10.29.20222505	Case Series N=3,099	Outpatients and hospitalized	Outpatients: 0.4mg/kg Hospital Patients: 0.3mg/kg	Outpatients:0.3 mg/kg x 1 dose Inpatients: 0.3mg/kg, Days 1,2,6,7	Mortality = 0.03% in 2688 outpatients, 1% in 300 non-ICU hospital patients, 30.6% in 111 ICU patients
Carvallo H, Argentina <i>medRxiv</i> doi.org/10.1101/2020.09.10.20191619	Case Series N=167	Outpatients and hospitalized	24mg=mild, 36mg=moderate, 48mg=severe	Days 0 and 7	All 135 with mild illness survived, 1/32 (3.1% of hospitalized patients died)
Alam A, Bangladesh, <i>J of Bangladesh College Phys and Surg</i> , 2020;38:10-15 doi.org/10.3329/jbcps.v38i0.47512	Case series N=100	Outpatients	0.2 mg/kg/kg + doxycycline	Once	All improved within 72 hours
Espatia-Hernandez G, Mexico <i>Biomedical Research</i> www.biomedres.info/biomed...-proof-of-concept-study-14435.html	Case Series N=28	Outpatients	6mg	Days 1,2, 7, 8	All pts recovered Average recovery time 3.6 days
Clinical Trials – Hospitalized Patients					% Ivermectin vs. % Controls
AUTHOR, COUNTRY, SOURCE	STUDY DESIGN, SIZE	STUDY SUBJECTS	IVERMECTIN DOSE	DOSE FREQUENCY	CLINICAL OUTCOMES REPORTED
Elgazzar A, Egypt <i>ResearchSquare</i> doi.org/10.21203/rs.3.rs-100956/v1	OL-RCT N=400	Hospitalized Patients	0.4 mg/kg	Once	Moderately ill: worsened 1% vs 22%, p<.001. Severely ill: worsened 4% vs 30% mortality 2% vs 20% both with p<.001
Niaee S. M. <i>Research Square</i> doi.org/10.21203/rs.3.rs-109670/v1	DB-RCT N=180	Hospitalized Patients	0.2, 0.3, 0.4 mg/kg (3 dosing strategies)	Once vs. Days 1,3,5	Mortality 3.3% vs. 18.3%. OR 0.18, (.06-0.55, p<.05)
Hashim H, Iraq <i>medRxiv</i> doi.org/10.1101/2020.10.26.20219345	SB-RCT N=140	2/3 outpatients, 1/3 hospital pts	0.2 mg/kg + doxycycline	Daily for 2–3 days	Recovery time 6.3 vs 13.6 days (p<.001), 0% vs 27.3% mortality in severely ill (p=.052)

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Spoorthi S, India <i>AIAM, 2020; 7(10):177-182</i>	RCT N=100	Hospitalized Patients	0.2mg/kg+ Doxycycline	Once	Shorter Hospital LOS, 3.7 vs. 4.7 days, p=.03, faster resolution of symptoms, 6.7 vs 7.9 days, p=.01
Ahmed S. Dhaka, Bangladesh <i>International Journal of Infectious Disease</i> doi.org/10.1016/j.ijid.2020.11.191	DB-RCT N=72	Hospitalized Patients	12mg	Daily for 5 days	Faster viral clearance 9.7 vs 12.7 days, p=.02
Chachar AZK, Pakistan <i>Int J Sciences</i> doi.org/10.18483/ijSci.2378	DB-RCT N=50	Hospitalized Patients-Mild	12mg	Two doses Day 1, one dose Day 2	64% vs 60% asymptomatic by Day 7
Portman-Baracco A, Brazil <i>Arch Bronconeumol. 2020</i> doi.org/10.1016/j.arbres.2020.06.011	OCT N=1408	Hospitalized patients	0.15 mg/kg	Once	Overall mortality 1.4% vs. 8.5%, HR 0.2, 95% CI 0.12-0.37, p<.0001
Soto-Beccerra P, Peru <i>medRxiv</i> doi.org/10.1101/2020.10.06.20208066	OCT N=5683, IVM, N=563	Hospitalized patients, database analysis	Unknown dose <48hrs after admission	Unknown	No benefits found
Rajter JC, Florida <i>Chest 2020</i> doi.org/10.1016/j.chest.2020.10.009	OCT N=280	Hospitalized patients	0.2 mg/kg + azithromycin	Day 1 and Day 7 if needed	Overall mortality 15.0% vs. 25.2%, p=.03, Severe illness mortality 38.8% vs. 80.7%, p=.001
Khan X, Bangladesh <i>Arch Bronconeumol. 2020</i> doi.org/10.1016/j.arbres.2020.08.007	OCT N=248	Hospitalized patients	12 mg	Once on admission	Mortality 0.9% vs. 6.8%, p<.05, LOS 9 vs. 15 days, p<.001
Gorial FI, Iraq <i>medRxiv</i> doi.org/10.1101/2020.07.07.20145979	OCT N=87	Hospitalized patients	0.2 mg/kg + HCQ and azithromycin	Once on admission	LOS 7.6 vs. 13.2 days, p<.001, 0/15 vs. 2/71 died
Budiraja S. India <i>medRxiv</i> doi.org/10.1101/2020.11.16.20232223	OCT N=1000 IVM=34	Hospitalized Patients	n/a	n/a	100% IVM pts recovered 11.1% mortality in non-IVM treated pts

Legend: DB-RCT = double-blind randomized controlled trial, HCQ = hydroxychloroquine, IVM = ivermectin, LOS = Length of stay, NS = non-statistically significant, p>.05, OCT = observational controlled trial, OL = open label, PCR – polymerase chain reaction, RCT = randomized controlled trial, SB-RCT =single blind, randomized controlled trial

Ivermectin in post-COVID-19 syndrome

Increasing reports of persistent, vexing, and even disabling symptoms after recovery from acute COVID-19 have been reported and which many have termed the condition as “long Covid” and patients as “long haulers”, estimated to occur in approximately 10% of cases (Callard and Perego, 2020;Rubin, 2020;Siegelman, 2020). Generally considered as a post-viral syndrome consisting of a chronic and sometimes disabling constellation of symptoms which include, in order, fatigue, shortness of breath, joint pains and chest pain. Many patients describe their most disabling symptom as impaired memory and concentration, often with extreme fatigue, described as “brain fog”, and are highly suggestive of the condition myalgic encephalomyelitis/chronic fatigue syndrome, a condition well-reported to begin after viral infections, in particular with Epstein-Barr virus. Although no specific

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treatments have been identified for long COVID, a recent manuscript by Aguirre-Chang et al from the National University of San Marcos in Peru reported on the experience with ivermectin in such patients (Aguirre-Chang, 2020). They treated 33 patients who were between 4 and 12 weeks from the onset of symptoms with escalating doses of ivermectin; 0.2mg/kg for 2 days if mild, 0.4mg/kg for 2 days if moderate, with doses extended if symptoms persisted. They found that in 87.9% of the patients, resolution of all symptoms was observed after two doses with an additional 7% reporting complete resolution after additional doses. Their experience suggests the need for controlled studies to better test efficacy in this vexing syndrome.

Epidemiological data showing impacts of widespread ivermectin use on population case counts and case fatality rates

Similar to the individual cities in Brazil that measured large decreases in case counts soon after distributing ivermectin in comparison to neighboring cities without such campaigns, in Peru, the government approved the use of ivermectin by decree on May 8, 2020, solely based on the *in vitro* study by Caly et al. from Australia (Chamie, 2020).⁸ Soon after, multiple state health ministries initiated ivermectin distribution campaigns in an effort to decrease what was at that time some of the highest COVID-19 morbidity and mortality rates in the world. Juan Chamie, a data analyst and member of the FLCCC Alliance recently posted a paper based on two critical sets of data that he compiled and compared; first he identified the timing and magnitude of each region's ivermectin interventions via a review of official communications, press releases, and the Peruvian Situation Room database in order to confirm the dates of effective delivery, and second, he extracted data on the total all-cause deaths from the region along with COVID-19 case counts in selected age groups over time from the registry of the National Computer System of Deaths (SINADEF), and from the National Institute of Statistics and Informatics (Chamie, 2020). It should be noted that he restricted his analyses to only those citizens over 60 years old in order to avoid the confounding of rises in the numbers of infected younger patients. With these data, he was then able to compare the timing of major decreases in this age group of both total COVID-19 cases and total deaths per 1000,000 people among 8 states in Peru with the initiation dates of their respective ivermectin distribution campaigns as shown in Figure 4 below.

⁸ <https://trialsitenews.com/trialsite-news-original-documentary-in-peru-about-ivermectin-and-covid-19/>

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Figure 4. Decrease in total case incidences and total deaths/population of COVID-19 in the over 60 population among 8 Peruvian states after deploying mass ivermectin distribution campaigns

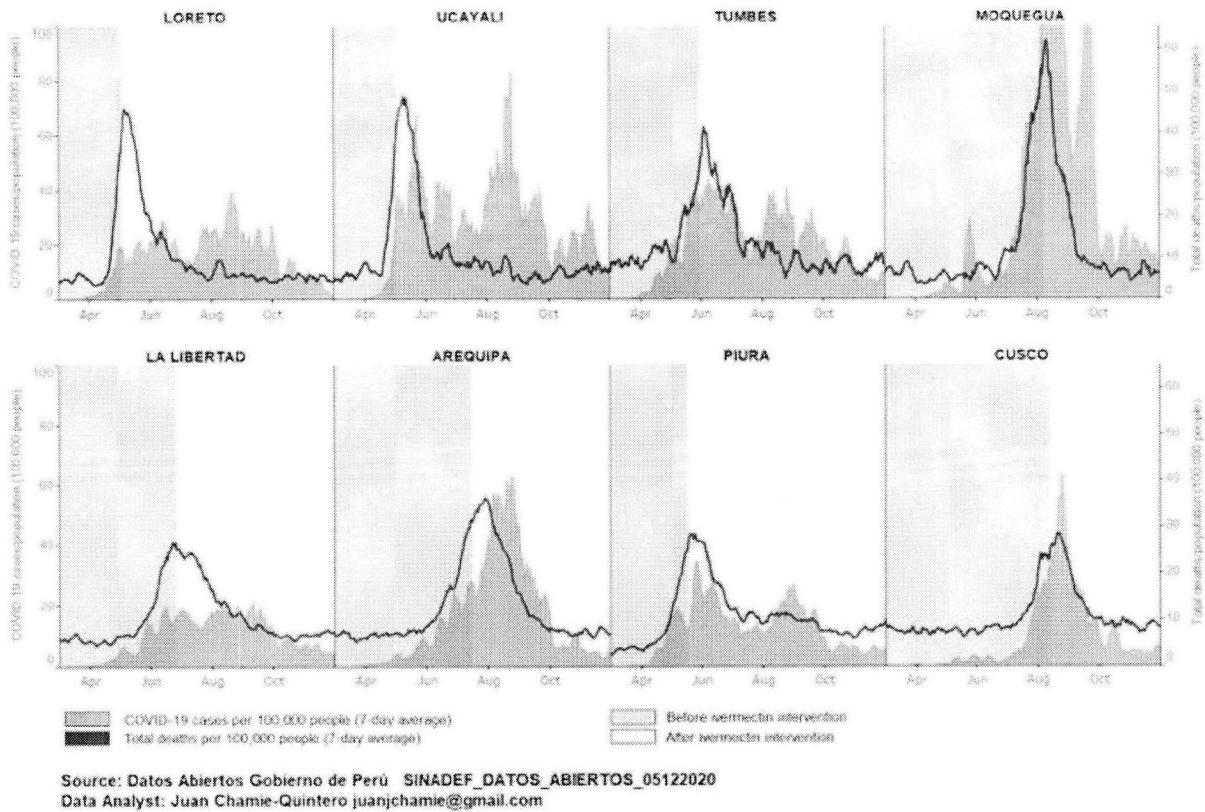
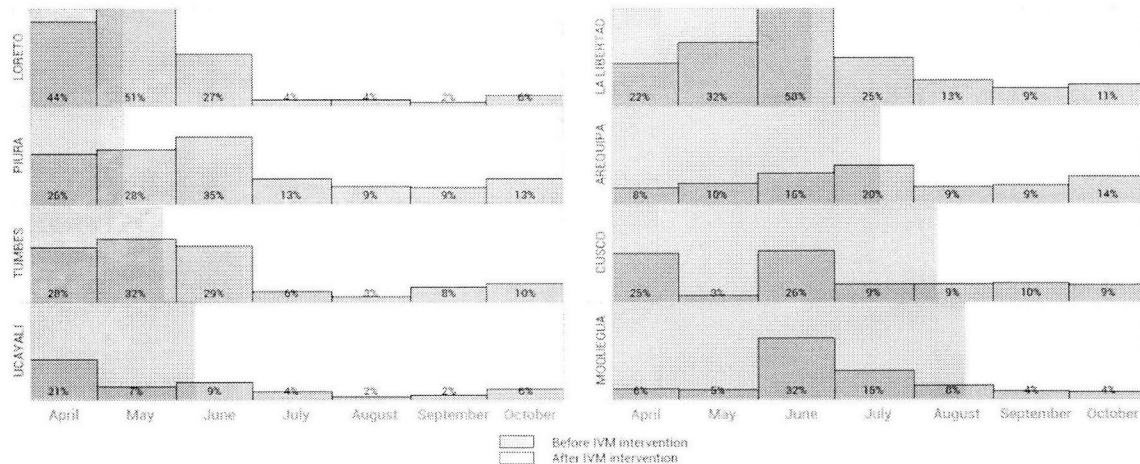


Figure 5 below from the same study presents data on the case fatality rates in patients over 60, again among the 8 states in Peru. Note the dramatically decreased case fatality rates among older patients with COVID-19 after ivermectin became widely distributed in those areas.

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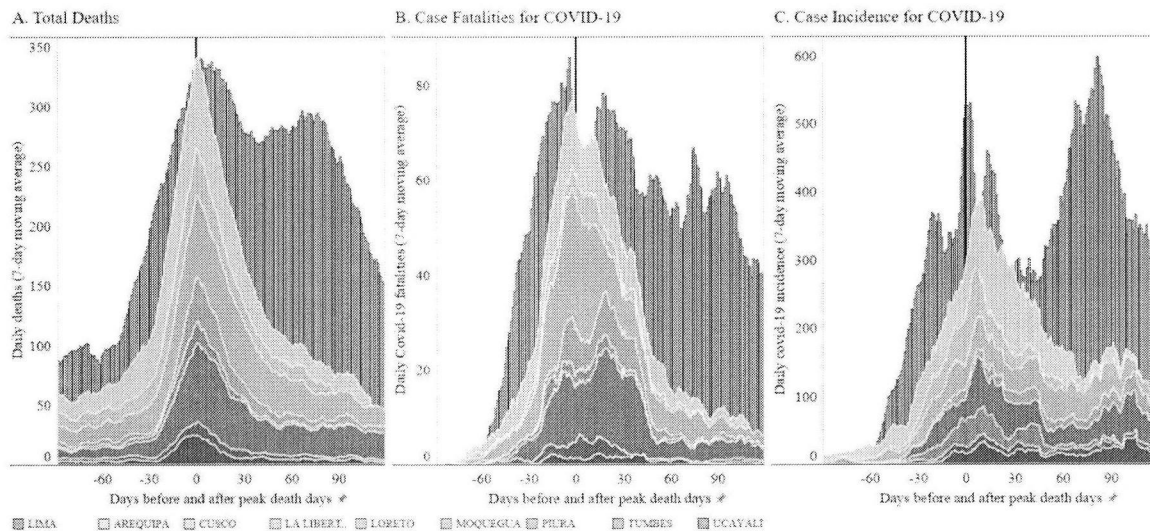
Figure 5. Monthly reported case fatality rates among patients over 60 in eight Peruvian states after deploying mass ivermectin treatment.



Source: Datos Abiertos Gobierno de Perú SINADef_DATOS_ABIERTOS_08112020 Data Analyst: Juan Chamie @jchamie

In an even more telling example, Chamie compared the case counts and fatality rates of the 8 states above with the city of Lima, where ivermectin was not distributed nor widely used in treatment during the same time period. Figure 6 below compares the lack of significant or sustained reductions in case counts or fatalities in Lima with the dramatic reductions in both outcomes among the 8 states with widespread ivermectin distribution.

