



Guidance and Management of COVID-19

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Guidance and Management of COVID-19

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Transmission:

Occurs via large droplet or fomites

Stages of Illness:

-Incubation: Median duration is 5-6 days with range of 1-14 days. Reports of viral shedding for 2 days prior to symptom development.

-Replicative (initial) stage: viral replication occurs over period of days. During this period, relatively mild symptoms occur due to viral cytopathic effect and innate immune response.

- Optimal time to use anti-viral therapies
- Patient's may not present until late in this stage due to mild symptoms

-Adaptive immunity stage: leads to falling viral titers, but may increase levels of inflammatory cytokines and lead to tissue damage with severe disease resulting from a cytokine storm.

- Can cause clinical deterioration and may be the cause of sudden change in patient condition • Initial symptoms don't predict future deterioration

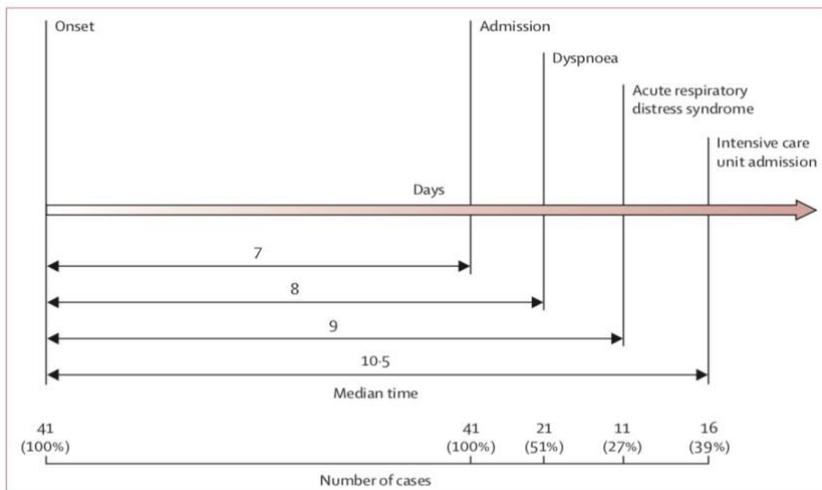


Figure 2: Timeline of 2019-nCoV cases after onset of illness

Pathophysiology:

The primary pathology in severe COVID-19 is thought to be two-fold.

- ARDS with diffuse alveolar damage.
Virus attaches to ACE2 receptors in the lungs causing cytopathic viral damage to pneumocytes.
- Cytokine storm: virus-activated host response

- Cytokine storm will present similarly to sepsis secondary to bacterial origin and may eventually develop a clinical picture similar to hemophagocytic lymphohistocytosis (HLH) which may cause elevated C-reactive protein/ferritin and is associated with increased mortality. (12)
- Fulminant viral myocarditis syndrome has been described and is associated with mortality.

Presentation:

- Males > females.
- The average age around 55 years.
- Most common comorbidities: hypertension, diabetes, and cardiovascular disease
- Most common presenting symptoms: Fever (88%) > cough (68%) > fatigue (38%) > sputum production (33%) > dyspnea (18%) > myalgia/arthralgia (15%) > sore throat (14%) > headache (14%) > chills (11%) > n/v (5%) > nasal congestion (5%) > diarrhea (4%) > hemoptysis (1%).
- Note that 11% of patients present without fever.
- Up to 10% of patients can present with GI symptoms (nausea and diarrhea) prior to fever/dyspnea. (5)

Precautions:

Standard:

- Contact (gown, gloves) + Droplet (surgical mask, eye shield).
- Aerosolizing Procedures (i.e. nebulization, bronchoscopy, airway, intubations, bag-mask ventilation): -Contact (gown, gloves, cap) + Droplet (eye shield) + Airborne (N95 respirator)

The most important thing to remember when using PPE is using it correctly (see Appendix for resources regarding proper PPE use). In the event of a large influx of patients, preventive measures will be diminished, and at this point, in the absence of adequate PPE, the most important component of PPE is wearing a fit tested facemask. (3) Providers should choose the appropriate size as indicated by his/her most recent fit test. In the event that a large influx of patients should occur and facemasks must be reused, follow the CDC recommendations for extended use and reuse.

Hand Hygiene:

- Ideally > 20 seconds
- Washing with soap/water OR alcohol containing gel
- Prior to donning PPE/entering room and during/after doffing PPE

Level of Care/Disposition:

Medicine Floor vs Step down unit admission:

- Based upon the clinical presentation and present comorbid conditions.

ICU consultation:

- Bilateral infiltrates in patients with positive COVID-19 PCR and:
 - Persistent O2 saturations < 95% on 6L nasal cannula
 - Persistent respiratory rate > 30 breaths per minute
 - P/FiO2 ratio < 300
 - If no ABG available, O2Sat/FiO2 < 250

Automatic ICU admission:

- Hemodynamic instability requiring vasopressor support

****ALL PATIENTS SHOULD BE ADMITTED TO DROPLET AND CONTACT ISOLATION AT A MINIMUM** IF the patient must have aerosolizing procedures (high flow nasal cannula, nebulization treatments or NIV (BiPAP/CPAP) or intubation) he/she must be admitted to AIRBORNE and CONTACT ISOLATION and placed in a negative pressure room if available. **Strong recommendation is to avoid nebulization treatments and NIV (BiPAP/CPAP)****

Risk factors for severe COVID-19 disease on admission

Risk factors for severe COVID-19 disease with progression to Acute Respiratory Distress Syndrome (ARDS). (5, 11)

At this time, there is no published score based upon risk factors to risk-stratify patients. Massachusetts General Hospital (MGH) is using risk factors for treatment stratification, not as a triage tool.

<i>Epidemiological</i>	<i>Vital Signs</i>	<i>Laboratory data</i>	<i>Imaging</i>
Age > 55 years	Respiratory rate > 24 breaths/min	D-dimer > 1000ng/mL	Bilateral airspace disease on CXR
Time (in days) since initial fever	Heart Rate > 125bpm	Ferritin > 300 ug/L	
Presence of chronic pulmonary disease Active smoking	SpO2 <94% on RA	CRP > 100	
Cardiovascular disease (HTN, CAD, CHF)	Temp >39 C	LDH > 245	
HIV regardless of CD4 status	SOFA>4, APACHE II (no score published that may serve as cut-off)	Elevated troponin	
Chronic kidney disease		Lymphopenia ALC <0.8 Neutrophilia (no reference range)	
Diabetes A1c>7.6%		CPK > 185	
Obesity		Influenza A-B coinfection	
Medications: use of biologics, transplant, or other immunosuppression		Coagulopathy	
NSAIDs, Hypertension w/ use of ACEI/ARB			

Table 1. Risk Factors for development of ARDS on admission.

- Time from illness onset to admission was approximately 7 days, worsening of disease to ARDS usually occurs 10-12 days after symptom onset, with multi organ dysfunction posing an increased risk of death. -Evidence from recent studies show that liver dysfunction, increased markers of inflammation, and coagulopathy seem to be linked with increased mortality.
- Liver damage indices total bilirubin, renal dysfunction indices.

-Inflammation-related indices (CRP, ESR, IL-6)

-Coagulation function indices were significantly elevated compared with patients with ARDS who survived. Fatalities occur within approximately 28 days of admission.

Laboratory/Testing:

Labs	Comments	Daily?
CBC with differential	Lymphopenia in ~ 80% Mild thrombocytopenia (poorer prognosis)	Yes
CMP	Transaminases Monitor for liver disease	Yes
D-dimer		Yes
Ferritin	Associated with hypercytokinemia	Yes
C-reactive Protein	Disease severity and prognosis	Yes
LDH		Yes
Troponin	Increased mortality Myocarditis in ~ 7% patients	No
Baseline EKG	For QT prolonging drugs	No
CPK		Yes
Procalcitonin	Typically, low in isolated COVID-19 cases Elevation suggests bacterial source	Yes
Vitamin D level	Check on admission and day 5	No

Viral Laboratory Tests:

HBC serologies	Evaluation for hepatitis/transaminase elevation
HCV antibody	Evaluation for hepatitis/transaminase elevation
HIV 1 & 2 Ab/Ag	Check prior to initiating anti-viral therapies
COVID-19 RT-PCR	Highly specific Moderately sensitive ~70% If negative and clinical suspicion is high, consider ongoing isolation and resampling in 48 hours (5)

Alternative infectious work up (to rule out other causes*):

Influenza PCR	Alternative etiology for viral UTRI/LRTI
Respiratory Virus PCR	Alternative etiology for viral UTRI/LRTI
Sputum Cultures/Gram Stain	Bacterial respiratory infections
Legionella/Pneumococcal Urinary Antigens	Non-invasive CAP

Procalcitonin	Usually < 0.5 Elevation suggests alternative diagnosis or concomitant bacterial infection
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* Please note that coinfection has been reported in 2-19% of SARS-CoV-2 positive patients. (4)

Imaging:

-Typical imaging findings initially show ground glass opacities, usually in a bilateral lower lobe distribution, often sparing the upper lobes.

-Some studies have shown CT scan findings prior to PCR positivity or symptom development in exposed health care workers.

-Sensitivity of CT scans vary among studies (86%-97%). Appears to be much higher in PCR positive patients and those with symptoms.

-See below for common radiologic findings and terminology seen in COVID-19 imaging.

-See next page for an illustrated guide to chest CT's of patients with COVID-19.

