Evidence check

updated 13 April 2020

Triage tools for ICU admission during COVID-19

Rapid review question

What triage tools are available to guide decisions about admission to ICU during COVID-19?

In brief

Covid-19

- There is considerable guidance around general principles for triaging patients to intensive care units during COVID-19. Key themes include; have decisions made by at least three physicians, multidisciplinary, shared and ethical decision making, documentation and transparency, reserving ICU admission for patients requiring ICU-specific interventions and not using age, on its own, as criteria.
- For COVID-19 specifically guidance is available including; NICE rapid guidance including a critical care referral algorithm (which were updated on 31st March), and the Swiss Academy of Medical Sciences released guidelines for ICU triage. Criteria from opinion sources and other organisations were also identified
- Triage criteria is generally based on clinical criteria and probability of survival, with a recently published triage tool also including criteria on likely duration of stay
- Some of the guidance specifies that criteria apply to all patients potentially in need of ICU admission not only to COVID-19 infected patients

Pandemics

- There is a substantial number of triage tools available for use in pandemics, generally based on the probability of survival, set clinical criteria, and patient factors such as age
- Of the triage tools that have been evaluated, all tools were effective in either increasing ICU bed availability, predicting the likelihood of ICU admission or predicting the need for mechanical ventilation. The Ontario Health Plan for an Influenza Pandemic (OHPIP) triage tool provided the greatest increase overall when compared to the NSW protocol and the Simple Triage Scoring System (STSS)
- Ethics considerations are crucial under conditions of resource scarcity. Key ethical issues during pandemics include; triage and allocation, ethical concerns of patients and families, ethical responsibilities to providers, conduct of research, and international concerns.

Limitations

New evidence on this topic is emerging rapidly. Health systems differ in the models of critical care provided pre-COVID-19.

Background

As the COVID-19 outbreak spreads, it is anticipated that ICUs will need to prepare for a potential surge of critically ill patients. (1)

Methods (Appendix 1)

PubMed and the grey literature was searched on the 27 March and updated on the 13 April. Studies specifically on paediatric/neonate populations, studies with no abstract and older versions of the same guideline were excluded.

Results (Tables 1 -3)

Many publications provide guidance on general triage principles. These include:

- Decisions to deny or prioritise care must be discussed with at least three physicians with experience in the treatment of respiratory failure in the ICU. Multidisciplinary and ethical decision making support may also be useful (2, 3)
- Shared decision-making processes with other clinicians, patients and families is needed (4, 5)
- Clear reasons to deny or prioritise care must be documented in writing to ensure transparency (3, 4, 6)
- Decisions must be reviewed regularly by a centralised state-level monitoring committee to ensure that there are no inappropriate inequities (7)
- Baseline ultrasound, oxygen saturation as measured by pulse oximetry and telemedicine can be used to augment assessment and clinical decision making (8)
- The Clinical Frailty Score (CFS) is being used to augment clinical decision making (3)
- On the 31st March 2020 NICE updated their critical care guidelines based on concerns raised by patient groups. Recommendations now clearly highlight the limitations of using the CFS as the sole assessment of frailty and highlights groups where this should not be used (5)
- The WHO identified the Integrated Interagency Triage Tool
- Age on its own is not recommended as a suitable criteria to decide on disproportionate care (2, 3, 5)
- Reserving ICU admission for patients requiring ICU-specific interventions has been recommended by medical societies. This may necessitate the following:
    I. Extended stays in the Emergency Department or Recovery
    II. Admission to areas capable of high dependency level monitoring
    III. Additional support/supervision for ward staff to manage patients of higher acuity (2, 4)
- Processes to expedite discharge from ICU should be implemented – for example, additional support for ward staff to manage patients of higher acuity or rapid decanting of patients to areas with greater clinical oversight (4)
- Criteria in resource-limited circumstances may be flexible and adaptable, and apply to all patients potentially in need of ICU admission, not only to COVID-19 infected patients (4, 6)

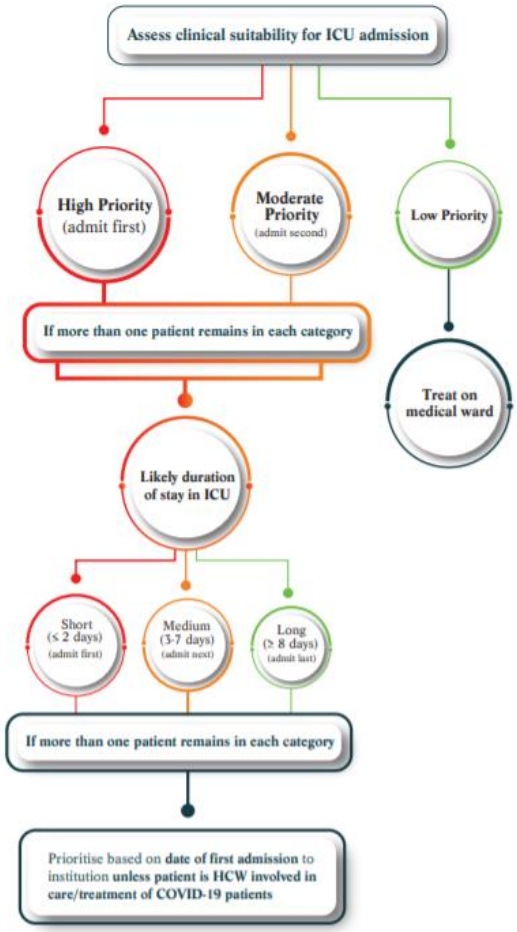
Emerging considerations

Mathematical modelling and analysis is being used to develop insights and policies for making bed allocation decisions in an intensive care unit (9)

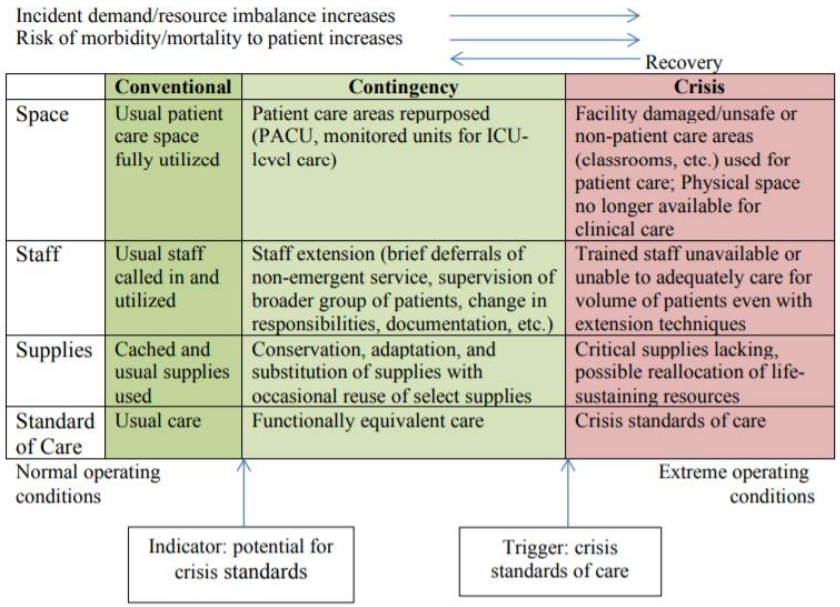
Ethical considerations

The most pressing ethical issues addressed in guidance from the American College of Chest Physicians include; triage and allocation, ethical concerns of patients and families, ethical responsibilities to providers, conduct of research, and international concerns. (7) The widely recognised principles of medical ethics including beneficence, non-maleficence, respect for autonomy and equity remain crucial under conditions of resource scarcity. (2, 6)