Figure 6. Covid-19 case fatalities and total deaths with and without mass ivermectin in different states of Peru



Data Analyst: Juan Chamie juanjchamie@gmail.com
 Sources: Total Deaths: cloud.minsa.gob.pe/s/NctBnHXDnccgWAg/download, datosabiertos.gob.pe/group/datos-abiertos-de-covid-19

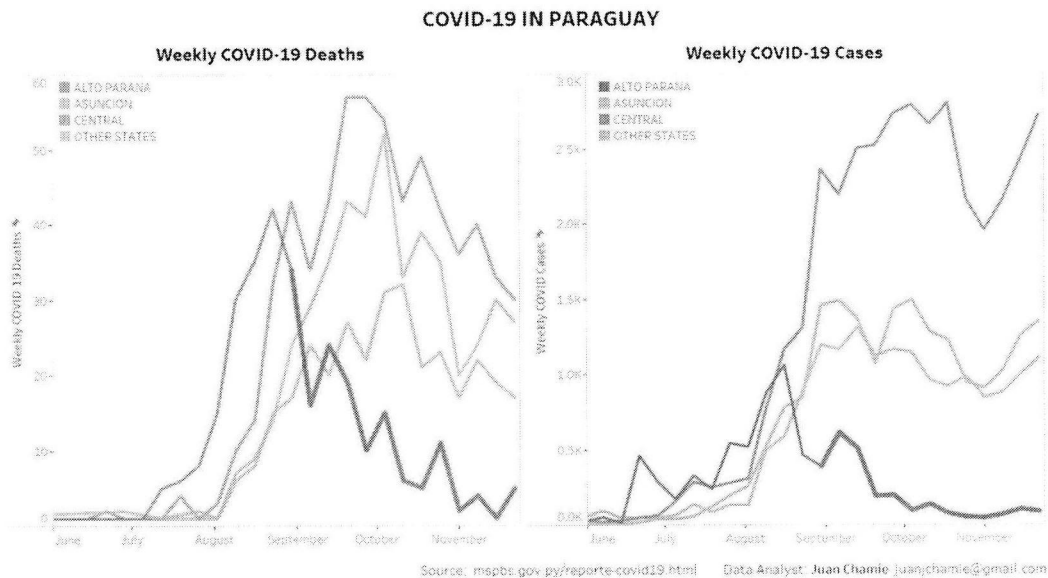
Legend: Daily total deaths, case fatalities and case incidence for COVID-19 in populations of patients age 60 and above for eight states in Peru deploying early mass ivermectin treatments vs. the state of Lima, including the capital city, where ivermectin treatment was applied months later.

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Another compelling example can be seen from the data compiled from Paraguay, again by Chamie, who noted that the government of the state of Alto Parana had launched an ivermectin distribution campaign in early September. Although the campaign was officially described as a “de-worming” program, this was interpreted as a guise by the region’s governor to avoid reprimand or conflict with the National Ministry of Health that recommended against use of ivermectin to treat COVID-19 in Paraguay.⁹ The program began with a distribution of 30,000 boxes of ivermectin and by October 15, the governor declared that there were very few cases left in the state as can be seen in Figure 5 below.¹⁰

Figure 7. Paraguay – COVID-19 case counts and deaths in Alto Parana (bolded blue line) after ivermectin distribution began compared to other regions.



The clinical evidence base for ivermectin against COVID-19

A summary of the statistically significant results from the above controlled trials are as follows:

Controlled trials in the prophylaxis of COVID-19 (8 studies)

- All 8 available controlled trial results show statistically significant reductions in transmission
- 3 RCT’s with large statistically significant reductions in transmission rates, N=774 patients (Chala, 2020;Elgazzar et al., 2020;Shouman, 2020)
- 5 OCT’s with large statistically significant reductions in transmission rates, N=2052 patients (Alam et al., 2020;Behera et al., 2020;Bernigaud et al., 2020;Carvalho et al., 2020b;Hellwig and Maia, 2020)

⁹ <https://public.tableau.com/profile/jchamie#!/vizhome/COVID-19PARAGUAY/Paraguay>

¹⁰ <https://public.tableau.com/profile/jchamie#!/vizhome/COVID-19PARAGUAY/Paraguay>

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Controlled trials in the treatment of COVID-19 (19 studies)

- 5 RCT's with statistically significant impacts in time to recovery or hospital length of stay (Elgazzar et al., 2020;Hashim et al., 2020;Mahmud, 2020;Niaee et al., 2020;Spoorthi V, 2020)
- 1 RCT with a near statistically significant decrease in time to recovery, $p=.07$, $N=130$ (Chowdhury et al., 2020)
- 1 RCT with a large, statistically significant reduction in the rate of deterioration or hospitalization, $N=363$ (Mahmud, 2020)
- 2 RCT's with a statistically significant decrease in viral load, days of anosmia and cough, $N=85$ (Chaccour et al., 2020;Ravikirti et al., 2021)
- 3 RCT's with large, statistically significant reductions in mortality ($N=695$) (Elgazzar et al., 2020;Niaee et al., 2020;Ravikirti et al., 2021)
- 1 RCT with a near statistically significant reduction in mortality, $p=0.052$ ($N=140$) (Hashim et al., 2020)
- 3 OCT's with large, statistically significant reductions in mortality ($N=1,688$) (Khan et al., 2020;Portmann-Baracco et al., 2020;Rajter et al., 2020)

Safety of Ivermectin

Numerous studies report low rates of adverse events, with the majority mild, transient, and largely attributed to the body's inflammatory response to the death of the parasites and include itching, rash, swollen lymph nodes, joint pains, fever and headache (Kircik et al., 2016). In a study which combined results from trials including over 50,000 patients, serious events occurred in less than 1% and largely associated with administration in Loa loa (Gardon et al., 1997). Further, according to the pharmaceutical reference standard *Lexicomp*, the only medications contraindicated for use with ivermectin are the concurrent administration of anti-tuberculosis and cholera vaccines while the anticoagulant warfarin would require dose monitoring. Another special caution is that immunosuppressed or organ transplant patients who are on calcineurin inhibitors such as tacrolimus or cyclosporine or the immunosuppressant sirolimus should have close monitoring of drug levels when on ivermectin given that interactions exist which can affect these levels. A longer list of drug interactions can be found on the *drugs.com* database, with nearly all interactions leading to a possibility of either increased or decreased blood levels of ivermectin. Given studies showing tolerance and lack of adverse effects in human subjects given escalating high doses of ivermectin, toxicity is unlikely although a reduced efficacy due to decreased levels may be a concern (Guzzo et al., 2002).

Concerns of safety in the setting of liver disease are unfounded given that, to our knowledge, only two cases of liver injury have ever been reported in association with ivermectin, with both cases rapidly resolved without need for treatment. (Sparsa et al., 2006;Veit et al., 2006). Further, no dose adjustments are required in patients with liver disease. Some have described ivermectin as potentially neurotoxic, yet one study performed a search of a global pharmaceutical database and found only 28 cases of serious neurological adverse events such as ataxia, altered consciousness, seizure, or tremor (Chandler, 2018). Potential explanations included the effects of concomitantly administered drugs which increase absorption past the blood brain barrier or polymorphisms in the *mdr-1* gene. However, the total number of reported cases suggests that such events are rare. Finally, ivermectin has been used safely in pregnant women, children, and infants.

Discussion

Currently, as of December 14, 2020, the accumulating evidence demonstrating the safety and efficacy of ivermectin in COVID-19 strongly supports its immediate use on a risk/benefit calculation in the context of a pandemic. Large-scale epidemiologic analyses validate the findings of *in vitro*, animal, prophylaxis, and clinical studies. Regions of the world with widespread ivermectin use have demonstrated a sizable reduction in case counts, hospitalizations, and fatality rates. This approach should be urgently considered in the presence of an escalating COVID-19 pandemic and as a bridge to vaccination. A recent systematic review of eight RCTs by Australian researchers, published as a pre-print, similarly concluded that ivermectin treatment led to a reduction in mortality, time to clinical recovery, the incidence of disease progression, and duration of hospital admission in patients across all stages of clinical severity (Kalfas et al., 2020). Our current review includes a total of 6,612 patients from 27 controlled studies [16 of them were RCTs, 5 double blinded, one single blinded, (n= 2,503)]; 11 published in peer-reviewed journals including 3,900 patients.

Pre-print publications have exploded during the COVID-19 pandemic. Except for hydroxychloroquine and convalescent plasma that were widely adopted before availability of any clinical data to support, almost all subsequent therapeutics were adopted after pre-print publication and *prior to peer review*. Examples include remdesivir, corticosteroids, and monoclonal antibodies. An even more aggressive example of rapid adoption was the initiation of inoculation programs using novel mRNA vaccines prior to review of either pre-print or peer-reviewed trials data by physicians ordering the inoculations for patients.¹¹ In all such situations, both academia and governmental health care agencies relaxed their standard to rise to the needs dictated by the pandemic.

In the context of ivermectin's long standing safety record, low cost, and wide availability along with the consistent, reproducible, large magnitude findings on transmission rates, need for hospitalization, mortality, and population-wide control of COVID-19 case and fatality rates in areas with widespread ivermectin distribution, insisting on the remaining studies to pass peer review prior to widespread adoption appears to be imprudent and to deviate from the now established standard approach towards adoption of new therapeutics during the pandemic. In fact, insisting on such a barrier to adoption would actually violate this new standard given that 12 of the 24 controlled trials have already been published in peer reviewed journals.

In regard to concerns over the validity of observational trial findings, it must be recognized that in the case of ivermectin; 1) half of the trials employed a randomized, controlled trial design (12 of the 24 reviewed above), and 2) that observational and randomized trial designs reach equivalent conclusions on average in nearly all diseases studied, as reported in a large Cochrane review of the topic from 2014 (Anglemyer et al., 2014). In particular, OCTs that employ propensity-matching techniques (as in the Rajter study from Florida), find near identical conclusions to later-conducted RCTs in many different disease states, including coronary syndromes, critical illness, and surgery (Dahabreh et al., 2012;Lonjon et al., 2014;Kitsios et al., 2015). Similarly, as evidenced in the prophylaxis (Figure 1) and treatment trial (Figures 2 and 3) meta-analyses as well as the summary trials table (Table 3), the entirety of the benefits found in both OCT and RCT trial designs align in both direction and magnitude of benefit. Such a consistency of benefit amongst numerous trials of varying designs from multiple different countries and centers around the world is both unique in the history of evidence-based medicine and provides strong, additional support to the conclusions reached in this review. All must consider Declaration 37 of the World Medical Association's "Helsinki Declaration on the Ethical Principles for Medical Research Involving Human Subjects," first established in 1964, which states:

¹¹ <https://www.wsj.com/articles/u-k-begins-rollout-of-pfizers-covid-19-vaccine-in-a-first-for-the-west-11607419672>

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*In the treatment of an individual patient, where proven interventions do not exist or other known interventions have been ineffective, the physician, after seeking expert advice, with informed consent from the patient or a legally authorized representative, may use an unproven intervention **if in the physician's judgement it offers hope of saving life, re-establishing health or alleviating suffering**. This intervention should subsequently be made the object of research, designed to evaluate its safety and efficacy. In all cases, new information must be recorded and, where appropriate, made publicly available.*

The continued challenges faced by health care providers in deciding on appropriate therapeutic interventions in patients with COVID-19 would be greatly eased if more updated and definitive evidence-based guidance came from the leading governmental health care agencies. Currently, in the United States, the treatment guidelines for COVID-19 are issued by the National Institutes of Health (NIH). Unfortunately, the NIH's recommendation on the use of ivermectin in COVID-19 patients was last updated on August 27, 2020. At that time, ivermectin received a recommendation of A-III *against* use outside of a clinical trial. An A-III recommendation, per the NIH recommendation scheme, means that it was a strong opinion (A), and based on expert opinion only (III) given that presumably little clinical evidence existed at the time to otherwise inform that recommendation.

Based on the totality of the clinical and epidemiologic evidence presented in this review, and in the context of a worsening pandemic in parts of the globe where ivermectin is not widely used, the authors believe the recommendation must be immediately updated to support and guide the nation's health care providers. One aspect that the NIH expert panel may debate is on the grade of recommendation that should be assigned to ivermectin. Based on the NIH rating scheme, the strongest recommendation possible would be an A-I in support of ivermectin which requires "one or more randomized trials with clinical outcomes and/or laboratory endpoints." Given that data from 16 randomized controlled trials (RCT's) demonstrate consistent and large improvements in "clinical outcomes" such as transmission rates, hospitalization rates, and death rates, it appears that the criteria for an A-I level recommendation has been exceeded. However, although troubling to consider, if experts somehow conclude that the entirety of the available RCT data should be invalidated and dismissed given that either; they were conducted outside of US shores and not by US pharmaceutical companies or academic research centers, that some studies were small or of "low quality", or that such data from foreign countries are not generalizable to American patients, an A-II level recommendation would then have to be considered. In the context of worsening pandemic conditions, when considering a safe, low-cost, widely available early treatment option, even an A-II would result in immediate, widespread adoption by providers in the treatment of COVID-19. The criteria for an A-II requires supportive findings from "one of more well-designed non-randomized, or observational cohort studies". Fortunately, there are many such studies on ivermectin in COVID-19, with one of the largest and best designed being Dr. Rajter's study from Florida, published in the major peer-reviewed medical journal *Chest*, where they used propensity matching, a technique accorded by many to be as valid a design as RCT's. Thus, at a minimum, an A-II recommendation is met, which again would and should lead to immediate and widespread adoption in early outpatient treatment, an area that has been little investigated and is devoid of any highly effective therapies at the time of this writing. Further, it is clear that these data presented far exceed any other NIH strength or quality level such as moderate strength (B), weak strength (C) or grade III quality. To merit the issuance of these lower grades of recommendation would require both a dismissal of the near entirety of the evidence presented in this review in addition to a risk benefit calculation resulting in the belief that the risks of widespread ivermectin use would far exceed any possible benefits in the context of rising case counts, deaths, lockdowns, unemployment, evictions, and bankruptcies.

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It is the authors opinion, that based on the totality of these data, the use of ivermectin as a prophylactic and early treatment option should receive an A-I level recommendation by the NIH in support of use by the nation's health care providers. When, or if, such a recommendation is issued, the Front Line COVID-19 Critical Care Alliance has developed a prophylaxis and early treatment protocol for COVID-19 (I-MASK+), centered around ivermectin combined with masking, social distancing, hand hygiene, Vitamin D, Vitamin C, quercetin, melatonin, and zinc, with all components known for either their anti-viral, anti-inflammatory, or preventive actions (Table 4). The I-MASK+ protocol suggests treatment approaches for prophylaxis of high-risk patients, post-exposure prophylaxis of household members with COVID-19, and an early treatment approach for patients ill with COVID-19.

Table 4. I-MASK+ Prophylaxis & Early Outpatient Treatment Protocol for COVID-19

Prophylaxis Protocol	
MEDICATION	RECOMMENDED DOSING
Ivermectin	<i>Prophylaxis for high-risk individuals:</i> 0.2 mg/kg per dose* — one dose today, 2 nd dose in 48 hours, then one dose every 2 weeks
	<i>Post COVID-19 exposure prophylaxis***: 0.2 mg/kg per dose, one dose today, 2nd dose in 48 hours</i>
Vitamin D3	1,000–3,000 IU/day
Vitamin C	1,000 mg twice daily
Quercetin	250 mg/day
Melatonin	6 mg before bedtime (causes drowsiness)
Zinc	50 mg/day of elemental zinc
Early Outpatient Treatment Protocol****	
MEDICATION	RECOMMENDED DOSING
Ivermectin	0.2 mg/kg per dose – one dose daily for minimum of 2 days, continue daily until recovered (max 5 days)
Vitamin D3	4,000 IU/day
Vitamin C	2,000 mg 2–3 times daily and Quercetin 250 mg twice a day
Melatonin	10 mg before bedtime (causes drowsiness)
Zinc	100 mg/day elemental zinc
Aspirin	325 mg/day (unless contraindicated)

* Example for a person of 60 kg body weight: 60 kg × 0.2 mg = 12 mg (1 kg = 2.2 lbs) = 4 tablets (3mg/tablet). To convert pounds, divide weight in pounds by 11: example for a person of 165 pounds: 165 ÷ 11 = 15 mg

** The dosing may be updated as further scientific studies emerge.

*** To use if a household member is COVID-19 positive, or if you have had prolonged exposure to a COVID-19+ patient without wearing a mask

**** For late phase – hospitalized patients – see the FLCCC's "MATH+" protocol on www.flccc.net

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In summary, based on the existing and cumulative body of evidence, we recommend the use of ivermectin in both prophylaxis and treatment for COVID-19. In the presence of a global COVID-19 surge, the widespread use of this safe, inexpensive, and effective intervention would lead to a drastic reduction in transmission rates and the morbidity and mortality in mild, moderate, and even severe disease phases. The authors are encouraged and hopeful at the prospect of the many favorable public health and societal impacts that would result once adopted for use.

