STATE OF MICHIGAN
DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Michigan Department of Health and Human Services COVID-19 Practice Management Guide

(Adapted from Department of Defense and Minnesota Department of Health)

This Document is appended as the Crisis Standards of Care for the State of Michigan. Clinical information is current as of 3/27/20.

Introduction: The novel coronavirus (COVID-19) has presented a daunting public health challenge across the world, United States, and Michigan, straining local and state health departments and the healthcare system. The Michigan Department of Health and Human Services (MDHHS) is working closely with healthcare providers, local health departments, and the Centers for Disease Control and Prevention (CDC) to actively monitor and provide guidance to address the outbreak. Crisis Standards of Care (CSC) address specific challenges of a pervasive or catastrophic public health event that has generated a change in standard of care by warranting a shift in focus from individual patients to the good of the community. In these situations, demand often exceeds available resources, warranting proactive steps to coordinate a statewide response for a prolonged period, assuring the best care possible despite resource limitations. In 2012, the National Academies of Sciences, Engineering and Medicine published national guidance documents for crisis standards of care planning (91). They recommend the incorporation of key elements into the development of crisis standards of care plans, including:

- Strong ethical grounding;
- Integrated and ongoing community and provider engagement, education, and communication;
- Assurances regarding legal authority and environment;
- Clear indicators, triggers, and lines of responsibility; and
- Evidenced-based clinical processes and operations.

In the event of a CSC situation, MDHHS will facilitate equitable access to care through public health recommendations, regulatory guidance, support of alternate care mechanisms (e.g., telephone hotlines, alternate care sites), and support public information dissemination in such an event.

This document serves only as guidance for clinicians providing care in Michigan during the COVID-19 outbreak. It is also a guide for hospital administrators who should be actively planning, or already implementing, Crisis Standards of Care in their facilities given the current status of the outbreak as of the date of this publication. References to Executive Orders and guidance documents from the State of Michigan are up to date as of the date of publication. Clinicians should always use their best clinical judgement when determining the care of their patients.

This is a guide and does not supersede Laws within the state of Michigan or individual clinical judgment

It is based upon the best information available at the time of publication. It is designed to provide information and assist decision making. It is not intended to define a standard of care and should not be construed as one. Neither should it be interpreted as prescribing an exclusive course of management. It was developed by experts in this field. Variations in practice will inevitably and appropriately occur when clinicians take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional making use of this guideline is responsible for evaluating the appropriateness of applying it in the setting of any particular clinical situation.

DoD COVID-19 PRACTICE MANAGEMENT GUIDE

Clinical Management of COVID-19

To consolidate resources and optimize the management for patients requiring clinical care during the global COVID-19 pandemic.

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BACKGROUND

Coronavirus disease 2019 (COVID-19) is a respiratory illness caused by a novel coronavirus (SARS-CoV-2). COVID-19 was first described in Wuhan, China in December 2019 and is now a global pandemic. Most of those affected have milder illness (80%), 15% will be severely ill (require oxygen) and 5% will require ICU care. (1) Of those who are critically ill, most require early intubation and mechanical ventilation. Other complications include septic shock and multi-organ failure, including acute kidney injury and cardiac injury.(2) Older age and comorbid diseases, such as COPD, hypertension and diabetes increase risk of death.(3, 4) The virus is highly contagious and spread via respiratory droplets, direct contact, and if aerosolized, airborne routes. The most common symptoms include fever, fatigue, dry cough, and shortness of breath.

The intent of this publication is to provide clinicians and medical treatment facilities (MTFs) with best practices based on latest evidence to optimize response to the current COVID-19 pandemic.

CLINICAL PRESENTATION & CLINICAL COURSE

1. Incubation period: ~4 days (interquartile range: 2 to 7 days).(5) Some studies have estimated a wider range for the incubation period; data for human infection with other coronaviruses (e.g. MERS-CoV, SARS-CoV) suggest that the incubation period may range from 2-14 days.
2. Frequently reported symptoms of patients admitted to the hospital: (3, 6-9)
    - Fever (77–98%)
    - Cough (46%–82%)
    - Myalgia or fatigue (11–52%)
    - Shortness of breath (3-31%)
    - GI symptoms, such as diarrhea and nausea (may approach 50%)
3. Among 1,099 hospitalized COVID-19 patients, fever was present in 44% at hospital admission, and developed in 89% during hospitalization. (10)
4. Less commonly reported symptoms: sore throat, headache, cough with sputum production and/or hemoptysis, and lower respiratory tract signs and symptoms.
5. Risk factors for severe illness are not yet clear, although older patients and those with chronic medical conditions may be at higher risk for severe illness. (11)
6. Children: Limited information is available about the clinical presentation, clinical course, and risk factors for severe COVID-19 in children. Of confirmed COVID-19 patients in China as of Feb 11, 2020, only 2.1% were aged <20 years, and no deaths were reported among those <10 years of age. From limited published reports, signs and symptoms among children with COVID-19 may be milder than adults, with most pediatric patients presenting with fever, cough, congestion, and rhinorrhea, and one report of primarily gastrointestinal symptoms (vomiting and diarrhea). Severe complications of acute respiratory distress syndrome and septic shock were reported in a 13-month old with COVID- 19 in China and another was reported in a 55-day old. (12-15)
7. Prolonged detection of SARS-CoV RNA has been reported in respiratory specimens (up to 22 days after illness onset) and stool specimens (at least 30 days after illness onset). (12,13)
8. Clinical presentation among reported cases of COVID-19 varies in severity from asymptomatic infection to mild illness to severe or fatal illness. Several reports suggest the potential for clinical deterioration during the second week of illness. In one report, among patients with confirmed COVID-19 and pneumonia, just over half of patients developed dyspnea a median of 8 days after illness onset (range: 5–13 days). In another report, the mean time from illness onset to hospital admission with pneumonia was 9 days. (3,8)
9. Acute respiratory distress syndrome (ARDS) developed in 17–29% of hospitalized patients, and secondary infection developed in 10%. In one report, the median time from symptom onset to ARDS was 8 days. (3, 6, 7) Approximately 20-30% of hospitalized patients with COVID-19 and pneumonia have

required intensive care for respiratory support. Compared to patients not admitted to an intensive care unit, critically ill patients were older (median age 66 years versus 51 years) and were more likely to have underlying co-morbid conditions (72% versus 37%). (3, 7)

10. Among critically ill patients admitted to an intensive care unit, 11–64% received high-flow oxygen therapy and 47-71% received mechanical ventilation; some hospitalized patients have required advanced organ support with endotracheal intubation and mechanical ventilation (4–42%).(6, 7, 11)
11. A small proportion (3-12% of ICU patients) have also been supported with extracorporeal membrane oxygenation (ECMO).(6, 7, 11) Other reported complications include cardiac injury, sudden cardiac death, arrhythmia, septic shock, liver dysfunction, acute kidney injury, and multi-organ failure. Post-mortem biopsies in one patient who died of ARDS reported pulmonary findings of diffuse alveolar damage. (16)
12. A case fatality rate of 2.3% has been reported among confirmed cases of COVID-19 in China. (11) However, the majority of these cases were hospitalized patients, so this mortality estimate is likely biased upward. Among hospitalized patients with pneumonia, the case fatality proportion has been reported as 4–15%. (3, 6, 7) In a report from one Chinese hospital, 61.5% of critically ill patients with COVID-19 had died by day 28 of ICU admission. Among all critically ill COVID-19 patients in China, the reported case fatality proportion was49%. (2)

**Adapted from the Center for Disease Control: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html*

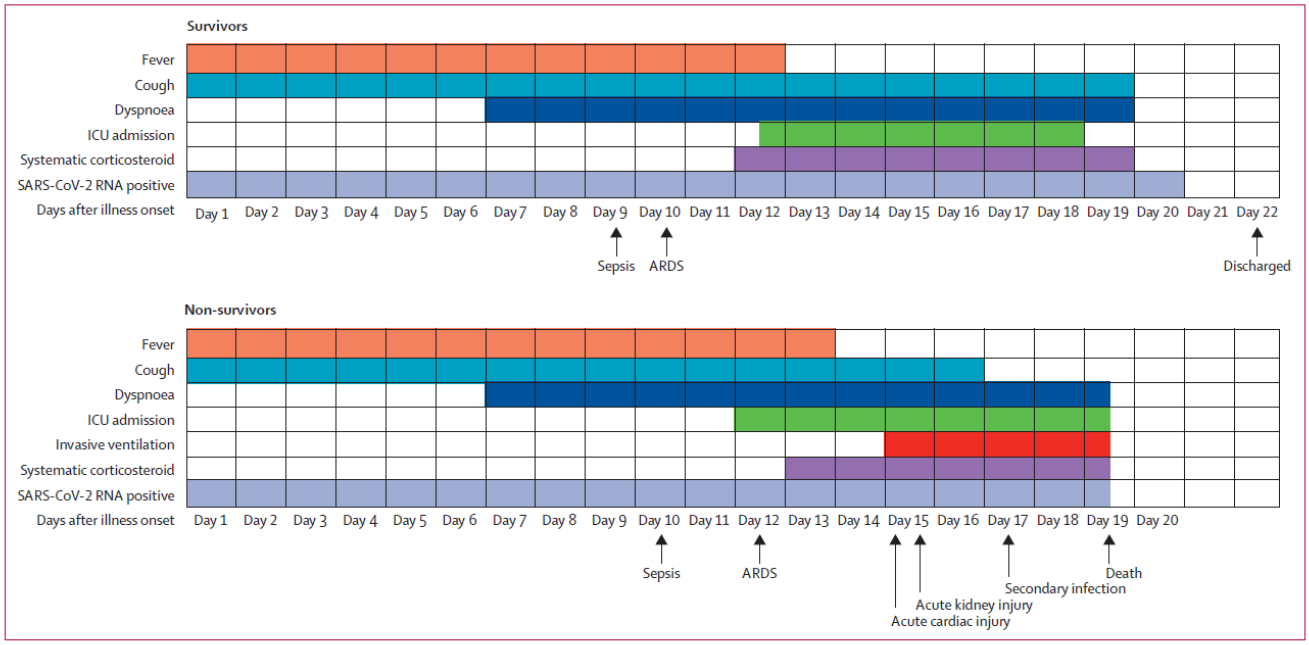


Figure 1: Clinical courses of major symptoms and outcomes and duration of viral shedding from illness onset in patients hospitalised with COVID-19
Figure shows median duration of symptoms and onset of complications and outcomes. ICU=intensive care unit. SARS-CoV-2=severe acute respiratory syndrome coronavirus 2. ARDS=acute respiratory distress syndrome. COVID-19=coronavirus disease 2019.

Figure 1. Clinical Courses of Major Symptoms and Outcomes and Duration of Viral Shedding [from Zhou, et al.; Lancet (2020)].(4)

PLANNING AND PREPARATION

Facility Incident Command and Systems.

1. A command structure with clearly defined roles and lines of communication should be established. These structures should have the ability to coordinate expansion or restriction of critical care resources through implementation of Contingency and Crisis Standards of Care (CSC) in conjunction with Unit medical directors, help coordinate "just in time" training as well as regional expert consultation (i.e. tele-consultation with critical care,

infectious disease, or other specialists), facilitate the flow of critical equipment and patients, and communicate/coordinate CSC changes on both a local and regional level liaise with the community as transition depends on regional, not just local, healthcare utilization.

2. Establish and Manage Crisis/Contingency Standards of Care
    a. CSC are "a substantial change in usual healthcare operations and the level of care it is possible to deliver, which is made necessary by a pervasive (e.g., pandemic influenza) or catastrophic (e.g., earthquake, hurricane) disaster." (19)
    b. The establishment of the CSC should enable specific legal and regulatory protections for health care providers when having to operate under conditions of limited medical resources and alternate models of care. Executive Order 2020-30, effective March 29, 2020, relaxes scope of practice requirements and reinforces an existing law that protects hospitals and health-care workers from liability for taking necessary steps to protect Michiganders during an emergency.
    c. Design and implementation of these standards for each agency should remain flexible based on each situation and should be tiered (i.e. normal operations, contingency, crisis) and have specific triggers to engage. In general contingency when >120% typical capacity and crisis when >150-200% capacity though this may be revised down or up depending on availability of staff, supplies, and space.
    d. CSC should be developed by multi-disciplinary groups and should in some ways be individualized to a facility. A list of topics that should be included:
        - Authority and triggers for enacting escalating CSC
        - Emergency credentialing and scope of practice changes as CSC escalate (nursing, physician, etc.)
        - Alterations in practice allowed (limiting documentation, changes in work hours and locations, changes in location of patient care and monitoring requirements

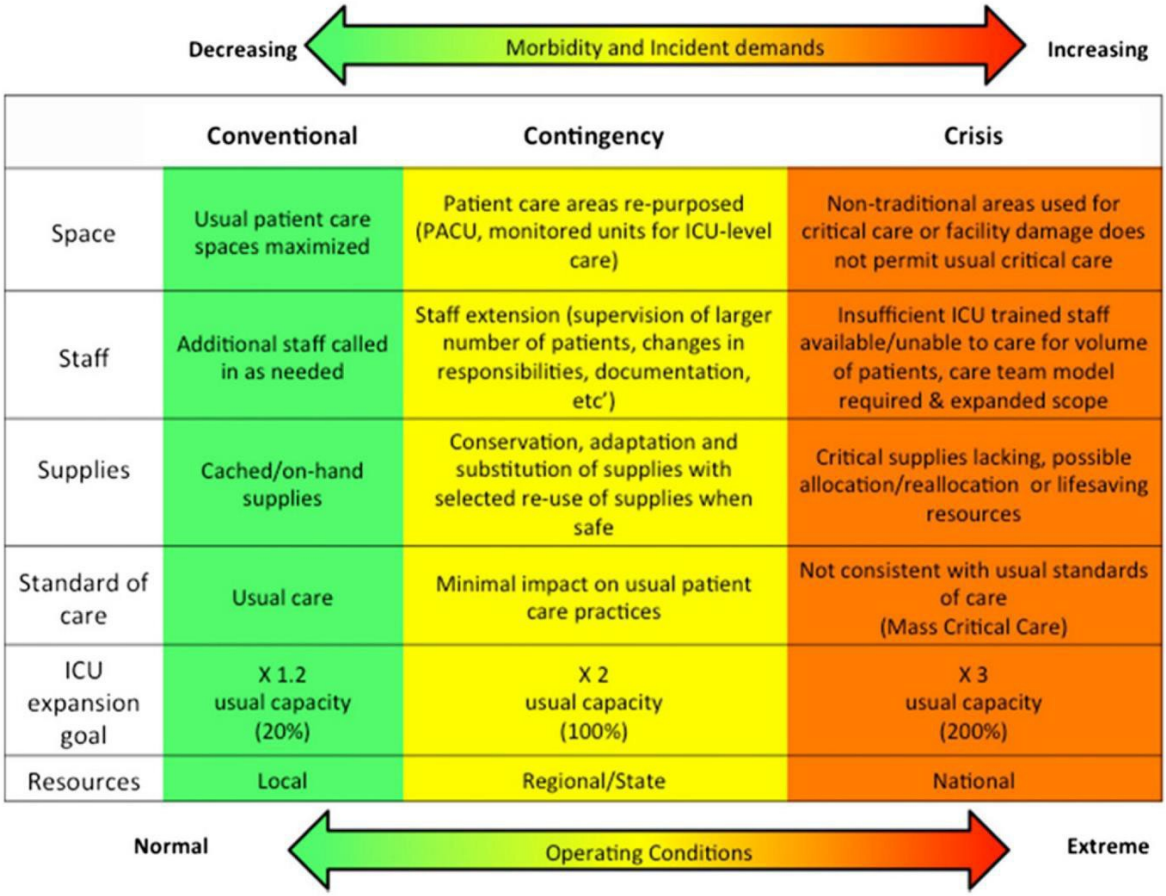


Figure 2. A framework outlining the conventional, contingency, and crisis surge responses. PACU: postanesthesia care unit. [from Christian, et al.; Chest (2014)].(20)

3. Establish clear Lines of Communication (LOC) to ensure:
    a. The ability to maintain power, particularly at austere or atypical site of care.
    b. The ability to rapidly download a transferrable version of clinical information to follow patients through the system.
    c. That the systems exist to efficiently share this information with staff.
    d. That the communication be consistent, from designated sources, and the information be trusted by staff.
4. Establish Patient Tracking and Re-unification systems:
    a. Command centers should also help plan and coordinate a system for patient tracking, identification, and the ability to communicate with family members and next of kin regarding status and location of loved ones who may be restricted from visitation. (23)
5. Establish security, access points, and "clean" areas with access restricted:
    a. Given high levels of stress, limited resources, potentially crowded living conditions, and considerable anxiety surrounding pandemic disease, coordination with security both for a facility and the ICU should be included in the planning process.
    b. Establish "satellite" units in alternative locations to care for critically ill patients unaffected by the pandemic to group contagious patients, cohort staff, and protect non-infected patients. (24)
    c. Consider allocating "high risk" staff (underlying medical conditions, age >60) to these sections.
    d. Consider access to specialty care that may be needed in these sections with screening as patients enter.
6. Coordination of re-prioritization of clinical duties:
    a. Limitation of non-urgent care, well visits, routine visits or imaging
    b. If prolonged, give consideration to designating satellite sites to continue routine, but necessary care
    c. Coordinate re-allocation of assets off loaded by limitations to areas of need (Critical Care, Inpatient care, Initial triage, and Urgent/Emergency Care).
    d. Limit administrative, educational and academic duties to those necessary to directly support patient care
    e. Develop Recall Roster for all assets (nursing, physician, housekeeping, dietary, security, admin, etc.) and triggers for re-calling those who may be needed from remote work.
7. Consider logistic/ancillary support needs when determining "Essential Personnel" for tasks including:
    a. Disposal of PPE and cleaning both "dirty" rooms and shared spaces. These tasks should be prioritized and will be in very high demand.
    b. Allocation of adequate space for safe, respectful care of the deceased.
    c. Designating locations and facilities to shelter and feed families of ill patients, staff members, and even families of staff members to augment and limit the up to 40-50% absenteeism anticipated with illness, school/childcare closure, and fear.

Preparing Critical Care Resources & Teams

1. ***Staffing.*** Many facilities have reduced staffing capabilities to support their ICUs. However, in a global pandemic requiring care for a surge of critically ill patients, additional staffing models should be considered. Although tele critical care resources should be optimized, there may still be significant deficits in critical care trained healthcare workers.
    a. Staff Shortages:
        i. Preparation also needs to be made to compensate for reduced staffing. Illness, fatigue, fear, and care giver duties, particularly with school/daycare closure, limit staff availability with some estimates as high as 60% absenteeism. (24, 28)
        ii. Strategies listed above may mitigate (facility based child care, cohort care teams,

etc.) but planning should consider at least a 25-40% reduction in staff availability. These guidelines are currently under review.

iii. The Society of Critical Care Medicine (SCCM) recommends the following staffing model to support expanded critical care bed capacity in the event of a global pandemic (https://www.sccm.org/Blog/March-2020/United-States-Resource-Availability-for-COVID-19), which includes use of multiple non-ICU trained healthcare workers (noted in red):(29)

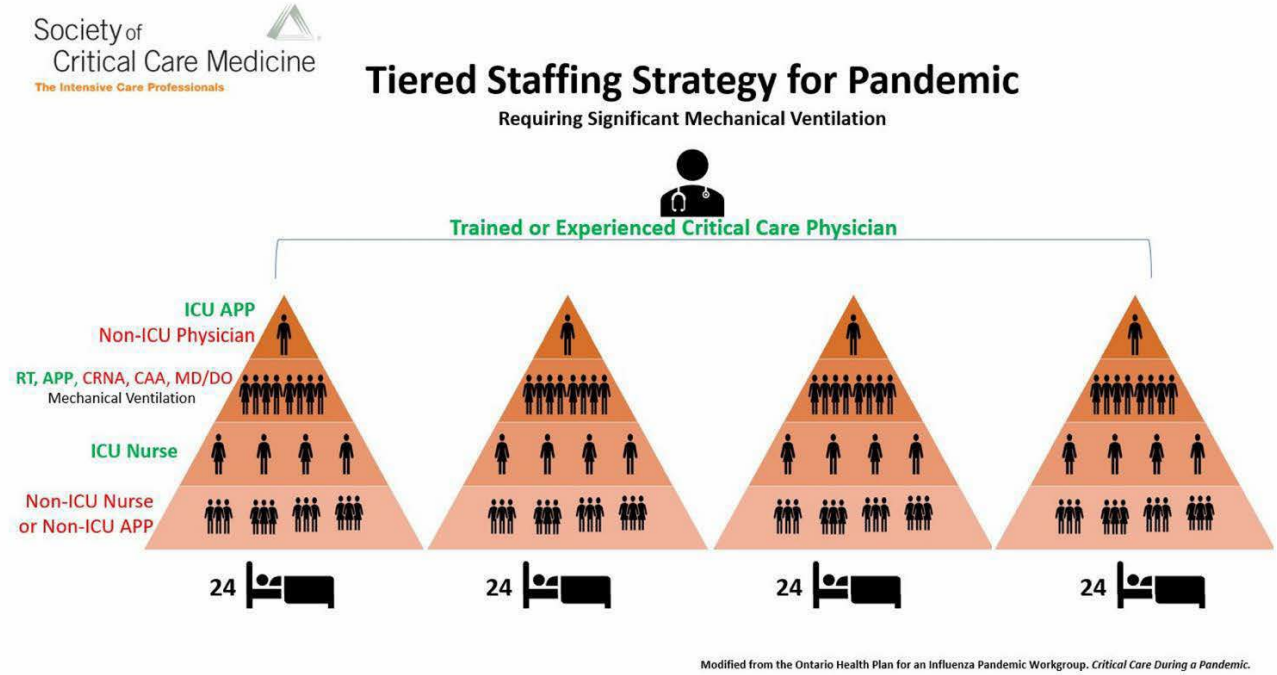


Figure 3. SCCM Tiered Staffing Strategy for Pandemic. APP: advanced practice provider; RT: respiratory therapist; CRNA: certified registered nurse anesthetist; MD/DO: physician [from SCCM link above].(29)

b. In accordance with Joint Commission regulations facilities and local leadership may cross-level providers as needed to provide any type of patient care, treatment and services necessary as a life saving measure- or to prevent serious harm, provided the care, treatment, and services provided are within the scope of the individual's license without modification of existing privileges. Privileging authorities may award disaster privileges on activation of their emergency management plans consistent with provisions established in DHA PM 6025.13, Volume 4.

