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Mental health outcomes associated with the COVID-19 pandemic: Prevalence and risk factors in a southern US state

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ABSTRACT

The COVID-19 pandemic has had a dramatic effect on the functioning of individuals and institutions around the world. This cross-sectional registry-based study examined some of the burdens of the pandemic, the prevalence of mental health difficulties, and risk factors for psychosocial morbidity among community residents in Arkansas. The study focused on a period of gradual reopening but rising infection rates. The investigation included validated screening measures of depressive symptoms (PHQ-9), generalized anxiety (GAD-7), trauma-related symptoms (PCL-5), and alcohol use (AUDIT-C). A notable percentage of participants reported elevated symptoms on each of these outcomes. In separate multivariable analyses that accounted for a number of demographic and pandemic-related covariates, individuals who reported greater pandemic-related disruption in daily life, and those with a prior history of mental health concerns, were more likely to screen positive for depressive, anxiety and trauma-related symptoms. Findings illuminate burdens experienced by community residents during a period of phased reopening, and offer a foundation for future screening and intervention initiatives.

1. Introduction

In the period since January 2020, when the World Health Organization (WHO, 2020) and the US Department of Health and Human Services (Health and Human Services, 2020) designated the coronavius disease (COVID-19) as a public health emergency, the pandemic has had a sweeping impact on daily life for individuals around the world. The high transmissibility of the virus in conjunction with the lack of approved vaccines and limited therapeutics have contributed to an international public health crisis. Communities have had to manage shortages of viral testing resources, diminished access to routine medical care, and sometimes conflicting preventative health recommendations. Physical distancing provisions have constrained access to work and recreation. The jarring economic effects have left many individuals unemployed or with reduced incomes, and almost everyone has grappled with disruptions in normal routines. These widespread changes might contribute to a range of psychosocial difficulties, including social isolation, anxiety, uncertainty, and loss.

There have been urgent calls for research regarding potential mental health effects of the COVID-19 pandemic (Holmes et al., 2020). As yet, relatively little is known about responses among the general population in the US (Liu et al, 2020; Tull et al, 2020), though work in this area is advancing rapidly. An initial wave of studies, mostly conducted in the immediate aftermath of the outbreak, suggested elevated levels of self-reported anxiety, depressive symptoms, and distress among community residents in China (e.g., Huang and Zhao, 2020; Qiu et al. 2020; Ren et al., 2020; Tang et al. 2020; Zhang and Ma, 2020) and then in other countries such as Italy (Forte et al., 2020; Germani et al., 2020), Spain (Gonzalez-Snguino et al., 2020), Germany (Bäuerle et al., 2020b; Petzold et al., 2020), India (Varshney et al. 2020), Egypt (El-Zoghby eta l. 2020), Hong Kong (Choi et al., 2020), and the US (Liu et al. 2020; Tull et al., 2020). Earlier studies similarly documented mental health sequelae following the Severe Acute Respiratory Syndrome (SARS) coronavirus epidemic, though these data were derived largely from recovered patients rather than the broader community (Gardner and Moallef, 2015). A larger, well-developed literature has focused on psychosocial responses to other types of community-level disasters, with findings pointing to consistent problems with depression and

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trauma-related symptoms, sometimes in tandem with other difficulties such as anxiety, substance use, and general distress (Beaglehole et al. 2018, Lowe et al. 2019; Pietrazk et al., 2012; Tang et al., 2017). The extent to which these difficulties might be associated with the evolving COVID-19 pandemic in the US remains uncertain, and clearly there is a need for additional research. Moreover, as yet very few investigations that have focused specifically on the experience of the general public during periods of phased reopening of businesses and institutions (Tan et al., 2020). Such research would be especially important in communities experiencing increased infection rates, where residents have struggled with the dilemma of increased access and social interaction but also increased risk.

Another salient concern involves efforts to identify which individuals may be most vulnerable to psychosocial morbidity in response to the pandemic. It is recognized that periods of upheaval affect different individuals in different ways (Mancini, 2020). Risk factors identified thus far in prior research regarding responses to the COVID-19 pandemic included female gender, younger age, and a previous history of mental health concerns (Bäuerle et al. 2020b; El-Zoghby et al., 2020; Forte et al., 2020; Germani et al., 2020; Gonzales-Sanguino, 2020; Rossi et al., 2020; Solomon and Constantinidou, 2020; Varshney et al., 2020). Specific aspects of the pandemic might be expected to increase vulnerability to distress as well, including viral exposure or infection, financial adversity, food insecurity, diminished access to healthcare, greater isolation associated with social distancing efforts, and increased disruption in daily life.