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None

Contribution to the field statement

COVID-19 has caused a worldwide pandemic that has caused over 1.5 million global deaths along with continued rising case counts, lockdowns, unemployment and recessions in multiple countries. In response, the Front Line COVID-19 Critical Care Alliance (FLCCC), formed early in the pandemic, began to review the rapidly emerging basic science, translational, and clinical data to develop effective treatment protocols. The supportive evidence and rationale for their highly effective hospital treatment protocol called “MATH+” was recently published in a major medical journal. More recently, during their ongoing review of the studies on a wide range of both novel and repurposed drugs, they identified that ivermectin, a widely used anti-parasitic medicine with known anti-viral and anti-inflammatory properties is proving a highly potent and multi-phase effective treatment against COVID-19. This manuscript comprehensively reviews the diverse and increasing amount of available evidence from studies on ivermectin which then concludes with the FLCCC consensus recommendation that ivermectin for both the prophylaxis and treatment of COVID-19 should be systematically and globally adopted with the achievable goal of saving countless lives and reversing the rising and persistent transmission rates in many areas of the world.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

Study conception and design: Pierre Kory, G. Umberto Meduri, Howard Kornfeld, Keith Berkowitz. Acquisition of data: Scott Mitchell, Eivind Norjevoll, Paul Marik, Fred Wagshul Analysis and interpretation of data: Paul Marik, Pierre Kory Drafting of manuscript: Pierre Kory Critical revision: Umberto Meduri, Joseph Varon.

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References

- Agarwal, A., Mukherjee, A., Kumar, G., Chatterjee, P., Bhatnagar, T., Malhotra, P., and Collaborators, P.T. (2020). Convalescent plasma in the management of moderate covid-19 in adults in India: open label phase II multicentre randomised controlled trial (PLACID Trial). *BMJ* 371, m3939.
- Aguirre-Chang, G. (2020). Post-Acute or prolonged COVID-19: treatment with ivermectin for patients with persistent, or post-acute symptoms *ResearchGate*.
- Ahmed, S., Karim, M.M., Ross, A.G., Hossain, M.S., Clemens, J.D., Sumiya, M.K., Phru, C.S., Rahman, M., Zaman, K., and Somani, J. (2020). A five day course of ivermectin for the treatment of COVID-19 may reduce the duration of illness. *International Journal of Infectious Diseases*.
- Alam, M., R, M., Pf, G., Md, M.Z., S, S., and Ma, C. (2020). Ivermectin as Pre-exposure Prophylaxis for COVID 19 among Healthcare Providers in a Selected Tertiary Hospital in Dhaka An Observational Study. *European Journal of Medical and Health Sciences*.
- Anglemyer, A., Horvath, H.T., and Bero, L. (2014). Healthcare outcomes assessed with observational study designs compared with those assessed in randomized trials. *Cochrane Database Syst Rev*, MR000034.
- Arevalo, A.P., Pagotto, R., Porfido, J., Daghero, H., Segovia, M., Yamasaki, K., Varela, B., Hill, M., Verdes, J.M., and Vega, M.D. (2020). Ivermectin reduces coronavirus infection in vivo: a mouse experimental model. *bioRxiv*.
- Atkinson, S.C., Audsley, M.D., Lieu, K.G., Marsh, G.A., Thomas, D.R., Heaton, S.M., Paxman, J.J., Wagstaff, K.M., Buckle, A.M., Moseley, G.W., Jans, D.A., and Borg, N.A. (2018). Recognition by host nuclear transport proteins drives disorder-to-order transition in Hendra virus V. *Scientific Reports* 8, 358.
- Babalola, O.E., Bode, C.O., Ajayi, A.A., Alakaloko, F.M., Akase, I.E., Otrofanowei, E., Salu, O.B., Adeyemo, W.L., Ademuyiwa, A.O., and Omilabu, S.A. Ivermectin shows clinical benefits in mild to moderate Covid19 disease: A randomised controlled double blind dose response study in Lagos. *medRxiv*, 2021.2001. 2005.21249131.
- Behera, P., Patro, B.K., Singh, A.K., Chandanshive, P.D., Ravikumar, S., Pradhan, S.K., Pentapati, S.S.K., Batmanabane, G., Padhy, B.M., and Bal, S. (2020). Role of ivermectin in the prevention of COVID-19 infection among healthcare workers in India: A matched case-control study. *medRxiv*.
- Bernigaud, C., Guillemot, D., Ahmed-Belkacem, A., Grimaldi-Bensouda, L., Lespine, A., Berry, F., Softic, L., Chenost, C., Do-Pham, G., and Giraudeau, B. (Year). "Bénéfice de l'ivermectine: de la gale à la COVID-19, un exemple de sérendipité", in: *Annales de Dermatologie et de Vénérologie*: Elsevier), A194.
- Bray, M., Rayner, C., Noël, F., Jans, D., and Wagstaff, K. (2020). Ivermectin and COVID-19: a report in Antiviral Research, widespread interest, an FDA warning, two letters to the editor and the authors' responses. *Antiviral Research*.
- Budhiraja, S., Soni, A., Jha, V., Indrayan, A., Dewan, A., Singh, O., Singh, Y., Chugh, I., Arora, V., and Pandey, R. (2020). Clinical Profile of First 1000 COVID-19 Cases Admitted at Tertiary Care Hospitals and the Correlates of their Mortality: An Indian Experience. *medRxiv*.
- Cadegiani, F.A., Goren, A., Wambier, C.G., and McCoy, J. (2020). Early COVID-19 Therapy with Azithromycin Plus Nitazoxanide, Ivermectin or Hydroxychloroquine in Outpatient Settings Significantly Reduced Symptoms Compared to Known Outcomes in Untreated Patients. *medRxiv*.
- Callard, F., and Perego, E. (2020). How and why patients made Long Covid. *Social Science & Medicine*, 113426.
- Caly, L., Druce, J.D., Catton, M.G., Jans, D.A., and Wagstaff, K.M. (2020a). The FDA-approved drug ivermectin inhibits the replication of SARS-CoV-2 in vitro. *Antiviral Res* 178, 104787.

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- Caly, L., Druce, J.D., Catton, M.G., Jans, D.A., and Wagstaff, K.M. (2020b). The FDA-approved drug ivermectin inhibits the replication of SARS-CoV-2 in vitro. *Antiviral Research* 178, 104787.
- Carvalho, H.E., Hirsch, R.R., and Farinella, M.E. (2020a). Safety and Efficacy of the combined use of ivermectin, dexamethasone, enoxaparin and aspirin against COVID-19. *medRxiv*.
- Carvalho, H.E., Roberto, H., Psaltis, A., and Veronica, C. (2020b). Study of the Efficacy and Safety of Topical Ivermectin+ Iota-Carrageenan in the Prophylaxis against COVID-19 in Health Personnel.
- Chaccour, C., Casellas, A., Blanco-Di Matteo, A., Pineda, I., Fernandez-Montero, A., Castillo, P.R., Richardson, M.-A., Mateos, M.R., Jordan-Iborra, C., and Brew, J. (2020). The effect of early treatment with ivermectin on viral load, symptoms and humoral response in patients with mild COVID-19: a pilot, double-blind, placebo-controlled, randomized clinical trial.
- Chachar, A.Z.K., Khan, K.A., Asif, M., Tanveer, K., Khaqan, A., and Basri, R. (2020). Effectiveness of Ivermectin in SARS-CoV-2/COVID-19 Patients. *International Journal of Sciences* 9, 31-35.
- Chala (2020). Prophylaxis Covid-19 in Healthcare Agents by Intensive Treatment With Ivermectin and Iota-carrageenan (Ivercar-Tuc). *ClinicalTrials.gov* NCT04701710.
- Chamie, J. (2020). *Real-World Evidence: The Case of Peru. Causality between Ivermectin and COVID-19 Infection Fatality Rate*.
- Chandler, R.E. (2018). Serious neurological adverse events after ivermectin—do they occur beyond the indication of onchocerciasis? *The American journal of tropical medicine and hygiene* 98, 382-388.
- Chowdhury, A.T.M.M., Shahbaz, M., Karim, M.R., Islam, J., Guo, D., and He, S. (2020). A Randomized Trial of Ivermectin-Doxycycline and Hydroxychloroquine-Azithromycin therapy on COVID19 patients.
- Ci, X., Li, H., Yu, Q., Zhang, X., Yu, L., Chen, N., Song, Y., and Deng, X. (2009). Avermectin exerts anti-inflammatory effect by downregulating the nuclear transcription factor kappa-B and mitogen-activated protein kinase activation pathway. *Fundam Clin Pharmacol* 23, 449-455.
- Consortium, W.S.T. (2020). Repurposed antiviral drugs for COVID-19—interim WHO SOLIDARITY trial results. *medRxiv. Preprint posted online* 15.
- Crump, A., and Omura, S. (2011). Ivermectin, 'wonder drug' from Japan: the human use perspective. *Proceedings of the Japan Academy, Series B* 87, 13-28.
- Dahabreh, I.J., Sheldrick, R.C., Paulus, J.K., Chung, M., Varvarigou, V., Jafri, H., Rassen, J.A., Trikalinos, T.A., and Kitsios, G.D. (2012). Do observational studies using propensity score methods agree with randomized trials? A systematic comparison of studies on acute coronary syndromes. *European Heart Journal* 33, 1893-1901.
- Dasgupta J, S.U., Bakshi a, Dasgupta a, Manna K, Saha, C De, Rk, Mukhopadhyay S, Bhattacharyya Np (2020). Nsp7 and Spike Glycoprotein of SARS-CoV-2 Are Envisaged as Potential Targets of Vitamin D and Ivermectin. *Preprints*.
- Dayer, M.R. (2020). Coronavirus (2019-nCoV) Deactivation via Spike Glycoprotein Shielding by Old Drugs, Bioinformatic Study.
- De Melo, G.D., Lazarini, F., Larrous, F., Feige, L., Kergoat, L., Marchio, A., Pineau, P., Lecuit, M., Lledo, P.-M., Changeux, J.-P., and Bourhy, H. (2020). Anti-COVID-19 efficacy of ivermectin in the golden hamster. *bioRxiv*, 2020.2011.2021.392639.
- Elgazzar, A., Hany, B., Youssef, S.A., Hafez, M., and Moussa, H. (2020). Efficacy and Safety of Ivermectin for Treatment and prophylaxis of COVID-19 Pandemic.
- Entrenas Castillo, M., Entrenas Costa, L.M., Vaquero Barrios, J.M., Alcalá Diaz, J.F., Lopez Miranda, J., Bouillon, R., and Quesada Gomez, J.M. (2020). "Effect of calcifediol treatment and best available therapy versus best available therapy on intensive care unit admission and mortality among patients hospitalized for COVID-19: A pilot randomized clinical study". *J Steroid Biochem Mol Biol* 203, 105751.
- Espitia-Hernandez, G., Munguia, L., Diaz-Chiguer, D., Lopez-Elizalde, R., and Jimenez-Ponce, F. (2020). Effects of Ivermectin-azithromycin-cholecalciferol combined therapy on COVID-19 infected patients: a proof of concept study.
- Gardon, J., Gardon-Wendel, N., Demanga, N., Kamgno, J., Chippaux, J.-P., and Boussinesq, M. (1997). Serious reactions after mass treatment of onchocerciasis with ivermectin in an area endemic for Loa loa infection. *The Lancet* 350, 18-22.
- Gorial, F.I., Mashhadani, S., Sayaly, H.M., Dakhil, B.D., Almashhadani, M.M., Aljabory, A.M., Abbas, Hassan M, Ghanim, M., and Rasheed, J.I. (2020). Effectiveness of Ivermectin as add-on Therapy in COVID-19 Management (Pilot Trial). *medRxiv*.

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- Götz, V., Magar, L., Dornfeld, D., Giese, S., Pohlmann, A., Höper, D., Kong, B.-W., Jans, D.A., Beer, M., Haller, O., and Schwemmle, M. (2016). Influenza A viruses escape from MxA restriction at the expense of efficient nuclear vRNP import. *Scientific Reports* 6, 23138.
- Guzzo, C., Furtek, C., Porras, A., Chen, C., Tipping, R., Clineschmidt, C., Sciberras, D., Hsieh, J., and Lasseter, K. (2002). Safety, Tolerability, and Pharmacokinetics of Escalating High Doses of Ivermectin in Healthy Adult Subjects. *Journal of clinical pharmacology* 42, 1122-1133.
- Hashim, H.A., Maulood, M.F., Rasheed, A.M., Fatak, D.F., Kabah, K.K., and Abdulmir, A.S. (2020). Controlled randomized clinical trial on using Ivermectin with Doxycycline for treating COVID-19 patients in Baghdad, Iraq. *medRxiv*.
- Hellwig, M.D., and Maia, A. (2020). A COVID-19 Prophylaxis? Lower incidence associated with prophylactic administration of Ivermectin. *Int J Antimicrob Agents*, 106248.
- Hermine, O., Mariette, X., Tharaux, P.L., Resche-Rigon, M., Porcher, R., Ravaud, P., and Group, C.-C. (2020). Effect of Tocilizumab vs Usual Care in Adults Hospitalized With COVID-19 and Moderate or Severe Pneumonia: A Randomized Clinical Trial. *JAMA Intern Med*.
- Horby, P., Lim, W.S., Emberson, J.R., Mafham, M., Bell, J.L., Linsell, L., Staplin, N., Brightling, C., Ustianowski, A., and Elmahi, E. (2020). Dexamethasone in hospitalized patients with Covid-19-preliminary report. *The New England journal of medicine*.
- Hussien, M.A., and Abdelaziz, A.E. (2020). Molecular docking suggests repurposing of brincidofovir as a potential drug targeting SARS-CoV-2 ACE2 receptor and main protease. *Network Modeling Analysis in Health Informatics and Bioinformatics* 9, 1-18.
- Jehi, L., Ji, X., Milinovich, A., Erzurum, S., Rubin, B.P., Gordon, S., Young, J.B., and Kattan, M.W. (2020). Individualizing Risk Prediction for Positive Coronavirus Disease 2019 Testing: Results From 11,672 Patients. *Chest* 158, 1364-1375.
- Kalfas, S., Visvanathan, K., Chan, K., and Drago, J. (2020). THE THERAPEUTIC POTENTIAL OF IVERMECTIN FOR COVID-19: A REVIEW OF MECHANISMS AND EVIDENCE. *medRxiv*.
- Khan, M.S.I., Khan, M.S.I., Debnath, C.R., Nath, P.N., Mahtab, M.A., Nabeka, H., Matsuda, S., and Akbar, S.M.F. (2020). Ivermectin Treatment May Improve the Prognosis of Patients With COVID-19. *Archivos de Bronconeumología*.
- King, C.R., Tessier, T.M., Dodge, M.J., Weinberg, J.B., and Mymryk, J.S. (2020). Inhibition of Human Adenovirus Replication by the Importin α/β 1 Nuclear Import Inhibitor Ivermectin. *Journal of Virology* 94.
- Kircik, L.H., Del Rosso, J.Q., Layton, A.M., and Schaubert, J. (2016). Over 25 Years of Clinical Experience With Ivermectin: An Overview of Safety for an Increasing Number of Indications. *Journal of drugs in dermatology : JDD* 15, 325-332.
- Kitsios, G.D., Dahabreh, I.J., Callahan, S., Paulus, J.K., Campagna, A.C., and Dargin, J.M. (2015). Can We Trust Observational Studies Using Propensity Scores in the Critical Care Literature? A Systematic Comparison With Randomized Clinical Trials. *Crit Care Med* 43, 1870-1879.
- Kory, P., Meduri, G.U., Iglesias, J., Varon, J., and Marik, P.E. (2020). Clinical and Scientific Rationale for the "MATH+" Hospital Treatment Protocol for COVID-19. *Journal of Intensive Care Medicine*.
- Lehrer, S., and Rheinstejn, P.H. (2020). Ivermectin Docks to the SARS-CoV-2 Spike Receptor-binding Domain Attached to ACE2. *In Vivo* 34, 3023-3026.
- Li, Y., Chen, M., Cao, H., Zhu, Y., Zheng, J., and Zhou, H. (2013). Extraordinary GU-rich single-strand RNA identified from SARS coronavirus contributes an excessive innate immune response. *Microbes Infect* 15, 88-95.
- Lonjon, G., Boutron, I., Trinquart, L., Ahmad, N., Aim, F., Nizard, R., and Ravaud, P. (2014). Comparison of treatment effect estimates from prospective nonrandomized studies with propensity score analysis and randomized controlled trials of surgical procedures. *Ann Surg* 259, 18-25.
- Lv, C., Liu, W., Wang, B., Dang, R., Qiu, L., Ren, J., Yan, C., Yang, Z., and Wang, X. (2018). Ivermectin inhibits DNA polymerase UL42 of pseudorabies virus entrance into the nucleus and proliferation of the virus in vitro and vivo. *Antiviral Research* 159, 55-62.
- Mahmud, R. (2020). A Randomized, Double-Blind Placebo Controlled Clinical Trial of Ivermectin plus Doxycycline for the Treatment of Confirmed Covid-19 Infection.
- Marik, P.E., Kory, P., Varon, J., Iglesias, J., and Meduri, G.U. (2020). MATH+ protocol for the treatment of SARS-CoV-2 infection: the scientific rationale. *Expert Review of Anti-infective Therapy*, 1-7.
- Mastrangelo, E., Pezzullo, M., De Burghgraeve, T., Kaptein, S., Pastorino, B., Dallmeier, K., De Lamballerie, X., Neyts, J., Hanson, A.M., Frick, D.N., Bolognesi, M., and Milani, M. (2012). Ivermectin is a potent inhibitor of flavivirus replication specifically targeting NS3 helicase activity: new prospects for an old drug. *Journal of Antimicrobial Chemotherapy* 67, 1884-1894.