2. ***Training of Staff.***
   a. ICU "Just in time training" for augmentees from other areas available at https://www.sccm.org/covid19 orhttps://www.sccm.org/disaster
      - Places with ICU care should develop brief local ICU orientation models focusing on safety practices, unit hierarchy, protocols, and consultative relationships but should be brief, no more than 4hrs.
   b. PPE; Donning and doffing officers should be assigned to train and monitor this.
      - These personnel could/should be pulled from non-clinical roles (administrators, support staff, etc.) and could fulfill a vital safety role after being trained. Training video: https://www.youtube.com/watch?v=bG6zISnenPg (30)
3. ***Equipment and Consumables.*** Daily assessment of ventilators, ventilator circuits, PPE, fluids, and sedating medication should be tracked with equipment burn rates estimated and updated as more information is available.
   a. Creation of intubation packs consisting of all necessary PPE (N95, hats, eye protection, gowns, shoe covers, disposable stethoscopes) to avoid providers assembling gear outside of treatment rooms should be considered and would augment ability to track supplies. This

will both avoid delays in care and the potential for entering the room without proper PPE.

b. Consider alternative options to reduce and re-use critical items such as PPE and ventilator circuits. No current guidance but local policies and solutions should be shared as they become available.

c. When expanding into OR or PACU, the spaced utilization of anesthesia ventilators should be considered. Some should be held in reserve based on facility needs for acute, non- COVID needs.

4. ***Space:***

a. ***ICU Contingency Units.*** Non-emergency medical and dental surgeries and procedures were temporarily restricted under Executive Order 2020-17, which means that some operating room capacity, pre- or post-anesthesia recovery, and other monitored, ventilator capably areas may be available to use as alternative ICU rooms.

b. **Ward Cohorting:** Consideration should be given to establishing COVID wards. This includes regular as well as ICU care areas. Clean barriers on open units similar to chemical "hot lines" could be used. This includes cohorting staff to "COVID-positive" or "COVID- negative" teams based on which cohort they are caring for to reduce transmission. In particular, it is recommended that patients with non-COVID-19 coronavirus be separated from COVID-19 patients because of the risk of homologous recombination.

Establishment Case Registry for Clinical Performance Improvement

1. Systematic collection and iterative analysis of key data on risk factors and outcomes, coupled where possible with collection and repository storage of residual material from pertinent clinical diagnostic specimens, is essential to optimization of care delivery.
2. This should be executed urgently in the context of an approved, directed performance improvement initiative, in the setting of a learning health system.

SCREENING AND TRIAGE: EARLY RECOGNITION OF PATIENTS WITH COVID-19

1. **Screening:** Screen and isolate all patients with suspected COVID-19 at the first point of contact with the health care system (ER/clinic/drive-through screening).
2. **Triage:** Triage patients using standardized triage tools and initiate the appropriate disposition decision depending on the clinical setting.
3. **Initial treatment of hospitalized inpatients** consists of optimized supportive care in the ward or intensive care unit. Patients with increased risk of severe disease and mortality include:
   - Age >60
   - Diabetes mellitus
   - Hypertension
   - Immunosuppression
   - Cardiopulmonary disease
4. Patients may present with mild symptoms but have high risk of deterioration and should be admitted to a designated unit for close monitoring.
5. **Mild Illness.** For mild illness, hospitalization may not be required unless concern about rapid deterioration. Isolation to contain/mitigate virus transmission should be prioritized. Safe home care can be performed according to CDC guidance (https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/caring-for-yourself-at-home.html).

6. **ICU Admission Criteria.** ICU admission and exclusion criteria may be a fluid decision based on the facility. Given that allocation of dedicated ICU beds and surge capabilities amongst individual hospitals are variable, each hospital should provide a specific plan regarding ICU admission/exclusion criteria. This could be based on the percentage of resources utilized (e.g., beds, ventilators). An example of a plan is provided below from the San Antonio VA:

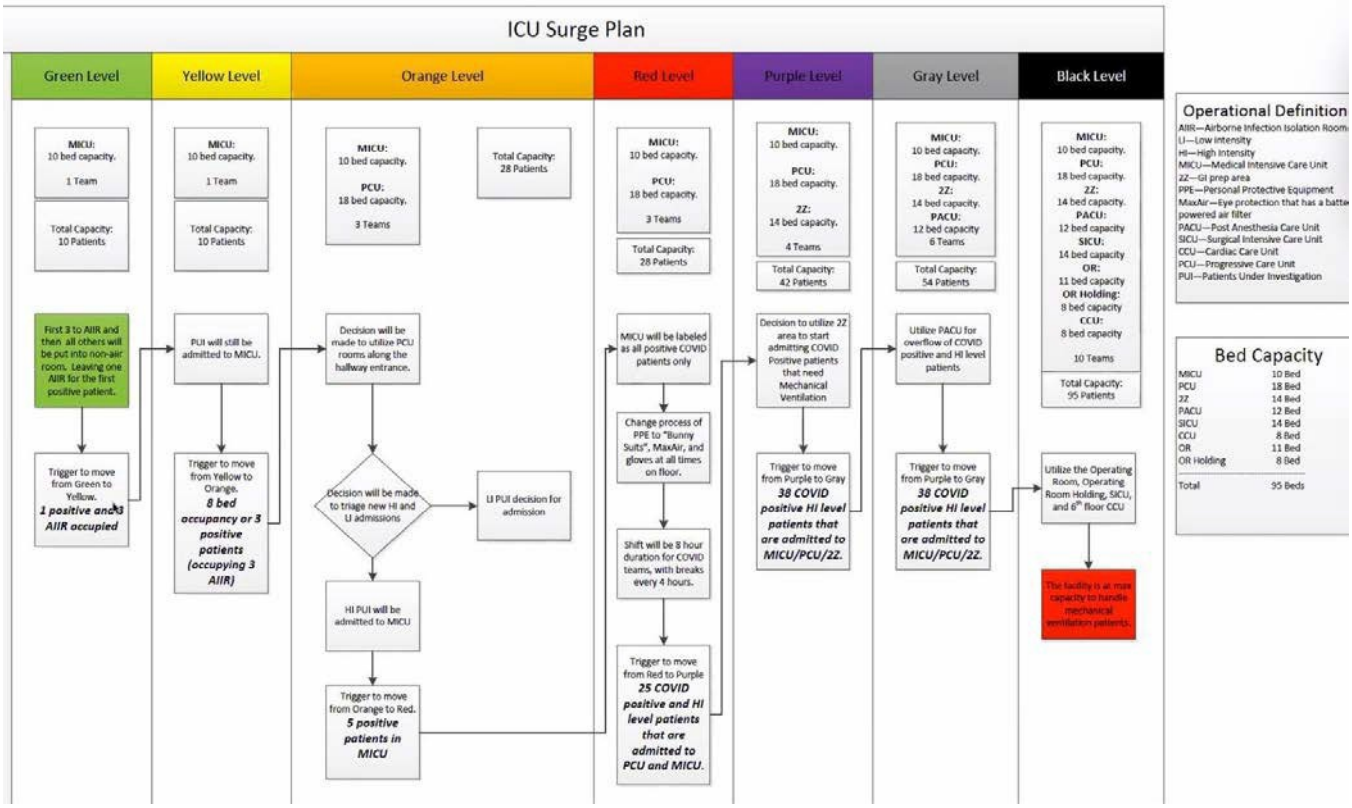


Figure 4. Example of an ICU Surge Plan (from the San Antonio Veteran's Affairs Hospital)

IMMEDIATE IMPLEMENTATION OF APPROPRIATE Infection Prevention Control (IPC) MEASURES

Prior to hospital admission, the patients should be actively separated such as through a tent outside the traditional confines of the hospital for testing purposes or a private room with the door closed within a facility as improved separation is ideal for infection control purposes.

Currently, the CDC's infection control guidance recommends standard and transmission based precautions. To protect health care workers and patients, Executive Order 2020-7 states that all health care facilities, residential care facilities, congregate care facilities, and juvenile justice facilities must prohibit from entering their facilities any visitors that:

- are not necessary for the provision of medical care, the support of activities of daily living, or the exercise of power of attorney or court-appointed guardianship for an individual under the facility's care;
- are not a parent, foster parent, or guardian of an individual who is 21 years of age or under and who is under the facility's care;
- are not visiting an individual under the facility's care that is in serious or critical condition or in hospice care;
- and are not visiting under exigent circumstances or for the purpose of performing official governmental functions.

Facilities must perform a health evaluation of all individuals that are not under the care of the facility each time the individual seeks to enter the facility, and must deny entry to those

individuals who do not meet the evaluation criteria (symptoms of a respiratory infection, such as fever, cough, shortness of breath, or sore throat; and contact in the last 14 days with someone with a confirmed diagnosis of COVID-19). A partner and doula accompanying a laboring mother are allowed to accompany the mother, as labor qualifies as an exigent circumstance under this order, as long as they pass the health evaluation required.

COLLECTION OF SPECIMENS FOR LABORATORY DIAGNOSIS

1. **Triage:** Patients should be triaged according to testing algorithm and initial testing should optimally be performed in a manner separated from the general patient population such as in a tented environment or designated area within a facility. When determined appropriate to test, initial laboratory collection will include nasopharyngeal swab for COVID-19 testing and additional tests as indicated.
2. **Specimen Collection:** Collect specimens from the upper respiratory tract (URT; nasopharyngeal AND, where clinical suspicion remains and URT specimens are negative, collect specimens from the lower respiratory tract when readily available (LRT; expectorated sputum, endotracheal aspirate,) for COVID- 19 virus testing by RT-PCR and bacterial strains. Recent CDC guidance has granted the ability to utilize nasal swabs or mid-turbinate swabs, either clinical or self-collected, as long as they are transported in appropriate viral transport media (i.e. VTM, UTM, M4, Aimes, etc.). Additionally, testing for other viral infections such as influenza should be obtained or if available a respiratory viral panel (i.e. Biofire). Avoid bronchoscopy to minimize aerosolization unless critical therapeutic indication. (31)
3. **Critically Ill Patients:** If admitting a critically ill patient, collect blood cultures for bacteria associated with pneumonia and sepsis, ideally before antimicrobial therapy. If bacterial pneumonia is suspected, DO NOT delay antimicrobial therapy to collect blood cultures. If available, procalcitonin may be helpful as COVID-19 has been associated with low procalcitonin levels which can minimize antibiotic overuse. (32)
4. **Confirming COVID-19.** Per CDC, "for initial diagnostic testing for COVID-19, CDC recommends collecting and testing upper respiratory tract specimens (nasopharyngeal swab). CDC also recommends testing lower respiratory tract specimens, if available. For patients who develop a productive cough, sputum should be collected and tested for COVID-19. The induction of sputum is not recommended. For patients for whom it is clinically indicated (e.g., those receiving invasive mechanical ventilation), a lower respiratory tract aspirate or bronchoalveolar lavage sample should be collected and tested as a lower respiratory tract specimen."
5. **Hospitalized Patients:** In hospitalized patients with confirmed COVID-19, repeated URT and LRT samples can be collected to demonstrate viral clearance. The frequency of specimen collection will depend on local epidemic characteristics and resources. The CDC now recommends that patients with COVID-19 can be discharged from a healthcare facility whenever clinically indicated. The decision to discontinue Transmission-Based Precautions should be made using a test-based strategy or a non-test-based strategy (i.e., time-since-illness-onset and time-since-recovery strategy). Meeting criteria for discontinuation of Transmission-Based Precautions is not a prerequisite for discharge.
6. **Personal Protective Equipment (PPE):** For collection of URT specimens, HCP should an N-95 or higher-level respirator (or facemask if a respirator is not available), eye protection, gloves, and a gown. When collecting LRT specimens, HCP in the room should wear an N95 or higher-level respirator, eye protection, gloves, and a gown. LRT specimen collection generally involves aerosol-generating procedures and should ideally be performed in an airborne infection isolation room.
7. **For pregnant patients:** COVID-19 testing of symptomatic pregnant women may need to be prioritized to enable access to specialized care. Per the CDC, People who are pregnant should be monitored since they are known to be at risk with severe viral illness, however, to date data on COVID-19 has not shown increased risk.
8. **Co-infection:** Dual infections with other respiratory viral and bacterial infections have been found in

SARS, MERS and COVID-19 patients. As a result, a positive test for a non-COVID-19 pathogen does not rule out COVID-19. At this stage, detailed microbiologic studies are needed in all suspected cases. Both URT and LRT specimens can be tested for other respiratory viruses, such as influenza A and B, respiratory syncytial virus, parainfluenza viruses, rhinoviruses, adenoviruses, enteroviruses (e.g. EVD68), human metapneumovirus and endemic human coronaviruses (i.e. HKU1, OC43, NL63, and 229E). LRT specimens can also be tested for bacterial pathogens, including Legionella pneumonia.

9. **Malaria-endemic areas:** If a patient recently returned from a malaria-endemic area, patients with fever should be tested for malaria or other co-infections with validated rapid diagnostic tests (RDTs) or thick and thin blood films and treated as appropriate. In endemic settings arbovirus infection (dengue/chikungunya) should also be considered in the differential diagnosis of undifferentiated febrile illness, particularly when thrombocytopenia is present. Co-infection with COVID-19 virus may also occur and a positive diagnostic test for dengue (e.g. dengue RDTs) does not exclude the testing for COVID-19.

MANAGEMENT OF MILD COVID-19: SYMPTOMATIC TREATMENT AND MONITORING

- The mainstay of treatment for mild cases of COVID-19 is supportive care.
- Those with mild disease may be managed as an outpatient, but the determination of outpatient vs inpatient care should be individualized based on consideration of symptom severity and risks for adverse outcomes (e.g., underlying illness and age), and the patient's social context:
    - Their access to resources such as food and other necessities for daily living
    - Their access to appropriate caregivers or ability to engage in self-care
    - Their ability to engage in symptom and public-health monitoring
    - The transmission risk within the home (e.g., the availability of a separate bedroom to minimize sharing of immediate living spaces with others, their access to appropriate personal protective equipment such as gloves and a facemask, their ability to adhere to home isolation, respiratory and hand hygiene, and environmental cleaning, and the presence of household members at increased risk for COVID-19 complications).(11, 33, 34)
- Although 81% of patients in a Chinese case series had mild symptoms, those who progressed to more severe disease were hospitalized a median of 7-11 days after the onset of illness.(4, 6, 35) Therefore, close monitoring for symptomatic progression through the second week of illness is important for non-hospitalized patients. Close monitoring should be emphasized in patients aged ≥ 60 years and/or with underlying medical comorbidities that may increase their risk for disease progression, to include: cardiovascular disease, cerebrovascular disease, chronic respiratory diseases, chronic kidney disease, chronic liver disease, diabetes, hypertension, cancer, immunocompromising conditions, and pregnancy. (6, 11, 35, 36)
- Monitoring for symptomatic improvement may be conducted by healthcare providers or public-health personnel.
- Clinicians should contact local public health and/or local/state health department regarding criteria for discontinuation of homeisolation.
    - Healthcare providers may provide patients or their caregivers access to available CDC guidance on home care: Preventing the Spread of Coronavirus Disease in Homes and Residential Communities
    - What to Do If You Are Sick
    - Caring for Someone at Home
    - Caring for Yourself at Home
    - MDHHS: COVID-19 Guidance for Healthcare Facilities for Discharge of Residents

Figure 5. CDC Home Care Management Recommendations for COVID-19 Patients (website above). (34)

- Theoretical concern has been raised that the use of non-steroidal anti-inflammatory drugs (NSAIDs) may lead to complications of COVID-19 due to NSAID-induced upregulation of angiotensin-converting enzyme 2 (ACE2), which is the cellular binding target for SARS-COV-2. Although there is no clinical evidence of association between NSAIDs and outcomes for COVID-19, the French Health Minister cautioned that use of ibuprofen could be an aggravating factor in COVID-19. (39) Society of Critical Care Medicine's Guidelines on the Management of Critically Ill Adults with COVID-19 states that the use of non-steroidal anti-inflammatory drugs to treat fever in patients with COVID-19 continues to be debated. Until more evidence is available, we suggest using acetaminophen/paracetamol to treat fever.

MANAGEMENT OF SEVERE COVID-19: OXYGEN THERAPY AND MONITORING

1. Give supplemental oxygen therapy immediately to patients with respiratory distress, hypoxemia, or shock and target SpO2 92-96%. (40,41)

2. Patients that have a persistent requirement for 5-6 L/min to maintain target SpO2 should be considered for early intubation/mechanical ventilation given risk of deterioration.
3. For adults, initiate oxygen therapy during resuscitation at 5-6 L/min and titrate flows to reach target SpO2 92-96% during resuscitation. If persistent requirement for 5-6 L/min and lacking resources for invasive ventilation, consider use high flow nasal oxygen (HFNC) or a face mask with a reservoir bag at 10-15 L/min if the patient is in critical condition.
4. Recommendations are evolving regarding risk: benefit, but favor HFNC over BIPAP/noninvasive ventilation (NIV) if early intubation and mechanical ventilation is not possible. HFNC is a more effective intervention for non-invasive management of ARDS that requires less staff intervention. HFNC is also potentially safer for staff than BIPAP/NIV. Avoid BIPAP, if HFNC is unsuccessful; early intubation is recommended. (31)
5. Recommend rapid sequence intubation (RSI) to minimize bagging for staff safety. Staff should have proper personal protective equipment for intubation including powered air purifying respirator (PAPR) if available or an N95 mask and face shield.
6. For children, use of nasal prongs or nasal cannula may be better tolerated, but the goal is to target SpO2 >94% during resuscitation, and >90% once stable.
7. Patients may deteriorate rapidly, so continuous monitoring is critical.
8. Aggressive fluid resuscitation may worsen oxygenation and outcomes in both children and adults, so in the absence of shock, fluid boluses should be minimized.
9. Avoid nebulizers, as metered dose inhalers are recommended for staff protection and avoidance of aerosol generation. (31)
10. Avoid routine steroids in patients without acute respiratory distress syndrome (ARDS) except under certain circumstances. However, consider steroids for intubated patients with ARDS per the Society of Critical Care Medicine's Guidelines on the Management of Critically Ill Adults with COVID-19.
11. For intubated patients with ARDS and a PaO2/FiO2 ratio<150, recommend early proning and consideration for transfer to an extracorporeal membrane oxygenation (ECMO) center. Prone patients may require paralysis with cisatricurium but resources may dictate per individual facility.
12. **Admission studies and labs**: Consider the following labs/studies for diagnosis, prognosis and risk stratification (and/or safety of agents) for all hospitalized patients with confirmed COVID-19/PUI:

Table 1. Laboratory and Study Considerations for Hospitalized Patients with COVID-19 (or PUI)

Recommended Daily Labs:

- Complete Blood Count (CBC) with diff (trend neutrophil-lymphocyte ratio, NLR)*
- Complete metabolic panel(CMP)
- CPK

Recommend on Admission (may repeat q2-3 days if abnormal or with clinical deterioration)

- D-dimer, PT/PTT,Fibrinogen
- Ferritin/CRP/ESR
- LDH
- IL-6
- Troponin (if suspect acute coronary syndrome or heart failure)
- SARS-CoV-2 test, Biofire rapid viraltesting
- Electrocardiogram (ECG) (daily withsevereinfection)
- Portable CXR

If Clinically Indicated

- Blood cultures
- Tracheal aspirates for intubated patients
- Viral serologies if LFTs are elevated if clinically indicated (HBV sAb/cAb/sAg, HCV Ab, HIV q/2 Ab/Ag)
- For acute kidney injury (i.e. serum creatinine >0.3 above baseline), send urinalysis and spot urine protein:creatinine)
- Procalcitonin

* https://emcrit.org/pulmcrit/nlr/

13. Do not allow ICU visitors for Infection Prevention and Control (IPC) purpose during a pandemic except under exigent circumstances.
14. Facilities should assess daily operational status via huddle of equipment including ventilators, medications (e.g. induction agents and paralytics), and staffing (including respiratory therapists, physicians and nursing). In the event of more patients than ventilators, then patients requiring intubation can be intubated and bag valve mask ventilated until a lower acuity patient can be extubated. Current science does not recommend splitting ventilators for COVID-19 patients.(https://emcrit.org/pulmcrit/split-ventilators)

MANAGEMENT OF SEVERE COVID-19: TREATMENT OF CO-INFECTIONS

1. Clinical judgment and patient severity will dictate provider decision on early antibiotic therapy.
2. Data on the prevalence of bacterial superinfection in patients with COVID-19 are limited per the Society of Critical Care Medicine's Guidelines on the Management of Critically Ill Adults with COVID-19.
3. Consider empiric antimicrobials for intubated patients with COVID-19. Recommend antibiotic guidance as per ATS/IDSA Community Acquired Pneumonia (CAP) guidelines or as per critical care or infectious disease consultation. (42) However, as a starting point upon intubation, the following table can be used until consultation is available:

Table 2. Empiric Antimicrobial Considerations for Intubated COVID-19 Patients (or PUI)

	Starting Antibiotic Regimen
No comorbidities or immunosuppression or risk factors for MRSA or *Pseudomonas aeruginosa**	• Ceftriaxone† 2 g once daily, *and* Azithromycin† 500 mg once daily
With comorbidities‡	• Cefepime 1-2 g every 8-12 hours, *and* Azithromycin† 500 mg once daily *OR* • Piperacillin-Tazobactam 4.5 g every 6-8 hours, *and* Azithromycin† 500 mg once daily

Definition of abbreviations: MRSA = methicillin-resistant *Staphylococcus aureus*
*Risk factors include prior respiratory isolation of MRSA or *P. aeruginosa* or recent hospitalization AND receipt of parenteral antibiotics (in the last 90 d). If concern for MRSA, add **Vancomycin** 15-20 mg/kg q 8-12 hours (usually 2g/dose)
†If Ceftriaxone not available, replace with **Ampicillin/Sulbactam** 3 g q6h; If Azithromycin not available, replace with **Doxycycline** 100 mg q12h
‡Comorbidities include chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancy; immunodeficiency/asplenia.

4. Recommend obtaining blood cultures and tracheal aspirate prior to initiation of antibiotics when feasible.
5. As noted in section on diagnostic testing, co-detection of other respiratory pathogens has been observed with SARS-CoV-2. For example, Stanford researchers recently provided rapid communication of experience with 562 SARS-CoV-2 tests; of 49 positive SARS-COV-2 results, 11 (22.4%) also had a co-infection, and of 127 positive for other viruses, 11 (8.66%) had a SARS-COV-2 co-infection. (https://medium.com/@nigam/higher-co-infection-rates-in-COVID-19-b24965088333)

MANAGEMENT OF CRITICAL COVID-19: ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS)

Development of Respiratory Failure

1. Recognize severe hypoxemic respiratory failure when a patient with respiratory distress is failing

to respond to standard oxygen therapy. Prepare to provide advanced oxygen and ventilatory support.

