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The Intersection Between Childhood Trauma, the COVID-19 Pandemic, and Trauma-related and Psychotic Symptoms in People With Psychotic Disorders

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Introduction: **People with psychotic disorders may be disproportionately affected by the traumatic effects of the COVID-19 pandemic. Childhood trauma, which also increases vulnerability to subsequent stressors, is common in individuals with psychosis. In this study, we investigated the intersection of the pandemic, childhood trauma, and psychotic and trauma-related symptoms in individuals with psychotic disorders.** ***Methods:*** **We administered a cross-sectional survey to 151 participants [47 schizophrenia (SZ), 53 psychotic bipolar disorder (BP)], 51 healthy control (HC)] during the COVID-19 pandemic. Participants were asked about exposure to the pandemic's impacts, childhood trauma, and post-traumatic stress, dissociative, and psychotic symptoms.** ***Results:*** **BP reported greater negative impacts to emotional health than SZ and HC and to non-COVID physical health than HC. SZ reported *less* impact on work and employment during the pandemic. There were no other group differences in pandemic-related adversities. We also found that cumulative exposure to the pandemic's negative impacts was significantly associated with PTSD symptoms but not psychotic or dissociative symptoms. Moreover, the number of adversities an individual experienced during the pandemic was strongly associated with the cumulative number of traumatic experiences they had in childhood.** ***Discussion:*** **Our results suggest that having a psychotic disorder does not, in and of itself, increase susceptibility to the pandemic's negative impacts. Instead, we provide evidence of a graded relationship between cumulative exposure to the pandemic's negative impacts and PTSD symptom severity, as well as a graded relationship between cumulative childhood traumatic experiences and the number pandemic adversities, across diagnoses.**

Keywords: schizophrenia/bipolar disorder/serious mental illness/coronavirus/post-traumatic stress disorder/dissociation

Introduction

The coronavirus disease 2019 (COVID-19) pandemic is an unprecedented world-wide public health crisis that has been associated with high levels of traumatic stress. While some individuals may find greater strength and resilience during a crisis, many large-scale disasters—like the COVID-19 pandemic—are accompanied by a subsequent increase in post-traumatic stress disorder (PTSD).[1] A meta-analysis of 76 studies, published approximately a year into the pandemic, showed that COVID-related post-traumatic stress symptoms are present in 36.3% of COVID-19 patients, 29.2% of healthcare workers, and 27.1% of the general population.[2]

Studies have shown that the pandemic can also exacerbate symptoms in individuals with existing mental illness,[3,4] a group generally considered to have higher susceptibility to stress. In particular, people with serious mental illness (SMI), such as those with schizophrenia (SZ) and bipolar disorder (BP), may be at disproportionately high risk of experiencing the pandemic's negative impacts.[5–9] Even before the pandemic began, people with psychotic disorders bore a high burden of disease and disability,[10,11] with more physical health problems,[12–14] higher rates of premature death,[15–17] greater risk of homelessness,[18] and higher rates of loneliness and social isolation.[19–21] These and other factors may make people with psychotic disorders more vulnerable to the adverse effects of the COVID-19 pandemic. Indeed, recent studies have shown an elevated risk of infection[22] and mortality[23,24] due to SARS-CoV-2 in individuals with SZ, even compared to individuals with other psychiatric disorders.

Beyond the direct effects of infection with SARS-CoV-2, psychosocial and environmental stress from the pandemic is expected to adversely affect the psychological and emotional well-being of individuals with psychotic

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disorders. Studies thus far have reported that individuals with SMI have poorer sleep,[25] more difficulty coping,[26,27] and higher levels of (and slower recovery from[25]) COVID-19-related stress,[25,26,28–30] anxiety,[25–30] depression,[25–30] loneliness,[26] and psychotic experiences[27,28] compared to individuals without psychiatric illness. However, there have been mixed findings, as some studies found no exacerbation of mood or psychotic symptoms in patients,[31,32] but rather an increase in self-reported well-being.[31]

One explanation for the conflicting findings may be differences in study design. Many studies only compared differences between patients and healthy controls,[26–30,33] making it difficult to determine how much of the differences are attributable to the pandemic versus baseline differences in psychopathology. The mixed findings may also reflect the effects of differing severities of exposure to pandemic-related adversities. The experience of the pandemic can be quite variable from one person to another (and one region to another[34]), yet most studies did not directly relate the cumulative number of pandemic-related exposures to measures of psychological distress. Studies that address these limitations are needed.

