# Emergency Department COVID-19 Management Tool

March 2021

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This tool was developed to provide a pragmatic framework to assist with severity classification, risk assessment, diagnostic workup, disposition, and treatment of patients with suspected or confirmed SARS-CoV-2 (COVID-19) in the emergency department.

- It is designed to assist with the management of adult patients (≥18 years old) with symptomatic infection.
- It is not a substitute for clinicians' own assessment and clinical judgement of what is best for the patient.
- This tool is not exhaustive in regards to diagnostic and treatment recommendations. Patients may present with particular conditions (MI, PE, stroke) that could be manifestations of severe or critical COVID-19. These conditions may require additional specific diagnostic and therapeutic interventions not discussed in this tool.
- Evidence on this topic is evolving quickly and may change recommendations.

## Step 1 - Severity Classification

Assess the patient's severity of disease utilizing NIH criteria.

| MILD | MODERATE | SEVERE | CRITICAL |
|---|---|---|---|
| **Individuals who have various signs and symptoms of COVID-19 (ANY):**<br>☐ Fever<br>☐ Cough<br>☐ Sore throat<br>☐ Malaise<br>☐ Headache<br>☐ Muscle pain<br>☐ Nausea, vomiting, diarrhea<br>☐ Loss of taste and smell<br>**BUT who do NOT have (ANY):**<br>☐ Shortness of breath<br>☐ Dyspnea<br>☐ Abnormal chest imaging (if obtained) | **Individuals who show evidence of lower respiratory disease during (ANY):**<br>☐ Clinical assessment<br>☐ Imaging<br>**AND who have:**<br>☐ SpO2 ≥94% on room air at sea level (in those with normal baseline SpO2 at rest) | **Individuals who have (ANY):**<br>☐ SpO2 <94% on room air at sea level (in those with normal baseline SpO2 at rest)<br>☐ Ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO2/FiO2) <300 mm Hg (if ABG obtained)<br>☐ RR >30 breaths/min<br>☐ Lung infiltrates >50% | **Individuals with (ANY):**<br>☐ Respiratory failure<br>☐ Septic shock<br>☐ Multiorgan dysfunction or failure |

**SEVERE** and **CRITICAL** Severity - Skip to Step 4 (**Diagnostic Testing**) on Page 2

## Step 2 - Risk Prognostication

Patients with **MILD** and **MODERATE** Severity should be further assessed to determine their risk of disease progression.
The **PRIEST Score** is a validated tool to predict a patients risk for end organ failure and/or mortality.

| Variable | | 1 Point | 2 Points | 3 Points | 4 Points |
|---|---|---|---|---|---|
| Respiratory rate (per minute) | ☐ 12-20 | ☐ 9-11 | ☐ 21-24 | ☐ <9 or >24 | |
| Oxygen saturation (%) | ☐ >95 | ☐ 94-95 | ☐ 92-93 | ☐ <92 | |
| Heart rate (per minute) | ☐ 51-90 | ☐ 41-50 or 91-110 | ☐ 111-130 | ☐ <41 or >130 | |
| Systolic BP (mmHg) | ☐ 111-219 | ☐ 101-110 | ☐ 91-100 | ☐ <91 or >219 | |
| Temperature (°C) | ☐ 36.1-38.0 | ☐ 35.1-36.0 or 38.1-39.0 | ☐ >39.0 | ☐ <35.1 | |
| Alertness | ☐ Alert | | | ☐ Confused | |
| Inspired oxygen | ☐ Room Air | | ☐ Supplemental Oxygen | | |
| Sex | ☐ Female | ☐ Male | | | |
| Age (years) | ☐ 16-49 | | ☐ 50-65 | ☐ 66-80 | ☐ >80 |
| Performance status | ☐ Unrestricted Normal Activity | ☐ Limited strenuous activity, can do light activity | ☐ Limited activity, can self-care | ☐ Limited self-care | ☐ Bed/chair bound, no self-care |
| **Total number of boxes checked in each column** | | _____ **x 1 =** | _____ **x 2 =** | _____ **x 3 =** | _____ **x 4 =** |
| **Calculate Score** | | **+** | **+** | **+** | **+** |

| Score | 0-1 | 2-3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Risk %** | **1%** | **2%** | **3%** | **9%** | **15%** | **18%** | **22%** | **26%** | **29%** | **34%** | **38%** | **47%** | **48%** | **50%** | **55%** | **66%** |

