Emergency department visits and readmissions after COVID-19 hospitalization: a cross-sectional analysis

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Dear Editor,

Beginning with its first documented case in January 2020, the COVID-19 pandemic has affected tens of millions of people across the world [1] and has necessitated changes in how health systems deliver care to patients. Understanding the anticipated clinical trajectory and healthcare utilization pattern for patients who have contracted this illness is necessary for preparation and coordination at the system level. In this report, we review patients with COVID-19 discharged from two hospitals in the Seattle area during its early initial outbreak and aim to (1) describe the time course of emergency department (ED) encounter and/or rehospitalization after discharge, (2) delineate reasons for the revisit, and (3) identify differences between patients with and without revisits at the individual and system level.

Washington State was the initial site of identified COVID-19 spread in the US [2] and a focal point for COVID-19 nationally during the early phase of the pandemic. King County, which includes the city of Seattle, experienced a COVID-19 outbreak in early-mid 2020 with peak daily new diagnoses on April 1, 2020 [3]. The study setting involves two hospitals, both of which are academic teaching centers and share an electronic medical record. One is a 570-bed quaternary hospital and the other a 413-bed county hospital/level 1 trauma center. The catchment area for both includes referrals from the surrounding five-state region. COVID-19 testing strategy at our institution was initially symptom-based but switched to universal testing for all admitted patients on April 13, 2020.

We reviewed consecutive discharges in which patients had a laboratory-confirmed SARS-CoV2 result and were discharged alive between February 28, 2020 and May 13, 2020. Patients under the age of 18 years old, pregnant patients, and those who died prior to discharge were excluded (Supplemental Fig. 1).

The primary outcome of interest (which we have termed a “revisit”) is an ED encounter or rehospitalization within 30 days after discharge. Encounters for planned procedures were not counted as revisits. Trained research assistants reviewed patient records to collect patient demographics, Charlson Comorbidity Index score, and hospitalization details. Presentation at both index hospitalization and revisit was coded as “directly related to COVID-19” if documented as such in the physician notes and/or if the patient presented with symptoms and timeframe consistent with CDC guidelines [4]. Reasons for presentation not directly related to COVID-19 were also recorded. A standardized REDCap survey tool [5] was used to collect the data. Approval was provided by the University of Washington Institutional Review Board.

Normally distributed variables are summarized as means with 95% confidence intervals (95% CI) and comparisons between groups were made using two-sided *t* tests. Non-normally distributed variables are summarized as medians with interquartile range (IQR) and comparisons between groups were made using Wilcoxon rank-sum test. Categorical variables are presented as counts with percentages and comparisons between groups were made using Fisher’s exact test. Statistical significance is defined as $p < 0.05$. Any missing data points are noted. Data were analyzed in Stata version 15.1 (College Station, TX).

Of 151 index COVID-19 discharges, 36 (24%) returned to the hospital during the study follow-up time period. The 7-day revisit rate was 11% (11 revisits to ED; 6 hospital readmissions), the 14-day revisit rate was 14% (14 revisits to ED; 7 hospital readmissions), and the 30-day revisit rate was 24% (20 revisits to ED; 16 hospital readmissions). In

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total, revisits occurred a median of 9 days (IQR 3.5–18.5) after discharge. These data are presented in Table 1.

Patients in this cohort averaged 59.6 years old and were predominantly male ($n=88$, 58%). The most commonly represented racial/ethnic groups included White/non-Hispanic ($n=62$, 41%), Hispanic/Latino ($n=37$, 25%), Asian ($n=22$, 15%), and Black/African American ($n=18$, 12%), and the most commonly spoken primary languages were English ($n=94$, 62%) and Spanish ($n=31$, 21%). The median Charlson Comorbidity Index score was 3 (IQR 1–5). A total of 60 (40%) patients were diagnosed with COVID-19 a median of 5 days (IQR 3–8) prior to index hospitalization. No statistically significant difference was noted by patient characteristics or COVID-19 diagnostic details when comparing revisit versus non-revisit groups. These data are presented in Table 2.