Table 1: Triage criteria in COVID-19

Study	Country	Study type	Triage framework/criteria
Sokol 2020 (10)	UK	Decision Making for Intensive Care Triage in COVID-19 Emergency	Triage teams, which should include at least two intensive care doctors, will be responsible for making decisions using the following criteria: 1. Clinical suitability for ICU admission (high, moderate, low) 2. Likely duration of stay in ICU (short, medium, long) 

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td>Bateman et al. 2020 (11)

The Commonwealth of Massachusetts Executive Office of Health and Human Services</td><td>US</td><td>Crisis Standards of Care Planning Guidance for the COVID-19 Pandemic</td><td>Disaster care continuum:
Figure 1: Disaster Care Continuum
 

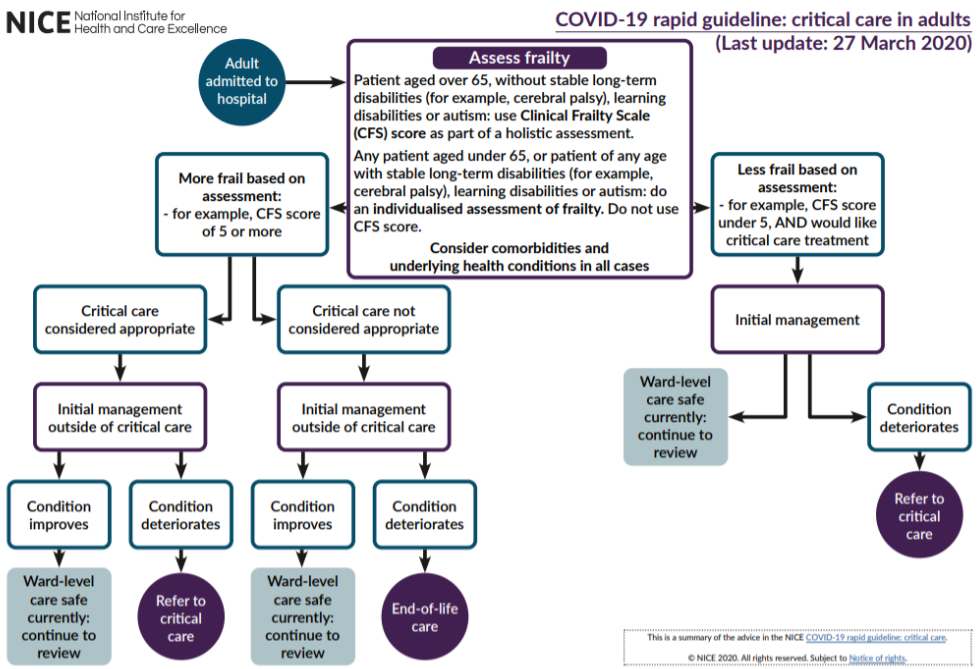
This triage process involves several steps, detailed below:
1. Calculating each patient’s priority score based on the multi-principle allocation framework;
2. Assigning each patient to a priority group (to which hospitals may assign colour codes); and
3. Determining on a frequent basis how many priority groups will receive access to critical care interventions.</td></tr>
</table>

Study	Country	Study type	Triage framework/criteria

Table 1: **Multi-principle Strategy to Allocate Critical Care to Adult Patients During a Public Health Emergency**

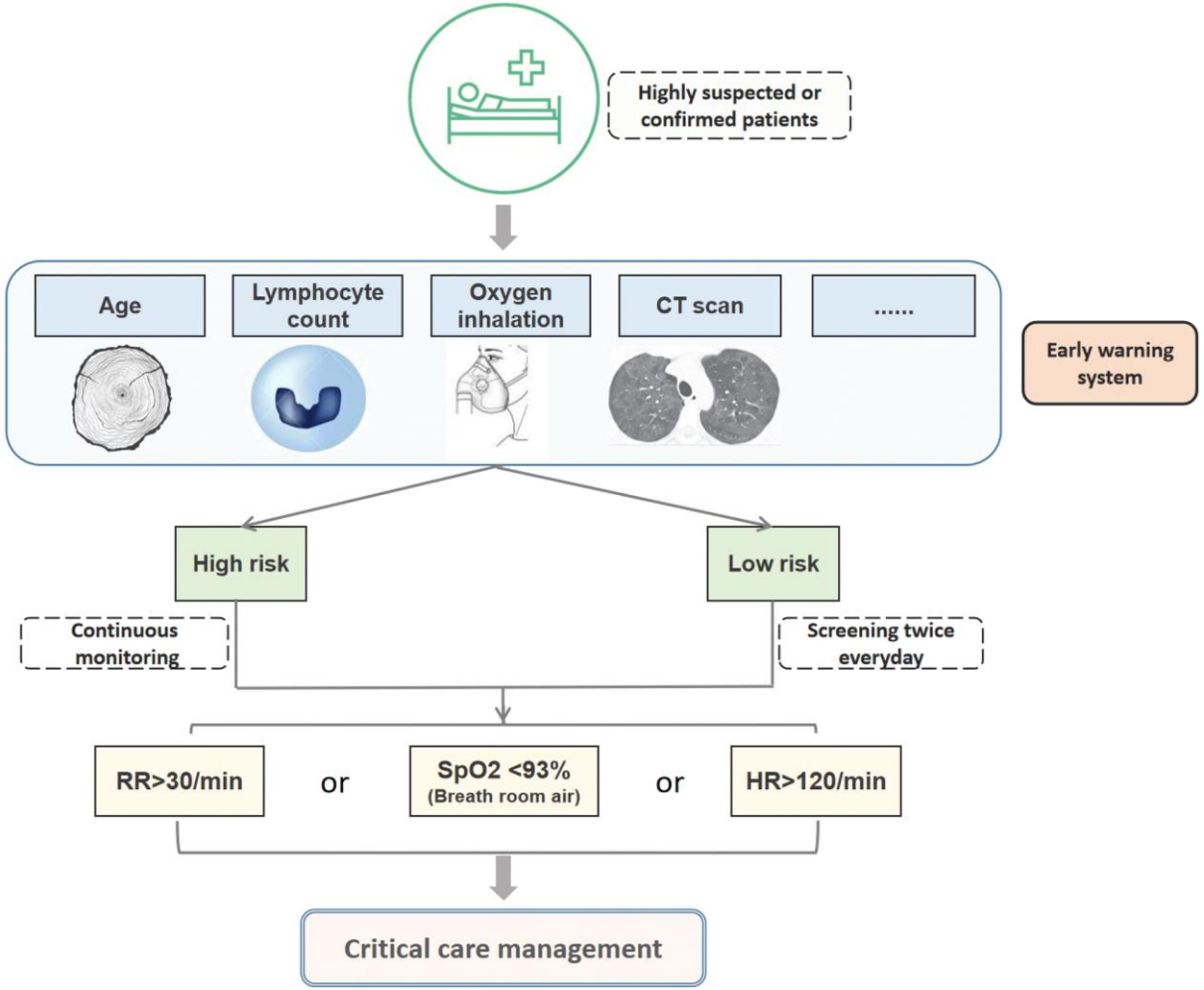
Principle	Specification	Point System*			
		1	2	3	4
Save the most lives	Prognosis for short-term survival (SOFA score)	SOFA score < 6	SOFA score 6-9	SOFA score 10-12	SOFA score > 12
Save the most life-years	Prognosis for long-term survival (medical assessment of comorbid conditions)	…	Major comorbid conditions with substantial impact on long-term survival	…	Severe comorbid conditions; death likely within 1 year