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- Maurya, D.K. (2020). A combination of ivermectin and doxycycline possibly blocks the viral entry and modulate the innate immune response in COVID-19 patients.
- Morgenstern, J., Redondo, J.N., De Leon, A., Canela, J.M., Torres, N., Tavares, J., Minaya, M., Lopez, O., Placido, A.M., and Castillo, A. (2020). The use of compassionate Ivermectin in the management of symptomatic outpatients and hospitalized patients with clinical diagnosis of COVID-19 at the Medical Center Bournigal and the Medical Center Punta Cana, Rescue Group, Dominican Republic, from may 1 to august 10, 2020. *medRxiv*.
- Nadkarni, G.N., Lala, A., Bagiella, E., Chang, H.L., Moreno, P.R., Pujadas, E., Arvind, V., Bose, S., Charney, A.W., Chen, M.D., Cordon-Cardo, C., Dunn, A.S., Farkouh, M.E., Glicksberg, B.S., Kia, A., Kohli-Seth, R., Levin, M.A., Timsina, P., Zhao, S., Fayad, Z.A., and Fuster, V. (2020). Anticoagulation, Bleeding, Mortality, and Pathology in Hospitalized Patients With COVID-19. *J Am Coll Cardiol* 76, 1815-1826.
- Nallusamy, S., Mannu, J., Ravikumar, C., Angamuthu, K., Nathan, B., Nachimuthu, K., Ramasamy, G., Muthurajan, R., Subbarayalu, M., and Neelakandan, K. (2020). Shortlisting Phytochemicals Exhibiting Inhibitory Activity against Major Proteins of SARS-CoV-2 through Virtual Screening.
- Niaee, M.S., Gheibi, N., Namdar, P., Allami, A., Zolghadr, L., Javadi, A., Karampour, A., Varnaseri, M., Bizhani, B., and Cheraghi, F. (2020). Ivermectin as an adjunct treatment for hospitalized adult COVID-19 patients: A randomized multi-center clinical trial.
- Perera, R.A., Tso, E., Tsang, O.T., Tsang, D.N., Fung, K., Leung, Y.W., Chin, A.W., Chu, D.K., Cheung, S.M., and Poon, L.L. (2020). SARS-CoV-2 virus culture from the upper respiratory tract: Correlation with viral load, subgenomic viral RNA and duration of illness. *MedRXiv*.
- Podder, C.S., Chowdhury, N., Sina, M.I., and Haque, W. (2020). Outcome of ivermectin treated mild to moderate COVID-19 cases: a single-centre, open-label, randomised controlled study. *IMC J. Med. Sci* 14.
- Polak, S.B., Van Gool, I.C., Cohen, D., Von Der Thusen, J.H., and Van Paassen, J. (2020). A systematic review of pathological findings in COVID-19: a pathophysiological timeline and possible mechanisms of disease progression. *Mod Pathol* 33, 2128-2138.
- Portmann-Baracco, A., Bryce-Alberti, M., and Accinelli, R.A. (2020). Antiviral and Anti-Inflammatory Properties of Ivermectin and Its Potential Use in Covid-19. *Arch Bronconeumol*.
- Rajter, J.C., Sherman, M.S., Fattah, N., Vogel, F., Sacks, J., and Rajter, J.J. (2020). Use of Ivermectin is Associated with Lower Mortality in Hospitalized Patients with COVID-19 (ICON study). *Chest*.
- Ravikirti, Roy, R., Pattadar, C., Raj, R., Agarwal, N., Biswas, B., Majhi, P.K., Rai, D.K., Shyama, Kumar, A., and Sarfaraz, A. (2021). Ivermectin as a potential treatment for mild to moderate COVID-19 – A double blind randomized placebo-controlled trial. *medRxiv*, 2021.2001.2005.21249310.
- Robin, R.C., Alam, R.F., Saber, S., Bhiuyan, E., Murshed, R., and Alam, M.T. (2020). A Case Series of 100 COVID-19 Positive Patients Treated with Combination of Ivermectin and Doxycycline. *Journal of Bangladesh College of Physicians and Surgeons*, 10-15.
- Rodriguez-Nava, G., Trelles-Garcia, D.P., Yanez-Bello, M.A., Chung, C.W., Trelles-Garcia, V.P., and Friedman, H.J. (2020). Atorvastatin associated with decreased hazard for death in COVID-19 patients admitted to an ICU: a retrospective cohort study. *Crit Care* 24, 429.
- Rubin, R. (2020). As Their Numbers Grow, COVID-19 “Long Haulers” Stump Experts. *JAMA* 324, 1381-1383.
- Salvarani, C., Dolci, G., Massari, M., Merlo, D.F., Cavuto, S., Savoldi, L., Bruzzi, P., Boni, F., Braglia, L., Turra, C., Ballerini, P.F., Sciascia, R., Zammarchi, L., Para, O., Scotton, P.G., Inojosa, W.O., Ravagnani, V., Salerno, N.D., Sainaghi, P.P., Brignone, A., Codeluppi, M., Teopompi, E., Milesi, M., Bertomoro, P., Claudio, N., Salio, M., Falcone, M., Cenderello, G., Donghi, L., Del Bono, V., Colombelli, P.L., Angheben, A., Passaro, A., Secondo, G., Pascale, R., Piazza, I., Facciolongo, N., Costantini, M., and Group, R.-T.-C.-S. (2020). Effect of Tocilizumab vs Standard Care on Clinical Worsening in Patients Hospitalized With COVID-19 Pneumonia: A Randomized Clinical Trial. *JAMA Intern Med*.
- Scheim, D. (2020). "From Cold to Killer: How SARS-CoV-2 Evolved without Hemagglutinin Esterase to Agglutinate, Then Clot Blood Cells in Pulmonary and Systemic Microvasculature". SSRN).
- Schmith, V.D., Zhou, J., and Lohmer, L.R. (2020). The Approved Dose of Ivermectin Alone is not the Ideal Dose for the Treatment of COVID-19. *Clinical Pharmacology & Therapeutics*.
- Sen Gupta, P.S., Biswal, S., Panda, S.K., Ray, A.K., and Rana, M.K. (2020). Binding mechanism and structural insights into the identified protein target of COVID-19 and importin-alpha with in-vitro effective drug ivermectin. *J Biomol Struct Dyn*, 1-10.

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- Shouman, W. (2020). Use of Ivermectin as a Prophylactic Option in Asymptomatic Family Close Contact for Patient with COVID-19. *Clinical Trials.gov*.
- Siegelman, J.N. (2020). Reflections of a COVID-19 Long Hauler. *JAMA*.
- Soto-Becerra, P., Culquichicón, C., Hurtado-Roca, Y., and Araujo-Castillo, R.V. (2020). Real-world effectiveness of hydroxychloroquine, azithromycin, and ivermectin among hospitalized COVID-19 patients: results of a target trial emulation using observational data from a nationwide healthcare system in Peru. *Azithromycin, and Ivermectin Among Hospitalized COVID-19 Patients: Results of a Target Trial Emulation Using Observational Data from a Nationwide Healthcare System in Peru*.
- Sparsa, A., Bonnetblanc, J., Peyrot, I., Loustaud-Ratti, V., Vidal, E., and Bedane, C. (Year). "Systemic adverse reactions with ivermectin treatment of scabies", in: *Annales de Dermatologie et de Venereologie*, 784-787.
- Spoorthi V, S.S. (2020). Utility of Ivermectin and Doxycycline combination for the treatment of SARS-CoV2. *International Archives of Integrated Medicine* 7, 177-182.
- Suravajhala, R., Parashar, A., Malik, B., Nagaraj, A.V., Padmanaban, G., Kishor, P.K., Polavarapu, R., and Suravajhala, P. (2020). Comparative Docking Studies on Curcumin with COVID-19 Proteins.
- Swargiary, A. (2020). Ivermectin as a promising RNA-dependent RNA polymerase inhibitor and a therapeutic drug against SARS-CoV2: Evidence from in silico studies.
- Tambo, E., Khater, E.I., Chen, J.H., Bergquist, R., and Zhou, X.N. Nobel prize for the artemisinin and ivermectin discoveries: a great boost towards elimination of the global infectious diseases of poverty.
- Tay, M.Y.F., Fraser, J.E., Chan, W.K.K., Moreland, N.J., Rathore, A.P., Wang, C., Vasudevan, S.G., and Jans, D.A. (2013). Nuclear localization of dengue virus (DENV) 1-4 non-structural protein 5; protection against all 4 DENV serotypes by the inhibitor Ivermectin. *Antiviral Research* 99, 301-306.
- Varghese, F.S., Kaukinen, P., Gläsker, S., Bepalov, M., Hanski, L., Wennerberg, K., Kümmerer, B.M., and Ahola, T. (2016). Discovery of berberine, abamectin and ivermectin as antivirals against chikungunya and other alphaviruses. *Antiviral Research* 126, 117-124.
- Veit, O., Beck, B., Steuerwald, M., and Hatz, C. (2006). First case of ivermectin-induced severe hepatitis. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 100, 795-797.
- Wagstaff, Kylie m., Sivakumaran, H., Heaton, Steven m., Harrich, D., and Jans, David a. (2012). Ivermectin is a specific inhibitor of importin α/β -mediated nuclear import able to inhibit replication of HIV-1 and dengue virus. *Biochemical Journal* 443, 851-856.
- Yang, S.N.Y., Atkinson, S.C., Wang, C., Lee, A., Bogoyevitch, M.A., Borg, N.A., and Jans, D.A. (2020). The broad spectrum antiviral ivermectin targets the host nuclear transport importin α/β heterodimer. *Antiviral Research* 177, 104760.
- Young, B.E., Ong, S.W., Ng, L.F., Anderson, D.E., Chia, W.N., Chia, P.Y., Ang, L.W., Mak, T.-M., Kalimuddin, S., and Chai, L.Y.A. (2020). Viral dynamics and immune correlates of COVID-19 disease severity. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*.
- Zhang, J., Rao, X., Li, Y., Zhu, Y., Liu, F., Guo, G., Luo, G., Meng, Z., De Backer, D., and Xiang, H. (2020a). High-dose vitamin C infusion for the treatment of critically ill COVID-19.
- Zhang, X., Song, Y., Ci, X., An, N., Ju, Y., Li, H., Wang, X., Han, C., Cui, J., and Deng, X. (2008). Ivermectin inhibits LPS-induced production of inflammatory cytokines and improves LPS-induced survival in mice. *Inflamm Res* 57, 524-529.
- Zhang, X., Song, Y., Xiong, H., Ci, X., Li, H., Yu, L., Zhang, L., and Deng, X. (2009). Inhibitory effects of ivermectin on nitric oxide and prostaglandin E2 production in LPS-stimulated RAW 264.7 macrophages. *Int Immunopharmacol* 9, 354-359.
- Zhang, X.-J., Qin, J.-J., Cheng, X., Shen, L., Zhao, Y.-C., Yuan, Y., Lei, F., Chen, M.-M., Yang, H., and Bai, L. (2020b). In-hospital use of statins is associated with a reduced risk of mortality among individuals with COVID-19. *Cell metabolism* 32, 176-187. e174.

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UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
GALVESTON DIVISION

ROBERT L. APTER, ET AL § 3:22-CV-00184
 §
V. § 10:32 A.M. TO 11:39 A.M.
 §
DEPARTMENT OF HEALTH AND §
HUMAN SERVICES, ET AL § NOVEMBER 1, 2022

HEARING ON MOTION TO DISMISS
BEFORE THE HONORABLE JEFFREY V. BROWN
Volume 1 of 1 Volume

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(Call to order of the Court.)

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10:32:27

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THE COURT: All right. One case on the Court's docket this morning. It's in Cause Number 3:22-CV-184, Robert L. Apter v. United States Department of Health and Human Services and others -- Robert Apter and others v. Department of Health and Human Services and others.

Will the attorneys make their appearances, please. Plaintiff first.

MR. KELSON: Jared Kelson for plaintiffs, Your Honor.

THE COURT: Good morning.

MR. McCOTTER: Trent McCotter for plaintiffs, Your Honor.

THE COURT: Good morning. Welcome.

MR. BELFER: Good morning, Your Honor. Isaac Belfer for the government.

THE COURT: Great. Good to have you.

MR. McDONALD: Good morning. Oliver McDonald for the government.

THE COURT: Great. And I understand we have some folks on the phone who are listening in, and I think George has already asked for you to mute your phones a couple of times and there are people who have not muted their phones and we're going to cut the thing off if --

1 we're getting a lot of feedback here in the courtroom.

2 Please mute your phones if you want to listen in.

3 All right. I have read the briefing in the case. I
4 appreciate y'all coming down this morning. Sorry the
10:33:30 5 weather is not ideal. This is our first time back in our
6 courtroom since -- in a few months. So it's nice to be
7 back in our regular courtroom.

8 I have a series of questions I want to ask you all;
9 but I would like to get kind of a general argument from
10:33:50 10 both sides first, recognizing that I am familiar with the
11 case and the briefing. If there is anything that y'all
12 want to add to the briefing you have already provided to
13 the Court, this is your opportunity to do it; and then,
14 we'll discuss some of the questions that I have for both
10:34:07 15 sides.

16 So it's the government's motion, if you would like to
17 get us started.

18 MR. BELFER: Can I come up here?

19 THE COURT: You can argue from there or from
10:34:17 20 right here in front of the bench, whichever you prefer, as
21 long as you are speaking into a microphone.

22 MR. BELFER: I'll try up there.

23 THE COURT: All right. Come on up. I'm sorry.
24 Hold on a second.

10:34:37 25 George, can you just mute them so we don't get --

Argument by Mr. Belfer

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1 CASE MANAGER: Yes. I can do that.

2 THE COURT: Just so we don't -- or just turn the
3 volume down so we don't hear them.

4 CASE MANAGER: Yeah. I lowered the volume.

10:34:47 5 THE COURT: I'm sorry. Go ahead.

