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Psychiatry Research

A Longitudinal Investigation of the Effects of the COVID-19 Pandemic on the Mental Health of Individuals with Pre-existing Severe Mental Illnesses

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ABSTRACT

Objective: Individuals with severe mental illnesses (SMI), including schizophrenia spectrum illnesses and affective disorders, may be at increased risk for negative mental health outcomes related to the COVID-19 pandemic. This study compared the severity of pre-pandemic symptoms and affective experiences to current symptoms to evaluate this possibility.
Methods: 148 individuals with SMI (92 with schizophrenia spectrum illnesses and 56 with affective disorders) were recruited from ongoing ecological momentary assessment studies that sampled day-to-day experiences and symptom severity prior to the pandemic. Participants completed a one-time phone survey that queried these same experiences/symptoms between April and June of 2020.
Results: Severity of affective experiences and psychotic symptoms remained stable across time, as did sleep duration. Well-being and the number of substances used increased during the early months of the pandemic. Increases in well-being were associated with being female and spending less time alone pre-pandemic. Patterns of stability/change did not differ according to diagnostic category.
Conclusions: At this relatively early stage, individuals with SMI are not reporting a worsening of symptoms or affective experiences and instead appear to be resilient in the face of the pandemic. Continued assessment is needed to determine whether this resilience will persist as the pandemic progresses.

1. Introduction

The COVID-19 pandemic has caused significant societal disruptions and dramatically impacted day-to-day behaviors and experiences. A burgeoning literature also demonstrates a strong link between the pandemic and mental health symptoms such as anxiety and depression (Rajkumar, 2020) that has prompted some to predict a subsequent second pandemic of mental health conditions (Choi et al., 2020). Supporting these assertions, a survey conducted in China among the general population in late January/early February 2020 reported moderate to severe anxiety symptoms in 28.8% of their sample and moderate to severe depressive symptoms in 16.5% of participants (Wang et al., 2020). Slightly higher incidences were reported in a larger study also conducted in China in February 2020, with 35.1%, 20.1%, and 18.2%

of survey respondents endorsing significant anxiety, depression, and sleep impairment, respectively (Huang and Zhao, 2020). An even later survey, which took place from the end of March 2020 to the end of May 2020 reported that 65.6% of the sample reported clinical levels of depression, anxiety, or stress (Tso and Park, 2020), perhaps suggesting that the mental health impact may increase with longer duration of the pandemic. Similar negative outcomes have also been reported in an American survey of the general population, where mean depression scores were above clinical cutoff, and over 25% of participants reported moderate to severe anxiety (Fitzpatrick et al., 2020). While it is unclear whether exceeding cutoffs on screening measures like those used in these cross-sectional survey studies (e.g., the Depression Anxiety Stress Scales) will equate to meeting clinical criteria, these findings indicate widespread negative impacts on mental health among members of the

general population.

Many experts have suggested that the COVID-19 pandemic may have an even more detrimental effect on individuals with pre-existing mental health conditions (Pfefferbaum and North, 2020), and in particular, those individuals with severe mental illnesses (SMIs) such as schizophrenia (Kozloff et al., 2020) and bipolar disorder (Stefana et al., 2020). For example, individuals with SMI may experience symptom exacerbations due to increased stress and greater risk of relapse due to disruptions in treatment delivery and availability (Chatterjee et al., 2020). Prevention strategies such as social distancing may also inadvertently worsen the symptoms of individuals with SMI, as these individuals may be more susceptible to isolation and loneliness (Hamada and Fan, 2020). Indeed, the few available empirical studies examining current symptoms have reported greater depression, anxiety, and stress in individuals with self-reported affective disorders (i.e., bipolar disorder or major depressive disorder) as compared to individuals without an affective disorder (Van Rheenen et al., 2020) and among individuals with SMI (i.e., bipolar disorder or psychotic disorder) relative to psychiatrically healthy controls (González-Blanco et al., 2020). Another cross-sectional study conducted in India found that 30% of individuals with SMI reported a re-emergence of psychiatric symptoms during COVID-19 lockdown (Muruganandam et al., 2020). Finally, there is also some suggestion of a differential impact across diagnoses such that individuals with affective disorders report greater COVID-19-related stress relative to individuals with schizophrenia spectrum illnesses (Hölzle et al., 2020).