2. All forms of respiratory therapy have a risk of aerosolization of the virus and risk to others. Comparison of non-invasive respiratory modalities continues to evolve, but presently use of HFNC should be favored over BIPAP. HFNC is more efficacious for non-invasive management of ARDS compared to BIPAP, is generally well tolerated, and requires less staff intervention (coming in and out of room for alarms and troubleshooting). If this therapy is attempted, it should ideally be confined to negative pressure isolation rooms and healthcare workers should have appropriate, to include N95 masks and PAPR.
3. Avoid use of nebulized medications when possible given the increased risk of aerosolization.
4. Non-invasive ventilation (e.g. CPAP, BiPAP) should in general be avoided given the rapid progression of respiratory failure in patients with ARDS from COVID-19 and the risks to staff. If escalation is required, early intubation should be performed. (41)

Endotracheal Intubation

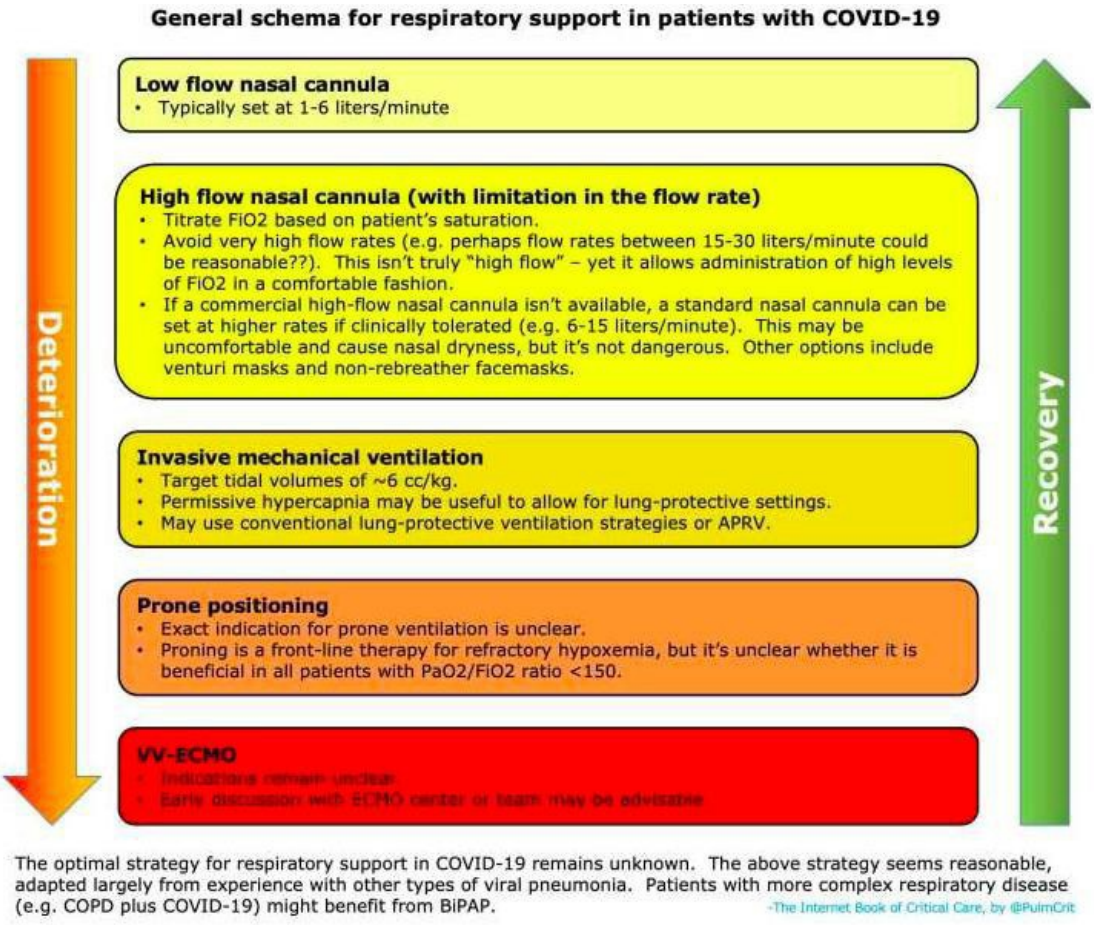
1. Intubation should be performed early for a number of reasons, including the rapid disease progression, but also the additional time required to prepare for intubation in full PPE.
2. Intubation has the highest risk of aerosolization and exposure to COVID-19 of all procedures, and the person performing intubation is most at risk.(31) For this reason, the most experienced person should perform endotracheal intubation to reduce exposure to the healthcare team and all team members should be in appropriate PPE with fit-tested N95 and medical protected head hood or powered air purifying respirator (PAPR) during intubation. If PAPR is unavailable, N95, hair cover, protective coverall, gown, double gloves, face shields, goggles, and shoe covers should be used. Limit the number of staff members during airway manipulation to reduce the risk of unnecessary exposure. (https://www.apsf.org/news-updates/perioperative-considerations-for-the-2019-novel-coronavirus-covid-19/)
3. A pre-intubation checklist is strongly encouraged, which should include supplies to be brought inside the room by specific team members and others that should remain outside the room in case they are needed. **Appendix A** provides an example intubation checklist (adapted from University of Washington). *Note: a disposable stethoscope should be used to avoid transferring the virus and staff should touch as little as possible in the room to avoid fomites.*
4. For patients with a normal airway assessment, awake intubation should be avoided and modified rapid sequence intubation with sufficient muscle relaxation is strongly encouraged. For patients with difficult airways, good preparation of airway devices and detailed intubation plans should be made in advance. (43)
5. Some centers have advocated for further reducing exposure during pre-oxygenation and ventilation through preparing an additional COVID Intubation Pack (**Appendix B**), in addition to intubation medications, a video laryngoscope (if used, or direct laryngoscopy), and a non-vented BiPAP mask. The following video demonstrates the set-up:(https://youtu.be/C78VTEAHhWU).
6. **Appendix C** provides a framework for intubation with medications and doses, although this is not a substitute for clinical judgement.
7. Additional cognitive aids have been developed and might be useful. **Appendix D** provides examples.

Management of ARDS

1. ***Non-invasive ventilation (NIV).*** It is recommended to avoid NIV because there is no exhalation filter. If there is an exception to this such as patients that chronically use NIV or DNI patients, these patients will require airborne isolation regardless of ICU/acute care status. *Note:* V60 ventilators are also highly aerosolizing and should be discouraged.
2. ***High-flow nasal cannula (HFNC).*** Although an area of controversy, early expert opinion favors HFNC

over other non-invasive modalities (https://emcrit.org/ibcc/COVID-19/#high_flow_nasal_cannula) because it appears to be well tolerated, more efficacious than BIPAP and less provider intensive. There is presently no definitive evidence that HFNC augments transmission of virus.

3. ***Mechanical Ventilation.*** COVID-19 does not appear to cause substantially reduced lung compliance as is typical with ARDS, but rather atelectasis and interstitial pneumonia. Physicians in Italy have described severe hypoxia with decent pulmonary compliance. (http://www.ventilab.org/2020/02/29/ventilazione-meccanica-e-polmonite-da-coronavirus/)
   a. Target *high **PEEP**, lung-protective tidal volume* (**4-8 mL/kg ideal body weight**), and lower inspiratory pressures (**plateau pressure <30 cm H_2O**).(41,44)
      i. Start with 6 mL/kg ideal body weight tidal volume and titrate as needed
      ii. In patients with moderate to severe ARDS, suggest higher PEEP instead of lower PEEP. PEEP tables are available to guide titration: http://www.ardsnet.org/tools.shtml
      iii. In younger children, maximal PEEP setting is 15 cm H_2O as higher PEEP can result in decreased cardiac output.
   b. *Permissive hypercapnia* ensuring adequate hemodynamics and a pH >7.15 may be tolerated
4. ***Proning.*** Evidence has shown that patients who are unable to adequately ventilate in the supine position may benefit from being placed in the prone position to improve oxygen saturation (PaO2), pulmonary mechanics, and arterial blood gases (ABGs). (45-49) Anecdotal reports from Italy have found that patients with COVID-19 usually respond well to early pronation.
5. Prone positioning requires proper sedation/pain medications and paralytic agents if necessary.
   a. Length of pronation cycle should be a minimum of 16 hours in the prone position with a return to supine positioning at least once a day.
   b. Prone positioning should be performed as clinically indicated within the first 24 hours of the diagnosis of severe hypoxemia.
   c. Recommend use of a manual proning protocol with coordination if mechanical beds are not available. **Appendix E** provides an example protocol, which was adapted from University Medical Center in Las Vegas, NV. Additional protocols (including videos) are available. (50)
   d. Pregnancy is *not* a contraindication for proning or neuromuscular blockade. (51)
6. ***Neuromuscular Blockade.*** In patients with moderate-severe ARDS (PaO2/FiO2<150), neuromuscular blockade by continuous infusion should **not** be routinely used, but may be considered in the setting of worsening hypoxia or hypercapnia and in situations where the patient's respiratory drive cannot be managed with sedation alone resulting in ventilator dyssynchrony and lung decruitment.
7. ***Airway suctioning.*** Use in-line catheters for airway suctioning and clamp endotracheal tube when disconnection is required (for example, transfer to a transport ventilator). Avoid disconnecting the patient from the ventilator, which results in loss of PEEP and atelectasis.
8. ***Bronchoscopy.*** Routine diagnostic bronchoscopy is **not** recommended. It is not necessary for the diagnosis of viral pneumonia and should be avoided to minimize aerosolization. Tracheal aspirate samples for diagnosis of COVD-19 are usually sufficient. If bronchoscopy is required for another reason, it should be performed with the same level of PPE as recommended for intubation.
9. ***Inhaled nitric oxide and prostacyclin.*** There is no evidence for routine use of inhaled nitric oxide, prostacyclin or other selective pulmonary vasodilators in acute respiratory failure. However, during emerging infectious disease outbreaks when resources are exhausted, inhaled nitric oxide and prostacyclin may be considered as a temporizing measure when patients develop refractory hypoxemia despite prone ventilation, or in the presence of contraindications to proning or ECMO.
10. ***Extracorporeal Membrane Oxygenation (ECMO).*** In settings with access to expertise in ECMO, consider referral of patients who have refractory hypoxemia despite lung protective ventilation who are otherwise appropriate candidates. For more information: https://www.elso.org/COVID-19.



https://emcrit.org/ibcc/COVID-19/#high_flow_nasal_cannula

https://i1.wp.com/emcrit.org/wp-content/uploads/2020/03/respsup.jpg?resize=713%2C600&ssl=1

MANAGEMENT OF CRITICAL ILLNESS AND COVID-19: PREVENTION OF COMPLICATIONS

Cardiovascular Disease (CVD)

Among 44,672 confirmed COVID-19 cases, those with cardiovascular disease (CVD), diabetes (DM) and hypertension (HTN) suffered from an increased case-fatality rate -10.5% for CVD, 7.3% for DM, 6.0% for HTN vs 2.3% overall. Furthermore, there several published reports suggesting SARS-CoV2 infection leading to exacerbation of CVD conditions, or CVD complications. (4, 35, 52)

1. ***Troponins and Basic Natriuretic Peptide (BNP) Evaluation.*** Elevated troponin is common (especially high sensitivity troponin), which is a strong predictor of mortality. Mild troponin elevation often does not represent a type-I (plaque rupture) myocardial infarction. Troponin value, velocity of change in troponin level, and echocardiographic imaging should guide the management of the elevated troponin, although current opinion advises that troponin and BNP should only be measured if clinical evaluation suggests acute coronary syndrome or heart failure. (53)
2. ***Electrocardiogram (ECG).*** Recommend ECG in suspected or acute coronary syndrome. May consider of obtaining from cardiac tele-monitoring screen.
3. ***Echocardiogram.*** An echocardiogram should only be ordered if it is likely to provide clinical benefit. Consider repeat echocardiograms only for clear change in clinical status. Point of Care Ultrasound (POCUS) exams may be used to screen/triage patients. Transesophageal

echocardiogram (TEE) requests should only be considered when no other alternative imaging modalities are available as the procedure may be aerosol producing.

4. ***Acute Myocardial Injury.***
    a. *Definition*: An algorithm for the interpretation of myocardial injury is provided for reference and is based on the 4th Universal Definition of Myocardial Infarction (http://www.onlinejacc.org/content/72/18/2231).
    b. *Incidence and Prognosis*: Recent reports found that 7-17% of hospitalized patients with COVID-19, have a combination of elevated cardiac biomarkers, in addition to electrocardiographic and echocardiographic abnormalities.(3, 4, 6) This myocardial injury appears to be a late manifestation (up to 14 days from illness onset).(4)
5. ***Myocarditis.***
    a. *Incidence*: In a case series of 150 patients with COVID patients, nearly 10% of deaths were attributed to myocarditis with circulatory failure, and in 33% of cases it was believed to have contributed as a mechanism for multisystem organ failure.(52) Currently, pericarditis has not yet been reported.
    b. *Diagnosis*: There is currently no role for endocardial biopsy. POCUS at initial evaluation to help protocol TTE. Serial TTE/POCUS only if it will impact management.
    c. *Management*: Supportive care depending on hemodynamic status. Case reports on different treatment strategies (glucocorticoid and IVIG) but none are validated by clinical trials.
6. ***Acute Coronary Syndrome.***
    a. *Incidence*: Based on available published data, there is a potential symptom overlap between acute coronary syndrome and COVID-19infection. (2)
    b. *Evaluation*: Goal is to differentiate acute plaque rupture, demand related ischemia or myocarditis. Recommendation is for cardiology consultation when unable to determine etiology.
    c. *Management*: Once the diagnosis of acute coronary syndrome is made, medical management should be coordinated with cardiology. ST-Elevation Myocardial Infarction (STEMI) Fibrinolytics protocols should be reviewed at each institution with cardiology to discuss care plans in the event of strained resources.
7. ***Cardiac Arrhythmias.***
    a. *Incidence*: Common CV manifestation in COVID-19 patients. Current cases series report an occurrence of unspecified arrhythmias in 17% of hospitalized patients with COVID-19 (44% of ICU patients vs 7% non ICU patients).(4) The new onset of malignant tachyarrhythmias in combination with acute myocardial injury should raise suspicion for potential underlying myocarditis.(2)
    b. *Management*: Follow ACLS protocols. Cardiology consultation.
8. ***Heart Failure and Cardiomyopathy.***
    a. *Incidence*: In a recent report it was observed that 23% of patients with COVID-19 had presentations consistent with heart failure. More frequently observed in patients who did not survive the hospitalization (51.9% vs 11.7%). (4) Fulminant cardiomyopathy can occur and is thought to be a late feature described in patients recovering from respiratory failure. Cardiogenic shock and cardiac arrest contributes to 7-33% of deaths. (52)
    b. *Mechanism*: SARS-CoV-2 is thought to infect host cells through ACE2 to cause COVID-19, while also causing damage to the myocardium, although specific mechanisms are uncertain. (54)
    c. *Management*: In the absence of high-grade AV block or unstable bradycardia, cardiogenic shock, or acute kidney injury (AKI), guideline directed medical therapies should be continued in patients with heart failure. Assessment of continuation of these therapies should be determined on a frequent basis depending on the patient's clinical status. The American College of Cardiology, Heart failure Society of America, and American Heart association published a joint statement at the time of this writing that recommends continuation of ACE-I/ARB therapy in patients withCOVID-19. (55)

Acute Kidney Injury

1. AKI requiring dialysis is reported in a subset of patients admitted to ICU.
2. The exact mechanism is unclear at this point, but AKI is present in ~7% of patients with pathology demonstrating acute tubular necrosis (a reflection of multiorgan failure). AKI correlates with an overall poor prognosis and seems to be the strongest predictor of mortality.

Nutrition

1. Oral and enteral routes of nutrition are preferred.
2. Post-pyloric feeding is preferred for critically ill and mechanically ventilated patients.
3. Energy supply should target. 25-30 kcal per kg body weight, the target protein content is 1.2-2.0 g/kg daily.
4. For elderly patients and/or those at high risk of aspiration or with abdominal distension, may give earlier consideration to parenteral nutrition.

Other

1. Implement the following interventions in Table 1 below to prevent complications associated with critical illness. These interventions are limited to feasible recommendations and are based on Surviving Sepsis or other guidelines and have been adapted from the WHO guidelines for COVID-19.

Table 3. Prevention of Complications

Anticipated outcome	Interventions
Reduce days of invasive mechanical ventilation	• Use weaning protocols that include daily assessment for readiness to breathe spontaneously • Minimize continuous or intermittent sedation, targeting specific titration endpoints (light sedation unless contraindicated) or with daily interruption of continuous sedative infusions
Reduce incidence of ventilator-associated pneumonia	• Oral intubation is preferable to nasal intubation in adolescents and adults • Keep patient in semi-recumbent position (head of bed elevation 30–45º) • Use a closed suctioning system; periodically drain and discard condensate in tubing • Use a new ventilator circuit for each patient; once patient is ventilated, change circuit if it is soiled or damaged, but notroutinely • Change heat moisture exchanger when it malfunctions, when soiled, or every 5–7 days
Reduce incidence of venous thromboembolism	• Use pharmacological prophylaxis (low molecular-weight heparin [preferred if available] or heparin 5000 units subcutaneously twice daily) in adolescents and adults without contraindications. For those with contraindications, use mechanical prophylaxis (intermittent pneumatic compression devices)
Reduce incidence of catheter-related bloodstream infection	• Use a checklist with completion verified by a real-time observer as reminder of each step needed for sterile insertion and as a daily reminder to remove catheter if no longer needed
Reduce incidence of pressure ulcers	• Turn patient every 2hours
Reduce incidence of stress ulcers and gastrointestinal (GI) bleeding	• Give early enteral nutrition (within 24–48 hours of admission) • Administer histamine-2 receptor blockers or proton-pump inhibitors in patients with risk factors for GI bleeding. Risk factors for GI bleeding include mechanical ventilation for ≥ 48 hours, coagulopathy, renal replacement therapy, liver disease, multiple comorbidities, and higher organ failure score
Reduce incidence of ICU-related weakness	• Actively mobilize the patient early in the course of illness when safe to do so

MANAGEMENT OF CRITICAL ILLNESS AND COVID-19: SEPTIC SHOCK & CARDIAC ARREST

Recognition of Septic Shock

1. Recognize septic shock in adults when infection is suspected or confirmed AND vasopressors are needed to maintain mean arterial pressure (MAP) 60-65 mmHg AND lactate is ≥ 2 mmol/L, in absence of hypovolemia. (40,56)
2. Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] < 5thcentile or > 2 SD below normal for age) or two or more of the following: altered mental state; bradycardia or tachycardia (HR < 90 bpm or > 160 bpm in infants and HR < 70 bpm or > 150

bpm in children); prolonged capillary refill (> 2 sec) or feeble pulses; tachypnea; mottled or cold skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.

3. Standard care includes early recognition and the following treatments within 1 hour of recognition: antimicrobial therapy, and initiation of fluid bolus and vasopressors for hypotension (Surviving Sepsis Guidelines). The use of central venous and arterial catheters should be based on resource availability and individual patient needs. Detailed guidelines from the Surviving Sepsis Campaign and WHO are available for the management of septic shock in adults and children.

Septic Shock Resuscitation

1. For septic shock in adults: give 250–500 mL crystalloid fluid as rapid bolus in first 15–30 minutes and reassess for signs of fluid overload after each bolus. (56)
2. For septic shock in children, give 10–20 mL/kg crystalloid fluid as a bolus as quickly as possible using a manual push and reassess for signs of fluid after each bolus. (57)
3. ***Avoid Excessive Fluid Resuscitation***. The cause of death from COVID-19 is most often ARDS and subsequent complications, which may be exacerbated by fluid administration. (2) Patients usually present with normal lactate and blood pressure, but some patients do suffer from superimposed bacterial septic shock. Conservative fluid therapy consistent with FACTT trial should be considered for patients with evidence of hypoperfusion and a history suggestive of total body hypovolemia (e.g. prolonged nausea/vomiting and diarrhea).(58) Consider use of point of care ultrasound (POCUS) to guide fluid resuscitation and prevent volume overload. If there is no response to fluid loading or signs of volume overload appear (e.g. jugular venous distension, crackles on lung auscultation, pulmonary edema on imaging, or hepatomegaly in children), then reduce or discontinue fluid administration. This step is particularly important in patients with hypoxemic respiratory failure.
4. Resuscitation endpoints include perfusion targets (e.g., MAP 60-65 mmHg in adults; urine output > 0.5 mL/kg/hr in adults or 1 mL/kg/hr in children; improved level of consciousness; and lactate).
5. In **pregnant women**, compression of the inferior vena cava can cause a decrease in venous return and cardiac preload and may result in hypotension. For this reason, pregnant women with sepsis and or septic shock may need to be placed in the left lateral decubitus position at 30 degrees to off-load the inferior vena cava.
6. Clinical trials conducted in resource-limited studies comparing aggressive versus conservative fluid regimens suggest higher mortality in patients treated with aggressive fluid regimens.
7. Do **not** use hypotonic crystalloids, starches, or gelatins for resuscitation.
8. Vasopressors should be administered when shock persists during or after fluid resuscitation to maintain MAP goal 60-65 mmHg.
9. If central venous catheters are not available, vasopressors can be given through a peripheral IV, but use a large vein and closely monitor for signs of extravasation and local tissue necrosis. If extravasation occurs, stop infusion. Vasopressors can also be administered through intraosseous needles.
10. If signs of poor perfusion and cardiac dysfunction persist despite achieving MAP target with fluids and vasopressors, consider an inotrope such as dobutamine.
11. Norepinephrine is considered first-line treatment in adult patients; epinephrine or vasopressin can be added to achieve the MAP target.
12. Angiotensin II (Giapreza) is a vasopressor that may provide benefit in vasodilatory refractory shock as a third-line agent. However, in a resource-constrained environment, this is an unproven costly therapy.
13. In children, epinephrine is considered first-line treatment, while norepinephrine can be added if shock persists despite optimal dose of epinephrine.

Rapid Response or Code Blue

1. A local Protected Code Blue Protocol should be developed for resuscitating COVID-19 patients that is peer-reviewed and based on the best available data and evidence. It should be updated based

on performance improvement data and experience.

2. Staff should be trained appropriately using high-fidelity simulation where possible.
3. Where it is necessary that the Rapid Response or Code Blue team attends, the following is recommended:
   a. PPE must be available that is equivalent to that used in ICU, therefore airborne precautions including an N95 mask.
   b. Entry to a patient's room should be limited to vital staff, which may mean a reduction in the Code Blue Team respondents.
   c. The patient should be assessed by the most senior medical staff available to determine appropriate management and disposition.
   d. If aerosol generating procedures (AGP) are required, these should ideally be performed in a negative pressure room, however, this needs to be balanced with the safety of transporting the patient.
   e. CPR is an AGP and we recommend all staff should wear airborne PPE including an N95 mask before commencing chest compressions. If available, an automated compressor device should be used to minimize required staff and exposure.
   f. If the patient is on a ventilator, keep the patient on a ventilator with an adjusted rate of 10 during CPR unless airway obstruction is suspected. If not intubated, consider placing a laryngeal mask airway (LMA) with a self-inflating bag, appropriate viral filter, and PEEP valve as intubation during an arrest will increase aerosolization of viral particles and increase the risk of spread.
   g. Avoid a prolonged code in patients that experience cardiac arrest who demonstrate signs of progressive cardiogenic shock or hypoxic respiratory failure.
   h. Focus on potentially reversible conditions (H's and T's): DOPE pneumonic for sudden hypoxia, identification and treatment of shockable rhythm, identification/treatment of tension pneumothorax. Consider use of portable ultrasound and obtain a blood gas.
   i. Equipment/medications that are needed in the room should be handled with attention to infection control best practices. If a specialized kit is not available, consider placing them through a crack in the door onto a bedside table in the room, but avoid physically handing it to code team personnel.
4. The following table identifies best practices based on a "Minimum, Better, Best" model, as the COVID-19 outbreak could ultimately result in limited resources based on observational data from other countries. The goal is to achieve all elements of each category, as "Good" equates with the minimum standard-of-care while "Best" equates with the most ideal condition.