COVID-19 pneumonia imaging classification	Rationale (6-11)	CT Findings*	Suggested Reporting Language
Typical appearance	Commonly reported imaging features of greater specificity for COVID-19 pneumonia.	Peripheral, bilateral , GGO* with or without consolidation or visible intralobular lines ("crazy-paving") Multifocal GGO of rounded morphology with or without consolidation or visible intralobular lines ("crazy-paving") Reverse halo sign or other findings of organizing pneumonia (seen later in the disease)	"Commonly reported imaging features of (COVID-19) pneumonia are present. Other processes such as influenza pneumonia and organizing pneumonia, as can be seen with drug toxicity and connective tissue disease, can cause a similar imaging pattern." [Cov19Typ]^
Indeterminate appearance	Nonspecific imaging features of COVID-19 pneumonia.	Absence of typical features AND Presence of: Multifocal, diffuse, perihilar, or unilateral GGO with or without consolidation lacking a specific distribution and are non-rounded or non-peripheral. Few very small GGO with a non-rounded and non-peripheral distribution	"Imaging features can be seen with (COVID-19) pneumonia, though are nonspecific and can occur with a variety of infectious and noninfectious processes." [Cov19Ind]^
Atypical appearance	Uncommonly or not reported features of COVID-19 pneumonia.	Absence of typical or indeterminate features AND Presence of: Isolated lobar or segmental consolidation without GGO Discrete small nodules (centrilobular, "tree-in-bud") Lung cavitation Smooth interlobular septal thickening with pleural effusion	"Imaging features are atypical or uncommonly reported for (COVID-19) pneumonia. Alternative diagnoses should be considered." [Cov19Aty]^
Negative for pneumonia	No features of pneumonia	No CT features to suggest pneumonia.	"No CT findings present to indicate pneumonia. (Note: CT may be negative in the early stages of COVID-19.) [Cov19Neg]^

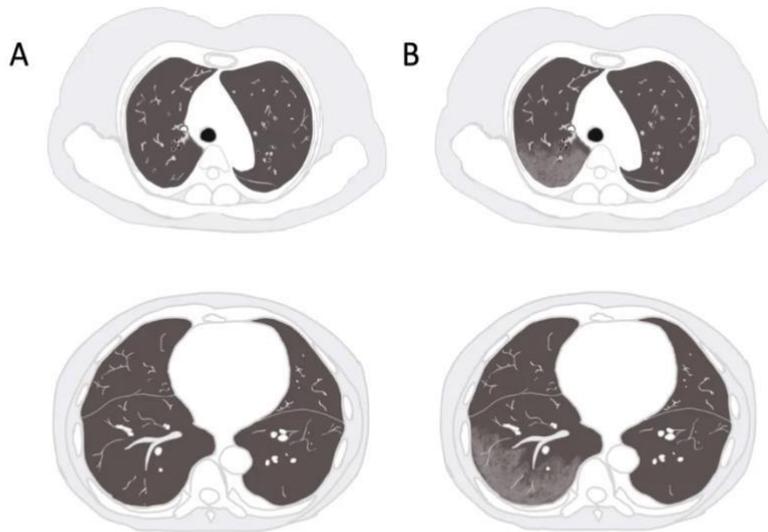


Figure 1: Illustration of chest CT evolution during COVID-19. **A.)** is normal lungs for comparison, top illustration represents upper lung zones while bottom shows lower lung zones. **B.)** is hypothetical early stage with unilateral (right), multifocal, peripherally-based GGO.

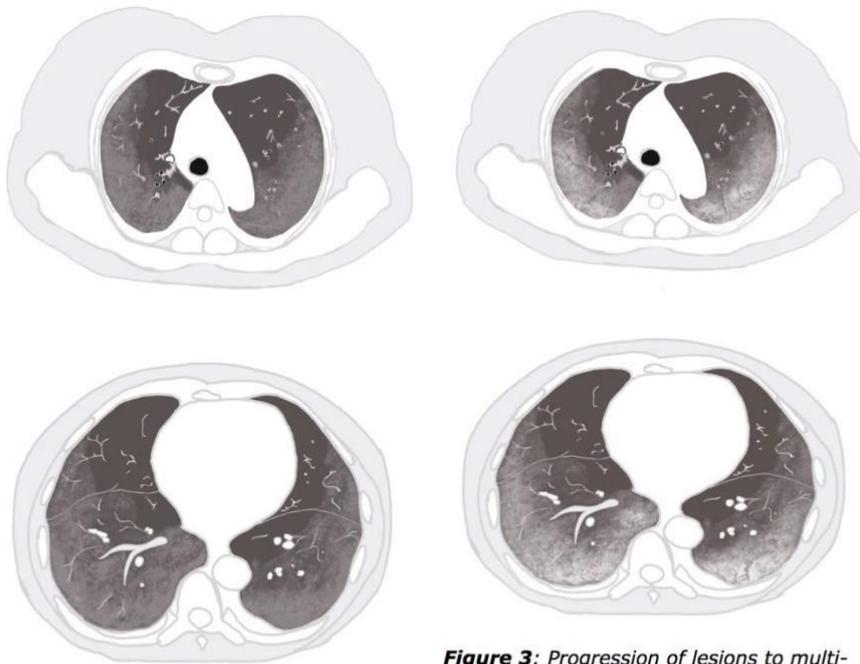


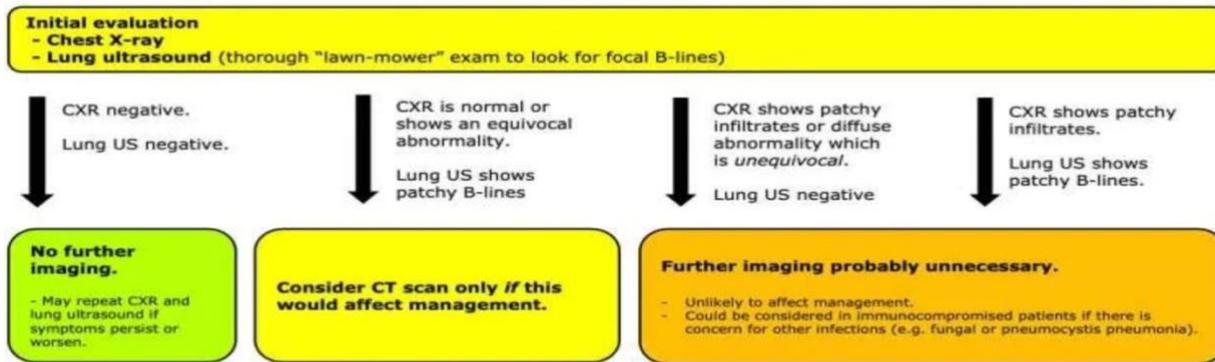
Figure 3: Progression of lesions to multifocal consolidations with air bronchograms. As well, there is bibasilar reticulations with 'crazy-paving' morphology. Note these are stylized illustrations and lung lesions needn't necessarily follow such linear evolution.

Figure 2: Illustration of further evolution of peripherally-based GGO. Lesions are now bilateral and multifocal.

(images from Pulmcc.org)

-Additionally, below is a proposed algorithm to ordering chest imaging.

Possible schema for imaging in patients with respiratory symptoms and suspected COVID-19



The optimal imaging strategy remains unknown. Chest X-ray and lung ultrasonography are a sensible place to start. CT scanning could have a role in some equivocal situations, but is generally unlikely to affect clinical management (since treatment for mild COVID-19 is supportive).

-The Internet Book of Critical Care, by @PulmCrit

Medications to avoid on admission:

-In the event of fever or mild pain avoid NSAIDS, choose Tylenol.

NSAIDS are associated with upregulation of ACE2 which may facilitate the infection with COVID-19 (6).

-It will be the policy of this institution to change ACEI or ARBs to alternate antihypertensives, though current CDC guidelines recommend continuing ACEI/ARB unless there is an indication outside of COVID for discontinuing the medication (e.g. hypotension, AKI).

Respiratory Support:

-Wide range of clinical presentations: mild URTIs -> florid ARDS requiring mechanical ventilation.

-Most of the patients admitted to the hospital will require some form of supplemental oxygen (4).

-All patients with SpO₂ < 92% should be placed on supplemental oxygen with nasal cannula.

-As disease progresses, the current recommendation is to utilize high flow nasal cannula and **avoid NIPPV (e.g. bipap).**

-It will be the recommendation of this institution that, if a patient deteriorates and needs high flow, the ICU team needs to be notified to start high flow.

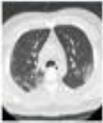
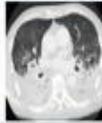
-NIPPV may be associated with aerosolization of respiratory particles.

-If placing these patients on high flow nasal cannula, practitioner dons a fit tested N95 mask. Flow rates > 30 LPM may produce aerosolized gas particles. For that reason, start with flow rates of 15-30 liters/min (potentially less aerosolization), and titrate FiO₂ to maintain SpO₂ > 90%.

****If a patient requires high-flow nasal cannula or bipap, it is prudent to let your ICU team know that this patient is deteriorating. In this patient population, intubation should occur early. See Intubation Tips below.**

-The course of these patient's respiratory failure is outlined nicely in the chart below from Bouadma et al.

-AVOID nebulized medications as these increase the aerosolization of respiratory particles. Change all nebs to metered dose inhalers (MDIs) when possible.

