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## Letter to the Editor

**COVID-19: Outcomes of patients with confirmed COVID-19 re-admitted to hospital.**

Dear Editor,

Ye et al., in this Journal, reported the characteristics of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) reactivation.<sup>1</sup> We aimed to investigate clinical outcomes of patients with confirmed COVID-19 who were re-admitted to hospital, in order to identify risk factors for patients discharged and subsequent management of COVID-19 in clinical practice. Clinical outcomes from hospitalised patients with COVID-19 are poor, with a reported mortality of 21%.<sup>2</sup> Age, sex, comorbidities, ethnicity and deprivation have all been shown to correlate with worse outcomes in patients with COVID-19, however the outcomes of hospitalised patients once discharged remains unknown.<sup>3–5</sup>

The North Middlesex University Hospital (NNUH), a 459 bed hospital on the outskirts of London, serving a population of over 350,000, was identified early as the second most COVID-19 pressured trust in the UK.<sup>6</sup> All patients with COVID-19, once discharged, were referred to the Home Referral Team (HRT), a team of clinicians specialising in General Practice who would follow up patients with a phone call either daily or every three days depending on COVID severity, unless discharged to a care home or another treatment centre.

Demographic, clinical, biochemical and radiological metadata were retrospectively collected and interrogated for all medical patients with confirmed SARS-CoV-2 infection between 09/03/2020 and 30/04/2020. NNUH performed 2275 SARS-CoV-2 PCR tests on 1911 patients, 729 of whom (38%) tested positive, 391 of whom were discharged. Of these, 39 patients re-presented to the hospital Emergency Department, with 25 then requiring re-admission. Re-admitted patients were further stratified into those with dyspnoea as their primary complaint. Chest radiographs were re-reviewed and blindly scored by an experienced radiologist using the British Society of Thoracic Imaging criteria.<sup>7</sup> All re-admitted patients had been appropriately referred to the HRT or transferred to a care provider.

The median age of the re-admission group was higher at 73 years (IQR 58–82) compared to discharged patients of 59 years (IQR 48–76); sex distribution was 60% male (15/25) in the readmission group versus 58.8% male

(429/729) in all COVID-19 patients and ethnicity was predominantly of Black, Asian or Minority Ethnic (BAME) background in both groups (absolute 62.5% discharged vs 57.1% re-admission) [Table 1]. Biomarker results were similar in both groups. Of those re-admitted; two patients required Intensive Care management, three patients died, and three further patients were discharged home as part of their end of life care.

In the re-admission group, the average time before being re-admitted to hospital was 10 days (IQR 6–15), with dyspnoea the presenting complaint in 13/25 (52%). Median oxygen saturations (SpO<sub>2</sub>) on re-admission were low at 90.5% (IQR 80.75–95) and even lower in the dyspnoea sub-group at 82% (IQR 77.0–89.25%) despite having adequate SpO<sub>2</sub> on discharge (median 94%). Biomarker differences between the two groups showed a higher median CRP of 76 in the dyspnoeic cohort (IQR 6.65–197.5) compared to the total readmission group of 45 (IQR 5.5–92). 50% of chest radiographs were reported as COVID on re-admission, rising to 57.1% in the dyspnoeic cohort. 6/13 (46%) patients in the dyspnoeic cohort underwent computed tomography (CT) of the thorax, one of whom was diagnosed with pulmonary emboli.

As far as we are aware, this is the first study looking at clinical outcomes for patients with COVID-19 who were re-admitted to hospital. The emergency re-presentation rate within 30 days appears low in the context of national emergency re-presentation averages (9.9% vs 14.0%).<sup>8</sup> and whilst this should be interpreted with caution within a pandemic, this may reflect the value of a remote follow up team. However, the high mortality rate (24%), and the median and prevalence of low SpO<sub>2</sub> results in patients re-admitted is concerning and warrants further studies to evaluate reasons for re-admission, ensuring appropriate safety-netting when discharged.

