The Effect of COVID-19 on Mood Disorders in Urban and Suburban Detroit

Sean Yaphe, MD,[1] Lakshmi Sundaresan, MD,[1] Jonathan D. Freedman, MD,[1] Samuel J. Weinberg, MD,[1] Ivana A. Vaughn, PhD,[2,3] Lois E. Lamerato, PhD,[2,3] Katarzyna Budzynska, MD[1,3]

Introduction: The COVID-19 pandemic has increased the global experience of anxiety and depression owing to social isolation and government-mandated quarantine for transmission reduction. To date, literature surrounding the mental health effects of COVID-19 for the U.S. population is limited.

Methods: This is a retrospective study from a large metropolitan Detroit health system. Patient encounters between December 23, 2018 and June 22, 2021, with March 23, 2020 being the start of Michigan state-wide lockdown, were used to define pre— and post—COVID-19 encounters, respectively. The data were divided into Detroit and non-Detroit on the basis of patient ZIP code. All patients aged $\geq$13 years with a visit with a family medicine provider were included. Outcome variables included Patient Health Questionnaires-2 and -9 and General Anxiety Disorder-7 scores; diagnoses of depression, anxiety, adjustment, and grief disorders; antidepressant prescriptions; and behavioral health referrals. Logistic regression was used to determine the incidence of composite mood disorder, depression, and anxiety.

Results: A total of 20,970 individuals were included in this study: 10,613 in the Detroit subgroup and 10,357 in the non-Detroit subgroup. A total of 88.2% of the Detroit population were Black, and 70% were female. Logistic regression shows that the incidence of composite mood disorder decreased with increasing age (OR=0.787, 0.608, 0.422, and 0.392; $p<0.001$). Male sex is a protective factor (OR=0.646, $p<0.001$). Federal insurance is the only factor presenting a statistically significant increased risk (OR=1.395, $p<0.001$). There was no statistical difference between residing in urban and suburban areas in the incidence of composite mood disorder (OR=0.996, $p=0.953$).

Conclusions: This research demonstrates that residing in an urban setting did not increase the risk of developing a mental health disorder during the COVID-19 period.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic continues to cause a major health crisis affecting the global population, with over 95.4 million cases in the U.S. and over 600 million worldwide. There are over 1.05 million confirmed deaths in the U.S. and 6.5 million

From the [1]Department of Family Medicine, Henry Ford Hospital, Detroit, Michigan; [2]Department of Public Health Sciences, Henry Ford Health, Detroit, Michigan; and [3]Henry Ford Health + Michigan State University Health Sciences, Detroit, Michigan

Address correspondence to: Katarzyna Budzynska, MD, Department of Family Medicine, Henry Ford Medical Center - Harbortown, 3370 E Jefferson, Detroit MI 48207. E-mail: kbudzyn1@hfhs.org.

worldwide.[1] Severe acute respiratory syndrome, Middle Eastern respiratory syndrome, and Ebola outbreaks and their subsequent isolation and quarantine periods were associated with adverse mental health consequences, particularly in anxiety and depression.[2−4] However, the global impact of each of these recent viruses pales in comparison with the ongoing global impact of the COVID-19 pandemic. COVID-19 and the resultant attempts to create public safety policies continue to introduce new stressors into ordinary life.[5]

Preliminary evidence suggests that symptoms of anxiety and depression are common psychological reactions to the COVID-19 pandemic.[6−11] Higher symptoms of anxiety and depression have been associated with lower household income,[10,11] medical comorbidities,[11−14] living in urban areas,[11,13] female sex,[10,12−17] and non-Black Americans.[18]

In addition to adverse mental health outcomes, the pandemic has had an effect on increased weight gain in both adults[19] and children and adolescents.[20,21] Early data demonstrate increased levels of mental health diagnoses during the COVID-19 pandemic compared with prepandemic levels.[7,8,14,17] One meta-analysis using largely inpatient samples from China found an increase in both anxiety and depressive symptoms, attributing the cause of increased mood disorders primarily to the inability to see loved ones in person due to hospitalization and quarantine along with fear from the disease or misinformation.[7]