Typical features according to current publications Age Mean (SD): 55.5 (13.1), Male (88%) Exposure to Huanan seafood market in Wuhan, China (49%) Chronic medical underlying illness (51%) Admission to Intensive Care Unit (23%)													
		FIRST WEEK				SECOND WEEK							
SETTING		WARD Illness day 4	WARD Illness day 5	WARD Illness day 6	WARD Illness day 7	WARD/ICU Illness day 8	ICU Illness day 9	ICU Illness day 10	ICU Illness day 11				
REPEATED SAMPLING OF THE NASOPHARYNX AND TRACHEAL ASPIRATES (IF INTUBATED) BY RT-PCR FOR THE COVID-19		Initial important viral shedding		Decrease of the viral shedding sometimes associated with transient respiratory deterioration		Respiratory failure, increase of the viral shedding and viremia or Decrease of the viral shedding, and superinfections			Duration of viral excretion unknown				
OXYGEN THERAPY AND MECHANICAL VENTILATION		NO		Consider oxygen support	FNC	FNC followed by MV	MV		MV				
ORGAN FAILURE		Typical signs according to current publications Fever, cough, and shortness of breath (13%) bilateral pneumonia (75%), lymphopenia (38%), thrombocytopenia (12%), prothrombin time decreased (30%), elevated liver enzyme levels (about 30%)		Deterioration of respiratory status with most often spontaneous recovery		ARDS If shock beware of superinfections ⚠️ Possible renal failure Neurological failure unlikely Hemostasis disorders			YES				
CO-INFECTION/SUPERINFECTION		NOT LIKELY				Consider a possible HAP/VAP and other nosocomial infections (see text for diagnostic procedures)			Profound immune paralysis and late onset infections				
ANTIBIOTICS		NO				Consider antibiotic therapy			YES				
ANTIVIRAL AGENTS		NO				Consider antiviral agents if deterioration ^a							

FNC = low nasal cannula; HFNC = high flow nasal cannula; HAP = healthcare-associated pneumonia; VAP = ventilator-associated pneumonia; MV = Mechanical ventilation;
^a The use of immunomodulation including corticosteroids is unlikely but debated.

Typical features of hospital admissions in severe cases (3).

Fluid Administration:

-Significant hemodynamic derangements are atypical.

-Average SBP 133 and 140 in survivors and non-survivors, respectively (2).

-If hemodynamic instability present, consider concomitant bacterial infection or myocarditis.

-It is our recommendation to avoid the use of maintenance IV fluids, high volume enteral nutrition, and fluid boluses (8). Consider early initiation of vasopressors to treat hypotension in patients who are not hypovolemic.

-We suggest using dynamic parameters such as skin temperature, capillary refilling time, and use of bedside ultrasound evaluation of fluid status over static parameters to assess fluid responsiveness.

-If IV fluids are needed, we recommend administration in the form of balanced crystalloid and in the smallest possible amount as guided by clinical exam, vitals, and bedside ultrasound exam.

Antibiotics:

-Secondary bacterial infections have been noted; however, the overall incidence of concomitant infections seems to vary between studies.

-Two studies (7, 5) reported a total of 16% and 15% secondary infections, respectively while one of the largest of studies (4) reported 0 secondary bacterial infections.

-Isolated secondary infections listed in these studies includes CRE Klebsiella, Aspergillus flavus, Aspergillus fumigatus, ESBL positive Klebsiella pneumonia, ESBL positive Pseudomonas aeruginosa, and ESBL-negative E. coli (2).

-Given the discordance among studies of secondary bacterial infection rates and the reports of concomitant infection with multi drug resistant organisms, in severe cases, we recommend:

-Starting broad spectrum antibiotics initially.

-De-escalation based upon culture and procalcitonin results.

Indications for transfer to ICU:

-Please see above criteria for ICU consultation and automatic admission

-Anecdotal evidence has shown these patients tend to decompensate rather quickly. For that reason, an early ICU transfer is warranted in the setting of clinical deterioration.

Intubation/Procedures:

-Proper donning and doffing of PPE is the most important aspect to performing aerosolizing procedures.

-For complete list of necessary PPE required for aerosolized particle-generating procedures see precautions section above.

Who to intubate:

-Deteriorating patients should be considered for **early** endotracheal intubation.

-Considerations for early invasive mechanical ventilation (8):

-Worsening hypercapnia/acidemia

-Respiratory fatigue

-Hemodynamic instability

-Altered mental status

Tips for Intubation: (see appendix for complete intubation checklist)

1. Aim for early intubation as opposed to use of BIPAP or HFNC. (Adequate NMB is preferred to prevent coughing, gagging, and aerosolization of particles.)
2. The most experienced clinician available should intubate, and intubation should be done using **video laryngoscopy**.
3. Don enhanced **respiratory PPE with N95 or PAPR** and use double-glove technique.
4. Limit a to a **3-person intubation team ,if possible, (RN, RT, intubator)** with all necessary equipment at bedside, including video laryngoscope.
5. Use of positive pressure ventilation or manual bagging **only** if clinically necessary.
6. Consider early placement of supraglottic airway in place of manual bagging for rescue oxygenation.
7. Upon ETT placement, **immediately inflate cuff** prior to giving positive pressure breath.

Emergency tracheal intubation checklist COVID-19

Personal Protective Equipment	Prepare Equipment	Prepare for Difficulty	In the Room	Post-procedure and Safety
OUTSIDE ROOM		INSIDE ROOM		
<p>PPE – be thorough, don't rush</p> <ul style="list-style-type: none"> <input type="checkbox"/> Wash hands <input type="checkbox"/> Buddy with checklist <input type="checkbox"/> Put on PPE <ul style="list-style-type: none"> <input type="checkbox"/> Long sleeved gown <input type="checkbox"/> FFP3 (or equivalent) mask <input type="checkbox"/> Gloves <input type="checkbox"/> Eyewear <input type="checkbox"/> Headwear and wipeable shoes as per local protocol <input type="checkbox"/> Final buddy check <input type="checkbox"/> Names on visors <p><input type="checkbox"/> Allocate roles:</p> <p>A: Team leader and intubator B: Cricoid force and intubator's assistant C: Drugs, monitor, timer D: Runner (outside) Decide who will do eFONA</p> <p><input type="checkbox"/> How does runner contact further help if required?</p>	<p><input type="checkbox"/> Check kit (kit dump)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Mapleson C with HME attached (preferred to BVM) <input type="checkbox"/> Catheter mount <input type="checkbox"/> Guedel airways <input type="checkbox"/> Working suction <input type="checkbox"/> Videolaryngoscope <input type="checkbox"/> Bougie/stylet <input type="checkbox"/> Tracheal tubes x2 <input type="checkbox"/> Ties and syringe <input type="checkbox"/> In-line suction ready <input type="checkbox"/> Tube clamp <input type="checkbox"/> 2nd generation SGA <input type="checkbox"/> eFONA set available <p><input type="checkbox"/> Do you have all the drugs required?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ketamine (or other) <input type="checkbox"/> Muscle relaxant <input type="checkbox"/> Vasopressor/inotrope <input type="checkbox"/> Maintenance sedation <p><input type="checkbox"/> Weight?</p> <p><input type="checkbox"/> Allergies?</p>	<p><input type="checkbox"/> If the airway is difficult, could we wake the patient up?</p> <p><input type="checkbox"/> VERBALISE the plan for a difficult intubation?</p> <p>Plan A: RSI Plan B/C: 2-handed 2-person mask ventilation & 2nd generation SGA</p> <div style="text-align: center;"> </div> <p>Plan D: Front of neck airway: scalpel bougie tube</p> <p><input type="checkbox"/> Confirm agreed plan</p> <p><input type="checkbox"/> Does anyone have any concerns?</p>	<p><input type="checkbox"/> Airway assessment</p> <ul style="list-style-type: none"> <input type="checkbox"/> MACOCHA <input type="checkbox"/> Identify cricothyroid membrane <p><input type="checkbox"/> Apply monitors</p> <ul style="list-style-type: none"> <input type="checkbox"/> Waveform capnography <input type="checkbox"/> SpO₂ <input type="checkbox"/> ECG <input type="checkbox"/> Blood pressure <p><input type="checkbox"/> Checked i.v. access (x2)</p> <p><input type="checkbox"/> Optimise position</p> <ul style="list-style-type: none"> <input type="checkbox"/> Consider ramping or reverse Trendelenburg <input type="checkbox"/> Firm mattress <p><input type="checkbox"/> Optimal pre-oxygenation</p> <ul style="list-style-type: none"> <input type="checkbox"/> ≥ 3 min or ETO₂ > 85% (No NIV, no HFNO) <p><input type="checkbox"/> Optimise patient condition before tracheal intubation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fluid/vasopressor/ inotrope <input type="checkbox"/> Aspirate nasogastric tube <input type="checkbox"/> Delayed sequence induction? <p><input type="checkbox"/> Now proceed</p>	<p><input type="checkbox"/> Airway management</p> <ul style="list-style-type: none"> <input type="checkbox"/> Inflate cuff before any ventilating <input type="checkbox"/> Check waveform capnography <input type="checkbox"/> Push/twist connections <input type="checkbox"/> Clamp tracheal tube before any disconnection <input type="checkbox"/> Avoid unnecessary disconnections <p><input type="checkbox"/> Other</p> <ul style="list-style-type: none"> <input type="checkbox"/> Insert nasogastric tube <input type="checkbox"/> Consider deep tracheal viral sample <p><input type="checkbox"/> Careful equipment disposal</p> <p><input type="checkbox"/> Decontamination of reusable equipment</p> <p><input type="checkbox"/> Complete and display intubation form</p> <p><input type="checkbox"/> Remove PPE</p> <ul style="list-style-type: none"> <input type="checkbox"/> Observed by buddy <input type="checkbox"/> Use checklist <input type="checkbox"/> Meticulous disposal <input type="checkbox"/> Wash hands <p><input type="checkbox"/> Clean room after 20 minutes</p>

Ventilator strategies:

- Lung protective ventilation for those requiring mechanical ventilation.
- Low tidal volume strategy (4-6mL/kg predicted body weight)
- Limit plateau pressures to less than 30cmH2O.
- Permissive hypercapnia is usually well tolerated.
- It is our recommendation to use higher PEEP strategy over lower PEEP strategy. (See Appendix 6 for PEEP tables)
- In the setting of persistent hypoxia despite low NMB, prone ventilation, inhaled pulmonary vasodilators, and recruitment maneuvers, further ventilator strategies could include APRV which provides high airway pressures and may facilitate secretion clearance. This ventilator setting is to be used at the discretion of the ICU attending.

