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Assessment of thirty-day readmission rate, timing, causes and predictors after hospitalization with COVID-19

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Abstract. Yeo I, Baek S, Kim J, Elshakh H, Voronina A, Lou MS, Vapnik J, Kaler R, Dai X, Goldbarg S (New York-Presbyterian Queens, Queens; Icahn School of Medicine at Mount Sinai, New York; New York-Presbyterian Queens, Queens, NY, USA). Assessment of thirty-day readmission rate, timing, causes and predictors after hospitalization with COVID-19. *J Intern Med* 2021; **290**: 157–165. https://doi.org/10.1111/joim.13241

Background. There are limited data on the characteristics of 30-day readmission after hospitalization with coronavirus disease 2019 (COVID-19).

Objectives. To examine the rate, timing, causes, predictors and outcomes of 30-day readmission after COVID-19 hospitalization.

Methods. From 13 March to 9 April 2020, all patients hospitalized with COVID-19 and discharged alive were included in this retrospective observational study. Multivariable logistic regression was used to identify the predictors of 30-day readmission, and a restricted cubic spline function was utilized to assess the linearity of the association between continuous predictors and 30-day readmission.

Results. A total of 1062 patients were included in the analysis, with a median follow-up time of 62 days. The mean age of patients was 56.5 years, and 40.5% were women. At the end of the study, a total of 48 (4.5%) patients were readmitted within 30 days of discharge, and a median time to readmission was 5 days. The most common primary diagnosis of 30-day readmission was a hypoxic respiratory failure (68.8%) followed by thromboembolism (12.5%) and sepsis (6.3%). The patients with a peak serum creatinine level of ≥1.29 mg/dL during the index hospitalization, compared to those with a creatinine of <1.29 mg/dL, had 2.4 times increased risk of 30-day readmission (adjusted odds ratio: 2.41; 95% CI: 1.23–4.74). The mortality rate during the readmission was 22.9%.

Conclusion. With 4.5% of the thirty-day readmission rate, COVID-19 survivors were readmitted early after hospital discharge, mainly due to morbidities of COVID-19. One in five readmitted COVID-19 survivors died during their readmission.

Keywords: COVID-19, epidemiology, patient readmission, readmission mortality, readmission predictor.

Introduction

Emergence of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has rapidly evolved into a pandemic and posed a substantial burden on the healthcare system. COVID-19 displays a broad spectrum of clinical manifestations ranging from asymptomatic infection to acute respiratory distress syndrome with multiorgan involvement [1,2]. Consequently, some patients develop various complications and experience a prolonged disease course. A growing body of literature reports the development of long-term sequelae of COVID-19 including diffuse lung damage and impaired pulmonary function [3,4]. The recovery course differs based on the severity of COVID-19, ranging from 2 weeks for mild disease to as long as 3 to 6 weeks for severe or critical disease [5]. However, little is known about hospital readmissions after COVID-19-related hospitalization, which is vital to understanding and facilitating the recovery course of the patients.

The risk of 30-day hospital readmission is a complex function of comorbidities, severity of disease that caused index hospitalization, transition to outpatient care, and patient recovery. Early readmission is associated with poor outcomes and negatively impacts the quality of life of

patients. Understanding the epidemiology of 30-day readmission in patients hospitalized with COVID-19 would allow the healthcare system to focus already limited resources and may improve patient outcomes during a pandemic. This study aimed to investigate the rate, timing, causes, predictors and outcome of 30-day readmissions after hospitalization with COVID-19.

Materials and methods

Study cohort

In this retrospective observational study, we included all consecutive patients who were hospitalized to New York-Presbyterian Queens, a 535-bed tertiary care teaching hospital, from 13 March to 9 April 2020, with SARS-CoV-2 infection confirmed by polymerase chain reaction (PCR) test of a nasopharyngeal specimen. The follow-up continued until the time of data cut-off, 4 June 2020. Patients who were younger than 18 years of age, who remained hospitalized at the time of data cut-off, who left the hospital against medical advice, or who died during the index hospitalization were excluded from the study. The institutional review board at New York-Presbyterian Queens hospital approved this research under an expedited review (approval #13210720).

