Introduction to Pediatric Ventilator Guidelines

This document contains a recommended triage protocol that could be applied when there are many pediatric patients in need of ventilator support and there is a limited supply of ventilators such as in pandemic influenza. Ventilator triage protocols are being discussed nationally. This "model" is meant to serve as a discussion tool for Clinical Review Committees at healthcare facilities that are charged with the development and implementation of guidelines for the allocation of scarce resources.

This triage protocol provides an example of the "tough decisions" that will need to be made about the allocation of scarce resources. The fact that there already is such a "model" and the ensuing discussion among clinicians and hospitals about this "model" ensures patients and the general public that clinicians and hospitals are studying these issues and preparing for making these difficult ethical and clinical decisions.

To date, this "Minnesota Model" has been reviewed by three groups of Wisconsin Critical Care Specialists. Minor modifications have been made, especially for pediatric patients. It is expected that, as more clinicians are involved in the discussion of these protocols, there will be further enhancements, leading to the eventual adoption of such guidelines by all hospitals across the state.

It is also expected that additional guidelines for the allocation of scarce resources will be developed. This may include guidelines for the triage of admissions to hospitals, for the triage of elective and urgent medical and surgical procedures, and for other such decisions that will arise from the scarcity of medical resources and personnel during a pandemic or disaster.

A similar tool is also available for adult patients.

Ventilator Triage Decision Tool for Pediatric Patients

In this model each patient would be assessed on a daily basis and triage decisions made based on the needs of all patients requiring mechanical ventilation.

Compared to other patient(s) requiring and awaiting mechanical ventilation, does this patient have significant differences in prognosis or resource utilization in one or more of the categories below that would justify re-allocation of the ventilator?

Lower Priority → **Higher Priority**

Category and Variables	LOW	MEDIUM	HIGH
1. Prognosis – PELOD score: PELOD when available	High potential for death according to predictive model (>35)	Intermediate potential for death according to predictive model (17-34)	Low potential for death according to predictive model (<17)
2. Prognosis - Oxygenation Index* Data: OI and ΔOI - for ventilated patients	Worsening or very high oxygenation index	Stable and/or intermediate oxygenation index (no or marginal improvement after adequate trial of mechanical ventilation based upon disease process)	Improving or low oxygenation index
3. Duration of Need: Data includes days ventilated – if applicable - and expected duration of ventilation	3a Long duration – estimate > 7 days on ventilator (ARDS in septic patient with chronic lung disease) 3b. Prolonged mechanical ventilation with poor or no progress toward weaning	3a. Moderate duration – estimate 3-7 days on ventilator (pneumonia in healthy patient) 3b. Making slow progress toward weaning	3a. Short duration – (estimate < 3 days on ventilator) 3b. Making good progress toward weaning
4. Duration of Benefit: Data includes prognosis/ duration modifying underlying diseases **	Severe underlying disease with poor short-term prognosis*** OR poor prognosis based upon epidemiology of specific disease	Severe underlying disease with poor long-term prognosis and/or ongoing resource demand (e.g.: home oxygen dependent, dialysis dependent) OR indeterminate / intermediate prognosis based upon epidemiology of specific disease process	No severe underlying disease OR good prognosis based upon epidemiology of specific disease state

*Oxygenation Index (OI) = Mean Airway Pressure (MAWP) x Inspired oxygen concentration (FiO2) / arterial oxygen pressure (PaO2)

(PaO2 may be estimated from peripheral oxygen saturation using the oxygen dissociation curve if blood gas measurements are unavailable)

OI = MAWP x FiO2 / PaO2

** Underlying disease may include epidemiologic prognostic information for *current* disease – e.g.: pandemic influenza mortality despite treatment in certain patient groups or with certain underlying medical conditions as well as *chronic* underlying conditions. Age is to be used in conjunction with other disease variables *only* to determine duration of benefit, not as stand-alone criteria or affecting prognosis.

***Examples of underlying diseases that may predict poor short-term survival or long-term resource demand may include (but are not limited to)

1. Congenital heart disease with poor chance of long term survival.

2. Cardiomyopathy with ejection fraction < 25% and pulmonary edema unresponsive to therapy

3. Severe chronic lung disease including pulmonary fibrosis, cystic fibrosis, obstructive or restrictive diseases requiring continuous home oxygen or mechanical ventilation use prior to onset of acute illness

4. Central nervous system, solid organ, or hematopoietic malignancy with poor prognosis for recovery.

5. Liver disease with ascites, history of variceal bleeding, fixed coagulopathy or encephalopathy;

6. Acute hepatic failure with hyperammonemia

7. Acute and chronic and irreversible neurologic impairment, which makes patient dependent for all personal cares (e.g.: severe stroke, congenital syndrome, persistent vegetative state, severe dementia etc.).

Pediatric Logistic Organ Dysfunction Score

Organ System and variable	Score = 0	1	10	20
Neurological: Glasgow Coma Score	12-15	7-11	4-6	3
	and		Or	
Pupillary reaction	Both reactive	NA	Both fixed	NA
Cardiovascular:				
Heart rate (beats/min)				
< 12 years of age	≤195	NA	>195	NA
➢ 12 years of age	≤150	NA	>150	NA
Systolic blood pressure (mmHg)				
< 1 month	>65	NA	35-65	< 35
1 month-1 year	>75	NA	35-75	< 35
1-12 years	> 85	NA	45-85	< 45
≥ 12 years	> 95	NA	55-95	< 55
Renal				
Creatinine (mg/dl)				
< 7 days	< 1.6	NA	≥ 1.6	NA
7 days-1 year	< 0.6	NA	≥ 0.6	NA
1-12 years	< 1.1	NA	≥ 1.1	NA
≥ 12 years	< 1.6	NA	≥ 1.6	NA
Respiratory				
PaO2/FiO2 ratio	> 9.3	NA	≤ 9.3	NA
	and			
PaCO2 (mmHg)	< 88	NA	≥ 88	NA
	and			
Mechanical Ventilation	No	Yes	NA	NA
Hematologic				
White Blood Cell Count ($x10^9$/L)	≥ 4.5	1.5-4.4	< 1.5	NA
	and	**or**		
Platelet count ($x10^9$/L)	≥ 35	< 35	NA	NA
Hepatic				
AST (IU/L)	< 950	≥ 950	NA	NA
	and	Or		
PTT or	≤ 60 sec.	> 60 sec.		
INR	< 1.4	≥ 1.4		