



# Health Care

## *Critical Resource Triage*

April 2020

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### **Overview**

As part of the COVID-19 Pandemic emergency preparedness efforts, University of Missouri Health Care (UMHC) is establishing a critical resource allocation guideline to provide a clinical and ethical-legal framework to assist health care teams and the general public in the event of severe shortages of critical resources for the critically ill. These guidelines are drawn from the work of Drs. Douglas White and Scott Halpern, who in response to the intensifying pandemic, consolidated a decade-long research and community engagement effort that has been expanded upon to create a model hospital policy.<sup>1-4</sup> Other resources utilized to develop this document include multiple state and institutional resource triage protocols and guidelines.<sup>5-6</sup> Many state agencies and health care systems have developed similar allocation guidelines based on these models, with the hope that they will never be needed.

The purpose of this document is to provide guidance for triage of critically ill patients when a public health emergency creates demand for critical resources, beyond the supply. These recommendations are designed to be enacted if:

- 1) Critical resource capacity is, or will shortly be, overwhelmed despite taking all appropriate steps to increase surge capacity for critically ill patients, or
- 2) A regional authority has declared a public health emergency

## Ethical Considerations

Our critical resource allocation is based on an ethical framework with five core components.<sup>7-10</sup>

- Duty to **care** is the fundamental professional obligation to care for patients.
- Duty of **stewardship** requires responsible management of resources during periods of scarcity.
- Duty to **plan and prepare** is the responsibility of government and healthcare systems to plan and prepare for foreseeable crises.
- **Distributive justice** requires that care and treatment be provided equitably to all and that no one be discriminated against.
- **Transparency** is a fiduciary responsibility ensuring that the process of developing allocation protocols seeks input, feedback and revision, promoting public trust.

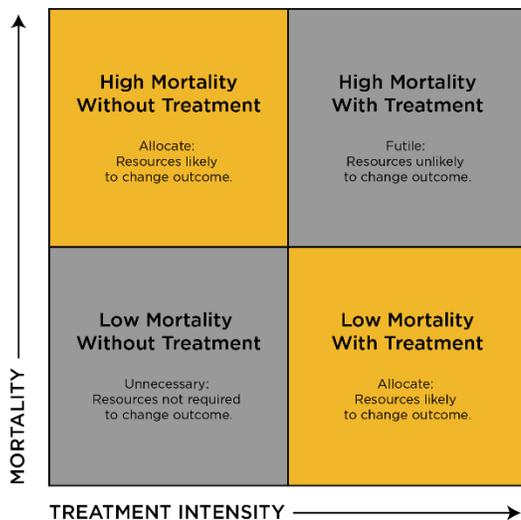
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*This framework is devoid of bias based upon age, race, ethnicity, gender, insurance status, perceptions of social worth, immigration status, or any other societal influence.*

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This allocation framework is grounded by ethical obligations above, is consistent with existing recommendations guiding allocation of scarce resources during a public health emergency, and has been informed by extensive consultation with citizens, disaster medicine experts, and ethicists. It is devoid of bias based upon age, race, ethnicity, gender, insurance status, perceptions of social worth, immigration status, or any other societal influence.

### Primary Goal: Save the most lives



In a public health emergency with resource scarcity, patients most likely to survive with treatment are prioritized, defined by short-term, not long-term (years) survival. Those with the highest probability of mortality with treatment, as well as those with the smallest probability of mortality without treatment, have *lowest* priority for receiving critical resources. Thus, patients most likely to survive without treatment, plus those most likely to survive with treatment increase the number of survivors.

The primary goal of this allocation framework is to save the most lives. By maximizing benefit to populations of patients, we provide the greatest good for the greatest number under dire circumstances when unfortunately all cannot be saved.<sup>1,2</sup> Clearly, this goal is dramatically different from the traditional focus of medical ethics, which centers primarily on promoting the wellbeing of individual patients.<sup>3</sup> As described below, the allocation framework operationalizes the broad public health goal of utilizing critical resources to treat patients most likely to survive to hospital discharge and beyond.<sup>4</sup>

The allocation framework described in this document differs in two important ways from other allocation frameworks. First, it does not categorically exclude any patients who otherwise would be eligible for critical resources. Instead, all patients are eligible to receive critical resources and a priority assignment based on the potential to benefit. The availability of critical resources determines how many priority groups will be accommodated.

Second, the allocation framework goes beyond simply attempting to maximize the number of patients who survive to hospital discharge, but rather strives to increase overall survival reflected in total life years.<sup>5</sup> The allocation framework should be considered an altered standard of care, necessitated by society and health care systems with scarce resources, needing to respond to extreme and emerging threats to public health, and seeking to maximize overall survival expressed as the number of life-years saved.

This document describes the creation of Triage Teams to ensure fair and consistent decision making, criteria for initial allocation of critical resources, and reassessment criteria to determine whether ongoing provision of critical resources is justified for individual patients with very low likelihood of surviving even with maximal treatment, or high likelihood of surviving without treatment.

## Section 1. Triage Officers and Team

Clinicians actively involved in treating patients will not make triage decisions. Instead, a physician will be designated as a Triage Officer, supported, if resources allow, by a Triage Team who will apply the allocation framework. The separation of triage and clinical care roles serves to promote objectivity, avert bias from conflict of commitment, and minimize moral distress. The Triage Team will collaborate with attending physicians to disclose triage decisions to patients and families.

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### Rationale for Triage Officers and Teams

The Triage Officer and team hold the responsibility of implementing the allocation plan. It is important to emphasize that physicians and care teams will not be expected, nor allowed to make triage decisions. These are difficult decisions grounded in population and public health ethics, not clinical ethics. Care teams have the responsibility to care and advocate for their individual patients, while the difficult process of triage is the responsibility of a Triage Officer and supporting team, using criteria that are universally applied. The Triage Officer and team will have expertise in applying the criteria objectively and fairly in each case.

### Potential Conflicts of Interest

While the incorporation of triage officers and teams will mitigate many of the conflicts of interest that may arise between health care providers and allocation determinations, it is recognized that there may be instances where the triage officer or members of the triage team may also have a conflict of interest. In a community the size of Boone county, it is possible that a family member, close friend or colleague may become ill and require critical resource allocation. In this scenario, the Triage Officer or Team member will:

1. Openly acknowledge and declare the potential conflict of interest
2. Disclose the conflict to Incident Command
3. Recuse her/himself from the critical resource triage process for the patient involved

In response to the member's recusal, a different member of the team will be assigned to apply the algorithm. The team member with possible conflict of interest will not participate in any portion of the Critical Resource Triage process regarding the patient in question. In the case where a prominent member of the community, such as the Mayor, Governor, or institutional leader has become ill and requires critical resource allocation, it is impossible to achieve complete impartiality, as the patient's notoriety is ubiquitous in the community. These scenarios may undergo additional scrutiny by the Triage Review Committee to ensure the algorithm is applied consistently and evenly.