Different geographic regions have encountered notable differences over time in SARS-CoV2 viral infection rates and local government mitigation responses. The current study was a registry-based cross-sectional investigation regarding mental health responses to the COVID-19 pandemic among community residents in Arkansas. Rural regions have been identified as among the populations of special interest (Holmes et al., 2020), though as yet rural areas of the US have not been studied. We sought to examine a number of clinically relevant psychosocial outcomes that might be adversely affected by a global traumatic event (i.e., elevated symptoms of depression, generalized anxiety, posttraumatic stress, and alcohol misuse), using validated self-report screening measures. Additionally, we evaluated a range of demographic and situational risk factors that might intensify vulnerability to psychosocial morbidity. We anticipated that heightened levels of anxiety, depression, and posttraumatic stress would be associated with specific situational factors, including perceived viral exposure or infection, food and financial insecurity, reduced access to routine medical care, greater disruption in daily life, more stringent social distancing, and diminished daily structure.

2. Methods

2.1. Participants

This was a cross-sectional registry-based observational study. The online survey was available for one month from May 22nd to June 24th, a period during which infection rates in Arkansas increased significantly (Centers for Disease Control and Prevention, 2020) while the state progressively reopened (phase 1 and early phase 2 in Arkansas). Emailed invitations with links to the online survey were distributed to individuals in the ARresearch registry, which is comprised of individuals who have expressed potential interest in research participation, and which varies widely with respect to rural vs. urban residence, socioeconomic resources, and racial/ethnic background. The registry is maintained by the Translational Research Center at the University of Arkansas for Medical Sciences (UAMS). Individuals were included if they were age 18 and older, resided in the state, and were listed in the registry as healthy community residents. An information form informed potential participants about study procedures, risks, and confidentiality provisions, and the return of the completed survey signified consent.

The study was approved by the UAMS Institutional Review Board with a waiver of documentation of written consent.

2.2. Outcome measures

The survey was administered using REDCap, a secure web application for online research which allows participants to enter responses online (Harris et al., 2009). To enhance comparability across other studies in progress, instruments were derived as much as possible from those posted on websites of the National Institutes of Health Office of Behavioral and Social Sciences Research COVID-19 Research Tools (nlm.nih.gov/dr2/COVID-19_BSSR_Research_Tools.pdf), the National Human and Social Sciences Research COVID-19 Research Tools (nlm.nih.gov/dr2/COVID-19_BSSR_Research_Tools.pdf), the National Human Genome Research Institute COVID-19 PhenX Toolkit (Phenx-toolkit.org/covid19), and the NIH Public Health Emergency and Disaster Research Response (DR2) COVID-19 resource (dr2.nlm.nih.gov/tools_resources).

2.2.1. Depression

The 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) was used to assess depressive symptoms. The reliability and construct validity of this screening instrument have been reported in multiple investigations (Kroenke et al., 2001, Levis et al., 2019). A cutoff score ≥10 has shown a sensitivity of 88% and a specificity of 85% for major depression in a meta-analysis of findings derived from a variety of medical and nonmedical settings (Levis et al., 2019).

2.2.2. Anxiety

The 7-item Generalized Anxiety Disorder questionnaire (GAD-7; Spitzer et al., 2006) was used to measure generalized anxiety. Studies in primary care patients (Spitzer et al. 2006) and the general population (Lowe et al. 2008) have supported the reliability and criterion-related validity of this measure. In a meta-analysis, a cutoff score of 10 demonstrated a sensitivity of 83% and specificity of 84% among individuals assessed in medical and community settings (Plummer et al., 2016).

2.2.3. Trauma-related symptoms

The 20-item PTSD Checklist for DSM-5 (PCL-5; Blevins et al., 2015) was used to evaluate trauma-related symptoms (Blevins et al. 2015). Instructions were keyed to the COVID-19 pandemic. Research suggests good internal consistency and convergent validity in student and clinical populations. A cut-off value of 33 has been viewed as an indicator of posttraumatic stress (Blevins et al. 2015; Bovin et al., 2015). (Our interest was in trauma-related symptoms; given the ongoing nature of the pandemic at the time of assessment no effort was made to assess temporal criteria for acute stress disorder or posttraumatic stress disorder.)

2.2.4. Alcohol use

The 3-item AUDIT-C (Bush et al., 1998) was used to assess alcohol use, as a secondary outcome. This measure has been widely used to screen for alcohol misuse. Cut-off scores of ≥4 for men and ≥3 for women have been used as indices of heavy alcohol use (Bush et al., 1998; Bradley et al., 2007).