Finally, there may be additional factors not measured in the above studies—such as prior history of trauma—that might moderate patients' response to the negative impacts of the pandemic. Recent studies in the non-psychiatric population[35–41] or in patients with non-psychotic disorders[42,43] have shown that early life adversities are associated with higher exposure to COVID-related adversities,[35] as well as to higher levels of stress,[38,40,41] anxiety,[35,39] depressive symptoms,[35,37,39] PTSD symptoms,[41–43] and psychotic-like symptoms[36] during the pandemic. Childhood trauma exposure is a strong risk factor for developing a psychotic disorder,[44,45] with studies showing a dose–response relationship between cumulative childhood adversities and psychosis risk.[46–50] As childhood trauma has been shown to strengthen the impact of daily stressors on psychotic experiences among people with psychosis,[51] it is therefore possible that prior trauma exposure renders people with psychotic disorders especially susceptible to the deleterious psychiatric and psychosocial effects of the pandemic. No study to our knowledge, however, has addressed this possibility.

Given that childhood trauma is associated with a range of diagnostic outcomes including psychosis, it is not surprising that trauma-related and psychotic disorders are highly comorbid. Approximately 29% of people with SZ, 37% of schizoaffective disorder, and 39% of BP meet criteria for comorbid PTSD.[52] Furthermore, psychotic and dissociative psychopathology share some common features (e.g., depersonalization, derealization, voice hearing, "made" experiences, etc.),[53–59] and studies have found that 27%−50%[60,61] of SZ patients also meet diagnostic criteria for a dissociative disorder. Importantly, individuals with a psychotic disorder who have a childhood trauma history tend to fare more poorly,[62] with greater severity of symptoms,[63–69] as well more and longer hospitalizations[66,67,70,71] and more protracted illness.[71,72]

In this study, we sought to investigate the intersection of the COVID-19 pandemic, childhood trauma severity, and psychotic and trauma-related symptoms in a sample of individuals with established psychotic disorders [schizophrenia spectrum (SZ) and psychotic bipolar disorder (BP)] and healthy individuals. Our hypotheses were that: (1) individuals with SZ and BP will have experienced more negative impacts of the pandemic than survey respondents without psychiatric illness; (2) the greater the pandemic's negative impacts, the greater the trauma-related and psychotic symptoms people with SZ and BP will have experienced; and (3) individuals with more severe childhood trauma histories will have experienced more pandemic-related adversities and (4) more severe psychotic and trauma-related symptoms during the pandemic.

Methods

Design and Sample

We conducted a cross-sectional survey study exploring trauma-related and psychotic symptoms in a sample of individuals with psychotic disorders and healthy controls during the COVID-19 pandemic. Data collection occurred from June 3, 2020 to November 23, 2020. This timeframe captures respondents' experiences roughly 2−8 months after the World Health Organization declared COVID-19 a pandemic on March 11, 2020. Key COVID-19-related developments that occurred during the study period include the US reporting 100 000 COVID-19 deaths on May 28, 2020, and surpassing 2 million (June 10, 2020) then 3 million (July 7, 2020) confirmed COVID-19 cases.[73] In the state of Massachusetts, where the vast majority of the survey respondents resided at the time of study participation, the governor declared a state of emergency due to COVID-19 on March 10, 2020. On March 23, 2020, all businesses that did not provide essential services were shut down and a prohibition was placed on any gatherings of more than 10 people.[74]

As data collection occurred in the midst of a statewide lockdown, we utilized online survey methods, which enabled people to participate safely without in-person contact. The study was approved by the Mass General Brigham (MGB) Institutional Review Board (IRB), which oversees human subjects' research at McLean Hospital. As this survey study involved no procedures for which written consent is normally required outside of research, the IRB granted a waiver of documentation of consent. Nevertheless, we felt it was important for participants to provide more than implied consent, and all participants indicated their agreement to participate with an online consent form that outlined the purpose of the study as well as potential risks and benefits of study participation.

The consent form and self-report questionnaires were administered using Research Electronic Data Capture (REDCap)[75] hosted at MGB.

We enrolled 151 men and women ages 18−89 who had previously participated in research in the McLean Hospital Schizophrenia and Bipolar Disorder Program and for whom we had diagnostic information either through the completion of the Structured Clinical Interview for Diagnosis (SCID) (n = 139) or through self-report of their clinical diagnosis (n = 12). Inclusion criteria for patients included a DSM-IV-TR or DSM-5 diagnosis of a schizophrenia spectrum disorder (SZ) or psychotic bipolar disorder (BP). Healthy control participants could not have a first-degree relative with a psychotic disorder.

