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Universal COVID-19 testing and a three-space triage protocol is associated with a nine-fold decrease in possible nosocomial infections in an inpatient psychiatric facility

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ABSTRACT

In May of 2020, the Substance Abuse and Mental Health Service Administration (SAMSA) issued guidelines for state psychiatric hospitals, recommending that these facilities adopt universal testing for COVID-19 and "three-space" triage protocols for dedicated COVID-19 positive, negative, and quarantine spaces to mitigate the risk of nosocomial infection. The Westchester Behavioral Health Center of New York Presbyterian Hospital (WBHC-NYP) adopted a comprehensive infection control protocol consistent with these recommendations in April, 2020.

We reviewed the records of 1,139 patients treated on the inpatient service at WBHC-NYP between March 14th and June 10th, 2020, dates corresponding to the first COVID-19 surge in the New York City metropolitan region. The incidence of detected nosocomial or possible nosocomial infections before and during the implementation of the protocol was 0.096 (16/167), or 0.96 infections per 10 at-risk patients. The incidence of nosocomial or possible nosocomial infections after complete implementation was 0.0110 (2/182), or 1.1 infections per 100 at-risk patients. The difference in incidence between the two time points was statistically significant ($p<.0003$) and represents a 9-fold decrease. Our findings support the institutional use of a combined testing and space allocation protocol to mitigate risk of outbreaks in confined settings.

1. Introduction

The COVID-19 pandemic has taxed an already burdened healthcare system (Amerio et al 2020). Patients with mental illness and substance use disorders are more likely than the general population to contract COVID-19 (Taquet et al., 2021; Wang et al., 2021). Once infected, those with neuropsychiatric conditions, like schizophrenia-spectrum illness or Alzheimer's disease, have higher mortality rates than unaffected cohorts (Li et al., 2020; Nemani et al., 2021; Yu et al., 2021). For patients requiring psychiatric admission, the confined environment of inpatient psychiatric facilities exacerbates the risk of infection as patients share common areas with limited space for social distancing. Severe COVID-19 outbreaks have repeatedly occurred in inpatient psychiatric facilities during the COVID-19 pandemic, undermining the central mission of these institutions to provide safe environments for acutely ill patients and taking a substantial toll on staff caring for COVID-19 patients (Barnett et al., 2020; Ji et al., 2020; Krass et al., 2020; Shao et al., 2020; Amerio et al. 2020). More broadly, outbreaks of COVID-19 in locked or enclosed institutional environments that house patients with mental illness such as nursing homes or correctional facilities have been a deadly hallmark of the pandemic (Barnert et al., 2020; Trabucchi and de Leo, 2020).

Despite declining regional infection rates and the expanding availability of multiple COVID-19 vaccines, sporadic institutional outbreaks are likely to continue. Twenty percent of the US population is reluctant to accept a vaccination (Rosenbaum, 2021). Inequitable distribution of COVID-19 vaccines may delay access in developing nations for months or years. Emerging variants of SARS-CoV-2 spread more rapidly than the wild type and may be capable of evading neutralizing antibodies ("About Variants of the Virus that Causes COVID-19 | CDC," n.d.;

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Weisblum et al., 2020). A substantial risk remains that pandemic COVID-19 may be followed by endemic COVID-19 or become a recurrent seasonal infection, and institutional settings must be prepared for the probability of outbreaks for the foreseeable future (Hunter, 2020; Murray and Piot, 2021)

In May, 2020, the Substance Abuse and Mental Health Services Administration (Samhsa, 2021) issued infection control guidance for state psychiatric hospitals designed to mitigate the risk of nosocomial COVID-19 outbreaks (Samhsa, n.d.). SAMHSA recommended that all newly admitted patients be tested for COVID-19. New patients with pending tests and existing patients who develop symptoms are to be quarantined until test results are available and COVID-19 positive patients should be confined to dedicated spaces isolated from the surrounding population. Such "three-space'' or "hot" (COVID-19 positive), "cold" (COVID-19 negative) and "quarantine" (awaiting COVID-19 test results) operational protocols can be challenging to implement rapidly. When the number of infected patients increases substantially during an institutional outbreak or community surge, establishing and implementing such protocols can be costly and burdensome, raising questions about whether doing so is worth the associated institutional resources (Russ et al., 2021).

