Allocation of Critical Care Resource and Ventilators in the Setting of a Pandemic

1. This document shall take effect in a surge context related to COVID-19 pandemic crisis as an effort to maximize population instead of individual outcomes. This document should serve as a guide in a triage setting as well as ongoing care being provided at KPC Healthsystems.

2. Triage and rationing decisions will be made based on objective data and documented on "Clinical Allocation Algorithm During Pandemic Surge" using evidence based criteria while recognizing that no tool can completely account for the complex nature of decision making and availability of information at the time of assessment and treatment.

3. The aim of this document is to be maximizing outcomes when utilizing advanced life support measures and critical care services when there is a limited number of available resources/ventilators.

4. During a pandemic surge, all patients will be screened for admission to critical care areas and continuation of critical care-level interventions including ventilator usage at regular intervals or when a change of condition occurs.

5. All effort should be made to communicate with family members of patients during this time and communicate decision making reasoning with family. In the event of inability to reach family or given constraints of patient care, decisions may be made without involvement of family.

6. KPC Healthsystems will utilize a Pandemic Triage Committee (PTC) to triage and initiate utilization of "Clinical Allocation Algorithm During Pandemic Surge." Team will consist an interdisciplinary members including members from the KPC Healthsystems bioethics committee.

7. Ongoing care will be provided by in-house medical staff.

8. In the event that multiple patients are deemed eligible for ventilator given similar likelihood of survival, randomization process such a lottery system will be used. These patients should receive alternate forms of oxygen therapy as they are awaiting ventilator availability.

9. Survival shall refer to all patients with a short term likelihood of recovery, not just COVID-19 positive or COVID-19 Person Under Investigation (PUI).

10. Bioethics team understands that in a pandemic situation such as the COVID-19 pandemic crisis, the medical staff has a duty to have a plan for front line healthcare providers who will bear the greatest burden. There is also a duty to be stewards for resource and resource allocation, use a system that is just and fair to all, have a plan

that promotes transparency and to provide as much support as is needed to the healthcare providers so that they may continue to care for their patients.

11. Based on clinical criteria, patient's code status can be adjusted to meet the needs for the allocation of resources put forth in this document, which can include extubation and initiation of comfort care measures or initiating DNR/DNI orders if medically indicated. If at all possible, family members should be informed and updated.

13. To ensure that patients receive the best care possible in a pandemic, a patient's attending physician does not determine whether his/her patient receives (or continues) with ventilator therapy; instead a triage officer or triage committee makes the decision. The KPC Healthsystems Pandemic Triage Committee (PTC)was formed for this purpose. The attending physician interacts with and conducts the clinical evaluation of a patient. The triage officer or triage committee examines the data provided by the attending physician and makes the determination about a patient's level of access to a ventilator. This role sequestration allows the clinical ventilator allocation protocol to operate smoothly.

7-Step Clinical Algorithm for Allocating
Critical Care and Mechanical Ventilators
in the Setting of a Pandemic Crisis

Step 1: Calculate each patient's Total Priority Score using the multi-principle allocation framework.

This allocation framework is based primarily on two considerations: 1) saving lives; and 2) saving life-years, both within the context of ensuring meaningful access for all patients and individualized patient assessments based on objective medical knowledge. Patients who are more likely to survive with intensive care are prioritized over patients who are less likely to survive with intensive care. Patients who do not have a severely limited life expectancy are given priority over those who have such advanced conditions that they have a very limited life expectancy even if they survive the acute critical illness.

First, **the attending** will calculate a SOFA score (Appendix 2), and then assign respective points to SOFA score from Table 1, row 1 (range from 1 to 4 points). Next **the attending** will calculate a Charlson Comorbity Index (CCI) score (Appendix 2) and then assign respective points to CCI score from Table 1, row 2 (range from 1 to 4 points). These two scores will be added together to produce a **Total Priority Score**, which ranges from 2 to 8. **The attending** will make the calculation and document it in "Clinical Allocation Algorithm During Pandemic Surge" form (Appendix 1) which will be placed on the chart before calling for the PTC consultation or intervention.