2.3. Demographic and pandemic-related measures

Participants completed a brief form regarding demographic characteristics (e.g., age, gender, ethnicity, prior medical and mental health conditions, etc.). Items concerning experiences with COVID-19 were drawn in part from the University of Southern California (2020) Center for Economic and Social Research Understanding America Study (UAS) Coronavirus Tracking Survey and the Australian Treatment Outcome Study (ATOS) 18-20 Year Follow-up study (Marel et al., 2020). Items

inquired about COVID-19 testing and perceived infection, using items adapted from the UAS, and about perceived exposure and perceived COVID-19 symptom severity, using items adapted from the ATOS. Three items (coded no, yes, not sure) inquired about food insecurity (i.e., "worried that you would run out of food;" "ate less than you think you should;" or "went without eating for a whole day"), and 2 items asked about financial insecurity (i.e., missed or delayed payment of rent/mortgage and utility bills), using items adapted from the UAS. Eight items (coded no, yes, not sure) assessed social activity/distancing behaviors (e.g., "attended a gathering with more than 10 people"), using items adapted from the UAS; these items were summed to create a total score.

A series of 7 items, created by the authors, assessed disruptions in daily life due to the pandemic (e.g., "trouble arranging for childcare," "trouble staying involved with family/friends"); each item was rated on a 4-point Likert scale and summed to derive a total score. Four single items, each with 4-5 response options, asked about other burdens, including illness or loss of loved ones due to COVID-19, and the impact of the pandemic on employment status, daily structure, and sheltering at home. Additional items regarding healthcare assessed whether the pandemic had affected access to usual medical care, and whether participants had sought psychotherapy or psychiatric medication in response to the pandemic (each coded no, yes, not sure). Finally, participants were asked about prior (pre-pandemic) mental health concerns, including a history of depression, anxiety, and PTSD diagnoses (each coded no, yes, not sure).

2.4. Statistical analysis

Descriptive statistics were used to summarize demographic variables and to characterize COVID-related burdens. Using established cut-off scores, we examined the frequency (percentage) of participants who screened positive for possible cases of depression (PHQ-9), generalized anxiety (GAD-7), posttraumatic stress (PCL-5), and alcohol misuse (AUDIT-C).

Preliminary bivariate analyses evaluated associations of elevated scores on the primary outcomes (i.e., scores above thresholds for depression, anxiety, and trauma) with demographic variables (e.g., age, ethnicity, gender, comorbidities) and situational risk factors (e.g., perceived exposure and infection, COVID-19 symptoms, food and financial insecurity, access to routine medical care, pandemic-related employment changes, illness or loss of loved ones, reduced daily structure, social activity, and disruption in daily activities,), using t-tests, or chi-square or Fisher Exact tests, as appropriate. Due to its non-normal distribution, a logarithmic transformation was used for the level of disruption in daily life; however, results were unchanged using the raw score, so the raw score is reported here for ease of interpretation. Several variables were dichotomized for the analysis, including marital status (married/living with partner vs. all others), ethnicity (minority group vs. non-minority), number of comorbidities (0 vs. 1 or more), food insecurity (no vs. yes to any of 3 items), financial insecurity (no vs. yes to any of 2 items), perceived viral exposure (none vs. significant or prolonged exposure at work, in the community, or at home), perceived viral infection (no vs. yes or not sure), perceived COVID-19-related symptoms (none vs. mild, moderate, or severe), illness/death of loved ones (not affected vs. COVID-19 illness or death of a loved one), pandemic-related employment changes (no adverse changes vs. loss of job, loss of business, temporary lay-off, or reduction in hours/income), sheltering at home (sheltering and working at home and leaving no more than a few times per week vs. more frequent departures), and daily structure (few planned or scheduled activities vs. at least several planned/scheduled activities per week). Separate multivariable logistic regression analyses were used to model associations of each outcome with demographic/situational factors that were significant in preliminary bivariate analyses. The data were checked for multi-collinearity and residuals were examined. As partial adjustment for

Table 1
Demographic characteristics.

Characteristic	N (%)	Mean (SD)
Gender		
male	133 (22.50)	
female	458 (77.50)	
marital status		
married/co-habitating	390 (65.99)	
not married	201 (34.01)	
income (n =591)		
$0-39,999	110 (18.77)	
≥$40,000	476 (81.23)	
ethnicity		
majority	492 (83.25)	
non-majority	99 (16.75)	
medical comorbidities		
none	254 (42.98)	
≥1	337 (57.02)	
depression caseness	123 (20.81)	
anxiety caseness	98 (16.58)	
trauma caseness (n =544)	29 (5.38)	
alcohol use caseness	207 (35.03)	
age		51.19 (14.81)
education (years)		15.93 (2.06)

multiple comparisons p-values <.01 were considered significant.

3. Results

3.1. Sample characteristics

A total of 591 individuals (35.3%) responded to survey, completed the mental health measures and were included in the analyses, of 1672 who were sent emailed invitations. Compared with those who not complete the survey, respondents were more likely to older (*p* =.001) and white (*p* =.001), and marginally more likely to be female (*p* = .011). Data from 52 (8.72%) participants were missing for the PCL-5 (which was located at the end of the survey); individuals who did not complete this measure did not differ from those who did on any of the demographic or outcome variables (all *p*'s >.08). Missing data for all of the remaining variables was negligible (i.e., 0.05%). Sample characteristics are listed in Table 1. Average age was 51.19 (14.81) years, and most participants were white (83.25%), female (77.50%) and well-educated (mean =15.93 years).