This study examined the impact of a comprehensive infection control protocol including universal testing and a "three-space" operational protocol on nosocomial COVID-19 infections in a large, free-standing psychiatric facility. We expected that implementing a "three-space" protocol would reduce infection rates within the hospital. The protocol was introduced at the Westchester Behavioral Health Center of New York Presbyterian Hospital (WBHC-NYP) during March and April, 2020, a surge period of COVID-19 transmission in the surrounding New York region. Although developed independently from and prior to the SAMHSA guidelines, the protocol is consistent with the SAMSHA recommendations and can be scaled up or down over the course of pandemic, endemic, or sporadic COVID-19 or other infectious disease outbreaks. The protocol is also flexible enough to be applied to residential settings, including nursing homes or correctional facilities.

METHODS

In March and April of 2020, WBHC-NYP implemented a series of interventions to mitigate transmission of COVID-19 based on recommendations from the Centers for Disease Control (CDC) and the New York Presbyterian Hospital's office of Infection Control and Prevention. We summarize the protocol below and have previously described it in full (Brody et al., 2020). For this report, we reviewed inpatient electronic medical records and captured the presence/absence of SARS-COV-2 testing dates and results, dates of admission and discharge, demographic information, psychiatric diagnosis, and inpatient hospital unit where patients received care. We chose the time period of March 14th, 2020 to June 10th, 2020 to correspond to dates of the local COVID-19 surge New York City Department of Health 2021.

Period 1 (March 14 until April 23, 2020): At the outset of the pandemic in March, only patients demonstrating possible COVID-19 symptoms were tested. Those who were COVID-19 positive remained on the unit to which they were originally admitted. They were placed on contact and droplet isolation precautions, confined to private rooms, and given in-room commodes if they did not have private, en-suite bathrooms. Staff caring for COVID-19 positive patients used personal protective equipment (PPE) including N95 masks, gowns, gloves and eye protection.

Other key interventions were implemented iteratively beginning on March 14th, when patient interactions were limited to socially-distanced cohorts. On March 18th, patient visitor restrictions begun. On March 22nd, all staff were required to wear surgical masks inside the facility. On March 31st, all patients were required to wear surgical masks in communal areas. On April 3rd, all newly admitted patients were required to undergo nasopharyngeal swab PCR testing. In response to a growing census of COVID-19 positive patients, two COVID-19 positive units were established on April 1st and April 8th. The staff on these units were required to wear full PPE when physically present on the unit. When possible, assessments and therapeutic activities were conducted over telehealth platforms (Kanellopoulos et al., 2021)

Beginning on April 8th, patients undergoing Electroconvulsive Therapy (ECT) were tested on a weekly basis. All hospitalized patients who had not been tested previously underwent testing on April 22nd and 23rd. Beginning on April 24th, all patients who used Continuous Positive Airway Pressure machines for sleep apnea were also tested on a weekly basis. A full timeline of infection control and prevention interventions and the completed algorithm are displayed in Table 2 and Figure 1.

Period 2 (April 24 until June 10, 2020): After the full implementation of mandatory universal testing on April 24, 2020, patients referred for psychiatric admission by Comprehensive Psychiatric Emergency Programs, medical/surgical floors, emergency departments, and Children's hospitals underwent testing at those facilities prior to transfer. Patients referred directly from an ambulatory setting, or inpatient setting where testing was not available, were admitted to a quarantine space and tested on arrival; they were subsequently transferred to a COVID-19 positive or a COVID-19 negative unit. Staff in the quarantine area adopted the same PPE use protocols as staff caring for COVID-19 positive patients.