## Step 3 - Risk Assessment

Assess the patient for additional risk factors that have been correlated with higher risk for severe disease, organ failure, and/or mortalty.
**If your patient has one (or especially multiple) risk factors, you may want to consider in the approach taken in subsequent steps for diagnostic testing, disposition, and treatment.**

The **CDC** notes that patient race/ethnicity, socioeconomic status, and healthcare resources may effect clinical outcomes and advise consideration in clinical risk assessment.

**Risk factors include, but are not limited to:**

- ☐ Cancer: especially those with diagnosis <1 year, actively in treatment, and/or hematologic malignancies
- ☐ Cardiovascular Disease
- ☐ Chronic Respiratory Disease (including COPD)
- ☐ Diabetes Type II
- ☐ Down's Syndrome
- ☐ Hypertension
- ☐ Immunosuppression (including organ transplant and asplenia)
- ☐ Neurologic disease (including dementia and previous strokes)
- ☐ Obesity (BMI ≥35)
- ☐ Obstructive Sleep Apnea
- ☐ Pregnancy
- ☐ Renal Disease (GFR ≤30)
- ☐ Steroid usage (recent)

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## Step 4 - Diagnostic Testing

The following imaging and lab tests should be considered based on your patients severity and risk for disease progression.

| MILD | MODERATE | SEVERE | CRITICAL |
|---|---|---|---|
| **Based on clinician's judgement, diagnostic testing may not be necessary in patients with (ALL):**<br>☐ Mild Severity<br>☐ PRIEST score ≤4<br>☐ 1 or less Risk Factors<br>**Exertional SpO2 may have limited ability to identify adverse outcomes in otherwise well-appearing patients:**<br>☐ <3% change in SpO2 | **Per the NIH...**<br>**Imaging:** the optimal imaging technique has not yet been defined for people with symptomatic COVID-19. Initial evaluation for these patients may include:<br>☐ Chest X-ray ☐ Pulmonary Ultrasound ☐ CT Chest (if indicated)<br>**ECG:** should be performed if indicated<br>☐ ECG<br>**Labs:**<br>☐ CBC w/ differential ☐ CMP<br>While not standard of care, the following may have prognostic value:<br>☐ CRP ☐ D-dimer ☐ Ferritin | | |

## Step 5 - Diagnostic Interpretation

The following lab results (if obtained) have been shown to potentially be indicators of risk of disease progression, more severe disease, and/or mortality.

Unfortunately, cutoffs used for abnormal lab values are heterogenous across studies and may need to be adjusted based on reference ranges at your facility.

**Lab Cutoffs:**

- ☐ ALT (>40 U/L)
- ☐ AST (>40 U/L)
- ☐ Creatinine (>1.5 mg/dL)
- ☐ CRP (>125 mg/L)
- ☐ D-dimer (≥1µg/mL)
- ☐ Ferritin (>300 µg/L)
- ☐ LDH (>250 U/L)
- ☐ Lymphopenia (<0.8 x$10^9$/L)
- ☐ Neutrophils (>8,000/$mm^3$)
- ☐ Thrombocytopenia (<150,000/$mm^3$)
- ☐ Troponin (>99%)
- ☐ WBC (>10,000/ $mm^3$)

## Step 6 - Disposition

The following represents a pragmatic approach for disposition of patients depending on their disease severity. Clinician's may want to consider a patient's risk for progression of disease based on PRIEST Score, risk factors, imaging, and labs in their disposition decision.