Thus far, most literature on the impacts of the COVID-19 pandemic on mental health has originated from Asia and Europe. One recent North American study aimed to address this gap of data and noted a threefold increase in the prevalence of depression during the COVID-19 pandemic compared with that before, identifying a higher burden of depressive symptoms reported by people of lower SES and greater exposure to stressors.[5]

As the global population is increasing toward urban living, mental health may become negatively impacted. High crime rates, violence, homelessness, pollutants, drug abuse, and lack of adequate mental health services have been identified as challenges to mental health in urban areas.[22] Current evidence of the impact of the COVID-19 pandemic on urban populations is lacking, and there is minimal literature comparing the mental health of urban with that of suburban populations during this pandemic.

The primary objective of this study was to examine the impact of COVID-19 on the incidence of mental health and anxiety and depression in the urban and suburban populations in a large metropolitan Detroit health system.

METHODS

Study Population
The study population was identified from the administrative databases of a large quaternary healthcare system in metropolitan Detroit. Data were extracted from linked electronic health records for the identified patients and subsequently analyzed.

With IRB approval, this study was a retrospective study using a large healthcare system administrative database with patient data analyzed from visits. Inclusion criteria included patients aged ≥13 years and who had an outpatient encounter between December 23, 2018, and June 22, 2021. An encounter was considered an in-person or scheduled telephone or video visit in both the pre−COVID-19 and post−COVID-19 periods. Patients were excluded if they were aged <13 years. The study range was defined as 15-month time periods before and after the Michigan state lockdown on March 23, 2020. These periods were referred to as the prelockdown (December 23, 2018, to March 22, 2020) and postlockdown (March 23, 2020, to June 22, 2021) periods.

Measures
The main outcome variable was incidence of composite mental health (diagnoses, positive screening tests, specialty referrals, or medication orders). Diagnoses were identified by encounter diagnoses coded with ICD-10-CM. The study team included diagnosis for depression (F32.X), anxiety (F41.X), grief (F43.81), and adjustment disorder (F43.2X). Mental health disorders were defined by positive screening tests for a Patient Health Questionnaire (PHQ)-9 or General Anxiety Disorder-7 (GAD-7) referrals to the hospital system's behavioral health virtual service or in-person behavioral health service and, finally, all commonly prescribed medications for mental health conditions. This included the medication classes of selective serotonin reuptake inhibitors and serotonin−norepinephrine reuptake inhibitors as well as bupropion and buspirone. The PHQ-9 is a multipurpose instrument for screening, diagnosing, monitoring, and measuring the severity of depression. Total scores of 5, 10, 15, and 20 represent cut points for mild, moderate, moderately severe, and severe depression, respectively. For the GAD-7, a score 5 or greater was positive. In this center, a medical assistant protocol has been developed to trigger the PHQ-9 evaluation. The medical assistant will see the patient first and evaluate with the PHQ-2 score. If the patient has a PHQ-2 ≥2, this will flag the system so that the healthcare professional will then ask the PHQ-9 questions.

Data collected included age, race, sex, comorbidities, smoking status, alcohol use, BMI, insurance status,

PHQ-9 scores, GAD-7 scores, diagnoses of anxiety or depression, adjustment disorder referral to behavioral health, and medication orders for anxiety and depression. These data were extracted from the Epic electronic medical record (Epic Systems, Verona, WI). Median household income derived from census data was collected through geocoding to the patient's address.

Composite variables were created to assess the incidence of mental health disorders. This variable assessed whether a patient had a mental health diagnosis, positive screening tests, behavior health referrals, or medication orders. Two similar composite variables were created, one for assessing the incidence of depression and the other for anxiety.