Patients on COVID-19 negative units who developed COVID-19-like symptoms were declared Persons Under Investigation (PUIs). They were room-restricted, retested, and placed on droplet and contact isolation. If they were able to maintain isolation precautions, they remained on the COVID-19 negative unit pending test results. If they were unable to adhere to contact and droplet precautions, they were transferred to a quarantine space or a COVID-19 positive unit. When PUIs converted to COVID-19 positive, they were transferred to a COVID-19 positive unit. The hospital's office of infection control and prevention provided consultation and recommendations for contact tracing to identify other patients or staff thought to be at substantial risk of infection. COVID-19 positive patients were retested 14 days after their original positive test if they were asymptomatic and not using antipyretic medication. When a patient tested negative, they were re-tested for confirmation. A patient who had two negative swabs in 48 hours was transferred to a COVID-19 negative unit.

2. Data collection

We reviewed the records of 1,139 patients who were treated on the inpatient service of WBHC-NYP between March 14th, 2020, when we implemented our first intervention (patient cohorting), and June 10th, 2020 corresponding to the end of the regional surge (New York City Department of Health, n.d.). We collected information including the presence or absence of testing and results, dates of admission and discharge, demographic information, psychiatric diagnosis, and unit of patient care.

Initial chart reviews were conducted by physicians or a psychologist who worked on one of the COVID-19 positive units (BB, ZS, DE, CS and DK). Records were flagged as "suspected nosocomial" if a patient became symptomatic and tested positive after admission. Prior studies indicate that the incubation period of COVID-19 varies widely and may be little as 2 and as great as 14 days (Backer et al., 2020; "Management of Patients with Confirmed 2019-nCoV | CDC," n.d.). On the basis of this incubation period, we created a second, automated candidate list for nosocomial infections by removing, in sequence 1) patients who were never symptomatic and therefore were never tested prior the adoption of our universal testing policy 2) patients who only had negative tests 3) patients who tested positive prior to or on the day of admission and 4) patients who tested positive within the first 48 hours of admission.

The remaining patients were suspected to have a nosocomial acquired infection if they had an initial positive test more than 48 hours after admission, including those who tested negative on admission and had a subsequent positive test. To delineate the graded potential of nosocomial acquisition given the infection incubation period, patients