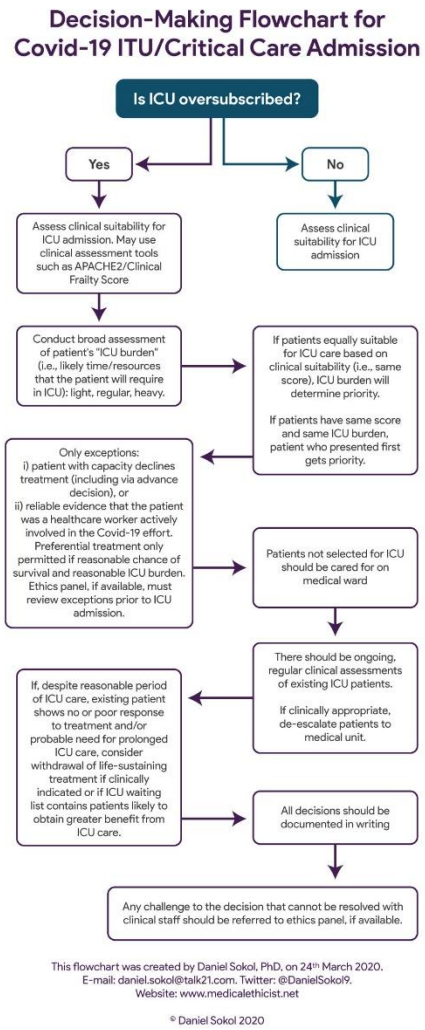
Category	
Level of Priority and Code Color	**Priority score from Multi-principle Scoring System**
RED **Highest priority**	**Priority score 1-3**
ORANGE **Intermediate priority** (reassess as needed)	Priority score 4-5
YELLOW **Lowest priority** (reassess as needed)	Priority score 6-8
GREEN **Do not manage with scarce critical care resources** (reassess as needed)	No significant organ failure or no requirement for critical care resources

Study	Country	Study type	Triage framework/criteria
NICE, 2020 (5)	UK	Critical care guideline	
Swiss Medical Weekly, 2020 (12)	Switzerland	COVID-19 pandemic: triage for intensive-care treatment under resource scarcity	***Stage A:*** *ICU beds available, but capacity limited* *→ Admission triage / resource management through decisions on discontinuation of treatment* ***Stage B: No ICU beds available*** *→ Admission triage / resource management through decisions on discontinuation of treatment* At Stage B, cardiopulmonary resuscitation is not to be undertaken, except for very brief resuscitation measures in the event of a cardiac arrest occurring in the course of medical interventions (e.g. asystole during spinal anaesthesia). ***Initial triage: criteria for ICU admission*** **Step 1:** Does the patient have any of the following inclusion criteria?

Study	Country	Study type	Triage framework/criteria
			• Requirement for invasive ventilatory support? • Requirement for hemodynamic support with vasoactive agents (noradrenaline-equivalent dose >0.1 µg/kg/ min)? If one of these inclusion criteria is fulfilled → Step 2 **Step 2:** Does the patient have any of the following exclusion criteria? Stage A • Patient's wishes (advance directive, etc.) • Unwitnessed cardiac arrest, recurrent cardiac arrest, cardiac arrest with no return of spontaneous circulation • Malignant disease with a life expectancy of less than 12 months • End-stage neurodegenerative disease • Severe and irreversible neurological event or condition • Chronic condition: • NYHA class IV heart failure • COPD GOLD 4 (D) • Liver cirrhosis, Child-Pugh score >8 • Severe dementia • Severe circulatory failure, treatment-resistant despite increased vasoactive dose (hypotension and/or persistent inadequate organ perfusion) • Estimated survival <12 months Stage B The following additional criteria are applied: • Severe trauma • Severe burns (>40% of total body surface area affected) with inhalation injury • Severe cerebral deficits after stroke • Chronic condition:NYHA class III or IV heart failure • COPD GOLD 4 (D) or COPD A–D with either FEV1 <25% or cor pulmonale or home oxygen therapy (long-term oxygen therapy) • Liver cirrhosis with refractory ascites or encephalopathy > stage I • Stage V chronic kidney disease (KDIGO) • Moderate dementia (confirmed)

Study	Country	Study type	Triage framework/criteria
			• Age14 >85 years • Age >75 years and at least one criterion • Liver cirrhosis • Stage III chronic kidney disease (KDIGO) • NYHA class >I heart failure • Estimated survival <24 months If one of the exclusion criteria is fulfilled, the patient is not to be admitted to the ICU.
The Australian and New Zealand Intensive Care Society (ANZICS), 2020	Australia	Principles	Decisions regarding admission to ICU during a pandemic should reflect routine intensive care practice, where the clinical judgement of the treating Intensivist is paramount, and there is a shared decision-making process with other clinicians, patients and their families. In the event of an overwhelming demand for critical care services we recommend the following principles should be considered for admission to the ICU: • The decision-making process should be open, transparent, reasonable and inclusive of patients, their families, ICU and non-ICU staff. • Similar ICU admission criteria should apply to all patients across all jurisdictions, and equally to patients with pandemic illness and those with other conditions. Senior Intensive Care medical staff, recognising available resources, should consider the probable outcome of the patient's condition, the burden of ICU treatment for the patient and their family, patients' comorbidities and wishes, and likelihood of response to treatment.
Sun, 2020 (13)	China	Letter to editor	

Study	Country	Study type	Triage framework/criteria
			
Sokol, 2020 (14)		BMJ Opinion	

Study	Country	Study type	Triage framework/criteria
			

Study	Country	Study type	Triage framework/criteria
Ministry of Health (15)	Sri Lanka	Clinical practice guideline	**Criteria for ICU admission to the dedicated ICU Referral and decision for ICU admission:** 1. Confirmed patients with COVID 19 AND 2. Acute and potentially reversible organ dysfunction poorly responding to initial resuscitation a. Severe respiratory failure or intubated (SpO2 /FiO2 ratio < 200) b. Refractory circulatory shock (SBP < 90 mmHg, Lactate > 4) c. More than single organ failure AND 3. Patient has adequate physiological reserves to survive critical illness eg; good baseline organ functions without significant chronic co-morbidities AND 4. Goals of ICU admission are defined. e.g; for full escalation of organ supports, limited escalation for 48 hours **Referral and decision for ICU admission** 1. Any physician or experienced member of the treating team may refer patients to designated ICU for admission of critically ill COVID 19 patients. 2. In addition, nursing staff, or members of the outreach/medical emergency team where one exists, may need to alert the ICU medical staff directly in circumstances of unusual urgency. 3. Consultant in-charge of the ICU or experienced member of the ICU team should carefully assess the patients trajectory and agree with the referring team to admit only those who will be potentially salvageable/ benefited by ICU care. 4. The referring team shall maintain responsibility for the patient up to admission to ICU, and shall remain responsible for ongoing management if admission is refused or deferred. Discharging patients from ICU: • Patient step down /discharge from the ICU to a HDU or ward has to be carefully and rapidly planed as the demand for bed will rise exponentially leading to collapse of all the critical care services.

Study	Country	Study type	Triage framework/criteria
			• Every patient should be daily assessed in ABCDE order to promptly de-escalate as they get better. De-escalation plan should be reviewed at least twice a day in-order to liberate patients from life sustaining measures early. • Patients stepped down from ICU/HDU should be send back to a separate cubicle in the cohort area for COVID 19 confirmed cases as some of them may still shed the virus at the time of the discharge. • Those who are with multiple co-morbidities and poor physiological reserves or unable to show expected progress during pre-determined ICU trial (eg; for 48 hours) should be either stepped down or not for further escalation in case of further deterioration. • Deceased patients with COVID 19 : Refer to the chapter on disposal of deceased
White, 2020 (16)	USA	Framework	Multiprinciple Allocation Framework The scoring system applies to all patients presenting with critical illness, not merely those with the disease or disorders that have caused the public health emergency. This process involves two steps: 1. Calculating each patient's priority score based on the multi-principle allocation framework (table 1 and 2); 2. Determining each day how many priority groups will receive access to critical care interventions (table 3).