| MILD | MODERATE | SEVERE | CRITICAL |
|---|---|---|---|
| ☐ **Discharge Home**<br>☐ Supply patient with educational materials on precautions and items to be monitoring at home (CDC Patient Educational Materials)<br><br>**Consider**<br>☐ Home pulse oximetry | ☐ **Discharge Home, consider if ALL:**<br>☐ PRIEST Score ≤4<br>☐ 1 (or less) Risk Factors<br>☐ No concerning Imaging or Lab results<br>☐ Capability and resources to care for self at home<br>☐ No other condition that warrants admission<br>☐ **Admission, consider if ANY:**<br>☐ PRIEST Score ≥5<br>☐ Multiple Risk Factors<br>☐ Concerning Imaging or Lab results<br>☐ Does NOT have the capability or resources to care for self at home<br><br>**Admission Location:**<br>Based on clinician's judgement<br>☐ Observation<br>☐ Inpatient Floor<br>☐ Intermediate<br>☐ **At times of surge and capacity constraints some patient who would normally be admitted to the hospital, may need to be sent home:**<br>☐ Supply patient with educational materials on precautions and items to be monitoring at home (CDC Patient Educational Materials)<br>☐ Follow-up visit arranged via PCP or tele-health<br>☐ Consider home pulse oximetry<br>☐ Consider home oxygen therapy | **Admission Location:**<br>based on clinician's judgement<br>☐ Floor Bed<br>☐ Intermediate<br>☐ ICU<br><br>☐ **Transfer**<br>☐ Consider transfer if your facility does not have the resources or capacity to care for a critically ill COVID patient.patient. | **Admission**<br>☐ ICU<br><br>☐ **Transfer**<br>☐ Consider transfer if your facility does not have the resources or capacity to care for a critically ill COVID patient.<br>☐ Consider transfer to an ECMO facility for patients who may benefit from this after consultation with receiving facility. |

**AMA**

☐ Patient wishes to leave Against Medical Advice (AMA) for admission to the hospital and/or additional therapeutic treatment.

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## Step 7a - Non-Pharmacologic Treatment

The following treatments should be considered based on your patient's severity and risk of disease progression.

| MILD | MODERATE | SEVERE | CRITICAL |
|---|---|---|---|
| ☐ Consider home oxygen therapy (for those who may benefit)<br>☐ Breathing exercises for breathlessness<br>☐ Progressive ambulation as tolerated (if no contraindication)<br>☐ Resting in the prone position if dyspneic<br>☐ Adequate rest/sleep<br>☐ Balanced diet<br>☐ Adequate hydration | | ☐ Oxygen support-nasal cannula, titrate up to 6L with an oxygenation goal of >92%<br>☐ High-Flow Nasal Cannula (HFNC) or high-velocity therapy (titrated up to a flow of 60L and FiO2 up to 100%) are recommended over NIPPV<br>☐ Non-Invasive Postive Pressure Ventilation (NIPPV) if HFNC not available<br>☐ Consider trial of awake prone positioning if patient can be monitored or can self rescue. Awake proning is contraindicated in patients in respiratory distress. | ☐ Intubation is recommended for severe respiratory failure:<br>☐ Oxygenation goal for ventilated patients should be 92-96%.<br>☐ Consider low tidal volume (VT) ventilation (VT 4–8 mL/kg of predicted body weight) over higher VT ventilation (VT >8 mL/kg) (AI).<br>☐ Target plateau pressures of <30 cm H2O (AII).<br>☐ A higher positive end-expiratory pressure (PEEP) strategy is recommended over a lower PEEP strategy (BII).<br>☐ For mechanically ventilated adults with refractory hypoxemia despite optimized ventilation, consider prone ventilation for 12 to 16 hours per day over no prone ventilation.<br>☐ Consider using a conservative fluid strategy over a liberal fluid strategy (BII).<br>☐ Insufficent Data to recommend for or against ECMO in these patients.<br>☐ Against the routine use of inhaled nitric oxide (AI). |

## Step 7b - Pharmacologic Treatment

The following medications should be considered for treatment based on the patient's severity and risk of disease progression.

