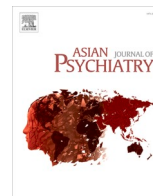




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Impact of SARS-CoV-2 infection and implementation of infection prevention and control (IPC) measures on inpatient psychiatric units

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ABSTRACT

Psychiatric inpatients are at high risk of acquiring and transmitting communicable diseases such as SARS-CoV-2 (COVID-19). Via chart review, the authors examined a cohort of COVID-positive psychiatric inpatients admitted between March and June of 2020, early in the pandemic, to Valleywise Health Medical Center (VMHC), in Arizona, USA. The goal was to assess the ways in which the virus itself as well as infection prevention and control (IPC) measures affected psychiatric inpatients. Variables examined included demographics, psychiatric diagnoses, COVID-19 symptoms, medical comorbidities, and length of stay. Behavioral health facilities encountered significant challenges in balancing the need for a therapeutic milieu and compliance with IPC measures. During the study period, 39 patients and 15 staff members contracted COVID. All but one COVID-positive staff member provided direct patient care. During the study period, VMHC behavioral health facilities were largely successful in identifying and quarantining COVID-positive patients. The hospital's IPC policies/procedures were constantly updated to incorporate new guidelines and address emerging knowledge about the virus, which may have lowered transmission rates and mitigated potential complications. To preserve quality and safety of psychiatric care, the therapeutic milieu was altered, which may have adversely affected patient care and/or lengthened hospital stay.

1. Introduction

Inpatient psychiatric facilities face unique challenges in addressing contagious illnesses such as COVID-19. Infection Prevention and Control (IPC) measures are critical in preventing the transmission of illnesses such as COVID-19 (Peters et al., 2018). These strategies could adversely affect the therapeutic milieu and alter traditional inpatient psychiatric care. Staff and patient mobility, communal living, and psychiatric symptoms and behaviors may pose problems with respect to adherence to IPC measures, quarantine protocols, and social distancing (Moreno et al., 2020). As outlined by Li (2020), the physical layout of psychiatric facilities encourages social interaction. In addition, patients and staff move between units for optimal utilization of staff and beds, as well as participation in daily activities, which can interfere with containment of

an infectious illness (Li, 2020).

Individuals with a serious mental illness (SMI) are more susceptible than the general population to COVID-19 for medical and psychosocial reasons (Yao et al., 2020). In this retrospective study, the authors review the experience of a large behavioral health system early in the pandemic. The article describes preventative measures that were implemented and challenges that were faced by staff and patients during the study period.

2. Methods

2.1. Facilities, locations, and units

VMHC in Arizona is a government-supported medical center with

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Table 1
Demographic information of COVID-19-positive patients.

Demographic Characteristics	N (%)
Male	34 (87)
Female	5 (13)
White	20 (51)
Hispanic/Latino	10 (26)
Black	9 (23)

N = number of patients. (%) = percentage

three inpatient psychiatric facilities containing a total of 356 beds. Behavioral health units include 342 adult inpatient psychiatric beds, one medical/geriatric unit (23 beds), and one adolescent unit (14 beds). One unit at the medical hospital (22 beds) treats patients with significant medical and psychiatric comorbidities. The units are locked and contain single and multi-bed rooms. A nursing administration log was utilized to identify COVID-positive patients at the three behavioral health facilities. The authors used electronic medical records of identified patients to collect patient demographics, admission date, COVID-19 test date, length of stay (LOS), psychiatric and medical diagnoses, and clinical outcomes. Hospital administration provided a deidentified list of COVID-positive staff. The authors reviewed IPC policies and measures that were implemented during the study period.

2.2. Study period

Retrospective data on a cohort of COVID-positive patients was collected for a 10-week period (March 28 to June 6, 2020) during the “first wave” of the pandemic in the USA. Care models and IPC protocols were updated often during that period and in the months to follow. The 10-week time frame was selected to study the initial effects of the pandemic on inpatient psychiatric settings.