Table 1. Multi-principle Strategy used to calculate Total Priority Score

Principle	Specification	Point System*			
		1	**2**	**3**	**4**
Save lives	Prognosis for short-term survival (SOFA score#)	SOFA score < 6	SOFA score 6-8	SOFA score 9-11	SOFA score ≥12
Save life-years	Prognosis for longer-term survival (CCI^ predicts prospects for survival after hospital discharge)	CCI 0-2	CCI 3	CCI 4-5	CCI ≥ 6

#SOFA= Sequential Organ Failure Assessment
^ CCI = Charlson Comorbidity Index Predicts 10-year survival in patients with multiple comorbidities.
*Scores range from 2-8, and persons with the lowest score would be given the highest priority to receive critical care beds and services.

Lower scores indicate higher likelihood of benefiting from critical care, and priority will be given to those with lower scores.

Example:
SOFA score 7 corresponds to 2 points. CCI score 4 corresponds to 3 points. **Total Priority Score** would be 5 points.

There are certain acute conditions that are known to predict poor hospital survival despite acute care, and these conditions may be used to exclude the patient from allocation critical care resources if resources are limited. Some of these conditions are listed in Table 2. If this plays a factor in the decision to withhold critical care resources, the attending or PTC will document their reasoning in the patient's medical record.

Table 2. Acute medical conditions at presentation

Patient has an acute medical condition that portends very poor survival to hospital discharge	
Catastrophic cardiac arrest	• Out-of-hospital unwitnessed arrest • Out-of-hospital witnessed arrest without ROSC after ≥30 mins of ACLS without shockable rhythm • In-emergency-department witnessed arrest without ROSC after ≥30 mins of ACLS without shockable rhythm
Catastrophic trauma	• Trauma Injury Severity Score predicting ≥90% mortality • Traumatic brain injury with Glasgow Coma Score motor response ≤ 1 at presentation
Severe burns	• American Burn Association expected survival ≤10% *(also consider TMMC burn survival experience and expertise)*
Catastrophic irreversible neurologic injury	• Anoxic brain injury present at time of presentation • Catastrophic stroke or intracranial hemorrhage
UCLA HS Futility Policy 1319 Criteria Met	• Critical care intervention could not possibly attain intended physiologic outcome • Imminently irreversible dying process underway

CRITICAL CARE PATIENT

The Pandemic Triage Committee will make determinations daily, or more frequently if needed, about what priority scores will result in access to critical care services. These determinations should be based on real-time knowledge of the degree of scarcity of the critical care resources, as well as information about the predicted volume of new cases that will be presenting for care over the near-term (several days).

Patients who are not triaged to receive critical care/ventilation will receive medical care that includes intensive symptom management and psychosocial support. They should be reassessed daily to determine if changes in resource availability or their clinical status warrant provision of critical care services. The PTC and Bioethics team will be available for consultation.

The attending must make every effort to speak with the family of the patient as well as the patient, if coherent, regarding the decisions of the PTC. The attending is responsible for the discussion of supportive/palliative care with the patient and their family.

Resolving "ties" in priority scores/categories between patients. In the event that there are 'ties' in priority scores/categories between patients and not enough critical care resources for all patients with the lowest scores, life-cycle considerations will be used as the first tiebreaker, with priority going to younger patients using the following categories: age 12-40, age 41-60; age 61-75; older than age 75. The second tiebreaker will consider individuals who perform tasks that are vital to the public health response, including those whose work directly supports the provision of acute care to others, should be given heightened priority.

If there are still ties after these two tiebreakers are applied, a lottery (i.e., random allocation) should be used to break the tie.

It is important to reiterate that all patients will be *eligible* to receive critical care beds and services regardless of their priority score. The availability of critical care resources will determine how many eligible patients will receive critical care.

Appeals process for individual triage decisions. For the initial triage decision, the only permissible appeals are those based on a claim that an error was made by the PTC in the calculation of the priority score or use/non-use of a tiebreaker. The process of evaluating the appeal should include the PTC verifying the accuracy of the priority score calculation by recalculating it. The treating clinician or PTC member should be prepared to explain the calculation to the patient or family on request.