While the studies reviewed above provide some evidence for a disproportionately negative impact on individuals with SMI, longitudinal studies with pre-pandemic data are necessary to accurately gauge the impact of the COVID-19 pandemic on individuals with pre-existing mental health conditions. To our knowledge, no studies have been conducted thus far that compare symptoms or affective experiences before and after the onset of the pandemic in individuals with SMI. However, one such study in college students found no increase in psychotic experiences during the pandemic (Hajdúk et al., 2020), and a study of older adults with pre-existing major depressive disorder counterintuitively found lower depression and anxiety during the pandemic (Hamm et al., 2020). Thus, it is possible that individuals with SMI may actually be somewhat resilient to the effects of the COVID-19 pandemic, but this remains untested.

Our research team has two ongoing NIMH-funded studies specifically focused on SMI that have cumulatively enrolled 232 individuals with diagnoses of schizophrenia, schizoaffective disorder, bipolar disorder (with or without psychotic features), or major depressive disorder with psychotic features (Moore et al., 2020). In both studies, participants completed self-ratings of symptom severity and daily mood experiences via ecological momentary assessments (EMA) administered multiple times each day over several days. Here, we contacted participants who had previously completed these parent studies via phone and asked them to answer the same questions that were included in the EMA questionnaires. Survey responses were collected between April 3, 2020 and June 4, 2020. The key aim of this report is therefore to compare pre-pandemic and current symptom ratings to identify the impact of the pandemic on mental health among individuals with pre-existing SMI. We also examined how factors such as broad diagnostic category (i.e., schizophrenia spectrum vs. affective disorders), typical daily activities (e.g., time spent alone), and demographic factors relate to change over time.

2. Methods

2.1. Participants

Of the 232 individuals enrolled in our ongoing studies, 148 participated in the phone survey. Participants diagnosed with either schizophrenia or schizoaffective disorder were included in the

Table 1
Participant demographic and clinical characteristics.

Characteristic	Schizophrenia Spectrum (n=92)		Affective Disorders (n=56)	
	n	(%)	n	(%)
Male *	42	45.7	16	28.6
Race *				
Caucasian	25	27.2	27	48.2
African American	52	56.5	11	19.6
Native American	1	1.1	1	1.8
Asian	2	2.2	6	10.7
Native Hawaiian/Pacific Islander	0	0	1	1.8
Other	12	13.0	10	17.9
Ethnicity				
Hispanic	21	22.8	17	30.4
Non-Hispanic	71	77.2	39	69.6
Diagnosis				
Schizophrenia	40	43.5	–	
Schizoaffective	52	56.5	–	
Bipolar, Psychotic Features	–		34	60.7
Bipolar, No Psychotic Features	–		21	37.5
MDD, with Psychotic Features	–		1	1.8
Employment Status*				
Employed, Full Time	3	3.3	10	17.9
Employed, Part Time	12	13.0	7	12.5
Unemployed	13	14.1	9	16.1
Stay-at-home Parent	0	0	1	1.8
Part-time Student	0	0	1	1.8
Full-time Student	0	0	3	5.4
Receiving Disability, Unemployed	53	57.6	20	35.7
Receiving Disability, Part-time work	7	7.6	2	3.6
Retired	1	1.1	3	5.4
Relationship Status[a]				
Single	56	62.9	30	53.6
In relationship	33	37.1	26	46.4
Residential Status[a]				
Independent, Financially Responsible	57	64.0	40	71.4
Independent, Not Financially Responsible	19	21.3	13	23.2
Residential Facility, Unsupervised	6	6.7	2	3.6
Residential Facility, Supervised	7	7.9	1	1.8
	Mean	SD	Mean	SD
Age (years)	42.95	10.76	40.77	11.76
Education (years) *	12.52	2.36	14.75	2.48
Estimated IQ *[,a]	93.96	10.11	102.27	11.32
PANSS positive total *[,a]	17.98	4.93	13.29	4.70
PANSS negative total *[,a]	12.98	3.74	10.43	2.44
PANSS general total *[,a]	31.52	8.13	28.93	6.40
MADRS[b]	12.14	11.27	13.50	11.76
YMRS *[,c]	1.21	3.02	2.70	5.08
SUMD *[,a]	4.40	1.69	3.48	0.97

