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Coronavirus Disease 2019 (COVID-19) Introduction and Disease Pathophysiology

In December 2019, clusters of patients with pneumonia of unknown etiology tracing back to mid-November and associated with exposures to a market in Wuhan, Hubei Province, China were reported. Through genome sequencing, a novel single-stranded beta-coronavirus was identified and named 2019-nCoV (referred to here as Severe Acute Respiratory Syndrome Coronavirus 2 or SARS-CoV-2). SARS-CoV-2 is the seventh known coronavirus to infect humans and is classified as a beta-coronavirus (joining MERS-CoV and SARS-CoV). The virus causes COVID-19, an acute febrile respiratory illness responsible for the 2020 global pandemic and widespread surges in hospitalizations and excess deaths in the US.1

SARS-CoV-2 primarily spreads between humans through inhalation of respiratory droplets and possibly aerosolized particles as well as indirectly through contact with surfaces contaminated with infected bodily secretions.2 Although replication-competent virus has been isolated from saliva and stool, and viral RNA has been isolated from semen and blood donations, there are no reported cases of SARS-CoV-2 transmission via fecal–oral, sexual, or bloodborne routes.3 The virus is thought to infect human hosts through binding of the virus spike (S) protein with angiotensin converting enzyme 2 (ACE2) receptors expressed by epithelial cells and pneumocytes of the respiratory tract. Other tissues that express ACE2 receptors, such as cardiomyocytes and podocytes, are also thought to be susceptible to SARS-CoV-2 through this mechanism. Type 2 transmembrane serine protease (TMPRSS2), present in host cells, promotes viral uptake by cleaving ACE2 and activating the SARS-CoV-2 S protein. Once internalized, the virus then releases RNA into the host cell nucleus resulting in viral replication and later dissemination of additional copies able to infect other host cells. The resulting viral illness triggers an immune response which can later be complicated by a severe systemic inflammatory response, the hallmark of which is a delayed cytokine release syndrome.4

Following initial infection with SARS-CoV-2, the median incubation period for COVID-19 is approximately 4-5 days in those who become symptomatic.5–6 SARS-CoV-2 viral shedding (and infectivity) occurs just prior to the onset of symptoms with viral load peaking afterwards and subsequently diminishing in the upper and lower respiratory tracts.7–9 The vast majority of infected individuals do not shed viable virus beyond 8 days after symptom onset and will experience resolution of illness within 1-2 weeks followed by a rise in anti-SARS-CoV-2 immunoglobulins.10

Please refer to Appendix A for further details on the molecular drivers of SARS-CoV-2 productive infection and estimated variation over time for detection of SARS-CoV-2 infection relative to symptom onset.
Clinical Evaluation of Persons Under Investigation (PUIs) and Patients with COVID-19

Presenting Symptoms

- SARS-CoV-2 infection has been identified in those who never develop symptoms (asymptomatic) and in patients not yet symptomatic (pre-symptomatic). Presenting symptoms of COVID-19 vary due to differing severities of illness and are listed in Table 1. It is important to note that patients may chronically experience some of these symptoms.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Reported prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever or chills</td>
<td>83-99%</td>
</tr>
<tr>
<td>Cough</td>
<td>59-82%</td>
</tr>
<tr>
<td>Shortness of breath or difficulty breathing</td>
<td>31-40%</td>
</tr>
<tr>
<td>Fatigue</td>
<td>44-70%</td>
</tr>
<tr>
<td>Muscle or body aches</td>
<td>11-35%</td>
</tr>
<tr>
<td>Headache</td>
<td></td>
</tr>
<tr>
<td>Sore throat</td>
<td></td>
</tr>
<tr>
<td>Nasal congestion</td>
<td></td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>15-39%</td>
</tr>
<tr>
<td>Loss of smell or taste</td>
<td>64-80%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>15-39%</td>
</tr>
<tr>
<td>Rash or skin changes</td>
<td></td>
</tr>
</tbody>
</table>

- Fever, cough, and shortness of breath are often present in those with severe illness. Atypical presentations can occur, however, with older adults and persons with medical comorbidities at times having delayed presentation of fever and respiratory symptoms.13

Risk factors for progression to severe or critical illness

- There are multiple potential risk factors for progression to severe or critical illness with resulting increased risk for mortality (Table 2). Patients with these risk factors may warrant closer and/or longer duration of monitoring for possible rapid clinical deterioration.
Table 2. Risk factors for progression to severe or critical illness. 

<table>
<thead>
<tr>
<th>Demographic or Underlying illness risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age more than 60 years</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
</tr>
<tr>
<td>Chronic lung disease</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>Hypertension (unless the only comorbidity present)</td>
</tr>
<tr>
<td>Heart disease</td>
</tr>
<tr>
<td>Immunosuppression</td>
</tr>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Smoking</td>
</tr>
</tbody>
</table>

- COVID-19 can be classified based on illness severity: mild, moderate, severe, and critical (defined in Table 3). In the largest COVID-19 cohort reported, approximately 81% of patients developed mild or moderate illness, 14% severe illness, and 5% progressed to critical illness. Deaths occurred primarily in those with critical illness. 

Table 3. COVID-19 Severity Classification. 

<table>
<thead>
<tr>
<th>Class</th>
<th>Clinical Evidence of Pneumoniaa</th>
<th>Respiratory Distress/Hypoxiab</th>
<th>ARDS/Sepsis/Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Moderate</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Severe</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Critical</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*a – based on symptoms, signs, or imaging findings. b – respiratory rate >30 per minute or resting SaO2 ≤94%.

- In those who progressed to severe or critical illness due to COVID-19, the median time required to progress from symptom onset to ARDS (and ICU admission) in cohort studies has been reported to be 8-12 days with survivors requiring a median hospital stay of greater than 10 days.
Physical Signs and Examination

• Physical examination maneuvers and techniques should be limited to systems that are relevant for clinical diagnosis and decision-making in order to minimize healthcare worker exposure to COVID-19; however, admission day and subsequent daily bedside physical examination should not be abandoned.

• Regular monitoring of vital signs with attention to respiratory status and respiratory rate is essential to exclude respiratory distress. Additional hemodynamics should be monitored for evidence of sepsis or shock.

• Cardiovascular and extremity exam should be focused on any signs of cardiomyopathy, heart failure, or venous thromboembolic disease.

• Lung exam should be conducted daily for evidence of new lobar consolidation or other findings of rales or wheezing.

• Neurological and psychiatric evaluation should be regularly completed to ensure there is no evidence of acute stroke, delirium, or development of depression or anxiety.

• Multiple dermatologic findings related to COVID-19 have been described and are included with visual examples in Appendix B.

SARS-CoV-2 Diagnostic and Follow-Up Testing

• The diagnosis of COVID-19 is based on detection of SARS-CoV-2 RNA by reverse transcription polymerase chain reaction (RT-PCR) obtained either from the upper or lower respiratory tract via nasopharyngeal swab or from sputum, tracheal, or endobronchial sampling. When clinically suspecting COVID-19, but presented with negative nasopharyngeal swab testing, sampling of the lower tract may be indicated. Clinical, laboratory, and/or imaging findings may be used to make a clinical diagnosis of COVID-19 if there is concern for possible initial false-negative testing.

• The RT-PCR targets 2 SARS-CoV-2 RNA targets: the S gene and ORF1ab gene with the presence of either by RT-PCR indicating a positive test.

• Detectable RNA can be present for many weeks beyond both symptom onset and clinical recovery. Detection of viral RNA from respiratory secretions does not necessarily indicate the presence of replication-competent virus or ongoing risk of virus transmission, however. To date, replicating SARS-CoV-2 virus has generally not been detected greater than 8 days after symptom onset.16-17 Immunocompromised individuals with COVID-19, however, may not follow the typical disease course in terms of duration of illness or viral shedding and subsequent immune response.18
RT-PCR results are reported as positive and negative for SARS-CoV-2 RNA. However, the test also provides a cycle threshold (Ct) value which serves as a measure of the viral load in the obtained respiratory sample. The Ct value is inversely related to the viral load and every increase in cycle threshold reflects a 2-fold reduction in viral RNA starting material.19

At times, especially when weeks out from symptom onset, the Ct value may occasionally aid in interpretation of positive swab results and clinical decisions regarding inpatient and outpatient clinical care. Obtaining and interpreting Ct values at Michigan Medicine currently requires direct correspondence with the Pathology department and should be done only in conjunction with an Infectious Diseases consultant.

The majority of infected individuals will experience resolution of illness within 1-2 weeks of symptom onset followed by a rise in anti-SARS-CoV-2 immunoglobulins (IgM and IgG).10 SARS-CoV-2 immunoglobulin (IgG) testing is available to document seroconversion but should not be used in the diagnosis of COVID-19. Inpatient antibody testing should generally only be obtained when working with an Infectious Diseases consultant.

At the present time, viral culturing and sequencing is not available for regular or widespread clinical usage. These remain investigational at Michigan Medicine.

Laboratory Findings in COVID-19

As highlighted in Table 4, obtaining routine blood and serum studies is recommended upon admission of any COVID-19 patient. Additionally, obtaining initial inflammatory markers may be of benefit for future monitoring should the patient clinical status deteriorate and/or to stratify for treatment options.

Obtaining bacterial cultures should be based on clinical suspicion for additional bacterial infections. Please note, induced-sputum cultures are typically recommended against in COVID-19 due to aerosolization of virus and the low rates of secondary bacterial infections seen to date.

Requesting lab draws every day of hospitalization for monitoring purposes only in COVID-19 is discouraged as it exposes healthcare workers to risk of infection. Consideration of regular but intermittent obtaining of laboratory studies is recommended. This consideration does not apply in cases of acute clinical changes, significant abnormalities requiring more regular monitoring, or in cases of clinical trials.
Table 4. Initial Admission and Follow Up Laboratory Findings

<table>
<thead>
<tr>
<th>Lab</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC with differential</td>
<td>Lymphopenia is the most common lab abnormality (&gt;80%).</td>
</tr>
<tr>
<td>Comprehensive Metabolic Profile</td>
<td>BUN &amp; Creatinine may be elevated due to associated renal insult. AST and ALT are often elevated.</td>
</tr>
<tr>
<td>C-Reactive Protein</td>
<td>Often elevated; subsequent increases during hospitalization may be most helpful for indirectly evaluating disease progression.</td>
</tr>
<tr>
<td>D-dimer</td>
<td>Often elevated; if severely elevated presence of VTE likely.</td>
</tr>
<tr>
<td>Ferritin</td>
<td>Often elevated and may correlate with disease activity.</td>
</tr>
<tr>
<td>Procalcitonin</td>
<td>May be elevated in COVID-19 despite lack of bacterial superinfection.</td>
</tr>
<tr>
<td>HS-troponin</td>
<td>Often elevated; may be useful to use as baseline if concern for cardiac ischemia develops later in hospitalization.</td>
</tr>
<tr>
<td>Prothrombin time/INR</td>
<td>May be mildly prolonged in a minority of patients.</td>
</tr>
<tr>
<td>Venous Blood Gas</td>
<td>May be useful in ruling out CO2 retention related to underlying obstructive airway disease.</td>
</tr>
<tr>
<td>Viral Respiratory Panel (RPAN)*</td>
<td>Viral co-infection is not often seen with COVID-19. May be obtained if would change management (influenza co-infection).</td>
</tr>
<tr>
<td>Respiratory Cultures</td>
<td>Often not required; induced sputum recommended against.</td>
</tr>
<tr>
<td>Type &amp; Screen</td>
<td>Necessary for blood transfusions including convalescent plasma.</td>
</tr>
</tbody>
</table>

*Future RT-CPR respiratory swab testing for COVID-19 testing will be automatically combined with Influenza & other viral/bacterial testing during Flu season.