Study	Country	Study type	Triage framework/criteria

Table 1. Multi-principle Strategy to Allocate Critical Care/Ventilators During a Public Health Emergency

Principle	Specification	Point System*			
		1	2	3	4
Save the most lives	Prognosis for short-term survival (SOFA score#)	SOFA score < 6	SOFA score 6-8	SOFA score 9-11	SOFA score ≥12
Save the most life-years	Prognosis for long-term survival (medical assessment of comorbid conditions)	…	Major comorbid conditions with substantial impact on long-term survival	…	Severely life-limiting conditions; death likely within 1 year

#SOFA= Sequential Organ Failure Assessment; note that another measure of acute physiology that predicts in-hospital mortality, such as LAPS2 score, could be used in place of SOFA, but should similarly be divided into 4 ranges.
*Scores range from 1-8, and persons with the lowest score would be given the highest priority to receive critical care beds and services.

Table 2. Examples of Major Comorbidities and Severely Life Limiting Comorbidities*

Examples of Major comorbidities (associated with significantly decreased long-term survival)	**Examples of Severely Life Limiting Comorbidities** (commonly associated with survival < 1 year)
• Moderate Alzheimer's disease or related dementia • Malignancy with a < 10 year expected survival • New York Heart Association Class III heart failure • Moderately severe chronic lung disease (e.g., COPD, IPF) • End-stage renal disease in patients < 75 • Severe multi-vessel CAD • Cirrhosis with history of decompensation	• Severe Alzheimer's disease or related dementia • Cancer being treated with only palliative interventions (including palliative chemotherapy or radiation) • New York Heart Association Class IV heart failure plus evidence of frailty • Severe chronic lung disease plus evidence of frailty • Cirrhosis with MELD score ≥20, ineligible for transplant • End-stage renal disease in patients older than 75

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td></td><td></td><td></td><td>
Table 3. Assigning Patients to Color-coded Priority Groups
<table>
<tr><th colspan="2">Use Raw Score from Multi-principle Scoring System to Assign Priority Category</th></tr>
<tr><th>Level of Priority and Code Color</th><th>Priority score from Multi-principle Scoring System</th></tr>
<tr><td>RED
Highest priority</td><td>Priority score 1-3</td></tr>
<tr><td>ORANGE
Intermediate priority
(reassess as needed)</td><td>Priority score 4-5</td></tr>
<tr><td>YELLOW
Lowest priority
(reassess as needed)</td><td>Priority score 6-8</td></tr>
</table>

All patients who meet usual medical indications for ICU beds and ventilators are eligible and are assigned a priority score using a 1 to 8 scale (lower scores indicate higher likelihood of benefit from critical care), based on (1) patients' likelihood of surviving to hospital discharge, assessed with an objective measure of acute illness severity; and (2) patients' likelihood of achieving longer-term survival based on the presence or absence of comorbid conditions that influence survival.
</td></tr>
<tr><td>Karras 2020 (17)</td><td>US</td><td>Critical Care Triage in the Covid-19 Pandemic (opinion)</td><td>Guidelines for Limiting Care

Criteria for the rationing of care depend on the numeric assessment of probability of survival and rely predominantly on clinical variables. These include:
• Respiratory failure/ARDS, shock, and multisystem organ failure (MSOF), particularly in elderly patients (with or without Covid-19) whose chances of survival are often poor despite best efforts.
• High potential for death and prolonged ventilation in patients with prior severe chronic organ dysfunction; for example, end-stage heart failure, end-stage chronic obstructive pulmonary disease (COPD) or interstitial fibrosis, metastatic lung cancer, chronic, severe liver disease.</td></tr>
</table>

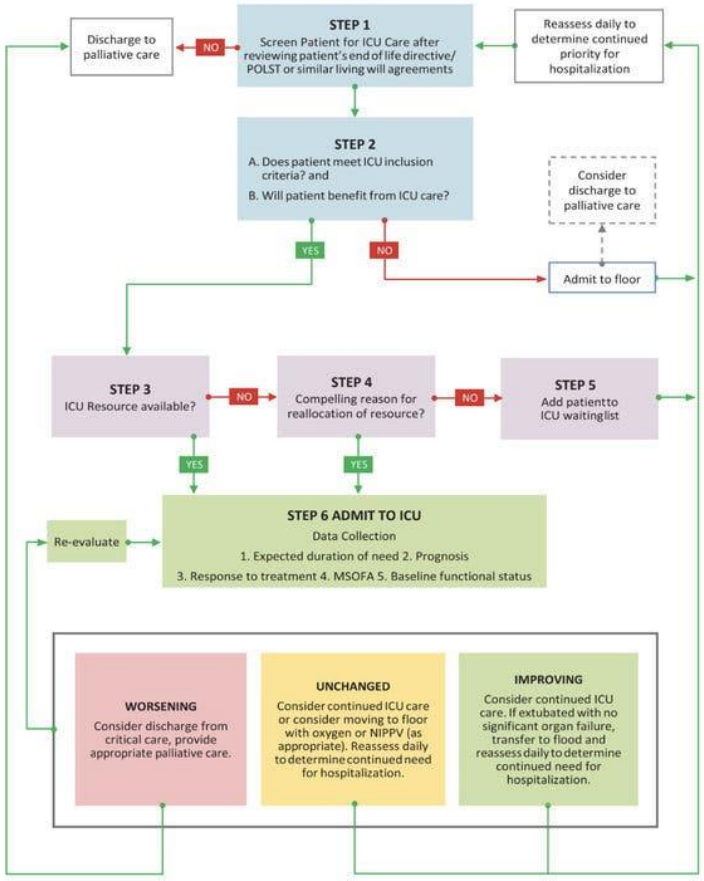
Study	Country	Study type	Triage framework/criteria
			• Use Sequential Organ Failure Assessment (SOFA) score and its trajectory over the first forty-eight to seventy-two hours of ICU care to assist in severity of illness assessment. A score above 12 would preclude offering mechanical ventilation. Periodic reassessment of patients on ventilatory support. Removal, if status is not improving, to make this resource available to other patients more likely to benefit.
Baker and Fink	US	New York Times article - Framework for critical care triage	