Data collection

Data on demographics, comorbidities, laboratory results, inpatient medications, and outcomes (including the length of stay, mortality and readmission) were manually abstracted from each patient's electronic health record (EHR) and collected using REDCap. Primary outcome was 30-day all-cause readmission. Only the first readmission within 30 days of discharge was included, and transfer to another hospital during the index hospitalization was not counted as a readmission. Primary cause of readmission was identified based on manual review of the admission note documented in EHR at the time of the readmission.

Statistical analysis

For descriptive analyses, baseline characteristics of patients were compared based on the occurrence of 30-day readmission. Categorical variables are presented as total count and percentage of patients, and continuous variables are reported as mean or median depending on their distributions. For comparison, chi-square test was used for categorical variables, and either the Student t-test or Mann–Whitney–Wilcoxon nonparametric test was used for continuous variables. To identify independent predictors of 30-day readmission, a multivariable logistic regression model was created for the outcome of 30-day readmission by including covariates that had univariate significance with the outcome ($P < 0.1$). Multicollinearity was assessed with the variance inflation factor. A restricted cubic spline function was used to test the linearity of the association between the continuous independent variables and 30-day readmission. Subsequently, to make the predictor of 30-day readmission more clinically interpretable, the serum creatinine level was dichotomized at the upper quartile of the range and included as a binary variable in the multivariable model. Performance of the multivariable model was assessed in terms of calibration-in-the-large, calibration slope, and the C-statistic. Internal validation was conducted by 1000 bootstrap resamples. The covariates with missing data and the proportions of missingness were as follows: BMI (8.3%), ethnicity (8.4%), hypertension (0.9%), diabetes mellitus (0.7%), hyperlipidemia (0.8%), white blood cell count (1.5%), lymphocytopenia (6.1%), lactate dehydrogenase (67%), procalcitonin (8.3%), D-dimer (70%), C-reactive protein (55.5%), ferritin (68%), creatinine (4.8%) and troponin (50%). Missing data of the covariates were handled with multiple imputation by creating 30 imputed data sets, and parameter estimates and standard errors were calculated using Rubin's method [6]. For sensitivity analysis, *E*-value was calculated to assess the potential effect of an unmeasured confounder on the association between the observed predictor and 30-day readmission [7]. The statistical analyses were performed using SAS software, version 9.4 (SAS Institute). All tests were 2-sided, with $P < 0.05$ indicating statistical significance. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Results

Baseline characteristics

From 13 March to 9 April 2020, 1522 patients admitted to New York-Presbyterian Queens hospital and tested positive for SARS-CoV-2 were reviewed. After excluding 460 patients, a total of 1062 patients discharged alive were included in the analysis (Figure 1). The median postdischarge follow-up time was 62 days (interquartile range [IQR],

55-68). Of 1062 patients, 79 patients (7.4%) returned to the emergency department (ED) and 48 patients (4.5% of total discharged patients, and 60.8% of those returned to the ED) were readmitted within 30 days of discharge. Table 1 presents a comparison of the baseline characteristics of COVID-19 patients, who survived the index hospitalization, based on the occurrence of 30-day readmission. Compared to patients without 30-day readmission, those readmitted within 30 days of discharge were older with lower BMI, more likely to be non-Hispanic white, and more frequently had hypertension, diabetes mellitus, congestive heart failure, coronary artery disease and atrial fibrillation. Also, patients with 30-day readmission had higher levels of peak serum procalcitonin, creatinine and troponin during their index hospitalization and were more frequently discharged to a facility than those not readmitted within 30 days of discharge.