## **Triage Officer**

A team of Triage Officers will be appointed. Desirable qualities include being a physician with established expertise in the management of critically ill patients (ideally, specialists in critical care and emergency medicine or the equivalent), recognized strength of leadership, effective communication and conflict resolution skills, and not actively involved in patient care while serving. One Triage Officer will be selected to lead and oversee the triage process. When deployed, the Triage Team will assess all patients requiring critical resources, assign a level of priority for each, and direct attention to the highest-priority patients. The Triage Officer and team will also make decisions regarding reallocation of critical resources that have previously been allocated, which is described below. Triage Teams are expected to always make determinations compliant with the allocation framework. To optimize effective functioning in a crisis, the Triage Officers and teams will be well prepared and trained in advance.

Triage Officers will be nominated by clinical department leaders. The Chief Medical Officer and Incident Command will approve all nominees. A roster of approved Triage Officers will be maintained and will be expansive enough to ensure that Triage Officers are available on short notice and at all times. It is also important that Triage Teams have sufficient rest between rotations on service.

## **Triage Team**

The Triage Team will consist of nurses and other staff. The role of Triage Team members is to provide information to the Triage Officer and to help facilitate and support her/his decision-making process. An experienced representative from hospital administration may also be linked to the team. The Triage Officer and team members will function in shifts lasting no longer than 13 hours. Team decisions and supporting documentation will be reported daily to appropriate hospital leadership and Incident Command.

## **Communication of triage decisions to patients and families**

Communicating to patients and families when resources are not allocated or withdrawn is a difficult process for all involved. Communication and disclosure of triage decisions to patients and families is a key component of a fair and respectful allocation process.<sup>6</sup> The Triage Officer and attending physicians should mutually support and collaboratively determine the best approach to inform the individual patient and family.

Options for who should communicate the decision include:

1. Only the attending physician
2. Only the Triage Officer
3. A collaborative effort between the two

The best approach will depend on a variety of case-specific factors, including the dynamics of the individual doctor-patient-family relationship, the known preferences of the patient, and the preferences of the attending physician. If the attending physician is comfortable with disclosing, this approach is useful as it coincides with the traditional responsibility of the patient's physician. Thus, communication regarding triage will bridge naturally to a conveyance of information about the clinical circumstances and prognosis. Having only one person convey the decision will also limit the number of clinicians exposed to a circulating pathogen. The third (collaborative) approach is useful because it may lessen moral distress for individual clinicians and may augment trust in the process, but these benefits must be balanced against the needs of the patient and family and risk of greater clinician exposure. It is important to convey the impartiality of the process, and that it was borne of extraordinary circumstances and public health concern. It is also important that patients and families know the personal attributes of the patient (race, ethnicity, gender, insurance status, perceptions of social worth, immigration status, etc.) were assuredly not considered in the decision. In cases where resources are withdrawn or not allocated, palliative care, religious services and others will be available to provide ongoing support and care for the patient and family.

## Triage Review Committee & Appeals

It is possible that patients, families, or clinicians will challenge individual triage decisions. The challenge must be respected, and a formal appeals mechanism will ensue. Appeals will be adjudicated in real time, to maintain operational feasibility and to provide timely resolution. For all triage decisions, the only permissible appeal will be those claiming an error in calculation of the priority score or use/non-use of the Limited Allocation Algorithm (detailed below). The treating clinician or Triage Officer should be prepared to explain the calculation to the patient, family, or care team immediately upon request. Several elements of the appeal process include:

- Individuals appealing triage decisions should explain the grounds for appeal.
- Appeals based on objection to the allocation framework will not be granted.
- The Triage Team will explain the rationale for the triage decision that was made.
- Appeals will be heard by the Triage Review Committee.
- The appeals process will occur in a timely manner.
- Decisions of the Triage Review Committee are final.
- The Triage Review Committee will periodically retrospectively evaluate to ensure that it is consistent, effective, fair, and timely in application of the allocation framework, and will ensure appropriate management of conflicts of interest.

The **Triage Review Committee** will be made up of individuals or their designees from hospital leadership. Clinicians, nurses, risk managers, ethics officers, palliative providers, clergy and others will be involved to provide impartial review of the triage priority.

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*The Triage Review  
Committee, composed of  
hospital leadership, will provide  
review of the triage process,  
and bear appeals.*

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## Section 2. Critical Resource Allocation Framework

All patients meeting usual medical indications for critical medical resources will be assigned a priority score using a 1-8 scale (lower scores indicate higher likelihood of benefit from resource allocation). This score is derived from:

1. Patients' likelihood of surviving to hospital discharge, assessed with an objective and validated measure of acute physiology (SOFA Score)
2. Patients' likelihood of achieving longer-term survival based on the presence or absence of comorbid conditions that may influence survival (**Table 1**).

After calculation, the triage score is converted into color-coded priority groups. All patients will be eligible to receive critical resources regardless of priority score, but critical resources will be allocated according to priority score. Availability of these services will determine how many patients will receive critical resources. Patients triaged to not receive critical resources will still be offered medical care, including intensive symptom management and psychosocial support. Specialist palliative care teams will provide additional support and consultation.

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*All patients will be eligible to receive critical resources regardless of priority score*

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Consistent with accepted altered standards of care during public health emergencies, the primary goal is to maximize benefit for populations of patients, thus providing the greatest benefit to as many as possible, knowing that some cannot survive and some will not receive the treatment they would under normal circumstances due to scarcity of resources. The scoring system applies to all patients requiring critical resources, not only the illness driving the public health emergency. For example, in the setting of a severe pandemic, patients presenting with respiratory failure and other illnesses not caused by the pandemic illness, including those on long term vent support, are subject to the same allocation framework. This process involves two steps, detailed below:

1. Calculate each patient's priority score based on the multi-principle allocation framework
2. Daily determination of priority groups who will receive access to critical interventions

Clinicians will provide immediate intervention and stabilization of any patient with critical illness, as they would under normal circumstances. Temporary critical resource support may be offered if required, to allow time for the Triage Officer to assess for allocation qualification. Every effort should be made to complete the initial assessment within 90 minutes of determining the need for critical services.