Minimum-Better-Best Paradigm for Limited Code Blue

	Minimum	Better	Best
Advance Directives	Discuss & document with every patient's medical power of attorney (MPOA) if patient unable to speak for self	Discuss & document with every patient; Involvement of Palliative Care for high risk	Develop a script for clinician that incorporates unique circumstances & ethical considerations if worsening pandemic. Ideally, there are DNRs for those who might code due to refractory cardiogenic shock or respiratory failure
Alert mechanism	Educate current Code Team members about who should respond to "Overhead Code Blue" to COVID patients	Early activation	Directed announcement ONLY to COVID Code Team
PPE / Precautions	Droplet for room; Minimize door opening	Airborne/Negative ISO; Infection Control Gatekeeper; Door remains closed	Use of PPE Checklist; PAPR
Communication (via PAPRs or individuals outside room)	Whiteboard for written instructions; Closed-loop	Speakerphone in room; Vocera; Gatekeeper	Personal communication devices; VA Video Connect (tablets)
CPR	Rotate 2 individuals who don't leave room	Rotate 2 individuals who don't leave room and accomplish multiple tasks based on pre-established priorities	Automated compressor device (e.g. LUCAS) (outside room) for high risk patients

IV access	Two standard functioning PIVs for all COVID patients	Tibial IO (if needed)	Early placement of central access before potential arrest
ACLS Equipment	Dedicated Code Cart for COVID ICU and wards; Accounting for Code Carts to ensure appropriate backups	For high-risk patients: consider early placement of defib pads in room or on patient, or prepositioning the Code Cart outside patient room	Specialized cart/kit containing appropriate meds, modular packs of equipment, and designated defibrillator; Dedicated COVID ward: US, EKG machine, portable CXR
Airway	Non-rebreather mask immediately over patient mask *OR* BVM with viral filter and ETCO2	Place LMA for non-intubated patients. For intubated patients, either leave on vent (if good chest rise, +ETCO2) or troubleshoot with DOPE pneumonic	Early intubation BEFORE arrest occurs
Simulation/Practice	Ongoing review and regular familiarization with Protected Code Blue policy; Development of "Mock COVID Code Blue"	One-time practice with all members of the COVID response teams	Regular practice and policy updates to all members of the COVID response team

Patient Transport

1. If COVID-19 is widespread in the community, surgical masks should be considered for ALL patients irrespective of COVID-19 status.
2. The movement of patients with COVID-19 should be limited with all efforts made to ensure the patient is initially admitted to the appropriate location.
3. If patient transport is necessary:
    a. Non-intubated patients should be transferred wearing a surgical mask over their oxygen delivery device which may include nasal prongs or a non-rebreather mask up to 15 L/min.
    b. Staff should wear airborne PPE.
    c. Once a patient is admitted to the ICU, transport outside of the ICU should be limited. If transport is required, then coordination should occur to ensure safety standards are maintained.
    d. Hallways must be cleared where possible and only essential staff should accompany the patient. Staff not involved in the transfer should not come within 6 feet of the patient.
    e. Intubated patients should have closed circuits with a viral filter in situ.

ADJUNCTIVE THERAPIES FOR COVID-19: TREATMENT PROTOCOLS

Note: *All therapies are investigational and none are proven as the literature is evolving quickly.* ***There are no specific therapeutics approved by the FDA to treat people with COVID-19.*** None can be routinely recommended for use outside of a randomized clinical trial. Additionally, there is no evidence for use of the following medications for outpatients or mildly ill patients. Use of these resources for that purpose should be discouraged through prescribing restricted to critical care, infectious disease, or rheumatology physicians.

Ethics of Clinical Research during a Pandemic

There are no US Food and Drug Administration (FDA)-approved drugs specifically for the treatment of patients with COVID-19. There is genuine uncertainty in the expert medical community over whether proposed off-label and investigational treatments are beneficial. Randomized, placebo-controlled trials (RCT) are the gold standard for determining if an experimental treatment can benefit patients. Some may question whether it is ethical to deprive patients of an agent that could potentially prevent or treat COVID-19, given the high mortality rate among critically ill patients and lack of known and available treatment options. A Committee of National Academies of Science, Engineering, and Medicine reviewed and conducted an analysis of the clinical trials conducted during the 2014–2015 Ebola virus disease outbreak in West Africa and found the that the RCT was an ethical and appropriate design to use, even in the context of

the Ebola epidemic. The position of "equipoise"—genuine uncertainty in the expert medical community over whether a treatment will be beneficial—"is the ethical basis for assigning only some participants to receive the agent. If the relative risks and benefits of an agent are unknown, participants who receive the experimental agent may receive a benefit or may be made worse off. Providing the experimental agent to all would expose all participants to potentially harmful effects." (59)

Steroids

1. There is a strong consideration to avoid routine steroids based on early data out of China as well as other studies related to Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV) which have shown that steroids actually delay viral clearance. (60)
2. However, new consensus guidelines recommend considering steroids for intubated COVID-19 patients with ARDS. (40)
3. Steroids may be indicated for vasopressor-refractory shock, asthma, COPD exacerbation, or for antenatal therapy at risk for preterm birth from 24-34 weeks of gestation.

Remdesivir

1. Remdesivir is an investigational intravenous drug with broad antiviral activity that inhibits viral replication through premature termination of RNA transcription and has in-vitro activity against SARS-CoV-2 and in- vitro and in-vivo activity against related betacoronaviruses. It has been tested in humans against Ebolavirus disease, where it was not found to be superior to other therapies in the PALM RCT. (61) It has shown promise in vitro and in animal models for coronavirus infection.(62-64)
2. National Institute of Allergy and Infectious Diseases (NIAID) is leading a multicenter adaptive design randomized placebo-controlled trial of candidate therapies for COVID-19, initially focused on comparing Remdesivir to placebo "A Multicenter, Adaptive, Randomized Blinded Controlled Trial of the Safety and Efficacy of Investigational Therapeutics for the Treatment of COVID-19 in Hospitalized Adults." MAMC, NMCSD, BAMC, NMCP and WRNMMC MTFs are participating sites through IDCRP. Potentially eligible candidates are adult DoD Health Care Beneficiaries meeting inclusion criteria (SARS-CoV-2 positive with evidence of pneumonia with oxygen saturation of ≤94% on room air or requiring supplemental oxygen or mechanical ventilation). Exclusion criteria include alanine aminotransaminase (ALT) or aspartate aminotransaminase (AST) levels >5 times the upper limit of normal, stage 4 severe chronic kidney disease or a requirement for dialysis [i.e., estimated glomerular filtration rate (eGFR) <30]. (https://clinicaltrials.gov/ct2/show/NCT04280705)
3. Gilead has two Phase 3 randomized open-label trials of remdesivir (5-days versus 10-days versus standard of care) open to enrollment for adults with COVID-19, radiographic evidence of pneumonia and oxygen saturation of ≤94% on room air (severe disease: https://clinicaltrials.gov/ct2/show/NCT04292899) or >94% on room air (moderate disease: https://clinicaltrials.gov/ct2/show/NCT04292730). Exclusion criteria include ALT or AST levels >5 times the upper limit of normal, participation in another clinical trial of an experimental treatment for COVID-19, requirement for mechanical ventilation, or creatinine clearance <50 mL/min..
4. Remdesivir is potentially available under compassionate use from Gilead for patients with clinical pneumonia: compassionateaccess@gilead.com. From Gilead's website; "Compassionate use requests must be submitted by a patient's treating physician. Gilead is currently assessing requests on an individual basis and require, at a minimum, that the patient be hospitalized with confirmed COVID-19 infection with significant clinical manifestations."
5. USAMMDA Force Health Protection Division has established an expanded access treatment IND with a limited number of treatment courses of Remdesivir for Active Duty Service Members CONUS/OCONUS (and Federal civilian and contract employees deployed OCONUS while in support of operational forces) meeting inclusion criteria. "Intermediate-Size Patient Population Expanded Access Protocol for Treatment of Coronavirus Disease 2019 (COVID-19) with Remdesivir." Clinicians should contact USAMMDA FHP Division to determine eligibility to receive product, 24-hour international telephone: +1-301-401-2768.

Chloroquine (CQ) and Hydroxychloroquine (HCQ)

1. These drugs have been widely used as anti-malarial treatment and prophylaxis and to treat autoimmune conditions.
2. BLUF: No high-quality evidence exists to support use at present. *Potential toxicities include QTc prolongation and risk forarrhythmias*.
3. In vitro studies have reported antiviral activity against SARS-CoV and more recently against SARS-CoV-2. Mouse studies for SARS-CoV demonstrated improved lung pathology without reduction in viral titers; similar animal studies for SARS-CoV-2 have not yet been completed. Recent studies conducted in China indicate in vitro activity of these agents against SARS-CoV-2, and a small survey in French patients showed reductions in viral load. An additional preliminary report on chloroquine clinical activity was released by investigators in China, but detailed information is pending. (64-67) Both CQ and HCQ concentrate in the lung. Optimal dosing needed to reach adequate concentrations in lung tissue for treatment of COVID-19 are unknown; modeling has suggested high doses might be required.(67) Despite showing in vitro antiviral activity, prior clinical trials demonstrated no benefit of CQ against other viral infections such as dengue virus, chikungunya, influenza, and HIV, though none investigated the use of chloroquine for coronavirus infection.(68-71) In a non-human primate study, hydroxychloroquine appeared to paradoxically enhance chikungunya infection.(72)
4. A report of 20 treated COVID-19 patients who received HCQ alone and in combination with azithromycin suggested that treatment was associated with viral load reduction over 6 days, compared to a nonrandomized control group, and were more pronounced in patients who received the combination; clinical impact was not assessed and methodologic issues limit the strength of the observation.(73) A brief report of a Chinese study of 100 COVID-19 patients suggested clinical improvement ("improved lung images, time to viral negative conversion, and shortening of disease course") with CQ or HCQ treatment versus an unspecified control; methodologic details were absent from the report, limiting the strength of conclusions.(74) If these comparisons are substantiated after availability of adequate additional data, this would be the first time chloroquine or hydroxychloroquine was found to be effective for the clinical management of a viral infection.
5. Several clinical trials have been initiated or are planned to study CQ and HCQ for treating and preventing COVID-19. Significant off-label use is occurring overseas and in some US hospitals.
6. A variety of dosing regimens have been reported in use, including: Hydroxychloroquine 400 mg PO BID x 1 days, then 200 mg PO BID x4 days.

Lopinavir/Ritonavir

1. Coronavirus cellular infectivity and replication are dependent on virally-encoded and cellular protease activity. Clinically used protease inhibitors effective for HIV and HCV infection have been examined for potential utility in treatment of SARS, MERS, andCOVID19.
2. Unconfirmed media reports from China suggested this combination to be effective for COVID-19 treatment. However, on 18 March 2020, RCT results were reported that found no benefit in patients who received lopinavir/ritonavir compared to standard care for treatment of severe disease. (75-77)
3. Do not use in combination with amiodarone (fatal arrhythmia), quetiapine (severe coma), or simvastatin (rhabdomyolysis).

Host-directed anti-inflammatory strategies

ARDS and sepsis, life-threatening downstream complications of COVID-19, and many other infectious and non-infectious conditions, remain significant unmet therapeutic gaps. Historically, numerous anti-inflammatory and anti-cytokine agents, as well as many other drug candidates, have been tested and failed to meaningfully affect morbidity and mortality in ARDS, sepsis and/or septic shock.

Anti-IL6 monoclonal antibodies

1. A variety of therapies are being administered to severely ill patients in China and elsewhere. One that is

receiving substantial attention currently is an anti-IL6 receptor humanized monoclonal antibody, tocilizumab (Actemra®), which was added to the treatment guidelines published by China's National Health Commission (4 Mar 20) to treat serious coronavirus patients with lung damage.

2. Tocilizumab and sarilumab are licensed in US for treatment of giant cell arteritis, rheumatoid arthritis, and cytokine release syndrome following CAR-T therapy. They carry a black box warning for risk of severe, potentially fatal, infections.
3. No high-quality evidence currently exists to support use. Some reports from China have suggested elevated IL6 levels are associated with severe disease in COVID19 infection, though other reports have not found the same association. Tocilizumab has been used in Italy according to anecdotal reports and an unpublished uncontrolled case series from China treated 21 hypoxemic patients with tocilizumab 400 mg IV x1 and reported improvement in respiratory parameters. (38, 78)
4. Manufacturer-supported US randomized controlled trials of tocilizumab and sarilumab are setto launch as of 20 March 2020.

Several additional agents are under investigation and information is expected to emerge rapidly. Discernment of benefits and harms from novel therapies will require diligent attention to quality of evidence reported. The American Society of Health-System Pharmacists last updated their Assessment of Evidence for COVID-19-Related Treatments on 21 March 2020, which can be found here: https://www.ashp.org/-/media/assets/pharmacy-practice/resource-centers/Coronavirus/docs/ASHP-COVID-19-Evidence-Table.ashx?la=en&hash=B414CC64FD64E1AE8CA47AD753BA744EDF4FFB8C.

CARING FOR SPECIAL POPULATIONS: Pregnancy, Nursing Mothers, Infants, Children, and the Elderly

Caring for Pregnant Women with COVID-19

1. Limited information on the effects of COVID-19 for pregnant women exist in the current literature and limited to 2 case series including 18 pregnant women. This small series showed severe respiratory morbidity in 1/18 cases. Clinical findings were similar in cases of non-pregnant adults. Pregnant women experience immunologic and physiologic changes that make them more susceptible to viral respiratory infections. Pregnant women might be at greater risk for severe illness, morbidity, or mortality compared with the general population, as is observed with other related coronavirus infections. Pregnant women should receive the same care as those who are not pregnant in regard to screening, radiology studies, laboratory evaluations and critical care.
2. American College of Obstetricians and Gynecologists (ACOG) and Society for Maternal-Fetal Medicine (SMFM) algorithm for outpatient assessment and management for pregnant women with suspected or confirmed novel coronavirus (COVID-19). https://www.acog.org/-/media/project/acog/acogorg/files/pdfs/clinical-guidance/practice-advisory/covid-19-algorithm.pdf?la=en&hash=2D9E7F62C97F8231561616FFDCA3B1A6
3. Case series suggest no evidence of vertical transmission, similar to other viral respiratory illnesses, such as influenza. (79)
4. Preterm delivery has been reported. Some cases were iatrogenic and not due to spontaneous preterm labor. No neonatal deaths have been reported. (79)
5. Patients confirmed with COVID-19 in pregnancy or deemed persons under investigation should be considered for enrollment in the Pregnancy Coronavirus Outcomes Registry (PRIORITY) (https://priority.ucsf.edu/).
6. **Admission**: Patients with suspected or confirmed COVID-19 should be admitted to a unit capable of caring for the respiratory needs of the patient as well as provide appropriate fetal monitoring as clinically indicated. Patient should be in isolation per hospital and CDC guidance.
7. **Guidance for treatment**: Aggressive infection control, testing for COVID-19, testing for co-infection, oxygen therapy as needed, avoidance of fluid overload, empiric antibiotics (due to risk

of superimposed bacterial risk), fetal and uterine contraction monitoring, early mechanical ventilation for progressive respiratory failure, individualized delivery planning, Maternal Fetal Medicine consultation, Pulmonology, Critical Care and Infectious disease involvement as indicated. Team based management is recommended. Consider early transfer of care to higher level facility if unable to provide services at MTF. (80) If a pregnant patient is admitted to an ICU for worsening pulmonary status, a Maternal Fetal Medicine consultation should be made.

8. **Imaging**: With few exceptions, radiation exposure through radiography, computed tomography (CT) scan, or nuclear medicine imaging techniques is at a dose much lower than the exposure associated with fetal harm. If these techniques are necessary in addition to ultrasonography or MRI or are more readily available for the diagnosis in question, they should not be withheld from a pregnant patient. The use of gadolinium contrast with MRI should be limited; it may be used as a contrast agent in a pregnant woman only if it significantly improves diagnostic performance and is expected to improvefetal or maternal outcome. (81)
9. **Delivery**: Delivery should be reserved for maternal and fetal indications. Recommend health care team wear appropriate PPE during delivery and delivery should be in a negative pressure room. For women infected in the third trimester who recover, attempts to postpone delivery until a negative test result or quarantine status is lifted. This will minimize risk of transmission to the neonate.
10. **Cesarean section**: Cesarean section should be reserved for maternal and fetal indications. Recommend operating room with negative pressure isolation.
11. **Antenatal surveillance**: Gestational age appropriate fetal monitoring should be part of the initial assessment of any women with respiratory symptoms and continuous fetal monitoring should be provided for any critically ill pregnant woman.
12. **Ultrasound**: Given how little is known about the natural history of COVID-19, mid-trimester ultrasound assessment may be considered following first or second trimester infection exposure. Third trimester growth assessment is reasonable to consider for later second trimester and third trimester infections.
13. **Follow up after diagnosis of COVID-19**: Patients should be treated according to symptom severity and admitted to the hospital if vital signs are abnormal or symptomatic support is indicated. When patient is discharged from the hospital a plan for follow up should be established. In non-pregnant patients with COVID-19 pneumonia there is evidence that respiratory status can worsen up to a week after symptoms initially presented. For that reason close follow up with patients via phone triage should be performed. If patients symptoms worsen arrangements should be made for patient to be seen by a health care provider to assess clinical status.
14. **Postpartum care**: Postpartum patients with COVID-19 should be isolated from other patients in a postpartum isolation room. Breastfeeding is encouraged. CDC recommends that temporary separation of mother and newborn to avoid exposure of the newborn to COVID-19. (https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcareguidance.html). Women who intend to breastfeed should be provided a dedicated breast pump to express breast milk. There is no evidence of virus transmission in breastmilk. (79) Discussions prior to delivery surrounding the possibility of early separation of mother and infant to avoid post-partum transmission. Considerations can be made to delay delivery to prevent unnecessary exposure to neonate but ultimately delivery timing should be made based on maternal and fetal indications.
15. Hospitals should develop a local plan for appropriate locations where COVID-19 positive patients can come to receive care to assure appropriate prenatal care is delivered to the patient and to minimize risk of exposure to the virus of other patients and health care workers. Pregnancy care should be considered non-elective.

Caring for Infants and Mothers with COVID-19: IPC and Breastfeeding

1. Vertical transmission does not appear to occur, but perinatal infection leading to severe manifestations has been documented. It is unknown whether newborns with COVID-19 are at increased risk for severe complications, but transmission after birth via contact with infectious respiratory secretions is aconcern. (82)

2. In addition to face mask and hand hygiene, consider temporarily separating a symptomatic PUI or COVID-19 mothers from her baby (e.g. separate rooms) depending on clinician judgement and individual circumstances. This carries risks as well (e.g. delayed maternal-child bonding, poor breastfeeding relationship, etc.).
3. COVID-19 positive postpartum mothers as well as postpartum PUIs will be counseled about the risks and benefits of colocation vs. separation.
4. Postpartum patients who elect to co-locate (also referred to as 'rooming in') with their infants will be encouraged to wear a facemask and gloves and to practice hand hygiene before each feeding. They will also be encouraged to wash any skin that may come in contact with the infant (e.g. breasts, chest, arms, etc.). They will be encouraged to limit other close contact with the infant(s) and a separate non-infected caregiver should be present to help care for the infant. This separate non-infected caregiver should perform a majority of the infant's care. While not breastfeeding, infants should be kept greater than 6 feet away from the mother within the room, per CDC guidance.

Pumping / Expressed Breast Milk (83)

1. Mothers who wish to breastfeed should be provided with a dedicated breast pump. (https://consultqd.clevelandclinic.org/managing-pregnancy-during-the-covid-19-pandemic/)
2. Postpartum patients who are pumping should follow CDC guidelines on equipment use and feeding.
3. Collecting Milk:
    a. Wipe the surface where syringes/bottles will be placed after collection with a germicidal disposable wipe, and cover surface with clean paper towel or cloth.
    b. Mother will wash hands and breasts before use and cleaning equipment before and after use. Mother will wear a mask while pumping.
    c. Mother collects breast milk by hand or by pump into clean syringes or bottles then ensures syringe/bottle cap is secured. The outside of the container will be wiped with a germicidal disposable wipe. A label in then placed to identify date, time, and patient.
    d. Transport and storage of breast milk from isolation room to common refrigerated storage should follow strict infection control procedures per hospital policy.

Infants

1. Infants born to mothers with confirmed COVID-19 should be considered PUIs.
2. All infants born to mothers with suspected or confirmed COVID-19 should be bathed immediately following delivery.
3. These infants should be tested for COVID-19 before hospital discharge. Prior to discharge, inpatient providers will directly discuss care of the infant with the follow-up provider.

Neonatal Intensive Care Unit (84)

1. COVID-19 positive postpartum mothers and their household contacts should not be allowed to visit in the NICU.
2. Any infant who has symptoms that meet criteria for NICU admission will be assessed by the NICU team and admitted to a COVID-19 cohort pod or other segregated section of the unit.
3. COVID-19 positive postpartum mothers and their household contacts will not be allowed to visit in the NICU.
4. For care teams assigned to infants requiring CPAP, SiPAP or undergoing aerosolizing procedures such as intubation, full PPE including N95 (or PAPR), eye shields, gown, hair cover, and gloves should be worn when caring handling the infant.
5. Patients requiring nasal cannula or those who are intubated on mechanical ventilation (closed circuit) require contact/droplet precautions when handling to include surgical mask, gown, hair cover, and gloves.
    a. Per WHO guidance for clinical management of COVID-19, "newer high-flow nasal

cannula (HFNC) and non-invasive ventilation (NIV) systems with food interface fitting do not create widespread dispersion of exhaled air and therefore should be associated with low risk of airborne transmission." These patients could be cared for with contact/droplet precautions only (to include facemask) but could consider N95 (or PAPR) if readily available.

