Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original Research Article

The Impact of the COVID-19 Pandemic on Psychiatric Emergency Service Volume and Hospital Admissions

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Background: *During the COVID-19 pandemic, there have been an increasing number of emergency department visits for behavioral health reasons, even as overall emergency department volumes have decreased. The impact of the pandemic and related public health interventions on specialized psychiatric emergency services has not been described. These services provide high-intensity care for severely ill patients who are likely to be homeless and underserved.* **Objective:** *We describe the change in total volume and psychiatric hospitalization rates among three psychiatric emergency services across the United States.* **Methods:** *Changes in volumes and hospitalization were assessed for statistical significance using a seasonal autoregressive integrated moving average with exogenous factors model from January 2018 to December 2020.* **Results:** *The pandemic's impact on volumes and hospitalization varied by site. In Denver (CO), there was a statistically significant 9% decrease in overall volumes, although an 18% increase in hospitalizations was not significant. In New York City (NY), there was a significant 7% decrease in volumes as well as a significant 6% decrease in hospitalizations. In Portland (OR), volumes decreased by 4% and hospitalizations increased by 6% although differences did not reach statistical significance.*
Conclusions: *There has been a decrease in volume at these services after the pandemic, but there are substantial variations in the magnitude of change and demand for hospitalization by region. These findings suggest a need to understand where patients in crisis are seeking care and how systems of care must adapt to changing utilization in the pandemic era.*
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Key words: emergency psychiatry, psychiatric emergency services, COVID-19, community mental health, health services.

INTRODUCTION

On March 11, 2020, the World Health Organization described COVID-19 to be a global pandemic. Soon thereafter, high rates of psychological distress including anxiety, depression, and insomnia were observed among survivors, health care workers, and the general public.[1] These effects relate not only to the public health interventions and social distancing required to reduce infection but also, in some instances, the direct neuropathology of severe acute respiratory syndrome

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coronavirus 2 (SARS-CoV-2) infection.[2] Moreover, the mental health burden of COVID-19 and its response has complicated public health responses to the pandemic. Many patients are less likely to seek medical care,[3,4] and health care workers struggle with high rates of burnout.[5] The impact of the pandemic on suicide and self-harm remains ambiguous.[6]

Many patients access mental health care through emergency departments (EDs), particularly for high-risk conditions including psychosis and suicidal ideation. The psychiatric consequences of COVID-19 and related public health responses have thus been reflected in changing patterns of ED utilization for behavioral health care during the pandemic. Earlier in the pandemic, the Centers for Disease Control and Prevention noted a dramatic drop in ED visits nationally, although the number of mental health ED visits increased over the same period.[7] Later Centers for Disease Control and Prevention reports noted that the proportion of ED visits for behavioral health reasons increased by 24% for children aged 5–11 years and 31% for children aged 12–17 years from 2019 to 2020.[8] Several single-site studies outside of the United States have observed an increasing number of ED visits for self-harm,[9,10] and a Centers for Disease Control and Prevention report described an increase in ED visits for suicide attempts and overdoses.[11] All these data reflect general ED populations rather than specialty emergency mental health services. One research letter described a drop in volume in a single psychiatric emergency service during the pandemic's first month.[12]

No data describe the impact of the ongoing pandemic on specialty psychiatric emergency services across the United States after the first month of the pandemic. Specialty emergency services—sometimes called psychiatric emergency services or comprehensive psychiatric emergency programs—provide robust assessment and management of behavioral crises with a multidisciplinary team in concert with community- and hospital-based partnerships. These services diagnose and manage psychiatric presentations in the ED setting to reduce ED length of stay, avert psychiatric hospitalizations, and promote recovery in less restrictive treatment settings.[13] Through their capacity to treat high-acuity patients and monitor the quality of behavioral health care delivered,[14] these services offer a unique resource for providing accessible, high-quality psychiatric care to communities underserved by mental health providers.[15]

In this report, we describe the impact of the COVID-19 pandemic and its public health response on encounter volume and hospitalizations among three psychiatric emergency services across the United States.

