

Point-of-Care Guides

Prognostic Tools for Risk Stratification in Patients With COVID-19

Lindy Krebs, MD, and Aaron Saguil, MD, MPH, University of Florida College of Medicine, Gainesville, Florida

Clinical Question

Is it possible to identify patients who are at low risk for severe disease from COVID-19 based on clinical examination alone or supplemented by laboratory testing?

Evidence Summary

Almost three years after the start of the COVID-19 pandemic, the health care system is still struggling to meet patient needs. More than 5,000 patients are hospitalized daily because of COVID-19, and more than 1,000 patients are dying from it each week.^{1,2} Meanwhile, the current influenza and respiratory syncytial virus (RSV) season has been more severe than in past years, with 330,000 patients hospitalized for influenza and an RSV hospitalization rate of 33.9 per 100,000 people.^{3,4} Because of this strain on the health care system, a simple tool to predict the need for hospitalization and risk of mortality in patients with COVID-19 would help facilitate disposition to the correct level of care.

The Lehigh Outpatient COVID Hospitalization (LOCH) risk score was developed using outpatient data to estimate a patient's risk for hospitalization caused by COVID-19. The risk score was derived from 5,843 outpatients 12 years and older and validated with an additional 3,806 outpatients infected primarily with the Delta variant. It was revalidated with 6,138 patients infected with the Omicron variant. The group evaluated four

models, each adding or changing one variable in the data set. Variables included age, dyspnea, the presence of a comorbidity, fever, respiratory rate, and oxygen saturation. The simplest score (i.e., age, dyspnea, and the presence of a comorbidity) is shown in *Table 1* with hospitalization rates for the Delta and Omicron validation populations.⁵ It is also available as a free online app (<https://ebell-projects.shinyapps.io/LehighRiskScore/>). The authors suggest that low-risk patients may be monitored with outpatient follow-up as needed. Those in the intermediate-risk category may need closer outpatient follow-up with frequent nurse

TABLE 1

Lehigh Outpatient COVID Hospitalization Risk Score

Clinical variable	Points
Dyspnea	1.5
Any comorbidity*	1
Age (years):	
12 to 49	0
50 to 59	1
60 to 69	1.5
≥ 70	2.5
Total (0 to 5):	_____

Score	No. of patients hospitalized/total (%)	
	Delta variant	Omicron variant
Low risk: 0	15/1,849 (0.82)	7/3,144 (0.2)
Intermediate risk: 1 to 2.5	84/1,623 (5.2)	34/2,613 (1.3)
High risk: ≥ 3	70/334 (21.0)	33/381 (8.7)

*—Comorbidities include type 1 or 2 diabetes mellitus, asthma, chronic obstructive pulmonary disease or chronic bronchitis, hypertension, cardiovascular disease, chronic kidney disease, chronic liver disease, or cancer.

Information from reference 5.

This guide is one in a series that offers evidence-based tools to assist family physicians in improving their decision-making at the point of care.

This series is coordinated by Mark H. Ebell, MD, MS, deputy editor for evidence-based medicine.

A collection of Point-of-Care Guides published in *AFP* is available at <https://www.aafp.org/afp/poc>.

CME This clinical content conforms to AAFP criteria for CME. See CME Quiz on page 575.

Author disclosure: No relevant financial relationships.

or clinician calls, whereas high-risk patients may benefit from emergency department referral for laboratory testing and imaging to evaluate the patient for admission. Because the researchers validated their findings with a cohort of patients infected with the Omicron variant, the tool may remain useful for future COVID-19 variants. The study was retrospective, and telehealth patients were excluded, which may have led to a selection bias.⁵

A group in Great Britain used 260 hospitals to prospectively derive the Coronavirus Clinical Characterisation Consortium (4C) Mortality Score with data from 35,463 adult patients hospitalized with COVID-19 and validated it with an additional 22,361 patients. The 4C Mortality Score is calculated using patient age, sex at birth, number of comorbidities, respiratory rate, oxygen saturation, Glasgow Coma Scale score, and urea and C-reactive protein levels (available at <https://isaric4c.net/risk/v2/>). Those scoring low, intermediate, high, and very high had rates of in-hospital mortality that were 1.2%, 9.9%, 31.4%, and 61.5%, respectively, in the U.K. validation cohort.⁶ This clinical prediction rule was retrospectively applied to 6,802 U.S. adults hospitalized with COVID-19 from 99 emergency departments. The 4C Mortality Score and rates of 30-day mortality (a different outcome than the one used by the U.K. group) in the U.S. validation are shown in *Table 2*.⁷ A limitation in both studies was that patients were infected with the ancestral variant; therefore, mortality rates are likely lower for each risk group with the Omicron variant.