Visitation

1. No visitors experiencing symptoms of a respiratory infection, such as fever, cough, shortness of breath, or sore throat; and contact in the last 14 days with someone with a confirmed diagnosis of COVID-19 is allowed in any health care facilities, residential care facilities, congregate care facilities, and juvenile justice facilities.
2. For NICU: A partner and doula may accompany the mother, if they pass the health evaluation
3. For Labor and Delivery: each laboring COVID-19 positive or PUI mother will be allowed to have a partner and doula with her who must remain with her throughout her admission (to include in post-partum recovery). The partner and doula should only be allowed in areas on the hospital necessary to support birth.
4. For post-partum / newborn nursery: each COVID-19 positive or PUI postpartum mother may be allowed to have a partner and doula with her who must remain with her throughout the admission. The partner should be isolated to the post-partum room and not be traveling elsewhere within the hospital.
    a. If the mother chooses to co-locate with the infant, her partner will be encouraged to help with the infant's care.
    b. If the mother chooses to be separated from her infant, the partner may help with the infant's care when they are brought to the room.
    c. Newborns who are PUIs are not eligible for elective circumcision.

https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcare-guidance.html University of Washington Handling of Breast Milk of COVID-19 Mothers

Caring for Children with COVID-19

1. Children (0-18 years) with COVID-19 are more likely to remain asymptomatic or have mildly symptomatic disease. Severe symptoms requiring admission for supplemental oxygen have been described in up to 10% of symptomatic children, particularly those under the age of 5, with the highest risk in those under 12 months of age. The mortality rate appears to be extremely low: one study out of China reported only one death in 2,143 pediatrics patients. (85)
2. The intersection with chronic pediatric respiratory conditions such as asthma, cystic fibrosis, and chronic lung disease, and with the attendant increased risk of severe disease, is unknown.
3. Respiratory virus co-infections and secondary bacterial infections are possible.
4. During periods of community transmission and in the absence of targeted therapy for mild and moderate disease, the decision to test children for SARS-CoV-2 is driven by resource availability, infection prevention and control principles, and epidemiologic contact tracing or hot-spot case finding.
5. Pediatric symptoms, if present, are similar to common viral respiratory infections with a majority of symptoms affecting the upper airway. This differs from adults, who tend to have lower respiratory symptoms most prominent. (13,85)
    - Fever 80-95% – majority <24 hr duration
    - (Dry) cough 45-80%
    - Myalgias or fatigue 10-45%
    - Pharyngitis 10-40%
    - Rhinorrhea and/or congestion 10-30%
    - Diarrhea 10-20%
    - Dyspnea or hypoxemia 5-10%
6. Most labs are normal to include inflammatory markers (ESR, CRP, procalcitonin), chemistries, kidney

and hepatic function. White blood cell count is typically normal but may be low.

7. If abnormal imaging, CXR will have non-specific increased lung markings or patchy infiltrates. Chest CT shows ground glass opacities.
8. Treatment of severe disease remains supportive, to include critical care interventions as required. Enrollment in clinical trials, or compassionate use of experimental therapies, should be considered for children with severe disease just as they would be for severely affected adults. There is no evidence to suggest that prophylaxis is necessary or effective for the majority of children.
9. Children appear to efficiently shed the virus, even if asymptomatic. Viral load is detectable in respiratory secretions for up to 2 weeks and in stool for up to 4 weeks. (86,87)
10. Given the prolonged duration of shedding of respiratory viruses in children, during periods of community transmission of SARS-CoV-2, it may be prudent to assume symptomatic children are infected, unless proven otherwise from an infection control standpoint - an issue particularly relevant to caregivers from vulnerable risk populations.

Caring for Older Persons with COVID-19

1. COVID-19 can result in severe disease and death among older adults. Early data from China suggest that a majority of deaths have occurred among adults aged ≥60 years especially those with underlying health conditions. In the United States, mortality rates in patients above age 85 have ranged 10-27%, and 3-11% among patients 65-84 years. (36)
2. Ensure that care for the older adult and severely ill is in keeping with their goals of care, advance directives and patient and family wishes.
3. Conversations regarding goals of care should continue to be part of routine care.
4. Patients should be informed about their condition, and, if desired, their prognosis, in a way that is easy to understand.
5. If the patient is unable to communicate meaningfully, ensure that a surrogate decision maker or health care agent has been identified in accordance with state law based on facility location.
6. Symptom management: Aggressive control of symptoms such as pain, dyspnea or other bothersome symptoms relieves unnecessary suffering and is therefore crucial for all patients regarding of age, function, comorbidities and prognosis.
    a. Pain
        - Acetaminophen should be used first, typically 500mg every 6 hours as needed.
        - If acetaminophen is insufficient, start an opiate (drug, dose, route, and frequency should be individualized and based on symptom severity, kidney/liver function and prior opiate exposure). Consider local supply in drug selection to mitigate risk of drug shortage.
        - Start a stimulant laxative, if prescribing an opiate to prevent constipation.
    b. Dyspnea
        - If providing supportive care and supplemental oxygen is ineffective for management of severe dyspnea, a low-dose opiate may be used to help alleviate symptoms.
    c. All providers should be able to provide basic symptom management, routine discussions about code status and goals of care in patients that are seriously ill.
    d. If complex symptom management, difficult discussions about code status, and care goals arise, consider consultation from a palliative medicine subspecialist if available at your institution.
7. Compassionate extubation in the setting of comfort oriented care or the actively dying patient should be considered a medical procedure similar to ventilator initiation and follow a specific plan as removal of the ventilator can cause discomfort.
8. When resources become scarce:
    a. Principles for guiding health care resource rationing during a pandemic has been

described using the following values: maximize benefits, treat people equally, promote and reward instrumental value, and give priority to the worst off. Additional guidance is available in Fair Allocation of Scarce Medical Resources in the Time of Covid-19

b. Decisions regarding allocation of resources should be made at local, regional, state or federal levels.
c. Providers should avoid discussing rationing care at the bedside and should continue to provide compassionate care for the individual patient.
d. Age and comorbidities should not be a factor for provision of care for older adults.
e. Individual decisions and institutional policy regarding allocation of resources should be discussed in an interdisciplinary fashion and include input from stakeholders such as palliative medicine and healthcare ethics experts.
f. Institutional policy should be frequently reevaluated given the rapidly evolving nature of this crisis.
g. Institutional Clinical Ethics Committees should work closely with palliative medicine services to review process and decision making in resource scarce environments. (88)

SURGICAL CONSIDERATIONS FOR PERSONS WITH COVID-19

Perioperative Care of COVID-19+ Patients and PUIs

Overview.

1. For purposes of surgical care, patients will be treated as presumed COVID-19 positive if they have symptoms/exposure history that warrants testing or are unable to provide information (obtunded or unable to communicate for any reason, poor historians, etc.). Any surgical patients that fall into the PUI category should be medically managed to the greatest extent before proceeding with surgery in an attempt to delay until confirmatory testing. Optimally, an OR or cluster of ORs should be predesignated with a distinct antechamber to maintain separation from non COVID patients. If negative pressure ORs aren't available, consult with facilities to ensure air handling is routed through HEPA filters.
2. All patient interaction will be performed with enhanced droplet precautions:
    - N95 respirator or PAPR
    - Eye protection- goggles, face mask (OR face shields/masks worn over N95), or plastic disposable wrap-around glasses. Eyeglasses are not adequate.
    - Gown, gloves, hair cover, shoe covers
3. Remove all PPE and place in a biohazard bag before exiting the room EXCEPT N95 mask.
4. Patients on the ward should be transported directly to the OR by the anesthesia team, similarly to an ICU patient. If assistance is needed with transport, every attempt should be made to use someone from the care team (nurse, surgeon, tech) to minimize exposure.
5. When transporting a ventilated patient, ensure an HME/HEPA filter is placed between the endotracheal tube and the Ambu bag. Hook the Ambu bag up prior to opening the door in the negative pressure room and ensure the door is closed when returning the patient and switching to the ventilator. The same filter may also be used on the exhalation loop of the anesthesia machine- do not throw it away.

In the OR

1. Make every attempt to take out all necessary meds and equipment from the carts prior to bringing patient into the room. It's better to waste a few meds and equipment instead of contaminating the cart.
2. Routine breaks for anesthesia providers should be avoided to limit exposure and conserve supplies. Cell phones should be left outside the OR to eliminate accidental contamination. Ensure help may be obtained using the OR phone.
3. Continue to wear full PPE for the duration of the case.

Intubation

1. If a negative pressure OR is unavailable, consider intubating the patient in a negative pressure room and transporting to the OR after intubation.
2. Consider video laryngoscopy.
3. Rapid Sequence Intubation should be performed when at all possible to avoid mask ventilation due to increased aerosolization of secretions.
4. Ensure HME/HEPA filter is on the exhalation limb or at the Y-piece (sampling line should be post filter).
5. Double glove and immediately remove outer glove after the airway is confirmed secure. Outer gloves may be used to wrap disposable portions of airway equipment after use. Consider, at a minimum, using hand sanitizer on inner gloves or exchange with new gloves.
6. Intubation and extubation generate a transient, significant droplet load for the room. Ensure all non-essential personnel are given the chance to leave the room if possible before performing the procedures.
7. Any external equipment (US machine, GlideScope, etc) needed for the case should be draped to the greatest extent possible and NOT REMOVED until the room is terminally cleaned.
8. ICU patients will recover in the ICU and floor patients should be taken to a negative pressure room in the PACU. If a negative pressure PACU room isn't available, use the ICU as a recovery room if bed space allows. Extubating in a PACU negative pressure or ICU room if necessary. If extubating in the OR, place a regular OR mask on the patient prior to transport to the PACU or ICU. If you elect to extubate a patient in the ICU rather than the OR, the anesthesia team should maintain responsibility for the patient until stable for routine handoff.
9. The ASA continues to update its website and has relevant links: https://www.asahq.org/in-the- spotlight/coronavirus-covid-19-information

Surge Capacity, Staffing, and 'Elective Surgery'

General guidelines to manage capacity, case mix, and staffing during a prolonged COVID response follow:

a. Executive Order 2020-17 temporarily restricts non-emergency medical and dental surgeries and procedures. When there are questions or controversies whether or not a surgical procedure is elective, the time sensitivity and/or medical necessity should be determined at the local level, preferably the Department of Surgery Chief.
b. ICU, inpatient ward, PACU and ambulatory capacity, staff availability, and OR supply chain capacity, need to be continuously assessed by perioperative leaders with the site-specific leadership. Classification of cases should be based on operative capacity (available, constrained, or none) as well as patient needs and adjusted based on the above assessment.
c. For emergency operation on a COVID-19 positive patients, treat these as aerosol generating procedures throughout the operative period (including intubation). Such cases should be performed with airborne precautions (N95 with face shield or PAPR) and preferably in a negative pressure room.

TELEMEDICINE SUPPORT DURING THE COVID-19 PANDEMIC

1. Telemedicine encompasses a set of tools that leverage information and communication technologies to most commonly extend medical care across geographic distances and boundaries. These same tools have a significant and unique potential to support care delivery during an infectious pandemic in order to decrease healthcare worker exposure to contagion (i.e. "clinical distancing"), reduce the usage of consumable PPE, while also enabling continued medical care delivery for non-infected patients while in their home. Accordingly, the CDC now

recommends the liberal use of telemedicine during the COVID19 Pandemic (https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/guidance-hcf.html).

2. Telemedicine can be provided through two primary mechanisms
    a. Direct-to-patient where the health care provider examines the patient in real-time, interactive audio or visual (or both) telecommunication system and the patient interacts with the offsite health care professional at the time the services are provided.
    b. Tele-Consultation. Services delivered in this manner may occur using telephonic (audio) only service delivery.

EMERGENCY MANAGEMENT SERVICES AND GROUND TRANSPORT OF PERSONS WITH COVID-19

Michigan has developed specific Emergency Protocols related to Emergency Medical Services (EMS) to facilitate identification and safe treatment and transport of patients with suspected COVID-19 infection during the COVID-19 pandemic. Dispatch centers have incorporated COVID-19 screening questions into their Emergency Medical Dispatch (EMD), but it is acknowledged that EMS may encounter patients that have not been pre-screened. In addition to screening and treatment protocols, several other protocols have been developed to meet the challenges associated with the requirement for COVID-19 crisis standards of care.

Michigan Emergency EMS Protocols for COVID 19 include:

- Destination and transport of patients at risk for coronavirus disease (covid-19)
- Personal Protection During Treatment of Patients at Risk for Coronavirus Disease (COVID-19) and Decontamination of Equipment after Use
- Telemedicine and stationary treatment of low acuity patients during covid-19 outbreak
- Specimen Collection for COVID 19Privileging and participating facilities release during covid-19 response
- Clinical treatment for patient with suspected covid-19 crisis standards of care
- Cardiac arrest in a patient with suspected covid-19 crisis standards of care

Strained EMS Response due to Increased 911 Calls/Requests

1. EMS systems may be stressed due to an influx of 911 calls due to known or suspected COVID-19 transmission or infection. In areas with limited EMS resources overwhelmed by 911 call volumes, the following should be considered:
    a. EMS and/or Fire Dispatch should triage 911 calls and prioritize responses accordingly (e.g. if a patient calls reporting signs and symptoms consistent with COVID-19, but denies respiratory distress and other complaints suggestive of a life-threatening condition (i.e. chest pain, etc.), ambulance services should be directed to an alternative, higher-acuity call.
    b. The Telehealth protocol may be utilized as appropriate to obtain medical control guidance in taking patient to an alternate destination such as urgent care, or treating in place.
    c. If EMS arrives on scene and determines that a patient does not have a life-threatening complaint (relating to the potential exposure or signs and symptoms of COVID-19), and other 911 calls are pending a response, EMS crews should follow the Refusal of Care Protocol Refusal of transport is not appropriate when call volumes are low.

Personal Protective Equipment (PPE) for Emergency Medical Services Personnel

1. EMS personnel providing care for a patient with possible COVID-19 infection should utilize the following recommended PPE:
    a. N-95 or higher level respirator or facemask (if a respirator is not available). N-95 respirators

or respirators that offer a higher level of protection should be used when performing an aerosol- generating procedure.

b. Eye protection: goggles or a disposable face shield that fully covers the front and sides of the face should be worn. Personal eyeglasses and contact lenses are not adequate eye protection.
c. A single pair of disposable patient examination gloves. Gloves should be changed if they tear or become heavily contaminated.
d. An isolation gown. If there are shortages of gowns, they should be prioritized for aerosol-generating procedures, and high-contact patient care activities that allow transfer of pathogens (e.g. moving the patient to the stretcher).

2. If providing patient care, EMS personnel should wear all recommended PPE. After completing patient care and before entering an isolated driver's compartment, drivers should remove and dispose of PPE and perform hand hygiene to avoid soiling the compartment. If the transport vehicle does not have an isolated driver's compartment, drivers should remove face shields or goggles, gowns and gloves, and perform hand hygiene. A respirator or facemask should continue to be used during transport.
3. On arrival, after the patient is released to the accepting facility, EMS personnel should remove and discard PPE and perform hand hygiene. Used PPE should be discarded in accordance with routine procedures**.**

EMS Transport of PUIs or Patients with Confirmed COVID-19 to a Healthcare Facility

1. A facemask should be worn by the patient for source control.
2. EMS personnel will notify the receiving healthcare facility that the patient has an exposure history and signs and symptoms suggestive of COVID-19 so that appropriate infection control precautions may be taken prior to arrival.
3. Family members and other contacts of patients with possible COVID-19 should not ride in the transport vehicle, if possible. If riding in the transport vehicle, they should wear a facemask. When possible, use vehicles that have isolated driver and patient compartments that can provide separate ventilation to each area.
   a. Close the door/window between these compartments before bringing the patient on board.
   b. During transport, vehicle ventilation in both compartments should be on non-recirculated mode to maximize air changes that reduce potentially infectious particles in the vehicle.
   c. If the vehicle is without an isolated driver compartment and ventilation must be used, open the outside air vents in the driver area and turn on the rear exhaust ventilation fans to the highest setting. This will create a negative pressure gradient in the patient compartment.
4. Follow facility procedures for transfer of the patient (e.g. wheel the patient directly into an examination room).

EMS Personnel Precautions for Procedures

1. Prior to the initiation of any patient care, all crew members must don appropriate PPE as outlined above.
2. If patient presentation allows, EMS personnel providing care to a patient suspected of having COVID-19 should contact Medical Direction before initiating an aerosol-generating procedure. These aerosolized procedures include:
   a. Nebulizer Treatments
   b. Bag Valve Mask (BVM) Ventilations
   c. Endotracheal Intubation
   d. Oropharyngeal Suctioning
   e. Continuous Positive Airway Pressure Ventilations (CPAP)
   f. Cardiopulmonary Resuscitation (CPR)

3. If an aerosol-generating procedure is required/recommended, the doors to the patient compartment of the ambulance should remain open to allow ventilation of the area during these procedures if possible. If the ambulance is equipped with an HVAC system it should remain on during patient transport.
4. If used, BVMs should have a HEPA filter attached. If the EMS agency has access to ventilators, units should contact the specific ventilator manufacturer for additional guidelines and to obtain part numbers for compatible HEPA filters.

Cleaning EMS Transport Vehicles After Transporting a PUI or Patient with Confirmed COVID-19

1. After transporting the patient, leave the rear doors of the transport vehicle open to allow for sufficient air changes to remove potentially infectious particles. The time to complete transfer of the patient to the receiving facility and complete all documentation should suffice.
2. When cleaning the vehicle, EMS clinicians should wear a disposable gown and gloves. A face shield or facemask and goggles should be worn if splashes or sprays during cleaning are anticipated.
3. Clean and disinfect reusable patient-care equipment before use on another patient, according to manufacturer's instructions.
4. Routine cleaning and disinfection procedures (e.g. use of cleaners and water to pre-clean surfaces prior to applying an EPA-registered, hospital-grade disinfectant for emerging viral pathogens) are appropriate for COVID-19.
5. Ensure disinfection procedures are followed consistently, to include the provision of adequate ventilation when chemicals are in use. Doors should remain open when cleaning the vehicle.

Follow-up for EMS Personnel after Caring for a PUI or Patient with Confirmed COVID-19

1. Local public health authorities should be notified about the patient so that appropriate follow-up monitoring can occur.
2. EMS personnel who have been exposed to a patient with suspected or confirmed COVID-19 should notify their chain of command to facilitate appropriate follow-up.
3. EMS agencies should develop local policies for assessing exposure risk and the management of EMS personnel potentially exposed to COVID-19. Decisions for monitoring and quarantine should be made in consultation with public health and infectious disease authorities.
4. EMS personnel should be alert for fever or respiratory symptoms (e.g. cough, shortness of breath, sore throat). If symptoms develop, it is recommended that they self-isolate and notify their public health authority to arrange for evaluation.

ETHICAL CONSIDERATIONS WHEN CARING FOR PERSONS WITH COVID-19

The COVID-19 pandemic outbreak is a global phenomenon that has impacted all countries and citizens, while straining public health systems to an unprecedented level in recent times. Some of the more challenging dilemmas encountered in the treatment of the disease center around the appropriate response procedures in triaging patients presenting with COVID-19 like symptoms, and the just and equitable distribution of scarce medical resources for those patients requiring more acute medical interventions in an inpatient hospital setting. Many of these challenges fall within the general considerations of justice as applied to medicine in regards to the process by which medical leaders decide to create and implement these treatment and allocation parameters.

Conceding at the outset that no static guidance can anticipate all the myriad factors that might arise as crucial variables in the clinical environment to influence the final decisions of those medical professionals on the frontlines in caring for these afflicted patients, the intent of this section is to provide references and resources from highly reputable and thought-leading organizations who have published comprehensive guidance on the ethical considerations at the bedside.

To that end, listed below is the recently published Ethical Framework Guidance by The Hastings Center which identifies critical bioethical issues for consideration in the development of both institutional response policies and individual treatment decisions. The Ethical Framework Guidance also contains numerous collateral references to previous works on the subject, which have been informed by best practices and past lessons learned during the MERS, SARS, H1N1, and Ebola outbreaks.

The Hastings Center COVID-19 Ethical Framework Materials (88)
https://www.thehastingscenter.org/ethicalframeworkcovid19/

The Society of Critical Care Medicine (SCCM) has also published various COVID-19 Emergency Resources to assist frontline health care providers in establishing appropriate care and checklist procedures in their clinical treatment methods. Those materials have also been listed below for reference going forward, and the website link will be continuously updated as new guidance is created for distribution, including a forthcoming ethical framework to be published in the near future.

The Society of Critical Care Medicine (SCCM) COVID-19 Emergency Resources https://www.sccm.org/disaster

Other frameworks and recommendations for ethical considerations in the setting of scare resources have been described. (90)

The New England Journal of Medicine: Fair Allocation of Scarce Medical Resources in the Time of Covid-19
https://www.nejm.org/doi/full/10.1056/NEJMsb2005114

The COVID-19 pandemic is, and continues to be, an incredibly dynamic, fluid, and evolving global health emergency. Issues and procedures will evolve and require refinement as more information becomes available about the nature and breadth of the disease. However, being familiar with the most recent counsel and guidance from the experts in the field will assist all medical leaders in implementing the best possible policies and treatment decisions for both individual patients and society at large.