### STEP 1: Calculate patients' priority score using multi-principle allocation framework

The framework is based on two considerations:

1. Saving the most lives
2. Saving the most life-years

Patients more likely to survive with treatment are prioritized over those less likely. Patients without comorbid conditions are given priority over those with conditions that limit life expectancy. The Sequential Organ Failure Assessment (SOFA) score is used to determine prognoses for hospital survival. For greater precision, individual patients' life-limiting comorbid conditions are also identified to determine long term prognosis.

Points are assigned according to the patient's SOFA or PELOD-2 (pediatrics) score (range from 1 to 4 points) plus the presence or absence of comorbid conditions - 2 points for major comorbidities, 4 points for serious comorbidities likely to cause death within a year (**Table 2**). These points are then added together to produce a total triage priority score, which ranges from 1 to 8. Lower scores indicate higher likelihood of benefiting from critical resource allocation, and priority will be given to those with lower scores.

**Table 1. Multi-principle Strategy for Allocation**

Goal	Category	Triage Priority Score			
		1 Point	2 Points	3 Points	Points
Short-term survival	<b>Adult</b> SOFA Score	<8	8-9	10-11	>11
	<b>Pediatrics</b> <b>&lt;18 years</b> PELOD-2 Score*	<12	12-13	14-16	>16
Long-term survival	Comorbidities		Major comorbidities		Serious comorbidities

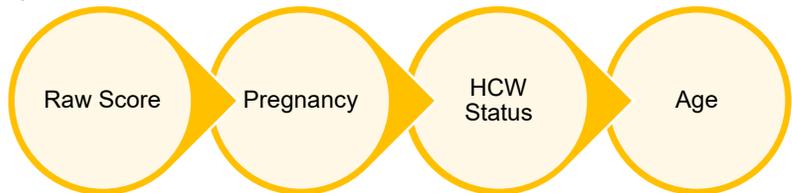
Scores range from 1-8, lowest scores given the highest priority to receive critical resources.

**Table 2. Examples of Major and Serious Comorbidities\***

Major Comorbidities	Serious Comorbidities
<ul style="list-style-type: none"> <li>Any malignancy undergoing treatment within the last year</li> <li>Congestive heart failure, Class 3</li> <li>Myocardial infarction ≤12 months, or multivessel CAD</li> <li>Chronic lung disease, requiring 2 medications</li> <li>Pulmonary hypertension, Class 3</li> <li>Chronic kidney disease, Stage 4</li> <li>Liver disease, Pugh Score B</li> <li>Immunodeficiency (HIV, XLA, CVID)</li> <li>Stroke history, with deficits req. ADL assistance</li> <li>Paraplegia or quadriplegia</li> <li>Chronic wounds, any cause</li> <li>BMI ≥ 50</li> </ul>	<ul style="list-style-type: none"> <li>Any metastatic malignancy</li> <li>Congestive Heart Failure, Class 4</li> <li>Subsequent myocardial infarction within 12 months</li> <li>Lung disease requiring oxygen at home</li> <li>Pulmonary hypertension, Class 4, cor pulmonale</li> <li>Chronic kidney disease Stage 5, Dialysis-dependent and &gt; 60 years old</li> <li>Liver Disease, Pugh Score C</li> <li>Severe immunodeficiency (SCID)</li> <li>TPN-dependent or severe malnutrition</li> </ul>

**Limited Allocation Algorithm**

Once resources are allocated to the highest priority category, there may be resources still available to allocate. In this case, a limited number of patients in the next priority group may receive critical resources based upon availability. This is accomplished by first stratifying the category by raw triage score. Ranked lowest to



highest, and consistent with the allocation framework, patients with the lowest scores will receive priority. The next “tie-breaker” gives priority to pregnant women in their third trimester. If ties still exist, priority is given to health care workers (nurses, therapists, physicians, EMS providers, etc.) in the clinical, administrative or research realms focused on the current health crisis. As a final tiebreaker, age can be utilized with younger patients given priority. The intent of making this age distinction is not to unfairly advantage the young or disadvantage the old. Younger persons are comparatively disadvantaged by not having had the opportunity of living every stage of life; making this allocation decision recognizes the value of offering all individuals equal opportunity to experience as many stages of life as possible. If this distinction is not readily apparent, or these four levels fail to stratify the category, random allocation will occur between the remaining individuals. Importantly, this rationale does not rely on considerations of intrinsic worth or social utility for types or groups of individuals.<sup>7</sup>

## No categorical exclusion criteria

We will not exclude anyone from access to critical resources during a public health emergency, for several reasons:

- 1) The use of rigid categorical exclusions would be a major departure from traditional norms of medical and nursing practice and raise fundamental questions of fairness.
- 2) Such restrictive measures are not necessary to accomplish public health goals in a pandemic situation. It is justifiably equitable and feasible to assign all patients a priority score and allow the availability of resources to dictate who and how many will receive treatment when all cannot.
- 3) Categorical exclusion policies may be interpreted to mean that some groups are “less worthy of saving,” leading to perceptions of unfairness and feelings of distrust.

In a public health emergency, public trust is essential to ensuring acceptance and compliance with restrictive public health measures. It must be made clear that all individuals are “worth saving” by openly recognizing that all patients who would otherwise receive critical resources under normal circumstances remain eligible to receive them in a public health emergency. Further, we allow the availability of resources to determine eligibility. There are some conditions that lead to immediate or near-immediate death despite aggressive treatment. These are futile clinical circumstances for which the standard of care is to not aggressively treat (e.g., cardiac arrest unresponsive to appropriate ACLS, massive intracranial bleeds, intractable shock, overwhelming sepsis, untreatable advanced malignancies, etc.). In a public health emergency, clinicians are likewise required to make clinical judgments about appropriateness of treatment using standards of care appropriate to the moment.

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*It must be made clear  
that all individuals are  
“worth saving”*

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## **STEP 2: Daily determination of priority group resource allocation**

The Triage Team will make determinations at least daily, and more frequently as needed, about what priority scores will have access to critical resources. These determinations will be based on real-time knowledge of the degree of scarcity of the critical resources, as well as information about the predicted volume of new cases that will be presenting for care over the near-term (several days). For example, should resources reach critically low levels, only patients with the highest priority (lowest scores, e.g., 1-3) would receive resource allocation. As scarcity subsides, patients with progressively lower priority (higher scores) will be given access.

Using priority categories is consistent with standard practices in disaster medicine and avoids allowing marginal differences in scores on an allocation framework that has not been extensively tested to be the determinative factor in allocation decisions.