Abbreviations: PANSS, Positive and Negative Syndrome Scale; MADRS, Montgomery-Asberg Depression Rating Scale; YMRS, Young Mania Rating Scale; SUMD, Scale to Assess Unawareness of Mental Disorder

* Schizophrenia spectrum and affective disorders groups differ at $p < .05$

[a] Information missing for 3 schizophrenia spectrum individuals.

[b] Information missing for 4 schizophrenia spectrum individuals.

[c] Information missing for 6 schizophrenia spectrum individuals.

schizophrenia spectrum group (n=92), and participants diagnosed with bipolar disorder (I or II) with or without psychotic features or major depression with psychotic features were included in the affective disorders group (n=56). Diagnoses were determined at baseline study visits using the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998) and the psychosis module of the Structured Clinical Interview for DSM-5 (SCID-5) (First et al., 2015). Raters were

trained on administration and scoring through videotape and practice interviews to acceptable inter-rater reliability (ICC > 0.80). Demographic characteristics of the study sample are presented in Table 1.

All participants were recruited from the University of California San Diego (UCSD), the University of Miami (UM), and The University of Texas at Dallas (UTD) through online advertisements and/or flyers at outpatient clinics. Inclusion and exclusion criteria varied slightly across studies, but in general, participants were adults aged between 18 and 65 with estimated IQ > 70, as indicated by word reading performance on either the Wide Range Achievement Test-3 (WRAT-3) (Wilkinson, 1993) or the WRAT-4 (Wilkinson and Robertson, 2006). No participants were receiving inpatient care, and all participants were free from neurological and/or neurodegenerative disorders. The institutional review boards at all three study sites approved the survey protocol, and all participants provided verbal consent for this survey.

2.2. Measures and procedures

2.2.1. Baseline clinical characteristics

As part of the parent studies, participants first completed a baseline visit during which diagnosis and study eligibility were confirmed and clinician ratings of symptom severity were obtained. The Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) was used to assess the severity of positive, negative, and general symptoms. Severity of depression symptoms was assessed using the Montgomery-Asberg Depression Rating Scale (MADRS) (Montgomery and Åsberg, 1979), and severity of manic symptoms was assessed using the Young Mania Rating Scale (YMRS) (Young et al., 1978). The Scale to Assess Unawareness of Mental Disorder (SUMD) was used to evaluate insight into illness (Amador et al., 1993). Descriptive statistics are provided in Table 1.

2.2.2. EMA questionnaires

Participants were then given a study-provided Samsung Galaxy S8 smartphone that was used to administer the EMA portion of the parent study. EMA questionnaires were developed by authors CAD, PDH, RCM, and AEP and were administered three times per day for either 30 days (Study 1) or 10 days (Study 2). Data collection for Study 1 began on Dec. 4, 2018 and for Study 2 on July 11, 2019, and enrollment is currently ongoing for both. Overall response rates to EMA questionnaires for individuals in the current sample was high, with participants completing 77.9% (SD = 22.2%) of all assessments in Study 1 (n = 80) and 84.3% (SD = 16.8%) of all assessments in Study 2 (n = 68).

Questionnaires for both studies included items about engagement in daily activities and social interactions (i.e., "Where are you?", "Who are you with?", "What are you doing?") for which participants selected responses from a drop-down list. Mood and psychotic symptoms (e.g., "since the past alarm, how much have you felt sad or depressed; since the last alarm how much have heard voices") were also queried and rated on a scale from 1 (not at all) to 7 (very much). Specific mood experiences included feeling sad/depressed, energized/excited, and happy; and specific psychotic symptoms were hearing voices and having paranoid thoughts. One additional question regarding sleep quantity (reported in hours/minutes) was asked at only the first survey of the day, and two additional questions were asked only at the last survey of the day - substances used (selected from a drop-down list) and overall level of well-being (rated from 1-7).