Radiographic Findings and Additional Studies

- **Chest radiographs** should not be used as a screening tool for COVID-19, though they may be useful in helping risk-stratify patients by likelihood of bacterial co-infection to help decide whether or not to prescribe antibiotics. Findings can vary depending on disease severity. Chest x-ray, when abnormal due to SARS-CoV-2 infection, typically will show patchy or diffuse reticular–nodular opacities and consolidation, with basal, peripheral and bilateral predominance.\(^{20}\)

- **Chest CT** findings in COVID-19 are nonspecific and can resemble other viral or atypical infections or non-infectious disease processes. Obtaining a CT chest would typically be reserved for when seeking after an alternative chest diagnosis or COVID-19-related complication (i.e., assessing for evidence of
bacterial co-infection). Please be aware that obtaining CT or MRI imaging of COVID-19 patients results in 30-minute room downtimes afterwards and could negatively impact hospital-wide clinical care if overused.

- Obtaining an EKG on admission is advisable to exclude evidence of cardiac ischemia or to use as comparison for later if ischemia becomes a concern. Obtaining a baseline EKG would also assist in ruling out occult arrhythmia and measuring the QTc to evaluate for medication contraindications.

- **Transthoracic echocardiograms** are of limited value acutely in the setting of COVID-19 unless clinical concern is high for significant structural or functional abnormality. Echocardiograms can be conducted at bedside but should only be performed when the results would significantly change active clinical management. All echocardiogram requests involving COVID-19 patients will require a verbal discussion between the ordering medical provider and an Echo lab cardiologist.

- There is currently no need to empirically anticoagulate patients with suspected acute DVT. Rather, **bedside DVU studies** should be performed to confirm or rule out suspected acute DVT. Please note, *obtaining DVU imaging of COVID-19 patients adds an additional 25 minutes for equipment disinfection.*

  - Bedside DVU studies should be performed to confirm or rule out suspected acute DVT, when it would alter clinical management, and should not be performed on patients with an existing indication for full dose anticoagulation or on those who are receiving comfort measures only.

  - DVT scans lack sensitivity or specificity for diagnosis of pulmonary embolism (PE) and in the setting of suspected PE, the patient should undergo appropriate cross sectional imaging or empiric treatment if imaging is unable to be obtained.
Testing Criteria for Suspected Symptomatic or Potentially Asymptomatic COVID-19

Please be aware that criteria may change; the most up-to-date source of information is:

- Indications for COVID-19 testing for patients in the emergency department are listed below in Table 5. Patients who qualify for testing through this algorithm will have a single nasopharyngeal swab* obtained and sent for COVID-19 PCR. An influenza/RSV PCR or RPAN can also be sent per provider discretion using the same swab to minimize resource waste. Beginning in late Fall, 2020, Michigan Medicine will begin using the BioFire Respiratory Panel 2.1 (RP2.1), a multiplexed nucleic acid test intended for the simultaneous qualitative detection and differentiation of nucleic acids from multiple viral and bacterial respiratory organisms, including SARS-CoV-2. Thus, there will soon be no need for separate SARS-CoV-2 and RPAN testing.

Table 5. Indications for COVID-19 testing in the emergency department.

<table>
<thead>
<tr>
<th>Any one of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned hospital admission</td>
</tr>
<tr>
<td>Fever (T &gt;100.4°F or 38°C) or chills</td>
</tr>
<tr>
<td>New cough</td>
</tr>
<tr>
<td>New shortness of breath or hypoxia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Any two of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>New muscle aches</td>
</tr>
<tr>
<td>New headache</td>
</tr>
<tr>
<td>New URI symptoms (rhinorrhea, nasal congestion, or sore throat)</td>
</tr>
<tr>
<td>New loss of sense of smell or taste</td>
</tr>
<tr>
<td>New diarrhea or vomiting</td>
</tr>
<tr>
<td>New rash</td>
</tr>
<tr>
<td>Close contact exposure** to someone diagnosed with COVID-19</td>
</tr>
</tbody>
</table>

*While collection using an NP swab is preferred, obtaining an oropharyngeal (OP) swab is acceptable if an NP collection is contraindicated. Examples include patients with facial trauma, nasal septal or palate defects, or severe coagulopathy or thrombocytopenia.

**Close Contact Exposure in a non-healthcare setting: Greater than 15 minutes of close face to face contact with someone diagnosed with COVID-19 within 2 days prior to and 10 days after the COVID-19 positive person’s diagnosis (positive test).
• In most cases, a single negative test will be sufficient to rule out COVID-19. In cases of high clinical suspicion and an initial negative test, a second COVID-19 NP swab should be performed or a lower respiratory source sought for testing.

• Patients with recently diagnosed COVID-19 infection (occurring in the prior 21 days) do not require retesting for admission. They should be placed in Special Pathogen precautions and remain under these precautions until de-escalation criteria are met.

• Currently, all patients admitted to Michigan Medicine should be screened for COVID-19. If there is a patient who was recently tested, IPE can be contacted to discuss the specific scenario and make a decision on testing requirements on a case-by-case basis.

• Patients transferred from an outside hospital should have had COVID-19 screening completed. IPE, in conjunction with Admissions/Bed Management, will determine if additional testing is needed for all accepted external transfers.

• Documented negative COVID-19 PCR test results from non-Michigan Medicine laboratories are acceptable with the exception of the following platforms: Abbott ID NOW, Quidel Sofia 2, and BD.
Personal Protective Equipment (PPE) Guidance

Up-to-date and additional information can be obtained through the IPE internal COVID-19 inpatient clinical guidance website: [http://www.med.umich.edu/i/ice/resources/clinical_guidance.html](http://www.med.umich.edu/i/ice/resources/clinical_guidance.html)

- All healthcare worker should be trained in proper donning and doffing of PPE.

- Any contact with PUIs and patients diagnosed with COVID-19 should occur with full compliance with current Michigan Medicine PPE guidelines.

- Michigan Medicine guidelines for PPE use are subject to change based on changing local, state, and national guidelines. Current recommendations, pertaining to the care of all COVID-19 patients, require the use of:
  
  - N95 respirator and
  - Eye protection/face shield (eye protection should be worn over glasses. Glasses may be worn under protective eyewear, face shields or PAPRs)
  
  or

  - PAPR (Powered Air-Purifying Respirator) in lieu of N95 and Eye protection (head covers are reusable by the same individual if cleaned properly between patient encounters)

- Single Gown
- Single set of Gloves

- Any additional contact with patients under Special Pathogens Precautions occurring outside of hospital or procedural rooms necessitates compliance with PPE guidelines.

- **During Medical Codes:** full use of PPE is warranted (N95 mask + face shield eye protection or PAPR, gown, gloves) for all patients who experience cardiopulmonary decompensation and require emergent CPR or intubation to avoid the additional steps of evaluating the etiology of a patient’s decompensation. Switching between compressors should occur with room entry and room exit and whenever possible, automated compression devices should be used.

- Other PPE Resources (such as posters, videos) are available on the Michigan Medicine IPE COVID-19 Inpatient Clinical Guidance website: [http://www.med.umich.edu/i/ice/resources/clinical_guidance.html](http://www.med.umich.edu/i/ice/resources/clinical_guidance.html).
Please note, due to a reliable supply of N95s to support current use, N95 reprocessing stopped on 6/24/2020. Those trained in mask reuse that use their N95 for brief clinical encounters may continue to store them in a brown paper bag labelled with their name and date.
COVID-19 Infection Prevention Measures, Precautions and Policies

- When considering testing or awaiting testing results for COVID-19 in ED/Inpatient areas, multiple initial precautionary measures and procedures are required.

  - Pregnant healthcare workers and immunocompromised healthcare workers should be excluded from caring for suspected or confirmed novel coronavirus patients.
  
  - Medical staff should write an order for Special Pathogens Precautions for Persons Under Investigation (PUI) or confirmed with COVID-19.
  
  - Nursing staff will place the Special Pathogens Precautions sign outside of the patient’s door. The door should remain closed except for healthcare workers entering/exiting room.
  
  - Patients that have a high likelihood of undergoing an High Risk Aerosol Generating Procedure (AGP) should be given first priority for negative pressure rooms. Table 6 lists all high-risk AGPs at Michigan Medicine.
  
  - When negative pressure rooms are not available, a regular room may be used with the door closed.
  
  - Patients who are being tested only because they are being admitted or to undergo a procedure but who are lacking any concerning symptoms for COVID-19 may be kept in standard precautions (surgical face mask and eye protection), though preferably in a single room.

Table 6. Aerosol Generating Procedures (AGPs) in order of highest risk for virus aerosolization

<table>
<thead>
<tr>
<th>Highest risk AGPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intubation</td>
</tr>
<tr>
<td>Bronchoscopy</td>
</tr>
<tr>
<td>Extubation</td>
</tr>
<tr>
<td>Manual ventilation (bag-mask or via artificial airway)</td>
</tr>
<tr>
<td>Cardiopulmonary resuscitation (CPR)</td>
</tr>
<tr>
<td>Tracheostomy placement/exchange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moderate-High risk surgical/procedural AGPs</th>
</tr>
</thead>
</table>

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Upper aerodigestive tract procedure
Intrathoracic surgery
Intra-abdominal surgery
Upper airway endoscopy
Lower GI endoscopy
Pulmonary function testing (PFTs)
Electroconvulsive therapy (ECT)

Additional AGPs

Open system suctioning (nasotracheal, tracheostomy, open ventilator, endotracheal)
Nebulizer treatments
Noninvasive positive pressure ventilation
Providing moist air or supplemental oxygen via face mask or trach mask with aerosol
Heated high-flow supplemental oxygen
Cough assist treatments
Exchanging tracheostomy tubes
Sputum induction
Chest tube manipulation
Mechanical ventilation (due to the risk of an unplanned ventilator circuit disruption)

Patient Transportation

• Intra-hospital transportation of inpatients with confirmed or suspected COVID-19 should be limited for medically-essential purposes only. Such considerations may include necessary testing (e.g. imaging) or change in location of care delivery. Coordination with patient transportation/SWAT and nursing is necessary prior to initiating transport.

• Per current institutional PPE guidance:
  - N95 respirators with eye protection/PAPR, gown, gloves are required to transport COVID positive or PUI patients.
  - N95 respirators with eye protection/PAPR, gown, gloves are required for staff to transport asymptomatic patients with no COVID-19 test or a pending COVID-19 test who are undergoing a high-risk Aerosol Generating Procedure (AGP).
  - Transport modality (e.g. wheelchair, stretcher) and any equipment leaving a COVID-19 patient room should be wiped down prior to transport with hospital-approved disinfectant to prevent hand contamination.
Mask recommendations and protocols for COVID-19 patients during transportation:
- Place an ear loop mask on patients covering their nose and mouth. Place an ear loop mask over any tracheostomies. It is not necessary to mask tracheostomies covered by a heat moisture exchange (HME).
- The patient being transported needs to wear a mask at all times. If a patient is not able to wear a mask, tissue should be provided should the patient need to cough during transport.
- If the patient is intubated, place a bacterial filter on the endotracheal tube or on the expiratory side of the breathing circuit of a ventilator or anesthesia machine prior to transport.
- If the patient is wearing a non-rebreather mask, consider alternate options such as a 15L/min high flow cannula or other options as clinically appropriate and patient-tolerated. Checking with the clinical care team is requested.
- Ensure the patient is wearing a clean patient gown.
- The patient should clean their hands with soap and water or with an alcohol-based hand rub before leaving the room if possible.
- The patient should be transported in a patient transport elevator with the transport team but no other visitors should be in the elevator. Elevators do not require an air-out period.
- If a PUI or COVID-19 patient is being discharged, instruct the person picking up the patient to pull up to the main entrance and wait for the patient ahead of time.
- Michigan Medicine staff will transport the patient out of the building following the steps above regarding staff PPE and masking of the patient.