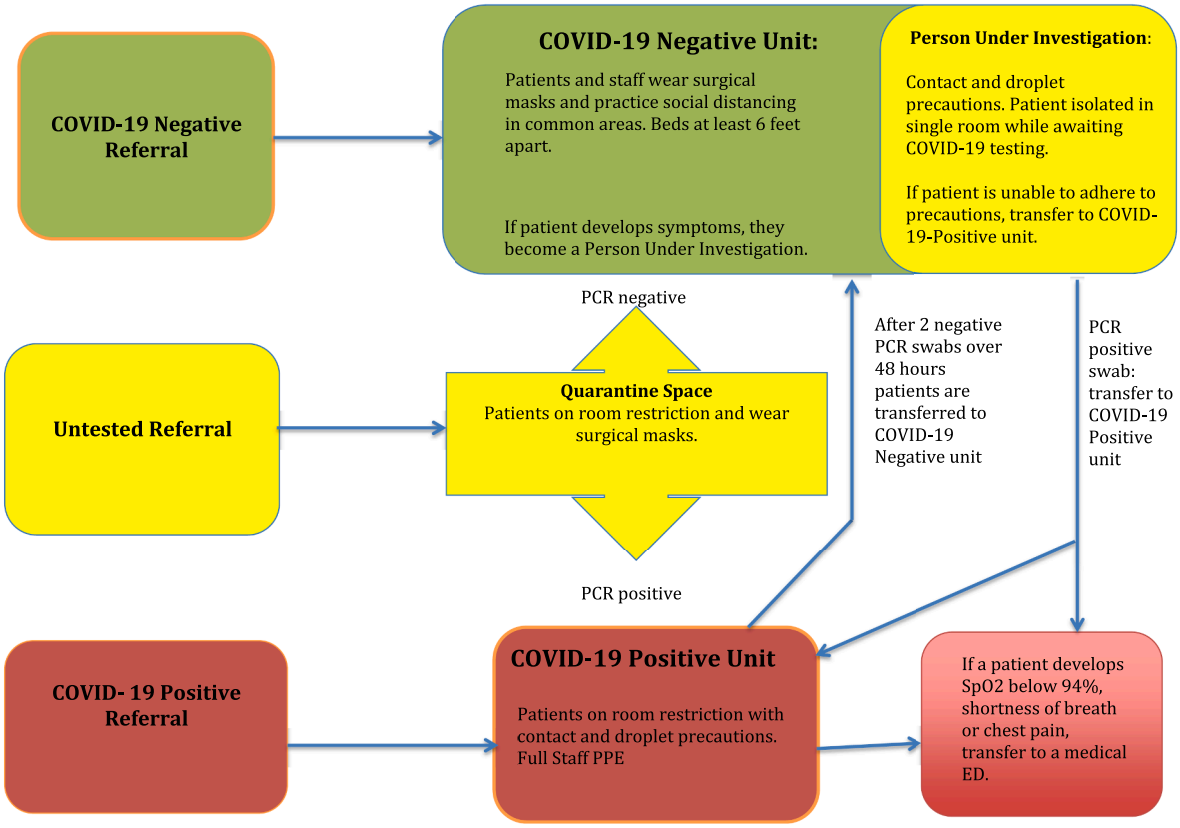

Fig. 1. Algorithm for COVID-19 testing and patient triage in a psychiatric facility.

who tested positive on hospital days 3-14 were labeled "possible nosocomial." Patients who tested positive on hospital day 15 or beyond were labeled "nosocomial." Finally, a senior internist (SP) reviewed the records of candidate nosocomial infection lists to reconcile any discrepancies between the hand-flagged "suspect nosocomial" list and the automated "possible nosocomial" and "nosocomial" candidate lists. The senior internist then made a final determination regarding characterizing an infection as community acquired, possible nosocomial or nosocomial.

3. Data analysis

We compared the incidence of "possible nosocomial" and "nosocomial" infections during Period 1 (March 14 until April 23, 2020) and Period 2 (April 24 until June 10th, 2020). The incidence of "nosocomial" and "possible nosocomial" infections was determined by dividing the number of cases for each period by the average hospitalized census of at-risk patients during the time period. The at-risk patient census was determined by subtracting the daily COVID-19 positive patient count from the total daily hospital census. If a patient recovered from COVID-19 and was transferred to a COVID-19 negative unit, they were assumed to be temporarily immune and were not included in the denominator of "at risk" patients for the incidence calculation for the remaining days of their admission. Chi square tests were used to compare the incidence of "nosocomial" and "possible nosocomial" between period 1 and period 2.

Table 1
Clinical and demographic characteristics of 1139 inpatients being treated in an inpatient psychiatric hospital between March 14th- June 10th, 2020.

	Total (N=1139)	COVID+ (N=87)	COVID- (N=1052)
AGE in YEARS Mean (SD)/ Range	**36.5 (16.6)/6-91**	36.9(15.3)/ 13-76	36.5 (16.8)/6-91
GENDER	**N (%)**	N (%)	N (%)
Female	**564 (49.5)**	33 (37.9)	531 (50.4)
Male	**568 (49.9)**	53 (60.9)	515 (48.9)
Trans or non-binary	**7 (0.6)**	1 (1.1)	6 (0.6)
PRIMARY ADMISSION DIAGNOSIS	**N (%)**	N (%)	N (%)
Psychotic Spectrum	**433 (38.0)**	32 (36.8)	402 (38.1)
Bipolar	**185 (16.2)**	20 (23.0)	165 (15.7)
MDD	**323 (28.4)**	26 (29.9)	297 (28.2)
Mood Disorder	**96 (8.4)**	4 (4.6)	92 (8.7)
Substance Use Disorders	**37 (3.2)**	2 (2.3)	35 (3.3)
Eating Disorders	**54 (4.4)**	2 (2.3)	52 (4.9)
Other	**11 (1.0)**	1 (1.1)	11 (1.0)
PRIMARY INSURANCE	N (%)	N (%)	N (%)
Commercial	**414 (36.3)**	21 (24.1)	393 (37.4)
Medicare	**146 (13.1)**	8 (9.2)	138 (13.1)
Medicaid*	**435 (36.5)**	51 (58.6)	384 (36.5)
Uninsured	**144 (13.0)**	7 (8.0)	137 (13.0)