Statistical Analysis

Patients were divided into Detroit and non-Detroit groups on the basis of their ZIP code. Statistical analysis investigated the patients who were in the pre−COVID-19 and post−COVID-19 time periods using SPSS software, Version 26. The mean and SD for continuous variables and frequencies for categorical variables were calculated. A multivariate logistic regression was completed to assess associations between covariates and the outcomes of incidence of composite mood disorders, composite anxiety disorder, and composite major depressive disorder.

RESULTS

A total of 20,970 individuals were included in this study: 10,613 in the Detroit subgroup and 10,357 in the non-Detroit subgroup. These individuals had at least 1 visit in the pre−COVID-19 and post−COVID-19 study periods. Table 1 portrays the demographics in the Detroit and non-Detroit populations. The Detroit population was mainly Black (88.2%) and female (70%). Most individuals had an income <$50,000 on the basis of census data (86.4%) and had federal insurance (50%). The non-Detroit population was primarily White (49.7%) and female (61.8%), had an income >$50,000 (83.4%), and had commercial insurance (67%).

Table 2 shows data related to mental health in Detroit and non-Detroit in pre−COVID-19 and post−COVID-19 time. In the pre−COVID-19 area, anxiety was diagnosed in about 8.8% of the Detroit population and 12.7% of the non-Detroit population, depression was diagnosed in 9.4% vs 11.3% respectively, and composite incidence of mental health was diagnosed in 19.4% vs 25.8% respectively. Compared with the pre−COVID-19 period, there was a decrease in the number of individuals screened for depression with the PHQ-9 in the post−COVID-19 period (% decrease in the numbers: 15.6%

Table 1. Demographics of the Detroit and Non-Detroit Population

Demographic	Detroit (*n*=10,613) *n* (%)	Non-Detroit (*n*=10,357) *n* (%)
Age, years		
13−17	349 (3.3)	154 (1.5)
18−40	2,707 (25.5)	2,737 (26.4)
41−64	4,684 (44.1)	5,023 (48.5)
65−79	2,181 (20.6)	2,050 (19.8)
≥80	692 (6.5)	393 (3.8)
Race		
Asian	53 (0.5)	801 (7.7)
Black	9,359 (88.2)	3,450 (33.3)
Hispanic	95 (0.9)	267 (2.6)
White	673 (6.3)	5,150 (49.7)
Other	433 (4.1)	689 (6.7)
Sex		
Female	7,431 (70)	6,399 (61.8)
Male	3,182 (30)	3,958 (38.2)
Income level, U.S. dollars		
<$25,000	2,046 (19.3)	56 (0.5)
$25,000−$49,999	7,118 (67.1)	1,665 (16.1)
$50,000−$75,000	1,006 (9.5)	3,344 (32.3)
>$75,000	407 (3.8)	5,290 (51.1)
NA	36 (0.3)	2 (0.0)
Federal insurance		
No	5,348 (50.4)	6,969 (67.3)
Yes	5,265 (49.6)	3,388 (32.7)

NA, not available.

Detroit vs 21.5% non-Detroit) (Table 2). The non-Detroit population also had a higher frequency of anxiety (12.7% pre−COVID-19 vs 12.8% post−COVID-19). A higher proportion of individuals was referred to behavioral health services in the Detroit population (10.5% vs 7.2%), whereas a higher proportion of individuals was prescribed medication in the non-Detroit population (19.5% vs 12.2%). After COVID-19, 26.5% of the non-Detroit population were positive for a mental health disorder using the composite positive data compared with 18.9% of the Detroit population.

