Characteristics of patients in inpatient psychiatry during the COVID-19 pandemic

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ARTICLE INFO	ABSTRACT
	To date, there have been limited publications examining the characteristics of psychiatric patients with COVID-19 in an inpatient setting. In this retrospective cohort review, we attempted to categorize the differences between patients admitted to the COVID unit versus the non-COVID unit using data from a community hospital located on Long Island, NY. We found that patients admitted to the COVID-19 unit had on average longer lengths of stay, were more likely to belong to non-white racial groups, and were less likely to be smokers.

1. Introduction

Severe Acute Respiratory Distress Syndrome 2 (SARS-CoV-2), a virus discovered in December 2019 in Wuhan, China, causes an extremely contagious infection, coronavirus disease 2019 (COVID-19). SARS-CoV-2 has had a differential impact depending on the patient population, with most individuals suffering a mild to moderate illness and recovering without complications and those with underlying medical conditions at an increased risk for severe illness [CDC, 2020]. The median incubation period is estimated to be 5.1 days, with the majority of those developing symptoms doing so within 11.5 days [Lauer et al., 2020]. At the time of writing, there have been more than 200 million cases worldwide, with the United States holding the largest proportion of cases with over 50 million infections [Ritchie et al., 2020]. During the Spring of 2020, New York State served to be an early epicenter of the COVID-19 pandemic within the United States. From March to May of 2020, the fatality rate was 9.2% overall and 32.1% among hospitalized patients [Thompson et al., 2020]. Following a growing body of epidemiological data demonstrating inequities in healthcare for minority groups, communities of color and high poverty areas had the highest rates of infection and hospitalization. Strikingly, COVID-19 is twice as fatal in Hispanic/Latino and Black/African American groups [New York City, 2020; Lopez et al., 2021]. The psychiatric care of individuals with COVID-19 poses additional challenges as the treatment traditionally involves close contact, frequent in-person safety monitoring, group therapy sessions, and sharing space for meals [E Bojdani et al., 2020]. Lastly, specialized psychiatric COVID-19 units require additional measures, including droplet precautions, quarantine, areas for donning and doffing of PPE (Personal Protective Equipment), as well as wearing N95 masks [CDC, 2020].

Clinically, we found that patients who tested positive for SARS-CoV-2 and were subsequently admitted to the inpatient psychiatric COVID-19 unit had more acute symptoms, fewer past psychiatric hospitalizations, required more medical management, and stayed longer in the hospital. Despite this, there is little available in terms of literature to help physicians to understand this association. Thus, using data from an inpatient psychiatric facility in Long Island, New York, we sought to answer two key questions. First, we wanted to answer: during the initial stages of the pandemic, what were the unique characteristics of inpatient psychiatric patients admitted to the COVID-19 unit? Next, we worked to determine: what factors underlie these findings? Through shedding light on these questions, we hope to aid future healthcare workers in understanding the specific needs of patients with COVID-19 and severe psychiatric illness in an inpatient psychiatric hospitalization.

2. Methods

This study was approved by the health system IRB. Patient data was retrieved by hospital MIS with the inclusion criteria consisting of age

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greater than or equal to 18 years old and being admitted to the inpatient psychiatric unit between March and December of 2020. Medical records were otherwise chosen randomly. Features collected included demographic information (age, gender, race), insurance status, admission date, discharge date, primary diagnosis, estimated past psychiatric hospitalizations, smoking status, BMI, vital signs (day 1 and day 2 of hospitalization), maximum temperature during hospitalization, maximum respiratory rate during the hospitalization, COVID-19 diagnosis, hypertension diagnosis, diabetes diagnosis, HIV diagnosis, sleep apnea diagnosis, number of admission medications, number of discharge medications, as-needed (PRN, Pro Re Nata) medications count, and PRN psychiatric medications count.

COVID-19 diagnosis was defined as the individual testing positive for SARS-CoV-2 on PCR. PRN medications were defined as all as-needed medications, one-time orders, or STAT orders, excluding nicotine replacement therapy. PRN psychiatric medications were defined as medicine used for the treatment of agitation, insomnia, anxiety, psychosis, or aggression. These medications included benzodiazepine, antipsychotic, and antihistamine medicines. Past psychiatric hospitalizations

were estimated based on documented prior hospitalizations on electronic medical record. Records indicating "multiple hospitalizations" without specifying a number were given a value of 2. Furthermore, schizophrenia spectrum disorders, including brief psychotic disorder, schizophreniform, and schizophrenia were combined into one primary diagnosis category.