Step 2: The PTC will conduct periodic reassessments of patients receiving critical care/ventilation. After 48 hours of care, or before if there is a significant change in condition, a multidimensional assessment should be used to quantify changes in patients' conditions, such as recalculation of severity of illness score (SOFA), appraisal of new complications, and treating clinicians' input. The PTC will assign a priority color code according to the Table 3. 48-Hour Assessment Tool and document it in the "Clinical Allocation Algorithm During Pandemic Surge" form and provide the patient with a wrist band according to classification.

Patients showing improvement will continue with critical care/ventilation until the next assessment. If there are patients in the queue for critical care services, then patients who upon reassessment show substantial clinical deterioration as evidenced by worsening SOFA scores or overall clinical judgment should have critical care withdrawn, including discontinuation of mechanical ventilation, after this decision is disclosed the patient and/or family. Although patients should generally be given the full duration of a trial, if patients experience a precipitous decline (e.g., refractory shock and DIC) or a highly morbid complication (e.g., massive stroke) which portends a very poor prognosis, the PTC may make a decision before the completion of the specified trial length that the patient is no longer eligible for critical care treatment

Patients who are no longer eligible for critical care treatment should receive medical care including intensive symptom management and psychosocial support. The palliative care team will be available for consultation.

Table 3. 48-Hour Assessment Tool

Triage code	Criteria	Action or Priority
Blue	SOFA score > 11 or SOFA score stable at 8-11 with no change	• Provide palliative care • Discharge from critical care
Red	SOFA score < 11 and decreasing	Highest priority
Yellow	SOFA score stable at < 8 with no change	Intermediate priority
Green	No longer dependent on ventilator	• Discharge from critical care

Step 3: If there is a change in priority level at 48-hour assessment, adjust patient's plan of care according to the 48-hour Assessment Tool. If there is no change, continue the current plan of care.

Step 4: After 120 hours of care, or before if there is a significant change in condition, a multidimensional assessment should be used to quantify changes in patients' conditions, such

as recalculation of severity of illness score (SOFA), appraisal of new complications, and treating clinicians' input. The PTC will assign a priority color code according to the Table 4. 120-Hour Assessment Tool and documenting it in the "Clinical Allocation Algorithm During Pandemic Surge" form and provide the patient with a wrist band according to classification.

Table 4. 120-Hour Assessment Tool

Triage code	Criteria	Action or Priority
Blue	SOFA score > 11 or SOFA score stable at < 8 with no change	• Provide palliative care • Discharge from critical care
Red	SOFA score < 11 and decreasing	Highest priority
Yellow	SOFA score stable at < 8 with minimal decrease (< 3-point decrease in past 72 hour)	Intermediate priority
Green	No longer dependent on ventilator	• Discharge from critical care

Step 5: If there is a change in priority level at 120-hour assessment, document current priority level and adjust patient's plan of care according to the triage tool. If there is no change, continue the current plan of care.

Step 6: For patients who remain allocated critical care-level interventions, a ventilator, or both at the 120-hour interval, continue assessment and documentation of with the SOFA score and a priority color code according to the Table 4. 120-Hour Assessment Tool **every 24 hours** and document in the "Clinical Allocation Algorithm Pandemic Surge" Form and provide the patient with a wrist band according to classification.

Step 7: If there is a change in priority level at 24-hour reassessment, adjust patient's plan of care according to the Table 4.120-hour Assessment Tool. If there is no change, continue the current plan of care.

In addition, there may be a scenario where there is an incoming red priority level patient(s) eligible for ventilator therapy and the CTC must remove a ventilator from a patient whose health is not improving. In this situation, first, patients in the blue category (or the yellow category if there are no blue priority level patients receiving ventilator therapy) are vulnerable for removal from ventilator therapy if they fail to meet criteria for continued ventilator use. A randomization process, such as a lottery, is used each time to select the (blue or yellow) patient who will no longer receive ventilator therapy. A patient may only be removed from a ventilator after an official clinical assessment has occurred or where the patient develops a medical condition on the **Table 2. Acute medical conditions**. However, if all ventilated patients are in the red priority level (i.e., have the highest level access), none of the patients are removed from ventilator therapy, even if there is an eligible (red priority level) patient waiting.