Patient Visitors
- Visitors are not permitted for hospitalized patients in Special Pathogen Precautions unless they are end-of-life status, deceased, or are being discharged and require a ride to meet them at a hospital entrance.

- Assuming a patient with COVID-19 has consented to correspondence between healthcare providers and patient family, primary team providers should seek to contact family by phone to given them daily clinical updates. Family should also be notified of any clinical changes in condition as well. If possible, use of patient or hospital-provided smart devices to allow for visual contact between family and patient is also recommended.

- In end-of-life situations, there is a limit of 2 designated visitors per patient.

- While in the patient room, visitors must wear appropriate PPE and be informed of risk.

- If a visitor is permitted for the above reasons, they must:
  - Be healthy.
- Wear a mask while in the healthcare facility.
- Remain in the patient room without moving around the hospital.
- Leave the hospital if they develop concerning symptoms.

Additional COVID-19 infection prevention hospital policies

- If a patient is in a room with a roommate who becomes positive for COVID-19, Infection Prevention will contact the patient’s clinical team to assist with disclosure to the roommate. If the roommate is still admitted, they will be placed in Droplet Precautions for 14 days after exposure or until discharge, whichever criteria is met first.

- If an admitted patient with symptoms concerning for COVID-19 refuses diagnostic testing, the patient must be managed in Special Pathogen Precautions.

- If an admitted asymptomatic patient refuses screening testing for COVID-19, the patient may be managed with standard precautions, but any high or high/moderate risk Aerosol Generating Procedures (AGP) performed on the patient must be performed under Special Pathogen precautions.

- If possible, avoid placing an asymptomatic patient with unknown COVID-19 status in a room with a roommate. This includes patients who have test results pending and patients who refused testing. If a patient with a COVID-19 test pending is placed in a room with a roommate, the patient should wear a mask until the test result is final. A private room is not required unless they may need an AGP performed.

Isolation De-Escalation for Hospitalized Patients After Negative COVID-19 Test in Persons Under Investigation (PUIs)

Please be aware that criteria may change; the most up-to-date source of information is:
http://www.med.umich.edu/ifice/resources/coronavirus/WorkflowForNegativeCOVID.pdf

Discontinuing Special Pathogen precautions in Symptomatic patients or those with Exposure Risk:

- Following a single negative initial COVID-19 screening test, staff may discontinue Special Pathogens precautions but should de-escalate to Droplet Precautions for:
  - Any patient requiring ICU level of care
  - Any patient with ongoing symptoms of unclear etiology
  - All pediatric patients in any patient location
- All Adult patients housed on pediatric units
- All adult HSCT and hematologic malignancy patients
- All patients housed on HSCT/hematologic malignancy units per IPE Droplet Precautions policy
- All patients with a +RPAN requiring Droplet Precautions per IPE Policy (e.g., influenza, RSV, etc.)
- All patients who identify a close exposure to an individual with COVID-19 in the last 14 days until the 14th day after exposure

**Discontinuing Special Pathogen precautions in Asymptomatic patients without exposure risk**

- Follow standard precautions (with universal masking) for all patients who do not meet any of the above criteria or who underwent asymptomatic COVID-19 screening with negative test results.

**Isolation De-escalation for Hospitalized patients with confirmed COVID-19**

- Special Pathogens Precautions may be discontinued after the following criteria are met:
  - Resolution of fever for >24 hours without use of fever-reducing medications
  - Improvement in respiratory symptoms defined as a significant reduction in supplemental oxygen requirement or at the discretion of Infection Prevention and Epidemiology staff
  - Negative COVID-19 PCR test result as outlined below:

  a. Obtained a minimum of 14 days after symptom onset
  b. Non-ventilated patients without tracheostomy:
     i. Two nasopharyngeal swabs collected >24 hours apart
  c. Ventilated or tracheostomy patients:
     i. Two nasopharyngeal swabs collected >24 hours apart plus one tracheal aspirate, or
     ii. Two tracheal aspirates collected >24 hours apart plus one nasopharyngeal swab
  d. Follow up tests should be prioritized in situations where results are likely to change management (e.g. prior to transfer to a different room or unit)
  e. If test remains positive, the provider team must wait 7 additional days prior to the next retesting

- Patients who meet the above criteria should be placed in:
  - Droplet Precautions:
    o if they remain in the same room, due to potential existing environmental contamination
    o if they are immunocompromised (patients who are receiving myelosuppressive chemotherapy for treatment of a malignancy, patients with an absolute neutrophil count (ANC) of <1000, patients with severe combined immunodeficiency syndrome (SCIDS), or adult heart and lung transplant patients during current transplant admission or within 30 days of transplant)
- Standard precautions (with universal masking): upon transfer to a new room (for non-immunocompromised patients only)

**Isolation De-Escalation for Ambulatory Patients with Confirmed COVID-19**

Special Pathogens Precautions may be discontinued and patients may be scheduled with standard precautions once both of the following criteria are met:

- **Never Hospitalized:** 21 days from date of COVID-19 diagnosis
- **Required Hospitalization:** 21 days from date of discharge unless patient met de-escalation criteria prior to discharge and >72 hours have passed since clinical recovery with resolution of fever without the use of fever reducing medications for >24 hours and improvement of respiratory symptoms
Supportive Care Strategies for Inpatients with COVID-19

• Patients with a mild clinical presentation (absence of viral pneumonia and hypoxia) may not initially require hospitalization, and many patients will be able to manage their illness at home. The decision to monitor a patient in the inpatient or outpatient setting should be made on a case-by-case basis at the discretion of the ED or admitting provider. This decision will depend on the clinical presentation, requirements for supportive care, potential risk factors for severe disease, and the ability of the patient to self-isolate at home. Patients with risk factors for severe illness (see above in Clinical Evaluation of COVID-19) should be monitored more closely given the possible risk of progression to severe illness, especially in the second week after symptom onset.10

Fever

• The NIH Coronavirus Disease 2019 (COVID-19) Treatment Guidelines recommend that there be no difference in the use of antipyretic strategies (e.g., with acetaminophen or NSAIDs) between patients with or without COVID-19.21 However, if there is concern for the presence or development of cardiac or renal injury, NSAID use should be minimized or avoided.

Hypoxia

• Hypoxia is a common reason for hospitalization in patients who have progressed to severe or critical COVID-19 with associated viral pneumonia.

• Supplemental oxygen preferentially should be initially delivered via humidified low-flow nasal cannula with goal SpO2 between 92-96%.

• Once requiring 6 liters per minute of oxygen via nasal cannula to maintain a resting SpO2 of ≥90%, alternative high-flow oxygen delivery should be considered and plans should be initiated for transfer to a negative pressure room and likely a higher level of care (moderate/intermediate or intensive care unit).

• Use of a nasal cannula up to 15 liters per minute or non-rebreather with proper facial seal can be used while awaiting escalation of level of care as these are not considered AGPs.

• Awake proning maneuvers can also be employed (best when done with the guidance of a proning team, if available, or medical staff trained in awake proning) once plans have been made to escalate care due to progressive hypoxia.
Heated high flow nasal cannula and Noninvasive Ventilation:

- If a patient requires >12 liters per minute of high-flow nasal cannula, a trial of heated high-flow nasal cannula (HHFNC) can be employed to avoid intubation or act as a bridge to intubation.

- With use of HHFNC, efforts should be made to limit flow to the least number of liters per minute; commonly used flow rates range between 30-60 liters per minute.

- While using HHFNC, if the fraction of inspired oxygen (FiO2) necessary to keep the SpO2 ≥92% is ≥0.70, preparations for intubation should be made if mechanical ventilation is within the scope of the goals of care.

- CPAP/BiPAP use for the purpose of avoiding intubation is discouraged in COVID-19 patients due to a lack of data demonstrating these modalities improve outcomes in hypoxic respiratory failure. Unless the patient is experiencing a concurrent heart failure exacerbation/pulmonary edema or COPD exacerbation, HHFNC should be used in place of CPAP or BiPAP.

- Home nocturnal CPAP/BiPAP may be continued if the patient is in a negative pressure room and is able to use the device independently. However, if escalating oxygen requirements or signs of worsening infection are present, CPAP or BiPAP may be continued, but transition to an ICU setting should be considered. Supplemental oxygen via nasal cannula may otherwise be used in lieu of nocturnal CPAP/BiPAP if the patient is noncompliant with their home device.

Use of Nebulizers and Metered dose inhalers:

- In non-intubated patients, avoid nebulizer therapy whenever clinically possible to avoid aerosolization. Nebulizer may be required in mechanically ventilated patients with obstructive airway disease.

Mechanical Ventilation

- The threshold for intubation in COVID-19 is controversial. Early intubation allows for a more controlled process, however hypoxia without clinical signs of respiratory distress can often be well-tolerated (the “happy-hypoxic” or “silent-hypoxic” patient) and mechanical ventilation can predispose to additional complications.²
• The final decision to intubate a patient should be made after a full discussion with the patient and family and in consultation with the critical care and intubating teams.

• Intubation generally should be performed by anesthesia providers skilled in acute airway management, with video laryngoscopy available if possible and while in a negative pressure room.

• The primary ventilator strategy is to minimize ventilator induced lung injury by (1) using low tidal volume (Vt) ventilation with Vt of 4-8 mL/kg of predicted body weight and (2) keeping plateau pressure below 30 mm H2O.

• A higher positive end expiratory pressure (PEEP) strategy should be utilized in most patients to improve oxygenation and decrease FiO2 requirements. However, a lower PEEP strategy can be used if higher PEEP results in worsened shock or elevated plateau pressures.

• Ventilatory parameters should titrate to pH rather than CO2. Hypercapnea and academia (pH goal 7.25-7.45) should be tolerated to allow for low tidal volumes.

• Respiratory rates will typically need to be high to accommodate low tidal volumes as well (typical rates are between 20-35 breaths per minute). Please note, however, in patients with obstructive lung disease, it is important to assess for air trapping.

• In the event that the pH is <7.15, tidal volume may be increased by 1 mL/kg until the tidal volume reaches 8 cc/kg.

• Recruitment maneuvers can also be considered to improve oxygenation.

• Neuromuscular blockade can be considered in patients with moderate-to-severe ARDS (acute respiratory distress syndrome with PaO2/FiO2 ratio < 150) with worsening hypoxemia despite optimizing ventilation strategy and in cases of ventilator dys-synchrony. Deep sedation must be achieved prior to initiating neuromuscular blockade, however.

• Prone ventilation for 12-16 hours per day should be considered in moderate-to-severe ARDS when the above interventions have been attempted without significant improvement. Proning takes a significant amount of training and resource coordination and should only be attempted by personnel competent in its use. Specific techniques to avoid brachial plexus injuries should be employed.
• If hypoxia persists in severe ARDS despite the above, a trial of inhaled pulmonary vasodilator can be attempted but should be tapered off if no rapid improvement in oxygenation is observed. This intervention is costly and not strongly supported by current critical care literature, however. A summary of mechanical ventilation strategy in COVID-19 is available in Appendix C.