A total of 200 medical records were collected. 21 medical records were removed from the study as they did not meet the inclusion criteria. This included patients that were admitted from the adolescent partial day program, detoxification program, and substance rehabilitation program. Patient data was stored on a HIPPA-compliant Redcap [Harris et al., 2009] server with all identifying information marked. Data was then manually verified by the investigators for accuracy. De-identified data were exported from Redcap for data analysis and visualization using Python (version 3.9.0) [Rossum et al., 2009] aided by Tableau (version 2021.2.4) [Tableau.com, 2021]and tableone package [Pollard et al., 2018]. The correlation was calculated using Point Biserial and Pearson's correlation coefficient.

Table 1
Demographic and clinical characteristics of COVID positive patients and COVID negative patients in inpatient Psychiatry.

		Overall	Negative	Positive	P-Value
n		179	79	100	
Age, mean (SD)		41.5 (15.1)	40.2 (13.2)	42.6 (16.5)	0.282
Length of stay, mean (SD)		20.3 (23.3)	14.9 (14.1)	24.5 (27.9)	0.003
BMI, mean (SD)		29.5 (8.6)	29.8 (7.8)	29.3 (9.2)	0.670
Admission medications, mean (SD)		4.7 (4.0)	4.6 (4.0)	4.8 (4.0)	0.833
Discharge medications, mean (SD)		6.2 (3.7)	6.6 (3.9)	5.9 (3.5)	0.177
PRN medications, mean (SD)		29.8 (43.1)	28.9 (44.8)	30.4 (41.9)	0.813
PRN Psychiatric medications, mean (SD)		16.3 (23.1)	15.4 (23.2)	17.1 (23.2)	0.634
Gender, n (%)	Female	76 (42.5)	30 (38.0)	46 (46.0)	0.354
	Male	103 (57.5)	49 (62.0)	54 (54.0)	
Race, n (%)	Asian	12 (6.7)	3 (3.8)	9 (9.0)	<0.001
	Black or African American	38 (21.2)	12 (15.2)	26 (26.0)	
	Hispanic	22 (12.3)	2 (2.5)	20 (20.0)	
	Other	1 (0.6)	1 (1.3)		
	White	106 (59.2)	61 (77.2)	45 (45.0)	
Insurance, n (%)	Commercial	40 (22.3)	18 (22.8)	22 (22.0)	0.195
	Medicaid	94 (52.5)	47 (59.5)	47 (47.0)	
	Medicare	40 (22.3)	13 (16.5)	27 (27.0)	
	Self Pay	5 (2.8)	1 (1.3)	4 (4.0)	
Primary diagnosis, n (%)	Bipolar disorder	59 (33.0)	37 (46.8)	22 (22.0)	0.008
	Major depressive disorder	49 (27.4)	19 (24.1)	30 (30.0)	
	Pervasive developmental disorder	1 (0.6)		1 (1.0)	
	Psychotic disorder unspecified	8 (4.5)	1 (1.3)	7 (7.0)	
	Schizoaffective disorder	43 (24.0)	17 (21.5)	26 (26.0)	
	Schizophrenia	19 (10.6)	5 (6.3)	14 (14.0)	
Estimated past hospitalizations, mean (SD)		3.8 (8.4)	4.7 (11.4)	3.0 (4.8)	0.220
Smoking Staus, n (%)	No	93 (52.0)	31 (39.2)	62 (62.0)	0.004
	Yes	86 (48.0)	48 (60.8)	38 (38.0)	
Hypertension, n (%)	No	129 (72.1)	51 (64.6)	78 (78.0)	0.068
	Yes	50 (27.9)	28 (35.4)	22 (22.0)	
Diabetes, n (%)	No	156 (87.2)	71 (89.9)	85 (85.0)	0.458
	Yes	23 (12.8)	8 (10.1)	15 (15.0)	
HIV, n (%)	No	177 (98.9)	79 (100.0)	98 (98.0)	0.504
	Yes	2 (1.1)		2 (2.0)	
Sleep apnea, n (%)	No	171 (95.5)	74 (93.7)	97 (97.0)	0.304
	Yes	8 (4.5)	5 (6.3)	3 (3.0)	
Temperature on day 1 (F), mean (SD)		97.9 (0.7)	97.8 (0.7)	97.9 (0.8)	0.284
Pulse on day 1 (BPM), mean (SD)		82.9 (14.0)	80.2 (13.7)	85.1 (13.8)	0.019
SBP on day 1 (mmHg), mean (SD)		123.5 (15.8)	124.2 (15.2)	123.0 (16.3)	0.601
DBP on day 1 (mmhg), mean (SD)		77.6 (11.0)	77.3 (11.1)	77.8 (11.0)	0.741
Respiratory rate on day 1 (BPM), mean (SD)		17.4 (1.1)	17.5 (1.1)	17.2 (1.1)	0.063
O2 Saturation on day 1 (%), mean (SD)		98.2 (1.5)	98.0 (1.4)	98.4 (1.6)	0.076
Temperature on day 2 (F), mean (SD)		97.7 (0.8)	97.7 (0.6)	97.7 (0.9)	0.720
Pulse on day 2 (BPM), mean (SD)		85.8 (15.5)	84.9 (16.8)	86.6 (14.5)	0.478
SBP on day 2 (mmHg), mean (SD)		123.4 (16.2)	126.1 (16.1)	121.2 (16.0)	0.048
DBP on day 2 (mmhg), mean (SD)		76.7 (11.2)	78.3 (11.5)	75.5 (10.8)	0.105
Respiratory rate on day 2 (BPM), mean (SD)		17.5 (1.2)	17.7 (0.9)	17.4 (1.3)	0.094
O2 Saturation day 2 (%), mean (SD)		98.0 (1.7)	97.9 (1.6)	98.1 (1.8)	0.404
Maximum temperature (F), mean (SD)		99.1 (0.6)	99.0 (0.5)	99.2 (0.6)	0.080
Maximum respiratory rate (BPM), mean (SD)		23.1 (19.4)	22.4 (20.1)	23.7 (18.9)	0.649