3. Results

3.1. COVID-19 study cohort

During the study periods, 39 psychiatric inpatients tested positive for COVID-19. Thirty-four (87%) were male and five (13%) were female. The age range was 18–73 years, with an average of 42.5 years. Twenty patients (51%) were white, nine (23%) were Black, and 10 (26%) were Hispanic. Patients received psychiatric medications as usual, with no changes due to the pandemic. The average LOS of COVID-positive psychiatric inpatients was 46 days, which is more than double the average

LOS of patients prior to the pandemic. Five patients from the cohort remained hospitalized at the conclusion of the study period (see Table 1). The first COVID-positive patient (P1) was identified on March 29, 2020 within 24 hours of admission. The first staff member tested positive on April 2, 2020. On April 15, a second patient (P2) tested positive on a different unit. By April 17 and 18, there was a rapid increase in COVID-positive patients and staff (see Fig. 1). In April and early May, several units at two other VHMC behavioral health locations were placed on quarantine status when COVID-positive patients were identified. Four male patients required physical restraints and involuntary medication for severe agitation and dangerous behaviors after they failed to adhere to repeated requests to remain in quarantine.

3.2. COVID symptoms

Of the 39 COVID-positive patients, 33 (84%) had mild cold-like symptoms for 1-2 days that required minimal medical interventions (see Table 2). A temperature of at least 100.4 F was noted in 11 (33%) patients. Ten (28%) patients had temperatures below 100.4 F. Symptoms included cough, headache, nausea, earache, sore/scratchy throat, nasal congestion, and chills. Three (8%) patients required transfer to medical units for treatment of COVID-related symptoms. One 43-year-old male required a ventilator and suffered multi-system medical complications. He remained medically hospitalized after the study period concluded and was eventually discharged to a nursing facility. Bacterial pneumonia was diagnosed in two patients; neither required ventilation and both recovered fully.

Table 2
Medical comorbidities in COVID-19-positive psychiatric patients.

Medical Comorbidity	N (%)
COPD / lung disease	22 (56)
Hypertension	16 (41)
Diabetes	10 (26)
Obesity (BMI>30)	4 (10)
Cardiac problems	3(8)
Hepatitis C	2 (5)
No comorbidity	16 (41)
One comorbidity	6 (15)
Two comorbidities	9 (23)
Three comorbidities	6 (15)

N = number of patients. (%) = percentage

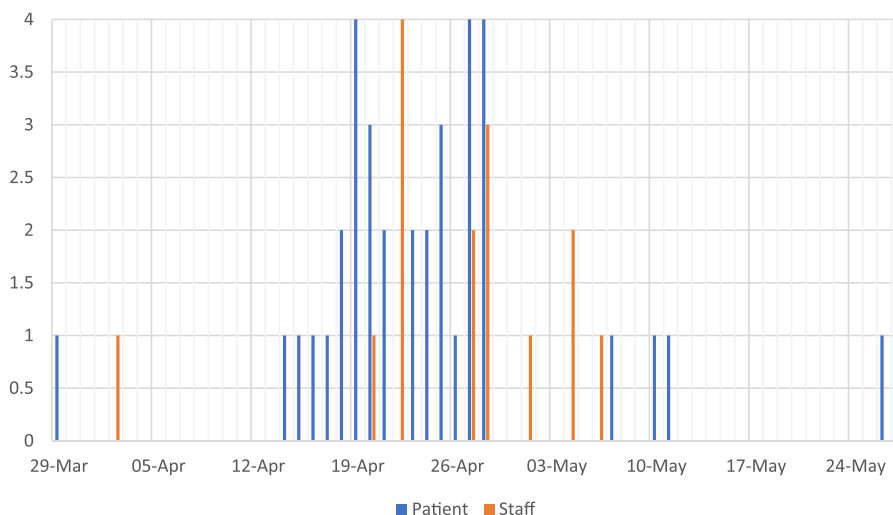


Fig. 1. Number of patients and staff testing positive for COVID-19 by date.