The first step in the recruitment process involved sending email invitations to eligible individuals. Individuals who replied with interest to the email invitation were sent a link to the REDCap survey with the consent form and questionnaires. If we did not receive a response to the initial email invitation, we additionally attempted to contact the individual by phone. There were three participants we reached by phone who had no access to, or challenges, using a computer. In these cases, we mailed by postal service a printed hard copy of the REDCap consent form and surveys, which these participants, in turn, completed and mailed back to research staff. After study completion, all subjects were compensated for their time with a $20 Amazon gift card.

Of the 365 individuals we invited (145 SZ, 131 BP, 89 HC), 151 subjects (47 SZ, 53 BP, 51 HC) enrolled and 150 completed all components of the study (one SZ participant completed the EPII but not the psychiatric symptom scales), yielding a response rate of 41.4% (32.4% SZ, 40.4% BP, 57.3% HC) and a completion rate of 41.1%.

Measures

Participants completed the Epidemic-Pandemic Impacts Inventory (EPII),[76] a recently developed 92-item self-report questionnaire that asks about the different areas of life affected by the coronavirus pandemic. Seventy-three items ask about negative impacts (EPII-neg) across nine domains, while 19 items inquire about positive changes (EPII-pos) during the pandemic (table 1). The EPII asks about the participant's direct experience of the pandemic ("me"), as well as the experiences of other household members ("person in home"). For this study, we generated composite scores for EPII-neg and EPII-pos using only the "me" responses. For the EPII-neg score, we summed 70 of the 73 EPII-neg items; we excluded items #42–43 about the emotional health of the participant's children ("increase in child behavioral or emotional problems" and "increase in child's sleep difficulties or nightmares"), and #72 ("someone died of this disease while in our home") which we considered to be an example of experiences more broadly captured by #73 ("death of close friend or family member from this disease"). In addition to calculating a total EPII-neg score, we also calculated subscores for the nine EPII-neg domains. As the EPII-pos score did not differ between the three participant groups ($F_{2,149}$ = 1.21, P = .301), we did not analyze EPII-pos scores further.

To assess childhood trauma history, we administered the Maltreatment and Abuse Chronology of Exposure (MACE),[77] a 52-item self-report questionnaire that assesses the severity and timing of ten categories of childhood maltreatment: emotional neglect (5 items), non-verbal emotional abuse (6 items), parental physical maltreatment (6 items), parental verbal abuse (4 items), peer emotional abuse (5 items), peer physical bullying (5 items), physical neglect (5 items), sexual abuse (7 items), witnessing interparental violence (5 items), and witnessing violence to siblings (4 items). For each item, participants indicated (yes/no) whether they had the particular experience in childhood (≤18 years). After reverse scoring the six items that ask about positive childhood experiences (#42–45, #51–52), we summed the 52 items (MACE sum) to generate a continuous measure of childhood trauma severity (range 0-52).

Finally, we asked participants about the severity of PTSD, dissociative, and psychotic experiences since the pandemic started, and especially in the past month. The Posttraumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders (DSM), 5th edition (PCL-5)[78,79] is a 20-item self-report measure that assesses the 20 DSM-5 symptoms of PTSD, including re-experiencing symptoms such as flashbacks and nightmares (criterion B, 5 items), avoidance of trauma-related stimuli (criterion C, 2 items), negative alterations in cognition and mood (criterion D, 7 items), and alterations in arousal and reactivity (criterion E, 6 items). Each item is given a Likert rating from 0 ("not at all") to 4 ("extremely"). We summed all 20 items to generate a continuous measure of PTSD symptom severity (range 0–80) for each individual. Research suggests that a PCL-5 cutoff score between 31 and 33 is indicative of probable PTSD.[78] A provisional diagnosis of PTSD can also be made by treating each item rated 2 ("moderately") or higher as an endorsed symptom, and following the DSM-5 diagnostic criteria (at least 1 criterion B, 1 C, 2 D, and 2 E items).[79]