3. Results

In total, 179 individuals were included in this study (Table 1). The COVID cohort consisted of 100 (55.8%) individuals, while the control cohort included 79 (44.1%) individuals.

3.1. Demographic data

The COVID cohort was 46.0% female, 54.0% male, 45.0% White, 26.0% Black or African American, 2.0% Hispanic, and 9.0% Asian, with a mean age of 42.6 (SD = 16.5). The control cohort was 38.0% female, 62.0% male, 77.2% White, 15.2% Black or African American, 2.5% Hispanic, and 6.7% Asian, with a mean age of 40.2 (SD = 13.2). Fig. 1 compares patients based on COVID-19 status and race. The majority (52.5%) of individuals in both cohorts were on Medicaid. For the COVID cohort, 47.0% had Medicaid, 27.0% had Medicare, 22.0% had commercial insurance, and 4.0% were self-pay. In comparison, for the control cohort, 59.5% had Medicaid, 16.5% had Medicare, 22.8% had commercial insurance, and 1.3% were self-pay.

3.2. Clinical features

The overall mean length of stay for both cohorts was 20.3 days (SD = 23.3). The mean length of stay for the COVID cohort was 24.5 days (SD = 27.9) and for the control cohort was 14.9 days (SD = 14.1) (Fig. 2). The COVID cohort had more individuals with major depressive disorder (30%), schizophrenia (14%), and schizoaffective disorder (26%), while the control cohort had more individuals with bipolar disorder (46.8%) (Fig. 3). The mean estimated past psychiatric hospitalizations was 3.0 (SD = 4.8) for the COVID cohort and 4.7 (SD = 11.4) for the control cohort. There were 21 patients in the COVID cohort with no prior psychiatric hospitalizations compared to 10 patients in the control cohort. Among first time hospitalization patients in the COVID cohort, 14 patients had the diagnosis of major depressive disorder, 3 patients had psychotic disorder unspecified, 3 had bipolar disorder, and 1 had schizoaffective disorder (Fig. 4).