METHODS

Sites

Site one, Denver Health, is an integrated, academically affiliated safety net health system in Colorado. Denver Health Medical Center has an 18-bed psychiatric emergency service integrated into a level 1 trauma center. The Denver Health Psychiatric Emergency Service (PES) has 24/7 psychiatry faculty coverage; faculty work alongside dedicated behavioral health nurses, advanced practitioners, and technicians. The PES receives adult and pediatric patients directly via ambulance, police, and walk-ins as well as on referral from the medical ED.

Site two is the Comprehensive Psychiatric Emergency Program at the Columbia University Medical Center in New York City, New York. The Comprehensive Psychiatric Emergency Program is part of a large multicampus academic medical center. The emergency psychiatry service provides psychiatric consultation services throughout the adult ED and operates a 24-bed locked psychiatry area. The team includes psychiatrists, nurse practitioners, psychiatric nurses, social workers, and recreation therapy. After evaluation, adult patients are routed to a variety of outpatient clinics and inpatient treatment areas both within the institution and with partnering organizations. Patients arrive as walk-ins, via ambulance, and via police.

Site three is Unity Center for Behavioral Health in Portland (OR). Unity is a 100-bed, academically affiliated psychiatric hospital with a PES. Unity is a partnership hospital with four regional health systems. The PES evaluates patients who arrive by walk in, ambulance, and on transfer from partner EDs. The service includes psychiatric technicians and nurses, psychiatric social workers, psychiatrists, psychiatric nurse practitioners, and peer support staff.

Outcomes

The outcomes of interest were changes in the total encounter volume (number of patient encounters) and

TABLE 1. Change in Psychiatric Emergency Service Volume and Hospitalization Rates During the COVID-19 Pandemic

Site	All encounters, n (% change)		Hospitalizations, n (% change)		Share of encounters resulting in hospitalization, % (% change)	
	2019	2020	2019	2020	2019	2020
Denver	5329	4840 (−9.2)	1023	1100 (+18.4)	19.2	22.7 (+18.2)
New York City	6851	6358 (−7.2)	3271	2841 (−6.4)	47.7	44.7 (−6.3)
Portland	10,832	10,354 (−4.4)	1894	1926 (+6.4)	17.5	18.6 (+6.3)
All sites	23,012	21,552 (−6.3)	6188	5867 (−5.2)	26.9	27.2 (+1.1)

total hospitalizations to medical or psychiatric inpatient units due to the COVID-19 pandemic. We obtained encounter volume and frequency of hospitalization among patients seen from January 2018 to December 2020 from each site's administrative and quality improvement data. A seasonal autoregressive integrated moving average (ARIMA) with seasonal and exogenous factors, or SARIMAX, model was applied to analyze the impact of the COVID-19 pandemic on volume and hospitalization rates. The SARIMAX model identifies statistically significant variations over time while also accounting for confounding fluctuations due to seasonal changes in volume. The SARIMAX accommodates analysis of encounters that may not be independent, as when encounters reflect multiple visits by the same patient. SARIMAX was chosen over alternative models such as Fourier analysis for its ability to simultaneously accommodate long-term linear trends in volume; varying seasonal changes in data; an exogenous variable (COVID-19 onset); and the potential that the impact of the exogenous variable may lag in time.[16,17] The optimal hyperparameters of the model were obtained using grid search. A unique model was created for both total volume and hospitalizations at each of the three sites. Each model was trained using data from January 1, 2018, to February 29, 2020. Each model was then fitted to a full set of data including an exogenous factor indicating if the datapoint took place before or after March 15, 2020. The coefficient of the exogenous COVID-19 variable was used to determine if there were significant changes in the volume of encounters or hospitalizations after controlling for historic volumes. All data were analyzed using Python v3.80 (Python.org) using the Statsmodels and Pandas packages.[18,19]

Data and code can be found at https://github.com/DenverHealth-BH/PES_volumes. The institutional review boards at all participating sites authorized this study.