The Dissociative Experiences Scale II (DES-II)[80] is a 28-item self-report measure that assesses the frequency of dissociative experiences, such as depersonalization, derealization, absorption, and amnesia. The scale was designed to assess the contribution of dissociation to various psychiatric disorders, as well as to screen for dissociative disorders or disorders with a significant dissociative component such as PTSD.[80] Respondents are instructed to indicate the percentage of time (in 10% increments from 0% to 100%) they have had each type of experience

Table 1. Epidemic-Pandemic Impacts Inventory (EPII) Categories and Example Items

Category	Example Items
Work and employment	Laid off from job or had to close own business; reduced work hours or furloughed; hard time making the transition to working from home; provided direct care to people with the disease (e.g., doctor, nurse, patient care assistant, radiologist).
Education and training	Had a child in home who could not go to school; adult unable to go to school or training for weeks or had to withdraw.
Home life	Childcare or babysitting unavailable when needed; had to take over teaching or instructing a child; had to move or relocate; became homeless; increase in verbal arguments or conflict with a partner or spouse; increase in physical conflict with a partner or spouse.
Social activities	Separated from family or close friends; family celebrations cancelled or restricted; planned travel or vacations cancelled; religious or spiritual activities cancelled or restricted; unable to be with a close family member in critical condition; unable to do enjoyable activities or hobbies.
Economic	Unable to get enough food or healthy food; unable to access clean water; unable to pay important bills like rent or utilities; difficulty getting places due to less access to public transportation or concerns about safety; unable to get needed medications.
Emotional health and well-being	Increase in mental health problems or symptoms (e.g., mood, anxiety, stress); increase in sleep problems or poor sleep quality; increase in use of alcohol or substances; unable to access mental health treatment or therapy; not satisfied with changes in mental health treatment or therapy; spent more time on screens and devices.
Physical health problems	Increase in health problems not related to this disease; less physical activity or exercise; overeating or eating more unhealthy foods (e.g., junk food); more time sitting down or being sedentary; important medical procedure cancelled (e.g. surgery); got less medical care than usual (e.g., routine or preventive care appointments).
Physical distancing and quarantine	Isolated or quarantined due to possible exposure to this disease; isolated or quarantined due to symptoms of this disease; isolated due to existing health conditions that increase risk of infection or disease; moved out or lived away from family due to a high-risk job (e.g., health care worker, first responder).
Infection history	Tested and currently have this disease; had symptoms of this disease but never tested; tested positive for this disease but no longer have it; got medical treatment due to severe symptoms of this disease; hospital stay due to this disease.
Positive change	More quality time with family or friends in person or from a distance; improved relationships with family or friends; increase in exercise or physical activity; more time in nature or being outdoors; more appreciative of things usually taken for granted; ate healthier foods; less use of alcohol or substances.

in daily life. The DES-II score is calculated as the mean of the 28 items. Though scores do not necessarily reflect psychopathology, as some DES items ask about non-pathological forms of dissociation (e.g., daydreaming), a score ≥30 has approximately 74% sensitivity and 80% specificity in identifying individuals with dissociative identity disorder.[81]

The Community Assessment of Psychic Experiences-Positive 15-items Scale (CAPE-P15)[82,83] is a 15-item questionnaire that assesses the frequency of positive psychotic-like experiences, including persecutory ideation (5 items), bizarre experiences (7 items), and perceptual abnormalities (3 items). Participants are asked to indicate how frequently they have experienced each item on a 4-point Likert scale ("never" to "nearly always"). Endorsed items (scores of ≥1) are also rated on their degree of associated distress. We summed the frequency scores to create a continuous measure of psychotic symptom severity (possible range 0–45). Similar to previously described methods,[82] and since it has been found that combining frequency and associated distress for each item did not increase the associations with other measures of psychological distress,[83] in this study, we did not include questions about the distress associated with each item.

Statistical Analyses

Group Differences in Demographic and Clinical Characteristics and EPII-neg Score

We performed all analyses using Stata version 15.1. To compare demographic characteristics, EPII-neg scores (and EPII-neg subscores), and symptom severities of the three participant groups (SZ, BP, HC), we conducted a one-way analysis of variance (ANOVA) for normally distributed continuous variables, the Kruskal-Wallis test for variables that did not follow a normal distribution, and chi-square tests for categorical variables. For these tests assessing for group differences, we considered results with $P < .05$ to be significant. For omnibus tests meeting the threshold for significance, we conducted post-hoc pairwise comparisons (using Dunn's test after Kruskal-Wallis tests), setting a significance threshold of $P < .05$ with Sidak correction.