Table 2: Triage criteria in pandemics

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td>Daughtery 2019 (18)</td><td>United States</td><td>Framework</td><td>
TABLE 1] Proposed Strategy for Ventilator Allocation in Epidemics of Novel Respiratory Pathogens
<table>
<tr><th rowspan="2">Principle</th><th rowspan="2">Specification</th><th colspan="4">Point System</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Prognosis for short-term survival</td><td>Adults (SOFA) or pediatrics (PELOD-2)</td><td>SOFA score ≤ 8</td><td>SOFA score 9-11</td><td>SOFA score 12-14</td><td>SOFA score > 14</td></tr>
<tr><td></td><td></td><td>PELOD-2 ≤ 12</td><td>PELOD-2 12-13</td><td>PELOD-2 14-16</td><td>PELOD-2 ≥ 17</td></tr>
<tr><td>Prognosis for long-term survival</td><td>Prognosis for long-term survival (assessment of comorbid conditions)</td><td>…</td><td>…</td><td>Severe comorbid conditions; death likely within 1 y</td><td>…</td></tr>
<tr><td>Secondary consideration</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lifecycle considerations</td><td>Prioritize those who have had the lease chance to live through life's stages (age)</td><td>Age 0-49 y</td><td>Age 50-69 y</td><td>Age 70-84 y</td><td>Age ≥ 85 y</td></tr>
</table>
Examples of severe comorbid conditions with associated life expectancy < 1 year are listed. This list is meant as a guideline and is not exhaustive. Patients meeting the criteria of < 1 y predicted survival based on what of the listed or other similar conditions should be assigned a score of 3. NYHA = New York Heart Association.
1. NYHA class IV heart failure.
2. Advanced lung disease with FEV_1 < 25% predicted, total lung capacity < 60% predicted, or baseline P_{AO_2} < 55 mm Hg.
3. Primary pulmonary hypertension with NYHA class III or IV heart failure.
4. Chronic liver disease with Child-Pugh score > 7.
5. Severe trauma.
6. Advanced untreatable neuromuscular disease.
7. Metastatic malignant disease or high-grade primary brain tumors.
</td></tr>
<tr><td>Kain 2019 (19)</td><td>Canada</td><td>Review article</td><td>
Table 1 Outline of possible triage strategies during a pandemic or other emergency situation where resources are limited. Multiple task forces favor FCFS and traditional methods as the most ethical during a pandemic
<table>
<tr><th>Method</th><th>Mechanism of medical triage</th><th>Prioritizing factor</th><th>Examples</th></tr>
<tr><td>Traditional</td><td>No formal mechanism of triage</td><td>No criteria</td><td>Many health care systems</td></tr>
<tr><td>Barron Dominque-Jean Larry</td><td>Treatment of the most urgent (i.e., sickest) patients, and deferring less sick or likely fatal cases</td><td>Market pull factor</td><td>How current system works in most of the developed world</td></tr>
<tr><td>Wilson</td><td>Concentrate treatment on the most likely to be successful. Some low probability cases will die that otherwise may have been saved</td><td>Likelihood of success</td><td>Pragmatic approach</td></tr>
<tr><td>First-come, first-served (FCFS)</td><td>Treatment based on arrival/ presentation regardless of severity of illness, rank, or any other criteria</td><td>Order of arrival</td><td>In part, how current system works in most of the world</td></tr>
<tr><td>Greatest good for greatest number (GGGN)</td><td>Depriving severely ill patients needing large amount of resources and attention, for multiple patients that are less sick and require less resources</td><td>Number of patients treated for given resources</td><td>Utilitarian approach</td></tr>
<tr><td>Less severity first treatment (LSFT)</td><td>Prioritize healthier patients that can be treated quickly to allow them to return to society, the labor force, etc.</td><td>Patients who are less sick</td><td>Many emergency departments have a fast track section</td></tr>
<tr><td>Maximize the fighting strength</td><td>Treat patients who are most likely to quickly return to duty with the least resource expenditure</td><td>Time needed for treatment of patients</td><td>Prioritize HCWs, key public health or government jobs, etc.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td>Christian 2014 (8)</td><td>Canada</td><td>CHEST consensus Guidelines</td><td>

TABLE 2] Inclusion Criteria for Critical Care Admission

<table>
<tr><th>Variable</th><th>Inclusion Criteria for Critical Care Admission</th></tr>
<tr><td>Requirement for invasive ventilatory support</td><td>Refractory hypoxemia (Spo_2 < 90% on nonrebreather mask Fio_2 > 0.85)
Respiratory acidosis with pH < 7.2
Clinical evidence of respiratory failure
Inability to protect or maintain airway</td></tr>
<tr><td>Hypotension</td><td>SBP < 90 mm Hg for adults (see BP parameters for all age-groups in Table 3) or relative hypotension with clinical evidence of shock for all ages (altered level of consciousness, decreased urine output, other end-organ failure) refractory to volume resuscitation requiring vasopressor/inotrope support that cannot be managed on the ward</td></tr>
</table>

SBP = systolic BP; Spo_2 = oxygen saturation as measured by pulse oximetry.

TABLE 3] Age-Based BP Parameters for Defining Hypotension

Group	Age	BP Parameter	Value
Adult	> 10 y	SBP	< 90
Child	1-10 y	SBP	< [70 + (2 × age in y)]
Infant	1 mo-1 y	SBP	< 70
Neonate	Term newborn-1 mo	SBP	< 60
Premature neonate	Preterm newborn	MAP	< Gestational age in wk

MAP = mean arterial pressure. See Table 2 legend for expansion of other abbreviation.

</td></tr>
</table>

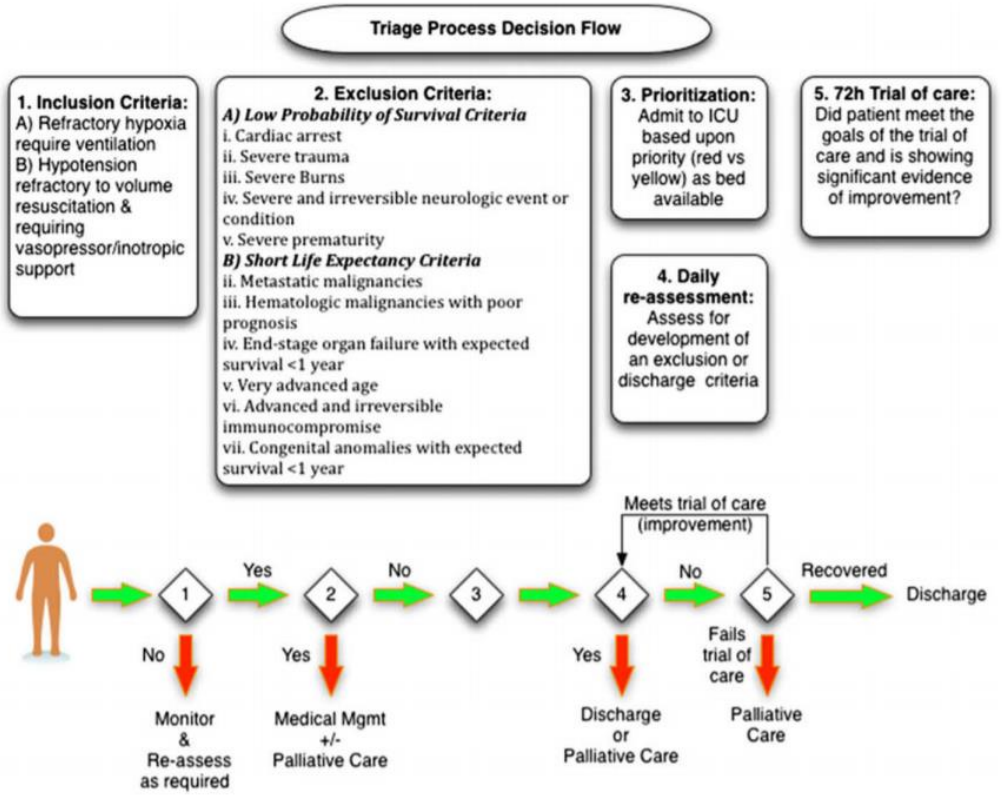
Study	Country	Study type	Triage framework/criteria
			

Figure 5 – *A conceptualized framework for how the critical care (tertiary) triage process and decisions would flow in a disaster or pandemic.*