2.2.3. Phone survey

To assess current symptoms, the same five mood and psychotic symptom questions from the EMA questionnaires were administered via phone. The questions regarding sleep, substance use, and well-being were also asked, and the response format was identical to that used for the EMA questionnaires.

2.3. Statistical Analyses

2.3.1. EMA data processing

To obtain estimates of pre-pandemic activity, responses to the three activity questions were first dichotomized to home vs. away; alone vs. with others, and working vs. other activity. The percentage of surveys with each category of response was then calculated and used in subsequent analyses. Ratings of moods, symptoms and reports of well-being were also averaged across all completed surveys for each participant to quantify pre-pandemic symptom severity. Sleep quantity was also averaged across all completed surveys, and for substance use, the number of substances used at each query were summed and then averaged across the total number of completed surveys. On average, EMA periods for Study 1 covered 28.8 days (SD = 4.62 days), and EMA periods for Study 2 covered 9.97 days (SD = 5.12 days).

2.3.2. Analyses

To assess representativeness of the current sample, demographic, baseline clinical characteristics, and EMA responses were first compared between those individuals in the parent studies who completed the survey (i.e., participants) and those who did not (i.e., non-participants). The effect of the pandemic on affective experiences, symptoms, and behavioral health (i.e., sleep and substance use) was then assessed via a series of repeated measures ANOVAs that used time as the within-subject variable (pre-pandemic EMA averages vs. current survey responses) and diagnostic category as the between-subjects variable (schizophrenia spectrum vs. affective disorders). In these analyses, elapsed time between the beginning of the EMA period and the current survey (mean (SD) = 225.55 (115.82) days) was included as a covariate, and the p-value for significance was set at .05. Pearson's r correlations between pre- and during-pandemic ratings were also calculated for the sample as a whole and for each diagnostic category to assess within-group rank order stability of scores over time.

To examine factors that may be related to change over time, we then calculated change scores for each of the dependent variables (during-pandemic rating minus pre-pandemic rating) and computed partial correlations with these change scores and demographic factors and EMA activity while controlling for elapsed time. Categorical independent variables were assessed with one-way ANCOVA. Additionally, the potential contribution of variability during the EMA period to changes pre- vs. during-pandemic was also examined by first calculating the intra-individual standard deviation for ratings of each outcome variable (i.e., moods, symptoms, sleep, substances used, and well-being) across all completed surveys for each participant. The correlation between these values and change scores was then computed while again controlling for elapsed time. Given the large number of comparisons examined in these last analyses of potentially contributing factors, only results significant at $p < .01$ are reported.

3. Results

3.1. Survey participants vs. non-participants

The participant group had a significantly higher percentage of females (60.8%) relative to the non-participant group (42.9%) ($\chi^2(1)$ = 6.96, $p = .008$) and had completed more years of education (participant mean = 13.36, SD = 2.63 vs. non-participant mean = 12.51, SD = 2.49; $t(230) = 2.44$, $p = .016$). There were no significant differences between participants and non-participants on any of the other demographic factors, including diagnosis, (all $ps > .14$) or baseline clinical characteristics/symptoms (all $ps > .07$). Groups also did not differ on mean levels of activity (i.e., being alone, being home, or working) during the EMA period or on EMA responses of affective experiences or symptom severity, sleep duration, or well-being. Participants reported using a greater number of substances (mean = 0.65, SD = 0.69) than non-participants during the EMA period (mean = 0.47, SD = 0.60; $t(215)$

Table 2
Descriptive Statistics for Symptom and Behavioral Health Ratings.