Timing, causes, predictors and mortality of 30-day readmission

Figure 2 demonstrates the timing of readmission within 30 days of discharge. Half of the 30-day readmissions occurred within 5 days of discharge. A repeat PCR test was performed for SARS-CoV-2 infection with a nasopharyngeal specimen for 30 of 48 patients readmitted. Of 30 patients retested, 22 (73.3%) remained positive. The most common primary diagnosis of readmission was a hypoxic respiratory failure ($n = 33$; 68.8%) followed by thromboembolism ($n = 5$ with acute pulmonary embolism and $n = 1$ with acute limb ischaemia; 12.5%) and sepsis ($n = 3$; 6.3%; Figure 3). After adjusting for baseline risk factors, a peak serum creatinine level measured during the index hospitalization was linearly associated with the risk of 30-day readmission (P for overall association < 0.001, p for non-linearity = 0.897) (Figure 4). The patients with a peak serum creatinine level of ≥1.29 mg/dL, compared to those with a creatinine of <1.29 mg/dL, were 2.4 times more likely to be readmitted within 30 days of discharge (Table 2, Figure 5). The multivariable model had adequate capacities for discrimination (C-statistic, 0.77) and calibration (Figure S1). *E*-value was 4.25 for peak creatinine ≥1.29 mg/dL and was 1.76 for the lower bound of confidence interval, suggesting that a set of unmeasured confounders would have to be associated with a 4.25-fold increased risk of readmission to explain away the observed association. In addition, a discharge creatinine level was assessed in the multivariable model, which was not significantly associated with the readmission (adjusted odds ratio: 1.54; 95% CI: 0.79–3.03; $P = 0.207$). The in-hospital mortality rate during the readmission was 22.9% (95% CI: 11.0% to 34.8%).

Discussion

In this retrospective observational study of 1062 multiethnic patients admitted with COVID-19 to a tertiary care hospital in New York City, we identified several key findings. First, the overall 30-day readmission rate after index hospitalization related to COVID-19 was 4.5%. Secondly, of those

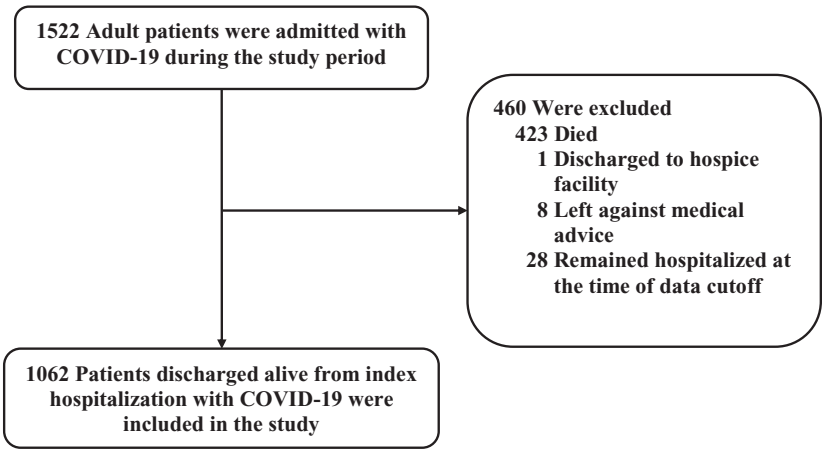

Fig. 1 *Study Baseline Cohort. Abbreviations: COVID-19, coronavirus disease 2019.*

Table 1. *Baseline characteristics of patients discharged alive from hospitalization related to COVID-19 stratified by occurrence of subsequent 30-day readmission*