### **Assigning patients to color-coded priority groups.**

Once a patient’s priority score is calculated using the multi-principle scoring system described in Table 2, each patient will be assigned to a color-coded priority group (Table 3). This color-coded assignment of priority groups is designed to allow Triage Officers to create operationally clear groups to receive critical resources, according to their priority score. For example, individuals in the red group have the best chance to benefit from critical interventions and will therefore receive priority over all other groups in the face of scarcity. The yellow group has intermediate priority and will receive critical resources if there are available resources after all patients in the red group have been allocated critical resources. The blue group has lowest priority and will receive critical resources if available after all patients in the red and yellow groups have been allocated critical resources.

It is important to reiterate and make clear that all patients are *eligible* to receive critical services regardless of their priority score. It is the *availability* of resources that determines who and how many are eligible to receive critical resources.

**Care of patients who do not receive critical resources.**

Patients who are not triaged to receive critical resources will receive intensive symptom management, spiritual and psychosocial support. They will be reassessed daily to determine if changes in resource availability or clinical status warrant reconsideration of resource allocation. The palliative care team and chaplain services will be available for consultation when and where needed.

**Table 3. Triage Priority Groups**

Priority Score 1-3	Priority Score 4-5	Priority Score 6-8
Highest Priority	Intermediate Priority	Lowest Priority
Resources allocated first.	Resources allocated based on availability	Resources allocated last

**Section 3. Reassessment for Continued Treatment**

The Triage Team will conduct periodic reassessments of all patients receiving critical resources during times of crisis (i.e. not merely those initially triaged under the crisis standards) to determine whether continued treatment is warranted. The timing of reassessments will be based on evolving understanding of typical disease trajectories and of the severity of the crisis. Patients will undergo reassessment identical to initial triage priority scoring, with one exception – clinical improvement or decline will be factored into the equation. All patients allocated critical resources services will be allowed a therapeutic trial, the duration of which will be determined by the clinical specifics of the public health threat and resource availability. Trial duration will be determined by Incident Command as early in the public health emergency as possible, and will reflect the natural history of the disease, preventive interventions, evidence-based treatment options, and other needed resources. The trial duration may be modified as appropriate if subsequent data emerge to suggest trial duration should be extended or shortened.

Patients undergoing reassessment and showing improvement, will continue to receive critical resources until the next assessment. Patients showing substantial clinical deterioration, as evidenced by worsening priority score, may have critical resources withdrawn, and allocated to those with a greater chance of survival. This will occur after discussion with the care team, patient and/or family. These patients will receive medical care including intensive symptom management and psychosocial support. Where available, specialist palliative care teams will provide additional support and consultation. In circumstances where patients experience a precipitous decline (e.g., refractory shock with DIC) or a highly morbid complication (e.g., massive stroke) which portends a very poor prognosis, the Triage Team may make the decision to discontinue treatment before completion of the treatment trial. In a public health emergency with scarce resources the goal of maximizing population outcomes would be jeopardized if patients determined unlikely to survive are allowed indefinite use of critical resources. Periodic objective reassessment also lessens the chance that subjective considerations will unduly influence patient selection for treatment.

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*In a public health emergency with scarce resources the goal of maximizing population outcomes would be jeopardized if patients determined unlikely to survive are allowed indefinite use of critical resources*

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## Section 4.

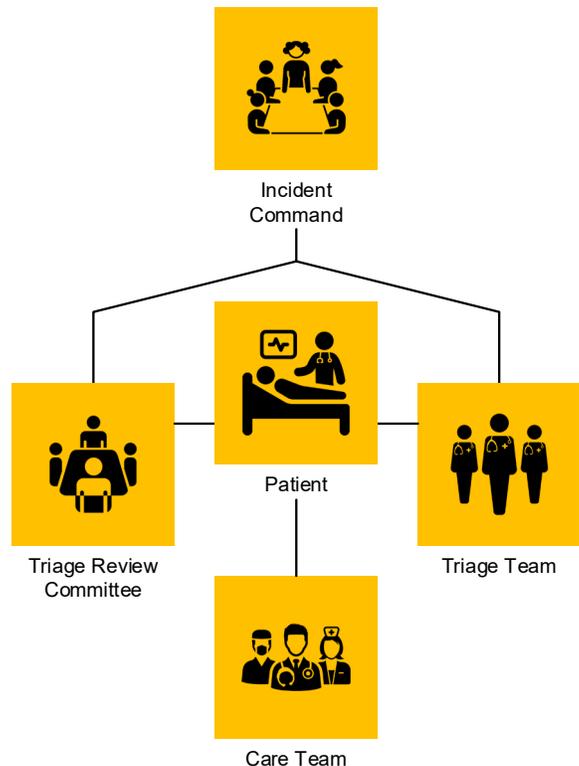
### Organization and Logistics of Triage

#### Triage Officer (4-6 Officers)

- Physician, preferably with critical care experience.
- Recognized as an effective leader.
- Effective communication and conflict resolution skills.
- Not actively involved in patient care while serving as Triage Officer.

#### Triage Officer Duties

- Each Triage Officer will be on-duty for 12.5 hours.
  - Day shift 0800-2030. Night shift 2000-0830, or as determined.
- Holds responsibility for initial triage scoring for all patients requiring critical resources, including those not affected by the current health crisis.
- May employ Triage Team members to aid in initial triage scoring dependent upon volume.
- Leads daily briefing at the end of shift (i.e. day shift, leads the 2000 briefing, night shift leads the 0800 briefing), or as determined by the Team.
- Notifies treating physicians of critical patient score determination and clarifies action based upon score.
- Communicates withdrawal or denial of resources to patient and families.
- Determines patient reassessment duty assignments for Triage Team members.
- Leads reassessment briefings with Triage Team.
- Delivers critical reassessment determinations to treating physicians.
- Liaison to Incident Command.
- Disclose potential conflicts of interest to Incident Command.



#### Triage Team (4-6 teams)

- Each 12.5-hour shift will include 1 of each: Triage Officer, Backup Triage Officer, Respiratory Therapist or clinical Pharmacist or other clinical staff, and a nurse. Nurses with critical care or emergency department experience preferred. If pediatric resource triage activated, one member should preferably have pediatric experience.
- An administrative assistant will be available during day shift to assist with reassessment.

#### Triage Team Duties

- Attend regular (approx. 30 min) briefings (via secure teleconference or TBD); suggested to occur at 0800 and 2000 (or TBD).
- Complete reassessments for assigned patients daily, and present scores during Reassessment Briefing (suggested 1100 or TBD).
- Document patient triage priority assessment scores.
- Aid in conflict resolution.
- Disclose potential conflicts of interest to Triage Officer or Incident Command.