Outcome measures are reported in Table 1. Twenty-one percent of participants reported clinically elevated levels of depressive symptoms on the PHQ-9, 16.58 % reported elevated generalized anxiety symptoms on the GAD-7, and 5.38% reported elevated levels of trauma symptoms on the PCL-5. Potential alcohol misuse was reported by 35.03 % (35.59 % of women and 33.08% of men) on the AUDIT-C.

Few participants (n = 52; 8.80%) had been tested for the novel coronavirus (SARS-CoV2), and only 3 (0.51%) had tested positive. Scores on other pandemic-related variables are listed on Table 2, and illustrate an appreciable level of burden. Among the notable findings, 129 (21.83%) of participants had experienced a loss of work or income due to the pandemic. Eighty six (14.55%) participants reported experiencing food insecurity, while 69 (11.68%) struggled with financial insecurity. Two hundred thirty seven (40.10 %) individuals reported diminished access to routine medical care. A notable proportion (n =99, 16.81%) were stringently sheltering and working at home, had supplies delivered to them, and rarely left their residence. As a result of the pandemic, many respondents (n =228, 38.58%) reported little daily structure, with few planned or scheduled activities. The percentage who had experienced illness or death of a loved one from the disease was small (n = 38, 6.43%). Interestingly, in response to the stress of the pandemic, a number of participants reported that they had sought mental health counseling (n =43; 7.28%) or had been started on

Table 2
Pandemic-related characteristics.

Characteristic	N (%)	Mean (SD)
tested for coronavirus		
not tested	539 (91.20)	
results pending	7 (1.18)	
negative	42 (7.11)	
positive	3 (.51)	
perceived COVID-19 symptoms	.	
none	542 (91.71)	
mild, moderate, or severe	49 (8.29)	
perceived infection		
no	456 (77.16)	
yes or not sure	135 (22.84)	
perceived exposure		
no	540 (91.53)	
yes (work, community, or home)	50 (8.47)	
food insecurity		.
no	505 (85.45)	
yes (worry run out; eat less than should; or no food for whole day)	86 (14.55)	
financial insecurity		
no	522 (88.32)	
yes (missed/delayed/paid less rent/mortgage; or missed/ delayed/paid less utility bills	69 (11.68)	
reduced access to medical care		
no	354 (59.90)	
yes	237 (40.10)	
loss of income or employment		
no	462 (78.17)	
yes (lost job/business; reduced hours; temporary lay off)	129 (21.83)	
daily structure (planned/scheduled activities)		
little (≤1-2x/week)	228 (38.58)	
more (>3x/week)	363 (61.42)	
sheltering at home		
stringent (no work/school outside of home, leave ≤1-2x/week	99 (16.81)	
relaxed (leave home >several times/week	490 (83.19)	
illness/death of loved one		
no	553 (93.57)	
yes	38 (6.43)	
disruptions in daily life (0-21)		4.75 (3.69)
social activity (0-8)		3.94 (1.67)

psychiatric medication (n = 27, 4.57%).

3.2. Factors associated with anxiety, depression, and trauma-related symptoms

Bivariate associations of the primary mental health outcomes with demographic and situational factors are displayed in Tables 3 and 4. With respect to demographic correlates, younger individuals (all *p*'s ≤.0002), women (all *p*'s ≤.005), and participants with lower family incomes (all *p*'s ≤.003) were significantly more likely to screen positive for depression and anxiety (but not trauma symptoms), and those who reported a prior history of mental health diagnoses (all *p*'s ≤.0001) were more likely to screen positive on all three mental health outcomes. Individuals with a greater number of medical comorbidities (*p* =.005), less education (*p* =.005), and those who were not married or living with a partner (*p* =.002) were significantly more likely to report clinically elevated levels of depressive symptoms.

In bivariate analyses, participants who experienced greater disruption in daily life due to the pandemic (all *p*'s ≤.0002), and those who believed or suspected that they had been infected with the virus (all *p*'s ≤.0005), were significantly more likely to screen positive on all three outcomes (Table 4). Individuals experiencing food insecurity (all *p*'s ≤.0001), financial insecurity (all *p*'s ≤.0001), reduced access to routine medical care (all *p*'s ≤.002), symptoms they ascribed to COVID-19

(all *p*'s ≤.0004), and lack of daily structure (all *p*'s ≤.006) were more likely to report elevated symptoms of depression and anxiety (but not trauma). Adverse changes in employment (all *p*'s ≤.0005) and more stringent sheltering at home (all *p*'s ≤.0008) were associated with significantly greater likelihood of screening positive for depression and trauma symptoms. In contrast, results were non-significant regarding associations with perceived viral exposure and with illness or death of loved ones (all *p*'s >.09).