RESULTS

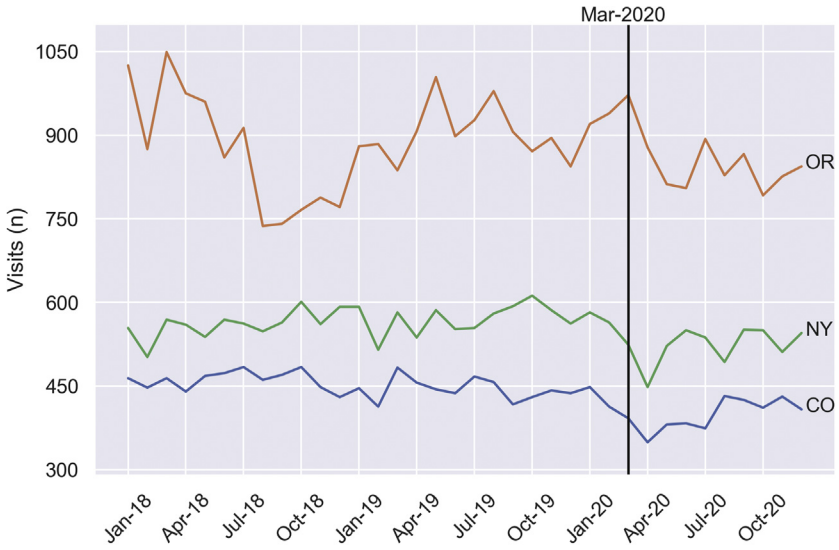
Overall volume decreased at all three sites from 2019 to 2020. This drop was more pronounced when confining analyses to April–December, over which time volumes dropped 9.8%, 9.0%, and 8.1% in Denver, New York City, and Portland, respectively. The percentage of ED encounters resulting in admission increased by 18.4% in Denver and by 6.4% in Portland and decreased by 6.4% in New York City. The overall number of admissions increased in Denver and Portland but decreased in New York City. Table 1 describes the overall change in volume and hospitalizations from 2019 to 2020. Figure 1 illustrates total volumes by month from 2018 to 2020. Figure 2 illustrates hospitalizations by month from 2018 to 2020.

SARIMAX models were applied to describe the statistical significance of changes in volume and hospitalization rates due to COVID-19 over time at all sites. Appendix 1 details and illustrates these analyses. In Denver, there was a significant decrease in overall census volume due to COVID ($z = -4.73$, $P < 0.0001$). There was a significant initial decrease in admission rates, which subsequently increased such that by the end of 2020, the pandemic did not appear to correlate with a significant increase in hospitalizations ($z = -1.90$, $P = 0.06$). In New York City, there was a significant decrease in volume ($z = -6.09$, $P < 0.0001$) and hospitalizations ($z = -2.34$, $P = 0.02$) due to the pandemic. In Portland, the change in overall census briefly decreased, but the impact of the pandemic on volume ($z = -0.47$, $P = 0.64$) and hospitalization rates ($z = -0.252$, $P = 0.80$) remained statistically insignificant.

DISCUSSION

While volume at specialized emergency psychiatric services decreased due to the pandemic, the size of this

FIGURE 1. Total Psychiatric Emergency Service Volume by Month.