Appendix 1

Clinical Allocation Algorithm During Pandemic Surge

STEP 1: Calculate each patient's Total Priority Score using the Multi-principle Strategy
First, __the attending__ will calculate a SOFA score (Table 1A), and then assign respective points to SOFA score from Table 1C, row 1 (range from 1 to 4 points). Next __the attending__ will calculate a Charlson Comorbity Index (CCI) score (Table 1B) and then assign respective points to CCI score from Table 1C, row 2 (range from 1 to 4 points). These two scores will be added together to produce a **Total Priority Score**, which ranges from 2 to 8. Lower scores indicate higher likelihood of benefiting from critical care, and priority will be given to those with lower scores.

Table 1A. SOFA Score

Appendix 1: Scoring criteria for the Sequential Organ-Failure Assessment (SOFA) score*

Variable	Score				
	0	1	2	3	4
PaO_2/FIO_2, mm Hg	> 400	≤ 400	≤ 300	≤ 200	≤ 100
Platelet count, × 10^6/L	> 150	≤ 150	≤ 100	≤ 50	≤ 20
Bilirubin level, mg/dL (μmol/L)	< 1.2 (< 20)	1.2–1.9 (20–32)	2.0–5.9 (33–100)	6.0–11.9 (101–203)	> 12 (> 203)
Hypotension†	None	MABP < 70	Dop ≤ 5	Dop > 5 Epi ≤ 0.1 Norepi ≤ 0.1	Dop > 15 Epi > 0.1 Norepi > 0.1
Glasgow Coma score	15	13–14	10–12	6–9	< 6
Creatinine level, mg/dL (μmol/L)	< 1.2 (< 106)	1.2–1.9 (106–168)	2.0–3.4 (169–300)	3.5–4.9 (301–433)	> 5 (> 434)

Can use website calculator https://www.mdcalc.com/sequential-organ-failure-assessment-sofa-score, or MDCalc Medical Calculator Smartphone App

Table 1B. Charlson Comorbidity Index (CCI)

Comorbidity	Score
Prior myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic pulmonary disease	1
Rheumatologic disease	1
Peptic ulcer disease	1
Mild liver disease	1
Diabetes	1
Cerebrovascular (hemiplegia) event	2
Moderate-to-severe renal disease	2
Diabetes with chronic complications	2
Cancer without metastases	2
Leukemia	2
Lymphoma	2
Moderate or severe liver disease	3
Metastatic solid tumor	6
Acquired immuno-deficiency syndrome (AIDS)	6

Can use website calculator https://www.mdcalc.com/charlson-comorbidity-index-cci or MDCalc Medical Calculator Smartphone App

Table 1C. Multi-principle Strategy used to calculate Total Priority Score

Principle	Specification	Point System*			
		1	**2**	**3**	**4**
Save lives	Prognosis for short-term survival (SOFA score[#])	SOFA score < 6	SOFA score 6-8	SOFA score 9-11	SOFA score ≥12
Save life-years	Prognosis for longer-term survival (CCI[^] predicts prospects for survival after hospital discharge)	CCI 0-2	CCI 3	CCI 4-5	CCI ≥ 6

SOFA score _____ corresponds to _____ points.
CCI score_____ corresponds to _____ points.

Total Priority Score _____

STEP 2: 48-hour Reassessment
Reevaluate patient with SOFA score at **48 hours** or before if a significant clinical change occurs and document. The patient will be provided with a wrist band according to priority of care (Table 2).

Table 2. 48-Hour Assessment Tool

Triage code	Criteria	Action or Priority
Blue	SOFA score > 11 or SOFA score stable at 8-11 with no change	• Provide palliative care • Discharge from critical care
Red	SOFA score < 11 and decreasing	Highest priority
Yellow	SOFA score stable at < 8 with no change	Intermediate priority
Green	No longer dependent on ventilator	• Discharge from critical care

48-hour Sofa Score ____ Priority Color Wristband _____

Step 3: If there is a change in priority level at 48-hour assessment, adjust patient's plan of care according to the 48-hour Assessment Tool. If there is no change, continue the current plan of care.