6 MR. BELFER: After receiving multiple reports of
7 patients requiring medical attention, including
8 hospitalization, after self-medicating with ivermectin
9 products intended for livestock, FDA made several public
10:35:02 10 statements on social media and on its website written in
11 informal conversational language warning the public about
12 certain risks of using ivermectin products to treat
13 COVID-19.

14 These statements included non-binding recommendations
10:35:15 15 to consumers who could purchase animal-use ivermectin over
16 the counter not to take ivermectin to treat COVID-19, but
17 the statements did not say that doctors could not
18 prescribe ivermectin to treat COVID-19 or that consumers
19 could not take ivermectin for that purpose.

10:35:31 20 Instead, they said that, "If your healthcare provider
21 writes you an ivermectin prescription, fill it through a
22 legitimate source such as a pharmacy and take it exactly
23 as prescribed."

24 Because the statements simply provided nonbinding
10:35:44 25 recommendations to consumers, they are not rules and,

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Argument by Mr. Belfer

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1 thus, are not agency action as required for waiver of
2 sovereign immunity. They did not bind the public or FDA,
3 did not interpret any substantive rules, and did not set
4 agency policy.

10:35:57 5 The statements are also not final agency action. They
6 do not mark the consummation of FDA's decision-making
7 process because they do not state FDA's final position on
8 the use of ivermectin to treat COVID-19 but instead
9 present FDA's tentative recommendations based on currently
10:36:14 10 available data.

11 They also do not have legal consequences for anyone
12 but simply provide nonbinding recommendations to
13 consumers.

14 Plaintiffs have also failed to meet their burden to
10:36:24 15 show standing. The amended complaint alleges five
16 injuries to plaintiffs and three injuries to their
17 patients.

18 Regarding injuries to the plaintiffs, the amended
19 complaint alleges: First, that there was interference
10:36:36 20 with their ability to practice medicine; second, that they
21 were referred to state medical boards; third, that they
22 were forced to resign from their jobs; fourth, they were
23 subjected to public ridicule; and fifth, that patients
24 delayed seeking treatment from plaintiffs.

10:36:51 25 And then with regard to injuries to their patients,

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Argument by Mr. Belfer

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1 the amended complaint alleges three injuries: First, that
2 pharmacists refused to fill patients' ivermectin
3 prescriptions; second, that insurance companies refused to
4 pay for those prescriptions; and third, that patients
10:37:06 5 delayed seeking treatment from plaintiffs or delayed
6 taking ivermectin.

7 As discussed in our briefs, many of those injuries are
8 not an adequate injury in fact. Plaintiffs have also not
9 shown that any of their claimed injuries are fairly
10:37:22 10 traceable to defendants' statements because their injuries
11 were caused by independent third-party conduct that was
12 not a predictable response to those statements.

13 For example, it was not predictable that plaintiffs'
14 employers would punish them for prescribing ivermectin to
10:37:33 15 treat COVID-19 when the statements themselves acknowledged
16 doctors' discretion to do just that.

17 Furthermore, plaintiffs have not shown that the
18 requested relief would likely redress their claimed
19 injuries. Many organizations, in addition to FDA, have
10:37:46 20 recommended against taking ivermectin to treat COVID-19;
21 and plaintiffs have not shown that removing just the cited
22 FDA statements would likely cause the third parties that
23 allegedly injured them to reverse their past decisions.

24 Finally, plaintiffs have failed to state a claim
10:38:01 25 because they did not present their issues in the amended

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Argument by Mr. Belfer

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1 complaint to FDA. They thereby deprived the agency of the
2 opportunity to consider their issues in the first instance
3 and prevented the agency from creating an administrative
4 record that addressed those issues.

10:38:15 5 So I would be happy to talk about any further issues
6 but I think that's a good summary and I'll answer any
7 questions the Court has.

8 THE COURT: Okay. All right. First of all, just
9 a couple of things on -- well, the -- you mentioned the
10:38:32 10 informational conversational tone of the social media
11 statements. To me, that seems like part of the problem in
12 that those statements don't include the qualifier
13 statements that the article has that was referred to; and
14 I think those -- I think as far as reputational harm goes,
10:39:04 15 it's the social media statements are what bother me the
16 most. And I don't even know where I'm going with the
17 question here.

18 But can you understand my concern with that? I mean,
19 it's like was the purpose of those statements really to
10:39:20 20 advise patients not to self-medicate with ivermectin? The
21 social media -- the social media comments in particular.

22 MR. BELFER: Right. So I don't think the record
23 shows the FDA's motivation for those statements in
24 particular. We do know that the article was motivated by
10:39:43 25 people self-medicating with animal-use ivermectin and

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Argument by Mr. Belfer

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1 requiring hospitalization. So we do know that that was
2 part of FDA's motivation.

3 And so I think with regards to the social media posts,
4 which are two tweets and an Instagram post, those
10:39:58 5 statements were clearly aimed at consumers. As we
6 discussed, they used this conversational language, you
7 know, "Hold your horses. You are not a horse. You are
8 not a cow." Information like that.

9 So clearly this was aimed at consumers. It was not
10:40:13 10 aimed at medical professionals or hospitals; and it was
11 not predictable that hospitals or insurance companies or
12 pharmacies would act based on these statements, let alone
13 it was not predictable that they would respond to these
14 statements by firing plaintiffs.

10:40:28 15 And indeed, the tweets linked to the article. And so
16 if you look at the tweets, they include the link to the
17 article. And so it was predictable that if you include
18 the link to the article, people, you know, will click on
19 the link and will see the full article, which includes
10:40:46 20 that disclaimer that if your doctor writes you a
21 prescription, you should fill it exactly as prescribed.

22 So in terms of the standing analysis when you are
23 asking was it predictable that third parties would take
24 the actions that they took based on the cited statements,
10:40:59 25 you know -- and it's plaintiffs' burden to show that; and

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Argument by Mr. Belfer

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1 plaintiffs have not met that burden because, first of all,
2 the tweets included links to the article and those
3 statements were clearly -- they were aimed at consumers,
4 and they were not the sort of statements FDA would make to
10:41:20 5 influence, for instance, hospitals or, you know,
6 pharmacies or insurance companies. Right.

7 So I think for those reasons plaintiffs have not shown
8 -- certainly have not shown traceability regarding those
9 statements.

10:41:33 10 And also, they have not shown redressability regarding
11 those statements because, as we discussed in our brief,
12 many organizations, in addition to FDA, have made public
13 statements advising against the use of ivermectin to treat
14 COVID-19.

10:41:45 15 So, you know, even if FDA's tweets and other
16 statements were taken down, there would still be many
17 statements by other organizations, like the World Health
18 Organization and Merck, which makes one of these drugs,
19 and CDC and NIH, all advising against the use of
10:41:58 20 ivermectin to treat COVID-19.

21 And so it would not -- plaintiffs have not shown that
22 they would -- that the third parties would likely undo
23 their actions, reverse their past decisions, given that
24 all those statements by other parties are still out there.

10:42:14 25 THE COURT: Okay. It's not just common sense

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Argument by Mr. Belfer

11

1 that it would be predictable that state boards would react
2 to statements by the FDA in ways that they did?

3 MR. BELFER: So state board -- no state board has
4 made any discipline against plaintiffs. There is an
10:42:30 5 allegation that Apter was referred to a state medical
6 board, but that's all we have. There is no indication
7 there has been any action whatsoever by that state medical
8 board and it's speculative, you know, if or when that
9 medical board will take any action. And as we discussed
10:42:46 10 in our brief, merely being referred to a state medical
11 board is not adequate injury in fact. So, you know,
12 again, it's purely speculative, you know, if or when that
13 state medical board will act and then what weight it might
14 give to that -- to that statement.

10:42:59 15 Importantly, it wasn't the state medical board that
16 cited the FDA statements. It was some unidentified third
17 party that included the statement in the referral to the
18 state medical board.

19 So, you know, I think to close the loop on that,
10:43:11 20 essentially, you have this simple allegation after it was
21 referred for discipline but, you know, we don't know if or
22 when the state medical board will act on the referral.

23 And, you know, if and when it does ultimately act, we
24 don't know to what extent it will give the FDA statements
10:43:28 25 any -- any weight and the fact that there are all these

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Argument by Mr. Belfer

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1 statements by other organizations, like the World Health
2 Organization and CDC and NIH, indicating that there is not
3 a showing that simply taking away the FDA statements would
4 make any difference or would cause them to act any
10:43:42 5 differently.

6 THE COURT: Okay. And you are getting into
7 redressability here. The plaintiffs say that I should
8 presume redressability at this stage. Are you aware of
9 any cases in which a motion to dismiss was granted on a
10:43:54 10 failure to show redressability?

11 MR. BELFER: Again, off the top of my head, I
12 can't. I can't think of one right now. But we do cite a
13 case in our brief. I believe it's the *Renal Physicians*
14 case from the, I think, DC Circuit, which says that you
10:44:10 15 can't presume redressability simply based on traceability.

16 So even if it's true that the government's statements
17 caused a third party to make a certain action, you
18 don't -- you can't presume redressability because it's
19 possible that some independent factor is holding those
10:44:26 20 third parties' actions in place.

21 So here, even if, you know, presuming that the FDA
22 cited statements influenced some third parties to take
23 adverse actions against the plaintiffs, you can't presume
24 redressability because there are these independent third
10:44:40 25 -- other organization statements, again, like the WHO and

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Argument by Mr. Belfer

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1 NIH and CDC, that are out there; and those statements are
2 still in place recommending against the use of COVID-19 --
3 against the use of ivermectin to treat COVID-19.

4 Additionally, you know, if the Court were to rule, for
10:44:55 5 instance, that the FDA does not have authority to make the
6 cited statements, that wouldn't affect the scientific --
7 the third-party's scientific understanding of the risks
8 and benefits of treating COVID-19. It would be a legal
9 ruling on, essentially, procedural authority grounds. It
10:45:09 10 wouldn't go to the scientific merits. And so it wouldn't
11 give the third parties any reason to change their
12 understanding of whether you should use ivermectin to
13 treat COVID-19.

14 And so for all those reasons, even if the Court were
10:45:21 15 to order that the cited statements be taken down,
16 plaintiffs haven't shown that that would make any
17 difference because there are all these other statements
18 out there; and their requested relief itself wouldn't give
19 the third parties any reason to change their understanding
10:45:34 20 of the risks and benefits of taking ivermectin to treat
21 COVID-19. So, you know, the plaintiffs have failed to
22 show redressability as well as traceability.

23 And, of course, that's only part of the jurisdictional
24 analysis. There is also sovereign immunity. And we think
10:45:48 25 that's actually an even clearer case why there is no

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Argument by Mr. Belfer

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1 jurisdiction here.

2 You know, again, these were -- these were tweets,
3 social media posts in conversational language. They were
4 nonbinding recommendations. They did not make -- they
10:46:02 5 were not binding on anyone. They were not binding on
6 private parties or the FDA. They did not set agency
7 policy. They were simply nonbinding recommendations to
8 the public. And so they were not agency action or final
9 agency action.

10:46:15 10 And as discussed in our briefs, an important
11 requirement for final agency action is that you need to
12 have a direct effect on the regulated party. So, for
13 instance, in the *Franklin v. Massachusetts* case, the
14 Supreme Court held that the secretary of commerce's report
10:46:30 15 to the president was not final agency action because it
16 was simply a nonbinding recommendation. The president's
17 report to Congress about congressional apportionment did
18 have a direct effect and was final; but the secretary of
19 commerce's report to the president was not final agency
10:46:46 20 action because it had, at most, an indirect effect on
21 apportionment. It was simply a nonbinding recommendation
22 to the president.

23 And similarly, in the *Bennett v. Spear* case the
24 Supreme Court upheld this notion that you need a direct
10:46:58 25 effect to be final agency action. And here, the

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Argument by Mr. Belfer

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1 plaintiffs have not shown any direct effect of any of the
2 cited statements on any other party. At most, they show
3 an indirect theory of causation, whereby the cited
4 statements influenced third parties, who in turn allegedly
10:47:13 5 injured plaintiffs. But that indirect line of causation
6 is not sufficient for final agency action.

7 THE COURT: And on exhaustion, is a citizen
8 petition the only way that the plaintiffs could have
9 challenged the FDA's actions with the agency itself in
10:47:29 10 this case? What else could they have done?

11 MR. BELFER: So I am -- I think in this
12 particular case I'm not -- I'm not aware of another
13 mechanism that they could have used.

14 I think, generally, in terms of the issue of
10:47:41 15 exhaustion, there is not only one mechanism. The focus is
16 not on which mechanism you use. Instead, the focus is on
17 just raising your issues somehow to the agency.

18 So, for instance, if there were, like, a drug
19 approval, then you could raise the issue in the course of
10:47:54 20 the back and forth with FDA about the drug approval or you
21 could raise it, you know, as appropriate, as a citizen
22 petition.

23 Here, I think a citizen petition would have been
24 appropriate. They could have filed a citizen petition
10:48:06 25 after FDA made its cited statements challenging those

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Argument by Mr. Kelson

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1 statements and they could have presented all of the issues
2 in their amended complaints to FDA in that citizen
3 petition and that would have been beneficial to the agency
4 by giving the FDA an opportunity to consider the issues,
10:48:19 5 in the first instance, to apply its expertise and
6 discretion, and it would have allowed the agency to
7 compile an administrative record that addressed their
8 issues.

9 And so, it would have benefited both the agency and
10:48:31 10 the Court; but they failed to do that. The plaintiffs ran
11 straight to court without giving FDA an opportunity to
12 address their issues in the first instance. And under
13 kind of core principles of administrative law, that's
14 unacceptable.

10:48:43 15 THE COURT: Okay. Let me hear from the
16 plaintiffs. I may have some more questions for you once I
17 have heard from them.

18 MR. BELFER: Thank you, Your Honor.

19 THE COURT: Thank you.

10:48:51 20 MR. KELSON: Good morning, Your Honor.

21 THE COURT: Good morning.

22 MR. KELSON: As a general matter, the FDA has no
23 authority to regulate the off-label use of drugs. It
24 never has. That dates back to the -- to when the FDCA was
10:49:08 25 first passed in 1938. It's been a repeated consideration

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Argument by Mr. Kelson

17

1 by Congress. They have never given the FDA that
2 authority. Going so far as to add a provision in
3 21 USC 396 to expressly prohibit interference, courts
4 across the entire country have repeatedly relied upon that
10:49:25 5 provision to show that -- to show that it applies to the
6 practice of medicine, including the prescription of drugs.

7 The government is trying to frame this case and its
8 actions and its response to reports about the use of
9 animal ivermectin. That doesn't explain why they then
10:49:42 10 pivoted to talk about human-use ivermectin. There is a
11 disconnect in what they are claiming the justification for
12 these actions were and what they actually did.

13 This is reaffirmed by the internal FDA documents that
14 talk about this new engagement strategy they had to
10:49:53 15 promote their recommendations to the public and the United
16 States. And it belies the fact that what they were trying
17 to do was stop the use of ivermectin. Their tweets are
18 explicit on that point.

19 So when the government says this was purely
10:50:05 20 informational, conversational, essentially a PR scheme or
21 a -- excuse me -- a PR endeavor, that doesn't explain
22 why -- that doesn't explain the language they actually
23 used, "Stop it. Stop it with the ivermectin."

24 In the government's brief when it refers to a number
10:50:20 25 of these statements, including the statements why you

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Argument by Mr. Kelson

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1 should not use ivermectin to treat or prevent COVID-19,
2 the government has to qualify the statements in its own
3 brief and say "if a doctor prescribes you ivermectin for
4 the use of COVID-19." The government's briefs, therefore,
10:50:34 5 implicitly recognize the title of that document; and the
6 FDA's other actions clearly convey that this is not an
7 acceptable way to treat these patients. The only reason
8 the FDA would engage in these actions is because of their
9 predictable effect, the only explanation.

10:50:49 10 The Court is right to understand -- recognize that
11 this is a very much common-sense case. The Supreme Court
12 recently, within the last year and a half, has made very,
13 very clear that courts are -- that courts and judges are
14 not required to exhibit a naivete from which ordinary
10:51:03 15 citizens are free. That was -- you know, that was --
16 excuse me. That was in 2019 in *Department of Commerce v.*
17 *New York*. That was Chief Justice Roberts. That applies
18 directly to this case.