**Pharmacologic recommendations for patients with COVID-19 are evolving quickly. For the latest updates visit the NIH or IDSA Guidelines.**

| MILD | MODERATE | SEVERE | CRITICAL |
|---|---|---|---|
| ☐ **Monoclonal Antibodies**<br>Recommendation for the use of bamlanivimab 700 mg plus etesevimab 1,400mg for the treatment of outpatients with mild to moderate COVID-19 who are at high risk of clinical progression as defined by the EUA (see footnote).<br>- See the Footnotes page for links to the FDA fact sheets with information on which patients qualify and may benefit from AB therapy.<br>- Benefits of AB therapy may be modified by COVID-19 variants.<br>If the above product is not available, follow the recommendations for bamlanivimab monotherapy and casirivimab plus imdevimab, which currently are "insufficient data to recommend either for or against" the use of bamlanivimab or the casirivimab plus imdevimab combination for the treatment of outpatients with mild to moderate COVID-19 who are at high risk of clinical progression as defined by their EUAs (see footnotes). | | | **Steroids and/or Remdesivir**<br>**One of the following options is recommended for these patients:**<br>☐ Remdesivir* alone (e.g., for patients who require minimal supplemental oxygen) (BIIa).<br>☐ Dexamethasone PLUS remdesivir* (e.g., for patients who require increasing amounts of oxygen) (BIII).<br>☐ Dexamethasone alone (e.g., when combination therapy with remdesivir cannot be used or is not available) (BI).<br>***Remdesivir should be used only in patients requiring supplemental O2 but not O2 through a high-flow device, noninvasive ventilation, invasive mechanical ventilation, or ECMO.**<br>**In the rare circumstances where corticosteroids cannot be used:**<br>☐ Baricitinib in combination with remdesivir (BIIa ) (e.g., for patients who require increasing amounts of oxygen). Baricitinib should not be used without remdesivir.<br>**If dexamethasone is NOT available:**<br>☐ Alternative corticosteroids such as prednisone, methylprednisolone, or hydrocortisone can be used (BIII)<br>**Tocilizumab**<br>☐ Tocilizumab in combination with dexamethasone is recommended in select hospitalized patients who are exhibiting rapid respiratory decompensation due to COVID-19. Full details and dosage is available here: Tocilizumab Info |
| **Steroids**<br>Dexamethasone (or other corticosteroids) should NOT be initiated in these patients (Mild: AIII, Moderate: AIIa)[1] | | | |
| **Remdesivir**<br>There is insufficient evidence to recommend either for or against the routine use of remdesivir. | ☐ **Remdesivir**<br>For hospitalized patients who require minimal supplemental oxygen (BIIa). | | |
| | ☐ **Anticoagulation**<br>Admitted nonpregnant adults should receive prophylactic dose anticoagulation (AIII) | | |

**Insufficient Evidence**

At this time there is insufficient data to recommend either for or against the following medications for SARS-CoV-2 (COVID-19):

- Colchichine
- Famotidine
- Fuvoxamine
- Herbal medications
- Ivermectin
- Vitamin C
- Vitamin D

**DO NOT USE**

The following are recommended AGAINST for the treatment of SARS-CoV-2 (COVID-19) at the time of publication of this tool:

- Anti-interluken-6 receptor monoclonal antibodies (except tocilizumab)(e.g., sarilumab, tocilizumab) or anti-IL-6 monoclonal antibody (siltuximab), except in a clinical trial (BI).
- Azithromycin alone (AI)
- Chloroquine or hydroxychloroquine with or without azithromycin (AI)
- Lopinavir/ritonavir (AI) or other HIV protease inhibitors (AIII) except in a clinical trial
- Zinc supplementation above the recommended daily dietary allowance for the prevention of COVID-19, except in a clinical trial (BIII)

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## SMART PHRASES

This page represents a list of phrases that clinicians may want to utilize within their EMR documentation. It is broken down based on the steps that are outlined on the prior pages of this tool. EMR and IT vendors may want to utilize these phrases, along with specific data that is selected by clinicians as they utilize electronic versions of this tool.