Additional management:

Neuromuscular blockade (NMB):

- We suggest using intermittent as-needed boluses of NMB agents over continuous NMB infusions to facilitate lung-protective ventilation.
- In the event of persistent ventilator dyssynchrony, the need for ongoing deep sedation, prone ventilation, or persistently high plateau pressures, we suggest using a continuous NMB agent infusion for up to 48 hours (9).

Prone positioning:

- Current reports suggest prone ventilation is effective in improving hypoxia.
- We recommend prone ventilation for 12-16 hours per day.
- We may have to manually prone patients in regular hospital beds as supply of Rotaprone beds may not be adequate to meet demand.

Inhaled Nitric Oxide:

-In mechanically ventilated patients with severe ARDS and hypoxemia despite optimizing ventilation and other rescue strategies, we suggest a trial of inhaled pulmonary vasodilators as a rescue therapy. If no improvement in oxygenation is observed, the treatment should be tapered off (9).

Recruitment maneuvers:

- In mechanically ventilated patients with severe ARDS and hypoxemia despite optimizing ventilation and other rescue strategies, we suggest using recruitment maneuvers, over not using.
-If recruitment maneuvers are used, we recommend against using staircase recruitment maneuvers. (9)

Steroids:

-Studies are not in agreement regarding steroid use in patients with and without ARDS secondary to COVID-19.
-Previous studies assessing steroid use in MERS and SARS have shown increased mortality.
-Data from the current COVID-19 pandemic are also discordant. Two small studies (2,5) showed no benefit of steroids in patients with severe COVID-19; however, one large study found reduced mortality amongst critically ill patients and patients with ARDS (4).
-In mechanically ventilated patients with ARDS, we suggest using systemic corticosteroids as this is the practice at our institution. For dosing please see appendix 4. Steroid use for ARDS in COVID-19 patients should be used at the discretion of the provider.
-Alternatively, Chinese Thoracic Society recommendations for treatment of COVID-19 patients with ARDS includes Methylprednisone 0.5-1mg/kg for a duration of 7 days.
-Meduri et al. are currently in the process of conducting randomized controlled trials to evaluate the use of steroids in these patients.

ECMO:

-In mechanically ventilated patients with refractory hypoxemia despite optimizing ventilation, use of rescue therapies, including proning, we recommend the use of venovenous (VV) ECMO if available, or referring the patient to an ECMO center.
-There are no clinical trials of ECMO in COVID-19 patients and a recent report from China suggests that 11.5% of COVID-19 patients in the ICU received ECMO, but their clinical course is unknown. (2;9)
-Ultimately, in an epidemic setting, the availability of ECMO circuits will be limited and patient selection will be limited to those who are likely to have the greatest chance of recovery.

Potential Therapies:(10)

Therapy	Dosing & Duration	Comments	Monitoring
<p>Hydroxychloroquine</p> <ul style="list-style-type: none"> Empiric therapy for hospitalized individuals with moderate illness who are high-risk for decompensation, severe, or critical illness Preferred therapy for hospitalized patients unable to obtain remdesivir. Start hydroxychloroquine while awaiting remdesivir approval and arrival to the hospital. Will need to discontinue hydroxychloroquine when remdesivir is started (per the research protocol) <p>Proposed mechanism of action:</p> <ul style="list-style-type: none"> Increases endosomal pH preventing virusendosome fusion Appears to interfere with terminal glycosylation of the cellular receptor, angiotensin-converting enzyme 2 thereby preventing binding of the virus <ul style="list-style-type: none"> Can be used as prophylaxis but not recommended due to limited supply 	<p>Adult dosing (≥18 years): 400 mg PO BID x 2 dose (load), then 200 mg PO BID</p> <p>Alternative regimen: 600 mg PO BID x2 doses (load), then 200 mg PO TID</p> <p>Pediatric dosing (<18 years): 10 mg/kg (max: 600 mg/dose) PO BID x2 (load), then 3 mg/kg PO TID (max: 200 mg/dose)</p> <p>Duration: 5 days</p> <p>In select patients with extended ventilation or profound immunosuppression, duration may be extended to 10-14 days</p>	<p>Consider adding tocilizumab if critically ill with associated cytokine storm (see criteria below)</p> <p>Adverse events: Retinopathy rash, nausea, glucose fluctuations, and diarrhea. GI symptoms can be mitigated by taking hydroxychloroquine with food.</p> <ul style="list-style-type: none"> Use with caution in diabetic patients; hypoglycemia may occur. Insulin requirements may decrease. Use with caution in patient at risk for QT prolongation. Recommend obtaining G6DP test. Postmarketing studies suggest the risk of hemolysis is very low. It is reasonable to start hydroxychloroquine in most patients while awaiting G6PD testing. Recommend avoid taking hydroxychloroquine with antacids. Separate administration by at least 4 hours. Hydroxychloroquine can be crushed. <p>Pregnant and Nursing Mothers: Hydroxychloroquine has been associated with fetal ocular toxicity</p>	<p>Labs: CBC, LFTs and renal function EKG – initial and throughout therapy for possible QT prolongation</p> <p>Partially metabolized by liver (CYP450) – do NOT combine with inhibitors of CYP450 (i.e. lopinavir/ritonavir)</p> <p>G6PD deficiency – use with caution due potential for hemolytic anemia; however, it is thought to be safe even with known deficiency</p> <p>If used with antidiabetic agents monitor for severe hypoglycemia</p> <p>Cardiomyopathy may appear with acute (or chronic) therapy</p> <p>No dose adjustments in manufacturer labeling but caution recommended in renal and hepatic impairment; Dose adjustments may be needed</p>