Table 3
Presenting symptoms of COVID-19-positive patient symptoms.

Symptoms of COVID-19	N (%)
Reported symptoms	36 (92)
Reported no symptoms	3 (8)
Temperature at 100.4 F or more	11(28)
Temperature below 100.4 F	10 (28)
Earache	1 (3)
Nausea	1 (3)
Headache	1 (3)
Sore/scratchy throat	2 (6)
Cough	6 (17)
Nasal congestion	2 (6)
Chills	3 (8)

N = number of patients. (%) = percentage

3.3. Medical comorbidities

Sixteen patients (41%) had Preexisting hypertension and 10 patients (25%) had diabetes. Lung disorders (e.g., chronic obstructive pulmonary disease, asthma, history of pneumonia or tuberculosis) were recorded in 22 (56%) patients. Obesity was noted in four (10%) patients. Other medical comorbidities in the cohort included hepatitis C in two patients (5%) and cardiac issues in three patients (8%). Sixteen (41%) patients had no comorbid medical conditions. Six patients (15%) had at least one known COVID-related medical comorbidity, nine patients (23%) had two comorbidities, and six patients (15%), all males, had three (see [Table 3](#)).

3.4. COVID-19 in psychiatry staff

Fifteen staff members tested positive for COVID-19 during the study period. No further data was gathered on the staff in order to protect their privacy.

4. Tracing of COVID-19

It was difficult to pinpoint the nexus of infection on the first psychiatric unit to identify a COVID case. The 14-day incubation period, the number of false negative test results, and transmission by asymptomatic patients hampered the identification of “Patient Zero” ([Benson et al., 2020](#)). Patient 1 (P1) and/or P2 were the likely epicenter of the outbreak. P1 tested positive on admission and P2 tested positive several days after admission, after taking two tests on the medical floor that came back negative for COVID. P2 likely contracted COVID-19 on the medical floor. The third patient (P3) tested negative on admission to the behavioral health unit but required an emergency room visit several days later. On his return to the behavioral health unit, he tested positive for COVID. P3 was likely exposed prior to admission or in the emergency room. In rapid succession, 13 patients on the unit where P2 and P3 were housed contracted COVID-19 (see [Fig. 1](#)). Although efforts were made to assign staff to the same unit to limit the potential spread of infection, there were times when staff were deployed elsewhere. The inability to keep staff working on the same units may have inadvertently contributed to the spread of COVID-19 to other units.

5. Effects of IPC measures on patient care at beginning of the study period

The hospital response plan for COVID-19 began in mid-March of 2020 and evolved daily. Many modifications were recommended by VPMC Infection Control and Arizona Department of Health Services. These modifications are described in the following sections.

5.1. Restriction of personal visits

The hospital system prohibited visitors early in the pandemic. As noted in one article ([Fagiolini et al., 2020](#)), lack of contact with their loved ones may have increased patient stress levels and affected their behavior adversely. Visitor restrictions also affected treatment planning. Case managers stopped meeting in person with patients and their treatment teams for discharge planning. Teleconference platforms were utilized to hold virtual meetings instead. Mental health court hearings were conducted by phone instead of in person. Cell phones, normally prohibited on the behavioral health units, were provided to quarantined patients to allow them to communicate with supportive others.

5.2. Preventive measures by staff

Each behavioral health location designated one entrance at which nurses took temperatures and screened staff with questions about COVID symptoms as they entered. This process has been described by Ying and colleatures ([Ying et al., 2020](#)). The screening process caused a bottleneck of staff outside the entrance, which increased the potential for viral transmission among staff. Subsequently, staff were asked to take their own temperatures at home and attest to asymptomatic status. A drive-up testing station was set up for staff who suspected exposure to COVID-19 ([Bradley et al., 2020](#)). Hospital staff were required to wear face masks while inside the facilities.