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APPENDIX A : COVID-19 INTUBATION PRE-ENTRY CHECKLIST*

For Providers:
To bring inside room:

Place a priority on rapid airway placement with video laryngoscopy (ie Glidescope) to create distance between operator and patient's airway, avoidance of BVM and NIV due to risk of aerosolization:

☐Airway Supplies:
- ETT (7 & 7.5 for adults, appropriate size for children) with syringe forcuff
- Glidescope or C-MAC (facilitate intubation from adistance)
- Appropriate stylet
- Bougie
- OG tube with syringe, lube andtape
- OP/NP airway
- Colorimetric end-tidal CO2 detector
- Suction setup

☐Disposable stethoscope
☐Sani-wipes (should be located inside room)

Keep outside room (on standby):

☐Back up Airway Supplies:
- Appropriate size laryngoscope blades (Mac 3 & 4 for adults) and handle (disposable preferred)
- Stylet
- BVM (avoid if possible due to risk of aerosolization ofpathogen)

☐Airway cart (never bring in room)
☐EZ-IO

For Nursing:
☐RSI meds kit
☐Restraints
☐Foley
☐ABG syringe
☐Post-intubation meds:
- propofol
- fentanyl
- phenylephrine
- norepinephrine drip

For Respiratory Therapy:
☐Ventilator with appropriate filters
☐ET securing device
☐Waveform capnography adapter
☐Viral filter for Ambubag

*Adapted from University of Washington (https://covid-19.uwmedicine.org/)

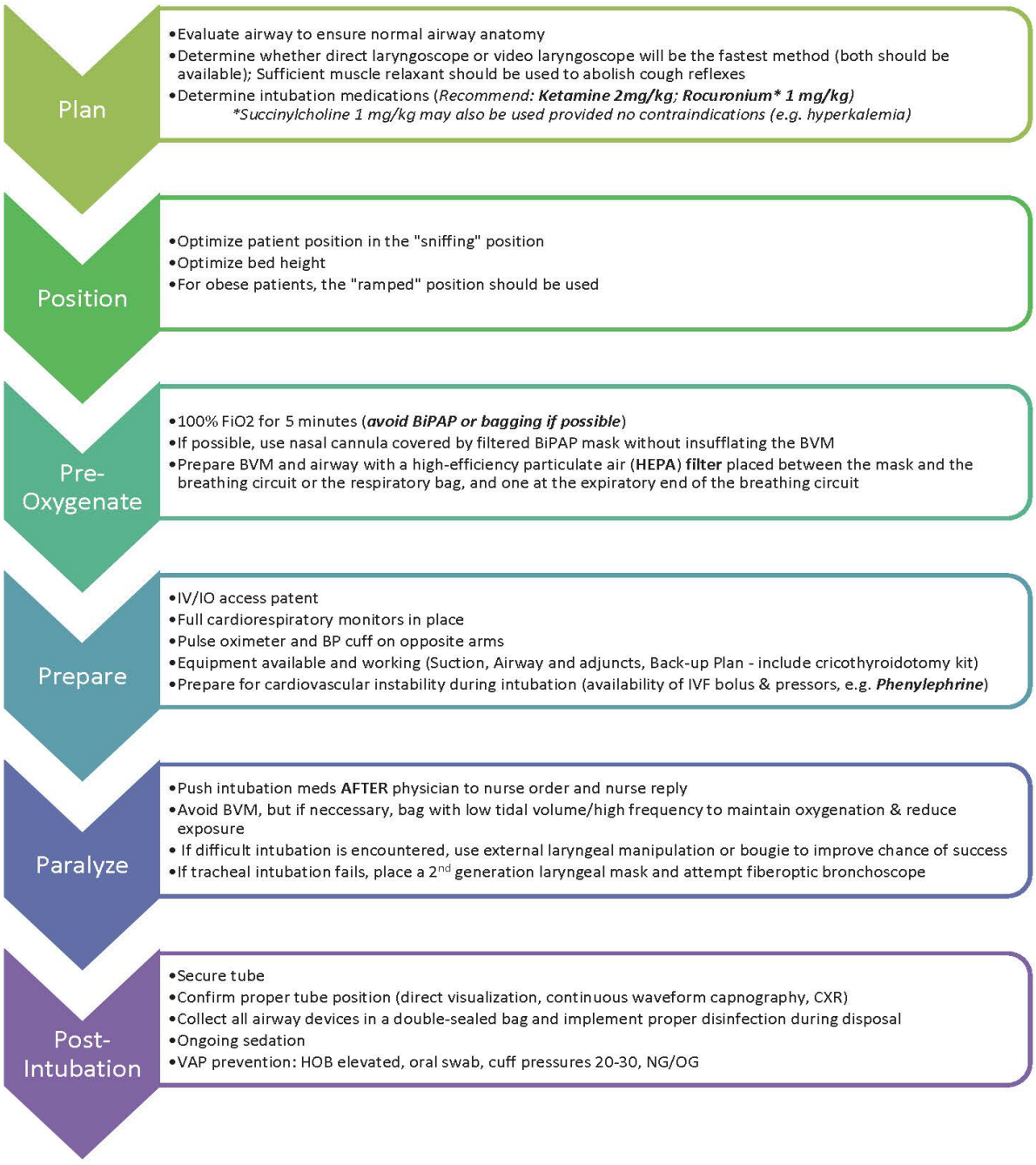
APPENDIX B: COVID-19 PRE-INTUBATIONPACK*

1. Adult BVM **
2. Nasal Cannula
3. Face Shield or Joint replacement Hood
4. End-tidal CO2 ETT Adaptor
5. End-tidal CO2 Tubing
6. Yellow Viral Filter
7. ETT Securement device
8. New, flexible tip bougie
9. PEEP Valve

*From: https://emcrit.org/emcrit/COVID-19-intubation-packs-and-preoxygenation-for-intubation/

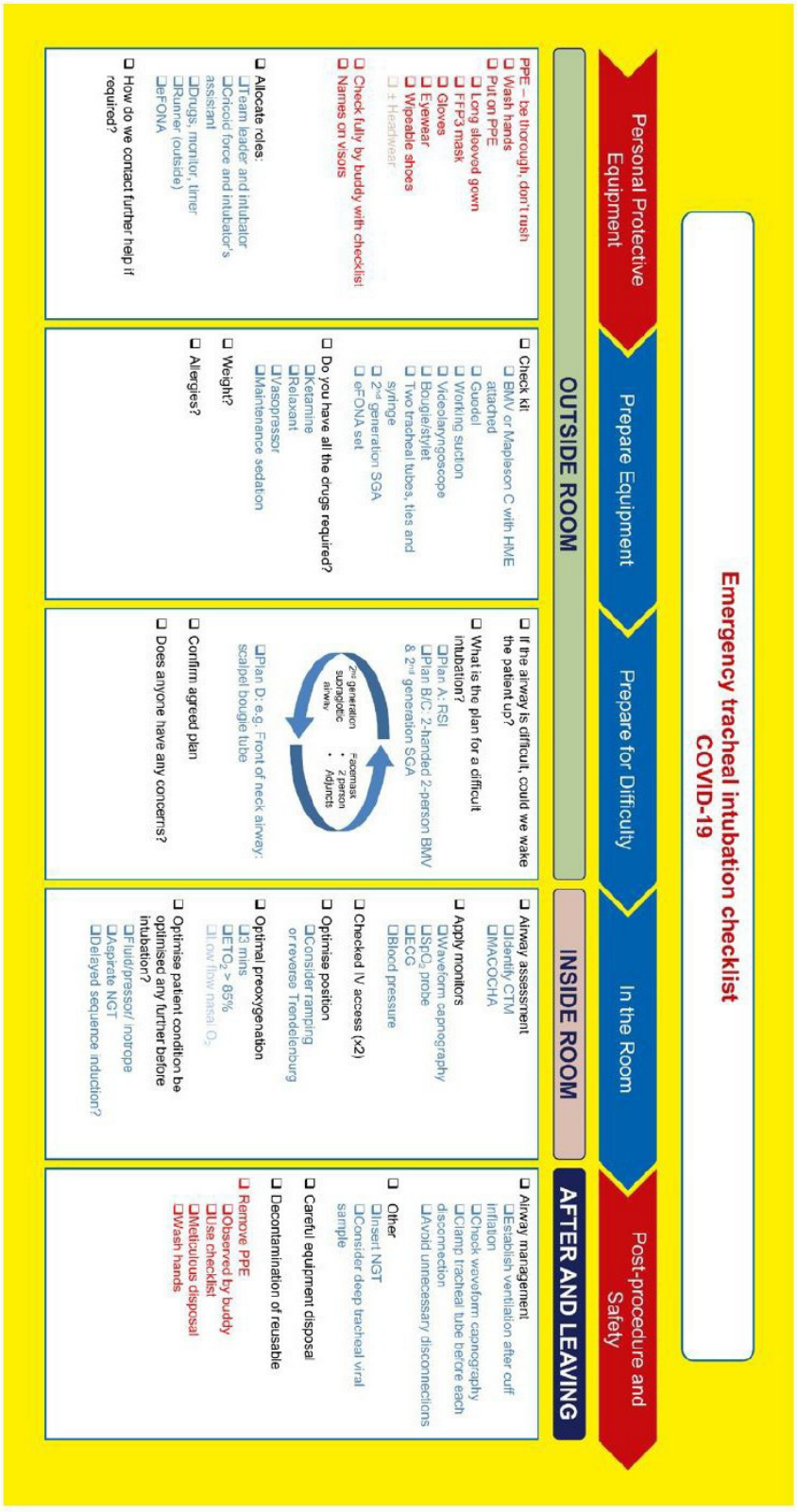
** if possible, avoiding use of BVM is preferred to avoid spread of pathogen to providers performing airway interventions

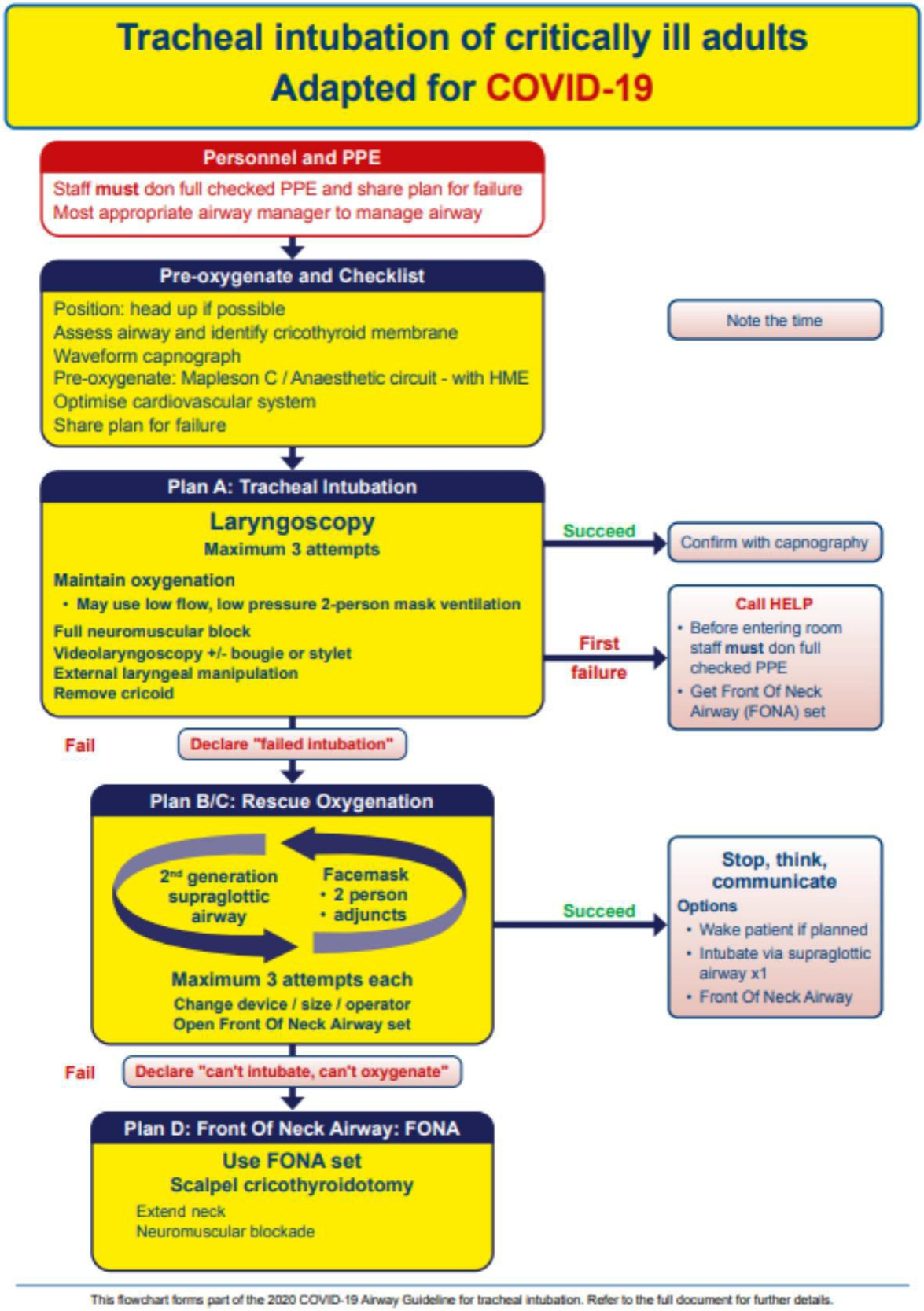
APPENDIX C : COVID-19 INTUBATION PROTOCOL



Guideline Only/Not a Substitute for Clinical Judgment

APPENDIX D : COVID-19 COGNITIVE AIDS FOR INTUBATION




Tracheal intubation of critically ill adults
Adapted for COVID-19
Personnel and PPE
Staff must don full checked PPE and share plan for failure
Most appropriate airway manager to manage airway
Pre-oxygenate and Checklist
Position: head up if possible
Assess airway and identify cricothyroid membrane
Waveform capnograph
Pre-oxygenate: Mapleson C / Anaesthetic circuit - with HME
Optimise cardiovascular system
Share plan for failure
Note the time
Plan A: Tracheal Intubation
Laryngoscopy
Maximum 3 attempts
Maintain oxygenation
• May use low flow, low pressure 2-person mask ventilation
Full neuromuscular block
Videolaryngoscopy +/- bougie or stylet
External laryngeal manipulation
Remove cricoid
Succeed
Confirm with capnography
First failure
Call HELP
• Before entering room staff must don full checked PPE
• Get Front Of Neck Airway (FONA) set
Fail
Declare "failed intubation"
Plan B/C: Rescue Oxygenation
2nd generation supraglottic airway
Facemask
• 2 person
• adjuncts
Maximum 3 attempts each
Change device / size / operator
Open Front Of Neck Airway set
Succeed
Stop, think, communicate
Options
• Wake patient if planned
• Intubate via supraglottic airway x1
• Front Of Neck Airway
Fail
Declare "can't intubate, can't oxygenate"
Plan D: Front Of Neck Airway: FONA
Use FONA set
Scalpel cricothyroidotomy
Extend neck
Neuromuscular blockade
This flowchart forms part of the 2020 COVID-19 Airway Guideline for tracheal intubation. Refer to the full document for further details.

Can't Intubate, Can't Oxygenate (CICO) in critically ill adults

Adapted for COVID-19

CALL FOR HELP

Declare "Can't Intubate, Can't Oxygenate"

Plan D: Front Of Neck Airway: FONA

Extend neck

Ensure neuromuscular blockade

Exclude oxygen failure and blocked circuit

Personnel and PPE

New staff **must** don full checked PPE

Most appropriate airway manager to perform FONA

Scalpel cricothyroidotomy

Equipment:
1. Scalpel (wide blade e.g. number 10 or 20)
2. Bougie (≤ 14 French gauge)
3. Tube (cuffed 5.0-6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane

Transverse stab incision through cricothyroid membrane

Turn blade through 90° (sharp edge towards the feet)

Slide Coudé tip of bougie along blade into trachea

Railroad lubricated cuffed tube into trachea

Inflate cuff, ventilate and confirm position with capnography

Secure tube

Impalpable cricothyroid membrane

Make a large midline vertical incision

Blunt dissection with fingers to separate tissues

Identify and stabilise the larynx

Proceed with technique for palpable cricothyroid membrane as above

Post-FONA care and follow up

- Closed tracheal suction
- Recruitment manoeuvre (if haemodynamically stable)
- Chest X-ray
- Monitor for complications
- Surgical review of FONA site
- Agree airway plan with senior clinicians
- Document and complete airway alert

This flowchart forms part of the 2020 COVID-19 Airway Guideline for tracheal intubation. Refer to the full document for further details.

APPENDIX E : ADULT PRONE POSITIONING PROTOCOL EXAMPLE*

*Adapted from University Medical Center (Las Vegas, NV)

Procedure for patient preparation prior to proning:

1. Obtain an order from the Fellow or Attending physician to place patient in the prone position. The order should include:
    a. Proper sedation/pain medications and paralytic agents ifnecessary.
    b. Length of time for each pronation cycle (patient should be in prone position a minimum of 16 hours, with a return to the supine position at least once aday).
    c. Prone positioning should be performed within the first 24 hours of the diagnosis of severe hypoxemia.
2. Explain proning procedure and benefits to patient and family members when present.
3. Prior to proning patient, make sure the following criteria have been met and necessary equipment is made available:
    a. Patient is mechanically ventilated via a secured endotracheal tube (ETT) with inlinesuction.
    b. RT is at bedside to evaluate securement of ETT with commercial tape and to place bite block as needed. Twill may be used in addition to the tape if additional securement is needed. Do not secure ETT with a commercial securement device (i.e.Hollister).
    c. Confirm patient intravenous access including central and arterial lines; verify lines are secure inplace.
    d. Remove ECG leads from anterior of torso; obtain new leads to place posteriorly once patient is prone. Electrocardiogram leads can be placed in the lateral limb position (left and right deltoid midaxillary line and left and right 12th intercostal space at the midaxillary line). The virtual lead (V1 or chest lead) can be placed on the dorsalsurface.
    e. Consider adhesive foam pads (i.e. Mepilex) to apply to boney prominences such as forehead, bilateral shoulders, chest, iliac crests and knees to preventpressureulcers.
    f. Obtain positioning pillows, blanket rolls or foam prone positioning kit from materials management or supply room.
    g. Continuous SpO2monitoring.
    h. Foley catheter and oral gastric tube secured inplace.
    i. Use fecal management system ifneeded.
    j. It is reasonable to provide enteral feedings while patient is in prone position. Elevation of head of bed in reverse Trendelenburg position helps reduce the risk of gastric aspiration. Post pyloric tubes are preferred.
    k. Lubricate patient's eyes prior to proning, then every six hours and as needed (Provider orderneeded).
    l. Assess and document pain and provide adequate sedation and pain management throughout the procedure.
    m. Patients may also require neuromuscular blocking agent duringproning.
    n. Remove head board and ensure bed brake is on.
    o. RT will perform and document a complete vent check including auscultation of bilateral lung sounds, ventilator settings, ETT positioning/depth, patient tidal volumes and ETT cuff pressures pre and post turn.

Procedure of manual pronation:

1. Assemble a minimum of a 5-person team consisting of at least on RT and the patient's RN. RT is to manage airway protection at the head of the bed and the other team members are positioned on either side of the bed to manually prone the patient. A fellow or attending physician should be present for the first turn.
2. Correctly position all tubes, taking into account the direction of theturn.
3. Lines inserted in the upper torso are aligned with either shoulder, exception is chest tubes or large bore tubes.
4. Tubes in the lower torso are aligned with either leg and extended off thebed.
5. Always initially turn the patient in the direction of theventilator.

Procedure for proper patient positioning (see diagram below):

1. Head and Neckpositioning:

    Place patient's head on a foam head positioner, which allows for the patient's head in a neutral position. Otherwise, support the patient's head in a rotated position paying attention to avoid pressure to the eyes and ears. Provide range of motion to the patient's head at least every hour, maintaining ETT tube alignment. Reposition head every two hours, head should be turned to the up are while in swimmer's pose, to avoid traction on the brachial plexus. Coordinate with RT to be present to maintain the airway while repositioning the head every two hours. This may require

positioning the ventilator at the head of the bed rather than on one side of the bed to allow for the head reposition. Raise the head enough to provide for proper spinal alignment: avoid hyperextension or flexion of the cervical spine. Ensure that the eyes have no pressure on the orbits and ears are properly aligned, flat and not folded.

2. Armpositioning:

   If using foam prone positioning kit, place patient's arms in foam positioners. While the patient is in a side lying position, gently position the arms in a swimmer's pose. The simmers pose entails the up are is in a supported, flexed position at the level of the shoulder and the down arm is parallel to the body in a position of comfort. When the arm is in the up position, keep the shoulder in a neutral position, abducted to 90 degrees and the elbow flexed at 90 degrees. Utilize pillows or blanket rolls to prevent hyperextension of the shoulder and to ensure the weight of the arm is supported. Note: Head position should be turned to the up arm while in swimmer's pose, to avoid traction on the brachial plexus.

   a. Alternate the arm and head position every two hours with the patient in a side lying position and provide passive range of motion exercise to all joints of the upper and lower extremities.

3. Patientpositioning:
   a. Manually reposition the patient a minimum of every 2 hours with a slight right lateral-pillow support position (20-30°) to prone (flat) to a slight left lateral-pillow supported position (20-30°) and back to prone position. The use of automatic bed rotation is not a replacement formanualrepositioning.

      Note: When placing the patient in the lateral-pillow support position, coordinate head and arm in the up position toward the tilted side (Do not use foam wedges for lateral turns).

   b. During lateral turns inspect the skin and positioning of the tubes, lines and catheters (tubing and penis) and reposition accordingly, i.e. Foley catheters, chest tubes, IV lines, etc.

4. Legpositioning:

   While in prone and/or lateral prone position float the knees with a pillow (be careful not to cause hyperextension of the hip), and place a foam roller, pillow or blanket roll under the ankle area to elevate the toes and prevent tension on the tendons in the foot and ankle region.

5. Tilt the patient into reverseTrendelenburg:

   Goal is 30 degrees, as patienttolerates.

6. Alternative position of the arms for comfort or if swimmer's position is contraindicated.

   For example, the patient, family or PT/OT one-time evaluation report history of rotator cuff tear, stroke, nerve damage, osteoarthritis of shoulder complex, history of clavicle fracture, hyper flexible joints.

   a. Arms can be left in the side lying position aligned with the body and repositioned ever two hours to a slightly abducted positon.

Patient monitoring and care:

1. Time patient isprone/supine:

   a. It is recommended in the literature that patient is placed in the prone position for a minimum of 16 hours. The timing for prone cycling requires a physician order and is always situational. Patients should be returned to supine position for up to four hours, once per day preferably early AM to allow the interdisciplinary team time to assess while in supine position. While in supine position, reassessment of oxygenation, skin assessment and other relevant exam elements should occur. If the patient does not tolerate being supine (i.e. requiring increased ventilator settings, decreasing PaO2/FiO2 ration, hemodynamically unstable or decreasing SpO2/PaO2) return patient to the proneposition.
   b. Patients in prone position should receive the same standard of care as a patient that is supine (i.e. oral care,

urinary catheter care, skin care, eye care, suctioning, etc.).

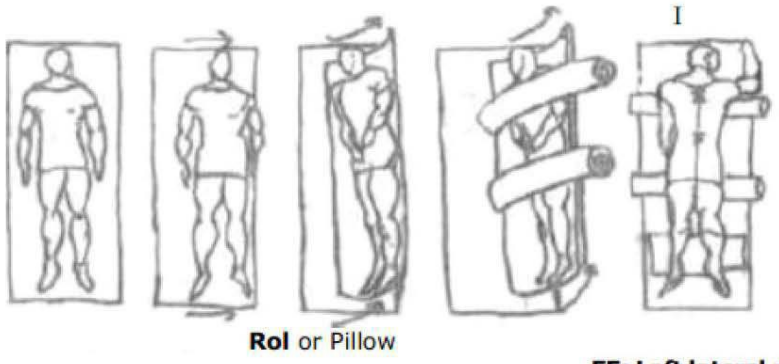
c. Discuss supine position tolerance and PaO2/FiO2 ratio in bedside report and during interdisciplinary rounds.
d. Ongoing assessment of how the patient is tolerating prone therapy and repositioning; documentation of all vital signs, capnography, patient and family education, length of time prone, patient's response to turning supine, any adverse events that occur and changes in the patient's condition.
e. Primary RN will coordinate with RT to re-secure ETT when the patient is supine and assist with turns, checking cuff pressures and tube placement before and after repositioning the patient; coordinate with radiology for chest x-ray when supine.
f. Monitor all tubes, lines, drains and catheters throughout the repositioning process and continue airway management, suctioning oral and ETT secretions.
g. Continue to evaluate enteral nutrition tolerance and maintain reverse Trendelenburg to help prevent ventilator associated pneumonia (VAP).
h. RT to change ETT tape at least once a day or more frequently if necessary due to facial swelling.
i. PaO2/FiO2 ratios should be calculated every day and when ventilator settings have been changed in order to identify candidates for returning to the supine position early.

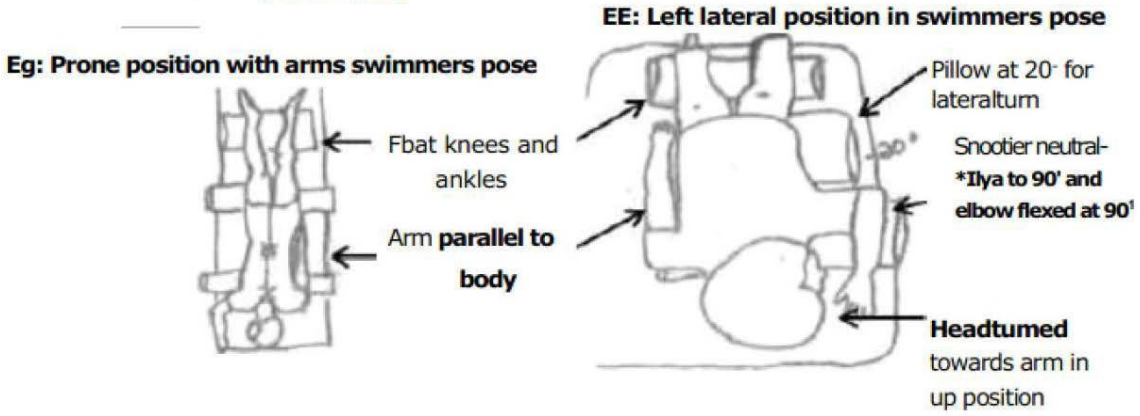
Consider discontinuation of the prone position if:

1. The patient no longer shows a positive response to the position change or mechanical ventilation support has been optimized.
2. The patient's PaO2/FiO2 ratio is >200 on less than 50% FiO2 and PEEP ≤10 cm of water.