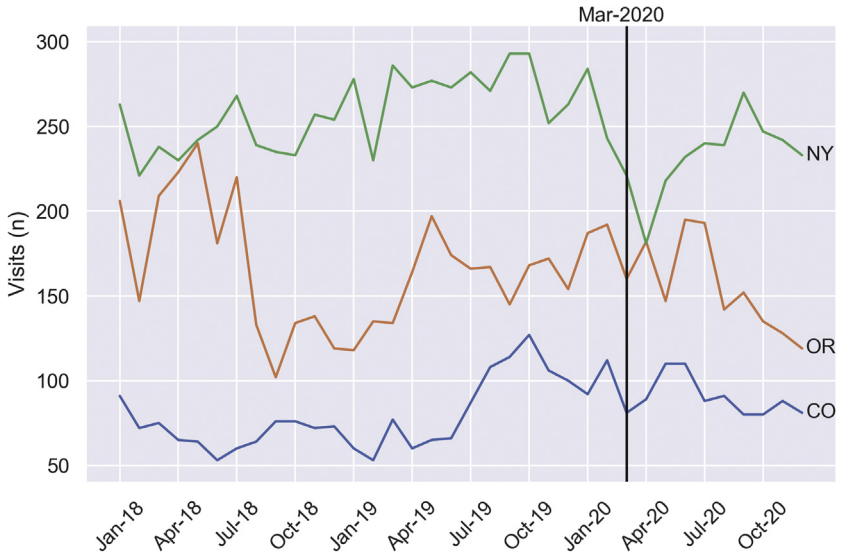


decrease and the impact on total number of hospitalizations varied substantially by locale. This variation suggests a need to better understand how emergency psychiatric services and inpatient psychiatric units fit within local networks of care that are stressed by the conditions of the pandemic.

Despite the mental health challenges of the pandemic, volume at these high-intensity psychiatric emergency programs dropped during the pandemic—although this drop did not reach statistical significance at the Portland site. This phenomenon runs counter to the overall trend of more ED visits involving behavioral health emergencies.[7] There are several reasons why volume trends at specialty psychiatric emergency services might not mirror the trend in general ED visits. During the pandemic, cities expanded emergency shelters to allow social distancing and offered short-term housing for homeless patients in hotels. These interventions might decrease care-seeking among PES patients, who are often homeless. It may also be that lower acuity presentations are not presenting to emergency psychiatric programs; rather, persons are contacting poison control centers[20,21] crisis lines[22] or presenting with somatic complaints to medical EDs. Some patients may be avoiding hospitals for fear of COVID-19 infection. Another explanation may lie in health systems' struggles to maintain staffing and operations during the early pandemic. Such operating challenges may have reduced capacity and PES volumes notwithstanding a demand for services. Although Portland experienced a statistically significant drop in volume earlier in the pandemic, these volumes rebounded somewhat through the end of 2020 and were within the range forecasted by the SARIMAX model.

There remained a large number of patient encounters resulting in hospitalization, particularly in Denver and Portland. The overall number of hospitalizations did not significantly change in these cities, although the share of encounters resulting in an admission increased by 18% and 6% from 2019 to 2020 in those cities, respectively. The decrease in overall volume is hence likely restricted to primarily lower acuity patient presentations. Patients with more severe illness or from underserved communities have continued to rely on hospital-based psychiatric emergency services. Some sicker patients may have avoided PES visits in the same manner as lower acuity patients, but this decreased volume may have been offset by other pandemic-related limitations on mental health service that resulted in increased admissions. For example, the unavailability of intensive outpatient and residential crisis programs limits opportunities for averting hospitalization once patients present to a PES. Moreover, patients who have foregone outpatient psychiatric care during the pandemic may be presenting to a PES only once too ill to safely discharge. Pandemic-era changes in outpatient care may disproportionately

FIGURE 2. Hospitalization After Psychiatric Emergency Service Visit by Month.



impact certain patient groups, for example, those who cannot use telepsychiatry.[23,24] Clinician leaders managing services with increasing hospitalization rates must anticipate staffing and workflows to care for a disproportionately sicker patient population who may require extended stays while awaiting inpatient hospitalization. We lack data on restraint, seclusion, and length of stay to describe how the course of care in the ED may have changed because of the pandemic.[14]

Alone among these sites, New York City had a marked decrease in hospitalizations in the pandemic era to date. New York City was among the first and worst hit cities of the pandemic in the United States. Inpatient psychiatric hospital closures were widespread, and field hospitals were common. These developments were less common in Denver and Portland. Homeless patients were emergently housed in New York hotels, whereas congregate living (albeit with more physical distancing) was more common in the other cities. When psychiatric hospitalization was available, inpatient programming was often cut and lengths of stay increased because of closure of supportive discharge programs. Thus, the observed decrease in New York City admissions may reflect reduced inpatient availability rather than reduced demand. Prolonged inpatient stays also decreased throughout emergency services, which cannot disposition patients. The curtailed operation of intensive community mental health services and police decreased clinical contact with severely ill patients and thereby decreased the number of referrals to the PES. The variation in volume changes by city suggests that the role of a specific PES varies among local communities, and the pandemic's impact on psychiatric services can be expected to vary as well. As 2020 progressed, psychiatric hospitalizations increased again in New York (Figure 2).