#### Triage Review Committee

- Purpose: Vote on all appeals, and to meet periodically to review the process.
- Backup Triage Officer is a non-voting member to assist with process questions and evaluation.
- Members: Chief Medical Officer, Chief Nursing Officer, Risk Management representative, Ethics representative or their chosen designees. Members may not actively be involved in clinical care of the patient undergoing appeal.

Alternate designees may include: ICU Directors, Clinical Department Chairs, Clinical Division Chiefs, Nursing Directors, Nursing leadership and will be chosen by members above as necessary.

### **Triage Review Committee Duties**

- Assess all appeals
  - Ensure triage score calculations are correct
  - Ensure assessment and appeal process proceeds appropriately
- Meet periodically. Frequency determined by the group.
  - Suggested meeting agenda:
    - Review cases regarding withdrawal of resources.
    - Review random selection of cases to ensure accurate scoring.
    - Review allocation priority categories.
    - Discuss the process and its efficacy.
    - Review any conflicts of interest and steps taken to mitigate concern.

## **Briefings**

### **Regular Triage Briefings**

- Attendance: Triage Officer (day & night), Triage Team, other key personnel deemed necessary by Triage Officer
- Format: Teleconference or in-person, dictated by Triage Officer
- Time: TBD
- Suggested briefing agenda/roles assigned:
  - Review total critical care patients – Incident Command member
  - Review changes in critical care patient volume from previous day– Incident Command member
  - Review current categories– Triage Officer
  - Review any withdrawal of resources – Triage Officer
  - Determine category to receive full resources (discussion, followed by simple majority vote) –Triage Officer
  - Individual patients assigned to Triage Team to perform reassessment – Triage Officer
  - Open forum

### **Regular Reassessment Briefing**

- Attendance: Triage Officer and Triage Team (day only)
- Format: Teleconference or in-person, dictated by Triage Officer
- Time: TBD
- Suggested briefing agenda
  - Review reassessments - All
  - Patients with the same score as previous day – Triage Officer
  - Patients with worse (higher) score than previous day – Triage Officer
  - Patients with better (lower) score than previous day – Triage Officer
  - Issues with score calculation - Triage Officer
  - Expected changes based upon Team assessments - All

## **Initial Scoring**

### **Triage Pager**

- Triage Officers will carry a pager to receive notifications of ICU/PCU admissions and transfers. Individuals not on duty will continue to receive pages, but not required to return them.

### **Triage Initiation Process**

- When a transfer bed request to an ICU or PCU is received by the bed board, an automatic page is generated to the Triage Officer.
- The Triage Officer then performs the initial assessment within 90 minutes.

- If triage assessment priority score is within range to NOT receive critical resources, the treating physician and family will be notified immediately by the Triage Officer.
- If an appeal is generated, it will be managed by the Triage Review Committee.

## Reassessment – Day Team Only

- All patients that are allocated critical resources, will be reassessed daily using the algorithm.
- At the Triage Briefing, Triage Team members will be assigned patients to review.
  - Assignment determination based upon Triage Officer discretion.
  - Reassessment will be performed no less than 12 hours since initial assessment, and no greater than 24 hours since initial assessment.
  - Reassessments completed in a shared, secure file. (IT secure)
- Patients are reassessed daily to determine trends
- While reassessments will occur daily, individual patient resource allocation decisions will occur every 48 hours. This is to allow patients the opportunity for improvement or decline.
- In the event of precipitous decline (refractory hypotension, CPR, refractory hypoxemia, massive CVA, etc.), critical resources may be withdrawn prior to the 48 hours, but only in cases where likelihood of survival extremely low. Every effort will be made to afford the full 48-hour trial of resources.
- Withdrawal of resources will be communicated if necessary.

## Communication of Triage Results

### Communication to Treating Physicians

- If the priority score calculation is high enough to withhold critical resources, the Triage Officer will communicate directly with the requesting treating physician and family.

### Communication to Patients

- Patients will be notified of triage priority scores if those scores put them at risk for withdrawal or denial of resources.
- The Triage Officer and treating physician if warranted, will deliver the message.
  - Triage Team members may deliver triage messages to patients and families.
- Appeals will expectedly occur, and will be forwarded to the Triage Review Committee.

## Appeals Process

Patients, patient families and treating physicians may request an appeal via the Triage Officer or Team. Appeals based upon scoring methodology will not be heard. Appeals should be completed within 2 hours of request.

### Initial/Reassessment Appeals

- Appeals will only be heard regarding potential errors in score calculation.
- The Triage Review Committee will manage the appeals process.
- Assessment scores will be reviewed and recalculated as necessary.
- Three members of the Review Committee are needed to render a decision, based on simple majority vote.
- Further appeals will not be heard.
- Triage Team members will be available to aid in explaining the scoring process to patients and families if necessary.

## Critical Resource Triage Activation

- When nearing the threshold of resource availability, the Triage Officer will be notified by Incident Command prior to resource exhaustion, to allow time for Critical Resource Triage activation.
- Lead time prior to resource exhaustion is dependent upon multiple factors, and will vary based upon the current health care emergency.

# Appendix A: University of Missouri Health Care Critical Resource Triage

## 1. Triage Priority Score Calculated

Triage Priority Score				
Category	1 Point	2 Points	3 Points	4 Points
Adult SOFA	<8	8-9	10-11	>11
Peds PELOD-2	<12	12-13	14-16	>16
Comorbid Conditions		Major		Serious
SOFA or PELOD-2 + Comorbid Points = Triage Score				

## 2. Initial Triage Priority Group determined

<b>Triage Priority Score</b> <b>1-3</b>	<b>Triage Priority Score</b> <b>4-5</b>	<b>Triage Priority Score</b> <b>6-8</b>
<b>Highest Priority</b> Resources allocated first.	<b>Intermediate Priority</b> Resources allocated based on availability	<b>Lowest Priority</b> Resources allocated last

## 3. All, Limited or No patients allocated resources based on categorical determination to each category. Resource allocation based upon availability.

<b>Full Allocation</b>	Patients receive critical resource allocation, and are reevaluated for triage at 48-hours.
<b>Limited Allocation</b>	Remaining resources will be allocated based on inter-categorical priority stratification via the Limited Algorithm.*
<b>Not Allocated</b>	In times of critical scarcity, lowest priority patients will not receive resources, and alternative pathways will be enacted, including palliation or non-admission.