Results of multivariable logistic regression analyses are presented in Table 5. After controlling for significant demographic variables, a greater likelihood of screening positive for depressive symptoms was associated with a prior history of mental health difficulties (OR =4.35, 95% CI: 2.57-7.36, *p*<.0001), being unmarried (OR =.48 ., 95% CI:.28-.83, *p*=.008), and experiencing greater disruption in daily life due to the pandemic (OR =1.21 95% CI: 1.12-1.30; *p* <.001). The likelihood of screening positive for anxiety was tied to younger age (OR =.97. 95% CI: .96-.99, *p*<.005), prior mental health history (OR =5.26, 95% CI: 2.95-9.40, *p*<.0001), and greater disruption in daily life (OR =1.12, 95% CI: 1.05-1.20, *p*<.001). Similarly, elevated trauma symptoms were associated with prior mental health history (OR =6.44, 95% CI: 2.10-19.72, *p*<.001) and increased disruption in daily life (OR =1.20, 95% CI: 1.09- 1.31, *p*<.0002). The other situational variables did not remain significant in multivariable analyses.

4. Discussion

This study offers an initial evaluation of mental health outcomes in response to the COVID-19 pandemic among community residents in Arkansas. Findings provide novel information regarding the experience of individuals in a rural southern region of the US. Additionally, this investigation is among the first to characterize a period of phased re-opening, during which infection rates continued to grow appreciably. Results indicate that a notable proportion of respondents experienced clinically elevated distress, as assessed by validated screening measures of depressive symptoms, generalized anxiety symptoms, trauma-related symptoms, and alcohol use. These levels would appear to exceed prevalence estimates derived from the general US population prior to the pandemic (Kessler et al., 2005), though the population estimates are based on diagnostic interviews rather than more provisional self-report instruments. Findings suggest that mental health difficulties are a salient concern in the post-acute period of the pandemic— that is, during an interval of gradual reopening of businesses and venues within the state (phases 1 and 2) but progressively mounting cases of infection.

Indications of heightened psychosocial morbidity are consistent with findings from earlier studies conducted in the more immediate aftermath of the outbreak in other countries (Bäuerle et al. 2020b; Forte et al., 2020; Gonzaelz-Sanguino et al., 2020; Huang and Zhao, 2020; Petzold et al., 2020; Ren et al. 2020; Rossi et al., 2020; Smith et al., 2020; Solomou and Constantinidou, 2020; Varshney et al, 2020; Wang et al., 2020), and in the US (Liu et al., 2020; Tull et al. 2020). The use of diverse outcome measures and cut-off values across different investigations limits the possibility for direct comparisons. However, among those that employed similar metrics, earlier studies in Germany (Bäuerle et al., 2020b), Spain (Gonzalez-Sanguino et al. 2020), and Hong Kong (Choi et al., 2020) reported that 14.4 to 19.8% of participants had exceeded cut-off values for depression on the PHQ-9 or briefer PHQ-2, and 14.0 to 21.6% had exceeded thresholds for generalized anxiety on the GAD-7 or GAD-2; these estimates are in range with the values found here (i.e., 20.8% for depression and 16.6% for anxiety). Prevalence rates were notably higher in an American study conducted with young adults earlier in the pandemic (43.3% and 45.4%, respectively), which is perhaps not surprising given the association between younger age and heightened distress (Liu et al, 2020). As yet, few studies have used any version of our measure of trauma symptoms (PCL-5); among those that have, findings have been quite variable but higher than our estimate of 5.4%

Table 3

Bivariate associations between demographic characteristics and mental health outcomes.