		Thirty-day readmission		
Characteristics	Overall	No	Yes	*P* value
Number of patients (%)	1062	1014 (95.5%)	48 (4.5%)	
Age, mean (SD), y	56.5 (16.6)	56.1 (16.5)	65.8 (17.4)	<0.001
Female sex, No. (%)	430 (40.5)	407 (40.1)	23 (47.9)	0.283
Body mass index, No. (%)				<0.001
<18.5	17 (1.8)	12 (1.3)	5 (11.1)	
18.5–24.9	286 (29.4)	271 (29.2)	15 (33.3)	
25.0–29.9	335 (34.4)	319 (34.4)	16 (35.6)	
30.0–39.9	276 (28.4)	268 (28.9)	8 (17.8)	
≥40.0	59 (6.0)	58 (6.2)	1 (2.2)	
Ethnicity, No. (%)[a]				<0.001
Non-hispanic white	173 (18.4)	161 (18.0)	12 (27.8)	
Non-hispanic black	69 (7.3)	63 (7.0)	6 (14.0)	
Asian	124 (13.2)	118 (13.2)	6 (14.0)	
Hispanic	432 (46.0)	419 (46.7)	13 (30.2)	
Other	142 (15.1)	136 (15.2)	6 (14.0)	
Comorbidities, No. (%)				
Hypertension	434 (41.3)	401 (39.9)	33 (68.8)	<0.001
Diabetes mellitus	272 (25.8)	253 (25.1)	19 (39.6)	0.025
Hyperlipidemia	301 (28.6)	285 (28.4)	16 (33.3)	0.456
Congestive heart failure	35 (3.3)	30 (3.0)	5 (10.4)	0.005
Coronary artery disease	90 (8.5)	82 (8.1)	8 (16.7)	0.037
Atrial fibrillation	48 (4.5)	43 (4.2)	5 (10.4)	0.044
Chronic kidney disease	67 (6.3)	54 (5.3)	13 (27.1)	<0.001
COPD/asthma	82 (7.7)	75 (7.4)	7 (14.6)	0.068
In-hospital workup, median (IQR)				
White blood cell count, $\times 10^9$/L	7.0 (5.2–9.3)	7.0 (5.3–9.4)	6.5 (5.0–8.7)	0.206
Lymphocytopenia, No. (%)	529 (53.1)	504 (53.0)	25 (54.4)	0.858
Lactate dehydrogenase, U/L[d]	386 (293–512)	388 (293–514)	375 (270–456)	0.579
Procalcitonin, ng/mL[d]	0.2 (0.1–0.4)	0.2 (0.1–0.4)	0.3 (0.1–3.3)	0.001
D-dimer, ng/mL[d]	708 (306–2595)	707 (304–2647)	911 (456–1817)	0.999
C-reactive protein, mg/dL[d]	10.4 (4.3–19.5)	10.8 (4.3–19.3)	6.5 (2.5–26.7)	0.442
Ferritin, ng/mL[d]	896 (501–1730)	922 (507–1779)	661 (402–1051)	0.028
Peak Creatinine, mg/dL[d]	0.9 (0.7–1.3)	0.9 (0.7–1.2)	1.3 (0.8–3.6)	<0.001
Discharge Creatinine, mg/dL[d]	0.8 (0.6–1.0)	0.8 (0.6–0.9)	0.9 (0.7–1.5)	0.012
Troponin-T, ng/mL[d]	0.01 (0.01–0.01)	0.01 (0.01–0.01)	0.04 (0.01–0.13)	<0.001
Abnormal Chest X-ray, No. (%)[b]	833 (78.4)	797 (78.6)	36 (75.0)	0.554
Medications, No. (%)				
Hydroxychloroquine	862 (81.2)	822 (81.1)	40 (83.3)	0.695
ACE inhibitor/ARB	174 (17.1)	163 (16.8)	11 (23.4)	0.242
Remdesivir	22 (2.1)	22 (2.1)	0 (0)	–

Table 1 (*Continued*)

Characteristics	Overall	Thirty-day readmission		*P* value
		No	Yes	
Tocilizumab	17 (1.6)	15 (1.5)	2 (4.2)	0.148
Hospitalization course				
Length of stay, median (IQR), d	6 (3–10)	6 (3–10)	6 (2–10)	0.569
Discharge disposition, No. (%)				0.009
Home	791 (74.5)	763 (75.3)	28 (58.3)	
Facility[c]	271 (25.5)	251 (24.7)	20 (41.7)	

Abbreviations: COVID-19, coronavirus disease 2019; IQR, interquartile range.
[a]Ethnicity data were collected based on self-report in prespecified fixed categories.
[b]Abnormal chest X-ray includes findings of consolidation, bilateral pulmonary infiltration, or ground-glass opacity.
[c]Facility includes skilled nursing facility, intermediate care facility, and inpatient rehabilitation facility.
[d]Missing proportion for serum biomarkers: lactate dehydrogenase (67%), procalcitonin (8.3%), D-dimer (70%), C-reactive protein (55.5%), ferritin (68%), peak creatinine (4.8%), discharge creatinine (4.8%) and troponin (50%).