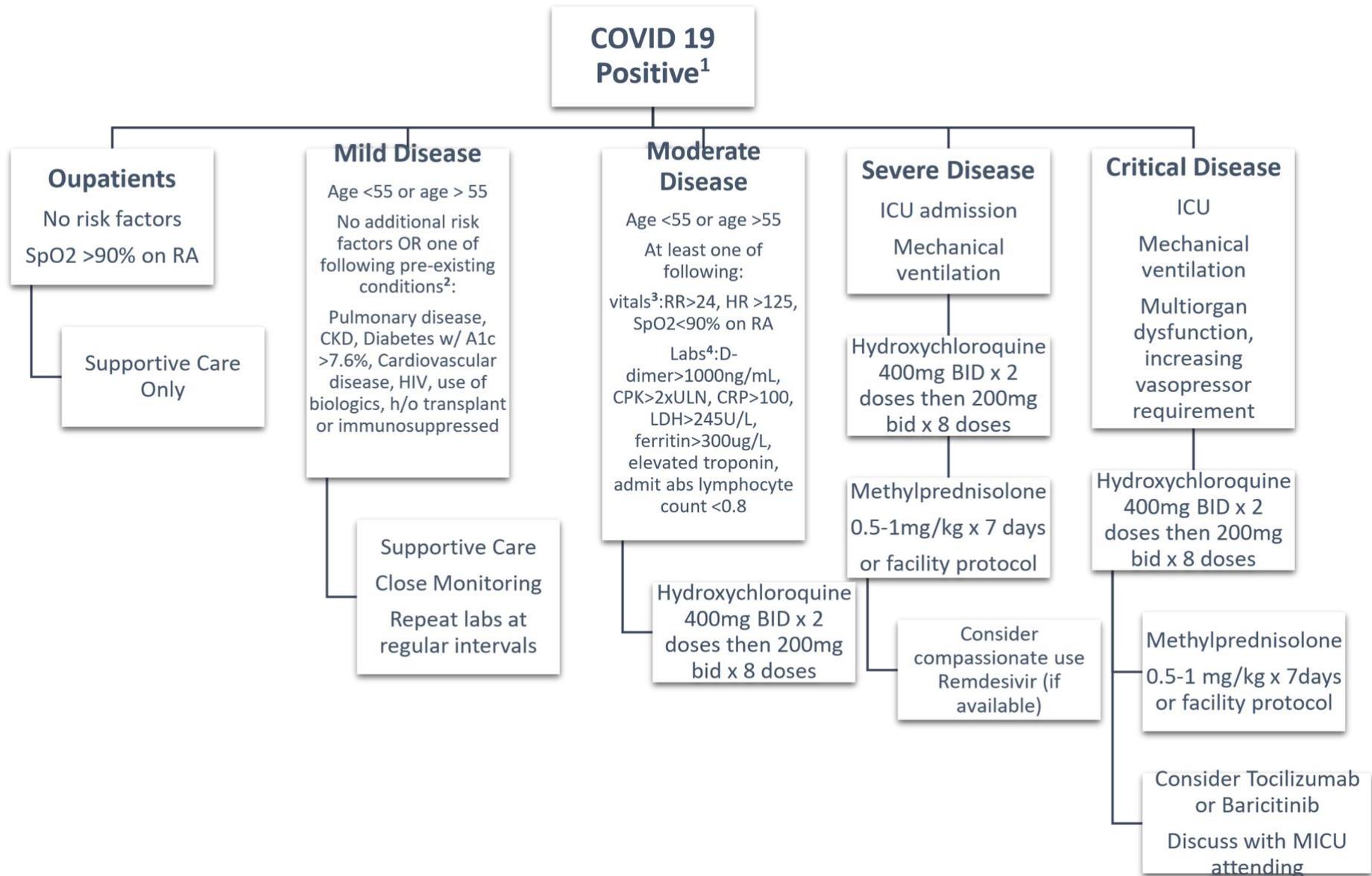
Therapy	Dosing & Duration	Comments	Monitoring
		in animal studies. Additionally, hydroxychloroquine is excreted into breast milk. Thorough evaluation of the risk:benefit should be discussed with the patient prior to starting therapy.	
<p>Tocilizumab</p> <p>Consider adding to antiviral therapy for patients meeting criteria below:</p> <ol style="list-style-type: none"> COVID-19 positive Refractory or worsening respiratory gas exchange on mechanical ventilation Indicators of severe cytokine storm (may include the following): <ul style="list-style-type: none"> Fever -may be mild initially but may progress up to > 40.5C Hypotension and uncontrolled SIRS (circulatory collapse, vascular leakage, peripheral or pulmonary edema, cardiac dysfunction) requiring increasing or high dose pressors Multi-organ failure AND Criteria for patients at high-risk for developing cytokine storm: <ul style="list-style-type: none"> Serum IL-6 $\geq 3x$ upper normal limit CRP > 100 mg/L 	<p>**Doses should be rounded to nearest full vial (80 mg, 200 mg, 400 mg vials available) **</p> <p>Adult Dosing (≥ 18 years):</p> <p>400 mg IV x 1 dose</p> <p>Pediatric Dosing (<18 years):</p> <p><6 kg: 12 mg/kg (actual body weight) IV 6-10 kg: 80 mg IV 10-14 kg: 160 mg IV 15-18 kg: 200 mg IV 19-21 kg: 240 mg IV 22-24 kg: 280 mg IV 25-27 kg: 320 mg IV 28-32 kg: 360 mg IV 33-60 kg: 400 mg IV >60 kg: use adult dosing</p> <p>Duration: One dose</p> <p>Consider giving additional dose 8-12 hours later if continued clinical decompensation</p>	<p>Adjunct therapy with interleukin-6 inhibitors, like tocilizumab, may improve oxygenation and time to symptom resolution in patients at high risk of cytokine storm.</p> <p>Contraindications:</p> <ul style="list-style-type: none"> Avoid in pregnancy Tocilizumab may be harmful to newborns, and mothers should stop breastfeeding if receiving tocilizumab <p>Serious adverse events:</p> <ul style="list-style-type: none"> Gastrointestinal perforation Anemia Hepatitis Infusion reaction <p>Strongly consider corticosteroids in addition to administration of tocilizumab</p>	<p>Labs: Quantiferon gold, CBC</p> <p>In the event of suspected cytokine storm, do not delay treatment to await quantiferon gold results</p> <p>No dose adjustment for renal impairment</p> <p>No dose adjustment for hepatic impairment but recommendation is not to initiate if active hepatic disease, or hepatic impairment. Cases of acute drug-induced liver failure requiring transplant have been reported with usage.</p> <p>May predispose to serious or life threatening infections including TB, fungal, bacterial, viral or other opportunistic infections. Avoid use if known active TB.</p>

Therapy	Dosing & Duration	Comments	Monitoring
<ul style="list-style-type: none"> Ferritin >300 ug/L (or surrogate) with doubling within 24 hours Ferritin >600 ug/L at presentation and LDH >250 Elevated D-dimer (>1 mg/L) <p>Mechanism of action:</p> <ul style="list-style-type: none"> Recombinant humanized anti-human IL-6 receptor monoclonal antibody that binds to both soluble and membranebound IL-6 receptors to inhibit signal transduction <p>IL-6 is pro-inflammatory and plays a role in the cytokine storm associated with SARS-CoV-2</p>			
<p>Baricitinib</p> <p>Consider adding to antiviral therapy for patients meeting criteria below:</p> <ol style="list-style-type: none"> COVID-19 positive Refractory or worsening respiratory gas exchange on mechanical ventilation Indicators of severe cytokine storm (may include the following): <ul style="list-style-type: none"> Fever -may be mild initially but may progress up to > 40.5C Hypotension and uncontrolled SIRS (circulatory collapse, vascular leakage, 	<p>Adult dosing:</p> <p>2mg – 4mg PO daily</p> <p>Duration: 7-14 days</p> <p>Clinical trial data suggests higher risk of thrombosis with larger (4mg) dosing</p>	<p>Adjunct therapy with janus kinase inhibitor, like baricitinib, may improve oxygenation and time to symptom resolution in patients at high risk of cytokine storm.</p> <p>Contraindications:</p> <ul style="list-style-type: none"> Avoid in pregnancy Baricitinib may be harmful to newborns, and mothers should stop breastfeeding if receiving baricitinib 	<p>Labs: Quantiferon gold, CBC, LFTs</p> <p>In the event of suspected cytokine storm, do not delay treatment to await quantiferon gold results</p> <p>Dose adjustment for renal impairment:</p> <ul style="list-style-type: none"> GFR >60mL/min – no adjustment GFR 30-60mL/min – 1mg once daily (if regular dose is 2mg daily) GFR <30m – use is not recommended

Therapy	Dosing & Duration	Comments	Monitoring
<p>peripheral or pulmonary edema, cardiac dysfunction) requiring increasing or high dose pressors</p> <ul style="list-style-type: none"> Multi-organ failure <p>AND</p> <p>Criteria for patients at high-risk for developing cytokine storm:</p> <ul style="list-style-type: none"> Serum IL-6 $\geq 3x$ upper normal limit CRP > 100 mg/L Ferritin >300 ug/L (or surrogate) with doubling within 24 hours Ferritin >600 ug/L at presentation and LDH >250 Elevated D-dimer (>1 mg/L) <p>Mechanism of action:</p> <p>Inhibits janus kinase (JAK) enzymes which are extracellular enzymes involved in immune cell function through a signaling pathway. Extracellular cytokine signaling cause JAKs to activate signal transducers and activators of transcription (STATs). JAK inhibition prevents activation of STATs and reduces serum IgG, IgM, IgA and CRP</p>		<p>Severe adverse events:</p> <ul style="list-style-type: none"> Gastrointestinal perforation Anemia and/or leukopenia Elevation of liver enzymes <ul style="list-style-type: none"> ALT > 5x ULN AST > 10x ULN <p>Strongly consider corticosteroids in addition to administration of tocilizumab</p> <p>*Criteria for administration may vary by facility, please refer to Pharmacy and/or facility specific protocols</p>	<p>No dose adjustment for mild – moderate hepatic impairment but use is not recommended in severe impairment because it has not been studied. Interrupt therapy if LFTs become dramatically elevated and consider druginduced liver injury</p> <p>Unknown how crushing and administration via gastric tube affects availability</p> <p>May predispose to serious or life threatening infections including TB, fungal, bacterial, viral or other opportunistic infections. Avoid use if known active TB</p>

Therapy	Dosing & Duration	Comments	Monitoring
<p>Remdesivir <i>Preferred therapy for patients hospitalized due to COVID-19 if criteria are met for obtaining product from manufacturer (see comments)</i></p> <p>Mechanism of action:</p> <ul style="list-style-type: none"> Adenosine analogue incorporates into viral RNA and results in premature termination <p>Under clinical development for treatment of Ebola virus</p>	<p>Adult dosing: 200 mg IV load, then 100 mg IV q24h</p> <p>Pediatric dosing*: <40kg: 5 mg/kg IV load, then 2.5 mg/kg q24h >40kg: 200 mg IV load, then 100 mg IV q24h</p> <p>Duration: Per protocol</p>	<p>Drug only available through Gilead with approved investigational new drug (IND) application.</p> <p>Criteria below are for compassionate use program. Inclusion Criteria:</p> <ul style="list-style-type: none"> Hospitalization SARS-CoV-2 by PCR Mechanical ventilation <p>Exclusion Criteria:</p> <ul style="list-style-type: none"> Multi-organ failure Vasopressor requirement ALT>5x ULN CrCl<30mL/min, dialysis, or CVVH Concomitant use of other experimental antiviral agents (e.g., lopinavir/ritonavir) Pregnancy <p>To start the request for remdesivir through Gilead’s expanded access program, contact Gilead using link https://rdvcu.gilead.com/and-obtain-the-emergency-IND-forms-from-the-FDA-website See column to right for FDA contact numbers and adverse events</p>	<p>Labs: LFTs</p> <p>May interact with medications metabolized through the cytochrome system. Carefully review medication list.</p> <p>FDA contact numbers:</p> <ul style="list-style-type: none"> M-F day (8:00-4:30): 301-796-3400 After hours/weekends: 866-300-4374 <p>See Appendix for facility specific protocols</p> <p>Adverse events: Increased liver enzymes. Also potential to have drug-drug interactions with medications metabolized through cytochrome system</p>

