

An Epidemiologic Study of COVID-19 Patients in a State Psychiatric Hospital: High Penetrance Rate Despite Following Initial CDC Guidelines

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Disclosures and Acknowledgments:

No authors have any conflicts of interest.

The authors appreciate the assistance of Robert Garry, PhD, Professor of Microbiology and Immunology at Tulane University School of Medicine and Xiao-Ming Yin, MD, PhD, Professor and Chair of Pathology and Laboratory Medicine at Tulane University School of Medicine who facilitated and coordinated testing.

Highlights:

- Asymptomatic COVID-19 positive patients are highly infectious, but there is limited data to support this as most testing is performed on symptomatic patients.
- Asymptomatic positive clients are likely adding to high penetrance in close quarter psychiatric facilities.
- Universal masking and higher levels of Personal Protective Equipment (PPE) utilization in these settings prior to the first positive case may be warranted if PPE supply is available.

Abstract

Objective: This is the first study to date in the United States to explore the transmission of coronavirus disease 2019 (COVID-19) in a state psychiatric hospital setting. **Method:** Symptomatic and asymptomatic patients were tested throughout a large psychiatric hospital to determine the penetrance rate. **Results:** Despite following initial CDC guidelines, in less than two weeks 78% (51 of 65) of tested patients in the building where the first positive patient was housed (building Zero) tested positive for COVID-19. Asymptomatic transmission was likely, as 88% (14 of 16) of tested asymptomatic patients in building Zero were positive, compared to a sample from the rest of the hospital where only 12% (6 of 51) of random asymptomatic patients tested positive. **Conclusion:** Large percentages of patients can become COVID-19 positive despite following initial CDC guidelines. As such, masking of all patients prior to the first positive case in close quarter settings appears warranted. Recent CDC guidelines comport with this strategy if PPE supplies are adequate.

The description of the coronavirus disease 2019 (COVID-19) crisis and its migration from WuHan, China to the United States has been well documented in countless articles. The spread of the virus has been ubiquitous in populations throughout the world (1). Those in confined settings such as prisons and long-term care facilities have been identified as particularly at-risk populations (2, 3). Further, recent studies have shown that individuals with coronavirus who are not yet exhibiting symptoms, and even those who never exhibit symptoms, are able to spread the disease (4, 5). As a result of close quarter housing and asymptomatic transmission, in addition to patient characteristics, psychiatric hospitals are particularly vulnerable (6). The focus of the current study was to explore the transmission of COVID-19 in a psychiatric inpatient setting, where initial Centers for Disease Control and Prevention (CDC) guidelines were followed.

The current study was conducted in a remote psychiatric hospital in the South. Patients are committed to the hospital by court order due to mental illness and significant legal charges, leading to dangerousness to the community at large. As such, patients are not easily discharged into the community. The hospital's units are close quarters with shared restrooms where 20 to 24 patients are housed on a single unit, and buildings consist of 4 units.

As the COVID-19 crisis started to infect the US population, the Executive Team of the hospital began making preparations for housing, isolation units, step down units, personal protective equipment (PPE), as well as halting admissions and discharges. The hospital followed CDC guidelines regarding screening patients and staff in anticipation of the potential impact of COVID-19 on this large mental health population with an equally large staff. All off campus appointments and new admissions were stopped on 3/12/20. All staff were screened with the

typical screening questions and temperature checks upon entering the campus beginning on 3/13/2020. At that time, no patients or staff tested positive or reported typical COVID-19 symptoms.

A building was identified that was suitable for isolation, step down positive, and stepdown negative patients. Staff were trained on PPE and isolation techniques as well as donning and doffing of PPE. Patients were screened for COVID-19 upon becoming symptomatic (temperature > 100.4), and those with a temperature > 99.5 and < 100.4 were monitored for further symptoms. New onset cough, diarrhea, respiratory complaints and < 93% oxygen saturation were checked on all suspicious patients. Suspicious patients were rapidly moved to the isolation unit pending test results. A stepdown positive unit was positioned next to the isolation unit in the same building. Patients with negative results were housed on a stepdown unit awaiting return to their normal units.

All processes, policies and procedures were accomplished using a leadership team composed of hospital leaders, State epidemiologists, CDC subject matter experts, and Tulane University Infectious Disease and epidemiologic expert guidance. No decisions were made without general agreement of plans as they emerged.

Patient Zero was identified as symptomatic of COVID-19 on 3/23/2020, was tested the following day, and received a positive result on 3/26/2020. Despite the use of rapid isolation, proper PPE, and other measures, the building where patient Zero was housed (building Zero) became rapidly infected. This was evident before testing was returned from State lab analysis. When a quarter of

patients of the patient Zero unit were affected, a decision was made by leadership to shelter in place on building Zero. Staff were assigned to this building and were not allowed to work on other buildings. Food was dropped off, and routine lab draws were curtailed or performed outside of the building. All psychiatric and social work visits were performed by telemedicine.

The decision for all patients and staff to wear PPE was made on 4/3/2020 with consensus from the CDC subject matter expert and State Epidemiologists.