When looking at the incident composite mood disorder, there is a statistically significant protective factor that increases with increasing age (Table 3) (OR=0.787, 0.608, 0.422, and 0.392; $p<0.001$ for ages ≥41 years). Male sex was also a protective factor (OR=0.646, $p<0.001$). Similar data are shown for age when looking at the incidence of composite depression and anxiety separately. For incidence of depression, age has been

Table 2. Data Related to Mental Health Disorders in the Detroit and Non-Detroit Populations

Variable	Detroit		Non-Detroit	
	Before COVID-19 (*n*=10,613) *n* (%)	After COVID-19 (*n*=10,613) *n* (%)	Before COVID-19 (10,357) *n* (%)	After COVID-19 (10,357) *n* (%)
PHQ-2/PHQ-9 categories				
Normal	6,043 (56.9)	4,519 (42.6)	6,668 (64.4)	4,547 (43.9)
Mild	225 (2.1)	183 (1.7)	239 (2.3)	207 (4.0)
Moderate	211 (2.0)	203 (1.9)	199 (1.9)	181 (1.7)
Moderately severe	208 (2.0)	163 (1.5)	141 (1.4)	129 (1.2)
Severe	143 (1.3)	112 (1.1)	131 (1.3)	87 (0.8)
Not done	3,783 (35.6)	5,435 (51.2)	2,979 (28.8)	5,222 (50.4)
Anxiety diagnosis	939 (8.8)	552 (5.2)	1,311 (12.7)	1,322 (12.8)
GAD-7 score categories				
GAD-7 score normal	163 (1.5)	162 (1.5)	229 (2.2)	256 (2.5)
GAD-7 score positive	513 (4.8)	611 (5.8)	503 (4.9)	598 (5.8)
Not done[a]	9,937 (93.6)	9,840 (92.7)	9,625 (92.9)	9,503 (91.8)
Depression diagnosis	1,000 (9.4)	1,101 (10.4)	1,166 (11.3)	1,209 (11.7)
Grief diagnosis	40 (0.4)	40 (0.4)	28 (0.3)	44 (0.4)
Adjustment disorder	199 (1.9)	250 (2.4)	105 (1.0)	124 (1.2)
Behavioral health referral	943 (8.9)	1,116 (10.5)	639 (6.2)	745 (7.2)
Medication ordered	1,158 (10.9)	1,290 (12.2)	1,840 (17.8)	2,017 (19.5)
Composite incident mental health disorders	2,054 (19.4)	2,009 (18.9)	2,671 (25.8)	2,749 (26.5)

[a]Not screened or not appropriate for screening.
GAD-7, General Anxiety Disorder 7; PHQ, Patient Health Questionnaire.

protective (OR=0.920, 0.704, 0.381, and 0.364; *p*<0.001 for ages ≥65 years), as well as male sex (OR=0.623, *p*<0.001) and Black race (OR=0.791, *p*<0.008). For incidence of anxiety disorder, age has been protective (OR=2.190, 0.793, 0.464, and 0.253; *p*<0.001 for ages ≥65 years), as well as male sex (OR=0.553, *p*<0.001) and Black race (OR=0.398, *p*<0.001). In the composite depression analysis, federal insurance is the only factor presenting a statistically significant increased risk (OR=1.395, *p*<0.001).

Table 3. Logistic Regression Analysis of the Incident Composite Mood Disorders, Incident Composite Depression, and Incident Composite Anxiety on Age, Sex, Race, Income Level, Insurance, and Location

Variable	Incident mood disorder			Incident depressive disorder			Incident anxiety disorder		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Detroit	0.996	0.860, 1.153	0.953	1.162	0.953, 1.421	0.140	0.423	0.355, 0.502	<0.001
Age, years									
13−17	1.000								
18−40	0.787	0.600, 1.048	0.092	0.920	0.643, 1.360	0.662	1.190	0.836, 1.747	0.354
41−64	0.608	0.466, 0.807	<0.001	0.704	0.494, 1.037	0.063	0.793	0.558, 1.161	0.212
65−79	0.422	0.315, 0.572	<0.001	0.381	0.257, 0.579	<0.001	0.464	0.318, 0.697	<0.001
≥80	0.392	0.270, 0.570	<0.001	0.364	0.219, 0.604	<0.001	0.253	0.148, 0.430	<0.001
Male	0.646	0.576, 0.723	<0.001	0.623	0.532, 0.728	<0.001	0.553	0.490, 0.624	<0.001
Black	0.984	0.864, 1.121	0.803	0.791	0.665, 0.942	0.008	0.398	0.348, 0.456	<0.001
Income level (U.S. dollars)									
<$25,000	1.000								
$25,000−$49,999	1.036	0.875, 1.234	0.684	0.857	0.699, 1.058	0.144	1.040	0.806, 1.358	0.771
$50,000−$75,000	0.983	0.793, 1.221	0.877	0.738	0.560, 0.973	0.031	1.175	0.881, 1.582	0.280
>$75,000	0.913	0.727, 1.150	0.437	0.587	0.435, 0.793	0.001	1.017	0.759, 1.377	0.910
Federal insurance	1.089	0.965, 1.227	0.164	1.395	1.195, 1.627	<0.001	1.209	1.052, 1.386	0.007

