CHEST

Triaging Access to Critical Care Resources in Patients With Chronic Respiratory Diseases in the Event of a Major COVID-19 Surge

Key Highlights From the Canadian Thoracic Society (CTS) Position Statement

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Viral pandemics can quickly overwhelm health system capacity. When a rapid increase in patients with coronavirus disease 2019 (COVID-19) led to ICU bed shortages in Northern Italy[1] and elsewhere, clinicians were forced to make difficult ICU resource allocation decisions. Similar surges are now being seen in other parts of the world, including the United States.

What Frameworks Are Available to Support Resource Allocation Decisions?

Ethical frameworks for stewardship of scarce healthcare resources[2] share the common dual aims of saving the most lives and maximizing gains in posttreatment length of life.[3] However, fulfilling these goals requires clinicians to estimate both the patient's probability of surviving the acute illness and life expectancy after the episode of critical illness. These estimations are particularly challenging in patients with underlying chronic respiratory diseases, and practical implementation frameworks are lacking.

Recently, several Canadian provinces published frameworks for ICU resource allocation that feature three levels of surge planning.[4] Each surge level provides progressively more strict exclusion criteria for ICU admission (and continued ICU care in those already receiving it), as follows:

Level 1—Patients with >80% expected mortality during or in the 6 to 12 months after critical illness
Level 2—Patients with >50% expected mortality during or in the 6 to 12 months after critical illness

ABBREVIATIONS: AE = acute exacerbation; CF = cystic fibrosis; CFS = clinical frailty score; COVID-19 = coronavirus disease 2019; CTS = Canadian Thoracic Society; DLCO = diffusing capacity of the lungs for carbon monoxide; ERS = European Respiratory Society; ESC = European Society of Cardiology; ILD = interstitial lung disease; IPF = idiopathic pulmonary fibrosis; PAH = pulmonary arterial hypertension; REVEAL = Registry to Evaluate Early and Long-Term Pulmonary Arterial Hypertension

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Level 3—Patients with >30% expected mortality during or in the 6 to 12 months after critical illness

To help clinicians to approximate these predicted mortalities in patients with chronic respiratory diseases, the Canadian Thoracic Society (CTS) produced a position statement describing corresponding characteristics in COPD, pulmonary fibrosis, cystic fibrosis (CF), and pulmonary arterial hypertension (PAH). This commentary summarizes those findings in an FAQ format. The full position statement,[5] including detailed explanations, rationale, and approach for predicting mortalities can be found online.[6]

How Did We Estimate Predicted Mortalities in Patients With Chronic Respiratory Conditions?

Disease-based expert groups from across Canada prepared criteria for each respiratory condition independently. Criteria were informed by published survival data, and where possible, complemented by (mostly indirect) data to estimate the impact of critical illness. Accordingly, they are primarily based on expert opinion and should be individualized and supplemented with clinical judgment.

Descriptions for each more severe mortality threshold supersede those in the less severe threshold, such that level 3 descriptions should practically be applied to predict >30% to 50% mortality and level 2 descriptions to predict >50% to 80% mortality.

Cystic Fibrosis

Which cystic fibrosis patients have >80% predicted mortality during or in the 6 to 12 months after critical illness (level 1)?

Patients with FEV_1 of <20% predicted when measured at the time of clinical stability fulfill this criterion.

Which cystic fibrosis patients have >50% predicted mortality during or in the 6 to 12 months after critical illness (level 2)?

Patients with FEV_1 of <20% predicted when measured at the time of clinical stability also fall into this category.

Which cystic fibrosis patients have >30% predicted mortality during or in the 6 to 12 months after critical illness (level 3)?

Patients with FEV_1 of <30% predicted when measured at the time of clinical stability are in this category.

Estimates were derived from the Canadian CF Registry, which captures data on more than 99% of Canadian CF patients. Although *FEV_1 of <20%* corresponds to an approximately 50% probability of death/transplantation at 1 year (level 2), this criterion was also recommended for level 1, given the additional expected mortality impact of the critical illness itself. The level 3 cutoff was based on the fact that approximately 30% of Canadian CF patients with FEV_1 of <30% will have died or received a transplant by 2 years.

Pulmonary Fibrosis

Which pulmonary fibrosis patients have >80% predicted mortality during or in the 6 to 12 months after critical illness (level 1)?

This level includes patients with:

FVC <50%-60%; **OR**
Diffusing capacity of lung for carbon monoxide (D_{LCO}) <30%-40% predicted; **OR**
Chronic supplemental oxygen use at home for >12 hours/day; **OR**
Echocardiographic evidence of pulmonary hypertension (estimated right ventricular systolic pressure >50 mm Hg)[a]; **OR**
Rapidly progressive disease[b]; **OR**

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History of acute exacerbation of ILD in the last 12 months.

Which pulmonary fibrosis patients have >50% predicted mortality during or in the 6 to 12 months after critical illness (level 2)?

Level 2 also comprises patients with:

FVC <50%-60%; **OR**
DLCO <30%-40% predicted; **OR**
Chronic supplemental oxygen use at home for >12 hours/day; **OR**
Echocardiographic evidence of pulmonary hypertension (estimated right ventricular systolic pressure >50 mm Hg)[a]; **OR**
Rapidly progressive disease[b] (>10% decline in FVC over the last 6 months associated with pronounced radiographic and clinical deterioration); **OR**
History of AE-ILD in the last 12 months.