% = percent of total N within column
* Indicates statistically significant difference (Chi Square=16.7, p<0.001); Medicaid insured patients were more likely than patients with other coverage, or no insurance coverage to be COVID+

4. Results

A total of 1,139 patients were treated on the inpatient services of WBHC-NYP Hospital between March 14th, 2020 and June 10th, 2020. COVID-19 positive patients were more likely to be Medicaid-insured than COVID-19 negative patients (Chi Square=16.7, p<0.001) (Table 1). Although COVID-19 positive patients were disproportionately men (60.9%) there was no statistically significant difference when comparing gender. Of the 1,139 patients, 832 had at least one SARS-CoV-2 nasopharyngeal swab test. Among the 832 tested patients, 702 were tested prior to or on admission and 130 patients were tested after admission because they were either symptomatic, had a high-risk

Table 2
Timeline of Infection Control and Prevention Interventions.

Time Period 1: March 14, 2020 to April 23, 2020: Iterative Interventions:	Time Period 2: April 24th, 2020 to June 8th 23, 2020: Three-space testing and Triage protocol:
3/14/2020: Patient group cohort or "pods" adopted to limit patient peer interaction.	Patients referred from Emergency Department's Medical / Surgical floors or Psychiatric Emergency Programs undergo testing prior arrival and are triaged to dedicated COVID-19 positive or COVID-19 negative spaces. Patients in ambulatory programs are triaged to an untested or quarantine space and tested on arrival.
3/16: Begin testing patients with COVID-19 like symptoms with nasopharyngeal swab PCR tests.	Staff on COVID-19 positive and quarantine spaces use full PPE (N95; eye protection; gowns and gloves). Groups and assessments conducted via telehealth when possible. Patients restricted to rooms.
3/18: 1st COVID-19 Positive patient identified. Patient placed on contact and droplet precautions in rooms; staff given N95, gowns, gloves, eye protection to care for COVID-19 positive patients.	Staff on COVID-19 negative spaces wear surgical masks. Patients attend meals and therapeutic activities in group cohorts. Patient who develop COVID-19 like symptoms are retested, placed on contact and droplet isolation and room restricted and involved staff use full PPE.
3/18: Visitors restricted for adult patients.	If PUI on COVID-19 negative unit converts, they are transferred to COVID-19 positive unit and contact tracing initiated.
3/26: All staff begin wearing surgical masks.	Patients using CPAP machines undergo weekly nasopharyngeal PCR testing (adopted on 4/24)
3/31: All patients begin wearing surgical masks.	
4/1: 1st dedicated COVID-19 positive unit opens.	
4/1: Begin weekly testing for patients undergoing ECT.	
4/3: Universal testing for newly admitted	
patients instituted.	
4/22-4/23: All previously untested patients undergo nasopharyngeal PCR testing.	

Time Period 1: March 14, 2020 to April 23, 2020: Iterative Interventions: **Time Period 2: April 24th, 2020 to June 8th 23, 2020: Three-space testing and Triage protocol:**

(*continued on next page*)

Table 2 (*continued*)