☐ **The ACEP Emergency Department COVID-19 Management Tool** was utilized to assist in the decision process on how to best manage this patient. This tool is a pragmatic approach to management of patient's with suspected or confirmed SARS-CoV-2 in the emergency department. It is based on guidelines from the CDC, NIH, and additional published studies. COVID-19 is a novel pandemic and as such evidence is rapidly evolving on the best way to manage patients with this condition.

| **Step 1- Severity** | ☐ **Severity Classification** was determined based on NIH criteria. |
|---|---|
| MILD | ☐ Based on the criteria present at the time of evaluation, the patient was determined to have MILD Severity. |
| MODERATE | ☐ Based on the criteria present at the time of evaluation, the patient was determined to have MODERATE Severity. |
| SEVERE | ☐ Based on the criteria present at the time of evaluation, the patient was determined to have SEVERE Severity. |
| CRITICAL | ☐ Based on the criteria present at the time of evaluation, the patient was determined to have CRITICAL Severity. |

| **Step 2 - Risk Prognostication** | ☐ The **PRIEST Score**, a validated tool to determine the risk of mortality and/or end-organ failure, was utilized to assess the patient's risk of disease progression. |
|---|---|
| PRIEST Score | ☐ Based on a PRIEST Score of _____ the patient is estimated to have a _____% risk. |

| **Step 3 - Risk Assessment** | ☐ A **Risk Assessment** was performed that considers additional factors that have been shown in published studies to increase a patient's risk for disease progression. |
|---|---|
| 0 Risk Factors | ☐ Patient did not have any additional risk factors based on those included within this tool. |
| 1 Risk Factor | ☐ Patient was noted to have an additional risk factor. |
| 2 (or more) Risk Factors | ☐ Patient was noted to have 2 (or more) additional risk factors. |

| **Step 4 - Diagnostic Testing** | ☐ Appropriate **Diagnostic Testing** was performed on the patient based on their severity and risk of disease progression. | |
|---|---|---|
| MILD... no additional testing obtained | ☐ No diagnostic testing was obtained, because the patient was noted to have MILD severity, ≤4 on the PRIEST Score, and ≤1 additional risk factors. | |
| Exertional O2 | Negative | ☐ An O2 saturation was obtained after the patient exerted themselves for >1 minute. Their SpO2 stayed stable. |
| | Positive | ☐ An O2 saturation was obtained after the patient exerted themselves for >1 minute. Their SpO2 dropped >3%. |
| Imaging / Labs Obtained | ☐ Appropriate imaging and labs were obtained in the emergency deparrtment based on clinical assessment of the patient. | |

| **Step 5 - Diagnostic Interpretation** | ☐ The **Diagnostic Interpretation** of imaging and labs that were obtained was as follows: |
|---|---|
| NO Concerning Imaging/Labs | ☐ There was no concern on imaging or labs. |
| Concerning Imaging | ☐ There was a concerning finding discovered on imaging that may prognosticate an increase in the patient's risk of disease progression. |
| Concerning Lab | ☐ There was a concerning finding discovered on lab testing that may prognosticate an increase in the patient's risk of disease progression. |
| Multiple Concerning Imaging/Labs | ☐ There were multiple imaging and/or lab testing results that may prognosticate an increase in the patient's risk of disease progression. |

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## SMART PHRASES (continued)

**Step 6 - Disposition**

☐ The most appropriate **Disposition** for the patient was determined based on the patient's severity classification and risk for disease progression.