Acute Kidney Injury & Renal Replacement Therapy

• Incidence of acute kidney injury (AKI) increases with severity of overall illness in COVID-19 and affects up to 60% of critically ill patients.

• Development of AKI is associated with increased mortality.

• The primary etiology of severe AKI in COVID-19 appears to be acute tubular necrosis (ATN) related to shock and multi-organ failure. Many patients also develop proteinuria, though it is unclear if there is a distinct COVID-19 kidney injury mechanism given ACE2 receptor expression within renal parenchyma.

• Given reports of viral shedding in the urine, the nephrology consult teams will not be transporting urine specimens for urine microscopy outside of the lab setting.

• Decision for renal replacement therapy (RRT) modality is per usual Michigan Medicine criteria. There is no evidence to guide a specific CRRT or intermittent hemodialysis prescription for COVID-19, though CRRT is favored as the initial modality for patients with hemodynamic instability (e.g. use of vasopressors, shock), significant fluid overload, and high catabolism.

• Timing of RRT initiation will depend on clinical factors.
  - One consideration would be earlier initiation with worsening respiratory status if a volume component is suspected.
  - Nephrology should be consulted earlier to assist in this determination and coordinate logistics in a timely manner.

• As COVID-19 is a highly inflammatory state, there have been reports of increased premature filter clotting. The nephrology team should be made aware of any nursing difficulties with CRRT management thought to be related to filter dysfunction.
Dehydration, Rehydration and Intravenous Fluids

- Conservative fluid management can prevent progressive hypoxia related to pulmonary edema or congestion, however volume resuscitation may be necessary to treat virus-mediated septic shock or associated volume depletion. In general, there are limited data to support a liberal versus conservative fluid strategy. A careful history and physical exam with specific attention to volume status is thus paramount in the early evaluation of patients with severe or critical COVID-19.

- Enteric (oral or via enteric tube) hydration is preferable over IV fluids when possible.

- Maintenance fluids should be avoided and intermittent IV fluids (or oral/NG tube hydration) used instead.

Cytopenias, Coagulopathy and Transfusion of Blood Products

- Blood products have intermittently had limited availability during the COVID-19 pandemic.

- Volume overload related to blood products may worsen oxygenation and increase pulmonary vascular congestion.

- A restrictive transfusion strategy (target Hematocrit ≥21%, Hemoglobin ≥7 g/dL) is recommended for use in COVID-19 patients unless the patient is actively bleeding or there is concern for acute coronary syndrome (in acute coronary syndrome, reduce transfusion threshold to hemoglobin ≥9 g/dL).

- FFP or 4 factor-PCC (lower volume) should be used for active bleeding in the setting of known or suspected coagulopathy.
  - Warfarin reversal or life-threatening coagulopathy: use 4 factor-PCC given longer effect and lower volume.
  - Platelets: target goal ≥10,000 unless actively bleeding.

Early Mobilization

- Many patients with COVID-19 will experience prolonged days of bed rest, muscle weakness, and debility.
• Mechanically ventilated patients and those with severe sepsis are at greatest risk of physical impairment following COVID-19.

• Early mobilization and engagement of physical and occupational therapy when clinically appropriate (stable oxygen requirements, able to follow commands) is recommended.

Hyperglycemia Management in COVID

• Hyperglycemia is a common complication in pre-diabetic and diabetic patients acutely ill with COVID-19. The potential use of systemic glucocorticoids also predisposes these patients to severe hyperglycemia which may contribute to increase morbidity and mortality.

• While often needing to hold home oral hypoglycemic, initiation of pre-prandial and bedtime glucose checks in conjunction with basal and bolus insulin regimens and use of correction insulin (sliding-scale insulin) is commonly required.

• Insulin infusions may become necessary, especially in patients who become critically ill, though if avoidable they should be discouraged due to increased burden of exposure on healthcare workers due to frequent point-of-care glucose checks.

• In cases of severe or symptomatic hyperglycemia, associated diabetic ketoacidosis, or refractory/brittle hyper- and/or hypoglycemia, there should be low threshold to seek assistance through a formal e-consultation with an Endocrinology consultant.

Hypercoagulability and COVID-19

• The pathogenesis for COVID-19-associated hypercoagulability remains unknown. However, hypoxia and systemic inflammation secondary to COVID-19 may lead to high levels of inflammatory cytokines and activation of the coagulation pathway.

• Patients with COVID-19 are at increased risk for venous and arterial thrombosis of both small and large vessels. However, the degree of increased risk reported in the literature has been quite variable. Laboratory abnormalities commonly observed among hospitalized patients with COVID-19-associated coagulopathy include:
  - Elevated D-dimer
  - Elevated fibrin degradation products
  - Prolonged prothrombin time
- Thrombocytopenia

- Elevated D-dimer levels have been associated with greater risk of death.

- While many reports have focused on the frequency of deep vein thrombosis (DVT) and pulmonary embolism (PE) complications for patients hospitalized with COVID-19, other thromboembolic events are commonly found. These include:
  - In situ immunothrombosis in the pulmonary arteries
  - Microvascular thrombosis of the toes
  - Thrombosis or clotting of catheters (e.g., dialysis)
  - Myocardial injury with ST-segment elevation
  - Acute limb ischemia
  - Large vessel strokes

- All patients with COVID-19 or clinical suspicion of COVID-19 should receive pharmacologic thromboembolic prophylaxis unless contraindications to such treatment exist. Pharmacologic prophylaxis has been associated with lower in-hospital mortality with similar mortality in patients who receive prophylactic or treatment-dose anticoagulation. Ambulation remains important when patients are able.
  - The preferred agent for prophylaxis in COVID-19 Michigan Medicine medical patients is low molecular weight heparin, enoxaparin, dosed at 40 mg daily (dose adjustments or use of subcutaneous heparin may be necessary in kidney disease or injury).

- There are currently insufficient data to recommend for or against using increasing anticoagulant doses for VTE prophylaxis in hospitalized COVID-19 patients outside the setting of a clinical trial.

- Hospitalized patients with COVID-19 should not routinely be discharged on VTE prophylaxis. Extended VTE prophylaxis should only be considered if a patient is at low risk of bleeding and high risk for VTE and is being discharged on an FDA-approved regimen per any established protocol for patients without COVID-19.

**Cardiac Complications of COVID-19**

- Cardiovascular complications of COVID-19 include myocarditis, acute myocardial infarction, heart failure, arrhythmia, and shock. Possible mechanisms of cardiac injury include cytokine storm, increased sympathetic tone, supply-demand mismatch, exacerbation of underlying disease, hypercoagulability, and direct cardiac involvement.
• Patients with underlying cardiovascular disease including hypertension and coronary disease are at higher risk for developing more severe illness and have a higher mortality when infected with COVID-19.  

• Myocardial injury
  - High sensitivity troponin (hs-troponin) should be checked on admission in all patients; elevations have been associated with increased mortality in COVID-19.  
  - Abnormal hs-troponin should NOT be considered an acute type I MI (plaque rupture) without additional supporting evidence.  
  - Consider hs-troponin elevation from demand ischemia or systemic inflammation in the setting of clear physiologic stressors such as fever, tachycardia, and hypoxia.  
  - Severely elevated values of hs-troponin should be incorporated into a provider’s overall assessment of the patient in regards to treatment and prognosis.  
  - There is no evidence to suggest benefit from anti-platelet or anticoagulant therapy for those with myocardial injury in the absence of a type I MI (plaque rupture).

• Acute Coronary Syndrome
  - The cardiac catheterization lab should be activated following normal protocols/procedures including use of the STEMI pager.  
  - For patients without an established COVID-19 diagnosis in whom acute plaque rupture is suspected, they should proceed to the negative pressure catheterization lab without delay. Following the procedure, full COVID-19 cleaning of the room should be performed.  
  - In appropriately-selected patients with known or suspected COVID-19 and an NSTEMI, conservative therapy may be appropriate.  
  - In patients with confirmed COVID-19 and an NSTEMI, an initial conservative strategy with medical management is recommended with coronary angiography reserved for hemodynamic instability or recalcitrant symptoms. Outpatient risk stratification is recommended once infection has resolved.  
  - In patients with suspected COVID-19 and an NSTEMI, an initial conservative strategy with medical management is recommended pending test results in the absence of hemodynamic instability.

• Myocarditis
  - Myocarditis is more common in COVID-19 than other viral illnesses possibly due to the affinity of the virus for ACE2 receptors which are highly concentrated on cardiac myocytes.
- Myocarditis can occur before or after worsening of pulmonary disease in COVID-19. Signs and symptoms range from mild to severe and may include: tachycardia, hypotension, chest pain (may be positional), dyspnea, orthopnea, and nausea/vomiting.

- Cardiogenic shock may be preceded by any of the following:
  - Worsening renal function or declining urine output
  - Progressive increase in liver transaminases
  - Altered mental status
  - Elevated lactate

- An echocardiogram should be obtained if there is concern for heart failure or shock.

- Early cardiology consultation should be obtained in the presence of myocardial dysfunction.

- Cardiac MRI may be considered in patients with suspected myocarditis, although ideally this would be performed after they have recovered from their acute illness and repeat COVID testing is negative.

- **Heart Failure**
  - BNP and NT-proBNP are markers of myocardial stress and are frequently elevated in patients with COVID-19.
  - An elevated BNP, in the absence of signs/symptoms of heart failure, is not an indication for an echocardiogram or initiation of treatment for heart failure; use of echocardiography should be restricted to those patients in whom it would meaningfully alter management.
  - The increased incidence of heart failure in the setting of COVID-19 is likely due to either an exacerbation of pre-existing left ventricular dysfunction or new cardiomyopathy (stress-induced versus myocarditis).
  - As with other patients with severe parenchymal lung disease and ARDS, patients may develop pulmonary hypertension and associated right heart failure.
  - In patients with pre-existing heart failure, routine medical management should be continued in the absence of a clear contraindication (i.e. hypotension, acute kidney injury). In patients who require discontinuation of medical therapy, medications should be restarted prior to hospital discharge.

- **Tachyarrhythmias**
  - Palpitations can be an initial complaint or symptom in COVID-19.\(^{32}\)
  - Arrhythmias occur frequently in hospitalized patients with COVID-19, most commonly in those admitted to the ICU.
  - Recommendations for ventricular arrhythmias:
    - New ventricular arrhythmias in the setting of troponin elevation and COVID-19 infection should increase concern for myocarditis.
o Decisions regarding antiarrhythmic drug use and management of ventricular arrhythmias should be made with input from the electrophysiology team as warranted.
- Recommendations for atrial fibrillation and supraventricular tachycardia
  - Use of rate control versus rhythm control strategies and a patient’s candidacy for anticoagulation should be made on a case-by-case basis.

- Cardiac Device Management
  - In patients with implantable cardioverter-defibrillators (ICDs), goals of care discussions should include a discussion regarding ICD tachy-therapies (shocks).
  - Patients who elect (or whose decision-maker elects) to have tachy-therapies on their ICDs turned off may have a “Donut Magnet” placed over the ICD and secured onto the skin with foam tape. Tachy-therapies will be inhibited as long as the magnet remains in place. The electrophysiology service should be called to inform of magnet placement.
  - Pacemakers without ICD function do not generally require reprogramming or magnet placement during end of life care. Any questions should be directed to the on-call cardiac electrophysiology fellow.

