ID# 1710

Factors Associated with Readmission Following COVID-19 Hospitalization

Elizabeth C. Verna, MD, MS[1], Charles Landis, MD, PhD[2], Robert S. Brown, Jr, MD[3], Andrea R. Mospan, PhD[4], Julie M. Crawford, MD[4], Janet S. Hildebrand, MPH[4], Heather L. Morris, PhD[4], Breda Munoz, PhD[4], Michael W. Fried, MD[4], K. Rajender Reddy, MD[5]

[1]Columbia University Irving Medical Center, [2]University of Washington Department of Medicine, [3]Weill Cornell Department of Medicine, [4]Target RWE Health Evidence Solutions, [5]University of Pennsylvania Department of Medicine

Target RWE Health Evidence Solutions

Background

- The risks of readmission after COVID-19 hospitalization are not well characterized.
- The aim of this study was to estimate the rate of readmission among COVID-19 inpatients and to identify risk factors for readmission that can be targeted for intervention. Mortality among readmitted patients was also assessed.

Methods

- The study population included 29,659 adult patients in the US hospitalized with COVID-19 who were admitted, discharged alive, and followed for readmission, between February 15 and June 6, 2020.
- Deidentified hospital chargemaster data were obtained from 297 hospitals in 40 states.
- Patient demographic factors, comorbidities, acute conditions present on first admission, and clinical characteristics were examined by readmission status.
- Standard statistical tests (chi-square, Kruskal Wallis) were used to evaluate associations between risk factors and readmission status.
- Multivariable logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) of readmission among the total population and death among the readmitted population.

Table 1. Characteristics of Hospitalized COVID-19 Patients by Readmission Type

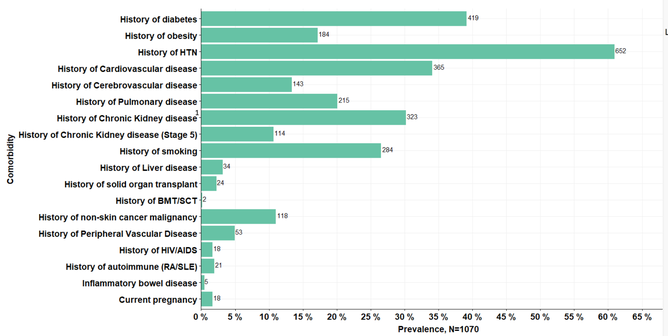
Characteristics	Readmitted to a Hospital: Yes (N=1070)	Readmitted to a Hospital: No (N=28589)	Total (N=29659)	P-Value[1]
Demographics				
Age group, n (%)				
18-40	85 (7.9)	3940 (13.8)	4025 (13.6)	<.0001
41-60	239 (22.3)	9287 (32.5)	9526 (32.1)	
>60	746 (69.7)	15362 (53.7)	16108 (54.3)	
Sex, n (%)				
Female	508 (47.5)	14186 (49.6)	14694 (49.5)	0.1685
Male	562 (52.5)	14403 (50.4)	14965 (50.5)	
Insurance[2], n (%)				
Commercial	149 (13.9)	6385 (22.3)	6534 (22.0)	<.0001
Medicaid	171 (16.0)	3632 (12.7)	3803 (12.8)	
Medicare	551 (51.5)	9418 (32.9)	9969 (33.6)	
Other	199 (18.6)	9154 (32.0)	9353 (31.5)	
Hospital Type, n (%)				
Major Teaching	509 (47.6)	11221 (39.2)	11730 (39.5)	<.0001
Minor Teaching	204 (19.1)	6078 (21.3)	6282 (21.2)	
Non-Teaching	357 (33.4)	11290 (39.5)	11647 (39.3)	
Census Region, n (%)				
Midwest	65 (6.1)	1587 (5.6)	1652 (5.6)	<.0001
Northeast	632 (59.1)	13594 (47.5)	14226 (48.0)	
South	277 (25.9)	9564 (33.5)	9841 (33.2)	
West	96 (9.0)	3844 (13.4)	3940 (13.3)	

[1]Chi-square test p-values reported
[2]Other includes other insurance and unknown

Results

- Of 29,659 hospitalized patients discharged alive, 1,070 (3.6%) were readmitted. 70% of readmitted patients were > 60 years vs. 54% of non-readmitted patients (p<.001). (Table 1)
- Readmitted patients were more likely to have chronic conditions including diabetes, hypertension, cardiovascular disease, and chronic kidney disease (CKD), than those not readmitted (p<.001). (Figure 1)
- Readmitted patients were also more likely to present on first admission with acute kidney injury (AKI), congestive heart failure, and cardiomyopathy (p<.001).
- Higher odds of readmission were observed in patients age >60 compared to 18-40, and those in the Northeast region compared to West or South. (Figure 2)
- Patients with comorbidities had higher odds of being readmitted; the strongest associations were observed for diabetes, cardiovascular disease, CKD stage 1-4 and stage 5.
- Length of initial hospital stay, chronic respiratory disease, and hypertension were associated with lower odds of readmission.
- High flow and mechanical ventilation, sepsis and AKI, were associated with higher odds of death among those readmitted. (Figure 3)
- 12.3% of readmitted patients died during the second hospitalization.