Testing by the State was being conserved for symptomatic patients, which was appropriate at the time. The author (JT) became aware that Tulane University School of Medicine was developing a testing procedure to help increase testing volume. When this testing became available the author saw an opportunity to get a significant sample from building Zero, to determine the penetrance rate of the virus on building Zero. This was done with consultation of the executive leadership and epidemiologists at the State and Tulane lab assistance. The purpose of this sample was to acquire a penetrance rate of asymptomatic and symptomatic patients on building Zero. This data in conjunction with data on patient's course had the potential to warn state officials and hospitals in the catchment area of potential future needs, such as hospital beds and ICU burden.

Methods

The current study was reviewed by the Tulane University Institutional Review Board and determined to be exempt. Existing, deidentified data analyzed in this study includes 160 COVID-19 tests collected from patients in an inpatient psychiatric hospital between 3/14/2020 and

4/8/2020. Sixty-eight tests of symptomatic patients were collected using State labs. The Tulane University School of Medicine lab provided an additional 92 tests for a sample of asymptomatic patients using a CDC 2019-Novel Coronavirus (2019-nCoV) Real-Time RT-PCR Diagnostic Panel (7). By the time the 92 additional patients were tested between 4/2/2020 and 4/4/2020, 3 had become symptomatic, 19 were mildly symptomatic, and 70 remained asymptomatic. Of the 92 additional tests, 41% ($N = 38$) were performed on the remaining patients in building Zero who had not yet been tested. The other 59% ($N = 54$) were performed on a random sample of asymptomatic patients throughout three other buildings in the hospital that were just beginning to become infected. Patient names were randomly selected for testing, excluding those who had already been tested and ensuring that at least one patient was chosen from each unit of the buildings. Analyses were conducted using SPSS (version 24).

Results

A majority of patients in this study were male (71%), with a mean age of 51.27 ($SD = 13.91$, range = 23.74 – 76.36). Two-thirds (66%) identified as Black, 33% as White, and 1% as Hispanic. Results from all 160 tests are presented in Table 1. The positive ($n = 51$) to negative ($n = 14$) ratio of building Zero demonstrates an alarmingly high rate of 78% for positive COVID-19 results for clients with valid test results. The positive ($n = 28$) to negative ($n = 57$) ratio of the other buildings sampled showed a much lower rate of 33%. Examining the 150 valid test results (excluding 10 pending), a chi-square test (with Yate's Continuity Correction) indicated that those in building Zero were significantly more likely to test positive compared to those in other buildings ($\chi^2 (1) = 28.82, p = <.001, \phi = .45$).

The subset of 67 tests of asymptomatic patients who had valid test results (excluding 3 pending) were further examined. A chi-square test (with Yate's Continuity Correction and Fisher's Exact Test) indicated those in building Zero were significantly more likely to test positive compared to those in other buildings ($\chi^2 (1) = 29.84, p < .001, \phi = .71$)

Discussion

These are preliminary data from testing conducted on symptomatic and asymptomatic patients in a state psychiatric hospital where the COV-SARs-2 virus has spread rapidly despite substantial preparation and following up to date CDC guidelines. Results demonstrate that many asymptomatic or mildly symptomatic patients were positive for COVID-19. It appears that typical CDC guidelines are not sufficient to contain spread in these close quarter settings.

While physical distancing is recommended to limit the spread of COVID-19, such distancing is not possible in close quarter confined settings. As such, some state prisons and county jails have decreased bail and/or released inmates early to decrease spread of the virus. However, given the nature of the offenses of patients in long-term psychiatric settings, combined with their high need for care, releasing patients is not a feasible option. Using field tents may be a solution for decreasing crowding and increasing physical distance; however, this is not possible in all settings.

Given the difficulties with physical separation, additional measures, such as universal masking, must be taken. Given the high number of asymptomatic and mildly symptomatic positive patients found in this study, waiting to implement masking until the first symptomatic patient tests

positive is not recommended. Of course, the limited availability of PPE must be taken into consideration. Another possible preventative measure is to test all staff members who have contact with patients, whether or not they are showing typical COVID-19 symptoms. It is possible that asymptomatic staff members may play a role in the introduction and/or spreading of the virus. Unfortunately, with limiting testing available, tests are typically reserved for symptomatic patients and staff.

Though the exact method of introduction of COVID-19 into the hospital in the current study is unknown, hospital administrators suspect that either 1) an asymptomatic staff member introduced the virus, or 2) patient Zero was exposed during an off campus medical appointment that occurred twelve days before patient Zero became symptomatic, and just one day before all off campus appointments were cancelled.

The ability to test asymptomatic patients was strength of this study, and allowed for an estimate of asymptomatic transmission of COVID-19 in a close quarter settings. However, the results should be interpreted with the following limitations in mind. Due to limited testing available, not all patients in the hospital were able to be tested. Thus, the penetrance rates provided are estimates based on subsamples.

Conclusions

It is recommended that all close quarters psychiatric facilities consider using universal masking prior to the initial case of COVID-19. Waiting for positive test results may result in rapid infection by symptomatic and asymptomatic infected patients.

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TABLE 1. Outcomes of COVID-19 Testing of Symptomatic and Asymptomatic Patients in Building of Patient Zero and All Other Buildings (n = 160).

	Negative	Positive	Pending	Total
Building zero				
Asymptomatic	2	14	0	16
Mildly symptomatic	5	12	2	19
Symptomatic	7	25	3	35
Total	14	51	5	70
All other buildings				
Asymptomatic	45	6	3	54
Symptomatic	12	22	2	36
Total	57	28	5	90