Therapy	Dosing & Duration	Comments	Monitoring
<p>Lopinavir-ritonavir (Kaletra®) <i>Alternative therapy if hydroxychloroquine and remdesivir are unavailable or if the patient has contraindications or adverse effects</i></p> <p>*Consult ID prior to initiation</p> <p>Mechanism of action:</p> <ul style="list-style-type: none"> Lopinavir - protease inhibitor Ritonavir – inhibits cytochrome P450 to boost lopinavir levels Studies with MERS-CoV and SARS-CoV-1 showed reduction of the viral load <p>May be more effective when combined with ribavirin; consider adding if no contraindication</p>	<p>Adult dosing: 400 mg-100 mg PO BID</p> <p>Pediatric dosing: <i>14 days to 6 months old:</i> lopinavir component 16 mg/kg PO BID</p> <p>6 months to 18 years: 15-25 kg: 200 mg-50 mg PO BID 26-35 kg: 300 mg-75 mg PO BID >35 kg: 400 mg-100 mg PO BID</p> <p>Duration: 5 days (10-14 days)</p> <p>In select patients with extended ventilation or profound immunosuppression duration may be extended</p> <p>Consider combining with ribavirin Adult dosing: 4gram PO load, then 1200mg PO q8h (or 8mg/kg IV q8h)</p> <p>Duration: 14 days</p>	<p>Check HIV antigen/antibody prior to first dose Adverse events: Hepatotoxicity, pancreatitis, diabetes, QT prolongation, lipid elevations, and fat redistribution Major substrate and inhibitor of Cytochrome P450, and can cause severe drug-drug interactions. Thorough evaluation of a patient’s mediation profile should be reviewed before starting therapy. Crushing and administration via gastric tube may decrease absorption by ~50%</p> <p>Pregnancy: Lopinavir-ritonavir is safe to use during pregnancy Ribavirin is contraindicated during pregnancy</p>	<p>Labs: HIV antigen/antibody prior to therapy initiation, LFTs, CBC</p> <p>Major substrate and inhibitor of cytochrome P450. Carefully review medication list</p> <p>No dosage adjustments of renal impairment</p> <p>No dosage adjustments for hepatic impairment. Lopinavir is metabolized hepatically and mild-moderate hepatic impairment can increase is AUC by ~30%. Use with caution in severe hepatic impairment.</p>



1. May be initiated if very strong suspicion and pending COVID-19 test
 Category 1⁽²⁾, Category 2⁽³⁾, Category 3⁽⁴⁾ risk factors for severe COVID-19 disease

Code Blue/ACLS:

- If a code blue is called on a patient with suspected or confirmed COVID-19, there will need to be a limit on the number of personnel in the room such that only the most experienced people who can perform multiple roles should enter the room.
- The code team leader should identify a Monitor who will log the names of the personnel who go into the room, their PPE, and their roles in the code.
- The code team leader should assign an additional team member to remain outside of the room to divert traffic and onlookers as well as manage orders and communications.
- Strict adherence to PPE (gown, gloves, eye shield, cap, N95 mask) with observed donning/doffing is required in Code Blue situations given that ACLS is a procedure that can lead to aerosolization of the virus.
- Providers should strongly consider DNR discussions prior to this happening as ACLS is likely to be ineffective/delayed and the risk of exposure to healthcare workers even with PPE is high.

Sources

1. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395:497-506
2. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV2 pneumonia in Wuhan, China: a single –centered, retrospective, observational study. *Lancet Respir Med* 2020; published online Feb 24. [https://doi.org/10.106/S2213-26\(20\)30079-5](https://doi.org/10.106/S2213-26(20)30079-5)
3. Bouadma, L., Lescure, F.-X., Lucet, J.-C., Yazdanpanah, Y., & Timsit, J.-F. (2020). Severe SARS-CoV-2 infections: practical considerations and management strategy for intensivists. *Intensive Care Medicine*. doi: 10.1007/s00134-020-05967-x
4. Wu C, Chen X, Cai Y, et al. (2020). Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China. *JAMA Internal Medicine*. doi: 10.1001/jamainternmed.2020.0994
5. Fei ZT, Yu-Ronghui Du-Guohui Fan-Ying Liu-Zhibo Liu-Jie Xiang-Yeming Wang-Bin Song-Xiaoying Gu-Lulu Guan-Yuan Wei-Hui Li-Xudong Wu-Jiuyang Xu-Shengjin Tu-Yi Zhang-Hua Chen-Bin Cao. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet* 2020. Published online Mar 9. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)
6. Fang, L., Karakiulakis, G., & Roth, M. (2020). Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? *The Lancet Respiratory Medicine*. doi: 10.1016/s22132600(20)30116-8
7. Ruan, Q., Yang, K., Wang, W., Jiang, L., & Song, J. (2020). Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. *Intensive Care Medicine*. doi: 10.1007/s00134-020-05991-x
8. Australian and New Zealand Intensive Care Society (2020) ANZICS COVID-19 Guidelines). Melbourne: ANZICS
9. Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)
10. University of Michigan. Inpatient guidance for diagnosis and treatment of COVID-19 in adults and children. [Med.umich.edu/asp](http://med.umich.edu/asp).
11. Massachusetts General Hospital. Massachusetts General Hospital COVID-19 Treatment Guidance. Version 1.0.
12. Internet Book of Critical Care. <https://emcrit.org/ibcc/covid19/>

Appendix

- Appendix 1: Intubation checklist
- Appendix 2: Code team guidance
- Appendix 3: Primer to talking to patients and families about Covid19
- Appendix 4: Steroid dosing for ARDS
- Appendix 5: Resources for proper donning/doffing of PPE
- Appendix 6: PEEP/FiO2 tables

Appendix 1:

Intubation checklist

COVID-19 Intubation Checklist

For Providers

To bring inside room:

McGrath

(Only bring in blade(s) you will be using)

Airway Box (includes the following)

- ETT (7 & 7.5) with syringe for cuff
- Stylet
- BVM with viral filter and PEEP valve ○ syringe, lube and ETT tape
- OP/NP airway
- Colorimetric end-tidal CO2 detector ○ Suction setup
- Consider taking the extra ETT out before you enter room

Disposable stethoscope

Sani-wipes (should be located inside room)

Keep outside room (on standby):

Direct laryngoscope (Mac 3&4 + handle)

Bougie (depending on whether the patient has anticipated difficult airway)

For Nursing

Etomidate 40 mg, Succinylcholine or rocuronium (either in pharmacy bag or pull from omnicell)

Restraints

Foley

ABG syringe

Post-intubation meds (*: in Omicell)

- propofol (preferred)*
- fentanyl* ○ midazolam*
- Levophed (premade)*

For Respiratory Care

Ventilator with appropriate filters

ET securing device

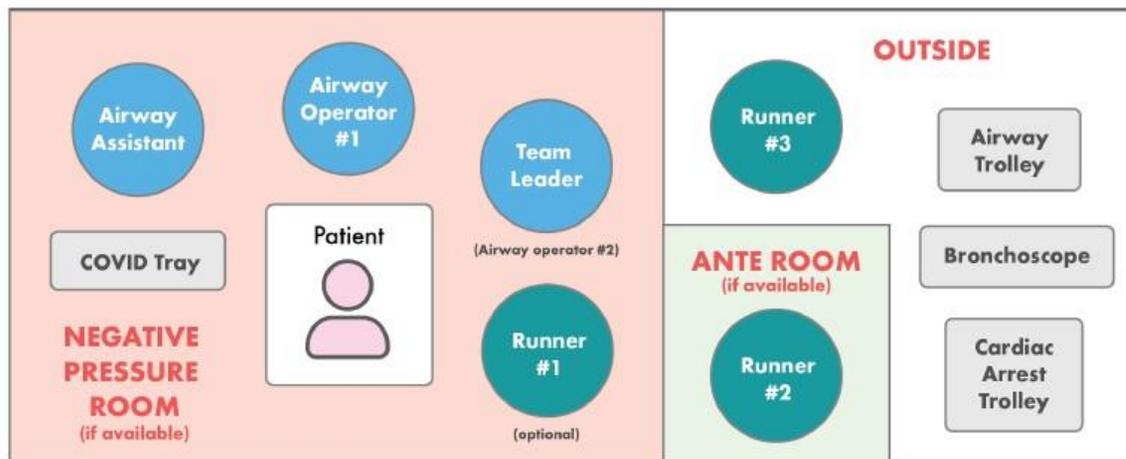
Viral filter for Ambubag



SAFE AIRWAY SOCIETY

COVID-19 AIRWAY MANAGEMENT

Team Members

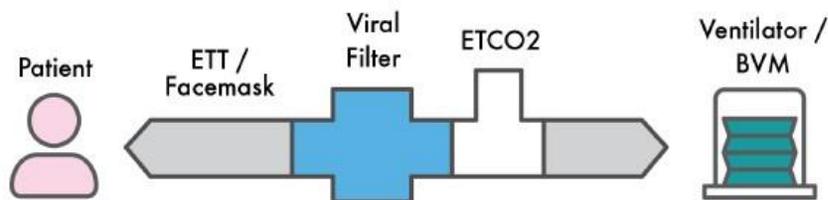


Intubation guidelines

- Preoxygenate 5 mins with nasal cannula or facemask
- Set up BVM with PEEP valve and viral filter between facemask and BVM outside room.
- Check battery of McGrath working
- Check for functioning IV, check suction setup
- Once pre oxygenated, give RSI meds
- Place BVM facemask over mouth, make good seal. If possible avoid bagging. If you have to bag use small tidal volumes
- Place ETT using McGrath with most experienced operator
- Once tube is in, inflate balloon and check CO2 detector (BVM should still have viral filter attached to it as it connects to the ETT)
- Connect vent circuit
- Only suction ETT after closed circuit is established
- Secure tube in place
- Place HME in circuit