There are limitations to this study. The use of encounter-level administrative data is consistent with prior reports and highlights implications for operating emergency psychiatric services but precludes insight into patient-level factors that might be driving utilization changes. Data on referral source and mode of arrival might contribute to an understanding of how changes in the community impacted PES volumes. These encounters may represent changing ED use among a subset of high utilizing or frequently hospitalized patients, and we cannot discern diagnostic risk factors for presentation and hospitalization. The consistency of observed changes across multiple sites, coinciding with the onset of the pandemic, makes it highly likely that these changes are due to the pandemic, and the ARIMA model allows us to control for confounding volume changes over time—nevertheless, the findings remain correlative. This methodology cannot discern the number of hospitalizations that result directly from COVID-19 infection and related psychiatric sequelae.[25]

These findings have important implications for research and public health planning. First, national data reports describing the impact of the pandemic on emergency psychiatric utilization should be acknowledged as limited: There have been appreciable regional variations on emergency psychiatric volumes and hospitalization rates since the pandemic began. Given the role of EDs and PESs as safety net mental health providers, understanding local nuance is critical to ensuring the needs of underserved and minority patients are not neglected through overgeneralized interpretation of national surveillance studies. This study included three urban PESs, and future investigation might incorporate rural crisis programs and additional geographic regions. In addition to PESs, fully describing changes in psychiatric emergencies requires data from alternative settings for seeking behavioral health care including crisis lines, poison control centers, community-based urgent cares, and walk-in crisis services. These settings are not often represented in traditional insurance and public health surveillance systems. Finally, observed increases in psychiatric hospitalization should be understood in terms of not only patients' clinical acuity but also decreasing access to alternative levels of care such as respite services and assertive community treatment programs. Anecdotally, higher intensity outpatient services are less accessible during the pandemic, yet there has been no accounting of the decrease in community care capacity.

CONCLUSIONS

The impact of the COVID-19 pandemic and related public health interventions on the accessibility and quality of psychiatric care are nuanced and evolving. The decreased use of psychiatric emergency services raises concerns as to where patients are receiving care, and whether health systems are adequately recognizing and treating psychiatric presentations outside of hospital and specialty mental health settings. The patients who continue to use these emergency services are frequently in need of high-intensity services such as hospitalization. We are concerned that these hospitalizations represent a patient population disproportionately impacted by the pandemic.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jaclp.2021.05.005.

Conflict of Interest: Dr. Simpson receives royalties from Taylor and Francis, unrelated to the present work. No other authors report disclosures.

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References

1. Cabrera MA, Karamsetty L, Simpson SA: Coronavirus and its implications for psychiatry: a rapid review of the early literature. Psychosomatics 2020; 61:607–615
2. Mazza MG, De Lorenzo R, Conte C, et al: Anxiety and depression in COVID-19 survivors: role of inflammatory and clinical predictors. Brain Behav Immun 2020; 89:594–600
3. Eberly LA, Kallan MJ, Julien HM, et al: Patient Characteristics Associated with Telemedicine Access for Primary and Specialty Ambulatory Care During the COVID-19 Pandemic. JAMA Netw Open 2020; 3:e2031640
4. Islam JY, Vidot DC, Havanur A, et al: Preventive behaviors and mental-health related symptoms among immunocompromised adults during the COVID-19 pandemic: an analysis of the COVID Impact Survey. AIDS Res Hum Retroviruses 2021; 37:304–313
5. Magill E, Siegel Z, Pike KM: The mental health of Frontline health care providers during pandemics: a rapid review of the literature. Psychiatr Serv 2020; 71:1260–1269
6. John A, Okolie C, Eyles E, et al: The impact of the COVID-19 pandemic on self-harm and suicidal behaviour: a living systematic review. F1000Res 2020; 9:1097
7. Hartnett KP, Kite-Powell A, DeVies J, et al: Impact of the COVID-19 pandemic on emergency department visits - United States, January 1, 2019-May 30, 2020. MMWR Morb Mortal Wkly Rep 2020; 69:699–704
8. Leeb RT, Bitsko RH, Radhakrishnan L, et al: Mental health-related emergency department visits among children aged <18 Years during the COVID-19 pandemic - United States, January 1-October 17, 2020. MMWR Morb Mortal Wkly Rep 2020; 69:1675–1680
9. Hernandez-Calle D, Martinez-Ales G, Mediavilla R, et al: Trends in psychiatric emergency department visits due to suicidal Ideation and suicide attempts during the COVID-19

