Factors Associated with Readmission Following COVID-19 Hospitalization

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Background Epidemiologic and clinical studies report that >80% of patients hospitalized with COVID-19 are discharged alive, and recent data suggest that survival is increasing. However, patients may experience relapse or complications after the initial hospitalization and require readmission. 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 comprised 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 15, 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.

Results Of 29,659 hospitalized patients discharged alive, 1,070 (3.6%) were readmitted. Seventy percent of readmitted patients were older than age 60 compared to 54% of non-readmitted patients (p<.001). 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). Readmitted patients were also more likely to present on first admission with acute kidney injury (AKI, 15.6% vs. 9.2%), congestive heart failure (6.4% vs. 2.4%), and cardiomyopathy (2.1% vs. 0.8%) (p<.001). In multivariable models, higher odds of readmission were observed in patients age >60 compared to 18-40 (OR=1.92, 95% CI=1.48, 2.5), and in the Northeast region compared to West (OR=1.43, 95% CI=1.14, 1.79) or South (OR=1.28, 95% CI=1.11, 1.49). Patients with comorbidities had higher odds of being readmitted; the strongest associations were observed for diabetes (OR=1.34, 95% CI=1.12, 1.6), cardiovascular disease (OR=1.46, 95% CI=1.23, 1.72), CKD stage 1-4 (OR=1.51, 95% CI=1.25, 1.81) and stage 5 (OR=2.27, 95% CI=1.81, 2.86). Chronic respiratory disease (OR=0.73, 95% CI=0.63, 0.84) and hypertension (OR=0.80, 95% CI=0.68, 0.94) were associated with lower odds of readmission. Length of initial hospital stay was associated with a modest reduction in readmission odds (OR=0.96, 95% CI=0.95, 0.97, per each day). 12.3% of readmitted patients died. Sepsis was associated with 3-fold higher odds of dying (OR=3.03, 95% CI=1.83, 5.02), and AKI with 85% higher odds (OR=1.85, 95% CI=1.11-3.1). Mechanical ventilation during second hospitalization was associated with mortality (OR=19.15, 95% CI=8.24, 44.5).

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.