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3/16: Begin testing patients with COVID-19 like symptoms with nasopharyngeal swab PCR tests.	Staff on COVID-19 positive and quarantine spaces use full PPE (N95; eye protection; gowns and gloves). Therapeutic groups and assessments are conducted via telehealth when possible. Patients restricted to rooms.
3/18: 1st COVID-19 Positive patient identified. Patient placed on contact and droplet precautions in rooms; staff given N95, gowns, gloves, eye protection to care for COVID-19 positive patients.	Staff on COVID-19 negative spaces wear surgical masks. Patients attend meals and therapeutic activities in group cohorts. Patient who develop COVID-19 like symptoms are retested, placed on contact and droplet isolation and room restricted. Treating staff use full PPE.
3/18: Visitors restricted for adult patients.	If PUI on COVID-19 negative unit converts, they are transferred to COVID-19 positive unit and contact tracing initiated.
3/26: All staff begin wearing surgical masks.	Patients using CPAP machines undergo weekly nasopharyngeal PCR testing (adopted on 4/24).
3/31: All patients begin wearing surgical masks. 4/1: 1st dedicated COVID-19 positive unit opens. 4/1: Begin weekly testing for patients undergoing ECT. 4/3: Universal testing for newly admitted patients instituted. 4/22-4/23: All previously untested patients undergo nasopharyngeal PCR testing.	

exposure, were undergoing ECT, were using a CPAP machine for sleep apnea, or because they needed testing for placement in a subsequent facility.134 patients were tested both prior to admission and again during their hospital course

Eighty-seven patients had a positive or "indeterminate" test result. On the basis of guidance from the hospital's laboratory, "indeterminate" results were considered positive and were treated as such clinically and for the purpose of this analysis. Twelve patients had an initial positive COVID-19 test during hospital days 3 through 14 and were classified as "possible nosocomial." Six patients had an initial positive COVID-19 test on hospital day 15 or beyond and were classified as "nosocomial." One patient who was initially admitted prior to adoption of universal testing, discharged, and then readmitted 6 days later, after the adoption of universal testing (or 12 days after the initial admission), was positive at the time of the second admission. He was considered a "possible nosocomial" infection for the purpose of this analysis. The cumulative number of community-acquired, possible nosocomial and nosocomial infections before and after the implementation of the full protocol is presented in Figure 2.

Sixteen of the 18 "possibly nosocomial" or "nosocomial" infections occurred during Period 1 (March 14 until April 23, 2020), prior to the full implementation of the protocol. One "possible nosocomial" and one "nosocomial" infection were identified during Period 2 (April 24 until June 8, 2020). Both cases were identified during the first week after our protocol was implemented in full. No additional "possible nosocomial" or "nosocomial" infections were identified in the latter 5 weeks of the study period.

The incidence of nosocomial or possibly nosocomial infections in Time Period 1 was 0.098 (16/164), or 0.98 infections per 10 at-risk patients. The incidence of nosocomial or possibly nosocomial infections in time period 2 was 0.0110 (2/182), or 1.1 infections per 100 at-risk patients. The difference in incidence between Period 1 and Period 2 was statistically significant ($z=3.64$; $p<.0003$) and represents a 9-fold decrease in nosocomial infections.

The "possible nosocomial" and "nosocomial" infections affected 6 out of the 12 inpatient units of WBHC-NYP. The unit with the most severe outbreak had 5 cases that were all classified as "nosocomial." Another unit, which is not physically contiguous to the first but in the same wing of the building, had 3 possibly nosocomial and 2 nosocomial cases. The remainder of the possible and presumed nosocomial cases affected 4 other units. Fifteen of 18 (83%) of the possible or nosocomial cases were located on the same wing of our institution.