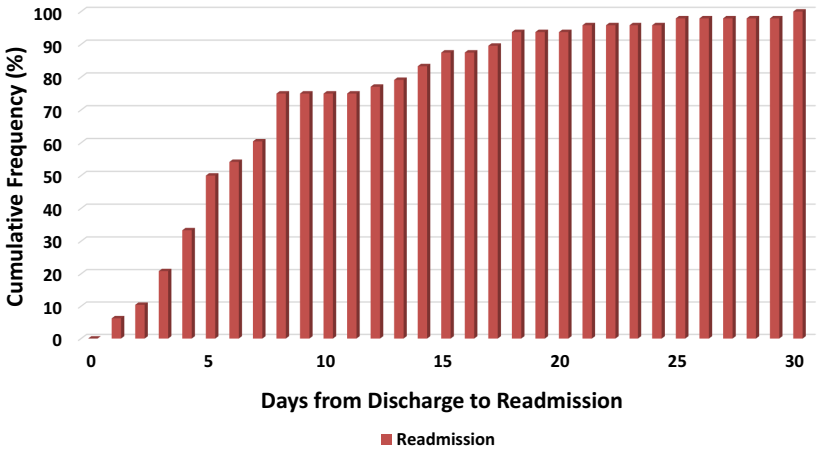

Fig. 2 *Timing of 30-Day Readmission by Postdischarge Day in Patients Readmitted after Index Hospitalization Related to COVID-19. Amongst those readmitted, 50% and 60.4% were readmitted within 5 and 7 days of discharge, respectively. COVID-19, coronavirus disease 2019.*

readmitted, more than half of the patients were readmitted within a week of discharge. Thirdly, the majority of readmissions were due to prolonged hypoxic respiratory failure. Fourthly, a peak serum creatinine level during index admission was linearly associated with risk of readmission, and patients with creatinine ≥1.29 mg/dL had ~2.5 times increased likelihood of readmission compared to those with <1.29 mg/dL. Finally, COVID-19 patients with 30-day readmission had a high in-hospital mortality rate of 22.9% during the readmission stay. To our knowledge, this study represents the first large observational study of 30-day readmission of hospitalized patients with confirmed COVID-19 in the United States.

A case series of 2081 patients discharged alive reported 2.2% of readmission rate, which, however, was based on a limited median postdischarge follow-up time of 4.4 days [8]. A readmission rate of 2.0% was observed in another study of 2864 patients in New York City [9]. However, this study was limited by a shorter follow-up of 14 days and a lack of multivariable analysis. Our study found that 4.5% of survivors were readmitted within 30 days of discharge mostly for the conditions

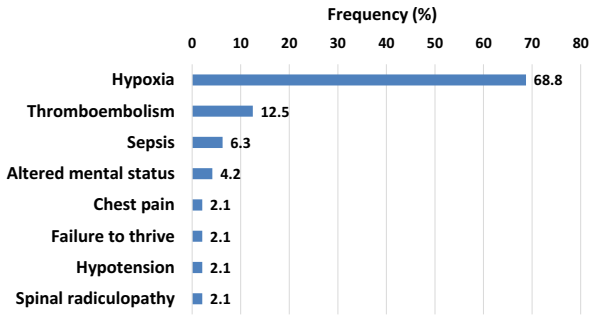

Fig. 3 *Primary Diagnoses of 30-Day Readmission after Index Hospitalization Related to COVID-19.*