Complications related to prone positioning:

1. Unplanned extubation
    a. Lines pulled
    b. Tubes kinked
    c. Hemodynamic instability
    d. Facial edema
    e. Pressure ulcers
    f. Aspiration
    g. Cornea labrasions





American Society of Anesthesiologists | apsf Anesthesia Patient Safety Foundation

APPENDIX F: Setup and Monitoring Instructions – Anesthesia Machine as an ICU Ventilator

SETUP

- Insure manual ventilation device readily available
- Connect/Check Central Gas Supplies
  - Check Line pressure – 45 psi or better
  - Full E-cylinders of oxygen and air as backup
  - Remove nitrous oxide hoses and cylinders
  - Bellows ventilators configured for compressed air supply Biomed can do with manufacturer guidelines
- Scavenger
  - Connect to suction or allow to enter patient room
- Vaporizers
  - Remove or drain
- Configure machine with disposables
  - Breathing Circuit
  - Filters
    - HMEF on airway, gas sampling on machine side
    - Second filter on the expiratory limb if possible (required if no filter on airway)
  - **??** Active humidifiers NOT recommended but may be needed if no HME. Will require special monitoring if placed.
  - Large (3 Liter) Reservoir Bag
  - Gas analyzer for oxygen and carbon dioxide
- Perform Self Test
  - Compliance measurement essential – do not change disposables after this
  - Confirm no errors
- Check alarms, set limits, set to max volume
  NOTE: Defaults may not apply to ICU patients
  - Inspired CO2 alarm at 5 mmHg
  - Expired CO2 alarm for permissive hypercapnia
  - Pressure alarms – High and low if apnea pressure alarm
  - Volume/Minute Ventilation
- Set APL valve to 0 cmH20

INITIATE THERAPY

- Fresh Gas Flow Options
  - Option 1: Low fresh gas flow to conserve oxygen
    - Preserves humidity
    - **CO2 Absorbent must be available and maintained**
    - **Inspired CO2 Alarm must be set to 5 mmHg**
  - Option 2: Fresh gas flow => minute ventilation
    - No CO2 Absorbent needed (increase FGF if Inspired CO2 present)
    - Humidification is essential – consider active humidifier
- Setting Oxygen Concentration
  - Electronic Flowmeters – Set delivered concentration and monitor inspired oxygen that results
  - Mechanical Flowmeters
    - Air/oxygen mix needed for delivered O2 concentration (see table)
  - Inspired oxygen concentration will need to be monitored especially during low flows - it will be less than the set concentration
- Set Ventilator (See CCM guidance)
  - Ventilation Mode
  - Settings
    - Rate
    - Volume
    - I:E Ratio
    - PEEP
- Start Ventilator
  - **SET SPIROMETRY LOOP REFERENCE IF AVAILABLE WHEN VENTILATION STARTED**
  - **NOTE PRESSURE AND FLOW WAVEFORMS – CONSIDER PHOTO OF BASELINE SCREEN**
  - Record monitored values
    - Pressure – Volume relationships
    - Gas concentrations as expect

3/26/2020

MONITORING SCHEDULE (Record manually time and value if EMR not connected to machine)

Task	Continuous	Hourly	q 4 hours	q 24 hours
Alarms	X			
CO2 Absorbent		X		
Monitored Parameters • Insp Oxygen • Insp and Exp CO2 • Insp Pressure • Tidal Volume • Spirometry • *Agent concentration*		X		
Inspect for humidity and secretions • Filters • Water trap		X		
Check Vap Fill if Sedating				
Change Filter/HME			X	
Increase FGF to MV or above for 15 minutes			X	
Perform Self Test*				X

*Anesthesia machine WILL NOT provide ventilation during the self-test. An alternate ventilation strategy that can be maintained for several minutes is required. Consider transport ventilator if manual ventilation bag not likely to be successful. Power to the machine should be cycled between every patient and at least every 25 days.

3/26/2020

Society of Critical Care Medicine
The Intensive Care Professionals

APPENDIX G: SCCM | Joint Statement on Multiple Patients Per Ventilator

Joint Statement on Multiple Patients Per Ventilator

March 26, 2020
12:00 p.m.

The Society of Critical Care Medicine (SCCM), American Association for Respiratory Care (AARC), American Society of Anesthesiologists (ASA), Anesthesia Patient Safety Foundation (ASPF), American Association of Critical-Care Nurses (AACN), and American College of Chest Physicians (CHEST) issue this consensus statement on the concept of placing multiple patients on a single mechanical ventilator.

The above-named organizations advise clinicians that sharing mechanical ventilators should not be attempted because it cannot be done safely with current equipment. The physiology of patients with COVID-19-onset acute respiratory distress syndrome (ARDS) is complex. Even in ideal circumstances, ventilating a single patient with ARDS and nonhomogenous lung disease is difficult and is associated with a 40%-60% mortality rate. Attempting to ventilate multiple patients with COVID-19, given the issues described here, could lead to poor outcomes and high mortality rates for all patients cohorted. In accordance with the exceedingly difficult, but not uncommon, triage decisions often made in medical crises, it is better to purpose the ventilator to the patient most likely to benefit than fail to prevent, or even cause, the demise of multiple patients.

Background: The interest in ventilating multiple patients on one ventilator has been piqued by those who would like to expand access to mechanical ventilators during the COVID-19 pandemic. The first modern descriptions of multiple patients per ventilator were advanced by Neyman et al in 2006[1] and Paladino et al in 2013.[2] However, in each instance, Branson, Rubinson, and others have cautioned against the use of this technique.[3-5] With current equipment designed for a single patient, we recommend that clinicians do not attempt to ventilate more than one patient with a single ventilator while any clinically proven, safe, and reliable therapy remains available (ie, in a dire, temporary emergency).

Attempting to ventilate multiple patients would likely require arranging the patients in a spoke-like fashion around the ventilator as a central hub. This positioning moves the patients away from the supplies of oxygen, air, and vacuum at the head of the bed. It also places the patients in proximity to each other, allowing for transfer of organisms. Spacing the patients farther apart would likely result in hypercarbia.

Spontaneous breathing by a single patient sensed by the ventilator would set the respiratory frequency for all the other patients. The added circuit volume could preclude triggering. Patients may also share gas between circuits in the absence of one-way valves. Pendelluft between patients is possible, resulting in both cross-infection and over-distension. Setting alarms can monitor only the total response of the patients' respiratory systems as a whole. This would hide changes occurring in only one patient. The reasons for avoiding ventilating multiple patients with a single ventilator are numerous.

These reasons include:

- Volumes would go to the most compliant lung segments.
- Positive end-expiratory pressure, which is of critical importance in these patients, would be impossible to manage.
- Monitoring patients and measuring pulmonary mechanics would be challenging, if not impossible.
- Alarm monitoring and management would not be feasible.
- Individualized management for clinical improvement or deterioration would be impossible.
- In the case of a cardiac arrest, ventilation to all patients would need to be stopped to allow the change to bag ventilation without aerosolizing the virus and exposing healthcare workers. This circumstance also would alter breath delivery dynamics to the other patients.
- The added circuit volume defeats the operational self-test (the test fails). The clinician would be required to operate the ventilator without a successful test, adding to errors in the measurement.
- Additional external monitoring would be required. The ventilator monitors the average pressures and volumes.
- Even if all patients connected to a single ventilator have the same clinical features at initiation, they could deteriorate and recover at different rates, and distribution of gas to each patient would be unequal and unmonitored. The sickest patient would get the smallest tidal volume and the improving patient would get the largest tidal volume.
- The greatest risks occur with sudden deterioration of a single patient (e.g., pneumothorax, kinked endotracheal tube), with the balance of ventilation distributed to the other patients.
- Finally, there are ethical issues. If the ventilator can be lifesaving for a single individual, using it on more than one patient at a time risks life-threatening treatment failure for all of them.

References

1. Neyman G, Irvin CB. A single ventilator for multiple simulated patients to meet disaster surge. *Acad Emerg Med*. 2006 Nov;13(11):1246-1249.
2. Paladino L, Silverberg M, Charcaflieh JG, et al. Increasing ventilator surge capacity in disasters: ventilation of four adult-human-sized sheep on a single ventilator with a modified circuit. *Resuscitation*. 2008 Apr;77(1):121-126.
3. Branson RD, Rubinson L. One ventilator, multiple patients: what the data really supports. *Resuscitation*. 2008 Oct;79(1):171-172; author reply 172-173.
4. Branson RD, Rubinson L. A single ventilator for multiple simulated patients to meet disaster surge. *Acad Emerg Med*. 2006 Dec;13(12):1352-1353; author reply 1353-1354.

5. Branson RD, Blakeman TC, Robinson BR, Johannigman JA. Use of a single ventilator to support 4 patients: laboratory evaluation of a limited concept. *Respir Care*. 2012 Mar;57(3):399-403.

APPENDIX H: PATIENT CARE: *STRATEGIES FOR SCARCE RESOURCE SITUATIONS*

Table of Contents

Version 2.0 December 2011

MINNESOTA DEPAR TMENT OF HEALTH OFFICE OF EMERGENCY PREPAREDNESS
www.health.state.mn.us/oep/healthcare

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625 Robert Street N. / St. Paul MN 55164
TEL: 651 201 . 5700 / TDD: 651 215 . 8980

PATIENT CARE

STRATEGIES FOR SCARCE RESOURCESITUATIONS Summary Card

Potential trigger events:	•Mass Casualty Incident (MCI) •Infrastructure damage/loss •Pandemic/Epidemic	•Supplier shortage •Recall/contamination of product •Isolation of facility due to access problems (flooding, etc)

How to use this card set:

1. Recognize or anticipate resource shortfall
2. Implement appropriate incident management system and plans; assign subject matter experts (technical specialists) toproblem
3. Determine degree of shortfall, expected demand, and duration; assess ability to obtain needed resources via local, regional, or national vendors or partners
4. Find category of resource on index
5. Refer to specific recommendations on card
6. Decide which strategies to implement and/or develop additional strategies appropriate for the facility andsituation
7. Assure consistent regional approach by informing public health authorities and other facilities if contingency or crisis strategies will continue beyond 24h and no regional options exist for re-supply or patient transfer; activate regional scarce resource coordination plans as appropriate

Core strategies to be employed (generally in order of preference) during, or in anticipation of a scarce resource situation are:

Prepare - pre-event actions taken to minimize resource scarcity (e.g., stockpiling of medications)
Substitute - use an essentially equivalent device, drug, or personnel for one that would usually be available (e.g., morphine for fentanyl)
Adapt – use a device, drug, or personnel that are not equivalent but that will provide sufficient care (e.g., anesthesia machine for mechanical ventilation) ***Conserve*** – use less of a resource by lowering dosage or changing utilization practices (e.g., minimizing use of oxygen driven nebulizers to conserve oxygen) ***Re-use*** – re-use (after appropriate disinfection / sterilization) items that would normally be single-use items
Re-allocate – restrict or prioritize use of resources to those patients with a better prognosis or greater need

Capacity

Conventional capacity – The spaces, staff, and supplies used are *consistent with daily practices* within the institution. These spaces and practices are used during a major mass casualty incident that triggers activation of the facility emergency operations plan.	**Contingency capacity** – The spaces, staff, and supplies used are not consistent with daily practices, but provide care to a standard that is *functionally equivalent* to usual patient care practices. These spaces or practices may be used temporarily during a major mass casualty incident or on a more sustained basis during a disaster (when the demands of the incident exceed community resources).	**Crisis capacity** – Adaptive spaces, staff, and supplies are not consistent with usual standards of care, but provide *sufficiency* of care in the setting of a catastrophic disaster (i.e., provide the best possible care to patients given the circumstances and resources available). Crisis capacity activation constitutes a significant ad- justment to standards of care (Hick et al, 2009).

This card set is designed to facilitate a structured approach to resource shortfalls at a healthcare facility. It is a decision support tool and assumes that incident management is implemented and that key personnel are familiar with ethical frameworks and processes that underlie these decisions (for more information see Institute of Medicine 2009 Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report- *http://www.nap.edu/catalog/12749.html* and the Minnesota Pandemic Ethics Project - http://www.health.state.mn.us/divs/idepc/ethics/).
Each facility will have to determine the most appropriate steps to take to address specific shortages. Pre-event familiarization with the contents of this card set is recommended to aid with event preparedness and anticipation of specific resource shortfalls. The cards do not provide comprehensive guidance, addressing only basic common categories of medical care. Facility personnel may determine additional coping mechanisms for the specific situation in addition to those outlined on these cards.

The content of this card set was developed by the Minnesota Department of Health (MDH) Science Advisory Team in conjunction with many subject matter experts whose input is greatly ap- preciated. This guidance does not represent the policy of MDH. Facilities and personnel implementing these strategies in crisis situations should assure communication of this to their healthcare and public health partners to assure the invocation of appropriate legal and regulatory protections in accord with State and Federal laws. This guidance may be updated or changed during an incident by the Science Advisory Team and MDH. The weblinks and resources listed are examples, and may not be the best sources of information available. Their listing does not imply endorse- ment by MDH.

Version December

MINNESOTA DEPAR TMENT OF
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OXYGEN

STRATEGIES FOR SCARCE RESOURCE

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Inhaled Medications • Restrict the use of Small Volume Nebulizers when inhaler substitutes areavailable. • Restrict continuous nebulization therapy. • Minimize frequency through medication substitution that results in fewer treatments (6h-12h instead of 4h-6h applications).	*Substitute & Conserve*			
High-Flow Applications • Restrict the use of high-flow cannula systems as these can demand 12 to 40 LPMflows. • Restrict the use of simple and partial rebreathing masks to 10 LPM maximum. • Restrict use of Gas Injection Nebulizers as they generally require oxygen flows between 10 LPM and 75 LPM. • Eliminate the use of oxygen-powered venturi suction systems as they may consume 15 to 50LPM.	*Conserve*			
Air-Oxygen Blenders • Eliminate the low-flow reference bleed occurring with any low-flow metered oxygen blender use. This can amount to an ad- ditional 12 LPM. Reserve air-oxygen blender use for mechanical ventilators using high-flow non-metered outlets. (These do not utilize reference bleeds). • Disconnect blenders when not in use.	*Conserve*			
Oxygen Conservation Devices • Use reservoir cannulas at 1/2 the flow setting of standard cannulas. • Replace simple and partial rebreather mask use with reservoir cannulas at flowrates of 6-10 LPM.	*Substitute & Adapt*			
Oxygen Concentrators if Electrical Power Is Present • Use hospital-based or independent home medical equipment supplier oxygen concentrators if available to provide low-flow cannula oxygen for patients and preserve the primary oxygen supply for more critical applications.	*Substitute &*			
Monitor Use and Revise Clinical Targets • Employ oxygen titration protocols to optimize flow or % to match targets for SPO2 or PaO2. • Minimize overall oxygen use by optimization of flow. • Discontinue oxygen at earliest possible time. **Starting Example** / **Initiate O2** / **O2** **Target** Normal Lung Adults: SPO2 <90% / SPO2 90% Infants & Peds: SPO2 <90% / SPO2 90-95% Severe COPD History: SPO2 <85% / SPO2 90% **Note**: Targets may be adjusted further downward depending on resources available, the patient'sclinical presentation, or measured PaO2 determination.	*Conserve*			
Expendable Oxygen Appliances • Use terminal sterilization or high-level disinfection procedures for oxygen appliances, small & large-bore tubing, and ventilator circuits. Bleach concentrations of 1:10, high-level chemical disinfection, or irradiation may be suitable. Ethylene oxide gas ster- ilization is optimal, but requires a 12-hour aeration cycle to prevent ethylene chlorohydrin formation with polyvinyl chloride plastics.	*Re-use*			
Oxygen Re-Allocation • Prioritize patients for oxygen administration during severe resource limitations.	*Re-Allocate*			

STAFFING

STRATEGIES FOR SCARCE RESOURCE

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Staff and Supply Planning • Assure facility has process and supporting policies for disaster credentialling and privileging - including degree of supervision required, clinical scope of practice, mentoring and orientation, and verification ofcredentials • Encourage employee preparedness planning (www.ready.gov and other resources). • Cache adequate personal protective equipment (PPE) and support supplies. • Educate staff on institutional disaster response. • Educate staff on community, regional and state disaster plans and resources. • Develop facility plans addressing staff's family / pets or staff shelter needs.	*Prepare*			
Focus Staff *Time* on Core Clinical Duties • Minimize meetings and relieve administrative responsibilities not related toevent. • Reduce documentation requirements. • Cohort patients to conserve PPE and reduce staff PPE donning/doffing time and frequency. • Restrict elective appointments and procedures.	*Conserve*			
Use Supplemental Staff • Bring in equally trained staff (burn or critical care nurses, Disaster Medical Assistance Team [DMAT], other health system or Federal sources). • Equally trained staff from administrative positions (nurse managers).	*Substitute*			
• Adjust personnel work schedules (longer but less frequent shifts, etc.) if this will not result in skill / PPE compliancedeterioration. • Use family members/lay volunteers to provide basic patient hygiene and feeding – releasing staff for other duties.	*Adapt*			
Focus Staff *Expertise* on Core Clinical Needs • Personnel with specific critical skills (ventilator, burn management) should concentrate on those skills; specify job duties that can be safely performed by other medical professionals. • Have specialty staff oversee larger numbers of less-specialized staff and patients (for example, a critical care nurse overseesthe intensive care issues of 9 patients while 3 medical/surgical nurses provide basic nursing care to 3 patientseach). • Limit use of laboratory, radiographic, and other studies, to allow staff reassignment and resource conservation. • Reduce availability of non-critical laboratory, radiographic, and other studies.	*Conserve*			
Use Alternative Personnel to Minimize Changes to Standard of Care • Use less trained personnel with appropriate mentoring and just-in-time education (e.g., healthcare trainees or otherhealth careworkers, Minnesota Responds Medical Reserve Corps, retirees). • Use less trained personnel to take over portions of skilled staff workload for which they have been trained. • Provide just-in-time training for specific skills. • Cancel most sub-specialty appointments, endoscopies, etc. and divert staff to emergency duties including in-hospital or assist- ing public health at external clinics/screening/dispensing sites.	*Adapt*			

NUTRITIONAL SUPPORT

STRATEGIES FOR SCARCE RESOURCE

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

RECOMMENDATIONS	***Strategy***	***Conventional***	***Contingency***	***Crisis***
Food • Maintain hospital supply of inexpensive, simple to prepare, long-shelf life foodstuffs as contingency for at least 96 hours with- out resupply, with additional supplies according to hazard vulnerability analysis (e.g., grains, beans, powdered milk, powdered protein products, pasta, and rice). Access existing or devise new emergency/disaster menuplans. • Maintain hospital supply of at least 30 days of enteral and parenteral nutrition components and consider additional supplies based on institution-specific needs. Review vendor agreements and their contingencies for delivery and production, including alternate vendors. Note: A 30-day supply based on usual use may be significantly shortened by the demand of a disaster.	*Prepare*			
Water • Stock bottled water sufficient for drinking needs for at least 96 hours if feasible (for staff, patients and family/visitors), or assure access to drinking water apart from usual supply. Potential water sources include food and beverage distributors. • Ensure there is a mechanism in place to verify tap water is safe to drink. • Infants: assure adequate stocks of formula and encourage breastfeeding.	*Prepare*			
Staff/Family • Plan to feed additional staff, patients, and family members of staff/patients in select situations (ice storm as an example ofa short-term incident, an epidemic as an example of a long-term incident).	*Prepare*			
Planning • Work with stakeholders to encourage home users of enteral and parenteral nutrition to have contingency plans and alternate delivery options. Home users of enteral nutrition typically receive delivery of 30 days supply and home users of parenteral nutrition typically receive a weekly supply. Anticipate receiving supply requests from home users during periods of shortage. Work with vendors regarding their plans for continuity of services and delivery. • Identify alternate sources of food supplies for the facility should prime vendors be unavailable (including restaurants – which may be closed during epidemics). Consider additional food supplies at hospitals that do not have food service management accounts. • Determine if policy on family provision of food to patients is in place, and what modifications might be needed or permitted in a disaster.	*Prepare*			
• Liberalize diets and provide basic nutrients orally, if possible. Total parenteral nutrition (TPN) use should be limited and priori- tized for neonatal and critically ill patients.	*Substitut*			
• Non-clinical personnel serve meals and may assist preparation. • Follow or modify current facility guidelines for family donation of meals to patients. • Anticipate and have a plan for the receipt of food donations. If donated food is accepted, it should be non-perishable, prepack- aged, and in single serving portions.	*Adapt*			

• Collaborate with pharmacy and nutrition services to identify patients appropriate to receive parenteral nutrition support vs. enteral nutrition. Access premixed TPN/PPN solutions from vendor if unable to compound. Refer to Centers for Disease Con- trol (CDC) Fact Sheets and American Society for Parenteral and Enteral Nutrition (ASPEN) Guidelines. Substitute oral supplements for enteral nutrition products if needed.	*Substitute & Adapt*			
• Eliminate or modify special diets temporarily. • Use blenderized food and fluids for enteral feedings rather than enteral nutrition products if shortages occur. Examples: 1. The Oley Foundation: Making Your Own Food for Tube Feeding, http://www.oley.org/lifeline/TubetalkSO07.html#Making%20your%20 own 2. Klein, Marsha Dunn, and Suzanne Evans Morris. Homemade Blended Formula Handbook. Tucson: Mealtime Notions LLC, 2007.	*Adapt*			

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Cache / Increase Supply Levels • Patients should have at least 30 days supply of home medications and obtain 90 day supply if pandemic, epidemic, or evacuation is imminent. • Examine formulary to determine commonly-used medications and classes that will be in immediate / high demand. • Increase supply levels or cache critical medications - particularly for low-cost items and analgesics. • Key examples include: **Analgesia** • morphine, other narcotic and non-narcotic (non-steroidals, acetaminephen) class - injectable and oral (narcotic conversion tool at http://www.globalrph.com/narcoticonv.htm) **Sedation** • particularly benzodiazepine (lorazepam, midazolam, diazepam) injectables **Anti-infective** • narrow and broad spectrum antibiotics for pneumonia, skin infections, open fractures, sepsis (e.g.: cephalosporins, quinolones, tetracyclines, macrolides, aminoglycosides, clindamycin, etc.), select antivirals **Pulmonary** • metered dose inhalers (albuterol, inhaled steroids), oral steroids (dexamethasone,prednisone) **Behavioral Health** • haloperidol, other injectable and oral anti-psychotics, common anti-depressants, anxiolytics **Other** • sodium bicarbonate, paralytics, induction agents (etomidate, propofol), proparacaine/tetracaine, atropine, pralidoxime, epinephrine, local anesthetics, antiemetics, insulin, common oral anti-hyper- tensive and diabetes medications	*Prepare*			
Use Equivalent Medications • Obtain medications from alternate supply sources (pharmaceutical representatives, pharmacycaches). **Pulmonary** • Metered dose inhalers instead of nebulized medications **Analgesia / Sedation** • Consider lorazepam for propofol substitution (and other agents in short supply) • ICU analgesia/sedation drips Morphine 4-10mg IV load then 2mg/h and titrate / re-bolus as needed usual 3-20mg/h); lorazepam 2-8mg or midazolam 1-5mg IV load then 2-8mg/h drip **Anti-infective** • Examples: cephalosporins, gentamicin, clindamycin substitute for unavailablebroad-spectrum antibiotic • Target therapy as soon as possible based upon organism identified. **Other** • Beta blockers, diuretics, calcium channel blockers, ace inhibitors, anti-depressants, anti-infectives	*Substitute* *Substitute*			
Reduce Use During High Demand • Restrict use of certain classes if limited stocks likely to run out (restrict use of prophylactic / empiric antibiotics after low risk wounds, etc.). • Decrease dose; consider using smaller doses of medications in high demand / likely to run out (reduce doses of medica- tions allowing blood pressure or glucose to run higher to ensure supply of medications adequate for anticipated duration of shortage). • Allow use of personal medications (inhalers, oral medications) in hospital	*Conserve*			
• Do without - consider impact if medications not taken during shortage (statins, etc.).	*Conserve*			

MEDICATION ADMINISTRATION

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

RECOMMENDATIONS	***Strategy***	***Conventional***	***Contingency***	***Crisis***
Modify Medication Administration • Emphasize oral, nasogastric, subcutaneous routes of medication administration. • Administer medications by gravity drip rather than IV pump if needed: *IV drip rate calculation - drops / minute = amount to be infused x drip set / time (minutes) (drip set = qtts / mL - 60, 10, etc.).* • Rule of 6: pt wgt (kg) x 6 = mg drug to add to 100ml fluid = 1mcg / kg / min for each 1	*Adapt*			
• Consider use of select medications beyond expiration date.* • Consider use of veterinary medications when alternative treatments are not available.*	*Adapt*			
Restrict Allocation of Select Medications • Allocate limited stocks of medications with consideration of regional/state guidance and available epidemiological informa- tion (e.g.: anti-viral medications such as olseltamivir)	*Re-Allocate*			
• Allocate limited stock to support other re-allocation decisions (ventilator use, etc.).	*Re-*			

*Legal protection such as Food and Drug Administration approval or waiver required.