The LOCH risk score is useful for assisting family physicians in deciding whether further testing or referral for emergency or inpatient care is warranted. In the emergency department or hospital, the 4C Mortality Score can be used to determine the appropriate level of care. These rules could aid with the appropriate disposition of patients and may reduce hospital overcrowding by safely discharging low-risk patients. These tools should be used in conjunction with clinical judgment to identify low-risk patients.

Applying the Evidence

A 55-year-old man with a history of hypertension, type 2 diabetes mellitus, and stage III chronic kidney disease presents with dyspnea, cough, fatigue, fever, and a positive home test for COVID-19. He has a temperature of 38.5°C (101.3°F), blood pressure of 118/74 mm Hg, respiratory rate of

TABLE 2

4C Mortality Score for 30-Day Mortality in Hospitalized Adults With COVID-19

Clinical variable	Points
Age (years):	
18 to 49	0
50 to 59	2
60 to 69	4
70 to 79	6
≥ 80	7
Male sex at birth	1
Comorbidities*:	
0	0
1	1
≥ 2	2
Respiratory rate (breaths per minute):	
< 20	0
20 to 29	1
≥ 30	2
Oxygen saturation on room air < 92%	2
Patient-reported altered mental status†	2
Blood urea nitrogen (mg per dL [mmol per L]):	
< 20 (7.1)	0
20 to 39 (7.1 to 13.9)	1
≥ 40 (14.3)	3
C-reactive protein (mg per dL [mg per L]):	
< 5 (50)	0
5 to 9.9 (50 to 99)	1
≥ 10 (100)	2
Total (range 0 to 21):	_____

4C score	30-day mortality (%)
Low risk: 0 to 3	0.8
Intermediate risk: 4 to 8	5.3
High risk: 9 to 14	22.3
Very high risk: ≥ 15	50.6

4C = Coronavirus Clinical Characterisation Consortium.

*—Comorbidities include chronic cardiac, respiratory, kidney, or liver disease, diabetes mellitus, malignancy, connective tissue disease, dementia, chronic neurologic conditions, and obesity.

†—The original U.K. 4C Mortality Score used the Glasgow Coma Scale score of less than 15 points.

Adapted from Gordon AJ, Govindarajan P, Bennett CL, et al. External validation of the 4C Mortality Score for hospitalised patients with COVID-19 in the RECOVER network. *BMJ Open*. 2022;12(4):e054700.

POINT-OF-CARE GUIDES

22 breaths per minute, and an oxygen saturation of 91% on room air. His LOCH risk score is 3.5, placing him in the high-risk group (corresponding to an 8.7% risk of hospitalization with the Omicron variant). You recommend emergency department referral; further workup shows a blood urea nitrogen level of 55 mg per dL (19.6 mmol per L) and C-reactive protein level of 12 mg per dL (120 mg per L). His 4C Mortality Score is 13, placing him in the high-risk category and corresponding with a 22.3% mortality rate. He is admitted to the inpatient hospital unit where he receives appropriate care.

Editor's Note: Dr. Saguil is a contributing editor for *AFP*.

Address correspondence to Lindy Krebs, MD, at lindy.williams@ufl.edu. Reprints are not available from the authors.

References

1. Centers for Disease Control and Prevention. New admissions of patients with confirmed COVID-19, United States. Accessed January 15, 2023. <https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions>
2. Centers for Disease Control and Prevention. Daily updates of totals by week and state. Provisional death counts for coronavirus disease 2019 (COVID-19). Accessed January 15, 2023. <https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm>
3. Centers for Disease Control and Prevention. 2022-2023 U.S. flu season: preliminary in-season burden estimates. Accessed January 15, 2023. <https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm>
4. Centers for Disease Control and Prevention. RSV-Associated Hospitalization Surveillance Network interactive dashboard. Accessed January 15, 2023. <https://www.cdc.gov/rsv/research/rsv-net/dashboard.html>
5. Ebell MH, Hamadani R, Kieber-Emmons A. Development and validation of simple risk scores to predict hospitalization in outpatients with COVID-19 including the Omicron variant. *J Am Board Fam Med*. 2022;35(6):1058-1064.
6. Knight SR, Ho A, Pius R, et al.; ISARIC4C investigators. Risk stratification of patients admitted to hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: development and validation of the 4C Mortality Score [published correction appears in *BMJ*. 2020;371:m4334]. *BMJ*. 2020;370:m3339.
7. Gordon AJ, Govindarajan P, Bennett CL, et al. External validation of the 4C Mortality Score for hospitalised patients with COVID-19 in the RECOVER network. *BMJ Open*. 2022;12(4):e054700. ■

Expand Your CME Activity Reach with AAFP Accreditation

- Reach 129,000+ family physicians to market your activities.
- No annual fees.
- Free CME provider resources.
- Friendly customer service.



Accredit your CME activities with AAFP.
aafp.org/creditsystem