Symptom	Schizophrenia Spectrum (n = 92)				Affective Disorders (n = 56)			
	Pre Mean (SD)	Post Mean (SD)	t	Cohen's d_z	Pre Mean (SD)	Post Mean (SD)	t	Cohen's d_z
Sad/Depressed	2.85 (1.58)	3.16 (2.20)	1.43	0.15	2.95 (1.33)	2.95 (2.05)	-.004	0.00
Energized/Excited	3.90 (1.59)	4.35 (2.13)	2.42*	0.25	3.34 (1.25)	3.41 (2.06)	0.28	0.04
Happy	4.29 (1.65)	4.74 (2.16)	2.50*	0.26	3.94 (1.31)	3.93 (1.92)	-0.07	0.01
Hearing Voices	2.47 (1.65)	2.42 (1.95)	-0.23	0.02	1.23 (0.46)	1.18 (0.64)	-0.59	0.08
Paranoia	3.16 (1.85)	3.16 (2.31)	0.01	0.00	1.79 (1.25)	1.89 (1.50)	0.61	0.08
Well-being[a]	**4.99 (1.36)**	**5.47 (1.70)**	**3.34***	**0.35**	**4.42 (1.10)**	**5.05 (1.30)**	**3.23***	**0.43**
Substances Used[a]	**0.75 (.075)**	**0.86 (0.86)**	**1.20**	**0.13**	**0.49 (.054)**	**0.71 (0.73)**	**2.06***	**0.28**
Sleep (in hours)[b]	7.35 (2.22)	7.01 (2.65)	-1.19	0.13	6.85 (1.61)	7.06 (2.64)	0.61	0.08

Note: Cohen's d_z calculated for within-group effect size as Cohen's dz = t/sqrt(N) in accord with Lakens (2013).
* Within group pre-post difference significant at $p < .05$
Bold indicates significant main effects of time at $p < .05$
[a] Data were missing for one individual in the Schizophrenia Spectrum group.
[b] Data were missing for two individuals in the Schizophrenia Spectrum group.

= 2.04, $p = .043$).

3.2. Comparison of pre- vs. during-pandemic affective experiences and symptom severity

Descriptive statistics for all pre- and during-pandemic ratings are provided in Table 2. The series of repeated measures ANOVAs revealed a number of significant main effects of group indicating higher ratings of feeling energized (F(1,145) = 7.26, p = .008, $\eta_p^2 = .048$), feeling happy (F(1,145) = 3.96, p = .048, $\eta_p^2 = .027$), hearing voices (F(1,145) = 30.95, p < .001, $\eta_p^2 = .176$), and having paranoid thoughts (F(1,145) = 26.29, p < .001, $\eta_p^2 = .153$) among individuals with schizophrenia spectrum illnesses relative to affective disorders. Individuals in the schizophrenia spectrum group also reported higher well-being as a main effect (F(1,144) = 4.84, p = .029, $\eta_p^2 = .033$), but groups did not differ in ratings of sadness, numbers of substances used, or sleep duration (ps > .08, $\eta_p^2 < .02$). Of note, within the schizophrenia spectrum illness group, higher ratings of paranoia were significantly negatively correlated with ratings of happiness (r = -.27, p = .01) and ratings of well-being (r = -.29, p = .006) but positively correlated with voices (r = .33, p = .001), suggesting that the group as a whole was not over-endorsing all items relative to the affective disorders group but that sub-groups of participants within the larger schizophrenia spectrum illness group may be driving the differences between diagnostic categories.

More importantly, significant main effects of time were revealed only for number of substances used (F(1,144) = 4.72, p = .031, $\eta_p^2 = .032$) and reports of well-being (F(1,144) = 11.20, p = .001, $\eta_p^2 = .072$) such that both increased during-pandemic. Across the sample as a whole, no statistically significant changes over time were evident for any of the assessed affective experiences/symptoms or for sleep duration (all ps > .29, $\eta_p^2 < .008$). Further, none of the group x time interactions were significant (all ps > .09, $\eta_p^2 < .019$) indicating that there were no systematic differences in change over time based on diagnostic category.