Due to initial shortages of personal protective equipment (PPE), staff were issued one surgical mask to wear. Staff members had to wear the same surgical mask until it became soiled or torn. In late June, staff received a reusable plastic face shield and were required to wear it with a mask while on the units. Eventually, enough surgical masks became available for daily changes.

5.3. Creation of “Admissions Observation Units” (AOUs) and admissions protocols

In March and April of 2020, the hospital created Admissions Observation Units (AOUs), which decreased the behavioral health capacity by 30 beds. These units, set up to house only one patient per room and bathroom, were used for all new inpatient psychiatric admissions in an effort to control the spread of COVID throughout the three facilities. All AOU patients were quarantined (see [Augenstein et al., 2020](#)). Once patients tested negative for COVID-19, they were moved to a general psychiatry unit with other healthy peers. If the test results were positive, they were moved to a COVID-positive unit.

5.4. Revision of IPC protocols

As more was learned about COVID-19, admission protocols were modified to minimize exposure and transmission. Initially, patients were transferred off AOUs after testing negative for COVID-19. Protocols were changed as providers learned about the 14-day incubation period of the virus, the potential for false negative test results early in the course of infection, and the observation that several patients converted from negative to positive status within days of receiving negative test results. Patients were required to test negative and be free of symptoms for 72 hours before they were transferred from an AOU to a general unit. Staff working on AOU and COVID units were required to wear full PPE at all times. Social distancing among patients and staff was enforced ([CDC, 2020](#); [Lauer et al., 2020](#)). Portable hand washing stations were provided outside every unit. Psychiatrists switched from meeting with their COVID-positive patients in person to meeting by videoconference to minimize exposure and to decrease use of PPE during nationwide shortages ([Turer et al., 2020](#)). Group activities for patients were halted. Common areas of the units were reconfigured to create more space. Meals were delivered to the units rather than allowing patients to use the communal dining halls.

5.5. Utilization of videoconference technology

Cell phones were provided to patients in quarantine. These phones had access that was limited to pre-selected internet sites. Providers interacted, when feasible, virtually with quarantined patients (see [Reay et al., 2020](#)). There were challenges with internet connectivity, consistency of internet access, and audio/video quality due to increased need for wireless access in the hospital.

6. Discussion

6.1. Challenges associated with IPC measures

6.1.1. Effects of acute episodes of illness and cognitive impairment on IPC measure implementation

Acute psychiatric symptoms, severe cognitive deficits, and/or information processing difficulties can interfere with patient ability and/or willingness to follow IPC measures ([Hernández-Huerta et al., 2020](#); [Luyckx et al., 2020](#)). As outlined by [Li \(2020\)](#), it is difficult to enforce covering of a sneeze or cough and the maintenance of proper social distance on inpatient behavioral health units.

The importance of hand washing may be difficult to impress on a person with acute psychiatric symptoms. Many psychiatric facilities use non-alcohol-based hand sanitizer to prevent adverse outcomes if patients ingest it. Non-alcohol-based hand sanitizer is considered ineffective against COVID-19 ([Berardi et al., 2020](#)). The three behavioral health locations changed hand sanitizer products and began monitoring patient access.

Psychiatric patients may have a compromised ability to maintain personal hygiene, therefore requiring reminders from staff to attend to cleanliness. Some patients, for example, avoid changing their clothing or their bed linens, or bathing or showering, due to altered thoughts, paranoia, depression, or forgetfulness. Some psychiatric inpatients, particularly those who have been homeless or those who are suffering from paranoid ideation, may become anxious when hospital staff attempt to assist them with activities of daily living ([Wang et al., 2020](#)).