Table 4. Comparison of Logistic Regression in Detroit and Non-Detroit Groups Looking at Incident Mood Disorder, Depression Disorder, and Anxiety Disorder

Variable	Incident mood disorder			Incident depression disorder			Incident anxiety disorder		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Age, years									
18−40									
Detroit	1.002	0.703, 1.468	0.992	1.125	0.728, 1.825	0.614	1.780	1.000, 3.521	0.070
Non-Detroit	0.493	0.326, 0.772	0.001	0.579	0.318, 1.164	0.096	0.919	0.589, 1.495	0.721
OR comparison	2.031			1.943			1.937		
41−64									
Detroit	0.870	0.614, 1.268	0.450	0.822	0.534, 1.330	0.399	1.096	0.615, 2.167	0.774
Non-Detroit	0.338	0.224, 0.526	<0.001	0.474	0.263, 0.945	0.021	0.626	0.403, 1.015	0.046
OR comparison	2.575			1.735			1.751		
65−79									
Detroit	0.486	0.331, 0.731	<0.001	0.382	0.234, 0.646	<0.001	0.429	0.218, 0.904	0.018
Non-Detroit	0.300	0.190, 0.487	<0.001	0.323	0.167, 0.676	0.001	0.409	0.254, 0.683	<0.001
OR comparison	1.619			1.185			1.048		
≥80									
Detroit	0.469	0.290, 0.760	0.002	0.471	0.260, 0.859	0.013	0.085	0.013, 0.322	0.001
Non-Detroit	0.283	0.154, 0.517	<0.001	0.188	0.067, 0.498	0.001	0.272	0.146, 0.510	<0.001
OR comparison	1.657			2.508			0.313		
Male									
Detroit	0.618	0.522, 0.728	<0.001	0.628	0.504, 0.775	<0.001	0.500	0.376, 0.655	<0.001
Non-Detroit	0.670	0.571, 0.783	<0.001	0.616	0.487, 0.774	<0.001	0.560	0.489, 0.640	<0.001
OR comparison	0.922			1.019			0.893		
Black									
Detroit	0.874	0.714, 1.080	0.205	0.774	0.603, 1.005	0.049	0.705	0.530, 0.954	0.020
Non-Detroit	1.090	0.923, 1.287	0.309	0.831	0.651, 1.056	0.133	0.328	0.276, 0.387	<0.001
OR comparison	0.802			0.931			2.153		
Income level									
$25,000−$49,999									
Detroit	1.046	0.880, 1.249	0.618	0.851	0.692, 1.054	0.133	1.029	0.788, 1.362	0.835
Non-Detroit	1.750	0.629, 7.281	0.354	2.695	0.576, 48.083	0.330	1.185	0.467, 4.007	0.751
OR comparison	0.598			0.316			0.869		
$50,000−$75,000									
Detroit	0.902	0.678, 1.190	0.471	0.726	0.502, 1.030	0.079	1.231	0.821, 1.826	0.306
Non-Detroit	1.862	0.674, 7.722	0.301	2.416	0.520, 43.018	0.385	1.287	0.511, 4.334	0.635
OR comparison	0.484			0.300			0.957		
>$75,000									
Detroit	0.701	0.440, 1.071	0.117	0.388	0.181, 0.730	0.007	0.923	0.469, 1.667	0.802
Non-Detroit	1.763	0.636, 7.321	0.346	1.978	0.423, 35.271	0.503	1.071	0.425, 3.608	0.897
OR comparison	0.398			0.196			0.862		
Federal insurance									
Detroit	1.107	0.952, 1.288	0.186	1.400	1.158, 1.692	<0.001	1.053	0.837, 1.321	0.660
Non-Detroit	1.048	0.852, 1.283	0.651	1.321	0.997, 1.733	0.048	1.222	1.024, 1.454	0.025
OR comparison	1.056			1.060			0.862		