STEP 4: 120-hour Reassessment
Reevaluate patient with SOFA score at **120 hours** or before if a significant clinical change occurs and document. Change wrist band as needed and notify medical team of change in order to adjust level of care (Table 3).

Table 3. 120-Hour Assessment Tool

Triage code	Criteria	Action or Priority
Blue	SOFA score > 11 or SOFA score stable at < 8 with no change	• Provide palliative care • Discharge from critical care
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Yellow	SOFA score stable at < 8 with minimal decrease (< 3-point decrease in past 72 hour)	Intermediate priority
Green	No longer dependent on ventilator	• Discharge from critical care

120-hour Sofa Score ____ Priority Color Wristband _____

Step 5: If there is a change in priority level at 48-hour assessment, adjust patient's plan of care according to the 48-hour Assessment Tool. If there is no change, continue the current plan of care.

Step 6: For patients who remain allocated critical care-level interventions, a ventilator, or both at the 120-hour interval, continue assessment and documentation of with the SOFA score and a priority color code according to the Table 4. 120-Hour Assessment Tool **every 24 hours** and provide the patient with a wrist band according to classification.

Step 7: If there is a change in priority level at 24-hour reassessment, adjust patient's plan of care according to the Table 4.120-hour Assessment Tool. If there is no change, continue the current plan of care.

144-hour Sofa Score _____ **Priority Color Wristband** _____

168-hour Sofa Score _____ **Priority Color Wristband** _____

192-hour Sofa Score _____ **Priority Color Wristband** _____

**216-hour Sofa Score** _____ **Priority Color Wristband** _____

Appendix 2

SOFA Score

Can use website calculator https://www.mdcalc.com/sequential-organ-failure-assessment-sofa-score, or MDCalc Medical Calculator Smartphone App

Appendix 1: Scoring criteria for the Sequential Organ-Failure Assessment (SOFA) score*

Variable	Score				
	0	1	2	3	4
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Bilirubin level, mg/dL (μmol/L)	< 1.2 (< 20)	1.2–1.9 (20–32)	2.0–5.9 (33–100)	6.0–11.9 (101–203)	> 12 (> 203)
Hypotension†	None	MABP < 70	Dop ≤ 5	Dop > 5 Epi ≤ 0.1 Norepi ≤ 0.1	Dop > 15 Epi > 0.1 Norepi > 0.1
Glasgow Coma score	15	13–14	10–12	6–9	< 6
Creatinine level, mg/dL (μmol/L)	< 1.2 (< 106)	1.2–1.9 (106–168)	2.0–3.4 (169–300)	3.5–4.9 (301–433)	> 5 (> 434)