The COVID cohort had a mean BMI of 29.3 (SD = 9.2) and the control cohort had a BMI of 29.8 (SD = 7.8). There were more smokers in the control cohort (60.8%) than in the COVID cohort (38%). Fewer
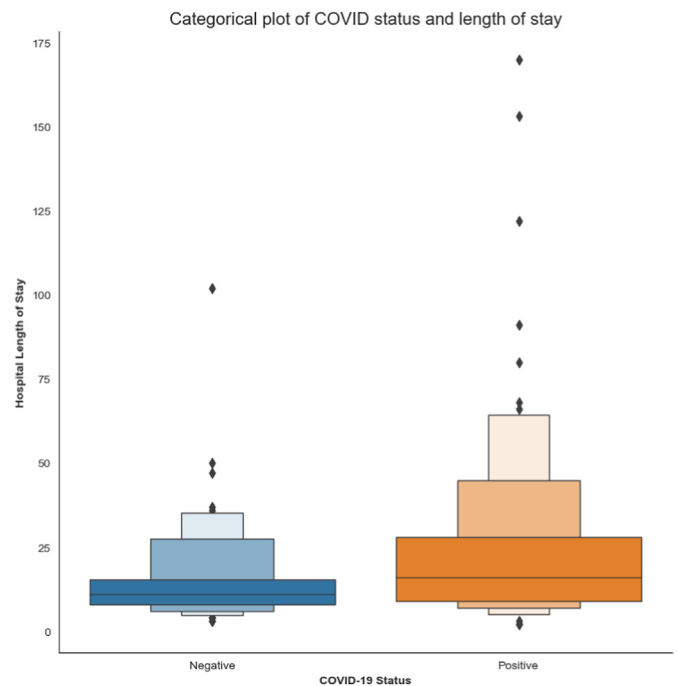

Fig. 2. Categorical plot of COVID status and length of stay.

individuals had a diagnosis of hypertension in the COVID group (22.0%) than the control group (35.4%). The prevalence of diabetes in the COVID and control cohorts was 15% and 10.1%, respectively. Moreover, there were 2% of individuals in the COVID group with HIV and none in the control group. Only 3% of the individuals in the COVID cohort had sleep apnea, whereas 6.3% of individuals in the control cohort had sleep apnea.

The control cohort had a mean PRN count of 28.9 (SD = 44.8) and the COVID cohort had a count of 30.4 (SD = 41.9). The psychiatric PRN count was comparable for both cohorts at 15.4 (SD = 23.2) and 17.1 (SD = 23.2), respectively. There was no significant difference in the number
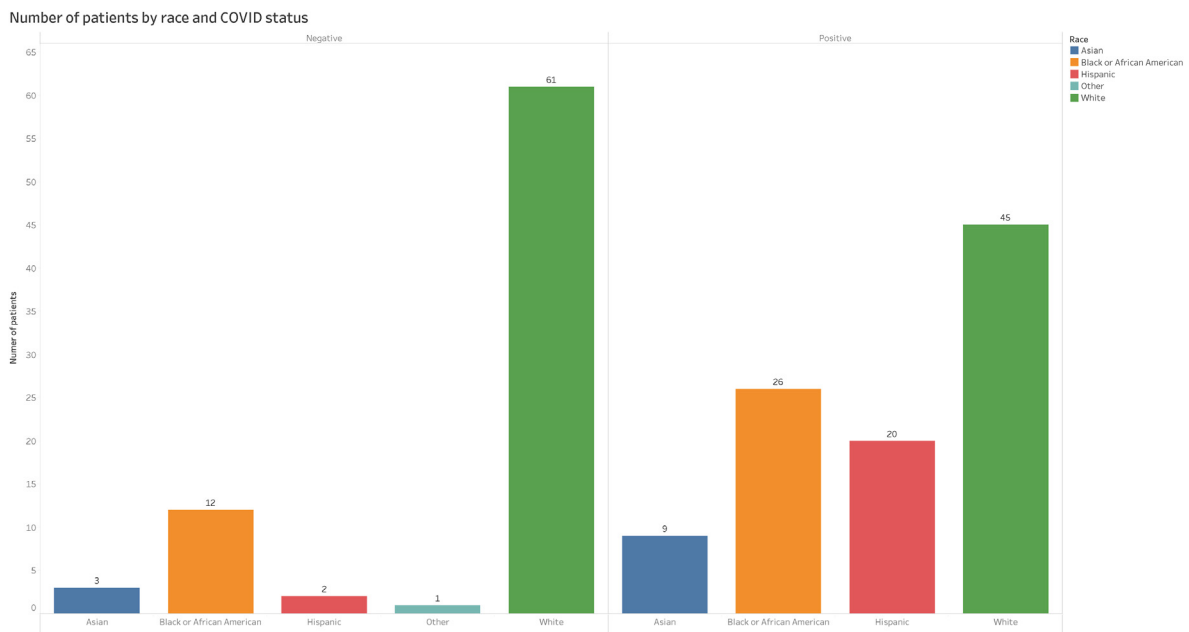