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td>Winsor 2014 (20)</td><td>Canada</td><td>Review article</td><td>
TABLE 1.
SOFA scoring tool
<table>
<tr><th>Triage Code</th><th>Criteria</th><th>Action or Priority</th></tr>
<tr><td>Blue</td><td>Exclusion criteria met or SOFA >11*</td><td>Manage medically
Provide palliative care as needed
Discharge from critical care</td></tr>
<tr><td>Red</td><td>SOFA score ≤7 or single-organ failure</td><td>Highest priority</td></tr>
<tr><td>Yellow</td><td>SOFA score 8–11</td><td>Intermediate priority</td></tr>
<tr><td>Green</td><td>No significant organ failure</td><td>Defer or discharge
Reassess as needed</td></tr>
</table>
*If an exclusion criteria is met or the Sequential Organ Failure Assessment (SOFA) score is >11 at any time from the initial assessment to 48 hours afterward, change the triage code to Blue and proceed as indicated.
Source: Data from Christian et al. (2006).
</td></tr>
<tr><td>Morton 2015 (21) (with images from (22)</td><td>United Kingdom</td><td>Comparative study of two tools with outcomes</td><td>
Simplified Triage Scoring System (STSS)
Table 1 The Simple Triage Scoring System
<table>
<tr><th>Variable</th><th>Odds ratio</th><th>95% confidence interval</th><th>Complex rule points</th><th>Simplified (final) rule points</th></tr>
<tr><td>Respiratory rate >30 breaths per minute</td><td>3.9</td><td>2.5-6.3</td><td>4</td><td>1</td></tr>
<tr><td>Shock index >1 (HR > BP)</td><td>2.8</td><td>1.8-4.2</td><td>3</td><td>1</td></tr>
<tr><td>Low oxygen saturation</td><td>2.8</td><td>1.8-4.2</td><td>3</td><td>1</td></tr>
<tr><td>Altered mental status</td><td>1.9</td><td>1.3-2.8</td><td>2</td><td>1</td></tr>
<tr><td>Age of 65 to 74 years</td><td>3.0</td><td>1.7-5.5</td><td>3</td><td>1</td></tr>
<tr><td>Age of at least 75 years</td><td>4.4</td><td>2.7-7.2</td><td>4</td><td>1</td></tr>
</table>
BP, blood pressure; HR, heart rate. Reproduced with the kind permission of Wolters Kluwer Health [14].

Ontario Health Plan for an Influenza Pandemic (OHPIP) tool (refer to Cheung et al. 2012 below)
</td></tr>
<tr><td>Cheung 2012 (23)</td><td>Australia</td><td>Comparative study of two tools with outcomes</td><td>NSW triage protocol</td></tr>
</table>

Study	Country	Study type	Triage framework/criteria
			1 New South Wales influenza pandemic triage protocol* **Tier 1** Do not offer AND withdraw life-sustaining therapy from patients with any of the following: 1. Respiratory failure requiring intubation *with* persistent hypotension (systolic blood pressure < 90 mmHg for adults) unresponsive to fluid therapy after 6–12 hours *and* signs of additional end-organ dysfunction (eg, oliguria, decreased mental status, cardiac ischaemia) 2. Failure to respond to mechanical ventilation (no improvement in oxygenation or lung compliance) and antibiotics after 72 hours of treatment for a bacterial pathogen 3. Laboratory or clinical evidence of ⩾4 organ systems failing: a. Pulmonary (acute respiratory distress syndrome, ventilatory failure, refractive hypoxia) b. Cardiovascular (left ventricular failure, hypotension, new ischaemia) c. Renal (hyperkalaemia, oliguria despite fluid resuscitation, increasing creatinine level) d. Hepatic (transaminase > 2 times normal upper limit, increased bilirubin or ammonia levels) e. Neurological (altered mental status not related to fluid volume status, metabolic or hypoxic source, stroke) f. Haematological (clinical or laboratory evidence of disseminated intravascular coagulation) g. Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy, or encephalopathy† h. Irreversible neurological impairment that makes the patient dependent for personal care (eg, severe stroke, congenital syndrome, persistent vegetative state)†

Study	Country	Study type	Triage framework/criteria
			Tier 2 Do not offer AND withdraw life-sustaining therapy from patients in respiratory failure requiring intubation with the following conditions, in addition to those in Tier 1. Patients with pre-existing system compromise or failure including: 1. Known congestive cardiac failure with ejection fraction < 25% (or persistent ischaemia unresponsive to therapy and pulmonary oedema) 2. Acute renal failure requiring haemodialysis 3. Severe chronic lung disease requiring home oxygen therapy† 4. Immunodeficiency syndromes at a stage where the patient is susceptible to opportunistic pathogens† 5. Active malignancy with poor potential for survival 6. Acute hepatic failure with hyperammonaemia **Tier 3** Specific triage protocols developed centrally and advised by specialist clinical groups: 1. Restriction of treatment based on disease-specific epidemiology and survival data for patient subgroups† 2. Expansion of pre-existing disease classes that will not be offered ventilatory support 3. Applying SOFA scoring to the triage process, establishing a cut-off score‡ SOFA = Sequential Organ Failure Assessment. *Reproduced with permission.[5,7] The triage protocol applies to all patients undergoing assessment for possible critical care and not only those with influenza-like symptoms. Tier 1 is used initially; Tiers 2 and 3 can be sequentially activated later, as demand for intensive care unit resources escalates. † Denotes criteria in the NSW triage protocol[5] that were modified from the original triage criteria.[7] ‡Refers to the prioritisation tool in the Ontario Health Plan for an Influenza Pandemic triage protocol (see Box 2). ◆ Ontario triage protocol

Study	Country	Study type	Triage framework/criteria

2 Ontario Health Plan for an Influenza Pandemic triage protocol*

1. Assess whether the patient meets the inclusion criteria
   - If yes, proceed to step 2
   - If no, reassess patient later to determine whether clinical status has deteriorated
2. Assess whether the patient meets the exclusion criteria
   - If no, proceed to step 3
   - If yes, the patient is excluded from critical care†
3. Proceed to prioritisation tool — initial assessment

Inclusion criteria

The patient must have one of the following:

A. Requirement for invasive ventilatory support

B. Hypotension with clinical evidence of shock refractory to fluid resuscitation, and requiring vasopressor or inotrope support

Exclusion criteria

The patient is excluded from admission or transfer to critical care if *any* of the following is present:

A. Severe trauma

B. Severe burns of patient with any two of the following: age > 60 years; > 40% of total body surface area affected; inhalational injury

C. Cardiac arrest: unwitnessed cardiac arrest; witnessed cardiac arrest, not responsive to electrical therapy; recurrent cardiac arrest

D. Severe baseline cognitive impairment

E. Advanced untreatable neuromuscular disease

F. Metastatic malignant disease

G. Advanced and irreversible immunocompromise

H. Severe and irreversible neurological event or condition

I. End-stage organ failure meeting the following criteria:

Heart
- NYHA Class III or IV heart failure

Lungs
- COPD with FEV_1 < 25% predicted, baseline PaO_2 < 55 mmHg, or secondary pulmonary hypertension
- Cystic fibrosis with postbronchodilator FEV_1 < 30% or baseline PaO_2 < 55 mmHg
- Pulmonary fibrosis with VC or TLC < 60% predicted, baseline PaO_2 < 55 mmHg, or secondary pulmonary hypertension
- Primary pulmonary hypertension with NYHA Class III or IV heart failure, right atrial pressure > 10 mmHg, or mean pulmonary arterial pressure > 50 mmHg