6.1.2. Impact of use of PPE

Face masks obscure the mouth, muffle the voice, and impersonalize the wearer. Patients experiencing acute psychosis, cognitive deficits, or mania may have difficulty interacting with masked staff ([Bojdani et al., 2020](#)). Paranoid patients may believe that staff are trying to hide their identity. Patients with cognitive or hearing impairments may struggle to understand masked staff. Some patients cannot identify who is speaking ([Wang et al., 2020](#)). A mask and/or full PPE can make it hard for others to interpret the emotions of the wearer ([Pal et al., 2020](#)). Full PPE can create uncertainty and fear in psychiatric patients. It may signify that something serious or medically dangerous is happening, that the patient must be very sick, or that staff intend to perform an undesired medical procedure on them ([Veluri, 2020](#)). It is therefore important that staff and physicians introduce themselves frequently to patients, and clarify their roles and reasons for the precautions, to allay patient fears and paranoia.

Behavioral health staff were asked to ensure that patients wore their masks properly. Some patients cannot tolerate the sensation of the mask, refrain from touching it, or keep both their nose and mouth covered. Some psychiatric patients may refuse to wear a mask. Constant directives from staff may cause patients to experience undue anxiety or to feel overly controlled, which is countertherapeutic from a psychiatric perspective and may necessitate increased use of "as needed" (PRN) medications. Frequent patient education about the importance of wearing masks, frequent hand washing or sanitizing, and maintaining physical distancing, all provided in a supportive manner, are essential on inpatient behavioral health units during a pandemic.

6.2. Quarantine status for inpatients

When one patient is under investigation or tests positive for COVID-19, the entire unit at that facility must be placed on quarantine status. Patients cannot be moved from their room unless it is for the purpose of discharge from the facility. No new patients can be admitted to the unit until the unit is taken off quarantine status. Behavioral health units can be adversely affected by placement on quarantine status, and patients may be affected by changes that are critical to maximize their health and safety. Hospital safety policy requires staff to monitor psychiatric inpatients every 15 minutes, so the doors to patient rooms must be opened; this required practice, however, may increase viral transmission. On a psychiatric unit, locking a patient behind a door is considered a form of restraint and necessitates staff to perform direct continuous observation. Quarantine status can pose an ethical dilemma if it is used to isolate a patient for IPC measures as opposed to harmful behaviors ([Brody et al., 2020](#); [Giallonardo et al., 2020](#); [Russ et al., 2020](#)). Another dilemma arises when patients refuse to be tested for COVID-19. They must be placed on quarantine status for 14 days or until they agree to be tested. These challenges during the study period were addressed by repeated education, reassurance, and support by hospital staff.

6.3. Testing in psychiatric facilities

Testing for COVID-19 is critical for identification, tracking, and containment. Initially, due to severe shortages, COVID-19 tests could only be obtained from the State's Health Department. It took up to seven days to obtain results. In early April 2020, VHMC obtained testing kits and created a screening protocol for the highest-risk patients, with results provided in 48 hours. On April 29, 2020, VHMC obtained the rapid COVID-19 test (12-hour results). The rapid test was made available to all psychiatric admissions, regardless of observable symptoms (discussed in [Zhang et al., 2020](#)).

6.4. Remote interviewing

Prior to the pandemic, most patients met with their psychiatric providers in person in small interview rooms. During the pandemic, patients not on quarantine status were interviewed in the dayroom, to allow for social distancing. This practice interfered with patient privacy. The change affected some patients' willingness to discuss symptoms or sensitive issues relevant to their treatment. During the pandemic, psychiatric providers met with quarantined patients using telemedicine. Hospital staff held a video device during these meetings for the patients who were too psychiatrically or medically compromised to manage them safely or correctly. This close contact between staff and patient increased risk of viral transmission. Some patients were suspicious of the technology, believing the interview was being recorded or broadcast. Due to the small screen, providers could see only the patient's face. This limitation increased difficulty assessing patients' affect and physical issues such as tardive dyskinesia. Nearby noise was a significant interference, making it hard for providers and patients to hear each other during telemedicine meetings. For some patients, difficulty locating the source of the provider's voice was disorienting and frightening. Providers became increasingly aware of these challenges with the use of technology and attempted to address them with patients.