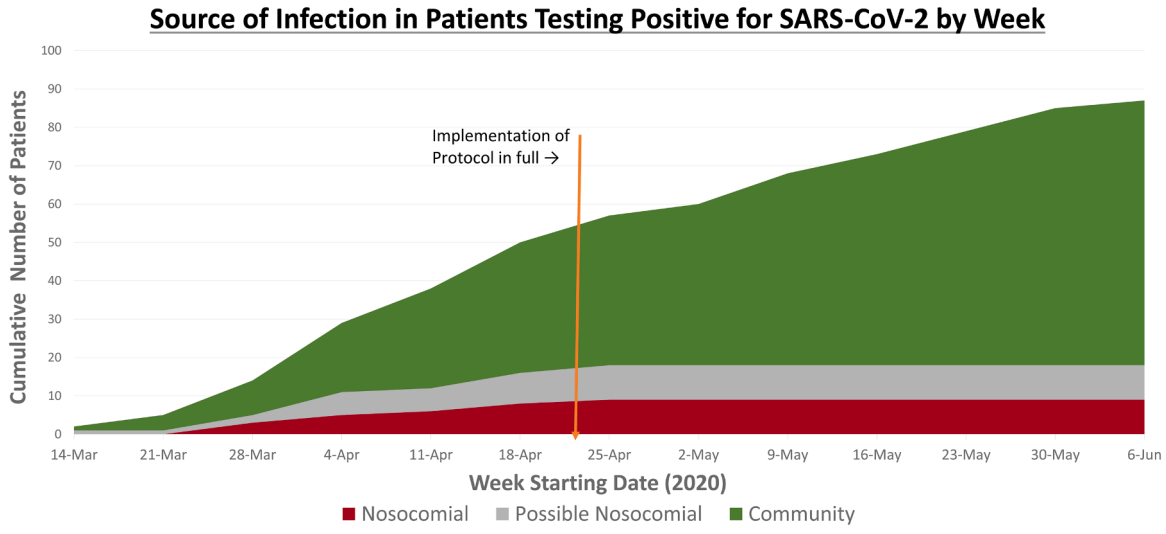

Fig. 2. Source of Infection in Patients Testing Positive for SARS-CoV-2.

5. Discussion

The principal finding of the current study is that the incidence of "possible nosocomial" and "nosocomial" infections, as defined, decreased nine-fold as our facility adopted a comprehensive infection control protocol including universal testing and a "three-space" system of dedicated COVID-19 positive, COVID-19 negative, and quarantine areas. Only one case of a possible nosocomial and one nosocomial infection were identified during the study period after the protocol was adopted in full. The success of the "three-space" protocol is remarkable because it protected psychiatrically hospitalized patients during a time of steep increases in admissions of patients with known community acquired COVID-19 infections. With proper institutional and public health support, similar protocols could be widely adopted by institutional settings that frequently house persons with serious mental illness.

COVID-19 is a pernicious threat to enclosed institutional settings for synergistic reasons. A long, variable incubation period of 2 to 14 days from viral exposure to detectable infection makes universal testing at the time of admission insufficient to identify all infected patients. The wide range of clinical presentations, including the entire absence of symptoms, greatly increases the likelihood of occult infection. Airborne transmission of the SARS-CoV-2 virus increases the risk of spread in indoor spaces with enclosed physical boundaries like psychiatric hospitals, nursing homes, and correctional facilities ("Science Brief: SARS-CoV-2 and Potential Airborne Transmission | CDC," n.d.). The significance of our main finding is that it provides justification for the financial, human and physical-plant resources necessary to implement a three-space protocol, as it significantly reduces COVID-19 spread in confined settings even in patient populations that may not be cooperative with infection control guidelines. We were pleasantly surprised by the patients' ability to adhere to isolation procedures since many, and especially patients with mood disorders, may have difficulty with sensory processing and found the isolation procedures challenging (Serafini et al 2017).

A critical factor when tailoring infection mitigation protocols is flexibility in accommodating a waxing and waning census of COVID-19 positive and potentially exposed patients. To accomplish this within our institution, two separate L-shaped units were divided by a physical barrier into 11-bed and 5-bed spaces. The resulting spaces could be used flexibly as designated COVID-19 positive spaces or quarantine areas to accommodate patients awaiting testing results, those requiring quarantine because of possible COVID-19 exposure, or recent travel to other states with high infection rates. Although our hospital maintained three physically separated areas, the number of patients who needed to be admitted to these spaces varied and often the designation of "COVID-19 positive" and "quarantine spaces" had to be switched. For example, if the confirmed COVID-19 positive census declined but more patients required testing or quarantine at the time of admission, the 5- and 11-bed spaces were "flipped" or repurposed to accommodate the population with the greater census.