Liver
- Child–Pugh score ≥ 7

J. Age > 85 years

K. Elective palliative surgery

Prioritisation tool‡

Criteria	Action or priority
Initial (admission) assessment	
Exclusion criteria met or SOFA score > 11	Exclude or discharge from critical care†
SOFA score ≤ 7 or single organ failure	Highest priority for access to critical care resources
SOFA score 8–11	Intermediate priority for access to critical care resources
No significant organ failure	Defer or discharge, reassess as needed
48-hour assessment	
Exclusion criteria met or SOFA score > 11 or SOFA score stable at 8–11 with no change	Discharge from critical care
SOFA score < 11 and decreasing	Highest priority for access to critical care resources
SOFA score stable at < 8 with no change	Intermediate priority for access to critical care resources
No longer dependent on ventilator	Discharge from critical care
120-hour assessment	
Exclusion criteria met or SOFA score > 11 or SOFA score < 8 with no change	Discharge from critical care
SOFA score < 11 and decreasing progressively	Highest priority for access to critical care resources
SOFA score < 8 with minimal decrease (< 3-point decrease in past 72 hours)	Intermediate priority for access to critical care resources
No longer dependent on ventilator	Discharge from critical care

<table>
<tr><th>Study</th><th>Country</th><th>Study type</th><th>Triage framework/criteria</th></tr>
<tr><td>Cheung 2012 (24)</td><td>Australia</td><td>Evaluation protocol triage tool</td><td>Influenza Pandemic ICU Triage (iPIT-1) protocol

Appendix 1. Influenza Pandemic ICU Triage (iPIT-1) protocol
Step 1: inclusion criterion
Only admit patients requiring invasive ventilation or inotropes/vasopressors
Step 2: exclusion criteria 1
Exclude the patient if they have any of the following conditions:
A. Elective palliative surgery
B. Severe trauma
Step 3: exclusion criteria 2
Exclude the patient if they have any of the following conditions:
A. Acute renal failure requiring dialysis
B. Severe burns with any two of the following: age > 60 years; > 40% of total body surface area affected; inhalational injury
C. Cardiac arrest with any of the following: unwitnessed cardiac arrest; witnessed arrest not responding to defibrillation or pacing; recurrent cardiac arrest
D. Advanced untreatable neuromuscular disease
Step 4: calculate Sequential Organ Failure Assessment (SOFA) score*

<table>
<tr><th></th><th colspan="5">Score</th></tr>
<tr><th>Variable</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Respiratory: PaO_2/FiO_2</td><td>> 400</td><td>⩽ 400</td><td>⩽ 300</td><td>⩽ 200</td><td>⩽ 100</td></tr>
<tr><td>Haematological: platelet count, × 10^6/L</td><td>> 150</td><td>⩽ 150</td><td>⩽ 100</td><td>⩽ 50</td><td>⩽ 20</td></tr>
<tr><td>Hepatic: bilirubin level, mg/dL (μmol/L)</td><td>< 1.2 (< 20)</td><td>1.2–1.9 (20–32)</td><td>2.0–5.9 (33–100)</td><td>6.0-11.9 (101–203)</td><td>> 12 (> 203)</td></tr>
<tr><td>Cardiovascular: hypotension†</td><td>None</td><td>Mean arterial blood pressure < 70 mmHg</td><td>Dopamine ⩽ 5</td><td>Dopamine > 5; epinephrine ⩽ 0.1; norepinephrine ⩽ 0.1</td><td>Dopamine > 15; epinephrine > 0.1; norepinephrine > 0.1</td></tr>
<tr><td>Neurological: Glasgow Coma Scale</td><td>15</td><td>13–14</td><td>10-12</td><td>6–9</td><td>< 6</td></tr>
<tr><td>Renal: creatinine level, mg/dL (μmol/L)</td><td>< 1.2 (< 106)</td><td>1.2–1.9 (106–168)</td><td>2.0–3.4 (169–300)</td><td>3.5–4.9 (301–433)</td><td>> 5 (> 434)</td></tr>
</table>

* Adapted with kind permission from Springer Science and Business Media: Vincent et al.[5] † Doses of dopamine, epinephrine and norepinephrine in μg/kg/min.</td></tr>
</table>

Study	Country	Study type	Triage framework/criteria
			Step 5: exclusion criteria 3 Exclude the patient if they have the following result from Step 4: A. SOFA score ⩽ 8 B. SOFA score ⩾ 14 **Step 6: calculate number of organ systems failing‡** Determine the number of following laboratory or clinical criteria for organ failure that the patient has present: A. Pulmonary: acute respiratory distress syndrome; ventilatory failure; refractive hypoxia B. Cardiovascular: left ventricular failure; hypotension; new ischaemia C. Renal: hyperkalaemia; oliguria despite fluid resuscitation; increasing creatinine D. Hepatic: transaminase levels more than twice the normal upper limit; increased bilirubin or ammonia levels E. Neurological: altered mental status not related to fluid volume status; metabolic or hypoxic source; stroke F. Haematological: clinical or laboratory evidence of disseminated intravascular coagulation G. Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy, or encephalopathy H. Irreversible neurological impairment that makes the patient dependent for personal care (eg, severe stroke, congenital syndrome, persistent vegetative state) **Step 7: exclusion criterion 4** Exclude the patient if they have three or more criteria from Step 6 present **Additional discharge criteria** **Step 8: discharge criterion 1** Between Day 2 (48 hours) and Day 6 (144 hours) after admission, discharge the patient if they are no longer receiving invasive mechanical ventilation **Step 9: discharge criterion 2** On Day 7 (168 hours) after admission, discharge the patient from the ICU For patients excluded or discharged, continue non-ICU level care and provide palliative care if indicated ‡ Adapted with kind permission from NSW Health — Policy Directive PD2010_028,[2] and John Wiley and Sons: Hick and O'Laughlin.[4] R

Table 2: Pandemic triage tools - outcomes

Study	Country	Study type	Tool	Outcomes
Adeniji 2011 (22)	United Kingdom	Retrospective review	STSS triage tool	The STSS group categorization demonstrated a better discriminating accuracy in predicting critical care resource usage (receiver operating characteristic area under the curve for ICU admission of 0.88 (0.78- 0.98) and need for MV of 0.91 (0.83-0.99). This compared to the staged SOFA score of 0.77 (0.65-0.89) and 0.87 (0.72-1.00) respectively. Low mortality rates limited analysis on survival predictions. The STSS accurately risk stratified according to their risk of death and predicted the likelihood of admission to critical care and the requirement for MV.
Cheung 2012 (23)	Australia	Comparative study of two tools with outcomes	NSW triage tool and Ontario Health Plan for an Influenza Pandemic (OHPIP)	The increases in ICU bed availability using Tiers 1, 2 and 3 of the NSW triage protocol were 3.5%, 14.7% and 22.7%, respectively, and 52.8% using the OHPIP triage protocol ($P < 0.001$). Re-evaluation after 12 hours incrementally increased ICU bed availability by 19.2%, 16.1% and 14.1%, respectively by tiers in the NSW protocol. The maximal cumulative increases in ICU bed availability using Tiers 1, 2 and 3 of the NSW triage protocol were 23.7%, 31.6% and 37.5%, respectively, at 72 hours ($P < 0.001$), and 65.0% using the OHPIP triage protocol, at 120 hours ($P < 0.001$). Both tools resulted in increases in ICU bed availability, but the OHPIP protocol provided the greatest increase overall.
Cheung 2012 (24)	Australia	Comparative study of two tools with outcomes	Influenza Pandemic ICU Triage (iPIT-1)	Applying the iPIT-1 protocol resulted in an increase in ICU bed availability at admission of 71.7% ± 0.6%.The iPIT protocol excludes patients with the lowest and highest ICU mortality, and provides increases in ICU bed availability. Adjusting the lower SOFA score exclusion limit provides a method of escalation or de-escalation to cope with demand.
Morton 2015 (21)	United Kingdom	Comparative study of two tools with outcomes	STSS and Ontario Health Plan for an Influenza Pandemic (OHPIP)	The OHPIP ratio predicted the need for mechanical ventilation with a receiver operating characteristic area under the curve of 0.885 (CI 0.817-0.952). The STSS score predicted the need for mechanical ventilation [ROC AUC 0.798 (CI 0.704-0.891)]. The reverse triage component of the OHPIP tool was a poor predictor of patient outcome. The OHPIP ratio was a better predictor of need for mechanical ventilation than STSS.