directly associated with COVID-19. There are several considerations for the 30-day readmission rate of COVID-19 patients that appears to be lower than that of seasonal influenza (14%) or community-acquired pneumonia (16.6%) [10,11]. The first possible explanation is the societal instructions to stay at home and to quarantine during recovery resulting in a delay seeking immediate medical attention not only for the complications of COVID-19 but also for non-COVID-19-associated conditions that would have otherwise led to hospital readmission. Such a global trend of underutilization of medical services for patients with non-COVID-19-related emergent health needs has been widely observed during the COVID-19 pandemic [12-14]. Importantly, delays in seeking care and lower readmissions have been shown, respectively, to be associated with worse clinical outcomes and increased postdischarge mortality for conditions including pneumonia [15-17]. Our findings raise a concern that, during a pandemic, recovering

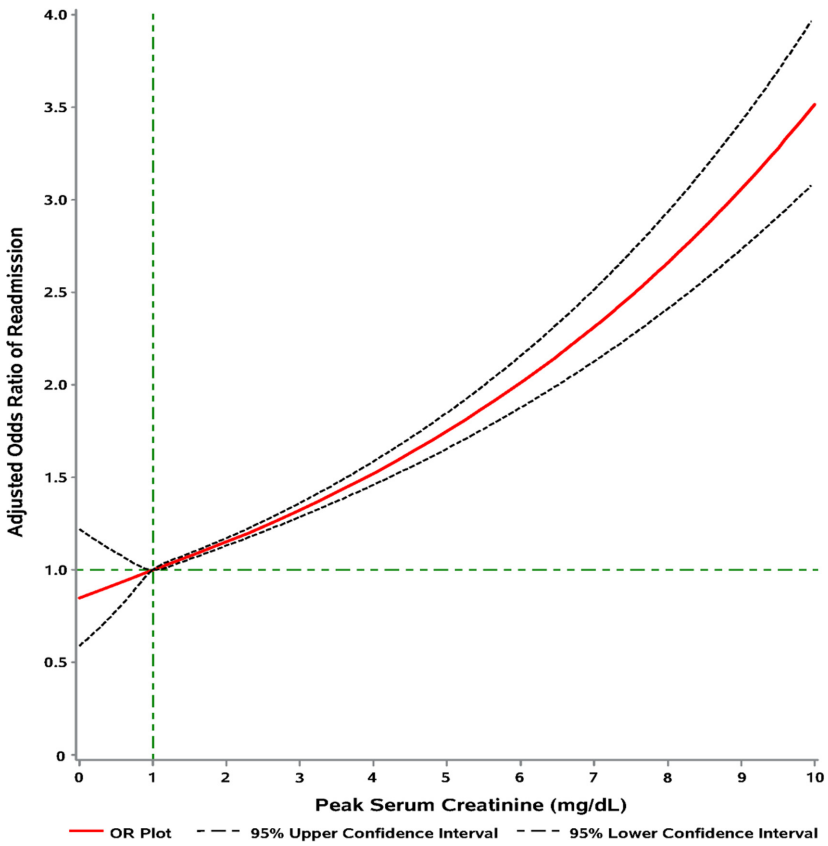

Fig. 4 *Association between Peak Serum Creatinine Level during Index Hospitalization Related to COVID-19 and 30-Day Readmission. A restricted cubic spline function was used adjusting for covariates including age, body mass index, hypertension, diabetes mellitus, congestive heart failure, coronary artery disease, atrial fibrillation, chronic obstructive pulmonary disease /asthma, lactate dehydrogenase, troponin and discharge disposition.*

Table 2. *Association of baseline characteristics of patients with 30-day readmission after index hospitalization related to COVID-19*