| | | |
|---|---|---|
| MILD | Discharge Home | ☐ Patients with MILD Severity, a low PRIEST Score, and ≤1 risk factors are appropriate for Discharge Home. |
| MODERATE | Discharge Home | ☐ Patients with MODERATE Severity, a low PRIEST Score, and ≤1 risk factors may be Discharged Home based on an emergency physician's clinical judgement. |
| | Admission | ☐ Patients with MODERATE Severity and an elevated PRIEST Score or the presence of risk factors for disease progression meet criteria for Hospital Admission. |
| | Reduced Capacity | ☐ At times of COVID volume surges or reductions in hospital bed capacity, some patients who would normally meet criteria to hospital admission, may need to be Discharged Home. |
| SEVERE | Admission | ☐ Patients with SEVERE Severity meet criteria for admission the hospital. |
| | Transfer | ☐ Transfer should be considered if you are at a facility that does not have the resources or capacity to care for a patient with SEVERE Severity. |
| CRITICAL | Admission | ☐ Patients with CRITICAL Severity meet criteria for admission to an ICU setting. |
| | Transfer | ☐ Transfer should be considered if you are at a facility that does not have the ICU resources or capacity to care for a patient with CRITICAL Severity. |
| | ECMO | ☐ Transfer may be considered to an ECMO facility if, based on clinical judgement, it is determined that the patient may benefit from this procedure. |
| AMA | | ☐ The patient signed out Against Medical Advice, despite the offer of admission to the hospital and treatment due to the severity of their COVID manifestation. The patient is of normal mentation and has the capacity to make this decision, while understanding the consequences to their health. |

**Step 7a - Non-Pharmacologic Treatment**

☐ The following **Non-Pharmacologic Treatments** were ordered on the patient, based on best practice guidelines at the time of publication of this tool.

| | | |
|---|---|---|
| MILD / MODERATE | Discharged Home | ☐ The patient was supplied with discharge instructions that includes activities (breathing exercises, balanced diet, etc.) they should consider at home. |
| | Home O2 | ☐ The patient was given a prescription for supplemental O2 at home. |
| | Home Pulse Oximetry | ☐ The patient was given instructions for how to use a pulse oximeter at home to measure periodically their oxygen levels. They were given clear instructions on what measurements would warrant a return to the emergncy department. |
| SEVERE | O2 via NC | ☐ Supplemental oxygen was administered to the patient via nasal cannula. The patient was monitored for response to therapy. |
| | HFNC | ☐ Additional oxygen was delivered via High-Flow Nasal Cannula (HFNC) per institutional protocol. |
| | NIPPV | ☐ Additional oxygen was delivered via Non-Invasive Positive Pressure Ventilation (NIPPV) per institutional protocol. |
| | Awake Proning | ☐ The patient was trialed on awake proning per institutioanl protocol. |
| CRITICAL | Intubation | ☐ Due to the patient's CRITICAL Severity and compromised respiratory status, they were intubated. |
| | Prone Ventilation | ☐ Prone ventilation was utilized per insitutional protocol. |
| | Conservative Fluids | ☐ Per NIH recommendatins, a conservative fluid strategy was utilized. |

**Step 7b - Pharmacologic Treatment**

☐ The following **Pharmacologic Treatments** were administered to the patient, based on NIH recommendations at the time of publication of this tool.