- ACE-inhibitors/ARBs:
  - COVID-19 patients who are prescribed angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) for cardiovascular disease (or other indications) should continue these medications unless there is a contraindication (e.g., AKI).21

- Statins:
  - Statin therapy should be continued in patients with known ASCVD, diabetes, or at high-risk for ASCVD if previously on statin therapy unless there is a contraindication (e.g., severe hepatitis).
  - The NIH recommends against the use of statins specifically for the treatment of COVID-19.21

- Anti-platelet therapy:
  - Continue unless severe active bleeding or marked thrombocytopenia.
• Immunosuppression:
  - In patients with COVID-19 and a history of heart transplantation, any changes to immunosuppression should be discussed with the HFT attending on service.

• Chronic antiarrhythmic drugs in the setting of known COVID-19 infection:
  - Patients on long-term sotalol or dofetilide therapy may require discontinuation or dose-reduction in the setting of fluctuating renal function or to accommodate new QT-prolonging drugs.
Pharmaceutical therapies Specific to COVID-19


- There are currently no FDA-approved therapies for COVID-19, though several are available through emergency authorization, expanded use and compassionate use trials and clinical trials.

- Multiple observational and randomized controlled trials have been conducted with multiple agents aimed at direct inhibition of viral cell entry or viral replication, augmentation of immune response, and mitigation of systemic inflammatory syndrome. Various outcomes have been studied with varying degrees of clinical benefit or possible harm. Descriptions of and recommendations for COVID-19 specific therapeutics are summarized in Table 7 and Table 8.

- All treatment with COVID-19 specific therapeutics should be performed under the guidance of an Infectious Diseases consultant.

- Limited supply of drug or blood products may cause usage recommendations and guidelines to fluctuate and adapt based on present restrictions.

Table 7. Current COVID-19 specific therapies.

<table>
<thead>
<tr>
<th>Remdesivir²¹,³³-³⁴</th>
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</thead>
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**Mechanism:** Acts as an adenosine triphosphate analog and competes for incorporation into RNA chains by the SARS-CoV-2 RNA-dependent RNA polymerase, resulting in delayed chain termination during viral RNA replication.

**Dosing & duration:** 200 mg IV load, then 100 mg IV every 24 hours for 5 days total duration.

**Criteria for use**: (1) Laboratory confirmed SARS-CoV-2 infection by PCR from a nasopharyngeal or respiratory sample and <14 days of symptoms (2) Severe Covid-19: SpO₂ ≤ 94% on room air or requires supplemental oxygen but not high-flow oxygen, non-invasive mechanical ventilation, mechanical ventilation, or ECMO (3) Radiographic evidence of pulmonary infiltrates.

*Exceptions to the criteria may be made on a case-by-case basis.*
Dexamethasone\textsuperscript{21,33,35}

**Mechanism:** Decreases inflammation by suppression of neutrophil migration, decreased production of inflammatory mediators, and reversal of increased capillary permeability; suppresses normal immune response.

**Dosing & duration:** 6 mg PO or IV every 24 hours for up to 10 days.

**Criteria for use:** (1) Recommended in most COVID-19 patients on supplemental oxygen and (2) Recommended in patients with COVID-19 who require mechanical ventilation. The benefit of dexamethasone is uncertain in patients with <7 days of symptoms.

Convalescent plasma\textsuperscript{21,33}

**Mechanism of action:** Provides passive immunity in the form of neutralizing antibodies (and/or possibly other immune mediators) directed against SARS-CoV-2.

**Dosing & duration:** 1-2 units of plasma, once. Units will be labelled as “High Titer” or “Low Titer” COVID-19 Convalescent Plasma; “High Titer” units will be preferentially used if available.

**Criteria for use:** Insufficient data are available regarding efficacy of convalescent plasma or the target population for use. Based on emerging evidence, efficacy may exist early in the disease course. Randomized clinical trials are ongoing. Convalescent plasma is available via FDA-issued Emergency Use Authorization for hospitalized patients with COVID-19 but not considered standard of care. Decisions regarding use outside of clinical trials should be individualized.

- **Hydroxychloroquine** (with and without azithromycin): Among hospitalized patients with COVID-19, the IDSA and NIH COVID-19 Treatment Guidelines recommend against use of hydroxychloroquine with and without azithromycin based on review of multiple randomized-controlled trials and observational data.

- Additional agents under investigation (therapies without any supportive evidence and/or associated with potential harm) include: tocilizumab, sarilumab, lopinavir/ritonavir, nitazoxanide, oseltamivir, baloxavir, interferon, ribavirin, IVIG. None of these agents are recommended unless in the context of a clinical trial.
• SARS-CoV-2-specific monoclonal antibodies are a promising possibility for treatment of COVID-19, but data and agents are not yet available outside of clinical trials.

Table 8. Pharmaceutical and Immunoglobulin Treatment Recommendations in COVID-19 by Disease Severity.

<table>
<thead>
<tr>
<th>COVID-19 severity</th>
<th>Mild-Moderate Illness</th>
<th>Severe Illness</th>
<th>Critical Illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen Supplement</td>
<td>None Required</td>
<td>Low-Flow Oxygen</td>
<td>High-Flow Oxygen</td>
</tr>
<tr>
<td>Remdesivir</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dexamethasone</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Convalescent Plasma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydroxychloroquine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional Agents</td>
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</tr>
</tbody>
</table>

- **Recommended** (or Available to use and appropriate per ID consultant or Blood Bank)
- **Recommended** only in limited circumstances, clinical trials or per ID consultant.
- **Not recommended** or recommended against use.

**Angiotensin Converting Enzyme Inhibitors (ACE-I) and Angiotensin II Receptor Blockers (ARB)**

• There are no data demonstrating beneficial or adverse outcomes with use of these drugs in COVID-19 or among COVID-19 patients with a history of cardiovascular disease taking these medications. As such, the American Heart Association and American College of Cardiology do **not** recommend routinely stopping ACE-I’s or ARB’s in patients with COVID-19.

**Antibiotic Management for Pneumonia in PUI and Confirmed COVID-19 Patients**

• In patients admitted with suspected COVID-19 pneumonia (testing pending), decisions whether to initiate antibiotic therapy should be based on guidance provided in the institutional pneumonia treatment and procalcitonin usage guidelines.

• Continuation/initiation of antibiotic therapy solely due to confirmation of COVID-19 pneumonia is not indicated as described below.

• In patients with confirmed COVID-19 pneumonia, community-onset bacterial co-infection is uncommon, even in critically ill patients, and elevated procalcitonin levels are not reliably associated with bacterial infection, especially in the setting of concomitant renal dysfunction. However,
negative procalcitonin values have a >98% negative predictive. Thus, if considering antibiotic therapy, a procalcitonin level could be helpful in deciding not to prescribe antibiotics if negative. As above, a positive value is often unlikely to be helpful.

- In a recent review of antibiotic use in 1,705 COVID-19 hospitalized patients in Michigan, the prevalence of confirmed community-onset bacterial co-infections was low (<4%). Despite this, approximately half of patients received early empiric antibacterial therapy.

- Empiric antibiotic therapy should therefore generally be discontinued once a patient is confirmed COVID-19 positive, but may be indicated in patients with leukocytosis and/or hemodynamic instability. De-escalation/discontinuation of antibiotics should be considered based on clinical and microbiological data.
Palliative Care & End-of-Life Considerations and Management in COVID-19

- In general, patients with COVID-19 have many symptoms consistent with other acute respiratory illnesses (influenza, pneumonia, etc.) and the principles of treatment remains the same. The main symptoms associated with COVID-19 are dyspnea, cough, restlessness, and GI distress. Aggressive management of these symptoms should be a mainstay of treatment, and need not be restricted to those at the end of life. Below are some general recommendations for management of these symptoms. Should these measures prove ineffective, consider consulting the Palliative Care service.

Dyspnea:

- Non-pharmacologic interventions:
  - Keeping the room cool
  - Elevating the head of the bed as tolerated
  - Oxygen as indicated
  - Avoid a fan as increased air circulation may increase risk for transmission

- Opioid therapy: Morphine is preferred, and should be used unless the patient has a documented morphine allergy, or renal failure. For help with dosing for uncontrolled symptoms or rotating opiates due to side effects, you may contact your pharmacist for aid or use helpful websites like www.globalrph for opioid conversions. The dosing recommendations below are for opioid naïve patients. Opioid tolerant patients may require higher doses than their chronic opioid regimen as described in the End of Life Dyspnea/Pain section below.

  - Oral or sublingual opioids (preferred route for those able to tolerate PO):
    - Morphine 5 mg PO q4hr PRN; if no response, increase to 10 mg PO q4hr PRN
    - Hydromorphone 1 mg PO q4hr PRN; if no response, increase to 2 mg PO q4hr PRN
  
  - IV (reserved for those patients who have failed oral narcotics or otherwise cannot tolerate oral/sublingual opioid administration)
    - Morphine 2 mg IV q4hr PRN; if no response increase to 4 mg IV q4hr PRN
    - Hydromorphone 0.2 mg IV q4hr PRN; if no response increase to 0.4 mg IV q4hr PRN
- Remember to start Senna 2 tablets at bedtime if the patient is taking any amount of scheduled opioid.

Cough:

- Pharmacologic

  - Non-opioids for dry cough (first line)
    - Guaifenesin 200-400 mg PRN PO q4hr to thin out thick secretions, making coughing or suctioning easier
    - Benzonatate (Tessalon) 100-200 mg PO TID PRN
    - Dextromethorphan 10-20 mg PO q4-6hr PRN to suppress cough

  - Opioids (limit to one opioid at a time) to suppress cough
    - Hydrocodone 5-10 mg PO q4hr PRN if not requiring other opioids
    - Morphine 5-10 mg PO liquid solution q4hrs PRN (tablets available as 7.5-15mg)

- If a patient is on already on opioids for pain, there is no need to start additional opioids for cough.

Nausea/Vomiting:

- Pharmacologic:

  - Ondansetron (first line) 8 mg PO/IV q8hr PRN (can be constipating)
  - Prochlorperazine (second line, in addition to ondansetron) 5-10 mg PO q6-8hr PRN
  - Promethazine (third line, instead of Prochlorperazine) 12.5-25 mg PO/IV q4-6h PRN
  - Olanzapine (fourth line, if all the above have failed) 2.5 mg PO BID
Diarrhea:

- Pharmacologic
  - Loperamide (first line) 2 mg PO after each loose stool to maximum 8 mg daily
  - Lomotil (second line) 1-2 mg PO BID-QID PRN

Abdominal Cramping:

- Pharmacologic
  - Hyoscyamine 0.125-0.25 mg PO/SL q4h PRN spasms
  - Dicyclomine 20-40 mg PO QID PRN
  - Remember that these medications are constipating

**Symptom Management at End of Life (EOL) in COVID+ patients**

**Guiding Principles:**

- For use when focus is entirely on comfort with DNAR order in place
- Most of these orders can be found in the End of Life Order Set. To access, type “End of Life orders” in MiChart and the order set should be available for use
- Anticipated symptoms: dyspnea, cough, restlessness, and GI distress
- Avoid PPE intensive interventions (frequent medication dosing, etc.)
- Avoid aerosolizing procedures

**Visitor Policy:**
• In end-of-life situations, there is a limit of 2 designated visitors per patient. Please coordinate with nursing and social worker on the unit to facilitate visitors.

• While in the patient room, visitors must wear appropriate PPE and be informed of risk.

• If a visitor is permitted for the above reasons, they must:
  - Be healthy.
  - Wear a mask while in the healthcare facility.
  - Remain in the patient room without moving around the hospital.
  - Leave the hospital if they develop concerning symptoms.