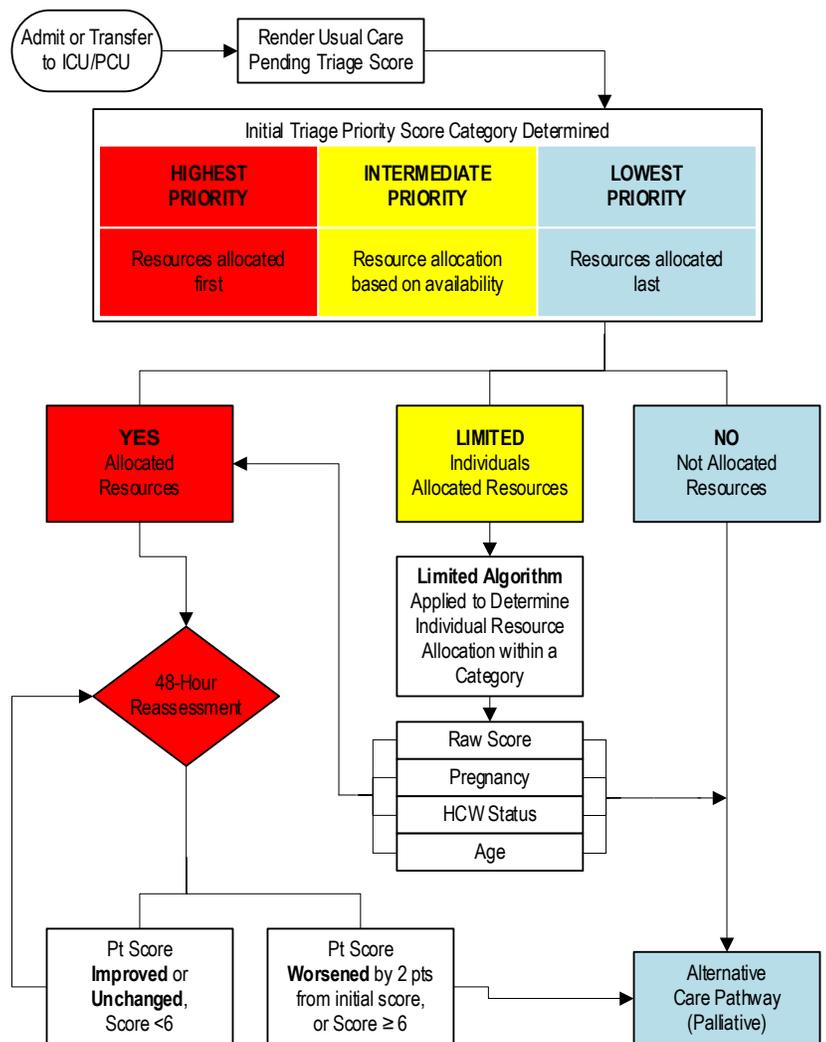
## 4. Patients receiving resources, reassessed at 48 hours.

If condition is improving or unchanged, and Triage Score remains < 6, patients continue to be allocated resources. If Triage Score has increased by 2 or more points from initial score, or ≥6, resources are withdrawn and alternative care pathway is pursued. Appeal process may be enacted.

## 5. Limited Algorithm: When there are not enough resources for an entire category, individuals are stratified within the category to determine resource allocation. Stratification proceeds as below:

1	2	3	4
Raw Score	Pregnancy	HCW Status	Age
Ranked lowest to highest, lowest raw scores receive resources first	In the event of a further tie, pregnant patients will be given priority	In the event of a tie in raw score, HCW's will be given priority	Further ties will be resolved by age, with youth given priority

If necessary, further 'ties' will be resolved by random allocation.



**Pregnancy:** 3rd trimester pregnancy with a viable fetus, confirmed by FHT monitoring

**HCW Status:** Health care workers actively employed and caring for patients and/or currently working in clinical, administrative or research realms focused on the current health crisis.

**Major comorbidity:** Those that decrease life expectancy by approximately 10 years, and/or are life-limiting, and/or require significant assistance from others. List below not all-inclusive.

**Serious comorbidity:** Severely life-limiting, and/or are a constant threat to life, and/or have approximately 1 year of less life expectancy. Examples are below, list is not all-inclusive.

Major Comorbidities	Serious Comorbidities
<ul style="list-style-type: none"> <li>Any malignancy undergoing treatment within the last year</li> <li>Congestive heart failure, Class 3</li> <li>Myocardial infarction ≤12 months, or multivessel CAD</li> <li>Chronic lung disease, requiring 2 medications</li> <li>Pulmonary hypertension, Class 3</li> <li>Chronic kidney disease, Stage 4</li> <li>Liver disease, Pugh Score B</li> <li>Immunodeficiency (HIV, XLA, COVID)</li> <li>Stroke history, with deficits req. ADL assistance</li> <li>Paraplegia or quadriplegia</li> <li>Chronic wounds, any cause</li> <li>BMI ≥ 50</li> </ul>	<ul style="list-style-type: none"> <li>Any metastatic malignancy</li> <li>Congestive Heart Failure, Class 4</li> <li>Subsequent myocardial infarction within 12 months</li> <li>Lung disease requiring oxygen at home</li> <li>Pulmonary hypertension, Class 4, cor pulmonale</li> <li>Chronic kidney disease Stage 5</li> <li>Dialysis-dependent and &gt; 60 years old</li> <li>Liver Disease, Pugh Score C</li> <li>Severe immunodeficiency (SCID)</li> <li>TPN-dependent or severe malnutrition</li> </ul>

# Appendix B: Prognostic Scoring Methods

SOFA Score					
	0	1	2	3	4
P:F Ratio Or SpO <sub>2</sub> /FIO <sub>2</sub>	>400	301-400	201-300	101-200	≤100
Platelets (x10 <sup>9</sup> /L)	>150	≤150	≤100	≤50	≤20
Bilirubin (mg/dL)	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	≥12
Hemodynamics (mcg/kg/min)	Normal	MAP <70	Dopa ≤5	Dopa >5 Epi ≤0.1 NE ≤0.1	Dopa >15 Epi >0.1 NE >0.1
GCS	15	13-14	10-12	6-9	<6
Creatinine (mg/dL)	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 or <500 mL/day UOP	≥5 or <200 mL/day UOP

PELOD-2 Score							
	0	1	2	3	4	5	6
GCS	≥11	5-10			3-4		
Pupils	Both react					Both fixed	
Lactate (mmol/L)	<5.0	5.0-10.9			≥11.0		
MAP (mmHg)							
0-<1 mos.	≥46		31-45	17-30			≤16
1-11 mos.	≥55		39-54	25-28			≤24
11-23 mos.	≥60		44-59	31-43			≤30
24-59 mos.	≥62		46-61	32-44			≤31
60-143 mos.	≥65		49-64	36-48			≤35
≥143 mos.	≥67		52-66	38-51			≤37
Creatinine (μmol/L)							
0-<1 mos.	≤69		≥70				
1-11 mos.	≤22		≥23				
11-23 mos.	≤34		≥35				
24-59 mos.	≤50		≥51				
60-143 mos.	≤58		≥59				
≥143 mos.	≤92		≥93				
PaO <sub>2</sub> (mmHg)/FIO <sub>2</sub>	≥61		≤60				
PaCO <sub>2</sub> (mmHg)	≤58			≥95			
Invasive Ventilation	No			Yes			
WBC (x10 <sup>9</sup> /L)	>2		≤2				
Platelets (x10 <sup>9</sup> /L)	≥142	77-141	≤76				

Predicted Mortality by SOFA or PELOD-2				
Score	<8	8-9	10-11	>11
SOFA Score	<8	8-9	10-11	>11
PELOD-2 Score	<12	12-13	14-16	>16
Mortality	0-27%	27-38%	50-71%	90-95%

Mortality best predicted in 1st 48 hours. Increasing scores have substantial increase in mortality, regardless of the initial score.