| | | |
|---|---|---|
| MILD / MODERATE | Monoclonal Antibodies | ☐ Monoclonal antibodies may be considered for patients with MILD or MODERATE Severity who have risk factors for disease progression based on the current EUA criteria. |
| | Steroids | ☐ Steroids are not recommended for patients with MILD or MODERATE Severity. |
| | Remdesivir | ☐ Remdesivir is not recommended for patients with MILD or MODERATE Severity. |
| PATIENTS WHO ARE ADMITTED | Anticoagulation | ☐ Prophylactic dose anticoagulation is recommended for all nonpregnant adults who are admitted to the hospital. |
| SEVERE / CRITICAL | Remdesivir | ☐ Remdesivir may be given alone to admitted patients who require minimal supplemental oxygen. |
| | Dexamethasone PLUS Remdesivir | ☐ Dexamethasone PLUS remdesivir should be considered for patients who require increasing amounts of oxygen. |
| | Dexamethasone | ☐ Dexamethasone may be given alone when combination therapy with remdesivir cannot be used or is not available. |
| | Baricitinib PLUS Remdesivir | ☐ In the rare circumstances where corticosteroids cannot be used, Baricitinib can be given in combination with remdesivir for patients who require increasing amounts of oxygen. |
| | Dexamethasone NOT available | ☐ Alternative corticosteroids (such as prednisone, methylprednisolone, or hydrocortisone) can be used if dexamethasone is not available. |
| | Tocilizumab | ☐ Tocilizumab in combination with dexamethasone is recommended selected hospitalized patients who are exhibiting rapid respiratory decompensation due to COVID-19. |

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## FOOTNOTES

### Step 1- Severity

- All severity classifications are outlined by the NIH. The NIH COVID-19 Treatment Guidelines Panel is a multi-disciplinary team of experts that meets routinely to discuss the impact of new evidence on best practices in addition to providing a standardized system for classifying clinical severity.[6]

### Step 2 - Risk Prognostication

- The PRIEST Score: is a validated tool to predict a patients risk for end organ failure and/or mortality.[14]

### Step 3- Risk Assessment

- **Race/Ethnicity and access to healthcare**: the CDC has more information on how race, ethnicity, and access to health care resources may affect outcomes[7]
- **Economic Disparity**: has been shown to be an independent variable of risk[11]
- **Cancer**[8]: especially those with recent diagnosis <1 year (OR 1.72) and/or hematologic malignancies (OR 2.8)[11]
- **Cardiovascular**: OR 3.4 mortality, 3.4 higher level of care[2]
- **Chronic Respiratory Disease**: OR 1.6[11] - 3.7[2] mortality
- **Diabetes**: OR 1.9 mortality[2], 1.8-2.1 higher level of care[2-3]
- **Down's Syndrome**: OR 10.4 mortality (independent of other variables)[15]
- **Hypertension**: OR 2.5 mortality[2], 3 higher level of care[2]
- **Immunosuppression / Asplenia**: OR 1.3 (asplenia) - 3.5 (immunosuppression) mortality[11]
- **Neurologic disease / Stroke / Dementia**: OR 2.2 (stroke / dementia) - 2.6 (other neurologic disease) mortality[2]
- **Obesity (BMI ≥35)**: FDA EUAs for AB use ≥35 for BMI cutoff
  - One study showed increased risk for mortality in those with BMI 40-44 (OR 2.7) and ≥45 kg (OR 4.2)[12]
- **Obstructive Sleep Apnea**: OR 2.9 hospitalization, 2.4 severe disease[10]
- **Pregnancy**: has been shown to have increased hospitalization (OR 3.5).[2]
  - Severe cases have been shown to have pre-term labor 45.4% compared to 6.9% of mild and recovered cases.[9]
  - ACOG has published a guideline to assist with risk stratification of pregnant patients
- **Renal Disease (GFR ≤30)**: OR 2.5[11] - 4.3 mortality[2]

### Step 4 - Diagnostic Testing

- **Exertional SpO2**: post-exertional SpO2 may provide modest prognostic information of adverse outcome at 30 days[5, 13, 21]
  - Optimal time interval is not established.
  - Some have suggested 1-2 minutes and a sit-stand option in the patient's room (due to COVID restrictions)[5]
  - A 3% drop has been used in several studies[21, 13]
  - Another study used a quick walk test of 6 minutes. Decrease in ≥3% or ≥5% (conservative cutoff) or postexercise ≤90% suggest poor outcome (need for mechanical ventilation) with LR+=3.5 and LR-=0.22[21]
- **Diagnostic Testing**: labs and imaging may be of assistance in determining patients risk for diease progression and mortality (Zhou F; Cummings MJ; Wynants L; Galloway JB; Zhao Z)
  - The NIH maintains recommendations for appropriate diagnostic testing.
  - The following represents a practical imaging approach[22] and a consenus guideline.[23]

### Step 5 - Diagnostic Interruption

**Imaging Interpretation**

- Pulmonary US (POCUS) is appropriate as a COVID rule-in test (with diagnostic accuracy similar to CT) but should not be used for risk classification.[24]
- Models to prognostic risk based on CXR[4] results have been published.