Characteristic	PHQ-9 Depression			GAD-7 Anxiety			PLC-5 Trauma		
	non-case	case	p-value	non-case	case	p-value	non-case	case	p-value
gender			.005*			.0005*			.09
male	117 (25.00)	16 (13.01)		124 (25.15)	9 (9.18)		123 (24.12)	3 (10.34)	
female	351 (75.00)	107 (86.99)		369 (74.85)	89 (90.82)		387 (75.88)	26 (89.66)	
marital status			.0002*			.07			.92
married/co-habitating	142 (30.34)	59 (47.97)		160 (32.45)	41 (41.84)		171 (33.53)	10 (34.38)	
not married	326 (69.66)	64 (52.03)		333 (67.55)	57 (58.16)		339 (66.47)	19 (65.52)	
income (n =591)			.0001*			.003*			.86
$0-39,999	70 (15.12)	40 (32.52)		81 (16.60)	29 (29.59)		94 (18.58)	5 (17.24)	
≥$40,000	393 (84.88)	83 (67.48)		407 (83.40)	69 (70.41)		412 (81.42)	24 (82.76)	
ethnicity			.04			.44			.08
majority	71 (15.17)	28 (22.76)		80 (16.23)	19 (19.39)		78 (15.29)	8 (27.59)	
non-majority	397 (84.83)	95 (77.24)		413 (83.77)	79 (80.61)		432 (84.71)	21 (72.41)	
medical comorbidities			.005*			.17			.19
none	215 (45.94)	39 (31.71)		218 (44.22)	36 (36.73)		221 (43.33)	9 (31.03)	
≥1	253 (54.06)	84 (68.29)		275 (55.78)	62 (63.27)		289 (56.67)	20 (68.97)	
age	52.33 (14.56)	46.82 (14.98)	.0002*	52.40 (14.72)	45.10 (13.78)	.0001*	51.88 (15.01)	45.03 (11.99)	.02
education (years)	16.05 (1.99)	15.46 (2.25)	.004*	15.99 (2.00)	15.63 (2.31)	.12	15.92 (2.01)	16.34 (2.68)	.27

Note: p-values derived from t-tests for continuous variables and chi-square or Fisher's Exact test for categorical variables; *p < .01

(Gonzalez-Sanguino et al., 2020; Liu et al., 2020). No comparisons are available as yet regarding our measure of alcohol use (AUDIT-C).

4.1. Potential risk factors

As anticipated, in bivariate analyses we found that younger participants, women, and individuals with lower incomes were more likely to screen positive for depression and anxiety (though not trauma symptoms), and those who had received a prior mental health diagnosis

(i.e., mood disorder, anxiety, or PTSD) were at higher risk for all three psychosocial outcomes. Similar findings were reported in previous investigations of mental health responses to the COVID-19 pandemic (Bäuerle et al., 2020b; Forte et al., 2020; Germani et al., 2020; Gonzalez-Sanguino et al., 2020; Rossi et al., 2020; Tang et al. 2020; Varshney et al., 2020), as well as in studies of other environmental disasters (Goldman and Galea, 2014; Lowe et al., 2019; Tang et al., 2017). Results regarding other demographic correlates have been inconsistent in prior research. We did not find strong effects for racial/

Table 4

Bivariate associations between pandemic characteristics and mental health outcomes.

Characteristic	PHQ-9 Depression			GAD-7 Anxiety			PLC-5 Trauma		
	non-case	case	p-value	non-case	case	p-value	non-case	case	p-value
perceived COVID-19 symptoms			.0001*			.0004*			.09
none	440 (94.02)	102 (82.93)		461 (93.51)	81 (82.65)		468 (91.76)	24 (82.76)	
mild, moderate, or severe	28 (5.98)	21 (17.07)		32 (6.49)	17 (17.35)		42 (8.24)	5 (17.24)	
perceived infection			.0001*			.0001*			.0005*
No	379 (80.98)	77 (62.60)		397 (80.53)	59 (60.20)		405 (79.41)	15 (51.72)	
yes or not sure	89 (19.02)	46 (37.40)		96 (19.47)	39 (39.80)		105 (20.59)	14 (48.28)	
perceived exposure			.10 .			.90			.28
no	432 (92.51)	108 (87.80)		450 (91.46)	90 (91.84)		469 (92.14)	25 (86.21)	
yes	35 (7.49)	15 (12.20)		42 (8.54)	8 (8.16)		40 (7.86)	4 (13.79)	
food insecurity			.0001*			.0001*			.02
no	421 (89.96)	84 (68.29)		439 (89.05)	66 (67.35)		445 (87.25)	21 (72.41)	
yes	47 (10.04)	39 (31.71)		54 (10.95)	32 (32.65)		65 (12.75)	8 (27.59)	
financial insecurity			.0001*			.0001*			.02
no	429 (91.67)	93 (75.61)		450 (91.28)	72 (73.47)		459 (90.00)	22 (75.86)	
yes	39 (8.33)	30 (24.39)		43 (8.72)	26 (26.53)		51 (9.00)	7 (24.14)	
reduced access medical care			.0001*			.002*			.17
no	299 (63.89)	55 (44.72)		309 (62.68)	45 (45.92)		311 (60.98)	14 (48.28)	
yes	169 (36.11)	68 (55.28)		184 (37.32)	53 (54.08)		199 (39.02)	15 (51.72)	
loss of income/employment			.0005*			.04			.0002*
no	380 (81.20)	82 (66.67)		393 (79.72)	69 (70.41)		410 (80.39)	15 (51.72)	
yes	88 (18.80)	41 (33.33)		100 (20.28)	29 (29.59)		100 (19.61)	14 (48.28)	
daily structure			.003*			.006*			.06
limited	166 (35.47)	62 (50.41)		178 (36.11)	50 (51.02)		193 (37.84)	16 (55.17)	
more extensive	302 (64.53)	61 (49.59)		315 (63.89)	48 (48.98)		317 (62.16)	13 (44.83)	
sheltering at home			.0008*			.012			.0004*
stringent	66 (14.16)	33 (26.83)		74 (15.07)	25 (25.51)		81 (15.94)	12 (41.38)	
relaxed	400 (85.84)	90 (73.17)		417 (84.96)	73 (74.49)		427 (84.06)	17 (58.62)	
illness/death loved one			.20			.75			.09
no	441 (94.23)	112 (91.06)		462 (93.71)	91 (92.86)		481 (94.31)	25 (86.21)	
yes	27 (5.77)	11 (8.94)		31 (6.29)	7 (7.14)		29 (5.69)	4 (13.79)	
disruptions in daily life	4.13 (3.18)	7.12 (4.46)	.0001*	4.32 (3.44)	6.91 (4.15)	.0001*	4.49 (3.45)	8.24 (4.71)	.0002*
social activity	3.98 (1.69)	3.78 (1.58)	.23	3.95 (1.68)	3.89 (1.63)	.73	3.95 (1.66)	4.10 (1.82)	.63