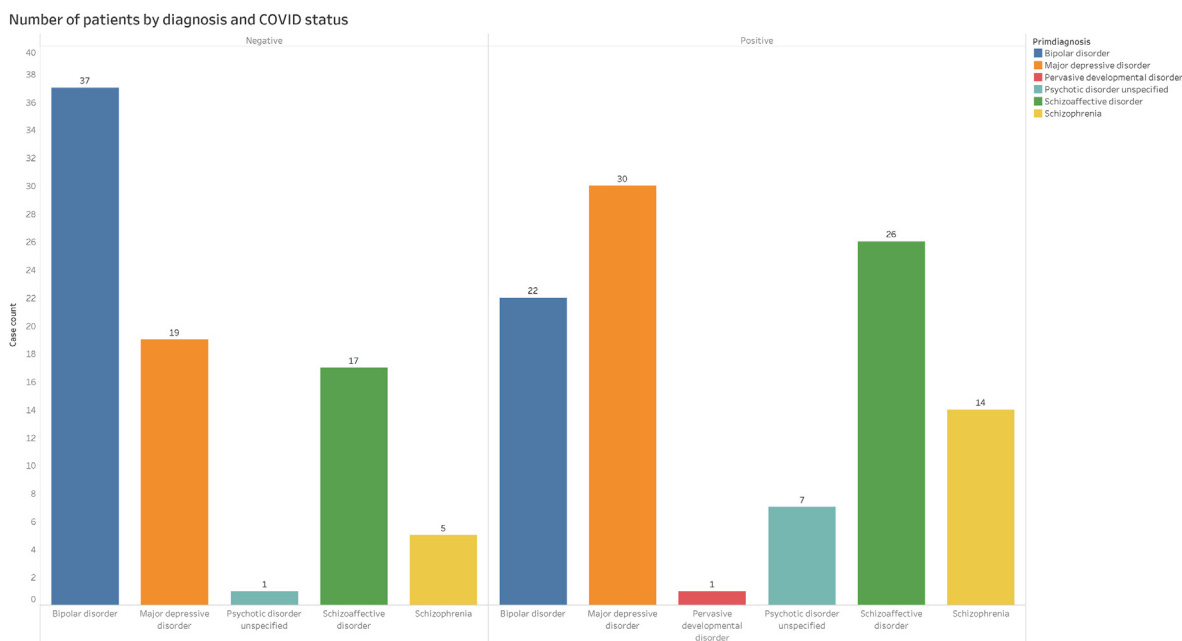**Fig. 1.** Number of patients by race and COVID status.

Number of patients by diagnosis and COVID status

Fig. 3. Number of patients by diagnosis and COVID status.

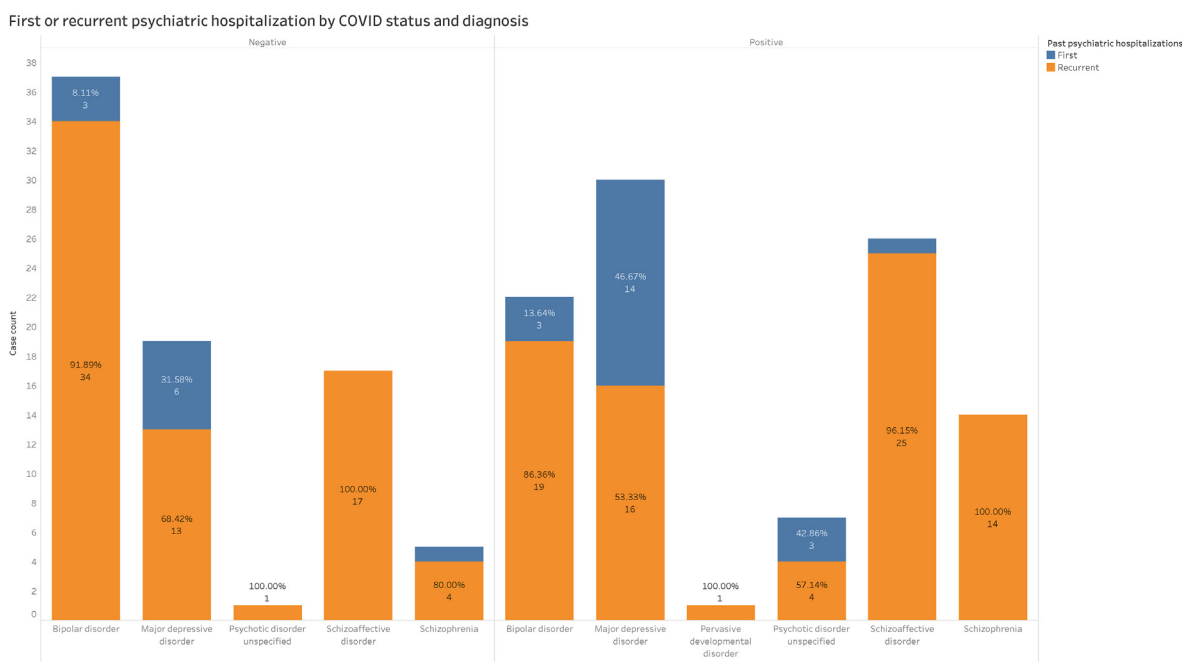First or recurrent psychiatric hospitalization by COVID status and diagnosis