In these circumstances, consider consulting the Palliative Care service:

• Measures described here are ineffective or there are allergies/intolerances to medication recommendations provided here

• Medication shortages affecting ability to follow guidelines

• Patient/family distress despite involvement of unit-based social work and spiritual care

• Severe agitation/restlessness and consideration for palliative sedation

Non-Pharmacologic comfort strategies (recommended for all patients):

• Comfortable lighting, objects

• Discontinue monitors and alarms

• Transition vital signs to q24h and PRN

• Oxygen may be provided for comfort

• Offer audio or video visit with family if tolerated

• Recommend social work and spiritual care support for family
• Review all orders for any non-essential medications, procedures, etc.

• Strongly consider use of a condom catheter, Foley catheter, or Purewick to decrease the need for bed changes

Pharmacologic Strategies

• Oral/Sublingual Medications (STRONGLY PREFERRED). IV/Parenteral (reserved for those patients who have failed or otherwise cannot tolerate oral/SL administration)

Secretions:

- Non Pharmacologic Strategies:
  ▪ Decrease enteral and IV fluids, allowing the patient to eat and drink by mouth for comfort

- Pharmacologic Strategies:
  ▪ Glycopyrrolate 1-2 mg PO q6-8hrs PRN
  ▪ Atropine ophthalmic 1% 1 drop sublingual q4 hours PRN
  ▪ Scopolamine Patch q72 hours (preferred if >1 dose per day of either other medication for secretions)
  ▪ Atropine 0.4 mg IV q4 hours PRN

Dyspnea/Pain:

• Use of concentrated oral liquid medications is preferred if decreased ability to swallow safely

• Elderly patients may need lower starting doses for some medications

• For patients previously on opioids, consider increasing dosing by 25%
Suggested starting doses for opioid naïve patients:

- Morphine (20 mg/mL) 5-7.5 mg PO q2hr PRN, if no response within 60 minutes, give a second dose and then increase to 10-15 mg q2h PRN (use the lower end of the dose range for elderly patients)

- Oxycodone 5 mg PO q2hr PRN, if no response within 60 minutes, give a second dose and increase to 10 mg q2h PRN

- If morphine allergic or in renal failure:
  - Hydromorphone 1 mg PO q2hr PRN; if no response, increase to 2 mg PO q2hr PRN

- For patients on chronic opioids, continue long-acting opioids and use the current short-acting opioids as a PRN (increase by 50% if ineffective for symptom control)
  - For refractory symptoms, add:
    - Morphine 2 mg IV q1hr PRN; if no response, give a second dose and then increase to 4 mg IV q1hr PRN

- If the patient is using >4 doses in the first 8 hours, it is recommended to start an opioid infusion with infusion rate = [total doses in 8 hours x dose (in mg)] / 8

- Assess for comfort q1-2 hours
  - If moderate-severe discomfort, bolus 100% of hourly rate and reassess in 1-2 hours
  - If >1 bolus dose over 4 hours, consider increasing infusion to 125-150% of the previous rate

- If morphine allergic or in renal failure:
  - Hydromorphone 0.2 mg IV q4hr PRN; if no response, increase to 0.4 mg IV q4hr PRN

- For refractory symptoms, add:
  - Lorazepam: 0.5-1 mg by mouth q4 hours PRN
- Lorazepam: 1-2 mg IV q4 hours as needed or consider Palliative Care consultation

Restlessness/Agitation

- Non Pharmacologic Strategies:
  - Re-enforce normal sleep-wake cycles: avoid sedating medications during the day, encourage the patient to be up during the day if possible, open window blinds to allow sunlight, initiate a sleep protocol
  - Frequent re-orientation to time, place, situation: avoid/minimize medications that can contribute to delirium (benzodiazepines, muscle relaxants, tricyclic antidepressants, etc.)
  - Evaluate and treat potentially reversible causes (pain, constipation, urinary retention, etc.)

- Pharmacologic
  - Olanzapine 2.5 mg BID PRN oral disintegrating tablet AND 5 mg QHS
  - Haloperidol: 0.5-1 mg by mouth q4 hours PRN
  - Lorazepam: 0.5-1 mg by mouth q4 hours PRN

Antipsychotic Therapy:

- All agents are QTc prolonging and should be used with caution in patients with (prior) QTc >475 ms
- Haloperidol: 0.5-1 mg IV q4 hours PRN
- Lorazepam: 0.5-1 mg IV q4 hours PRN
- For patients at EOL with cough, nausea, vomiting, constipation, and diarrhea: see non-EOL symptom management section
Death Exam:

- Check for response to verbal/tactile stimuli
- Check pulse, heart, and lung sounds for at least one minute
- Check at least 2 brainstem reflexes (typically pupils and corneal)
- Time of death is when the exam is completed (please include in your note)

Documentation:

- Use .deathnote to document
- Remove “Family at bedside” and “Noted to be in asystole on monitor” if not appropriate
- Ask the clerk or nurse for a “death packet” and complete all physician/APP contents
- Determine if the bedside nurse or provider will contact Gift of Life. If provider, review handout in death packet about Gift of Life prior to calling. Gift of Life needs to be called for ALL patients.
- Complete the discharge summary using “discharge as deceased” tab
- Call family to notify them of the death.

- Review autopsy consent/denial if not completed previously – You will need an operator on the line to complete the phone consent for autopsy with the next of kin (NOK). After notifying the family of the death and discussing autopsy, tell them that you will call back momentarily with the Consent Line to complete the paperwork and ask them to remain by the phone. Dial 0 or 936-5087 for the Consent Line, tell them you need a phone consent for autopsy paperwork, and give them the phone number. Review the discussion briefly with the NOK and operator on the line and verify their decision to pursue autopsy or not. Check the appropriate box on the paperwork and write on the signature line “phone consent obtained” before returning it to the clerk. If the family cannot be located, page the Office of Decedent Affairs for further assistance.
Communication:

- For further aid and assistance in how to talk about some difficult topics related to COVID-19, please see Appendix D.
Discharging COVID-19 Patients Home or to Post-Discharge Medical Facilities

- If patients have shown stability or are improving, discharge from hospital should be considered. Patients who fit any of the 4 categories below are reasonable for discharge, although these criteria should not override your clinical judgment:

  - The patient is <70 years of age with low inflammatory markers on admission, no co-morbidities (immunocompromised or suppressed state, cardiovascular disease, hypertension, diabetes, cerebrovascular disease, chronic lung disease/asthma, malignancy, and chronic kidney disease), and not on supplemental oxygen on the proposed day of discharge.

  - Those clinically improving, requiring <2L/min of oxygen, and are > 12 days from symptom onset - regardless of age, co-morbidities, or inflammatory markers.

  - Any patient who is clinically improving with decreasing oxygen needs (<2L/min) and has a support system who can help them return to the ED if worsening, regardless of days from symptom onset, age, co-morbidities, or inflammatory markers.

  - Any patient who is clinically stable (not necessarily improving) after 24-48 hours of monitoring, does not require supplemental oxygen (above baseline needs) and has a support system that can help them return to the ED if worsening.

- A key component of discharge planning is assessment of patient ability to care for themselves independently at home. If you suspect a patient may not be able to provide adequate self-care, please consult physical and occupational therapy to help determine the patient’s discharge needs (home with assist vs subacute rehab) and consult with case management as needed.

- Per CDC guidelines, ALL COVID-19 positive patients need the ability to self-isolate for 10 days from symptom onset AND have been afebrile for at least 24 hours (without the use of antipyretics) AND have resolution of symptoms. Self-isolation can occur at home or at an accepting subacute rehab/skilled nursing facility. Please note that this means that patients who require help at home from friends/family may not be able to be discharged home as they would not be able to self-isolate away from helping friends/family. Please consult with care management for options in these situations.
• It is preferred that patients be off oxygen when being discharged. This can be individualized based on the case and support system at home, and if a patient has proven stability and is on a low level of oxygen (<2L/min). We caution against discharge on oxygen supplementation of more than 2 L (unless patient was previously on at home).

• Patients who are discharged should be provided with instructions on criteria to return to the emergency room. Worsening subjective or objective shortness of breath should be the main trigger for returning to the hospital. Constitutional symptoms such as fevers, cough, myalgia and weakness may be prolonged, but do not require re-evaluation in a hospital setting.

• A test-based strategy is no longer recommended to determine when to discontinue home isolation, except in very specific circumstances. Consultation with Infectious Diseases or IPE may be necessary for patients in these specific circumstances (e.g., immunocompromised COVID-19 patients or immunocompromised family members of recovering COVID-19 patients).

• Accumulating evidence supports ending isolation and precautions for persons with COVID-19 using a symptom-based strategy. Specifically, researchers have reported that people with mild to moderate COVID-19 remain infectious no longer than 10 days after their symptoms began, and those with more severe illness or those who are severely immunocompromised remain infectious no longer than 20 days after their symptoms began. Therefore, CDC has updated the recommendations for discontinuing home isolation as follows:

  - Persons with COVID-19 who have symptoms and were directed to care for themselves at home may discontinue isolation under the following conditions: at least 10 days* have passed since symptom onset and, at least 24 hours have passed since resolution of fever without the use of fever-reducing medications, and other symptoms have improved.

• A limited number of persons with severe illness may produce replication-competent virus beyond 10 days, that may warrant extending duration of isolation for up to 20 days after symptom onset. Consider consultation with infection control experts if there is any uncertainty.

• There are rare reports of persons being reinfected with COVID-19 months following their initial infection. Therefore, if a person who has recovered from COVID-19 has new symptoms of COVID-19, the person may need an evaluation for reinfection, especially if that person has had close contact with someone infected with COVID-19. The patient should isolate and contact a healthcare provider to be evaluated for other causes of their symptoms, and possibly retested.

• Avoid having patients with confirmed or suspected COVID-19 enter the community pharmacies.
- Pharmacist counseling for PUI or COVID-19 confirmed patients can be provided over the phone to the extent possible.

- A pharmacist or designee can contact a patient or caregiver to determine the best method to get discharge medication to a COVID-19 patient. This may include the following methods:
  
  - **Hallway Delivery (Preferred Option-Discharged Patients):** Pharmacy team member delivers medication(s) to patient’s nurse in the hallway outside of patient room or location in the ED or inpatient unit.
  
  - **Curbside Delivery (Preferred Option-Clinic Patients or Those Screened and Banned from Building Entry):** Pharmacy team member delivers medication(s) to the curbside, to patient and/or caregiver in their vehicle.
  
  - **Caregiver/Visitor Pick Up:** Patient’s caregiver/visitor picks up medication(s) from the Community Pharmacy on their behalf.
  
  - **Mail Delivery:** For medications that are not needed same-day, pharmacy team may offer to provide medication(s) via mail delivery service.
  
  - **Staff Member Pick Up (non-controlled substance medications only):** A member of the patient’s care team may pick up medication(s) on their behalf.
References


Figure 1: Molecular drivers of SARS-CoV-2 productive infection

Figure 2: Estimated Variation Over Time for Detection of SARS-CoV-2 Infection

<table>
<thead>
<tr>
<th>Before symptom onset</th>
<th>After symptom onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection unlikely</td>
<td>PCR - likely positive</td>
</tr>
<tr>
<td></td>
<td>PCR - likely negative</td>
</tr>
</tbody>
</table>

Symptom onset:
- Nasopharyngeal swab PCR
- Saliva PCR
- Sputum PCR
- IgG antibody
- IgM antibody

Antibody detection
Emerging Skin Manifestations of COVID-19

**URTICARIA**

Hives, commonly seen in viral rashes were reported in confirmed and suspected cases in Italy, France, Finland, Canada and US.