Note: p-values derived from t-tests for continuous demographic variables and chi-square or Fisher's Exact test for categorical variables; *p < .01

Table 5
Logistic regression predicting mental health caseness at 12 months.

Predictor	OR	95% CI	p-value
Depression			
age	.98	.96- .95	.01
sex	1.62	.84- 3.18	.15
education	.94	.83- 1.07	.36
marital status	.48	.28- .83	.008*
income	.81	.42- 1.58	.54
comorbidities	1.71	.99- 2.96	.06
prior mental health diagnosis	4.35	2.57- 7.36	.0001*
loss of income/employment	1.10	.63- 1.91	.74
food insecurity	1.18	.61– 2.29	.62
financial insecurity	1.02	.54– 2.08	.95
reduced access to medical care	.95	.56- 1.61	.85
self-reported COVID-19 symptoms	1.50	.63- 3.57	.36
perceived infection	1.68	.93- 3.02	.08
stringent sheltering at home	.58	.33- 1.04	.07
daily structure	.72	.44- 1.18	.20
disruption in daily life	1.21	1.12- 1.30	.0001*
Anxiety			
age	.97	.96- .99	.005*
sex	2.53	1.15- 5.58	.02
income	.79	.43- 1.47	.46
prior mental health diagnosis	5.26	2.95- 9.40	.0001*
food insecurity	1.49	.76- 2.92	.25
financial insecurity	1.30	.66- 2.56	.46
reduced access to medical care	1.06	.62- 1.81	.83
self-reported COVID-19 symptoms	1.37	.58- 3.23	.47
perceived infection	1.91	1.04- 3.48	.04
daily structure	.71	.42- 1.17	.18
disruption in daily life	1.12	1.05- 1.20	.001*
Trauma			
prior mental health diagnosis	6.44	2.10-19.72	.001*
perceived infection	2.49	1.08- 5.74	.03
loss of income/employment	2.50	1.08- 5.78	.03
stringent sheltering at home	.36	.15- .85	.02
disruption in daily life	1.20	1.09- 1.31	.0002*

* p < .01

ethnic background. Nonetheless, given that minority groups face greater risks for COVID-19 complications and mortality (Khunti, 2020), as well as broader inequities in healthcare, it seems clear that potential mental health sequelae in minority communities continue to merit close attention.

Consistent with hypotheses, several aspects of the pandemic were related to poorer outcomes in bivariate analyses. Individuals who believed (or were unsure) that they had been infected were more likely to screen positive on all three mental health outcomes, and those who perceived that they had experienced physical symptoms of COVID-19 were more likely to screen positive for depression and anxiety. (The number of participants who had received actual test results was too small to support meaningful analyses for viral status.)

As anticipated, individuals who experienced food insecurity or financial insecurity were more likely to screen positive for depression and anxiety (with a non-significant trend for trauma symptoms). Loss of income or employment was related to greater risk for depression and trauma symptoms. These results are a notable concern, given the breadth of the economic crisis precipitated by the pandemic, and underscore the need to address the mental health costs of economic turmoil. Participants who experienced reduced access to routine health care were more likely to report elevated depression and anxiety symptoms. The gradual resumption of services by primary and specialty care clinics, facilitated in part by broader use of telemedicine platforms, might help diminish these concerns over time. Fundamental changes in the fabric of daily life were also related to mental health difficulties. Individuals who had the least structure in their daily lives, with fewer planned or scheduled activities to organize their day, were more likely to screen positive for depression and anxiety, while those who were more stringent in their efforts to shelter at home, seldom leaving their

residence, were more likely to screen positive for depression and trauma symptoms. Moreover, greater disruption in daily life (as reflected in difficulties caring for others for whom one is responsible, arranging childcare, sustaining activities or religious pursuits, maintaining valued connections with family and friends, etc.) was associated with greater likelihood of clinically elevated distress on all three outcomes. These findings are consistent with concerns that have been expressed about the adverse effects of ruptured routines, responsibilities, and social ties in the aftermath of the pandemic (Holmes et al., 2020; Tull et al., 2020).