HEMODYNAMIC SUPPORT AND IV FLUIDS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Cache Additional Intravenous (IV) Cannulas, Tubing, Fluids, Medications, and Administration Supplies	*Prepare*			
Use Scheduled Dosing and Drip Dosing When Possible • Reserve IV pump use for critical medications such as sedatives and hemodynamic support.	*Conserve*			
Minimize Invasive Monitoring • Substitute other assessments (e.g., clinical signs, ultrasound) of central venous pressure (CVP). • When required, assess CVP intermittently via manual methods using bedside saline manometer or transducer moved be- tween multiple patients as needed, or by height of blood column in CVP line held vertically while patient supine.	*Conserve*			
Utilize appropriate oral rehydration solution: • Oral rehydration solution: 1 liter water (5 cups) + 1 tsp salt + 8 tsp sugar, add flavor (e.g., ½ cup orange juice, other) as needed. • Rehydration for moderate dehydration 50-100mL / kg over 2-4 hours Pediatric hydration: Pediatric maintenance fluids: • 4 mL/kg/h for first 10kg of body weight (40 mL/h for 1st 10 kg) • 2 mL/kg/h for second 10kg of body weight (20 mL/h for 2nd 10kg = 60 mL/h for 20kg child) • 1 mL/kg/h for each kg over 20kg (example - 40 kg child = 60 mL/h plus 20 mL/h = 80 mL/h) Supplement for each diarrhea or emesis NOTE: Clinical (urine output, etc.) and laboratory (BUN, urine specific gravity) assessments and electrolyte correction are key compo- nents of fluid therapy and are not specifically addressed by these recommendations. NOTE: For further information and examples, see http://rehydrate.org, http://www.bt.cdc.gov/disasters/hurricanes/pdf/dguidelines. pdf and http://www.ped.med.utah.edu/cai/howto/IntravenousFluidOrders.PDF.	*Substitute*			
Provide Nasogastric Hydration Instead of IV Hydration When Practical • Patients with impediments to oral hydration may be successfully hydrated and maintained with nasogastric (NG)tubes. • For fluid support, 8-12F (pediatric: infant 3.5F, < 2yrs 5F) tubes are better tolerated than standard size tubes.	*Substitute*			
Substitute Epinephrine for Other Vasopressor Agents • For hemodynamically unstable patients who are adequately volume-resuscitated, consider adding 6mg epinephrine (6mL of 1:1000) to 1000mL NS on minidrip tubing and titrate to target blood pressure. • Epinephrine 1:1000 (1mg/mL) multi-dose vials available for drip use.	*Substitute*			
Re-use CVP, NG, and Other Supplies After Appropriate Sterilization / Disinfection • Cleaning for all devices should precede high-level disinfection or sterilization. • High-level disinfection for at least twenty minutes for devices in contact with body surfaces (including mucous membranes);glutaraldehyde, hydrogen peroxide 6%, or bleach (5.25%) diluted 1:20 (2500 ppm) are acceptable solutions. NOTE: chlorine levels reduced if stored in polyethylene containers - double the bleach concentration to compensate). • Sterilize devices in contact with bloodstream (e.g., ethylene oxide sterilization for CVP catheters).	*Re-use*		(disinfection – NG, etc)	(steriliza - tion - central line, etc)

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Intraosseous / Subcutaneous (Hypodermoclysis) Replacement Fluids • Consider as an option when alternative routes of fluid administration areimpossible/unavailable • Intraosseous before percutaneous Intraosseous • Intraosseous infusion is not generally recommended for hydration purposes, but may be used until alternative routes are available. Intraosseous infusion requires pump or pressure bag. Rate of fluid delivery is often limited by pain of pressure within the marrow cavity. This may be reduced by pre-medication with lidocaine 0.5mg/kg slow IV push. Hypodermoclysis • Cannot correct more than moderate dehydration via thistechnique. • Many medications cannot be administered subcutaneously. • Common infusion sites: pectoral chest, abdomen, thighs, upper arms. • Common fluids: normal saline (NS), D5NS, D5 1/2 NS (Can add up to 20-40 mEq potassium if needed.) • Insert 21/24 gauge needle into subcutaneous tissue at a 45 degree angle, adjust drip rate to 1-2 mL per minute. (May use 2 sites simultaneously if needed.) • Maximal volume about 3 liters / day; requires site rotation. • Local swelling can be reduced with massage to area. • Hyaluronidase 150 units / liter facilitates fluid absorption but not required; may not decrease occurrence of localedema.	*Substitute*			
Consider Use of Veterinary and Other Alternative Sources for Intravenous Fluids and Administration Sets	*Adapt*			

MECHANICAL VENTILATION / EXTERNAL OXYGENATION

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Increase Hospital Stocks of Ventilators and Ventilator Circuits, ECMO or bypass circuits	*Prepare*			
Access Alternative Sources for Ventilators / specialized equipment • Obtain specialized equipment from vendors, healthcare partners, regional, state, or Federal stockpiles via usualemergency management processes and provide just-in-time training and quick reference materials for obtained equipment.	*Substitute*			
Decrease Demand for Ventilators • Increase threshold for intubation / ventilation. • Decrease elective procedures that require post-operative intubation. • Decrease elective procedures that utilize anesthesia machines. • Use non-invasive ventilatory support when possible.	*Conserve*			
Re-use Ventilator Circuits • Appropriate cleaning must precede sterilization. • If using gas (ethylene oxide) sterilization, allow full 12 hour aeration cycle to avoid accumulation of toxic byproducts on surface. • Use irradiation or other techniques as appropriate.	*Re-use*			
Use Alternative Respiratory Support Technologies • Use transport ventilators with appropriate alarms - especially for stable patients without complex ventilation requirements. • Use anesthesia machines for mechanical ventilation as appropriate / capable. • Use bi-level (BiPAP) equipment to provide mechanical ventilation.	*Adapt*			
• Consider bag-valve ventilation as temporary measure while awaiting definitive solution / equipment (as appropriate tosituation				

MECHANICAL VENTILATION / EXTERNAL OXYGENATION

Assign Limited Ventilators to Patients Most Likely to Benefit if No Other Options Are Available ***STEP ONE*:** assess patient acuity using SOFA (see next page+) scoring table and/or other parameters appropriate to the situation (agent-specific prognostic indicators, modifications based on agent involved).	*Re-allocate*			

ORGAN SYSTEM	SCORE =	1	2	3	4
RESPIRATORY Pa02 /	> 400	< 400	< 300	< 200 with resp.	< 100 with resp.
HEMATOLOGIC Platelets	> 150	< 150	< 100	< 50	< 20
HEPATIC Bilirubin (mg / dl)	< 1.2	1.2 – 1.9	2.0 – 5.9	6 – 11.9	> 12
CARDIOVASCULAR Hypotension	None	Mean Arterial Pressure	Dopamine < 5 or any	Dopamine > 5 or Epi < 0.1	Dopamine > 15 or Epi > 0.1
CENTRAL NERVOUS SYSTEM	15	13 - 14	10 - 12	6 - 9	<6
RENAL Creatinine	<1.2	1.2 - 1.9	2.0 - 3.4	3.5 - 4.9	>5.0

MECHANICAL VENTILATION / EXTERNAL OXYGENATION

RECOMMENDATIONS				***Strategy***	***Crisis***
***STEP TWO*:** Compared to other patient(s) requiring and awaiting external ventilation / oxygenation, does this patient have significant differences in prognosis or re-source utilization in one or more categories below that would justify re-allocation of the ventilator / unit? Factors listed in relative order of importance/weight. Injury/ epidemiologic factors may ha				*Re-allocate*	
Criteria	Patient keeps resource		Resource re-allocated		
1.Organ system function[a]	Low potential for death death (SOFA score ≤ 7)	Intermediate potential for death (SOFA score 8-11)	High potential for (SOFA score ≥12)		
2.Duration of benefit / prognosis	Good prognosis based upon epidemiology of specific disease/ injury.	Indeterminate / intermediate prognosis based upon epidemiology of specific dis-ease / injury	Poor prognosis based upon epidemiology of specific disease / injury (e g; pandemic influenza)		
	No severe underlying disease.[b]	Severe underlying disease with poor long-term prognosis and/or ongoing resource demand (e.g., home oxygen dependent, dialysis dependent) and unlikely to survive more than 1-2 years	Severe underlying disease with poor short-term (e.g., <1 year) prognosis		
3.Duration of need	Short duration – flash pulmonary edema, chest trauma, other conditions preexisting anticipating < 3 days on ventilator	Moderate duration – e.g., pneumonia in healthy patient (estimate 3-7days on	Long duration – e.g., ARDS, particularly in setting of ventilator) lung disease		
4.Response to mechanical ventila- tion	Improving ventilatory	Stable ventilatory parameters over time	Worsening ventilatory		
[a] The Sequential Organ Failure Assessment (SOFA) score is the currently preferred assessment tool but other predictive models may be used depending on the situation / epidemiol- ogy. Note: SOFA scores were not designed to forecast mortality, and thus single or a few point difference between patients may not represent a 'substantial difference' in mortality, but larger differences and trends can be extremely helpful in determining resource assignment					
[b] Examples of underlying diseases that predict poor short-term survival include (but are not limited to): 1. Congestive heart failure with ejection fraction < 25% (or persistent ischemia unresponsive to therapy or non-reversible ischemia with pulmonary edema) 2. Severe chronic lung disease including pulmonary fibrosis, cystic fibrosis, obstructive or restrictive diseases requiring continuous home oxygen use prior to onset of acuteillness 3. Central nervous system, solid organ, or hematopoietic malignancy with poor prognosis forrecovery 4. Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy orencephalopathy					
[c]Changes in Oxygenation Index over time may provide comparative data, though of uncertain prognostic significance. OI = MAWP x FiO2 / PaO2 where: OI = oxygenation index, MAWP= Mean Airway Pressure, FiO2 = inspired oxygen concentration, PaO2 = arterial oxygen pressure (May be estimated from oxygen dissociation curve if blood gas unavailable.)					
***STEP THREE*:** Re-allocate ventilator / resource only if patient presenting with respiratory failure has significantly better chance of survival/benefit as compared to patient currently receiving ventilation. Follow additional regional and state/federal guidance and institutional processes for scarce					

BLOOD PRODUCTS

STRATEGIES FOR SCARCE RESOURCE

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

Category	*RECOMMENDATIONS*	*Healthcare*	*Blood Center*	*Strategy*	*Conventional*	*Contingency*	*Crisis*
All Blood	• Increase donations if required, and consider local increase in frozenreserves • Increase O positive levels • Consider maintaining a frozen blood reserve if severe shortage • Increase recruitment for specific product needs		√	*Prepare*			
	• Consider adjustments to donor HGB/HCT eligibility		√	*Adapt*			
	• Relax travel deferrals for possible malaria and BSE (bovine spongiformencephalitis)*		√	*Prepare*			
Packed Red Blood Cells	• Use cell-saver and auto-transfusion to degree possible	√		*Re-use*			
	• Limit O negative use to women of child-bearing age • Use O positive in emergent transfusion in males or non-child bearing females to conserve O nega- tive	√		*Conserve*			
	• Change donations from whole blood to 2x RBC apheresis collection if specific shortage of		√	*Adapt*			
	• More aggressive crystalloid resuscitation prior to transfusion in shortage situations (blood substi- tutes may play future role)	√		*Conserve*			
	• Long-term shortage, collect autologous blood pre-operatively and consider cross-over	√		*Conserve*			
	• Enforce lower hemoglobin triggers for transfusion (for example, HGB 7)	√		*Conserve*			
	• Consider limiting high-consumption elective surgeries (select cardiac, orthopedic, etc)	√		*Conserve*			
	• Consider use of erythropoietin (EPO) for chronic anemia in appropriate patients	√		*Adapt*			
	• Further limit PRBC use, if needed, to active bleeding states, consider subsequent restrictions includ- ing transfusion only for end-organ damage, then to shock states only	√		*Re-allocate*			
	• Consider Minimum Qualifications for Survival (MQS) limits on use of PRBCs (for example, only initi- ate for patients that will require < 6 units PRBCs and/or consider stopping transfusion when > 6 units utilized). Specific MQS limits should reflect available resources	√		*Re-allocate*			
	• Reduce or waive usual 56 day inter-donation period* based upon pre-donation hemoglobin		√	*Adapt*			
	• Reduce weight restrictions for 2x RBC apheresis donations according to instruments usedand medical director guidance*		√	*Adapt*			
Fresh Frozen	• Though not true substitute, consider use of fibrinolysis inhibitors or other modalities to reverseco- agulopathic states (tranexamic acid, aminocaproic acid, activated coagulation factor use, or other appropriate therapies)	√		*Substitute*			
	• Consider reduction in red cell : FFP ratios in massive transfusion protocols in consultation with blood bank medical staff	√		*Conserve*			
	• No anticipatory use of FFP in hemorrhage without documented coagulopathy	√		*Conserve*			
	• Obtain FDA variance to exceed 24 collections per year for critical types*		√	*Adapt*			

*FDA approval/variance required via American Association of Blood Banks (AABB)

BLOOD PRODUCTS

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

Category	*RECOMMENDATIONS*	*Healthcare*	*Blood Center*	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Platelets	• Though not true substitute, consider use of desmopressin (DDAVP) to stimulate improved platelet performance in renal and hepatic failure patients	√		*Substitute*			
	• May use leukoreduced whole blood pooled platelets (and, if required, consider non-leukore- duced whole blood pooled platelets)		√	*Adapt*	Leukoreduced		Non-leu-koreduce
	• Convert less needed ABO Whole Blood to Apheresis		√	*Adapt*			
	• Transfuse platelets only for active bleeding, further restrict to life-threatening bleedingif required by situation	√		*Conserve*			
	• No prophylactic use of platelets	√		*Conserve*			
	• Accept female platelet donors without HLA antibody screen		√	*Adapt*			
	• Accept female donors for pooled and stored platelets		√	*Adapt*			
	• Apply for variance of 7 day outdate requirement*		√	*Adapt*			
	• Consider a 24 hr hold until the culture is obtained and immediate release for both Pooland Apheresis		√	*Adapt*			
	• Obtain FDA variance to allow new Pool and Store sites to ship across state lines*		√	*Adapt*			
	• Reduce pool sizes to platelets from 3 whole blood donations		√	*Adapt*			

*FDA approval/variance required via American Association of Blood Banks (AABB)

RENAL REPLACEMENT THERAPY

REGIONAL RESOURCE CARD

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

Resource cards are intended to provide incident-specific tactics and planning information to supplement the general strategy cards. They are organized according to the'CO-S-TR' framework of incident response planning – http://www.dmphp.org/cgi/content/full/2/Supplement_1/S51.

Category	*RESOURCE and RECOMMENDATIONS*	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Command, Control, Communication, Coordination	**General Preparedness Information** Compared to other critical care interventions, hemodialysis offers equipment availability, expansion capacity, and care coordination that greatly reduces the risk of contingency and crisis care, at least in our geographic area. Disaster dialysis challenges generally result from: 1. Lack of clean water sources (each hemodialysis requires about 160 liters ultra-clean water) 2. Relocation of dialysis-dependent patients to a new area (evacuation of nursing homes, flood zones, etc.) 3. Increase in patients requiring dialysis (crush syndrome, unusual infections) Outpatient • Primary providers are DaVita and Fresenius – both have extensive contingency plans to increasecapacity and relocate patients (including toll-free numbers to access dialysisservices) • Renal Network 11 (multi-state renal planning, quality, and emergency preparedness) has database of all di- alysis patients in the state/region and assists coordination activities (http://www.esrdnet11.org/resources/ disaster_prep_resources.asp) Inpatient • Most facilities lease inpatient services via contract with above or other agencies; some have own nurses and program – plans should account for contingency use of alternate services / leasing services	*Prepare*			
	Shortage of Renal Replacement Therapy (RRT) Resources • Affected facility should contact involved/affected dialysis provider companies and organizations asexpert consultants[1] (MDH OEP and the Renal Network 11 website maintain contact information)				
Space	**Relocated Patients Requiring Outpatient Dialysis** • Contact usual outpatient provider network to schedule at new facility – refer patients to'hotlines' as needed **Excess Patients Requiring Dialysis** • Transfer patients to other facilities capable of providingdialysis • Consider moving patients to facilities with in-house water purification if water quality is an issue formul- tiple inpatients requiring dialysis	*Substitute*			
	• Consider moving other inpatient or outpatient dialysis staff and equipment to facilities requiring increased dialysis capacity	*Adapt*			

RENAL REPLACEMENT THERAPY
REGIONAL RESOURCE CARD

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Supplies	**Water Supply** • Quantify water-purifying machines available for bedside dialysismachines • Identify facilities providing high-volume services purify their own water and pipe to specific rooms inthe dialysis unit, intensive care, etc. • Identify water-purifying and dialysis machines to be obtained through leaseagreements	*Prepare*			
	Water Contamination • Consider alternate sources ofwater	*Prepare*			
	• Consider transferring stable inpatients to outpatient dialysis centers for dialysis treatments and vice	*Substitute*			
	• Consider use of MN National Guard water reserves and purification equipment – but must assureadequate purity for dialysis (potable is NOT sufficiently clean)	*Adapt*			
	Power Outage or Shortage • Consider transferring stable inpatients to outpatient dialysis centers for dialysis treatments and vice versa • Consider transferring inpatients to other hospitals	*Substitute* *Adapt*			
	Dialysis Catheters, Machines, Reverse Osmosis Machines, and/or Other Supply Shortages ***Note:*** Dialysis catheters and tubing are inexpensive, relatively interchangeable, and supplied by several manufacturers				
	• Stock adequate dialysis tubing sets and venous access catheters (Quinton, etc.) for at least one month's usual use	*Prepare*			
	• Identify provider network and other sources of supplies and machines				
	• Transfer machines/supplies between outpatient centers and hospitals, or betweenhospitals	*Substitute*			
Staff	**Dialysis Staff Shortages**[2] • Non-dialysis nursing staff to take on "routine" elements of dialysis nursing (e.g., taking VS, monitoring respi- ratory and hemodynamic status, etc.)	*Substitute*			
	• Dialysis nursing staff to supervise non-dialysis nursing staff providing some dialysis functions • Outpatient dialysis techs may be used to supervise dialysis runs if provider deficit is critical issue (would be unlikely aside from potentially in pandemic or other situation affecting staff)	*Adapt*			
Special	**Community Planning** • Medical needs of re-located renal failure patients are substantial; planning on community level should incorporate their medication and dietary needs during evacuation and sheltering	*Prepare*			
	Insufficient Resources Available For All Patients Requiring Dialysis • Change dialysis from 'scheduled' to 'as needed' based on clinical and laboratory findings (particularly hyper- kalemia and impairment of respiration) – parameters may change based on demand for	*Conserve*			

	• Conceivable (but extraordinary, given outpatient dialysis machine resources) situations may occur where resources are insufficient to the point that some patients may not be able to receive dialysis (for example, pandemic when demand nationwide exceeds available resources) – access to dialysis should be considered as part of critical care intervention prioritization (see Mechanical Ventilation Strategies for Scarce Resource Situations)	*Re-allocate*			

RENAL REPLACEMENT THERAPY
REGIONAL RESOURCE CARD

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Treatment	**Crush Syndrome** • Initiate IV hydration and acidosis prevention protocols "in the field" for crush injuries to prevent/treat rhab- domyolysis in hospital settings	*Conserve*			
	Mode of Dialysis • Restrict to hemodialysis only for inpatient care (avoid continuous renal replacement therapy(CRRT) and peritoneal dialysis (PD) due to duration of machine use (CRRT) and supply	*Substitute*			
	Increased Demand on Resources • Shorten duration of dialysis for patients that are more likely to tolerate itsafely • Patients to utilize their home "kits" of medication (Kayexalate) and follow dietary plans to help increase time between treatments, if necessary	*Conserve*			
Transportation	**Transportation Interruptions** • Dialysis patients may require alternate transportation to assure ongoing access to dialysis treatment. • Chronic patients should coordinate with their service providers / dialysis clinics first for transportation and other assistance during service/transportation interruptions. • Emergency management and/or the health and medical sector may have to supplement contingency transportation to dialysis during ice stroms or other interruptions to transportation.	*Prepar* *e*			

[1] The major national dialysis corporations have extensive experience contending with disasters; their input during any anticipated or actual incident is imperative to optimize the best patient care in Minnesota.

[2] See Staffing in the Core Clinical Strategies for Scarce Resource Situations cardset.