**Lab Interpretation**

- **ALT (>40 U/L)** is associated with increased mortality.[2]
- **AST (>40 U/L)** is associated with increased mortality.[2]
- **Creatinine (>133 µmol/L)** is associated with increased mortality.[2]
- **CRP (>125 mg/L)** is associated with increased mortality[27] and intubation within 48-hours.[31]
- **D-dimer (≥1µg/mL)** is associated with increased mortality.[2]
- **Ferritin (>300 µg/L)** is associated with increased mortality and worsening oxygenation within 48-hours.[27, 28]
- **LDH (>250 U/L)** is associated with increased mortality[27] and worsening oxygenation[29] or intubation within 48-hours.[30]
- **Lymphopenia (<0.8 x10$^9$/L)** is associated with increased mortality and higher level of care.[2]
- **Neutrophils (>8,000/mm$^3$)** is associated with increased mortality.[2]
- **Thrombocytopenia (<150,000/mm$^3$)** is associated within increased mortality and higher level of care.[2]
- **Troponin (>99%)** is associated with increased mortality.[2]
- **WBC (>10,000/ mm$^3$)** is associated with increased mortality.[2]

### Step 6 - Disposition

The CDC maintains Patient Educational Materials.

**Helpful links from JAMA include:**

- What does this mean for families?
  - https://jamanetwork.com/journals/jamapediatrics/fullarticle/2763176
- Masks
  - https://jamanetwork.com/journals/jama/fullarticle/2764955
- Stopping the spread
  - https://jamanetwork.com/journals/jama/fullarticle/2763533
- What is herd immunity?
  - https://jamanetwork.com/journals/jama/fullarticle/2772168

### Step 7a - Non-Pharmacologic Treatment

**Studies in COVID and other viral illnesses[20], have shown the benefit of:**

- Rest[16]
- Healthy diet[17]
- Adequate sleep[18]
- Exercise[19]

**Issues with SpO2 measurements**

- If sending patients home with instructions for pulse oximetry, be mindful that SpO2 readings should always be considered an estimate of oxygen saturation. The FDA has just issued precautions on SpO2 devices.[26]
- If an FDA-cleared pulse oximeter reads 90%, then the true oxygen saturation in the blood is generally between 86-94%. Pulse oximeter accuracy is highest at saturations of 90-100%, intermediate at 80-90%, and lowest below 80%.
- Additionally, SpO2 measurements have been shown not be as reliable in patients with pigmentation of their skin[25]

**Treatment of Severe and Critical patients**

- Recommendations for respiratory support, IV fluids, and other interventions are maintained by the NIH HERE.

### Step 7b - Pharmacologic Treatment

**Medications** - recommendations are maintained by the NIH and IDSA.

**Monoclonal Antibodies** - specific information can be found here:

- FDA Fact sheet for healthcare providers: emergency use authorization (EUA) of bamlanivimab and etesevimab. 2021. Available at: https://www.fda.gov/media/145802/download. Accessed February 16, 2021.
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### NIH

**Rating of Recommendations**

- A = Strong
- B = Moderate
- C = Optional

**Rating of Evidence**

- I = One or more randomized trials without major limitations
- IIa = Other randomized trials or subgroup analyses of randomized trials
- IIb = Nonrandomized trials or observational cohort studies
- III = expert opinion

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# Emergency Department COVID-19 Management Tool

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