[a]Prominent right ventricular dilation and hypokinesis preceding COVID-19 infection should also be considered. A conservative measure of 50 mm Hg was selected, given heterogeneous and predominantly retrospective supporting evidence and high prevalence of risk factors for group 2 pulmonary hypertension in ILD patients.

[b]10% decline in FVC over the last 6 months associated with pronounced radiographic and clinical deterioration.

Which pulmonary fibrosis patients have >30% predicted mortality during or in the 6 to 12 months after critical illness (level 3)?

Patients with the following criteria fall under level 3:

FVC <75%; **OR**
DLCO <55% predicted

The gender, age, physiology (GAP) prediction model is the most widely validated prognostic tool used in clinical practice.[7] A ≥10% reduction in FVC over 6 to 12 months also predicts acute exacerbation, hospitalization, and death. Median survival after acute exacerbation of idiopathic pulmonary fibrosis (IPF; AE-IPF) is 3 to 4 months.[8] Our criteria were derived from literature describing long-term IPF outcomes, predisposing factors, and clinical course of AE-IPF, and risk of poor outcomes after surgical lung biopsy.[9,10] Because we could not identify clear criteria for >50% predicted mortality (level 2), we reiterated criteria for >80% predicted mortality (level 1). Level 3 criteria were validated in the GAP model, predicting a relatively low probability of 1-year mortality.[7]

COPD

Which COPD patients have >80% predicted mortality during or in the 6 to 12 months after critical illness (level 1)?

Patients with the following criteria fall under level 1:

FEV_1 <50% predicted; **AND**
Chronic hypoxemia ($Pa_{O_2} \leq 55$ mm Hg) or chronic hypercapnia ($Pa_{CO_2} > 55$ mm Hg); **AND**
Clinical frailty score (CFS) of ≥ 7.

Which COPD patients have >50% predicted mortality during or in the 6 to 12 months after critical illness (level 2)?

Patients with the following conditions are considered to be in level 2:

FEV_1 < 50% predicted; **AND**
CFS ≥ 6.

Which COPD patients have >30% predicted mortality during or in the 6 to 12 months after critical illness (level 3)?

Patients meeting the following criteria are considered to be in level 3:

FEV_1 < 50% predicted; **AND**
≥2 hospitalizations within the last 12 months for an acute exacerbation of COPD; **AND**
CFS ≥ 5.

We recommend against relying solely on pulmonary function and dyspnea severity (eg, modified Medical Research Council dyspnea scale) to make triage decisions. COPD patients with documented chronic hypoxemia and hypercapnia have higher 1-year mortality.[11,12] A history of frequent acute exacerbations of COPD is a strong predictor of mortality.[13,14] The CFS is a validated measure of frailty that has been shown to predict mortality in the year after ICU admission.[15] Accordingly, we recommend using the CFS to improve prognostication for all surge categories in COPD patients.

PAH

Which PAH patients have >80% predicted mortality during or in the 6 to 12 months after critical illness (level 1)?

PAH patients who are considered to be in level 1 include those with a high-risk profile (Registry to Evaluate Early and Long-Term Pulmonary Arterial Hypertension [REVEAL] 2.0 score ≥ 9 or high-risk European Respiratory Society/European Society of Cardiology [ESC/ERS] score) while on optimal therapy (at least two oral medications and a parenteral prostacyclin, if eligible).

Which PAH patients have >50% predicted mortality during or in the 6 to 12 months after critical illness (level 2)?

Patients with these conditions are considered to be in level 2:

- An intermediate risk profile (REVEAL 2.0 score 7-8 or intermediate-risk ESC/ERS score) while on optimal therapy; **AND**
- Age ≥ 75 years; **AND**
- Either a recent hospitalization for worsening PAH/right heart failure in the past 3 months or the presence of other significant comorbidities (especially chronic renal failure)

Which PAH patients have >30% predicted mortality during or in the 6-12 months after critical illness (level 3)?

Patients meeting the following criteria are considered to be in level 3:

- An intermediate-risk profile (REVEAL 2.0 score 7-8 or intermediate-risk ESC/ERS score) while on optimal therapy; **AND**
- Age < 75 years **AND**
- Either a recent hospitalization for worsening PAH/right heart failure in the past 3 months or the presence of other significant comorbidities (especially chronic renal failure)

Poor prognostic factors in PAH include systemic sclerosis origin of PAH; older age; male sex; severe symptoms (New York Heart Association Class III-IV); reduced exercise capacity; comorbidities (eg, renal dysfunction); severe right ventricular dysfunction; and hospitalizations for right heart failure.[16] Available risk prediction tools include the U.S. REVEAL 2.0 risk score[16] and the ESC/ERS risk assessment tool.[17] We supplemented mortality predictions from these tools with estimates of the effects of critical illness. Our recommendations apply only to PAH (not to pulmonary hypertension groups 2-5).

Given that the pandemic is a rapidly evolving situation, the CTS plans to update this guidance as new information becomes available. We recommend monitoring the CTS website[6] for updates.

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