Fig. 4. First or recurrent psychiatric hospitalization by COVID status and diagnosis.

of admission medications (4.6 vs 4.8) and discharge medications (6.6 vs 5.9) between both cohorts. There was also no significant difference in vital signs on the first 2 days of admission, maximum temperature, and maximum respiratory rate in both cohorts.

3.3. Analysis

Using Point Biserial correlation to compare dichotomous data to continuous data, there was a mild but statistically significant correlation of 0.21 (p = 0.0057) between COVID status and length of stay. When comparing COVID status and smoking, there was an inverse, weak, correlation of −0.22 (p = 0.0023). The Pearson Correlation coefficient measures the relationship between two datasets. The length of stay and

the number of PRN medications had a Pearson Correlation coefficient of 0.40 (p < 0.001), indicating a moderate but statistically significant correlation. However, there was no significant difference in the number of PRN medications between both cohorts.

4. Discussion

In this retrospective cohort study of 179 patients, we sought to compare the characteristics of inpatient psychiatric patients depending on their COVID-19 status, with information on patients being collected between March and December of 2020. In terms of demographic data, we found significant differences in terms of race, primary psychiatric diagnosis, and smoking status between the COVID and non-COVID cohorts.

Unsurprisingly, we found that the COVID cohort contained a higher proportion of individuals of the non-white race (Asian, Black/African American, Hispanic, p < 0.001). We also found that a significantly lower proportion of those in the COVID cohort were smokers (p = 0.004). Lastly, and arguably the result with the greatest clinical implication, was that we found a significant difference in the length of stay between the COVID and non-COVID cohorts (p = 0.003). We found no significant difference in terms of PRN medication administration between the two cohorts.

Before investigating the underpinnings of these results, it is important to acknowledge the limitations of our study. First, we excluded 21 records from our analysis due to not meeting the inclusion criteria. Next, several patients were transferred from other hospitals in the health system. This resulted in an underestimation of the length of stay for these patients, as many had already received a degree of psychiatric care before admission. Additionally, those with severe symptoms were transferred to the medical unit and not included in the study. This could have skewed data on the COVID cohort in terms of PRN medication administration, length of stay, and symptom severity. Finally, younger patients were excluded from our study, limiting the external validity of our results.

Beginning with the data that is most consistent with existing literature on COVID and social determinants of health, it was not particularly surprising that the COVID cohort contained more individuals of minority background. Those of Black and Hispanic backgrounds within the US are more likely to reside in crowded living quarters, belong to multi-generational households, and occupy jobs that cannot be performed remotely (transit workers, grocery store clerks, nursing aids). It follows that these individuals are at an increased risk of acquiring infection with COVID-19. The implication of these results is particularly important, as these minority groups are also more likely to have hypertension, diabetes, and obesity, comorbidities associated with increased hospitalization, and worse outcomes [Lopez, 2021]. Moreover, while smoking is an established risk factor for Middle Eastern Respiratory Syndrome (MERS), at present, data on the incidence of COVID-19 in smokers has been inconclusive and contradictory [Westen-Lagerweij, 2021; Shastri, 2021]. That we found that our COVID cohort had a lower rate of smoking may be a logical extension of existing data on smoking rates, as our COVID cohort contained a larger proportion of Black and Hispanic individuals, and members of these racial groups have been found to have lower rates of smoking than Whites within the US [Cornelius et al., 2020; Williams et al., 2016]. The implication of this is again clinical, as an increasing amount of evidence supports that smokers infected with COVID-19 are at an increased risk of developing more severe symptoms.