The study team then separated the Detroit and non-Detroit subgroups and compared ORs (Table 4). As age increases, the risk of developing a mental health disorder decreases in both populations; however, in the non-Detroit population, the risk is even less than in the Detroit population (OR decreases from 0.493 to 0.283 in non-Detroit vs 1.002 to 0.469 in Detroit). This is seen with increasing age in the composite depression and composite anxiety analysis as well. Although both ORs were <1.0, it is also important to note that a Black individual living in

Detroit compared with outside of Detroit has over twofold risk of developing anxiety (OR=0.705 vs 0.328).

DISCUSSION

This is the first study comparing the impacts of COVID-19 on mental health between an urban setting and a nonurban setting in the U.S. Moreover, this study is unique because it represents the largest Black population in the U.S., with 88% of the Detroit population studied identifying as Black.

This research demonstrates that residing in an urban setting did not increase the risk of developing a mental health disorder. Increasing age, male sex, and Black race were in fact protective factors for the incidence of mental health disorders during the COVID-19 pandemic. Although these were protective factors, they were still less protective than those observed in the patients living outside of Detroit. Results showed that there is a 30% reduction in the risk of developing anxiety if one is Black living in Detroit, compared with an almost 70% reduction in risk for this same person if they were living outside of Detroit.

This study's results are consistent with existing literature. The Understanding America COVID-19 Tracking Survey from March to November 2020 assessed the difference over time in the prevalence of anxiety and depression between Black and non-Black Americans and found that Black Americans were significantly less likely to report symptoms for anxiety, depression, or both during the pandemic. In this study, by September 2020, although the prevalence of depression remained stable in non-Black Americans, it gradually declined among Black Americans.[18] It can be postulated that the struggles against economic, health, and racial inequalities faced prior to the pandemic meant that added stressors during the pandemic had minimal impact on the mental health of urban populations.

The stigma surrounding mental health continues to be present, particularly in the Black, male community. Presenting to the clinic for concerns for depression or anxiety may often be perceived as weak. Individuals may be more prone to utilizing alcohol or illicit drugs to feel better. As such, this must be considered when looking at the incidence of mental health disorders during COVID-19. Although this study was unable to comment on alcohol and illicit drug use, a recent study from the University of Michigan showed that, overall, suicide and overdose deaths decreased, whereas alcohol-related deaths increased. Within demographic groups, overdose deaths did increase for Black individuals, women, and married/widowed people.[23]

Most published studies focus on the early months of the pandemic or were from Europe or Asia. A study investigating urban versus rural populations early in the pandemic showed similar prevalence in mental health and social well-being outcomes in both groups of respondents.[24] A systematic review of 43 studies included 2 studies that showed a significantly higher level of depressive symptoms. Those with pre-existing psychiatric disorders reported worsening of psychiatric symptoms. In the general public, there were lower psychological well-being and higher scores of anxiety and depression than before COVID-19.[17]

Interestingly, the only factor in this study presenting a statistically significant increased risk for mental health disorders was having federal compared with private insurance. Looking solely at the incidence of depressive disorders, having federal insurance had an almost 40% increased risk. To date, no other studies have shown how mental health during the pandemic may have been impacted by the type of insurance. Certainly, this can present a major stressor. The type of insurance dictates the availability of medical resources and social services one has access to. With limited services available, there is the potential to exacerbate stress should a physical or mental illness arise during the pandemic. Further research is warranted to discern the extent to which insurance plays a role in driving mental health concerns.