Our data suggests patients with COVID-19 who are re-admitted may be at increased risk of hypoxia and death. Based on our data on the average time before re-presentation at 10 days, enhanced, personalised follow up at 7 days in a formalised COVID-19 clinic with radiological imaging and oxygen saturation recording using pulse oximetry probes may help early identification of those at risk of deterioration, thus preventing re-admission. Our study has a number of limitations including a moderate sample size, no stratification of COVID-19 severity and a higher than average proportion of patients from BAME backgrounds, reflecting our local demographic. This study was strengthened with the use of local data from a highly pressurised region of the epicentre of the COVID-19 epidemic in the United Kingdom. Further studies, using large datasets with detailed clinical data are urgently needed to investigate both the drivers of and causes for the risk of re-admission, hypoxia and death in re-admissions from COVID-19.

**Declaration of Competing Interest**

None.

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**Table 1**  
Demographic, clinical and outcome data for patients with confirmed COVID-19 re-admitted to hospital.

	All patients 729	Patients discharged 391	Patients readmitted 25	Readmitted dyspnoeic cohort 14
<b>Demographics</b>				
Age: median (I)	66(53–80)	59(48–76)	73(58–82)	68(57–81)
<b>Sex:</b>				
Male	429/729		15(60.0)	8(57.1)
Female	300/729		10(40.0)	6(42.9)
<b>Ethnicity</b>				
BAME: absolute(%)	324(60.8)	192(62.5)	12(57.1)	8(72.7)
White European: absolute(%)	209(39.2)	115(37.5)	9(42.9)	3(27.3)
<b>Co-morbidities:</b>				
Any co-morbidity			24(96.0)	14(100.0)
Hypertension			16(64.0)	11(78.5)
Diabetes			6(24.0)	4(25.0)
<b>Admission 1</b>				
Peak neutrophil count: median (I)	6.97 (4.99–8.95)	6(4.36–7.88)	5.55(4.65–7.34)	5.53 (4.5625–5.95)
Nadir lymphocyte count: median (I)	0.77(0.54–1.09)	1(0.64–1.15)	0.82 (0.66–1.05)	0.83 (0.70–0.91)
Peakferritin: median (I)	819(417–1640)	692(324.25–1300.25392)(184–846.5)		414(213.5–828.25)
PeakCRP: median (I)	85.4 (53.3–150.18)	72(40.05–94.65)	62.7(16.15–84.85)	61.7(39.68–80.10)
Iw admission?	102(14.0)	15(3.84)	2(8.0)	0(0.0)
Length ofstayfrom COVID diagnosis: median (I)	6(3–10)	7(4–11)	6(1–9)	5(0–8)
<b>Discharge 1</b>				
SpO2 on discharge: median (I)			94.5 (92.25–96)	94.0(92.0–96.0)
<b>Readmission</b>				
Time to readmission			10(6–15)	11(7.5–14.5)
<b>Reason for readmission</b>				
SOB: absolute (%)			13(52.0)	NA
Other: absolute(%)			12(48.0)	NA
<b>SpO2 on admission</b>				
Mmission neutrophil count: median (I)			90.5 (80.75–95)	82(77.0–89.25)
Mmission lymphocytecount: median (I)			6.09 (5.07–10.93)	6.09 (5.05–11.00)
Mmission ferritin: median (I)			1.11 (0.79–1.85)	1(0.6–1.27)
Mmission CRP: median (I)			597 (102–1158)	378(87.5–890.25)
CXR			45(5.5–92)	76(6.65–197.5)
COVID: absolute (%)			24	14
Non-COVID: absolute(%)			12(50.0)	8(57.1)
Normal: absolute(%)			6(25.0)	5(35.7)
<b>Outcome of admission 2</b>				
Died/End of Life: absolute (%)			6(24.0)	4(28.6)
Recovered: absolute (%)			16(64.0)	8(57.1)
Still admitted: absolute (%)			3(12.50)	2(14.3)
Transferred: absolute(%)			0(0)	0

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