Appendix 1

PubMed Search string: ((((((2019-nCoV[title/abstract] or nCoV[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] or "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract])))))) AND ("triage"[MeSH Terms] OR "triage"[title/abstract])) AND (("intensive care"[title/abstract] OR "ICU"[title/abstract] OR "critical care"[title/abstract] OR "Intensive Care Units"[MesH Terms]))

PubMed Search string: ("pandemics"[MeSH Terms] OR pandemic*[title/abstract]) AND ((("intensive care"[title/abstract] OR "ICU"[title/abstract] OR "critical care"[title/abstract] OR "Intensive Care Units"[MesH Terms])) AND ("triage"[MeSH Terms] OR "triage"[title/abstract]))

References

1. Liew MF, Siow WT, MacLaren G, See KC. Preparing for COVID-19: early experience from an intensive care unit in Singapore. Crit Care. 2020;24(1):83.
2. Swiss Academy Of Medical S. COVID-19 pandemic: triage for intensive-care treatment under resource scarcity. Swiss Med Wkly. 2020;150:w20229.
3. Belgian Society of Intensive Care Medicine. Ethical principles concerning proportionality of critical care during the COVID-19 pandemic: advice by the Belgian Society of IC medicine. Accessed on 27 March 2020 Available from: https://wwwhartcentrumhasseltbe/professioneel/nieuws-professioneel/ethical-principles-concerning-proportionality-of-critical-care-during-the-covid-19-pandemic-advice-by-the-belgian-society-of-ic-medicine. 2020.
4. The Australian and New Zealand Intensive Care Society (ANZICS) COVID-19 Guidelines. Version 1. Accessed on 27 March 2020 Available from: http://cechealthnswgovau/__data/assets/pdf_file/0004/572512/ANZICS-COVID-19-Guidelines-Version-1pdf. 2020.
5. NICE Guideline. COVID-19 rapid guideline: critical care in adults. [NG159]. Accessed on 27 March 2020 Available from: https://wwwniceorguk/guidance/ng159. 2020.
6. Marco Vergano GB, Alberto Giannini, Giuseppe Gristina, Sergio Livigni, Giovanni Mistraletti, Flavia Petrini. Clinical ethics recommendations for the allocation of intensive care treatments in exceptional resource limited circumstances accessed on 27 March 2020 Available from: http://wwwsiaartiit/SiteAssets/News/COVID19%20-%20documenti%20SIAARTI/SIAARTI%20-%20Covid-19%20-%20Clinical%20Ethics%20Reccomendationspdf. 2020.
7. Biddison LD, Berkowitz KA, Courtney B, De Jong CM, Devereaux AV, Kissoon N, et al. Ethical considerations: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. Chest. 2014;146(4 Suppl):e145S-55S.
8. Christian MD, Sprung CL, King MA, Dichter JR, Kissoon N, Devereaux AV, et al. Triage: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. Chest. 2014;146(4 Suppl):e61S-74S.
9. Huiyin Ouyang NTA, Serhan Ziya Allocation of Intensive Care Unit Beds in Periods of High Demand. Published Online:10 Feb 2020https://doiorg/101287/opre20191876. 2020.
10. Sokol D. Decision Making for Intensive Care Triage in COVID-19 Emergency. A Practical Guide for Clinicians and Hospital Managers. Accessed on 13 April 2020 Available from: http://medicalethicistnet/wp-content/uploads/2016/06/v5-Sokol-ICU-Triage-April-2020pdf. 2020.
11. The Commonwealth of Massachusetts. Executive Office of Health and Human Services. Crisis Standards of Care Planning Guidance for the COVID-19 Pandemic. Accessed on 12 April 2020 Available from: https://d279m997dpfwglcloudfrontnet/wp/2020/04/CSC_April-7_2020pdf. 2020.
12. Swiss Academy of Medical Sciences. COVID-19 pandemic: triage for intensive-care treatment under resource scarcity. Accessed on 29 March 2020 Available from: file:///C:/Users/60045140/Downloads/guidelines_v2_sams_triage_intensive_care_resource_scarcity_20200324pdf. 2020.

13. Sun Q, Qiu H, Huang M, Yang Y. Lower mortality of COVID-19 by early recognition and intervention: experience from Jiangsu Province. Ann Intensive Care. 2020;10(1):33.
14. Sokol D. Daniel Sokol: The life and death decisions of covid-19. TheBMJOpinion. 2020;Accessed 27 March 2020 Available from https://blogs.bmj.com/bmj/2020/03/20/daniel-sokol-the-life-and-death-decisions-of-covid-19/.
15. Ministry of Health Sri Lanka. Provisional Clinical Practice Guidelines on COVID-19 suspected and confirmed patients. Accessed on 27 March 2020 Available from: http://wwwepidgovlk/web/images/pdf/Circulars/Corona_virus/covid-19-cpg_march-2020-moh-slpdf. 2020.
16. White DB, Lo B. A Framework for Rationing Ventilators and Critical Care Beds During the COVID-19 Pandemic. Jama. 2020.
17. G K. Critical Care Triage in the Covid-19 Pandemic. Beckers clinical leadership and infection control. 2020;Accessed on 12 April 2020. Available from https://www.beckershospitalreview.com/quality/critical-care-triage-in-the-covid-19-pandemic.html.
18. Daugherty Biddison EL, Faden R, Gwon HS, Mareiniss DP, Regenberg AC, Schoch-Spana M, et al. Too Many Patients…A Framework to Guide Statewide Allocation of Scarce Mechanical Ventilation During Disasters. Chest. 2019;155(4):848-54.
19. Kain T, Fowler R. Preparing intensive care for the next pandemic influenza. Crit Care. 2019;23(1):337.
20. Winsor S, Bensimon CM, Sibbald R, Anstey K, Chidwick P, Coughlin K, et al. Identifying prioritization criteria to supplement critical care triage protocols for the allocation of ventilators during a pandemic influenza. Healthc Q. 2014;17(2):44-51.
21. Morton B, Tang L, Gale R, Kelly M, Robertson H, Mogk M, et al. Performance of influenza-specific triage tools in an H1N1-positive cohort: P/F ratio better predicts the need for mechanical ventilation and critical care admission. Br J Anaesth. 2015;114(6):927-33.
22. Adeniji KA, Cusack R. The Simple Triage Scoring System (STSS) successfully predicts mortality and critical care resource utilization in H1N1 pandemic flu: a retrospective analysis. Crit Care. 2011;15(1):R39.
23. Cheung WK, Myburgh J, Seppelt IM, Parr MJ, Blackwell N, Demonte S, et al. A multicentre evaluation of two intensive care unit triage protocols for use in an influenza pandemic. Med J Aust. 2012;197(3):178-81.
24. Cheung W, Myburgh J, Seppelt IM, Parr MJ, Blackwell N, Demonte S, et al. Development and evaluation of an influenza pandemic intensive care unit triage protocol. Crit Care Resusc. 2012;14(3):185-90.

Document history

Original search 27 March 2020	**Updates 13 April**
ICU triage	• Four new publications included • Key messages updated to include new triage tool also incorporating length of stay in tool • Added a limitations section • Methods updated to reflect new evidence check format