Limitations

This study does present some limitations. First, this is a retrospective study. Diagnoses that are included have been manually added to a patient's chart by a provider into their problem lists. Thus, it is possible that there was underreporting of comorbidities and social history because of this. For example, data regarding alcohol, illicit drug, and cigarette use were not included because they were not accurately reported in the electronic medical record. Second, in evaluating for depression and anxiety in the time periods, the entire population was not screened. Third, racial and sex demographics for the study population are not representative of national demographics.

CONCLUSIONS

This is the first study comparing urban with nonurban areas of Detroit and the impact of COVID-19 on mental health. This is also one of the first studies to look closely at how COVID-19 has particularly impacted an urban population that is largely Black. The study found that there is no increased risk of incidence of mood disorder, depression, or anxiety with Detroit residency. However, when comparing Detroit with non-Detroit residency,

the incidence is still twofold greater in Detroit residents who are Black than in non-Detroit residents who are Black. Future studies should focus on prospective data to characterize the long-term impacts of COVID-19 on mental health disorders in diverse populations. The future quality initiatives should focus on increasing screening for anxiety and depression in outpatient settings and development of tracking systems to ensure behavioral health referrals are followed through. This study could help to develop and strengthen policy that the virtual visits during the pandemic are important and need to happen to help screen patients for anxiety, depression, and mood disorder. Referrals to behavioral health should include plans to bridge the gap to care during pandemics and consider closer follow-up if not able to establish care with behavioral health services.

ACKNOWLEDGMENTS

CREDIT AUTHOR STATEMENT

Sean Yaphe: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing, Formal analysis. Lakshmi Sundaresan: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. Jonathan D. Freedman: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. Samuel J. Weinberg: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. Ivana A. Vaughn: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing, Formal analysis. Lois E. Lamarato: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing, Formal analysis. Katarzyna Budzynska: Conceptualization, Data curation, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing, Supervision.