pandemic in Madrid, Spain. J Clin Psychiatry 2020; 81:20l13419
10. Joyce LR, Richardson SK, McCombie A, et al: Mental health presentations to Christchurch hospital emergency department during COVID-19 lockdown. Emerg Med Australas 2020; 33:324–330
11. Holland KM, Jones C, Vivolo-Kantor AM, et al: Trends in US emergency department visits for mental health, overdose, and Violence outcomes before and during the COVID-19 pandemic. JAMA psychiatry 2021; 78:372–379
12. Goldenberg MN, Parwani V: Psychiatric emergency department volume during Covid-19 pandemic. Am J Emerg Med 2021; 41:233–234
13. Halmer TC, Beall RC, Shah AA, et al: Health policy considerations in treating mental and behavioral health emergencies in the United States. Emerg Med Clin North Am 2015; 33:875–891
14. Balfour ME, Tanner K, Jurica PJ, et al: Crisis Reliability Indicators supporting emergency services (crises): a Framework for developing Performance Measures for behavioral health crisis and psychiatric emergency programs. Community Ment Health J 2016; 52:1–9
15. Zhang X, Carabello M, Hill T, et al: Trends of Racial/Ethnic differences in emergency department care outcomes among adults in the United States from 2005 to 2016. Front Med (Lausanne) 2020; 7:300
16. Hategeka C, Ruton H, Karamouzian M, et al: Use of interrupted time series methods in the evaluation of health system quality improvement interventions: a methodological systematic review. BMJ Glob Health 2020; 5:e003567
17. Jandoc R, Burden AM, Mamdani M, et al: Interrupted time series analysis in drug utilization research is increasing: systematic review and recommendations. J Clin Epidemiol 2015; 68:950–956
18. Seabold S, Perktold J: Statsmodels: Econometric and statistical modeling with Python. Proceedings of the Python in Science Conference [cited 2020 March 9]; Available from: https://conference.scipy.org/proceedings/scipy2010/pdfs/seabold.pdf; 2010
19. McKinney W: Data Structures for statistical Computing in Python. Proceedings of the Python in Science Conference [cited 2021 March 9]; Available from: https://conference.scipy.org/proceedings/scipy2010/mckinney.html; 2010
20. Abbott E: Pandemic 'red flags' poison control calls for cleaning products, hand sanitizer, drug overdoses. Buffalo, NY: WBFO NPR [updated February 24, 2021; cited 2021 March 9]; Available from: https://news.wbfo.org/post/pandemic-red-flags-poison-control-calls-cleaning-products-hand-sanitizer-drug-overdoses; 2021
21. Ontiveros ST, Levine MD, Cantrell FL, et al: Despair in the time of COVID: a look at suicidal ingestions reported to the California Poison Control System during the pandemic. Acad Emerg Med 2021; 28:300–305
22. Colorado Department of Human Services: Colorado crisis line continues record-breaking volume during COVID-19 pandemic [updated November 23; cited 2021 March 9]; Available from: https://cdhs.colorado.gov/press-release/colorado-crisis-line-continues-record-breaking-volume-during-covid-19-pandemic; 2020
23. Simpson SA, Dumas A, McDowell AK, et al: Novel Coronavirus and related public health interventions are negatively impacting mental health services. Psychosomatics 2020; 61:568–571
24. Muruganandam P, Neelamegam S, Menon V, et al: COVID-19 and Severe Mental Illness: impact on patients and its relation with their awareness about COVID-19. Psychiatry Res 2020; 291:113265
25. Ferrando SJ, Klepacz L, Lynch S, et al: Psychiatric emergencies during the height of the COVID-19 pandemic in the suburban New York City area. J Psychiatr Res 2021; 136:552–559