

LETTER TO THE EDITOR

General correspondence

Risk factors for readmission following inpatient management of COVID-19 in a low-prevalence setting

There are minimal data on post-COVID-19 readmissions in relatively low-prevalence countries such as Australia. Data prior to COVID-19 demonstrate that hospitalised patients have up to a 20% chance of a 30-day unplanned readmission, representing a significant human, financial and resource burden.¹

We performed a single-centre, observational cohort study of inpatients admitted to Austin Health from March

to October 2020, investigating demographic, clinical, laboratory and treatment parameters associated with readmission to hospital within 6 months following initial inpatient management of COVID-19. Patients with a single index admission were compared to those readmitted, then grouped according to reason for readmission (i.e. respiratory or COVID-19-specific symptoms, complications of COVID-19, or unrelated presentation). Chi-squared and rank sum tests were performed for univariate analysis using Stata MP16.1 (StataCorp, College Station, TX, USA).

Table 1 Demographic and clinical risk factors for re-admission (at index admission)

	Total	Not readmitted	Readmitted	P-value
<i>n</i>	169	145	24	
Demographics				
Age, median (IQR) (years)	59 (43, 74)	59 (43, 76)	57.5 (43, 67)	0.54
Age > 65 years	65 (38.5%)	58 (40.0%)	7 (29.2%)	0.31
Age > 80 years	31 (18.3%)	29 (20.0%)	2 (8.3%)	0.17
Sex (female)	92 (54.4%)	77 (53.1%)	15 (62.5%)	0.39
Cardiac disease	22 (13.2%)	20 (14.0%)	2 (8.3%)	0.45
Chronic liver disease	1 (0.6%)	1 (0.7%)	0 (0.0%)	0.68
Chronic respiratory disease	40 (24.0%)	31 (21.7%)	9 (37.5%)	0.09
Diabetes	41 (24.6%)	36 (25.2%)	5 (20.8%)	0.65
Hypertension	61 (36.5%)	54 (37.8%)	7 (29.2%)	0.42
ACEi or ARB treatment	37 (61%)	34 (63%)	3 (43%)	0.31
Severity				
CCI (age adjusted), median (IQR)	2 (0, 5)	2 (0, 5)	2 (1.5, 3.5)	0.66
Lung infiltrates >50% on CXR?	23 (32%)	21 (33%)	2 (20%)	0.40
NIH COVID-19 disease severity on admission†				
Asymptomatic	1 (0.9%)	1 (1%)	0 (0%)	0.72
Mild	16 (14.3%)	13 (14%)	3 (18%)	
Moderate	53 (47.3%)	43 (45%)	10 (59%)	
Severe	35 (31.3%)	32 (34%)	3 (18%)	
Critical	7 (6.3%)	6 (6%)	1 (6%)	
ICU admission	25 (15.2%)	19 (13.4%)	6 (26.1%)	0.11
Length of stay, median (IQR)	5 (2, 10)	5 (2, 9)	7 (4, 20)	0.04
Laboratory parameters				
Haemoglobin, median (IQR) (g/L)	135 (123, 146)	135 (123, 146.5)	137 (121, 146)	0.74
Lymphocytes, median (IQR) ($\times 10^9/L$)	1.0 (0.7, 1.4)	1.0 (0.7, 1.4)	1.0 (0.6, 1.5)	0.87
Creatinine, median (IQR) ($\mu\text{mol/L}$)	76 (60, 95)	76.5 (60, 95)	71 (60, 86)	0.37
CRP, median (IQR) (mg/L)	40.7 (16.7, 109)	40.7 (16.7, 98.3)	48.1 (16.7, 126)	0.85
Procalcitonin, median (IQR) ($\mu\text{g/L}$)	0.14 (0.05, 0.38)	0.14 (0.06, 0.38)	0.155 (0.05, 0.36)	0.95
Ferritin, median (IQR) ($\mu\text{g/L}$)	424 (175, 778)	424 (199, 770)	413 (119, 1061)	0.87
LDH, median (IQR) (units/L)	280 (235, 359)	271 (224, 362)	292 (264, 327)	0.57
Treatment				
Remdesivir	25 (16.2%)	23 (17.3%)	2 (9.5%)	0.37
Corticosteroids	62 (38.0%)	52 (37.1%)	10 (43.5%)	0.56
Supplemental nasal oxygen	51 (38.1%)	40 (34.8%)	11 (57.9%)	0.06