**COVID TOES**

Perniosis-like lesions (above) more likely in otherwise well patients, and true acral ischemia with purpuric lesions, more likely in ill patients.

**MORBILLIFORM**

Diffuse maculopapular eruption, as seen in Dengue, seen in COVID-19 patients in Italy, France and Finland.

**LIVEDO RETICULARIS**

Transient blanching or mottling of skin from suspected ischemia of cutaneous blood vessels.

**VESICULAR**

Chicken pox-like vesicles on erythematous base seen in COVID-19 patients in Italy and US.

**PETECHIAL**

Bleeding under the skin resulted in petechial eruption on COVID-19 confirmed patients in Italy and US.

- Dermatologists across nations and borders are reporting skin manifestations of confirmed and suspected cases of COVID-19.
- About 20% of COVID-19 patients in north Italian hospitals had skin manifestations.
Overview of COVID-19 ARDS Mechanical Ventilator Management Strategies
Michigan Medicine, Ann Arbor MI

1: Basic Lung Protective Ventilation
- ARDS Network ventilation strategy:
  a. Use VCV or PCV, targeting VT 6 mL/kg PBW
  b. Maintain Pplat <30 cm H2O
  c. PEEP/FiO2 0.5
  - Reduce VT to 5 or 4 mL/kg if necessary
  c. PEEP/FiO2 per high PEEP table (see below)
  - Consider maintaining driving pressure <12-15 cm H2O
  - If consolidation is asymmetrical, consider placing ‘good lung’ in dependent position

2: PT-Vent Asynchrony
* Consider minor ventilator adjustments (eg, flow rate & pattern, inspiratory pause)
* Assess potential to treat with pharmacologic agents (eg, sedation, NMB agents), especially in pt with severe ARDS and strong respiratory drive
* For double-triggering, consider increasing VT 1 mL/kg (max 8 mL/kg), provided Pplat <30 cm H2O
* For flow asynchrony, consider a variable flow pressure breath mode of ventilation:
  - Volume targeted PC (PRVC, VC+, AutoFlow)
  - Pressure control, pressure support

Prone Positioning
* Consider after initial 12-24 hrs of stabilization
* * Use 16 hr/day (generally 4 pm to 10 am)
* Discontinue when:
  - Instability in prone position
  - Supine x 4 hr, PaO2/FiO2 >150 on FiO2 <0.60 & PEEP <10

Recruitment Maneuvers
* Consider for pts with clear de-recruitment, negative Ptp or PaO2/FiO2 <150
  * Recommend PCV with: 1) 40/20-25 for 1-3 min (as tolerated) or 2) delta-P of 15 and increase PEEP by 5 up to PIP of 40
  * If CPAP method used, limit to 15-30 seconds
  * Provider should be at bedside if pressures >40 cm H2O used

Neuromuscular Blockade
* No benefit of routine use of NMB in moderate-severe ARDS.
* Consider use if significant asynchrony and concern for VILI.

Esophageal Pressure (Pes) Guided Therapy
* Informs of transpulmonary end-inspiratory (Ptp-plat) and end-expiratory (Ptp-PEEP) pressures
* Requires AVEA ventilator & placement of Pes catheter

Airway Pressure Release Ventilation (APRV)
* Increases Pmean with lower Pplat; lacks outcomes benefit
* Concern for P-SILI in pt with strong respiratory drive

Inhaled Nitric Oxide (iNO)
* Start at 10 ppm
* If positive response (improved oxygenation) or brought in by Survival Flight:
  - Maintain at 10 ppm and reduce FiO2 down to 0.8, then titrate
  - iNO down, or consider Veltri or iloprost, per Respiratory Care
* If no response, discuss with team to consider stopping
NOTE: iNO is a very costly drug compared to alternatives

Extracorporeal Membrane Oxygenation (ECMO)
* Absolute contraindications: irreversible pulmonary process
* Evaluate, but lower survival if on vent 7-10 days pre-ECMO
* Consider if: PaO2/FiO2 <50 x3 hrs or <80 x6 hrs, or pH <7.25 w/PaCO2 >60 x6 hrs

High Frequency Oscillatory Ventilation (HFOV)
* Strong recommendation against routine use

Patient with COVID-19 & ARDS
Use a Basic Lung Protective Ventilation Strategy (see #1)

Asynchrony?
Yes
No

PaO2/FiO2 <150?
No
Yes

- Consider nonrespiratory causes (e.g., PFO, PE, etc.)
- Fluid restriction and diuresis as necessary

PaO2/FiO2 <100?
- Consider Patient Transfer to D Unit/Regular ICU if Available

Consider Patient Transfer to D Unit/Regular ICU if Available

Per clinical situation, consider:
- Strong recommendation for:
  - Prone’ (high nursing req)
- Conditioned recommendation for:
  - Higher PEEP'
  - Recruitment maneuvers
- Evidence for efficacy is limited:
  - Neuromuscular Blockade
  - Pes
  - APRV
  - Inhaled prostacyclin / iNO
  - ECMO'

FiO2/PEEP Tables
Higher PEEP/ Lower FiO2 table (from ROSE study)

<table>
<thead>
<tr>
<th>Step</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
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<td>24</td>
</tr>
</tbody>
</table>

Higher PEEP table is recommended for patients with COVID-19
**OVERVIEW OF VENTILATOR MODES** by Nick Mark MD

**Goals for mechanical ventilation:**
1. **Oxygenation** – support PaO2/SpO2
2. **Ventilation** – maintain pH
3. **Patient comfort** – vent synchrony, ↓ sedation
4. **Facilitate weaning** – minimize muscle loss, promote readiness to wean from support

**Ventilator Modes:**
Fall into two broad categories: **pressure** and **volume** modes. Each mode has three features:
- Trigger (T) – what initiates a breath?
- Cycle (C) – what ends a breath?
- Limit (L) – what stops a breath early?
Each mode has Pros and Cons to consider.

**Measurement and optimization:**

- **ABG/SpO2**
  - pH / PCO2 / PaO2 / HCO3
  - VENTILATION: If you want to increase the pH → increase the ventilation parameters
  - OXYGENATION: If you want to change the PaO2 or SpO2 adjust oxygenation parameters (FiO2 and PEEP)

### Ventilator Modes Table

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
<th>Major settings / example</th>
<th>Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC</td>
<td>Volume Control (a.k.a. assist control volume)</td>
<td>Good general-purpose mode; Ensures a minimum MV is achieved. Good mode for lung protective ventilation (LPV)</td>
<td>Requires you to monitor pressures to avoid barotrauma. (See my OnePager on ARDS for details.)</td>
<td>RR, TV, PEEP, FIO2</td>
<td>Pressures (Ppeak, Pplat)</td>
</tr>
<tr>
<td>PC</td>
<td>Pressure Control (a.k.a. assist control pressure)</td>
<td>Good for limiting pressure; may be more comfortable for select patients. Also can be used for LPV (no difference in mortality)</td>
<td>Requires you to monitor volumes to avoid volutrauma or hypoventilation</td>
<td>RR, IP, T, Risetime, PEEP, FIO2</td>
<td>Volumes (TV, MV)</td>
</tr>
<tr>
<td>PRVC</td>
<td>Pressure Regulated Volume Control (a.k.a. VC+, APV, Autoflow)</td>
<td>Guarantees TV but delivers pressure-controlled breaths; (e.g. low risk of causing VILI), which potentially may be more comfortable for patients</td>
<td>In patients who are struggling (e.g. high WOB) this mode will provide less support</td>
<td>RR, TV, T, Risetime, Pmax PEEP, FIO2</td>
<td>Pressures &amp; volumes</td>
</tr>
<tr>
<td>SIMV</td>
<td>Synchronous Intermittent Mandatory Ventilation</td>
<td>May be useful for patients with hiccups to avoid alkalemia</td>
<td>Seldom used; not effective for weaning; often found to be uncomfortable</td>
<td>RR, TV, PEEP, FIO2</td>
<td>Pressure (Ppeak, Pplat)</td>
</tr>
<tr>
<td>PS</td>
<td>Pressure Support</td>
<td>Ideal weaning mode (used in SBTs and for prolonged periods); most comfortable because it allows patient to control ventilation</td>
<td>Does not guarantee a rate; need to monitor to ensure adequate ventilation</td>
<td>PS, PEEP, FIO2</td>
<td>Volumes (TV, MV)</td>
</tr>
<tr>
<td>APRV</td>
<td>Airway Pressure Release Ventilation (a.k.a. Bi-Vent)</td>
<td>Great for ARDS patients who are spontaneously breathing (e.g. not on NMB); may improve comfort &amp; oxygenation (but no mortality benefit)</td>
<td>Complex mode/settings; Risk of VILI if settings are done improperly; doesn’t make sense if on NMB</td>
<td>THigh, TLow, PHigh, PLow, FIO2</td>
<td>Volumes &amp; gas exchange PCO2 / ETCO2</td>
</tr>
</tbody>
</table>

**Note that**
- Volumes (TV, MV)
- Pressure (Ppeak, Pplat)
Why did we create this guide?

VitalTalk is based in Seattle and here, it’s real. We’ve had patients die, and not all were elderly. Our colleagues are sick too. 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 is in this guide?

We’ve crowdsourced this 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 two 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.

How can I share this guide?

We’re offering this primer freely. Email it, link it, spread it around. What we do ask when you share or adapt this guide is to:

- include our VitalTalk logo (email info@vitaltalk.org)
- attribute us with “Adapted from VitalTalk” (if you adapt this guide)
- let people know they can find the most up to date version on our website.

Help us improve it-- tell us what we missed, what didn’t work, where you got stuck by emailing tonyback@uw.edu and info@vitaltalk.org. 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.
Using these tips

This is a super-concentrated blast of tips focused on COVID. We’ve pared away all the usual educational stuff because we know you’re busy. If you want more, check out the talking maps and videos on fundamental communication skills, family conferences, and goals of care at vitaltalk.org.

As the pandemic evolves, the caseload in your region will determine whether your clinic or hospital or institution is ‘conventional’ mode (usual care), ‘contingency mode’ (resources stretched although care functionally close to usual), or ‘crisis’ mode (demand outstrips resources). Most of the tips here are for conventional or contingency mode. If your region moves to crisis standards, how medicine is practiced will change dramatically—triage decisions will be stark and choices will be limited. If needed, future versions of this doc will shift towards crisis. For now, please note that the crisis mode tips are marked [C] and should be reserved for a crisis designated by your institution. And remember that even in a crisis, we can still provide compassion and respect for every person.

Some of the communication tips in this document depict ways to explain resource allocation to a patient or family or caregiver. However, note that decisions about how resources are allocated—what criteria are used or where lines are drawn—should happen at a different level—at the regional or state or country level. Rationing should not occur at the bedside. In these tips, we steer away from complex discussions about rationing, and use language that is for laypeople rather than ethicists.

About VitalTalk

VitalTalk is a 501c3 nonprofit social impact organization 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.

What’s inside?