REFERENCES

1. World Health Organization. WHO Coronavirus (COVID-19) Dashboard 2022. https://data.who.int/dashboards/covid19/cases?m49=840&n=o.
2. Khan S, Siddique R, Li H, et al. Impact of coronavirus outbreak on psychological health. *J Glob Health.* 2020;10(1):010331. https://doi.org/10.7189/JOGH.10.010331.
3. Hawryluck L, Gold WL, Robinson S, Pogorski S, Galea S, Styra R. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg Infect Dis.* 2004;10(7):1206–1212. https://doi.org/10.3201/eid1007.030703.
4. Jalloh MF, Li W, Bunnell RE, et al. Impact of Ebola experiences and risk perceptions on mental health in Sierra Leone, July 2015. *BMJ Glob Health.* 2018;3(2):e000471. https://doi.org/10.1136/bmjgh-2017-000471.
5. Ettman CK, Abdalla SM, Cohen GH, Sampson L, Vivier PM, Galea S. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Netw Open.* 2020;3(9):e2019686. https://doi.org/10.1001/jamanetworkopen.2020.19686.
6. Nearchou F, Douglas E. Traumatic distress of Covid-19 and depression in the general population: exploring the role of resilience, anxiety, and hope. *Int J Environ Res Public Health.* 2021;18(16):8485. https://doi.org/10.3390/ijerph18168485.
7. Deng J, Zhou F, Hou W, et al. The prevalence of depression, anxiety, and sleep disturbances in COVID-19 patients: a meta-analysis. *Ann N Y Acad Sci.* 2021;1486(1):90–111. https://doi.org/10.1111/nyas.14506.
8. Bäuerle A, Teufel M, Musche V, et al. Increased generalized anxiety, depression and distress during the COVID-19 pandemic: a cross-sectional study in Germany. *J Public Health (Oxf).* 2020;42(4):672–678. https://doi.org/10.1093/pubmed/fdaa106.
9. Huang Y, Zhao N. 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. *Esliver Psychiatry Res Sliver.* 2020;288:2–3.
10. Lei L, Huang X, Zhang S, Yang J, Yang L, Xu M. Comparison of Prevalence and Associated Factors of Anxiety and Depression among People Affected by versus People Unaffected by Quarantine during the COVID-19 Epidemic in Southwestern China. *Med Sci Monit.* 2020;26:e924609. https://doi.org/10.12659/MSM.924609.
11. Boden M, Zimmerman L, Azevedo KJ, et al. Addressing the mental health impact of COVID-19 through population health. *Clin Psychol Rev.* 2021;85:102006. https://doi.org/10.1016/j.cpr.2021.102006.
12. Mazza C, Ricci E, Biondi S, et al. A nationwide survey of psychological distress among Italian people during the Covid-19 pandemic: immediate psychological responses and associated factors. *Int J Environ Res Public Health.* 2020;17(9):1–14. https://doi.org/10.3390/ijerph17093165.
13. Özdin S, Bayrak Özdin Ş. Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: the importance of gender. *Int J Soc Psychiatry.* 2020;66(5):504–511. https://doi.org/10.1177/0020764020927051.
14. Kwong ASF, Pearson RM, Adams MJ, et al. Mental health before and during the COVID-19 pandemic in two longitudinal UK population cohorts. *Br J Psychiatry.* 2021;218(6):334–343. https://doi.org/10.1192/bjp.2020.242.
15. Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L. 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. *J Affect Disord.* 2020;277:55–64.
16. González-Sanguino C, Ausín B, Castellanos MÁ, et al. Mental health consequences during the initial stage of the 2020 coronavirus pandemic (COVID-19) in Spain. *Brain Behav Immun.* 2020;87:172–176. https://doi.org/10.1016/j.bbi.2020.05.040.
17. Vindegaard N, Benros ME. 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. *Brain Behav Immun.* 2020;89:531–542.
18. Owens V, Saw HW. Black Americans demonstrate comparatively low levels of depression and anxiety during the COVID-19 pandemic. *PLoS One.* 2021;16(6):e0253654. https://doi.org/10.1371/journal.pone.0253654.
19. Lin AL, Vittinghoff E, Olgin JE, Pletcher MJ, Marcus GM. Body weight changes during pandemic-related shelter-in-place in a longitudinal cohort study. *JAMA Netw Open.* 2021;4(3):e212536. https://doi.org/10.1001/jamanetworkopen.2021.2536.

20. Woolford SJ, Sidell M, Li X, et al. Changes in body mass index among children and adolescents during the COVID-19 pandemic. *JAMA*. 2021;326(14):1434–1436. https://doi.org/10.1001/jama.2021.15036.

21. Lange SJ, Kompaniyets L, Freedman DS, et al. Longitudinal trends in body mass index before and during the COVID-19 pandemic among persons aged 2-19 years - United States, 2018-2020. *MMWR Morb Mortal Wkly Rep.* 2021;70(37):1278–1283. https://doi.org/10.15585/mmwr.mm7037a3.

22. Okkels N, Kristiansen CB, Munk-Jørgensen P, Sartorius N. Urban mental health: challenges and perspectives. *Curr Opin Psychiatry.* 2018;31(3):258–264. https://doi.org/10.1097/YCO.0000000000000413.

23. Larson PS, Bergmans RS. Impact of the COVID-19 pandemic on temporal patterns of mental health and substance abuse related mortality in Michigan: an interrupted time series analysis. *Lancet Reg Health Am.* 2022;10:100218. https://doi.org/10.1016/j.lana.2022.100218.

24. Henning-Smith C, Meltzer G, Kobayashi LC, Finlay JM. Rural/urban differences in mental health and social well-being among older US adults in the early months of the COVID-19 pandemic. *Aging Ment Health.* 2023;27(3):505–511. https://doi.org/10.1080/13607863.2022.2060184.