Multivariable analyses, which accounted for the effects of each of these demographic and situational risk factors, suggested that vulnerability to clinically meaningful depression was highest among individuals with a prior history of mental health problems, those who were unmarried, and those who experienced greater disruption in daily life due to the pandemic. Risks for generalized anxiety were highest among community residents who had a prior mental health history, lower incomes, and who experienced greater disruption in daily life. Similarly, the likelihood of elevated trauma symptoms was most pronounced among those with prior mental health diagnoses and greater disruption in daily life stemming from the pandemic.

4.2. Clinical Implications

Current results, in conjunction with findings from other studies reviewed here, suggest a need to marshal a range of pragmatic, accessible mental health services across the spectrum of care from prevention through screening and treatment. The need may be acute in view of an anticipated surge in demand for mental health care in response to the pandemic (Figueroa and Aguilera, 2020), especially in regions such as Arkansas struggling with protracted problems with disease mitigation, or those subjected to subsequent waves of infection. Internet-based services are expected to play a major role; evidence supports the efficacy of interventions delivered on digital platforms (e.g., Andersson et al., 2014) and smartphone applications (e.g., Firth et al., 2017). In the US and a number of other countries, barriers to billing for telehealth services have been reduced, but there remain racial and age-related disparities in digital literacy and access to technology (Figueroa and Aguilera, 2020). There have been preliminary efforts to develop interventions specifically geared toward the challenges of the pandemic (e.g., Bäuerle et al., 2020a; Figueroa and Aguilera, 2020; Sanderson et al., 2020; Wei et al., 2020), and these initiatives can be expected to grow.

4.3. Strengths and limitations

This study is among the first to examine mental health outcomes among community residents in Arkansas, and one of the few investigations to use validated screening tools to evaluate these outcomes in the US. On average, the sample is older than those evaluated in many prior studies, which offers novel information about the experiences of individuals at increased risk for COVID-19-related mortality. The large sample, range of clinically relevant outcomes, and detailed attention to pandemic-related risk factors are among the salient features of the study. Moreover, extensive efforts were made to select established measures that would allow for comparisons with future investigations. The study has important limitations as well. The cross-sectional design precludes any inferences about casual or temporal relationships (e.g., it is possible mental health difficulties contributed to greater financial insecurity or more stringent sheltering at home, rather than vice versa). Further research is needed to examine changes in these outcomes over time, especially in view of the rapidly evolving nature of local infection rates, mitigation efforts, and economic disruptions. Additionally, the sample was drawn from a research registry, and though it was racially, economically, and geographically diverse, it is not a representative sample of the population. Women were overrepresented, which is

common in survey studies (Bäuerle et al., 2020b; Forte et al., 2020; Germani et al., 2020; Gonzaelz-Sanguino et al, 2020), and African Americans and younger individuals were under-represented relative to the state population. The response rate was modest (35%), though in keeping with rates often observed in web-based community surveys (Porter and Whitcomb, 2003; Sinclair et al., 2012). To address these issues regarding selection bias and cross-sectional analyses, population-based studies using longitudinal designs would offer an important contribution at the next phase of research; such work is underway. Scores on self-report screening measures are not the same as clinical diagnoses; in subsequent investigations it would be useful to include information derived from diagnostic interviews. Finally, other variables that might be associated with mental health outcomes merit attention in future research, including level of media exposure, perceptions of personal risk, safety provisions associated with return to work, and attitudes toward vaccination.

In sum, results suggest heightened levels of psychiatric morbidity during a period of reopening in response to the COVID-19 pandemic, among community participants in a rural southern US state. Individuals who struggle with greater interference in their day-to-day lives, and those with preexisting mental health difficulties, may be most vulnerable to mental health sequelae.

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CRediT authorship contribution statement

Allen C. Sherman: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Project administration. **Mark L Williams:** Conceptualization, Methodology, Writing - review & editing. **Benjamin C Amick:** Conceptualization, Methodology, Writing - review & editing. **Teresa J. Hudson:** Conceptualization, Methodology, Writing - review & editing. **Erick L Messias:** Conceptualization, Methodology, Writing - review & editing.

Declaration of Competing Interest

We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2020.113476.

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