- Throw away mcgrath blade. Wipe down Mcgrath with saniwipes inside the room. Set aside
- Doff gown, gloves, face shield and hat inside room
- Perform hand hygiene. Take Mcgrath and come out of room
- Sanitize the McGrath with saniwipes again (allow dwell and dry time of at least 3 mins) and set aside
- Perform hand hygiene
- Remove mask
- Everything else that was in the room (extra blades, tubes etc) must be discarded

Circuit Setup



Collaboration between Safe Airway Society + RNS ASCAR

v1.0 March 2020

Courtesy:

UW Medicine guidelines

Australia airway society consensus statement

Appendix 2:

Code guidelines

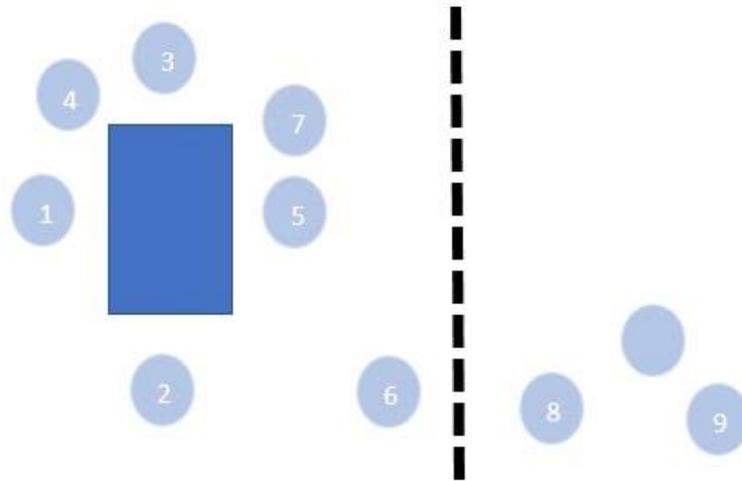
Guidance for Cardiopulmonary Arrest Teams in COVID 19 Patients

These guidelines are to safeguard staff, patients, and to conserve our supply of Personal Protective Equipment

- All emergent medical responses (Codes) should continue in patients with known or suspected COVID 19. Primary teams should have frank discussion regarding DNR with patients/surrogates on admission/transfer. Involve the palliative care team early.
- The following individuals should remain outside of the patient room throughout the event
 - Pharmacists, additional nursing staff, additional physician staff, laboratory personnel
 - Any individual needed inside the room will be requested directly by the physician leading the event
- The following individuals should NOT ENTER the room
 - Lab, spiritual care, nursing supervisor,
- Learners (observers, medical students, respiratory care students, etc.) should not participate in events on these patient and should not remain on the patient care floor during the event
- All responding personnel MUST practice hand hygiene AND use appropriate Personal Protective Equipment prior to entering the isolation area.
- Efforts should be made to conserve as much PPE as possible by limiting the response to include ESSENTIAL personnel only. This includes one person per role with others remaining outside the room unless called.
- An isolation nurse will be present at each event to help facilitate proper use of PPE and adherence to these guidelines.
- There will be a sign outside a presumed or confirmed Covid patient's room: STOP. Please see the patient's nurse. There may also be a droplet precaution or airborne precaution sign outside the door.
- All EH patients with known or suspected COVID 19 should be assumed to be on AIRBORNE precautions
- DO NOT leave doors to patient isolation rooms open, enter or exit and close the door immediately, minimize trips where possible
- In order to conserve emergency medications, many of which are on national shortage, the medication and fluid trays should be removed from the EH cart prior to the cart being moved into the isolation room. These trays should remain outside the room if possible to avoid cross contamination and drug waste
 - The individual who removes the trays, most likely the pharmacist, should provide 10 minutes of standard ACLS medications to the MRT already in the room. This includes:
 - 3 doses of epinephrine (already prepared if prefilled syringes aren't available)
 - 1 dose of calcium chloride
 - 5 sodium chloride flushes
- Additional therapies will be provided as needed by the clinical scenario. Medication therapy will be managed from outside the room when possible. A communication line should be established if possible between the providers in the room and pharmacy outside the room so that it can be communicated if additional medications are needed.

Disinfect all equipment immediately upon termination of the event

Code for cardiac arrest



Inside Room		Outside Room	
Role	Duty	Role	Duty
MRT (1)	Assume defibrillator control, pull medications for administration Observe compression quality, note if the compressors need to be changed	Isolation RN (8)	Will observe donning/doffing procedures and control access to room, act as gatekeeper
Code Leader (2)	First or most senior physician for the code team; directs resuscitation & delegates tasks as needed	Pharmacist (9)	Retrieves medication tray from cart prior to cart entering room Calculates medication dosages, prepares meds as needed; Passes meds into room
Intubating Provider (3) (RT or PCCM Fellow)	First / most senior responding airway person only; Establishes artificial airway; PCCM Fellow may assist with vascular access; Backup chest compressor after airway access obtained		
Respiratory Therapist (4)	Bag ventilation should be performed with viral filter on Ambu	Additional RN (10)	Remains outside the room unless called in
ICU RN (5)	Administers Medications, Backup chest compressor		
Bedside RN (6)	Provides History and events preceding arrest; Assumes the role of compressor or Medications RN		
Recorder RN (7)	Documents code activities; Time keeping; Retrieves additional medications through doorway from pharmacist if needed		

Code for intubation (if patient has a pulse and code is called for intubation)

- Nurse – only one
- MD or Intubating Respiratory therapist- The most senior responding person only (one assistant if absolutely necessary)
 - Intubation should occur as soon as safely possible following CoViD-19 intubation guidelines

- Respiratory Therapy – one staff member only. Bag ventilation should be performed with viral filter on Ambu
- Isolation RN – Will observe donning/doffing procedures and control access to room, act as gatekeeper
- **Appropriate PPE for presumed or suspected Covid patients during intubation or code for individuals entering the room. Team members not entering the room do not need PPE**
 - N95 mask
 - Face shield or goggles
 - Hat
 - Gown
 - Double gloves

Appendix 3:

Primer on talking to patients and families about Covid19

COVID-ready communication skills: a VitalTalk open source primer

Who?

To health care professionals everywhere: these are unprecedented times. There's no roadmap. We're facing conversations that we never expected—or wanted—to have.

Why?

We've had patients die, and not all were elderly. All over the country we are all getting calls and concerns about how to handle the possible surge. We're realizing that our professional duty might pose a risk to the people at home that we love. Worse, what we're seeing now might be the trickle that becomes a tsunami. Like what's happening in [Italy](#). Hard to ignore. Not something you can leave at work.

But there is another side to this too. Our colleagues are pitching in. People are stepping up to support each other in unexpected, beautiful ways. Together we can be bigger. And we can make it through this with our empathy, compassion, and sense of service intact.

What?

In that spirit, we've crowdsourced this little primer to provide some practical advice on how to talk about some difficult topics related to COVID-19. Building on our experience studying and teaching communication for 2 decades, we've drawn on our networks to crowdsource the challenges and match them with advice from some of the best clinicians we know. If you know our work, you'll recognize some familiar themes and also find new material. It's incomplete and imperfect. But it's a start.

How?

We're offering this primer freely. Email it, link it, spread it around. Don't hesitate to change the links so it works for your particular clinic or institution or system. Then help us improve it. Tell us what we missed, what didn't work, where you got stuck. The next iteration could be better because of you.

Stay safe.

Our world needs you—your expertise, your kindness, your aspirations, and your strength. We're grateful you are here.

About VitalTalk

[VitalTalk](#) is a 501c3 nonprofit social impact startup dedicated to making communication skills for serious illness part of every clinician’s toolbox. This content will be in our free [VitalTalk Tips app](#) for iOS and Android very soon.

Screening

When someone is worried they might be infected

<i>What they say</i>	<i>What you say</i>
Why aren’t they testing everybody?	We don’t have enough test kits. <i>I wish it were different.</i>
Why do the tests take so long?	The lab is doing them as fast as they can. <i>I know it’s hard to wait.</i>
How come the basketball players got tested?	I don’t know the details, but what I can tell you is that was a different time. <i>The situation is changing so fast that what we did a week ago is not what we are doing today.</i>

Triaging

When you’re deciding where a patient should go

<i>What they say</i>	<i>What you say</i>
Why shouldn’t I just go to the hospital?	Our primary concern is your safety. We are trying to organize how people come in. Please fill out the questions online. <i>You can help speed up the process for yourself and everyone else.</i>
Why are you keeping me out of the hospital?	I imagine you are worried and want the best possible care. Right now, the hospital has become a dangerous place unless you really, really need it. <i>The safest thing for you</i> is to ____.

Admitting

When your patient needs the hospital, or the ICU

<i>What they say</i>	<i>What you say</i>
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Does this mean I have COVID19?	We will need to test you with a nasal swab, and we will know the result by tomorrow. <i>It is normal to feel stressed when you are waiting for results,</i> so do things that help you keep your balance.
How bad is this?	From the information I have now and from my exam, your situation is serious enough that you should be in the hospital. <i>We will know more in the next day,</i> and we will update you.
Is my grandfather going to make it?	<i>I imagine you are scared.</i> Here's what I can say: because he is 90, and is already dealing with other illnesses, <i>it is quite possible that he will not make it out of the hospital. Honestly, it is too soon to say for certain.</i>
Are you saying that no one can visit me?	<i>I know it is hard to not have visitors.</i> The risk of spreading the virus is so high that I am sorry to say we cannot allow visitors. <i>They will be in more danger if they come into the hospital.</i> I wish things were different.
How can you not let me in for a visit?	The risk of spreading the virus is so high that I am sorry to say we cannot allow visitors. We can help you be in contact electronically. <i>I wish I could let you visit, because I know it's important, but it is not possible now.</i>

Counseling

When coping needs a boost, or emotions are running high

What they say	What you say
I'm scared.	This is such a tough situation. <i>I think anyone would be scared.</i> Could you share more with me?