	Univariate analysis		Multivariable analysis	
Predictors	Unadjusted Odds Ratio (95% CI)	*P* value	Adjusted Odds Ratio (95% CI)	*P* value
Creatinine ≥ 1.29 mg/dL[a]	1.19 (1.10–1.28)	<0.001	2.41 (1.23–4.74)	0.011
Age	1.04 (1.02–1.06)	<0.001	1.01 (0.99–1.03)	0.358
Body mass index		0.002		0.085
<18.5	8.307 (2.61–26.4)	<0.001	4.24 (1.24–16.2)	0.023
18.5–24.9	1.10 (0.54–2.27)	0.789	0.88 (0.41–1.87)	0.731
25.0–29.9	1 (reference)	–	1 (reference)	–
30.0–39.9	0.60 (0.25–1.41)	0.239	0.58 (0.24–1.40)	0.223
≥40.0	0.34 (0.05–2.64)	0.305	0.25 (0.03–1.98)	0.188
Hypertension	3.30 (1.77–6.16)	<0.001	1.63 (0.73–3.62)	0.229
Diabetes mellitus	1.95 (1.08–3.54)	0.028	1.29 (0.65–2.56)	0.461
Congestive heart failure	3.81 (1.41–10.31)	0.008	1.87 (0.55–6.29)	0.312
Coronary artery disease	2.27 (1.03–5.02)	0.042	1.05 (0.43–2.57)	0.921
Atrial fibrillation	2.63 (0.99–6.96)	0.052	1.19 (0.35–4.01)	0.781
COPD/asthma	2.14 (0.93–4.93)	0.075	1.56 (0.61–3.97)	0.352
Lactate dehydrogenase	1.00 (1.00–1.00)	0.044	1.00 (0.99–1.00)	0.236
Troponin	1.87 (1.02–3.44)	0.045	1.27 (0.61–2.64)	0.528
Discharge disposition			1 (reference)	–
Home	1 (reference)	–		
Facility	2.17 (1.20–3.92)	0.010	1.11 (0.57–2.19)	0.757

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; COVID-19, coronavirus disease 2019.
[a]Modeled with Creatinine < 1.29 mg/dL as a reference.

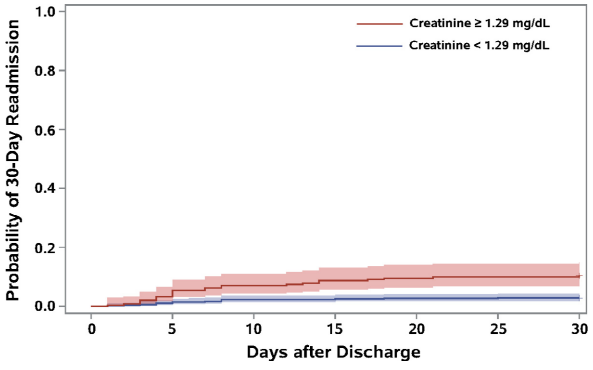

Fig. 5 *Thirty-Day Readmission after Hospital Discharge in Patients with Peak Serum Creatinine Levels of ≥1.29 mg/dL and <1.29 mg/dL from Index Hospitalization Related to COVID-19. The shaded areas represent 95% confidence intervals.* P < *0.001.*

COVID-19 patients may suffer and even die without seeking timely medical attention for potentially necessary inpatient level of care. Secondly, it is possible that the significant constraints of hospital resources may have limited readmissions only to critically ill patients, as indicated by a high mortality rate of 23% during the readmission, comparable to the index hospitalization mortality rate of 28%. Currently, there is no established guideline on decision-making for readmission when they return for morbidity after discharge. Further research is needed to establish a risk model for patients returning to a hospital to predict their risk of disease progression and readmit those with higher risks for deterioration.

Renal involvement is frequently observed in COVID-19 with ~37% of patients developing acute kidney injury (AKI) [18]. The pathophysiology of AKI in COVID-19 is thought to be multifactorial including direct infection of renal endothelium by SARS-CoV-2 causing endotheliitis, microthromboemboli due to hypercoagulability, SARS-CoV-2-related immune response dysregulation, and