Figure 1. Characteristics of Hospitalized COVID-19 Patients by Readmission Type



Hypertension (HTN), bone marrow transplant/ stem cell transplant (BMT/SCT), human immunodeficiency virus/ acquired immunodeficiency syndrome (HIV/AIDS), rheumatoid arthritis/ systemic lupus erythematosus (RA/SLE)

[1]Includes chronic kidney disease stages 1 to 5

Table 2. Characteristics of the First Hospitalization for Patients with COVID-19 by Readmission Type

Characteristics	Readmitted to a Hospital: Yes (N=1070)	Readmitted to a Hospital: No (N=28589)	Total (N=29659)	P-Value[1]
Discharge disposition, n (%)				
AMA	19 (1.8)	291 (1.0)	310 (1.0)	<.0001
Home	672 (62.8)	20111 (70.3)	20783 (70.1)	
Hospital	50 (4.7)	1465 (5.1)	1515 (5.1)	
Long-term or skilled care facility	329 (30.7)	6722 (23.5)	7051 (23.8)	
Total duration of hospital stay (days)				
Median (n)	7.0 (1070)	8.0 (28589)	8.0 (29659)	<.0001
Min - Max	2.0 - 54.0	2.0 - 107.0	2.0 - 107.0	
ICU level of care, n (%)	84 (7.9)	3497 (12.2)	3581 (12.1)	<.0001
Duration on ICU (days)				
Median (n)	4.0 (84)	6.0 (3497)	6.0 (3581)	<.0001
Min - Max	1.0 - 35.0	1.0 - 69.0	1.0 - 69.0	

[1]Chi-square test and Kruskal-Wallis test p-values reported for categorical and continuous variables, respectively

Figure 2. Odds of Readmission for Patients Hospitalized with COVID-19

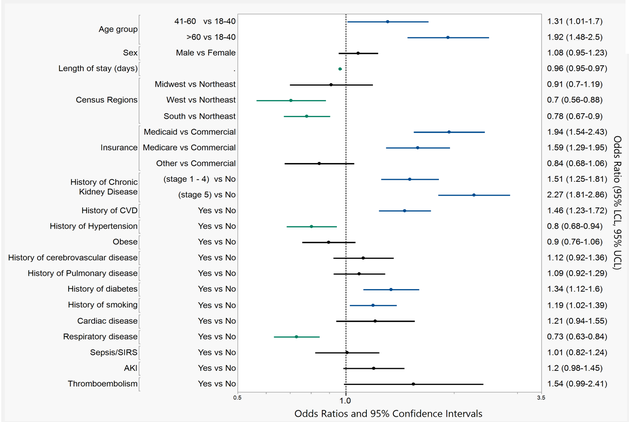


Figure 3. Odds of Death After Second Readmission Among Patients Hospitalized with COVID 19

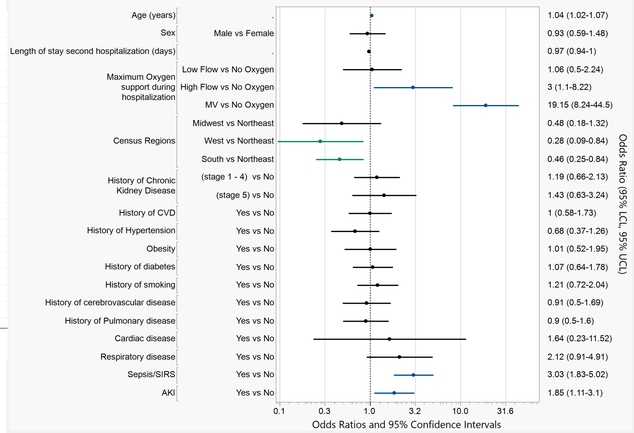
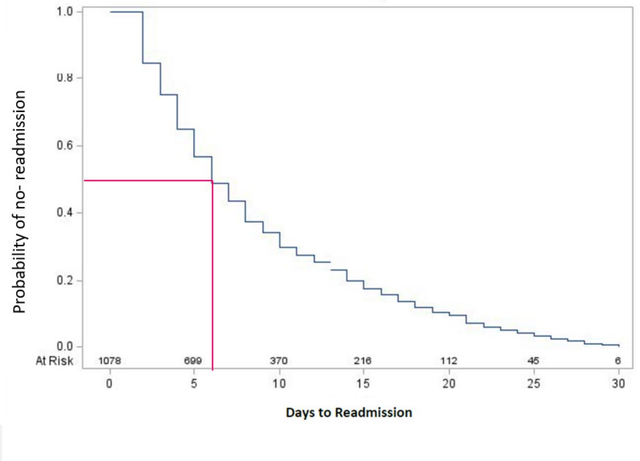


Figure 4. Time to Readmission



Conclusions

- **Among this large US population of COVID-19 inpatients discharged alive, 3.6 % required readmission.**
- **Readmission rate was higher in those with chronic diseases and those experiencing AKI or cardiac complications during first hospitalization.**
- **Patients with AKI, sepsis, and those requiring mechanical ventilation had higher mortality during the readmission.**
- **These findings should inform strategies to mitigate risks of readmission due to complications from COVID-19.**

Acknowledgements and Disclosures: This work was supported by Target RWE. Target RWE is responsible for the design and conduct of the study; collection, management, analysis and interpretation of the data; preparation, review and approval of the publication. The data were derived from a commercial insurance claims database that requires a data sharing agreement and data license for access.