19 To address some of -- to address upfront some of the
10:51:21 20 government's arguments and some of the government's
21 briefing, I want to be very clear to the Court that the
22 government did not move under 12(b)(6) to challenge any of
23 these claims on their merits. The government is, thus,
24 conceding that the plaintiffs have alleged plausible
10:51:32 25 interference in their practice of medicine, that they have

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Argument by Mr. Kelson

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1 alleged plausible claims under the APA. The government
2 has, instead, challenged them all on standing grounds or
3 challenged them on administrative exhaustion grounds or
4 sovereign immunity.

10:51:37

5 That should inform the Court's position and that
6 should also -- the Court should also take that into
7 consideration when the government tries to backdoor merits
8 considerations into other aspects of this case.

10:51:54

9 Second, in the government's reply brief the government
10 replies or the government cites *TransUnion* and says that
11 the plaintiffs are only alleging statutory violations.
12 That is incorrect. We are alleging real harms to real
13 people that are reinforced by the statute that Congress
14 passed in 21, Section 396 and, to be honest, the entirety
15 of the FDCA, which does not give the FDA the authority
16 that it is trying to assume.

10:52:10

17 More importantly, if the Court would like to look at
18 -- if the Court would look at *TransUnion*, the government
19 omits the rest of the case, which weighs heavily in favor
20 of the plaintiffs here. *TransUnion* is very clear that
21 there is an injury in fact when there is a harm that is
22 traditionally recognized as providing the basis for a
23 lawsuit in America or if there is some sort of common-law
24 analog. The Court is also very clear that it doesn't have
25 to be an exact duplicate. That Congress through statute

10:52:35

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Argument by Mr. Kelson

20

1 or Congress through its own expressions can recognize
2 harms that might have been too trivial at common law but
3 were, nonetheless, harms.

4 In fact, in *TransUnion* the exact example that the
10:52:48 5 Court used is various intangible harms, including
6 reputational harm. That is one of the -- that is one of
7 the allegations the plaintiffs have made here and, in
8 fact, provided evidence that they have been maligned on
9 line and that they constantly suffer reputational harm.

10:52:59 10 If the government is going to label ivermectin a horse
11 medicine or a horse dewormer and promulgate the idea that
12 it is only for animals, then the natural correlation is
13 that doctors who prescribe it are horse doctors or quack
14 doctors, which has been -- which has played out. That is
10:53:12 15 enough of a harm to get into court.

16 In addition, *TransUnion* also emphasizes the due
17 respect that courts should pay to the decisions of
18 Congress; and Congress has been very clear that the FDA
19 should not interfere in the practice of medicine. Now the
10:53:27 20 Court has -- while the Court has recognized that that
21 cannot completely -- that cannot completely remove the
22 necessity of showing injury, it should inform the Court's
23 decision that it is consistent with the Fifth Circuit's
24 decision that the plaintiffs need only show an
10:53:39 25 identifiable trifle of an injury. The bar is low. Any

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1 sort of injury will do, and the plaintiffs have alleged
2 many here. That injury is sufficient, even if the harm is
3 difficult to prove or difficult to quantify.

4 Moving forward, the government places a lot of
10:53:56 5 emphasis on traceability. The government's arguments in
6 this regard are flawed.

7 I'm sorry. I have one more thought I just had about
8 the injury. When the Court talked about injury in *Lujan*,
9 it discussed both a forward and a backward looking
10:54:16 10 analysis. The exact language in *Lujan* allows plaintiffs
11 to present evidence of harms that have accrued.

12 So even if -- I guess this transitions into the --
13 sorry. This transitions into traceability. So even if
14 this wasn't predictable, which is a standard for
10:54:34 15 traceability, if in retrospect the plaintiffs can show how
16 these harms were determinative or were caused by the
17 plaintiffs, de facto causality, that is traceability. The
18 plaintiffs are not cabined into the predictability test,
19 even though that is one way of establishing traceability
10:54:50 20 under the constitution, recognized by both the Fifth
21 Circuit and by the Supreme Court.

22 It's unclear what the -- what the government would
23 have thought their tweets were going to do if -- by saying
24 "stop it with the ivermectin" or "stop it" except to,
10:55:03 25 well, stop the use of ivermectin. The government engaged

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1 in a singularly effective campaign here to malign a common
2 drug that has been used for a very long time and has been
3 dispensed in billions of doses. It's one of the most
4 famously safe drugs in the history of human medicine.

10:55:18 5 And when people did exactly what the FDA said to "Stop
6 it. Stop it with the ivermectin," I don't understand how
7 that would not be traceable back to the FDA.

8 So if it wasn't -- so it was predictable. It also, in
9 retrospect, clearly points back to the FDA. When everyone
10:55:36 10 points to the FDA, there is a pretty good chance that
11 that's where it is coming from.

12 The plaintiff -- or the government has repeatedly
13 stated that people have their own scientific intuitions
14 about the ivermectin. That's not what is happening here.
10:55:47 15 People are pointing back and saying, "The FDA said no.
16 The FDA said no."

17 That is not a scientific analysis. That is a
18 deference to the FDA, to an agency that the federal
19 government set up to be an authoritative voice on the use
10:55:59 20 of drugs but limited that authority not to practice
21 medicine and not to make recommendations about medicine.

22 So in that regard the FDA's actions cannot be excused
23 simply because they presume that everyone else has these
24 scientific understanding -- this scientific understanding.

10:56:14 25 That transitions into redressability. Again, this

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1 is -- there is a common-sense intuition that when everyone
2 points to these FDA statements if a court were to come out
3 and say they were made without lawful authority and vacate
4 them that they would somehow retain their same equal
10:56:30 5 persuasive force. That seems to brink reality, as well.

6 In addition, the government points to a number of
7 other entities that have taken positions on ivermectin.
8 Each of them are severely flawed. I am not aware of the
9 FDA ever pointing to a pharmaceutical company and saying
10:56:44 10 that its statements have the same force and effect or are
11 of the same persuasive nature as the FDA. That, to me, is
12 a strange argument I have never heard from the FDA before.

13 And I don't suspect the FDA plans on deferring to
14 pharmaceutical companies in the future. In addition, the
10:57:00 15 FDA regularly disagrees with the World Health
16 Organization. Remdesivir is a great example of that. And
17 the FDA seems to think that its -- that its voice on these
18 drugs is more important than the World Health
19 Organization's. That's enough to undermine reliance on
10:57:14 20 the World Health Organization, which also is not an
21 American body and doesn't have the same effect in the
22 United States.

23 The CDC regularly cites to the FDA, and the CDC does
24 not specialize in the use of drugs in America. And the
10:57:23 25 NIH for a long period of time took no position on

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1 ivermectin, a long period of time during which harm was
2 caused to these plaintiffs. So the FDA can't point to the
3 NIH and say that it has some sort of -- that it has the
4 same effect.

10:57:38 5 In addition, the Fifth Circuit has made very clear
6 with redressability, especially at this stage of
7 litigation, that plaintiffs have established their
8 standing if a favorable ruling could potentially lessen
9 the plaintiffs' injury. It's a very low bar, and there is
10:57:54 10 absolutely a potential chance that the injury could be
11 lessened here. That case is *Sanchez v. R.G.L.* It's 761
12 F.3d 495. I believe it's cited in our brief, as well.

13 But it seems very clear that when everyone is pointing
14 to the FDA that if this court were to vacate those FDA
10:58:12 15 statements that there is a potential chance or that it
16 could potentially lessen the injury that these doctors are
17 suffering.

18 In addition, in *McClure v. Ashcroft*, the Fifth Circuit
19 as well, says you only need to show an arguable chance
10:58:25 20 that a third party might consider changing its policy.
21 The government points out that Dr. Apter is subject to
22 current investigation or current proceedings against his
23 medical license. That referral came from the Iowa State
24 Board of Medicine. It came from another state board.
10:58:39 25 This was not some random person throwing a document into a

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1 referral and sending it to a state board.

2 The FDA's actions here, their statements, their
3 tweets, they are showing up in court filings. They are
4 being relied upon by courts as the standard of care in
10:58:53 5 malpractice proceedings. They are showing up in state
6 board proceedings, as we have shown here. They are
7 showing up in public discourse as a way to malign and ruin
8 the reputations of doctors who have been working their
9 level best to fight a pandemic.

10:59:04 10 What the FDA has done is pervasive throughout the
11 entirety of healthcare and has caused significant injury
12 to these plaintiffs. And for this court to declare them
13 unlawful and to vacate them and to enjoin the agency from
14 engaging in an unlawful practice of medicine in the
10:59:19 15 future, it undoubtedly would not only address those
16 injuries it would -- it would undoubtedly redress those
17 injuries.

18 More importantly, the practice of medicine is so well
19 established in this country in the use of off-label drugs.
10:59:32 20 Up to about 40 percent of off label -- of drugs are used
21 off label in critical care. The presumption there should
22 be that if the FDA -- if that has changed somehow for
23 ivermectin and it started with the FDA, if that -- if that
24 action by the FDA is vacated that will -- that somehow
10:59:46 25 that normal will resurface. It's been that way since the

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1 beginning of the practice of medicine in this country and
2 it's unclear why the FDA has decided in this particular
3 case to try and interfere with it but that's exactly
4 what's happened.

10:59:59 5 On the sovereign immunity points that the government
6 points out, I would like to respond in a few ways. The
7 first is that this court should be careful to make sure
8 that -- to view the ultra vires claim and the APA claim
9 separately. They are separate claims, and the standards
11:00:14 10 for them are separate.

11 First off, under *Larson* the Supreme Court has been
12 clear that when you are seeking injunctive relief against
13 federal officers for exceeding their authority that that's
14 not barred by sovereign immunity. *Larson* resolves the
11:00:28 15 case for the ultra vires -- *Larson* resolves the sovereign
16 immunity issue for the ultra vires case.

17 THE COURT: Wait. Say -- say that again, please,
18 on *Larson*.

19 MR. KELSON: *Larson* resolves the sovereign
11:00:41 20 immunity issue for the ultra vires claim. The government
21 has exceeded its authority; and under *Larson*, sovereign
22 immunity does not bar -- sovereign immunity does not bar
23 injunctive relief against, quote, a federal officer that
24 acted in excess of his authority or under authority not
11:00:56 25 validly conferred. That's *Larson* at 333 -- sorry -- 337

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1 in the U.S. Reports, Pages 690 to 691. It's also cited in
2 our brief extensively.

3 In addition, the government decides -- the government
4 waited until the reply brief to challenge the plaintiffs'
11:01:13 5 interpretation of Section 396. Not only have multiple
6 circuit courts applied that -- the plaintiffs'
7 interpretation of Section 396 about prohibiting the
8 interference of the practice of medicine, but this case is
9 not dependent upon that provision.

11:01:28 10 Whether or not Section 396 is in effect, the FDCA does
11 not give the FDA authority to do what it's doing here.
12 That provision is an emphasis that was added by Congress
13 to make sure the FDA did not overstep. But if you go back
14 to the debates leading up to the 1938 Act and all through
11:01:44 15 the present, Congress has repeatedly expressed that the
16 FDCA does not have the authority to interfere with the
17 practice of medicine. This is nothing new.

18 And so whether or not this court finds that
19 Section 396 applies here, it doesn't change the outcome of
11:01:56 20 this case. Section 396 is merely an exclamation point
21 showing that Congress really did not want the agency doing
22 what it's doing now.

23 Moving on to the APA waiver of sovereign immunity, in
24 5 USC, Section 702, again, the difference between the
11:02:13 25 ultra vires and the APA claims is important. The ultra

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1 vires claim does not require final agency action. It only
2 requires agency action. That is very, very clear from the
3 Fifth Circuit's precedent, for example, the
4 *Alabama-Coushatta* case.

11:02:27 5 The Fifth Circuit has also been clear that pretty much
6 everything an agency does qualifies as an agency action
7 under the -- under the APA. There is Fifth Circuit
8 precedent that is directly on point.

9 I don't how to pronounce the case, *Avoyelles*
11:02:42 10 *Sportsmen's League*; but that one is very explicit that
11 anything the agency does is at least an agency action.
12 The question then becomes if it's final.

13 In addition, you have the *Data Processing* [sic] case,
14 which very clearly says for even informational statements
11:02:51 15 or agency action the debate will be over whether they are
16 final.

17 So to be very clear, as soon as the agency acted they
18 waived -- Section 702 waived sovereign immunity for an
19 ultra vires claim. Finality is not a requirement.

11:03:03 20 For the other APA claims where finality would be a
21 requirement, it is also clear the agency has acted with
22 finality here. The agency has maintained this position
23 for a year and a half. While they say -- while the agency
24 has said that they might change their position based upon
11:03:17 25 further factual analysis, the Fifth Circuit expressly

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1 rejected that argument recently in the *Data Processing*
2 case -- or the *Data Marketing* case. If you would like a
3 citation, that's 45 F.4th at 854.

4 The Fifth Circuit was very clear and actually
11:03:33 5 chastising the government that it recycles an argument the
6 Supreme Court has repeatedly rejected. The action isn't
7 final because the agency can change its position after
8 more fact finding. This argument is squarely foreclosed
9 by numerous Supreme Court decisions.

11:03:44 10 It would also mean that no agency action is ever final
11 because the agency can always change its mind after
12 further fact finding.

13 Looking at this case then, the agency has maintained
14 its position for a year and a half. Their statements are
11:03:55 15 not qualified: "Stop it" and "Stop it with the
16 ivermectin," "Should I take ivermectin to treat COVID-19"
17 or "Should I take ivermectin to treat or prevent COVID-19?
18 No." Those are not qualified statements.

19 And the fact that they are followed up with "if my
11:04:08 20 doctor gives me ivermectin, take it exactly as prescribed"
21 -- whatever that language exactly is -- does not change
22 the fact that they have just stated unequivocally, "Should
23 I take ivermectin? No." Period.

24 And so even if -- in reading those statements
11:04:21 25 together, it's very clear that the government is either --

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1 it's very clear that the best way to interpret that
2 statement is that -- the best way to interpret that
3 statement is that if my doctor prescribes me ivermectin
4 for something else.

11:04:37 5 If the government was -- wanted to be clear that if
6 the government -- that doctors could prescribe ivermectin
7 for COVID-19 and then should be taken exactly as
8 prescribed, it could have said that; but it chose not to,
9 instead, putting all its emphasis and references to
11:04:50 10 COVID-19 to tell doctors and to tell patients they should
11 not -- to tell patients they should not take it and to
12 tell the public that they should not take it either.

13 I'm sure that this court is aware that doctors and
14 patients are part of the public and that patients are
11:05:01 15 consumers. So saying that this document -- saying that
16 the government's main document why you should not take
17 ivermectin to treat or prevent COVID-19, by saying that
18 that was directed to consumers is not a fail proof -- is
19 not some sort of argument to get out of the real effect
11:05:17 20 that that document had or the fact that it is directly
21 talking to people that are in the doctor-patient
22 relationship.

23 In addition, on the finality point, the Fifth Circuit
24 and the Supreme Court have been very clear that finality
11:05:28 25 is flexible and pragmatic. As part of that flexibility

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1 and that pragmatic consideration, this court should be
2 mindful of the fact that Congress in Section 396 said that
3 the FDA can't interfere in the practice of medicine.

4 It would be very passing strange if the agency could
11:05:44 5 do exactly what Congress told them not to and they could
6 turn around and say, "Our action wasn't final though. So
7 it's okay." Congress recognized that there was some sort
8 of real-world effect of the agency interfering in the
9 practice of medicine; and in so doing, that agency action
11:05:57 10 would have to -- would be final.

11 In addition, the Fifth Circuit has said it's a -- the
12 action only has to be binding as a practical matter, where
13 private parties might rely on it as the norm. That's the
14 *Texas v. EEOC* case. And it's very clear that it's become
11:06:13 15 a norm. Courts are relying on it as the standard of care.

16 Like, directly under the Fifth Circuit's precedent in
17 *Texas v. EEOC* you would -- as a practical matter the FDA
18 statements have now become a norm in society. They have
19 been the norm that is being relied upon by professional
11:06:28 20 bodies, by advisory bodies and by courts.

21 In that same case, the Fifth Circuit continued that
22 private party -- an agency action is final if private
23 parties are reasonably led to believe that failure to
24 conform will bring adverse consequences. I think it's
11:06:42 25 safe to say that failure to conform with the FDA's

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1 position here has brought adverse consequences to these
2 doctors both reputationally, the fact that Dr. Apter is
3 now facing board charges.