Table 1 Continued

	Total	Not readmitted	Readmitted	P-value
High-flow nasal oxygen	9 (5.6%)	6 (4.3%)	3 (13.0%)	0.09
Mechanical ventilation	9 (5.5%)	8 (5.7%)	1 (4.3%)	0.79
Subgroup analysis: respiratory or COVID-19-specific symptoms and COVID-19 complications				
<i>n</i>	160	145	15	
ICU admission	24 (15.3%)	19 (13.4%)	5 (33.3%)	0.041
Supplemental nasal oxygen	48 (37.8%)	40 (34.8%)	8 (66.7%)	0.030
High-flow nasal oxygen	9 (5.9%)	6 (4.3%)	3 (20.0%)	0.014

†Based on NIH COVID-19 Treatment Guidelines.² ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CCI, Charlson Comorbidity Index (age adjusted); CRP, C-reactive protein; CXR, chest X-ray; ICU, intensive care unit; IQR, interquartile range, LDH, lactate dehydrogenase; NIH, National Institutes of Health.

Data from the index admission are summarised in Table 1. Of 169 patients admitted with COVID-19 between March and October 2020 who survived to discharge, 24 (14.2%) were readmitted to hospital within 6 months (median, 36 days; interquartile range, 15–67 days). Ten (5.9%) patients re-presented with respiratory or COVID-19-specific symptoms, five (3.0%) patients re-presented with COVID-19 complications, and nine (5.3%) patients re-presented with unrelated problems (Supporting Information Table S1).

In whole cohort analysis, increased length of stay during index admission was significantly associated with readmission (5 days vs 7 days, $P = 0.04$). A non-significant increase in readmission was noted in patients with pre-existing chronic respiratory disease, patients requiring supplemental oxygen, and patients admitted to the intensive care unit (ICU). In sub-group analysis of only those patients who re-presented with respiratory or COVID-19-specific symptoms or complications of COVID-19 ($n = 15$), ICU admission ($P = 0.04$), supplemental oxygen ($P = 0.03$) and high-flow nasal oxygen (HFNO) ($P = 0.01$) were significantly associated with readmission. Of those who re-presented within 30 days of index admission ($n = 12$), readmission was increased in patients with pre-existing chronic respiratory disease (21.7% vs 41.7%, $P = 0.12$), and a significant association was found with HFNO ($P = 0.004$).



To our knowledge, this is the first study investigating readmission trends following hospitalisation with COVID-19 in a low-prevalence country. Our data compare with a large US registry study that reported a 60-day re-presentation rate of 9%, a COVID-19-related re-presentation rate of 45%, and included respiratory comorbidity as a risk for re-presentation.³ We found a positive association between length of stay and

readmission, in contrast to other studies where premature discharge was thought to contribute to 'bounce-back' admissions.^{3,4}

Although limited by small numbers and single-centre follow up, we found an association between parameters indicating a more severe illness course (ICU, HFNO, length of stay) and readmission, although no association between National Institutes of Health (NIH)-calculated severity of index illness at presentation² and readmission. International experience investigating early readmission after COVID-19 hospitalisation shows mixed results;^{4,5} however, an increased likelihood of readmission in patients requiring HFNO in index admission has been associated with poor prognosis in other studies.⁶

As length of stay, ICU admission, supplemental oxygen requirement and HFNO were associated with readmission for COVID-19 or associated complications, this group of patients should be a focus for targeted post-acute care.

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George P. Drewett ¹, R. Kimberley Chan,² Nicholas Jones,^{2,4} Hari Wimalaswaran,^{3,4,5} Mark E. Howard,^{3,4} Christine F. McDonald,^{3,4,5} Jason Kwong,^{1,6} Olivia Smibert,^{1,7} Natasha E. Holmes ^{1,8,9} and Jason A. Trubiano^{1,4}

Departments of ¹Infectious Diseases, ²General Medicine, and ³Respiratory and Sleep Medicine, Austin Health, Melbourne, Victoria, and ⁴Department of Medicine, University of Melbourne, ⁵Institute for Breathing and Sleep, Heidelberg, ⁶Department of Microbiology & Immunology, University of Melbourne, ⁷Dept of Oncology, Peter McCallum Cancer Centre, University of Melbourne, ⁸Department of Critical Care, The University of Melbourne, Parkville, and ⁹Data Analytics Research and Evaluation (DARE) Centre, Austin Health and The University of Melbourne, VIC, Australia

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Table S1 Reason for re-admission.