Screening ____________ When someone is worried they might be infected
Preferencing ____________ When someone may want to opt out of hospitalization
Triaging ________________ When you’re deciding where a patient should go
Admitting ________________ When your patient needs the hospital, or the ICU
Counseling ________________ When coping needs a boost, or emotions are running high
Deciding ________________ When things aren’t going well, goals of care, code status
Resourcing ________________ When limitations force you to choose, and even ration
Notifying ________________ When you are telling someone over the phone
Anticipating ______________ When you’re worrying about what might happen
Grieving ________________ When you’ve lost someone
### Screening: When someone is worried, they might be infected

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

### Preferencing: When someone may want to opt out of hospitalization

<table>
<thead>
<tr>
<th>What they say</th>
<th>What you say</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am worried about this new virus. What should I be doing?</td>
<td>You are right to be concerned. Here’s what you can do. Please limit your contact with others—we call it social distancing. Then you should pick a person who knows you well enough to talk to doctors for you if you did get really sick. That person is your proxy. Finally, if you are the kind of person who would say, no thanks, I don’t want to go to the hospital and end up dying on machines, you should tell us and your proxy.</td>
</tr>
<tr>
<td>I realize that I’m not doing well medically even without this new virus. I want to take my chances at home / in this long term care facility.</td>
<td>Thank you for telling me that. What I am hearing is that you would rather not go to the hospital if we suspected that you have the virus. Did I get that right?</td>
</tr>
<tr>
<td>I don’t want to come to the end of my life like a vegetable being kept alive on a machine. [in a long term care facility or at home]</td>
<td>I respect that. Here’s what I’d like to propose. We will continue to take care of you. The best case is that you don’t get the virus. The worst case is that you get the virus despite our precautions—and then we will keep you here and make sure you are comfortable for as long as you are with us.</td>
</tr>
<tr>
<td>I am this person’s proxy / health care agent. I know their medical condition is bad—that they probably wouldn’t survive the virus. Do you have to take them to the hospital?</td>
<td>It is so helpful for you to speak for them, thank you. If their medical condition did get worse, we could arrange for hospice (or palliative care) to see them where they are. We can hope for the best and plan for the worst.</td>
</tr>
</tbody>
</table>
## Triaging: When you’re deciding where a patient should go

<table>
<thead>
<tr>
<th>What they say</th>
<th>What you say</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why shouldn’t I just go to the hospital?</td>
<td>Our primary concern is your safety. We are trying to organize how people come in. Please fill out the questions online. <strong>You can help speed up the process for yourself and everyone else.</strong></td>
</tr>
<tr>
<td>Why are you keeping me out of the hospital?</td>
<td>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. <strong>The safest thing for you is to _____.</strong></td>
</tr>
</tbody>
</table>

## Admitting: When your patient needs the hospital, or the ICU

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

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

### Deciding: When Things Aren’t Going Well, Goals of Care, Code Status

<table>
<thead>
<tr>
<th>What they say</th>
<th>What you say</th>
</tr>
</thead>
<tbody>
<tr>
<td>I want everything possible. I want to live.</td>
<td>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? What do I need to know about you to do a better job taking care of you?</td>
</tr>
<tr>
<td>I don’t think my spouse would have wanted this.</td>
<td>Well, let’s pause and talk about what they would have wanted. Can you tell me what they considered most important in their life? What meant the most to them, gave their life meaning?</td>
</tr>
<tr>
<td>I don’t want to end up being a vegetable or on a machine.</td>
<td>Thank you, it is very important for me to know that. Can you say more about what you mean?</td>
</tr>
<tr>
<td>I am not sure what my spouse wanted—we never spoke about it.</td>
<td>You know, many people find themselves in the same boat. This is a hard situation. To be honest, given their overall condition now, if we need to put them on a breathing machine or do CPR, they will not make it. The odds are just against us. My recommendation is that we accept that he will not live much longer and allow him to pass on peacefully. I suspect that may be hard to hear. What do you think?</td>
</tr>
<tr>
<td>What they say</td>
<td>What you say, and why</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Why can’t my 90 year old grandmother go to the ICU?</td>
<td><em>This is an extraordinary time. We are trying to use resources in a way that is fair for everyone.</em> Your grandmother’s situation does not meet the criteria for the ICU today. I wish things were different. [C]</td>
</tr>
<tr>
<td>Shouldn’t I be in an intensive care unit?</td>
<td>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. <em>If this were a year ago, we might be making a different decision. This is an extraordinary time.</em> I wish I had more resources.[C]</td>
</tr>
<tr>
<td>My grandmother needs the ICU! Or she is going to die!</td>
<td>I know this is a scary situation, and I am worried for your grandmother myself. <em>This virus is so deadly that even if we could transfer her to the ICU, I am not sure she would make it.</em> So we need to be prepared that she could die. We will do everything we can for her.[C]</td>
</tr>
<tr>
<td>Are you just discriminating against her because she is old?</td>
<td>I can see how it might seem like that. No, we are not discriminating. <em>We are using guidelines that were developed by people in this community to prepare for an event like this.</em> The guidelines have been developed over the years, involving health care professionals, ethicists, and lay people to consider all the pros and cons. I can see that you really care about her. [C]</td>
</tr>
<tr>
<td>You’re treating us differently because of the color of our skin.</td>
<td><em>I can imagine that you may have had negative experiences in the past with health care simply because of who you are.</em> 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. [C]</td>
</tr>
<tr>
<td>It sounds like you are rationing.</td>
<td>What we are doing is trying to spread out our resources in the best way possible. <em>This is a time where I wish we had more for every single person in this hospital.</em> [C]</td>
</tr>
<tr>
<td>You’re playing God. You can’t do that.</td>
<td>I am sorry. I did not mean to give you that feeling. <em>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.</em> I wish we had more. Please understand that we are all working as hard as possible. [C]</td>
</tr>
<tr>
<td>Can’t you get 15 more ventilators from somewhere else?</td>
<td>Right now the hospital is operating over capacity. It is not possible for us to increase our capacity like that overnight. And <em>I realize that must be disappointing to hear.</em> [C]</td>
</tr>
<tr>
<td>How can you just take them off a ventilator when their life depends on it?</td>
<td>I’m so sorry that her condition has gotten worse, even though we are doing everything. Because we are in an extraordinary time, we are following special guidelines that apply to everyone here. We cannot continue to provide critical care to patients who are not getting better. This means that we need to accept that she will die, and that we need to take her off the ventilator. I wish things were different. [C]</td>
</tr>
</tbody>
</table>
### Notifying: When you are telling someone over the phone

<table>
<thead>
<tr>
<th>What they say</th>
<th>What you say</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes I’m his daughter. I am 5 hours away.</td>
<td>I have something serious to talk about with you. Are you in a place where you can talk?</td>
</tr>
<tr>
<td>What is going on? Has something happened?</td>
<td>I am calling about your father. He died a short time ago. The cause was COVID19.</td>
</tr>
<tr>
<td>[Crying]</td>
<td>I am so sorry for your loss. [Silence] [If you feel you must say something: Take your time. I am here.]</td>
</tr>
<tr>
<td>I knew this was coming, but I didn’t realize it would happen this fast.</td>
<td>I can only imagine how shocking this must be. It is sad. [Silence] [Wait for them to restart]</td>
</tr>
</tbody>
</table>

### Anticipating: When you’re worrying about what might happen

<table>
<thead>
<tr>
<th>What you fear</th>
<th>What you can do</th>
</tr>
</thead>
<tbody>
<tr>
<td>That patient’s son is going to be very angry.</td>
<td>Before you go in the room, take a moment for one deep breath. <em>What’s the anger about?</em> Love, responsibility, fear?</td>
</tr>
<tr>
<td>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.</td>
<td><em>Remember what you can do:</em> 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.</td>
</tr>
<tr>
<td>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.</td>
<td>Talk to them about what you are worried about. You can decide together about what is best. There are no simple answers. But <em>worries are easier to bear when you share them.</em></td>
</tr>
<tr>
<td>I am afraid of burnout, and of losing my heart.</td>
<td>Can you look for moments every day where you connect with someone, share something, enjoy something? <em>It is possible to find little pockets of peace even in the middle of a maelstrom.</em></td>
</tr>
<tr>
<td>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.</td>
<td>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? <em>Remember that whatever your own state, that these feelings are inextricable to our human condition.</em> Can you accept them, not try to push them away, and then decide what you need</td>
</tr>
</tbody>
</table>
Grieving: When you’ve lost someone

<table>
<thead>
<tr>
<th>What I’m thinking</th>
<th>What you can do</th>
</tr>
</thead>
<tbody>
<tr>
<td>I should have been able to save that person.</td>
<td>Notice: <em>am I talking myself the way I would talk to a good friend?</em> 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.</td>
</tr>
<tr>
<td>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</td>
<td>Notice: <em>am I letting everything get to me?</em> 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? And then ask ourselves: <em>can I step into a less reactive, more balanced place even as I move into the next thing?</em></td>
</tr>
</tbody>
</table>

Feedback from our community

We would like to thank our community for contributing edits and ideas--they are extremely valuable.

Please note that this guide is designed as a completely-stand-alone-guide for clinicians, and thus some recommendations are slightly different than what we would teach in the context of an in-person or live virtual course.

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- Vicki Sakata MD
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- Cambia Health Foundation
<table>
<thead>
<tr>
<th>Step</th>
<th>What You Say or Do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check-in</strong></td>
<td>Take a deep break (yourself!)&lt;br&gt;“How are you doing with all this?” (take their emotional temperature)</td>
</tr>
<tr>
<td><strong>Ask About Covid</strong></td>
<td>“What have you been thinking about COVID and your situation”</td>
</tr>
<tr>
<td><strong>Lay Out Issues</strong></td>
<td>“Here is something I want us to be prepared for.”&lt;br&gt;“You mentioned COVID. I agree.”&lt;br&gt;“Is there anything you want us to know if you got COVID/ if your COVID gets really bad?”</td>
</tr>
<tr>
<td><strong>Motive Them</strong></td>
<td>“If things took a turn for the worse, what you say now can help your family/loved ones.”&lt;br&gt;“Who is your backup person—who helps us make decisions if you can’t speak? Who else?” [two backup people is best]&lt;br&gt;“We’re in an extraordinary situation. Given that, what matters to you?” [about any part of your life? About your health care]&lt;br&gt;Make a recommendation—if they would be able to hear it.&lt;br&gt;“Based on what I’ve heard I’d recommend [this]. What do you think?”</td>
</tr>
<tr>
<td><strong>Expect Emotion</strong></td>
<td>Watch for this – acknowledge at any point.&lt;br&gt;“This can be hard to talk about.”</td>
</tr>
<tr>
<td><strong>Record The Discussion</strong></td>
<td>Any documentation [even brief] will help your colleagues and your patient.&lt;br&gt;“I’ll write what you said in the chart. It’s really helpful, thank you.”</td>
</tr>
</tbody>
</table>
### SHARE *

**TALKING ABOUT RESOURCE ALLOCATION (I.E. RATIONING)**

<table>
<thead>
<tr>
<th>STEP</th>
<th>WHAT YOU SAY OR DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHOW</td>
<td>“Here’s what our institution/system/region is doing for patients with this condition.”  &lt;br&gt;(Start the part directly relevant to that person.)</td>
</tr>
<tr>
<td>HEADLINE</td>
<td>“So for you, what this means is that we care for you on the floor. We will not transfer you to the ICU. We don’t do CPR if your heart stops.”</td>
</tr>
<tr>
<td>AFFIRM</td>
<td>“We will be doing [the care plan], and we hope you will recover.”</td>
</tr>
<tr>
<td>RESPOND</td>
<td>“I can see that you are concerned.”</td>
</tr>
<tr>
<td>EMPHASIZE</td>
<td>“We are using the same rules with every other patient in this hospital/system/institution. We are not singling you out.”</td>
</tr>
</tbody>
</table>

*FOR CRISIS ONLY: This talking map is only used when an institution has declared use of crisis standards of care or a surge state. When the crisis standards or surge are discontinued, this map should no longer be used.*