4 So viewed in that flexible and pragmatic sense, there
11:06:52 5 are numerous factors which weigh in favor of finality
6 here, not to mention the common sense -- not to mention
7 the common sense view of what the agency has done in
8 reading its own language.

9 As an additional point, just in response to the
11:07:07 10 government, in *Bennett* the government was acting on a
11 third party. So there is -- there is some -- there is
12 other cases where the fact -- the fact of the matter is
13 there are legal consequences. The government can't
14 launder its actions by making -- setting up some sort of
11:07:22 15 standard that can then be relied upon as a third party to
16 impose those -- by a third party to impose those
17 consequences.

18 In addition or finally, in response to the
19 government's reply brief, I would like to point out to the
11:07:33 20 Court specifically that on page, I believe it was, 21 the
21 government makes very clear in its reply brief that it is
22 not arguing a citizen petition is required. That
23 concession is incredibly important because the Fifth
24 Circuit has been very, very clear that unless exhaustion
11:07:51 25 is required by statute or by regulation, the only time

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1 administrative exhaustion is necessary is when there is
2 some sort of adversarial proceeding below.

3 In fact, the government cites repeatedly *Palm Valley*.
4 In Footnote 6 of that opinion Judge Costa is explicit that
11:08:06 5 the administrative exhaustion requirements only apply in
6 that case because there is a regulation that requires it.

7 If there is no regulation, you have to have
8 adversarial proceedings below. You have to have something
9 tantamount to a judicial proceeding. That is not present
11:08:19 10 here. That is not in any way present here because the
11 government gave no process. Instead, it acted
12 unilaterally to push its -- to push its public campaign.

13 In fact, the examples that the government gives talk
14 about when there is, for example, some sort of agency
11:08:34 15 proceeding over a drug approval, when there is some sort
16 of existing agency proceeding. There was none here. And
17 if a citizen petition is not required, which we contend it
18 is not, based upon the plain language but also based upon
19 the government's own admission that a citizen petition is
11:08:46 20 not required, then we are in a separate world of
21 administrative exhaustion.

22 And what the government would purport to this court
23 would be a fundamental change in how administrative
24 exhaustion has been run in this country and they would
11:08:56 25 impose a brand new requirement that has never been

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1 recognized that a party must go to an agency and litigate
2 its case with an agency before it goes to the government
3 when the agency gave no process ahead of time.

4 The whole purpose of administrative exhaustion is to
11:09:09 5 avoid parties sandbagging an agency and waiting until
6 court to raise their claims or to give the agency the
7 opportunity to engage -- to apply its expertise during its
8 proceedings.

9 None of that applies here. None of these
11:09:20 10 considerations are relevant. There were no proceedings.
11 The government has acted. It's been final. In addition,
12 this is a legal question. This is not some sort of
13 factual dispute for the agency. And so the fact that
14 there is no agency expertise here that the Court would
11:09:36 15 need to defer to, none of the factors that weigh in favor
16 of agency exhaustion would otherwise apply.

17 So agency -- by the government's own admission, agency
18 exhaustion is not required by the law. It is not required
19 by a statute. By very clear Fifth Circuit case law and by
11:09:51 20 -- it is not required as a prudential matter; and even if
21 it were required as a prudential matter, there are ample
22 reasons for this court to weigh that exhaustion
23 requirement because none of the factors that weigh in
24 favor of exhaustion are present here.

11:10:06 25 I think that that is -- those are my main responses to

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1 what the government has said. If you have -- you know, if
2 the Court has any questions, I would happy to answer them.

3 THE COURT: Sure. No. I appreciate that. Are
4 you aware of any cases anywhere else where patients are
11:10:21 5 the plaintiffs suing over the FDA's comments on
6 ivermectin?

7 MR. KELSON: I don't know of any -- I am not
8 aware of any cases where patients are suing the FDA.

9 THE COURT: All right. Any idea why there aren't
11:10:35 10 any -- I guess this is a doctors' case, not a patients'
11 case is why there aren't any --

12 MR. KELSON: It's a doctors' case.

13 THE COURT: -- patients among the plaintiffs in
14 this case here today.

11:10:44 15 And another kind of general question.

16 MR. KELSON: Just as one consideration for the
17 Court, when it comes to the need for ivermectin, the
18 plaintiffs see these things every day. They are well
19 immersed in the science; and they are well immersed,
11:11:03 20 actually, in the practice of medicine prescribing
21 ivermectin or trying to prescribe ivermectin and dealing
22 with the public backlash they get for doing so.

23 With patients, most patients are only seeking
24 treatment for COVID; and then once it's over, it's done.
11:11:14 25 But the benefits of a lawsuit and the motivation for a

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1 lawsuit are significantly diminished in that regard.

2 Whereas with these doctors, they have been living in
3 this world for a year or a year and a half now and they
4 have suffered significant reputational harm as a result of
11:11:26 5 it. They see this interference with their practice of
6 medicine every year -- every day. It takes an extreme
7 toll on them but also then makes it difficult when they
8 are constantly battling trying to write prescriptions and
9 get prescriptions for their patients and then they are
11:11:39 10 fighting with pharmacists who are saying, "Well, the FDA
11 says no."

12 And so, just as a practical matter in that regard, the
13 explicit answer or the exact answer to your question is I
14 am not aware of any plaintiffs that are suing the FDA. I
11:11:51 15 do know some plaintiffs -- I do know of some plaintiffs
16 who have sued hospitals to try and get ivermectin in the
17 past. There were a few of them in the news.

18 But it also is very easy for the Court to see why this
19 is a particularly problematic issue for doctors, and that
11:12:05 20 is why the three plaintiffs in this case that I represent
21 have been willing to undertake the expensive burden of
22 litigation to try and rectify the injuries that they have
23 suffered.

24 THE COURT: I believe the government noted that
11:12:18 25 it was, like, 26 months or something from the time the FDA

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1 first started making these statements that the lawsuit was
2 filed. Is there a reason for that delay?

3 MR. KELSON: So I think there are -- there are a
4 number of reasons that could be relevant. I'm not sure
11:12:33 5 that they are in any way required to bring a lawsuit
6 within a certain -- they have a four-year statute of
7 limitations under the APA or six-year statute of
8 limitations.

9 When the government first started in 2020 or early
11:12:44 10 2021, the statements were significantly more benign. They
11 were problematic, but they were more benign. It really
12 took off in August when they started with the "You are not
13 a horse. You are not a cow" campaign and when they
14 started labeling doctors as essentially horse doctors or
11:12:59 15 quack doctors. And so that -- that exacerbated the
16 injury. The government then doubled down recently, I
17 believe it was in April, with another tweet.

18 So to say this is anything about animal ivermectin is
19 even more problematic under the light of the fact that
11:13:14 20 they are continuing the horse trope many, many months
21 afterwards.

22 As a result, because the government has maintained
23 these documents and has been doubling down on them, like,
24 the injury has been increasingly severe. And, quite
11:13:26 25 frankly, sometimes it takes a while to find a lawyer who

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1 will take your case.

2 There are a number of considerations and then, you
3 know, we put an extensive amount of work into trying to
4 find all the publicly-available examples we could have to
11:13:39 5 track down what was going on and to make sure that we
6 could substantiate the plaintiffs' claims.

7 So for those reasons and the fact that the plaintiffs
8 have a significantly long runway, six years to bring APA
9 claims, 26 months isn't actually unreasonable at all.

11:13:56 10 THE COURT: You argue for a very broad
11 interpretation of agency -- of what constitutes agency
12 action. If everything an agency does is agency action
13 under the APA, then does that mean the APA is kind of a
14 general waiver of sovereign immunity? That's kind of what
11:14:15 15 it sounds like.

16 MR. KELSON: No. No. Because, yes, everything
17 -- the Fifth Circuit has been explicit that everything an
18 agency does is going to fall under the definition of
19 agency action; but to bring a claim under the APA, for
11:14:27 20 example, and to claim a waiver of sovereign immunity under
21 the APA, you have to show final agency action. So that is
22 one distinction.

23 The ultra vires claim, which is not -- which does not
24 have a finality requirement to it under the Fifth
11:14:38 25 Circuit's precedent, yes, if an agency acts then there is

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1 a waiver of sovereign immunity but it's very limited and
2 it only applies to injunctive relief, not damages. That
3 also should not concern the Court because it only becomes
4 relevant when the agency has acted unlawfully.

11:14:51 5 All the government's arguments here have nothing to do
6 about whether or not their actions were lawful. They have
7 everything to do about setting up barriers for the
8 plaintiffs to begin a course to seek remedy.

9 And so to the extent that the agencies act unlawfully,
11:15:01 10 then, yes, they would be subject to suit. If the agencies
11 haven't acted unlawfully, it actually becomes immaterial
12 whether or not agency action is brought because any agency
13 action that would be -- any challenge to any agency action
14 -- I'm sorry. I might have been speaking to quickly.

11:15:15 15 Any challenge to any agency action that is lawful will
16 be promptly dismissed, and so it's not going to be a
17 burden on the agency either.

18 THE COURT: Is any informational statement that
19 the FDA makes an ultra vires act by the agency?

11:15:31 20 MR. KELSON: That would be an agency specific
21 inquiry, Your Honor. The FDA in this particular case
22 is -- the FDA sits in a very unique spot in the United
23 States because of the authority that the government has
24 given it to regulate the approval of drugs to let the
11:15:49 25 drugs enter into the market and withholding the ability to

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1 interfere with the practice of medicine.

2 Most informational statements are not going to be
3 problematic. The FDA talks about how, well, we've issued
4 warning letters in the past. That's not -- that might be
11:16:03 5 an agency action, but it's not unlawful for them to issue
6 a warning letter to a doctor or to someone who has -- to
7 someone who is marketing a drug -- who is marketing a drug
8 contrary to the FDCA.

9 The statements here go far beyond purely
11:16:22 10 informational. These are not informational statements.
11 These are directives to the public. These are directives
12 to patients or these are strong medical -- these are
13 medical recommendations. That is the heart of the
14 practice of medicine.

11:16:32 15 And so this case needs to be viewed in the
16 context-specific capacity of the fact that we are dealing
17 with the FDA which has significant authority in this area,
18 which has outsized -- which throws around outsized weight
19 in this area and the fact that Congress has explicitly
11:16:49 20 recognized the problems that the FDA could cause if it
21 started meddling in the practice of medicine. It's
22 relevant throughout the debates. It's relevant in
23 Section 396 of Title 21.

24 And so in this particular case we are not talking
11:17:01 25 about informational statements only. We are talking about

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1 statements that are making recommendations about medicine.
2 We're talking about statements that are directing the
3 public to "stop it" or to "stop it with the ivermectin."

4 So in that regard, this case is not about whether or
11:17:15 5 not informational statements are illegal. It's about the
6 statements here that the FDA has made.

7 Also, if the government -- the government has
8 mentioned or has tried to make the argument that it's just
9 -- that it can speak freely. That's a merits argument,
11:17:25 10 and that should not be resolved at the motion to dismiss
11 stage because the government has not raised a 12(b) (6)
12 motion challenging the merits of the claims.

13 THE COURT: You mentioned warning letters.
14 Warning letters seem like they are more than
11:17:39 15 informational. They can approach being a directive, too,
16 can't they?

17 MR. KELSON: The FDCA has the authority to police
18 how drugs are marketed. That's like -- that is within
19 their express statutory authority. So it's -- it's
11:17:50 20 somewhat of a red herring or a straw man where the
21 government says, "Look, we send out these warning letters
22 telling a pharmacist we heard that you are promoting this
23 drug and saying that it is -- it should be used for these
24 purposes."

11:17:59 25 That is separate from what is going on here because we

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1 are not talking about advertising drugs for this -- for
2 sale and distribution. We're talking about how doctors
3 deal with their patients and what drugs should be used for
4 particular treatments off label.

11:18:11 5 The FDA has authority over what -- over when drugs can
6 be admitted to the market, what labeling they can use, and
7 how they can be marketed. If they issue a warning label
8 on those conditions that is within their authority, then
9 they are within their authority; but that's not what they
11:18:25 10 are doing here. They are telling people to stop -- they
11 are telling consumers, not distributors. They are telling
12 consumers to stop it. They are telling doctors, the
13 public, to stop it. That is a totally different thing
14 that is outside of their authority.

11:18:38 15 THE COURT: I know that courts have held that
16 warnings letters are not final agency action. If warning
17 letters aren't, then how can the statements in this case
18 be?

19 MR. KELSON: So, in the first instance, a warning
11:18:56 20 letter is more tentative than a statement like "Stop it"
21 or "Stop it with the ivermectin." So there is a
22 difference in the tone of the letter -- of the statements.

23 In addition, Section 396 should inform this court's
24 flexible and pragmatic approach to finality.

11:19:13 25 In addition, the warning letters -- the warning

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1 letters are explicitly, by their terms, in preparation for
2 a potential enforcement action. And so they are very
3 clearly non-final by their nature. They are issuing a
4 warning that in the future they may choose to take action;
11:19:30 5 whereas, these statements about ivermectin have no such
6 future action attached. They are not -- they are not in
7 anticipation of something else. They are not a warning.
8 They are not an initial volley in an ongoing conversation
9 with a regulated party. These are direct and final
11:19:45 10 statements to the public, to doctors, to consumers, to
11 patients. And so, in that regard, they are different.

12 And in the event the Court feels otherwise, none of
13 that affects the ultra vires claim which, in any event,
14 should proceed.

11:19:57 15 THE COURT: Okay. Well, thank you. I'm going to
16 see if the government has anything else, but I appreciate
17 it.

18 Counsel, you are welcome to -- go ahead. You are
19 welcome to cover whatever you would like in response to
11:20:14 20 the plaintiffs' arguments; but I would like you to
21 specifically address, for one thing, the allegation that
22 the statements the FDA made that the plaintiffs are
23 complaining about in this case were not merely
24 informational but were more like directives.

11:20:33 25 MR. BELFER: Yes, Your Honor. The cited

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1 statements were not directives. They were not mandatory.
2 They were recommendations. They said what parties should
3 do. They said, for example, why you should not take
4 ivermectin to treat COVID-19. They did not say you may
11:20:50 5 not do it, you must not do it. They did not say it's
6 prohibited or it's unlawful. They also did not say that
7 doctors may not prescribe ivermectin.

8 THE COURT: Well, they very flippantly say "stop
9 it" in the tweet.

11:21:04 10 MR. BELFER: Yeah. They use informal language,
11 that is true; but they did not -- they did not say you may
12 not do this or it is unlawful. If you look at the
13 language they used, it is -- yes, it's informal. It's
14 conversational, but it's not mandatory. It never said
11:21:17 15 this is unlawful, it's prohibited. And so that contrasts
16 with, you know, other things that FDA might say where it
17 is more -- more mandatory.

18 And if you look at the kind of statements at issue
19 here, we are not talking about a publication of the CFR or
11:21:31 20 an official memorandum. We're talking about tweets and
21 Instagram posts and website posts. These are much more
22 informal fora.

23 And so if you look at the informal fora, the fact that
24 this is informal conversational language, plaintiffs
11:21:45 25 cannot show that it was predictable that anyone would look

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1 at these statements and think that they were prohibited
2 from taking ivermectin to treat COVID-19, especially given
3 that, you know, the tweets both linked to the article and
4 the article said that doctors have discretion and that if
11:21:56 5 your doctor prescribes ivermectin, take it exactly as
6 prescribed.

7 So a few general points before we get into the
8 specific issues that plaintiffs raised. So plaintiffs
9 argue that -- they tried to frame this case as about the
11:22:15 10 off-label use of drugs, off-label prescription; but this
11 is not a case about off-label prescription. This is a
12 case in particular about the use of ivermectin to treat
13 COVID-19.

14 No one is questioning that doctors generally have
11:22:26 15 authority to prescribe off-label in appropriate
16 circumstances. Instead, what FDA is saying here is it's
17 warning consumers about the risks of using ivermectin to
18 treat COVID-19.

19 And the fact that FDA generally does not prohibit
11:22:40 20 doctors from prescribing off-label has never been taken to
21 be a limitation of FDA's authority to communicate
22 publicly. FDA communicates publicly about the risks of
23 drugs all the time. And, in fact, in the amended
24 complaint the plaintiffs concede that FDA generally has
11:22:53 25 authority to communicate to the public about the risks of

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1 drugs. So there is no dispute that FDA generally has
2 authority to communicate with the public about the risk of
3 drugs.