I need some hope.	Tell me about the things you are hoping for? <i>I want to understand more.</i>
You people are incompetent!	I can see why you are not happy with things. <i>I am willing to do what is in my power to improve things for you.</i> What could I do that would help?
I want to talk to your boss.	I can see you are frustrated. <i>I will ask my boss to come by as soon as they can. Please realize that they are juggling many things right now.</i>
Do I need to say my goodbyes?	I'm hoping that's not the case. And I worry time could indeed be short. What most pressing on your mind?

Deciding

When things aren't going well, goals of care, code status

What they say	What you say
I want everything possible. I want to live.	We are doing everything we can. This is a tough situation. Could we step back for a moment so I can learn more about you? <i>What do I need to know about you to do a better job taking care of you?</i>
I don't think my grandfather would have wanted this.	Well, let's pause and talk about what he would have wanted. Can you tell me what he considered most important in his life? <i>What meant the most to him, gave his life meaning?</i>
I don't want to end up being a vegetable or on a machine.	Thank you, it is very important for me to know that. <i>Can you say more about what you mean?</i>

<p>I am not sure what my grandfather wanted—we never spoke about it.</p>	<p>You know, many people find themselves in the same boat. This is a hard situation. To be honest, given his overall condition now, if we need to put him on a breathing machine or do CPR, he will not make it. The odds are just against him. My recommendation is that we accept that he will not live much longer and allow him to pass on peacefully. I know that is hard to hear. What do you think?</p>
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Resourcing

When limitations force you to choose, and even ration

What they say	What you say, and why
<p>Why can't my 90 year old grandmother go to the ICU?</p>	<p>This is an extraordinary time. We are trying to use resources in a way that is fair for everyone. Your grandmother's situation does not meet the criteria for the ICU today. I wish things were different.</p>
<p>Shouldn't I be in an intensive care unit?</p>	<p>Your situation does not meet criteria for the ICU right now. The hospital is using special rules about the ICU because we are trying to use our resources in a way that is fair for everyone. If this were a year ago, we might be making a different decision. This is an extraordinary time. I wish I had more resources.</p>
<p>My grandmother needs the ICU! Or she is going to die!</p>	<p>I know this is a scary situation, and I am worried for your grandmother myself. This virus is so deadly that even if we could transfer her to the ICU, I am not sure she would make it. So we need to be prepared that she could die. We will do everything we can for her.</p>
<p>Are you just discriminating against her because she is old?</p>	<p>No. We are using guidelines that were developed by people in this community to prepare for an event like this—clinicians, policymakers, and regular people—so that no one is singled out. These guidelines have been developed over years--they weren't done yesterday. I know it is hard to hear this.</p>

<p>You're treating us differently because of the color of our skin.</p>	<p><i>I can imagine that you may have had negative experiences in the past with health care simply because of who you are.</i> That is not fair, and I wish things had been different. The situation today is that our medical resources are stretched so thin that we are using guidelines that were developed by people in this community, including people of color, so that we can be fair. I do not want people to be treated by the color of their skin either.</p>
<p>It sounds like you are rationing.</p>	<p>What we are doing is trying to spread out our resources in the best way possible. <i>This is a time where I wish we had more for every single person in this hospital.</i></p>
<p>You're playing God. You can't do that.</p>	<p>I am sorry. I did not mean to give you that feeling. I am just a clinician doing the best I can. <i>Across the city, every hospital is working together to try to use resources in a way that is fair for everyone. I realize that we don't have enough.</i> I wish we had more. Please understand that we are all working as hard as possible.</p>
<p>Can't you get 15 more ventilators from somewhere else?</p>	<p>Right now the hospital is operating over capacity. It is not possible for us to increase our capacity like that overnight. And <i>I realize that is disappointing to hear.</i></p>

Anticipating

When you're worrying about what might happen

What you fear	What you can do
<p>That patient's son is going to be very angry.</p>	<p>Before you go in the room, take a moment for one deep breath. <i>What's the anger about?</i> Love, responsibility, fear?</p>
<p>I don't know how to tell this adorable grandmother that I can't put her in the ICU and that she is going to die.</p>	<p><i>Remember what you can do:</i> you can hear what she's concerned about, you can explain what's happening, you can help her prepare, you can be present. These are gifts.</p>

<p>I have been working all day with infected people and I am worried I could be passing this on to the people who matter most.</p>	<p>Talk to them about what you are worried about. You can decide together about what is best. There are no simple answers. But worries are easier to bear when you share them.</p>
<p>I am afraid of burnout, and of losing my heart.</p>	<p>Can you look for moments every day where you connect with someone, share something, enjoy something? It is possible to find little pockets of peace even in the middle of a maelstrom.</p>
<p>I'm worried that I will be overwhelmed and that I won't be able to do what is really the best for my patients.</p>	<p>Check your own state of being, even if you only have a moment. If one extreme is wiped out, and the other is feeling strong, where am I now? Remember that whatever your own state, that these feelings are inextricable to our human condition. Can you accept them, not try to push them away, and then decide what you need</p>

Grieving

When you've lost someone

What I'm thinking	What you can do
<p>I should have been able to save that person.</p>	<p>Notice: am I grading myself? Could I step back and just feel? Maybe it's sadness, or frustration, or just fatigue. Those feelings are normal. And these times are distinctly abnormal.</p>
<p>OMG I cannot believe we don't have the right equipment / how mean that person was to me / how everything I do seems like its blowing up</p>	<p>Notice: am I catastrophizing? Is all this analyzing really about something else? Like how sad this is, how powerless I feel, how puny our efforts look? Under these conditions, such thoughts are to be expected. But we don't have to let them suck us under. Can we notice them, and feel them, maybe share them?</p> <p>And then ask ourselves: can I step into a less reactive, more balanced place even as I move into the next thing?</p>

Appendix 4:

Table 1. Methylprednisolone treatment of early ARDS.

Early moderate –to- severe ARDS (PaO₂:FiO₂ ≤ 200 on PEEP 5 cmH₂O)			
Time	Intravenous administration form	Dosage	
Loading	Bolus over 30 min	1 mg/kg	
Days 1 to 14* † ‡ ¶	Infusion at 10 cc/hour	1 mg/kg/day	If extubated < day 14 advance to day 15
Days 15 to 21* ‡ ¶	Infusion at 10 cc/hour	0.5 mg/kg/day	
Days 22 to 25* ‡ ¶	Infusion at 10 cc/hour	0.25 mg/kg/day	
Days 26 to 28* ‡ ¶	Infusion at 10 cc/hour	0.125 mg/kg/day	
<p>IV = intravenous. The dosage is adjusted to ideal body weight and round up to the nearest 10 mg (i.e., 77 mg round up to 80 mg). The bolus is given over 30 minutes. The infusion is obtained by adding the daily dosage to 240 cc of normal saline and run at 10cc/hour.</p> <p>*Five days after the patient can ingest medications, methylprednisolone is administered per os in one single daily equivalent dose. Enteral absorption of methylprednisolone is compromised for days after extubation. Prednisone (available in 1-mg, 5-mg, 10-mg, and 20-mg strengths) can be used in place of methylprednisolone.</p> <p>†If between days 1 to 14 the patient is extubated, the patient is advanced to day 15 of drug therapy and tapered according to schedule.</p> <p>‡When patients leave the intensive care unit, if they are still not tolerating enteral intake for at least 5 days, they should be given the dosage specified but divided into two doses and given every 12 h IV push until tolerating ingestion of medications by mouth.</p>			

Table 2. Dexamethasone treatment of early ARDS.

Early moderate –to- severe ARDS (PaO₂:FiO₂ ≤ 200 on PEEP 5 cmH₂O)	
Days 1 to 5	Dexamethasone 20 mg QD
Days 6 to 10	Dexamethasone 10 mg QD
Days 11 to 14	Dexamethasone 5 mg QD

Prior to initiation obtain CRP and PCT – Monitor CRP and O₂sat/FiO₂ daily

If patient shows no improvement in 3-4 days call Meduri [482-2122]

Add – for 4 days

Vitamin C 1.5 g every 6 h

Thiamine 200 mg every 12 h

Vitamin D 480,000 IU dose (60ml) x 1 dose on day one; recheck level on day 5. If low, supplement 96,000 IU / day for 5 days.

Appendix 5:

Resources for proper use of personal protective equipment (PPE)

Donning and Doffing of PPE – CDC Diagram

<https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>

PPE Donning Video for COVID-19 – Public Health England https://www.youtube.com/watch?v=kKz_vNGsNhC

PPE Doffing Video for COVID-19 – Public Health England <https://www.youtube.com/watch?v=oUo5O1JmLHO>

PAPR for Airborne and Contact Precautions – Baylor College of Medicine

<https://www.youtube.com/watch?v=BZcUyuj>

Appendix 6:

Lower PEEP/higher FiO₂

FiO₂	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO₂	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO₂

FiO₂	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO₂	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24