Correlations between pre- and during-pandemic ratings were of medium to large effect sizes (see Table 3) indicating good rank order stability over time. This was most evident in the sample as a whole; however, within the separate diagnostic categories, there were a few symptoms that were less stable (e.g. paranoia for the schizophrenia spectrum group and hearing voices for the affective disorders group). A comparison of strength of correlations between groups using the Fisher r-to-z transformation revealed significantly stronger associations between pre- and during-pandemic scores in the schizophrenia spectrum group for hearing voices (p = .03) and well-being (p = .011) and stronger associations in the affective disorders group for paranoia (p = .009).

Table 3
Correlations Between Pre- and During-pandemic Ratings

Symptom	Schizophrenia Spectrum (n = 92)	Affective Disorders (n = 56)	Combined Sample (n = 148)
	r	r	r
Sad/Depressed	.439**	.459**	.433**
Energized/Excited	.587**	.430*	.553**
Happy	.623**	.600**	.622**
Hearing Voices	.559**	.253	.609**
Paranoia	.273*	.624**	.417**
Well-being[a]	.607**	.259	.524**
Substances Used[a]	.477**	.203	.409**
Sleep (in hours)[b]	.368**	.408*	.372**

** p < .001
* p < .01
[a] Data were missing for one individual in the Schizophrenia Spectrum group.
[b] Data were missing for two individuals in the Schizophrenia Spectrum group.

3.3. Factors relating to change over time

To assess factors that may contribute to greater pandemic-induced change, all demographic and clinical factors listed in Table 1 were examined. Due to uneven distributions across categories, employment status was dichotomized as employed vs. unemployed, and race was reclassified into three categories: Caucasian, African American, and Other. Similarly, analyses of specific diagnosis were limited to schizophrenia, schizoaffective disorder, bipolar with psychotic features, and bipolar without psychotic features given that only one participant had a diagnosis of MDD.

No factors were significantly associated with change over time for sad/depressed, energized/excited, happy, sleep duration, or number of substances used. Individuals who were employed at baseline showed a decrease in voices (mean = -.56, SD = 1.38) relative to those who were unemployed (mean = .18, SD = 1.38; t(143) = 3.00, p = .003), and females reported a greater increase in well-being as compared to males (female mean = .80, SD = 1.39; male mean = .14, SD = 1.38; t(145) = 2.82, p = .006). Higher general symptoms of psychopathology at baseline as assessed by the PANSS were related to a decrease in paranoia over time (r = -.25, p = .003), and less time spent alone during the EMA period was associated with an increase in well-being during-pandemic (r = -.297, p < .001). No other demographic or activity variables, including specific diagnosis or variability in EMA ratings, were significant.

3.4. Post hoc analyses

Potential effects of site (UTD vs. UCSD vs. UM) and parent study (Study 1 vs. Study 2) on change over time were tested using a series of one-way ANOVAs and two-sample t-tests, respectively. Amount of change did not differ across sites for any of the affective experiences, symptoms, or behavioral health outcomes (all ps ≥ .10). Similarly, change across time did not differ depending on parent study for any of the variables of interest except for substance use (Study 1 mean = .40, SD = .86 vs. Study 2 mean = -.14, SD = .67; $t(145) = 4.19$, $p < .001$). The repeated measures ANOVA on number of substances used was therefore repeated while controlling for parent study. The main effect of time remained significant F(1,144) = 21.97, p < .001, $\eta_p^2 = .132$), and the main effect of group and interaction remained non-significant (both p > .40).

4. Discussion

This study examined the effects of the COVID-19 pandemic on the day-to-day mental health of individuals with pre-existing severe mental illness by comparing pre-pandemic ratings of symptom severity and behavioral health to ratings collected during-pandemic. Contrary to expectations, there were no significant changes in mood experiences or psychotic symptoms over time, and sleep duration was also unaffected. Participants did report a small but significant increase in the number of substances used, and somewhat surprisingly, participants also reported a significant increase in well-being post-pandemic onset. Diagnostic category (i.e. schizophrenia spectrum illness vs. affective disorder) did not have any impact on these results, suggesting that they apply broadly to SMI. Thus, the lack of symptom exacerbations and increase in well-being suggest that individuals with SMI, regardless of specific diagnosis, coped relatively well in the early months of the pandemic and did not experience negative effects on their day-to-day mental health.