Glasgow Coma Score			
	Adults & Children	Infants & Toddlers	Score
Best Eye Response	No eye opening	No eye opening	1
	Open to pain	Open to pain	2
	Open to verbal command	Open to speech	3
	Open spontaneously	Open spontaneously	4
Best Verbal Response	No verbal response	No verbal response	1
	Incomprehensible sounds	Moans to pain	2
	Inappropriate words	Cries to pain	3
	Confused	Irritable, crying	4
	Oriented	Coos or babbles (nml)	5
Best Motor Response	No motor response	No motor response	1
	Extension to pain	Extension to pain	2
	Flexion to pain	Flexion to pain	3
	Withdraws from pain	Withdraws from pain	4
	Localizes to pain	Withdraws from touch	5
	Obeys commands	Spontaneous/Purposeful	6

Chronic Kidney Disease Stages (mL/min)	
Stage 1	≥90
Stage 2	89-60
Stage 3a	59-45
Stage 3b	44-30
Stage 4	29-15
Stage 5	<15

Pugh Score		
	Value	Score
Total Serum Bilirubin (mg/dL)	<2	1
	2-3	2
	>3	3
Serum Albumin (g/dL)	>3.5	1
	2.8-35	2
	<2.8	3
INR	<1.7	1
	1.7-2.2	2
	>2.2	3
Ascites	None	1
	Controlled medically	2
	Poorly controlled	3
Encephalopathy	None	1
	Controlled medically	2
	Poorly controlled	3

NYHA CHF Class & WHO Pulmonary HTN Classes	
Class I	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitations or dyspnea.
Class II	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitations or dyspnea.
Class III	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitations or dyspnea.
Class IV	Unable to carry out physical activity without discomfort. Symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased.

Pugh Score	Description	Class
5-6	Life expectancy 15-20 years. Periop mortality 10%	A
7-9	Liver transplant evaluation. Periop mortality 30%	B
10-15	Life expectancy 1-3 years. Periop mortality 82%	C

Chronic Severe Malnutrition	
Energy Intake	<75% for >1 month
Weight Loss	>5% per month
Fat Loss (orbital, triceps, thorax)	Severe
Muscle Loss (temporal, shoulders, extremities)	Severe
Anasarca	Severe

## References:

University of Pittsburgh Allocation of Scarce Resources, 2020  
 Maryland Framework for the Allocation of Scarce Life-sustaining Medical Resources, 2017  
 Tennessee Altered Standards of Care, 2016  
 Florida Influenza Pandemic Triage and Scarce Resource Allocation, 2011  
 Utah Pandemic Influenza Hospital and ICU Triage Guidelines, 2009  
 New York Ventilator Allocation Guidelines, 2015  
 White, Ann Int Med 2009;150(2):132-138.  
 Leteurtre S, et al. Crit Care Med 2013;41(7):1761-73.

Aubert CE, et al. Mayo Clin Proc Inn Qual Out 2020;4(1):40-49.  
 Stenholm S, et al. Int J Obesity 2017;41(5):769-775.  
 Cho H, et al. Ann Int Med 2013;159(10):667-76.  
 Schofield C, et al. Bull World Health Organ 1996;74(2):223-229.  
 Vetta F, et al. Clin Nutr 1999;18(5):259-267.  
 Simonneau G, et al. J Am Coll Cardiol. 2009;54:S43-S54.  
 Ferreira FL, et al. JAMA. 2001 Oct 10;286(14):1754-8.  
 Sendagire C, et al. BMC Anesthesiology 2017; 17(12).  
 van Walraven, C, et al. Med Care 2009;47(6):626-633.  
 Leteurtre S, et al. Crit Care Med. 2013 Jul;41(7):1761-73.

White JV, et al. J Parenter Enteral Nutr. 2012 May;36(3):275-83.  
 Childress JF, et al. J Law Med Ethics 2002;30:170-8.  
 Gostin L. JAMA 2006;295:1700-4.  
 Beauchamp TL, et al. Principles of Biomedical Ethics. 6th ed. ed. 2009.  
 Daugherty Biddison EL, et al. Ann Am Thorac Soc 2014;11:777-83.  
 White DB, et al. Ann Int Med 2009;150:132-8.  
 Young MJ, et al. Crit Care Med 2012;40:261-6.  
 Emanuel EJ, et al. Science 2006;312:854-5.  
 Neuberger J, et al. BMJ 1998;317:172-5.

## Appendix C: 3-Week Triage Team Schedule (4 Teams)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Day	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1
Night	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2

Day	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2
Night	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1

Day	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 3</b> TO3, RN3, PharmD1 Backup: TO4	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1
Night	<b>Team 2</b> TO2, RN2, RT2 Backup: TO1	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 4</b> TO4, RN4, PharmD2 Backup: TO3	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2	<b>Team 1</b> TO1, RN1, RT1 Backup: TO2

This is for 4 Triage Officers –minimum number necessary to function.

Pool: TO1, TO2, TO3, TO4

RN1, RN2, RN3, RN4

RT1, RT2, PharmD1, PharmD2

3-day duties allow for familiarity with the system and the patients, and allows connectivity with treating physicians to streamline the process. Completing 3-day duties also allows for rest time in-between, and return to clinical duty for those 3 days if necessary. Alternative staffing models are acceptable. This represents a suggested plan.