The length of stay was significantly longer for those with COVID. Despite this, the PRN administration for those with COVID was not significantly different from those without COVID. Thus, the underlying justification for these findings must relate not to the illness itself, but the collateral consequences of COVID-19 on patients during the initial stages of the pandemic. Given the severity of mental illness faced by inpatient psychiatric patients, it is not uncommon for patients to require additional accommodations before discharge that are unique to the psychiatric setting. Beyond the normal practice of securing an outpatient provider before discharge can be achieved, patients can require services like housing accommodations, assisted outpatient treatment (AOT), personalized recovery-oriented services (PROS), Assertive Community Treatments (ACT), and partial hospitalization programs (PHPs). Despite attempts to waive telehealth regulations during the pandemic to make care more accessible, outpatient programs were forced to adjust their enrollment criteria and conduct more robust screening initiatives [E. Bojdani et al., 2020]. Housing opportunities, like congregate-care facilities, were more reluctant to accept patients, resulting in hospital discharge that was found to be delayed anywhere from 7 to 47 days [Millard et al., 2020]. The result was patients remaining in the inpatient setting for a longer duration, resulting not only in increased costs but also reduced capacity to admit new patients at a time when the incidence of psychiatric illness was on the rise [Xiong et al., 2020].

Lastly, we attempted to analyze the relationship between psychiatric illness and COVID-19 infection. Compared to the control cohort, the COVID-19 cohort had more than twice the number of patients with a first-time psychiatric hospitalization, and patients in the COVID-19 cohort had on average fewer past psychiatric hospitalizations. However, our study lacked data on the precise timeline between COVID-19 infection and the onset of psychiatric symptoms. This timeline is particularly important, as evidence stretching back to influenza outbreaks of the 18th and 19th centuries has demonstrated the increased incidence of psychiatric disease following viral infection [Emily et al., 2020]. Only now are we gaining insight into this association, with the pathophysiologic commonality of aberrant inflammation being posited as the mechanism underlying the increased incidence of psychiatric symptoms in those with and recovering from COVID-19 [Bauer et al., 2019; Bryce et al., 2021; Emily et al., 2020; Jansen et al., 2021; Kazi et al., 2021; Khademi et al., 2021; Mazza et al., 2020; Senra H, 2021]. COVID-19 has been shown to precipitate neuroinflammation via the release of proinflammatory cytokines both acutely and after the initial infection, with these proinflammatory cytokines having the potential to reduce monoamine levels, blunt neuroplasticity, and promote excitotoxicity [Bauer et al., 2019; Emily et al., 2020]. Thus, additional research is needed to map out the specific timeline between COVID-19 infection and the development of psychiatric symptoms, in the hope of characterizing COVID-19's role in exacerbating psychiatric illness.

5. Conclusion

In this study, we attempted to map out the characteristics of inpatient psychiatric patients depending on COVID-19 status. We found that, of patients surveyed from March to December of 2020, patients admitted to the COVID-19 unit had on average a longer length of stay, were more likely to belong to minority racial groups, and were less likely to be smokers. Although a largely novel investigation, this data aligned with the existing literature on COVID positive patients within inpatient psychiatric settings. The increased length of stay in COVID-positive patients was likely an extension of difficulty securing housing and outpatient care, as corroborated by Millard et al. [Millard et al., 2020]. Lastly, we found that members of the COVID-19 cohort had fewer past psychiatric hospitalizations and were more often admitted as part of a first-time psychiatric hospitalization. As both mental illness and COVID-19 become increasingly ubiquitous, future work is needed to understand not only the direct contribution of COVID-19 to psychiatric illness, but also the long-term impact of the collateral consequences (i.e. increased length of stay) of COVID-19 on the psychiatric well-being of patients after discharge [Nochaiwong et al., 2021].

Author statement

Chenen Hsieh: Conceptualization, Investigation, Writing - Original Draft, Writing - Review & Editing, Visualization, Formal analysis. **Austin Fischer**: Investigation, Writing - Original Draft, Writing - Review & Editing. **Jessica Castillo**: Conceptualization, Investigation, Writing - Original Draft. **Giulia Sorrentino**: Writing - Review & Editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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