kidney congestion from right ventricular failure due to COVID-19 pneumonia [2,19,20]. Notably, AKI in COVID-19 has been shown to be associated with increased mortality whilst the overall burden of AKI in COVID-19 might be underestimated as the baseline creatinine levels before admission might not be readily available [18,21,22]. Our study has extended prior literature by revealing that the peak creatinine level during index hospitalization with COVID-19 is independently associated with 30-day readmission. Whilst the reason for the association between increased creatinine level and readmission remains unclear, we speculate that the renal dysfunction might be a surrogate marker for more extensive disease and multiorgan involvement and thus portend prolonged recovery tied to the risk of subsequent readmission. Our findings suggest that patients with elevated peak creatinine levels observed during a COVID-19-related hospitalization are at risk for readmission and continued outpatient monitoring is needed. Whether an early follow-up with a phone call or in a post-COVID clinic helps avoid preventable early readmissions or provide a timely referral for inpatient care based on the individual course of recovery requires further investigation.

Limitations

There are several limitations in this study. First, the readmission rate may have been underestimated by not capturing readmissions to other institutions since the data were derived from a single centre. However, the 30-day readmission rates for myocardial infarction, heart failure and pneumonia at our institution parallel that of national measures. Nevertheless, New York City emerged as an epicentre amid the COVID-19 pandemic facing significant limitations of resources which could have affected readmission rates during the study period [23]. Therefore, the finding of our study may not be entirely generalizable to other states or countries. Secondly, there are unmeasured confounding factors in the assessment of an association between the creatinine level and readmission. The odds ratio for 30-day readmission was 2.41 for patients with peak serum creatinine level ≥1.29 mg/dL. The E-value for this point estimate was 4.25 and for the lower confidence interval limit was 1.76, which indicated that the observed odds ratio of 2.41 for readmission could only be explained by an unmeasured confounder that was associated with both SARS-CoV-2 infection and risk of 30-day readmission by a risk ratio of more than 4.25 above and beyond that of the confounders measured in this study (lower confidence bound 1.76). Since this risk ratio is much greater than any known measured confounding factors in the current study, such as age or congestive heart failure, it is unlikely that an unmeasured confounder would overcome the observed effect of elevated creatinine level on 30-day readmission. Nonetheless, the association between creatinine level and 30-day readmission observed in the current study should be interpreted as a hypothesis-generating finding rather than an indication for a causal association because this observational study was not specifically designed to elucidate such causality. Additional limitation of this study is missing data for some variables. However, we used validated methods to address the missing data to minimize bias. Lastly, the regression analysis needs a careful interpretation as our multivariable model is subject to overfitting and imprecise statistical associations, given a relatively small number of readmissions.

Conclusion

With a 4.5% of 30-day readmission rate, one in five readmitted COVID-19 survivors of index hospitalization died during their readmission. The majority of readmission occurred early after discharge and was caused by morbidities of COVID-19. Whether the seemingly low 30-day readmission rate of COVID-19 survivors indicates their uncomplicated recovery course, underutilization of medical services, or the consequences of a strained healthcare system remains an area of further research.

Conflicts of interest

All authors report no potential conflicts of interest to disclose.

Author contribution

Ilhwan Yeo: Conceptualization (lead); Data curation (lead); Formal analysis (lead); Investigation (lead); Methodology (lead); Project administration (lead); Resources (lead); Software (lead); Supervision (lead); Validation (lead); Writing-original draft (lead); Writing-review & editing (lead). **Seunghyup Baek:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Joon Kim:** Project administration (supporting); Supervision (equal); Writing-original draft (supporting); Writing-review

& editing (supporting). **Hadya Elshakh:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Angelina Voronina:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Man Si Lou:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Joshua Vapnik:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Ravinder Kaler:** Data curation (supporting); Project administration (supporting); Resources (supporting); Writing-review & editing (supporting). **Xuming Dai:** Project administration (supporting); Resources (supporting); Supervision (supporting); Writing-original draft (supporting); Writing-review & editing (supporting). **Seth Goldbarg:** Conceptualization (supporting); Investigation (supporting); Project administration (supporting); Supervision (supporting); Writing-original draft (supporting); Writing-review & editing (supporting).

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Fig S1 Calibration plot of predicted probability versus observed probability of 30-day readmission after COVID-19 hospitalization for the prediction model.