Fewer patients were admitted at their index hospitalization for reasons directly related to COVID-19 in the revisit group as compared to the non-revisit group (53 vs 83%, $p=0.001$). Patients in the revisit group had a shorter length of stay than the non-revisit group (median 4 days [IQR 2–10.5] vs 7 days [IQR 3–15], $p=0.047$). Discharge location also differed by revisit vs non-revisit group (independent living/stable housing: 61 vs 67%; independent living/unstable housing: 2 vs 9%; institutional setting: 14 vs 24%; $p=0.031$).

A total of 44 (29%) patients spent time in the intensive care unit at some point during hospitalization. Only 26 (17%) patients were cleared from COVID-19 and had infection precautions lifted prior to discharge. No statistically significant difference between revisit vs non-revisit groups was noted for these variables.

Of all revisits, half ($n=18$, 50%) were directly related to worsening COVID-19 symptoms. In both ED-only revisits and hospital readmissions, individuals presented for other medical issues not directly related to COVID-19 including fall/trauma, CVA/TIA, hematologic/oncologic issues, and

non-stroke neurologic issues. Additionally, patients revisited the ED for pain, psychiatric issues, and substance use-related (intoxication/withdrawal) issues and were readmitted to the hospital for acute renal failure. This information is presented in Table 3.

In conclusion, we found that nearly a quarter of patients with COVID-19 who discharged during the study time period had a revisit (either ED encounter or rehospitalization) within 30 days of discharge. These patients had a shorter index hospital length of stay and a higher proportion of discharge to unstable housing than patients without a revisit.

Our 30-day hospital readmission rate of 11% is higher than most reported comparisons both in the US (2.2% overall readmission rate in New York City [6], 6.8% 30-day hospital readmission in Rhode Island [7], 10.3% overall hospital readmission in Boston [8]) and globally (2.3% overall hospital readmission in Wuhan [9], 4.4% overall hospital readmission in Madrid [10], 4.5% overall hospital readmission in South Korea [11], 7.1% 30-day hospital readmission in Turkey [12]). This could reflect the fact that some studies defined readmissions more strictly as COVID-related presentation or that some were confounded by a large number of patients remaining hospitalized during the study time period. Geographic differences, system function/capacity, and post-hospitalization follow-up and monitoring variability may also contribute. While much of the literature focuses on hospital readmission specifically, we have demonstrated that ED encounters also frequently occur after discharge. Around half of revisits in our cohort occurred in the ED, which is consistent with previous reports [13].

Several key findings from our data warrant additional attention. First, we have corroborated the finding from previous studies [10, 13] that shorter COVID-19 index hospital length of stay is associated with revisits after discharge. While the mechanism for this is not yet clear, it is possible either that there are unforeseen late-developing COVID-19 clinical changes that need to be better characterized and/or that system-level factors such as increased bed demand place strain on discharge decisions. Second, we have identified that discharge location is related to revisit rate with discharge to unstable housing over-represented in the revisit group and discharge to stable housing or an institutional setting under-represented. This supports the call for equitable approaches to care including both structural and individual responses to housing needs [14]. Finally, we highlight that reasons for admission are heterogeneous, especially in patients with revisits. Only around half of index admissions and revisits were directly related to COVID-19 for this population, but whether these presentations are truly unrelated or represent potential longer term sequelae of infection is undetermined. As more information is learned about the COVID-19 infection, it is possible that some issues (neurologic, hematologic,

Table 1 Frequency and time course of revisits

	All revisits	By type of revisit	
		ED-only	Hospital readmission
Time course of revisit, n (%)			
7-day	17 (11%)	11 (7%)	6 (4%)
14-day	21 (14%)	14 (9%)	7 (5%)
30-day	36 (24%)	20 (13%)	16 (11%)
Median time to revisit, days (IQR)	9 (3.5–18.5)	7 (3.5–16)	15 (3–26)

Data presented as a percentage of all eligible discharges ($n=151$)

Table 2 Comparison of revisit vs no revisit groups by patient characteristics, COVID-19 diagnostic details, and index hospitalization outcomes