Note: PaO_2 = partial pressure of arterial oxygen; FIO_2 = fraction of inspired oxygen; MABP = mean arterial blood pressure, in mm Hg;
*Adapted, with permission, from Ferreira FL, Bota DP, Bross A, et al. Serial evaluation of the SOFA score to predict outcome in critically ill patients. *JAMA* 2001;286: 1754-8. Copyright © 2001, American Medical Association. All rights reserved.
†Dop (dopamine), epi (epinephrine) and norepi (norepinephrine) doses in μg/kg per min.
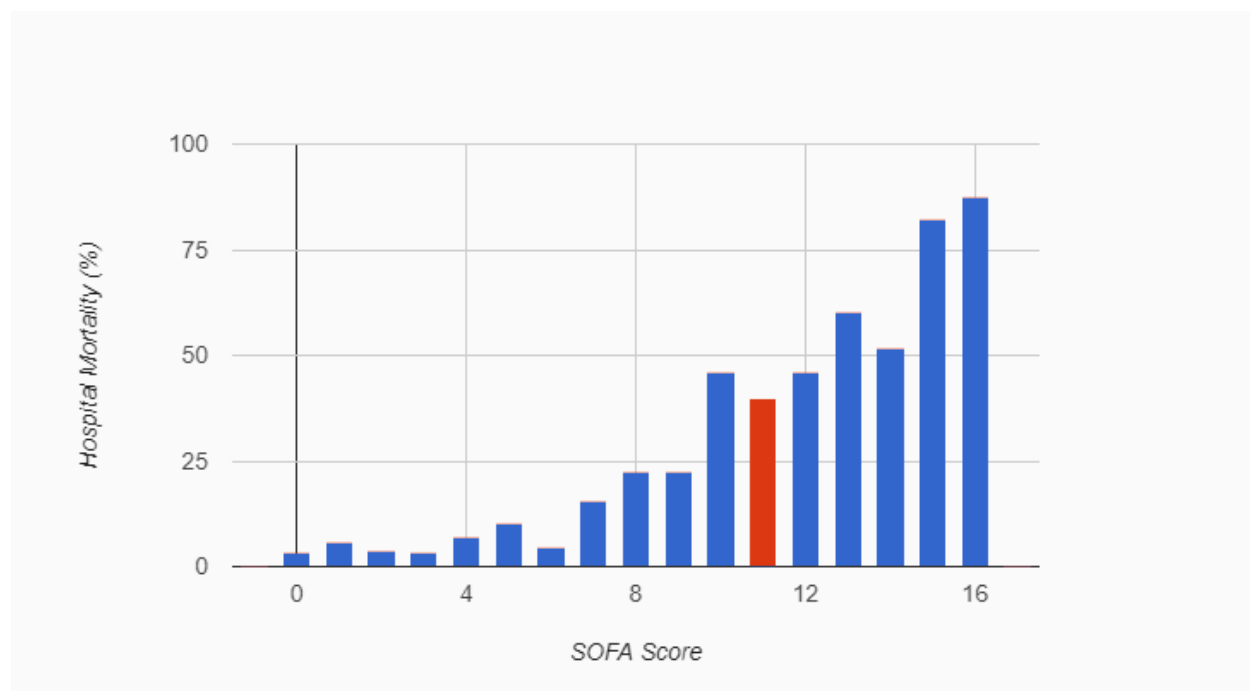
Above: Hospital mortality rate associated with maximum SOFA score. The mortality rate was nearly 90% in patients with a SOFA score of more than 15

Charlson Comorbidity Index (CCI)
Predicts 10-year survival in patients with multiple comorbidities.

Addition of the selected points:

Variable	Definition	Points
Myocardial infarction	History of definite or probable MI (EKG changes and/or enzyme changes)	1
Congestive heart failure	Exertional or paroxysmal nocturnal dyspnea and has responded to digitalis, diuretics, or afterload reducing agents	1
Peripheral vascular disease	Intermittent claudication or past bypass for chronic arterial insufficiency, history of gangrene or acute arterial insufficiency, or untreated thoracic or abdominal aneurysm (≥6 cm)	1
Cerebrovascular accident or transient ischemic attack	History of a cerebrovascular accident with minor or no residua and transient ischemic attacks	1
Dementia	Chronic cognitive deficit	1
Chronic obstructive pulmonary disease	-	1
Connective tissue disease	-	1
Peptic ulcer disease	Any history of treatment for ulcer disease or history of ulcer bleeding	1
Mild liver disease	Mild = chronic hepatitis (or cirrhosis without portal hypertension)	1
Uncomplicated diabetes	-	1
Hemiplegia	-	2
Moderate to severe chronic kidney disease	Severe = on dialysis, status post kidney transplant, uremia, moderate = creatinine >3 mg/dL (0.27 mmol/L)	2
Diabetes with end-organ damage	-	2
Localized solid tumor	-	2
Leukemia	-	2
Lymphoma	-	2
Moderate to severe liver disease	Severe = cirrhosis and portal hypertension with variceal bleeding history, moderate = cirrhosis and portal hypertension but no variceal bleeding history	3
Metastatic solid tumor	-	6
AIDS*	-	6

Plus 1 point for every decade age 50 years and over, maximum 4 points.

Note: liver disease and diabetes inputs are mutually exclusive (e.g. do not give points for both "mild liver disease" and "moderate or severe liver disease").

*This data is from the original Charlson study in 1987, before the widespread availability of effective antiretroviral therapy. We are not aware of any re-evaluations of the CCI using more recent data.

FACTS & FIGURES
10-year survival = $0.983^{\wedge}(e^{CCI \times 0.9})$

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