It is difficult to determine what may be contributing to the increase in number of substances used and well-being. Our examination of contributing factors did not identify any systematic associations for substance use and indicated that for well-being, only being female and spending less time alone were related to increased ratings. It is not clear why women with SMI would report a greater increase in well-being than males, particularly given conflicting evidence from the general population (Pieh et al., 2020); however, this suggests an important distinction related to gender in SMI that deserves further study. The finding that spending less time alone pre-pandemic was associated with increased well-being during-pandemic is consistent with studies showing that social support is associated with resiliency (Liu et al., 2020). Here, being alone less frequently pre-pandemic may be indicative of larger or higher quality social networks that are able to be drawn upon during-pandemic and that may increase one's sense of overall well-being.

When considering these findings, aspects of the study design should be noted. Strengths include the sample size, inclusion of both schizophrenia spectrum illnesses and affective disorders, and availability of EMA data. By averaging multiple days of assessments, estimates of pre-pandemic experiences and symptoms are likely to be highly precise, thus maximizing the ability to detect change due to the pandemic. Limitations include the possibility of selection bias, which should be considered when generalizing these results to other individuals with SMI. While there were few differences between survey participants and non-participants, participants were more likely to be female, to have more years of education, and to use a greater number of substances relative to non-participants. Second, our results regarding substance use pertain only to the number of substances being used and not amounts of use or whether or not that use is problematic.

Finally, it is important to emphasize that data were collected relatively early in the pandemic and only at one timepoint between the beginning of April and May of 2020. Texas, California, and Florida all enacted school closures beginning in mid-March, and the governing bodies of all three sites had also either mandated or recommended the closure of non-essential retail and commercial establishments (e.g., restaurants, bars, gyms, etc.) prior to the beginning of our survey period. The number of positive cases climbed steadily from 274,143 on April 3, 2020 to 1,862,656 on June 4, 2020, as did the number of deaths – from 6,496 to 108,064 (Centers for Disease Control and Prevention, 2020). Thus, our survey period captures a time of exponential growth in COVID-19 cases/deaths and unprecedented governmental attempts to slow spread of the virus that represents a critical period of the pandemic. However, it is quite possible that negative effects make take time to accrue (e.g., as the economy continues to be impacted, as "quarantine fatigue" (Zhao et al., 2020) sets in, etc.). Thus, longer longitudinal studies are needed to determine whether the mental health stability reported here is likely to continue or if trajectories of declining mental health will emerge as the pandemic continues. Nevertheless, the current results provide the first evidence to date that individuals with SMI are showing resilience in the early stages of the COVID-19 pandemic rather than a worsening of symptoms and a decline in mental health.

CRediT authorship contribution statement

Amy E. Pinkham: Validation, Formal analysis, Writing - original draft. **Robert A. Ackerman:** Conceptualization, Methodology, Resources, Writing - review & editing, Project administration, Funding acquisition. **Colin A. Depp:** Conceptualization, Methodology, Resources, Writing - review & editing, Project administration, Funding acquisition. **Philip D. Harvey:** Conceptualization, Methodology, Resources, Writing - review & editing, Project administration, Funding acquisition. **Raeanne C. Moore:** Conceptualization, Methodology, Resources, Writing - review & editing, Project administration, Funding acquisition.

Declaration of Competing Interest

Dr. Moore is a co-founder of KeyWise AI, Inc. and a consultant for NeuroUX. Dr. Harvey has received consulting fees or travel reimbursements from Acadia Pharma, Alkermes, Bio Excel, Boehringer Ingelheim, Minerva Pharma, Otsuka Pharma, Regeneron Pharma, Roche Pharma, and Sunovion Pharma during the past year. He receives royalties from the Brief Assessment of Cognition in Schizophrenia. He is chief scientific officer of i-Function, Inc. He had a research grant from Takeda and from the Stanley Medical Research Foundation. No other authors have conflicts of interest to report.

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