	Total N=151	Revisit N=36	No revisit N=115	P
Patient characteristics				
Age, mean (95% CI)	59.6 (56.8–62.4)	60.6 (54.6–66.5)	59.3 (56.1–62.5)	NS
Sex, n (%)				NS
Female	63 (42%)	12 (33%)	51 (44%)	
Male	88 (58%)	24 (67%)	64 (57%)	
Race/ethnicity, n (%), 1 value missing				NS
White, non-Hispanic	62 (41%)	12 (33%)	50 (44%)	
Hispanic/Latino	37 (25%)	9 (25%)	28 (25%)	
Asian	22 (15%)	5 (14%)	17 (15%)	
Black/African American	18 (12%)	8 (22%)	10 (9%)	
American Indian/Alaska Native	3 (2%)	2 (6%)	1 (1%)	
Native Hawaiian/Pacific Islander	3 (2%)	0 (0%)	3 (3%)	
Multiple races	5 (3%)	0 (0%)	5 (4%)	
Primary language, n (%)				NS
English	94 (62%)	20 (56%)	74 (64%)	
Spanish	31 (21%)	7 (19%)	24 (21%)	
Other	26 (17%)	9 (25%)	17 (15%)	
Charlson comorbidity index, median (IQR)	3 (1–5)	3 (1.5–6)	3 (1–5)	NS
COVID-19 diagnostic details				
Diagnosed prior to hospitalization, n (%)	60 (40%)	15 (42%)	45 (39%)	NS
Median time between diagnosis and hospitalization, days (IQR)	5 (3–8)	5 (1–7)	5 (3–8)	NS
Index hospitalization outcomes				
Reason for index hospitalization directly related to COVID-19, n (%)	114 (75%)	19 (53%)	95 (83%)	0.001
Length of stay, median (IQR)	6 (3–13)	4 (2–10.5)	7 (3–15)	0.047
Transfer to ICU, n (%)	44 (29%)	8 (22%)	36 (31%)	NS
Clearance from isolation precautions, n (%)	26 (17%)	6 (17%)	20 (17%)	NS
Discharge location, n (%)				
Independent living/stable housing	99 (66%)	22 (61%)	77 (67%)	0.031
Independent living/unstable housing*	19 (13%)	9 (25%)	10 (9%)	
Institutional setting**	33 (22%)	5 (14%)	28 (24%)	

*Independent living/unstable housing includes discharge to street, vehicle, medical respite center, homeless shelter, or transitional COVID-19 homeless shelter

**Institutional setting includes discharge to skilled nursing facility, adult family home, assisted living facility, inpatient rehabilitation, psychiatric facility, or jail/prison

NS Non-significant, $p \geq 0.05$

etc.) may be identified as complications of the infection itself though currently we are unable to characterize these findings as such.

Though this study includes a relatively small sample size, we used a time period that spans the majority of the local outbreak and thus avoided the challenge of omitting a large proportion of patients who remain hospitalized. Further, while the local health care system experienced some strain, crisis standards of care were not implemented. Thus, we believe our findings are relevant and generalizable to hospital systems that continue to face a significant but not overwhelming COVID-19 burden. We also included patients

from two hospitals that share a medical record. When comparing between hospitals, we did not identify a statistically significant difference in revisits, though there were some differences identified in demographics and outcomes that may reflect the different patient populations served (Supplemental Table 1). Additional exploration of hospital-based or geographic-based differences in revisits is an important area of future study.

In conclusion, our results indicate that patients commonly access the healthcare system after index COVID-19 discharge and do so with a variety of presenting complaints. In addition, our findings suggest that attention to social needs

Table 3 Reasons for revisit

	All revisits <i>N</i> = 36	ED-only <i>N</i> = 20	Hospital readmission <i>N</i> = 16
Symptoms directly related to COVID-19, <i>n</i> (%)	18 (50%)	8 (40%)	10 (63%)
Non-COVID-19 medical concern, <i>n</i> (%)	18 (50%)	12 (60%)	6 (38%)
Fall/trauma	5	4	1
CVA/TIA	2	1	1
Hematologic/oncologic issue	2	1	1
Neurologic issue, non-stroke	2	1	1
GI issue	2	2	0
Acute renal failure	2	0	2
Pain, cause unspecified	1	1	0
Psychiatric issue	1	1	0
Substance use-related (intoxication/withdrawal)	1	1	0

such as housing security may be impactful in preventing readmissions and that additional investigation to better understand the impact of index length of stay is warranted.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Human and animal rights No direct contact with human participants or animals was performed as part of this study.

Informed consent The study was approved by the University of Washington Institutional Review Board (#10471) and the requirement for informed consent or HIPAA authorization was waived.

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