4 Plaintiffs argue that Section 396 is a limitation on
11:23:05 5 that authority. But tellingly, in their argument, the
6 plaintiffs don't really defend 396 and for good reason.
7 Section 396 is directed to medical devices, not drugs.
8 And even beyond that, 396 is -- does not establish any
9 general interest in -- against interference with the
11:23:22 10 practice of medicine, let alone any interest to get into
11 FDA communications. It's not about that.

12 Instead, 396 is very specific. It's about doctors'
13 authority to prescribe or administer medical devices; and
14 even if you could strike out the word "devices" and
11:23:38 15 replace it with "drugs," it would still only be about
16 doctors' authority to prescribe or administer drugs. And
17 here there is no allegation that doctors' authority to
18 prescribe or administer drugs was ever impaired.

19 The plaintiffs, by their own admission, have continued
11:23:51 20 to prescribe ivermectin. So they always had the
21 authority. It may be that patients were not able to fill
22 prescriptions, but the doctors themselves always had the
23 authority. So Section 396 is not applicable, and there is
24 -- there is really no general interest against
11:24:05 25 interference with the practice of medicine at issue here.

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1 So I would like to respond in particular to a few of
2 the arguments that have been made on the various issues in
3 this case. Starting with sovereign immunity, plaintiffs
4 argue that their ultra vires claim is essentially an
11:24:23 5 exception to sovereign immunity.

6 But in the *Danos* case from the Fifth Circuit, the
7 court said that it's not enough simply to allege that an
8 agency action is unlawful or unauthorized. You have to do
9 more. You have to show that the agency had no colorable
11:24:38 10 basis for its exercise of authority; and plaintiffs have
11 not done that here because, again, they concede that FDA
12 generally has authority to communicate with the public
13 about the risk of drugs. They argue that 396 is a
14 limitation on that authority; but as we discussed, 396 is
11:24:51 15 inapposite here.

16 And so plaintiffs have not met the standard under
17 *Danos* of showing the FDA had no colorable basis for the
18 exercise of its authority. Right.

19 And so with regard to agency action, plaintiffs take
11:25:06 20 the position that essentially any -- any statements by the
21 agency is agency action. And they say that the Fifth
22 Circuit has held that essentially everything an agency
23 does is agency action, but that's simply not true.

24 If you look at cases like *Alabama-Coushatta* or
11:25:22 25 *Walmart*, both Fifth Circuit cases, those make clear that

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1 not everything is agency action. In their briefing,
2 plaintiffs rely specifically on their contention that the
3 agency -- the cited statements are a rule. That is their
4 basis for saying there is agency action.

11:25:37 5 So let's look at the definition of a rule. The
6 definition of a rule -- I can pull it up right here. So,
7 essentially, to be a rule you need to be binding on either
8 the agency or a private party or you need to interpret a
9 substantive rule or you need to set agency policy. Those
11:25:53 10 are all the rules. But here the cited statements are none
11 of those things. They are not binding on anyone. They
12 don't interpret any rule, and they do not -- they don't
13 set agency policy.

14 And so you need to meet -- plaintiffs rely on a rule,
11:26:09 15 but here the cited statements simply don't meet the
16 statutory definition of a rule.

17 And then, with regard to final agency action, I guess
18 starting with consummation of the agency decision-making
19 process, we do not argue that the consummation prong is
11:26:25 20 met simply because the cited statements might be revised
21 in the future.

22 Sure. An agency can always take future action, but
23 that's not what we're arguing. Instead, our argument is
24 that if you look at the face of the cited statements
11:26:38 25 themselves, they are expressly tentative. They state that

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1 they are based on currently available data, that more data
2 is needed, and that clinical trials are ongoing.

3 So if you just look at the face of the statements,
4 they are expressly tentative and based on currently
11:26:50 5 available data. They do not state FDA's final definitive
6 position on the use of ivermectin to treat COVID-19.

7 You know, plaintiffs say that these statements --
8 going to the legal consequence prong, plaintiffs say that
9 these statements are unequivocal. They are not
11:27:06 10 unequivocal. They generally recommend against using
11 ivermectin but they also say if your doctor prescribes it,
12 take it exactly as prescribed. And there is no allegation
13 that anyone read part of the statement but not the entire
14 statement. And so plaintiffs have not shown that
11:27:18 15 plaintiffs would not read the entire statement and see
16 that nuance in the statements.

17 Plaintiffs cite *Texas v. EEOC* regarding this notion
18 that if the agency establishes a norm that that's final
19 agency action; but the *Texas v. EEOC* case is plainly
11:27:33 20 inapposite. In that case, the agency established a norm;
21 and if private parties did not comply with the norm, they
22 were subject to legal liability. They could be sued for
23 failing to comply with the norm. That's a direct effect
24 on those third parties by changing their legal liability.

11:27:47 25 Here, there is no effect. The cited statements have

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1 no effect on anyone's legal liability. There is no direct
2 legal consequence on anyone.

3 And, similarly, the plaintiffs cite the *Bennett* case
4 but *Bennett* -- and that's *Bennett v. Spear* with the
11:28:00 5 Supreme Court -- is, again, different. In *Bennett* the
6 Fish and Wildlife Service issued a biological opinion; and
7 if other agencies did not comply with that biological
8 opinion, they could be subject to criminal and civil
9 liability. So in *Bennett* there was a direct legal effect
11:28:15 10 on other agencies. If they did not comply with the Fish
11 and Wildlife Services statement, they could be subject to
12 criminal or civil liability.

13 Again, here there is no similar direct effect. No one
14 would be subject to criminal or civil liability if they
11:28:28 15 prescribed ivermectin to treat COVID-19. Instead, the
16 statement expressly acknowledged that doctors can
17 prescribe ivermectin for that purpose.

18 So I would like to say a few words about standing. So
19 the plaintiffs argue that FDA is trying to stop the use of
11:28:48 20 ivermectin and that its purpose -- its purpose was to stop
21 the use of ivermectin; but again, if you look at the
22 language of the statements, FDA never said that doctors
23 cannot prescribe ivermectin to treat COVID-19. They said
24 doctor -- if your doctor writes you a prescription, fill
11:29:03 25 it and take it exactly as prescribed. So the FDA

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1 expressly acknowledged that you can use ivermectin for
2 this purpose if your doctor prescribes it.

3 And, you know, looking at FDA's intent, FDA was really
4 focused on consumers. It was advising consumers who could
11:29:20 5 buy this product over the counter that they shouldn't take
6 it. They did not say that if your doctor prescribes it,
7 don't take it. They said follow your doctor's advice. If
8 your doctor prescribes it, take it exactly as prescribed.

9 You -- right. So regarding the *TransUnion* case, you
11:29:35 10 know, plaintiffs say that essentially that there is injury
11 in fact here, and they cite that case. So what the
12 Supreme Court held is that you cannot presume an injury in
13 fact just because there is an alleged statutory violation.
14 You still need to look under Article III at whether
11:29:55 15 plaintiffs have met the requirement for standing.

16 So, as we discussed, there is no violation of 396.
17 FDA did not exceed its authority. But even if plaintiffs
18 had shown a violation of Section 396, that is not itself
19 alone -- that itself is not alone -- that alone is not
11:30:10 20 sufficient to show standing. You would still need to show
21 an injury in fact under Article III.

22 And because the alleged violation, interference with
23 the practice of medicine, is a vague conclusory allegation
24 and plaintiffs were always able to prescribe ivermectin,
11:30:26 25 they have not shown any injury in fact under Article III.

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1 Regarding traceability, you know, plaintiffs try to
2 minimize their burden to show traceability; but
3 importantly, the standard is that -- or, sorry. Under the
4 *Daves* case from the Fifth Circuit the Court held that it's
11:30:44 5 substantially more difficult to show traceability when the
6 causal chain relies on independent third-party conduct.
7 And so to meet that much higher burden when, as here,
8 plaintiffs rely on this indirect causal chain, you need to
9 show that the third-party conduct would be a predictable
11:31:02 10 response to the cited statements.

11 And because FDA statements were directed at consumers,
12 they were, you know, informal, conversational, and because
13 they expressly acknowledged doctors' discretion to
14 prescribe ivermectin, it would not be predictable that,
11:31:14 15 for example, a hospital would punish a doctor for
16 prescribing ivermectin when the statements themselves
17 acknowledged that doctors could prescribe ivermectin to
18 treat COVID-19.

19 You know, plaintiffs state that everyone is pointing
11:31:27 20 to FDA. So, surely, FDA must have caused the third-party
21 conduct. But if you look at what is alleged in the
22 complaints in the exhibits, it's clear that third parties
23 are not just relying on FDA.

24 For example, Exhibit 12, which is the statement of
11:31:42 25 Sentara, which is a former employer of Dr. Marik, they did

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1 not simply rely on FDA. Instead, they cited statements
2 from many organizations -- FDA, CDC and several other
3 organizations -- and they provided independent medical
4 analysis. They said there is no randomized control trial
11:31:59 5 that supports use of ivermectin to treat COVID-19.

6 So, you know, plaintiffs' employers, pharmacies,
7 insurance companies, these are sophisticated entities that
8 make independent -- that exercise independent professional
9 judgment as shown by Exhibit 12. They did not simply take
11:32:13 10 what FDA said and accept it at face value. They looked at
11 FDA statements in combination with the statements made by
12 many other organizations. They also performed independent
13 scientific analysis. They looked at the data. And based
14 on all of that, they concluded that they would not
11:32:27 15 recommend prescribing ivermectin.

16 And so, you know, that undermines redressability
17 because it shows that even if you took away FDA cited
18 statements, just those statements, you would still have
19 all those other third-party statements that Sentara and
11:32:42 20 other organizations relied on.

21 And I would just give you a few more citations.
22 Exhibit 25, which is the joint statement by the American
23 Medical Association and other organizations, also. So
24 it's not just FDA but many other -- many other statements.

11:32:55 25 And the *DeMarco* case the plaintiffs cite, that cites

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1 not just FDA but many other organizations.

2 And so simply taking away these particular FDA
3 statements, plaintiffs have not shown that that would
4 likely cause third parties to reverse their past conduct;

11:33:07 5 and again, that's the standard. You have to show -- you
6 have to -- you have to have allegations that plausibly
7 allege that it would be likely that third parties would
8 reverse their past conduct and redress plaintiffs'
9 injuries, and plaintiffs have not shown that it would be

11:33:21 10 likely. Right.

11 So I think, for all those reasons, plaintiffs have not
12 shown that there is any waiver of sovereign immunity
13 because they have not shown agency action or final agency
14 action. And they also have not shown that they have
11:33:38 15 standing because they have not shown injury in fact for
16 many of their injuries, and none of their injuries
17 satisfied the traceability or addressability prongs.

18 So unless Your Honor has any further questions.

19 THE COURT: No. I don't think I do right now. I
11:33:53 20 appreciate it. I'm going to give the plaintiffs the last
21 word. Thank you, Counsel. Appreciate it.

22 MR. BELFER: Thank you, Your Honor.

23 MR. KELSON: I believe the government began by
24 saying that these were only informal tweets, these were
11:34:16 25 only informal Instagram posts or LinkedIn posts.

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1 The government can't launder unlawful action as a good
2 PR scheme or as a good PR endeavor. The agency acted.
3 Whether it acted through an informal way with definitive
4 language or whether it went through the Federal Register
11:34:33 5 doesn't change the fact that the agency acted here.

6 The government is trying to -- tries to downplay
7 *TransUnion*; but *TransUnion* explicitly recognizes that
8 while you can't merely allege statutory harm, other
9 injuries can be drawn from past precedent, from common-law
11:34:52 10 analogs. It specifically points out reputational harm,
11 which we have alleged here.

12 There is a common-law analog to tortious interference
13 with a doctor-patient relationship that's recognized in
14 Texas. If you -- you know, if you want a case for that,
11:35:02 15 you can look at the *Garcia* case from the Northern District
16 of Texas. It's 1999 -- it's an unpublished case; but it
17 cites a number of other Texas cases -- 1999 Westlaw
18 362787.

19 So *TransUnion* squarely supports the plaintiffs here.
11:35:19 20 It shows that their injuries are real, that while there is
21 a statutory violation, which should inform the Court's
22 interpretation of the injury, and since they only need an
23 identifiable trifle, there is also plenty of common-law
24 analogs to show exactly what it is the doctors have
11:35:35 25 alleged here.

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1 One of the amicus briefs, the American Association of
2 Physicians and Surgeons also points out the *Tozzi* case
3 where an agency labeling something as dioxin was enough to
4 cause harm. It was enough to establish standing.

11:35:43 5 The FDA has labeled this a horse drug. The FDA has
6 maligned the use of ivermectin and that the agency has
7 told people to stop it. If there was standing in the
8 *Tozzi* case from the DC Circuit, then there is definitely
9 standing here.

11:35:59 10 I am not in any way backing away from the plaintiffs'
11 interpretation of Section 396. That statute has been
12 repeatedly interpreted by circuits across the entire
13 United States as applying to the practice of medicine,
14 including the prescription of drugs.

11:36:12 15 The government in its briefing says that by using a
16 "see" statement, a "see" signal to introduce the citation
17 that the government is -- that the Fifth Circuit was
18 saying that it was an unrelated -- it was a related but
19 not directly on point case. That is not what a "see"
11:36:26 20 signal means. A "see" signal means that the cited -- or
21 the citation directly supports the proposition stated in
22 the preceding sentence. That is Bluebook Rule 1.2.

23 As a result, all these courts have recognized that it
24 applies. If you look at the -- to the extent there is a
11:36:41 25 scriveners error in that provision, so be it; but that

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1 provision was clearly intended to stop the FDA. And even
2 if it wasn't, the FDA doesn't have this authority. That
3 has been very clear for 100 years.

4 I don't -- I don't -- unless the Court would prefer
11:37:00 5 otherwise, I don't need to walk through all the -- I don't
6 need to re-walk through all the arguments that we have
7 already made in response to the government, except I would
8 -- the only additions I would make is to point the Court
9 to *Avoyelles Sportsmen's League* where the Fifth Circuit
11:37:15 10 was explicit that the APA defines the term "rule" broadly
11 enough to include virtually every statement an agency may
12 make. That's a direct quote from a Fifth Circuit case.

13 In addition, the definition of "rule" in the rule --
14 in the APA is not exhaustive. It is prefaced by the word
11:37:29 15 "includes." That means that there -- it is giving
16 examples of a fall within a rule; and as the Fifth Circuit
17 has recognized, that includes every statement an agency
18 may make.

19 And if the Fifth Circuit's precedent isn't sufficient
11:37:43 20 to satisfy this case, which we believe it is, there is
21 also a DC Circuit case on the finality issue called
22 *Ciba-Geigy Corp.* It's cited in our briefs. But it talks
23 about how a hyper-technical approach is not appropriate
24 and that a series of pronouncements may constitute final
11:37:59 25 agency action if their cumulative effect causes injury.

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1 That case is directly on point.

2 So to the extent this court wants to look outside the
3 Fifth Circuit, the DC Circuit has a case that is directly
4 on point with both *Tozzi* and *Ciba-Geigy*, both of which are
11:38:13 5 cited either in our brief or in the amicus brief.

6 In sum, the doctors here have been suffering -- have
7 suffered injuries at the hands of the FDA's public
8 pressure campaign for a long time now, well over a year.
9 And this court has the power to stop that or to give them
11:38:39 10 the possibility of seeking relief. The redressability
11 standard is low. They just have to show the potential for
12 some sort of relief.

13 Especially at this stage of the proceedings, the
14 standard is plausibility; and the plaintiffs have
11:38:51 15 unquestionably made plausible arguments, cited numerous --
16 numerous public statements, numerous public actions by the
17 agency that establish more than a plausible injury, more
18 than a plausible traceability back to the FDA, and more
19 than plausible redressability. That's all that is
11:39:10 20 required at this stage in the proceeding.

21 And that just -- that is only the publicly-available
22 information that we have been able -- that we have seen,
23 that we have been able to find. Recently, in *Biden v.*
24 *Missouri* it's become very apparent that government
11:39:24 25 officials have been acting in nonpublic ways to pressure

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