Our report has several key strengths. In prior work, we have shown that a subset 683 consecutively admitted patients in our dataset who underwent universal testing prior to or on admission had a positive rate of 9.8%. This is a high burden of COVID-19 infected-patients that represents a substantial stress test for our protocol (Brody et al., 2021). Our sample size of 1,139 is larger than those of similar prior studies and builds on their findings. (Li et al., 2021; Spitzer Sverd et al., 2021).

The study also has several limitations. Because we do not have follow up data on patients after their discharge, it is likely that the true number of nosocomial infections is higher than we were able to identify. Although we performed contact tracing and tested at-risk patients when a COVID-19 patient was identified, the long incubation period and frequent turnover on our acute units makes it possible that some nosocomial infections were not detected. The incubation period also creates a long window (days 3-14) during which a detected infection may be nosocomial or community acquired, leading the majority of cases we identified to fall into the "possible nosocomial" category. Because universal mandatory screening was not implemented until mid-way through time period 1 and because COVID-19 is frequently asymptomatic, it is possible that we have underestimated the number of nosocomial infections in time period 1 and thus underestimated the efficacy of the three-space protocol. However, local COVID-19 infection rates were declining during the period 2, leading to greater pressure on the infection prevention efforts during time period 1 (Brody, 2021). As the universal testing and "three space" protocol has many elements, we cannot identify which of the procedures led to reduction in nosocomial infections. For example, although universal masking alone undoubtedly contributed to the reduction in nosocomial infections, additional nosocomial or possible nosocomial cases continued for several weeks until the protocol was adopted in full.

Our "three-space" protocol was successfully implemented in a large acute care psychiatric inpatient facility with the ability to provide the space for separation of infected patients. The procedures described in this paper may be difficult to implement in small hospitals with limited space dedicated to behavioral health care. Therefore, we recommend that such facilities give consideration to requiring mandatory COVID-19 testing and referring infected patients to larger regional centers that have adequate space and resources to implement a three-space protocol.

In conclusion, implementation of a universal COVID-19 testing and a "three-space" triage protocol of admissions led to a drastic decline in possible nosocomial COVID-19 infections at a time of a steep surge in community acquired COVID-19 infections in psychiatric inpatients. Flexibility to rapidly convert COVID-19 negative spaces to quarantine spaces or quarantine spaces to COVID-19 positive and vice versa is critical as local infection rates wax and wane with the emergence of new variants and seasonal surges. Our procedures can be applied to residential settings, including nursing homes or correctional facilities and can be scaled up or down over the course of pandemic, endemic or sporadic COVID-19 or of other infectious disease outbreaks.With proper institutional and public health support, similar protocol could be widely adopted by institutional settings that frequently house persons with serious mental illness during pandemics.

Author statement

Benjamin Brody conceived the project in discussions with Drs. Parish and Kanellopoulos. He performed chart reviews and wrote the manuscript.

Zhenzhen Shi performed chart reviews, background research and assisted in editing the manuscript.

Charles Shaffer performed chart reviews, background research and assistance with figures.

Zhenzhen Shi performed chart reviews and assisted in editing the manuscript.

Katarzyna Wyka served as statistical consultant and assisted in editing the manuscript.

George Alexopoulos provided substantive feedback on a earlier version of the manuscript and contributed substantive revisions.

Helen Nazario assisted with testing data and analysis.

Sharon Parish led all general medical activities during the months described and participated in the conceptualization project. She also edited the manuscript.

Mark Russ oversaw all clinical activities on the campus during the time period described and assisted in editing the manuscript.

Dora Kanellopoulos conceived the project in discussions with Drs. Brody and Parish. She oversaw database management and data analysis. She also performed chart reviews and participated in the editing of the manuscript.

Declaration of Competing Interests

Dr. Alexopoulos served on Advisory Board of Eisai and of Janssen

Pharmaceuticals and receives support from P50 MH113838. He also served on the Speakers Bureaus of Allergan, Otsuka, and Takeda-Lundbeck.

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