Other meetings were changed to occur by phone or by video visit during the study period. Discharge planning meetings and family meetings were conducted by phone rather than in person. Because outpatient providers and family could not visit patients during the first wave of the pandemic, it was difficult to fully ascertain treatment response and/or readiness for discharge from the hospital. Legal preparations and mental health court proceedings were conducted via teleconference, which were challenging for some patients to follow. Recognizing these difficulties, some legal advocates at the behavioral health facilities donned PPE and met face-to-face with non-quarantined

patients to explain the process and provide support.

6.5 Study data compared to Arizona state statistics By May 19, 2020, according to the Data Dashboard in 2020, Maricopa County, the largest county in the state of Arizona, documented a COVID positivity rate in the general population of 5.9%. By June 15, 2020, this rate had increased to 8.56%. The 39-patient cohort in the current study represented 11% of the total psychiatric inpatient population at VHMC during the study period. The rate of hospitalization in Maricopa County for the treatment of COVID-19 was 10% on June 15, 2020. This statistic is consistent with the rate found in the study cohort and with a rate of 10.9% in a comparable New Jersey psychiatric facility (COVID-19, 2020).

In May of 2020, one-half of the general population in Arizona who tested positive for COVID-19 were 20–44 years old. In Arizona, 18% of the COVID-positive general population was white, 26% was Hispanic, and 3% was Black. Fifty-two percent of the Arizona state COVID population were female and 48% were male. The study cohort had more male patients than did the Arizona state statistics because the initial COVID outbreak at the behavioral health facility occurred on an all-male unit (see Table 1 for comparisons). Nearly one-fourth (24%) of Arizona's COVID-positive patients reported chronic medical conditions including diabetes, cardiac disease, hypertension, COPD, and chronic renal or liver disease.

In the study cohort, the percentages of Hispanic (21%) and Black (29%) patients were similar to the general population of the state of Arizona. Compared to Arizona state statistics, the study cohort had more than twice the number of patients (56%) with COVID-19-related medical comorbidities than did the general population in Arizona. This finding is not surprising, because SMI patients are at high risk for medical complications and die approximately 25 years earlier than the general population (Parks et al., 2006).

The study's facilities serve primarily SMI patients who are indigent and have medical comorbidities. These factors might have affected the early spike in COVID cases on the behavioral health units. 6.6 Success in managing COVID-19 on behavioral health units Early in the study period, there was a sharp rise in positivity in the behavioral health facilities after the first three COVID-positive patients were identified. With constantly evolving information about COVID-19, implementation of tighter IPC measures, and availability of rapid testing, the rate of infection on behavioral health units decreased. These changes suggest efficacy of implemented measures. Dedication of hospital staff in applying the IPC measures with fidelity cannot be understated. Only three patients in the study cohort developed significant medical complications from COVID infections, and only one patient remained in serious condition at the conclusion of the study period.

For patients and staff, the biggest challenge was enforcing the restrictions on the behavioral health units that were on quarantine status. Inpatients required constant direction and support to maintain relative isolation in their hospital rooms. Boredom was a significant problem. Most patients expressed more concern about the no-visitor policy than about the virus. Many community placements refused COVID-positive or exposed patients, thwarting discharge plans and increasing LOS in the hospital.

6.5. A perspective from Asian countries

Asia accounts for 58% of the world population, and approximately 15% of COVID cases and deaths, while the USA and Europe each account for 30–40%. Thus, infection rates appeared lower during the study period in Asian countries, and outcomes appeared better in Asian countries than they did in Arizona state, USA. These findings may be due to various factors, including a younger Asian than USA population, and more centralized and coordinated health care strategies in Asia (Tandon, 2021a). The lower infection and death rates in Asia could also be due to systematic underreporting of COVID-19 cases (Samaddar et al., 2020). In India, for example, there was lower morbidity from the alpha variant

of COVID-19 during the initial wave of the pandemic, but a catastrophic upsurge of cases and fatalities in India in the spring of 2021 due to the delta variant. Similar drastic increases in the number of cases were documented in other South Asian countries such as Nepal, Afghanistan, and Bangladesh (Bhutta et al., 2021).