## Appendix D: Critical Resource Triage Personnel Pool

	Triage Officer (Physician)	Triage Team (Staff)	Triage Review Committee
Total Needed	6	12	9
Per Shift Needed	1	2	3
Preferred Draw Pool	ED, CICU, SICU, Anesthesia	CCRN, Emergency Dept Nurse, RT, PharmD	CMO, CNO, Ethics, Risk Management
Alt. Draw Pool	Cardiology, CT/Vasc Surgery, Oncology, Palliative	Palliative Nurse, Dialysis Nurse, Bedside Nurses, Dieticians, Social Workers	CMO: Clinical Chairs, Clinical Division Chiefs, ICU Directors  CNO: Nursing Director, Nursing Leadership  Risk/Ethics: Representation from respective committees
Prerequisites	May not have patient care duties during shift.	May not have clinical duties during shifts.	Available for appeals only. May continue clinical care duties that do not involve direct care with the patient in question.

Some duties may be performed remotely.

## Appendix E: Acknowledgements & References

### References

1. White and Halpern. A Model Hospital Policy for Allocating Scarce Critical Care Resources. 2020  
<https://www.ccm.pitt.edu/?q=content/model-hospital-policy-allocating-scarce-critical-care-resources-available-online-now>. Accessed March 24, 2020
2. White DB, Katz MH, Luce JM, Lo B. Who should receive life support during a public health emergency? Using ethical principles to improve allocation decisions. *Ann Intern Med.* 2009;150:132-138
3. Biddison E, R Faden, Gwon H, et al. Too Many Patients...A Framework to Guide Statewide Allocation of Scarce Mechanical Ventilation During Disasters. *CHEST.* 2018;155(4):848 - 854
4. Daugherty Biddison EL, Gwon H, Schoch-Spana M, et al. The community speaks: understanding ethical values in allocation of scarce lifesaving resources during disasters. *Annals of the American Thoracic Society* 2014;11:777-83.
5. Utah Pandemic Influenza Hospital and ICU Triage Guidelines. 2009. [http://pandemicflu.utah.gov/plan/med\\_triage081109.pdf](http://pandemicflu.utah.gov/plan/med_triage081109.pdf). Accessed April 3, 2020
6. New York State Task Force on Life and the Law. Ventilator Allocation Guidelines. 2015  
[https://www.health.ny.gov/regulations/task\\_force/reports\\_publications/docs/ventilator\\_guidelines.pdf](https://www.health.ny.gov/regulations/task_force/reports_publications/docs/ventilator_guidelines.pdf) Accessed March 24, 2020
7. AMA Code of Medical Ethics. Crisis standards of care: Guidance from the AMA Code of Medical. <https://www.ama-assn.org/delivering-care/public-health>. Accessed April 3, 2020
8. Beauchamp TL and Childress JF. Principles of Biomedical Ethics. 7th ed. New York, NY: Oxford University Press. 2015
9. Kinlaw K and Levine R. Ethical Guidelines in Pandemic Influenza – Recommendations of the Ethics Subcommittee of the Advisory Committee to the Director, Centers for Disease Control and Prevention. 2007.  
[https://www.cdc.gov/od/science/integrity/phethics/docs/panflu\\_ethic\\_guidelines.pdf](https://www.cdc.gov/od/science/integrity/phethics/docs/panflu_ethic_guidelines.pdf). Accessed April 3, 2020
10. American College of Physicians Ethics Manual 7th Ed. *Ann Intern Med.* 2019;170(2\_Suppl):S1-S32

### Existing Protocols Evaluated

- Missouri Hospital Association. A framework for managing the 2020 COVID-19 pandemic response and implementing crisis standards of care. V. 1.0. 2020.
- White DB, et al. University of Pittsburgh Allocation of Scarce Critical Care Resources During a Public Health Emergency, 2020.
- Daugherty-Biddison L, et al. Maryland Framework for the Allocation of Scarce Life-sustaining Medical Resources in a Catastrophic Public Health Emergency, 2017.
- Tennessee Altered Standards of Care Workgroup. Guidance for the Ethical Allocation of Scarce Resources during a Community -Wide Public Health Emergency as Declared by the Governor of Tennessee. Version 1.6. 2016.
- Florida Department of Health. Influenza Pandemic Triage and Scarce Resource Allocation Guidelines. V.10.5. 2011.
- Utah Hospitals and Health Systems Association. Utah Pandemic Influenza Hospital and ICU Triage Guidelines. V. 2. 2009.
- New York State Task Force on Life and the Law. Ventilator Allocation Guidelines. 2015.

### Additional Resources Referenced

- Childress JF, et al. Public health ethics: mapping the terrain. *J Law Med Ethics* 2002;30:170-8.
- Gostin L. Public health strategies for pandemic influenza: ethics and the law. *JAMA* 2006;295:1700-4.
- Young MJ, et al. Rationing in the intensive care unit: to disclose or disguise? *Crit Care Med* 2012;40:261-6.
- Emanuel EJ, et al. Public health. Who should get influenza vaccine when not all can? *Science* 2006;312:854-5.
- Leteurtre S, et al. PELOD-2: an update of the Pediatric Logistic Organ Dysfunction Score. *Crit Care Med* 2013;41(7):1761-73.
- Sendagire C, et al. Feasibility of the modified sequential organ function assessment score in a resource-constrained setting: a prospective observational study. *BMC Anesthesiology* 2017; 17(12).
- Ferreira FL, et al. Serial evaluation of the SOFA score to predict outcome in critically ill patients. *JAMA.* 2001 Oct 10;286(14):1754-8.
- van Walraven, C, et al. A modification of the Elixhauser comorbidity measures into a point system for hospital death using administrative data. *Med Care* 2009;47(6):626-633.
- Cho H, et al. Comorbidity-adjusted life expectancy: a new tool to inform recommendations for optimal screening strategies. *Ann Int Med* 2013;159(10):667-76.
- Aubert CE, et al. Best definition of multimorbidity to identify patients with high health care resource utilization. *Mayo Clin Proc Inn Qual Out* 2020;4(1):40-49.
- Stenholm S, et al. Body mass index as a predictor of healthy and disease-free life expectancy between ages 50 and 75: a multicohort study. *Int J Obesity* 2017;41(5):769-775.
- Schofield C, et al. Why have mortality rates for severe malnutrition remained so high? *Bull World Health Organ* 1996;74(2):223-229.
- Vetta F, et al. The impact of malnutrition on the quality of life in the elderly. *Clin Nutr* 1999;18(5):259-267.
- White JV, et al. Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). *J Parenter Enteral Nutr.* 2012 May;36(3):275-83.
- Simonneau G, et al. Updated clinical classification of pulmonary hypertension. *J Am Coll Cardiol.* 2009;54:S43-54.
- Neuberger J, Adams D, MacMaster P, Maidment A, Speed M. Assessing priorities for allocation of donor liver grafts: survey of public and clinicians. *BMJ* 1998;317:172-5.