The pandemic revealed the strengths and exposed the weaknesses of health care systems around the world, highlighting the importance of a coordinated global response. The importance of sharing resources, sharing accurate information, and engaging in clear communication among international governments and community/organizations is critical to manage a pandemic (Tandon, 2021a). Treating psychiatric patients in inpatient settings is particularly challenging in middle- and low-income Asian countries. Resources are limited, fewer psychiatric providers may be available, and there may be a significant stigma against seeking behavioral health services. Furthermore, the COVID pandemic has had unpredictable consequences and effects on hospital care of psychiatric patients. In Turkey, one study found that 10% of patients receiving medical treatment for COVID required psychiatric consultation. This finding suggests that COVID-19 may be associated with increased vulnerability to neuropsychiatric disorders, increasing negative outcomes of the disease (Turhan et al., 2021). Despite concerns in the medical community about the potentially adverse effects of COVID-19 on emotional well-being, a modest reduction in total suicide rates has been identified since the pandemic began. One study found no significant net increase in suicide rates during the first year of the COVID-19 pandemic (Tandon, 2021b). In Japan, inpatient hospitalizations appear reduced by about 2% (Usuda et al., 2021); however, seclusion rates within the inpatient population reportedly increased by 0.4–0.7% during the pandemic. This increased need for the use of seclusion in inpatient psychiatric hospital settings could be due to staff having no choice but to isolate patients with suspected COVID-19 if they cannot adhere to quarantine guidelines (Usuda et al., 2021). Confounding factors are that many people may not have sought psychiatric treatment during the pandemic for fear of potential exposure to COVID in hospital or clinic settings. Even severely ill patients may have stayed at home, some may have died from COVID before they could receive psychiatric treatment, and some suicides may have gone unreported.

7. Conclusions

Infection control prior to the pandemic was daunting for psychiatric facilities, especially the population served at systems like VHMC described in this article. Overall, the three large behavioral health facilities at VHMC were largely successful in identifying and quarantining patients with COVID-19 early in the pandemic. The risk of contracting the virus during the study period was high, and the facilities' actions may have prevented new cases of COVID and mitigated complications for those with the disease. Despite the challenges and restrictions, psychiatric care was provided safely to all patients during the study period and no patient was denied behavioral health care.

It is difficult to quantify the negative impact of IPC protocols and procedures on patients' psychiatric symptoms and recovery. Isolation, detachment, loneliness, lack of group activities, and limited in-person meetings with providers and outpatient treatment teams may have adversely affected illness course and patient LOS in the hospital. For several patients, use of physical restraints and involuntary medication was a regrettable result of enforcing quarantine. Increased LOS for discharge-ready patients was frustrating and even demoralizing. Use of telemedicine may have affected the quality of psychiatric assessments in ways that are still unknown. It remains unclear if overall treatment and patient satisfaction were affected by the imposed IPC measures.

Future research into these topics is needed to inform behavioral health providers about IPC measures in inpatient psychiatric settings, because these protocols may have to be in place for some time to come. Research focused on evaluating effects of specific and different IPC interventions/protocols on patient experience and outcomes is needed.

Table 4
Outcome of COVID-related comorbidities.

Outcomes of COVID-19 Infection	N (%)
Fully recovered	38 (97)
Mild symptoms	33 (84)
Medical inpatient care	3 (8)
Asymptomatic and afebrile	3 (8)
Fully recovered	38 (97)

N = number of patients. (%) = percentage

Creative solutions for delivering care via videoconference technology and use of technology to provide patients with therapeutic activities should be more aggressively developed, utilized, and evaluated to improve adjunctive treatments during this pandemic (see Table 4).

Declaration of Competing Interest

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