Relationships Between Continuous Measures

We first examined Spearman correlations (1) between EPII-neg and PCL-5, DES-II, and CAPE-P15 scores, respectively; (2) between the MACE sum score and the PCL-5, DES-II, and CAPE-P15 scores, respectively; and (3) between the MACE sum score and EPII-neg.

We also examined the above relationships (1) and (2) using multiple regression, setting symptom severity (PCL-5, DES-II, or CAPE-P15) as the dependent variable and EPII-neg or MACE sum score as primary independent variable. To examine relationship (3), we set EPII-neg as the dependent variable and MACE sum score as the primary independent variable. As there were significant between-group differences in the demographic variables, we controlled for age, gender, and education (dummy coded as college graduate, yes/no), as well as diagnosis (SZ, BP), in our regression models. The residuals from these models approximated a normal distribution. Because the Breush-Pagan/Cook-Weisberg test indicated that the residuals (in all models except the regression of EPII-neg on MACE score) were heteroscedastic, we calculated robust HC3 standard errors in all affected models. For each set of tests, we set the significance threshold at $P < .016$ [alpha of 0.05 Bonferroni-corrected for three comparisons (PCL-5, DES-II, CAPE-P15)]. We report β values and their 95% confidence intervals (95% CI) in addition to the P-value. To provide a more standardized measure of effect size, we also calculated the local effect size of the primary predictor within the overall regression model using Cohen's f^2, where $f^2 \geq 0.02$, $f^2 \geq 0.15$, and $f^2 \geq 0.35$ represent small, medium, and large effect sizes.[84,85]

Interaction Between Negative Impacts and Childhood Trauma Severity on Symptoms

We calculated a regression model where we set PCL-5 score as the dependent variable, EPII-neg, MACE sum, and the EPII-neg x MACE sum interaction term as the independent variables, with age, sex, college education, and diagnosis as covariates. We focused on the interaction between EPII-neg and the MACE sum score. We also did this for models with DES-II and CAPE-P15, respectively, as outcomes. Similar to above, we set the significance threshold at $P < .016$ [alpha of 0.05 Bonferroni-corrected for three comparisons (PCL-5, DES-II, CAPE-P15)]. As these models had heteroscedastic residuals, we used robust standard errors.

Results

Demographic and Clinical Characteristics

There were significant differences between the three groups in age, sex, and level of completed education (table 2). Pairwise comparisons showed that SZ patients were older than HC; BP did not differ significantly from the other groups in age. SZ had fewer females than BP and HC; BP and HC did not significantly differ in sex composition. SZ had lower education than BP and HC, while BP and HC did not significantly differ in education.

The three groups also differed significantly in the severity of childhood trauma history as indicated by the MACE sum score, with scores higher in both SZ and BP compared to HC but not compared to each other (table 2). The three groups differed in the PCL-5, DES-II, and CAPE-P15 scores, with scores higher in both SZ and BP compared to HC for all three scores; for psychotic symptoms, SZ was also more severe than BP. Applying the DSM-5 diagnostic criteria to the PCL-5

Table 2. Demographic and Clinical Characteristics

	All Subjects	Schizophrenia Spectrum (SZ)	Bipolar Disorder (BP)	Healthy Controls (HC)	Test Statistic	*P*-Value
Sample size	*N* = 151	*n* = 47	*n* = 53	*n* = 51	–	–
Age, mean ± SD	33.6 ± 10.2	37 ± 10.3	33.2± 11.0	31.0 ± 8.6	$F = 4.50$	**.013**[1]
Female, no. (%)	90 (59.6%)	17 (36.2%)	39 (73.6%)	34 (66.7%)	$\chi^2 = 16.08$	**.0003**[1,3]
Education, no. (%)					$\chi^2 = 28.09$	**.002**[1,3]
High school/GED	5 (3.3%)	4 (8.5%)	0 (0.0%)	1 (2.0%)	–	–
Part college	39 (25.8%)	21 (44.7%)	13 (24.5%)	5 (9.8%)	–	–
Graduated 2-year college	4 (2.7%)	1 (2.1%)	2 (3.8%)	1 (2.0%)	–	–
College/bachelor's degree	46 (30.5%)	10 (21.3%)	19 (35.9%)	17 (33.3%)	–	–
Part graduate/professional	14 (9.3%)	1 (2.1%)	4 (7.6%)	9 (17.7%)	–	–
Graduate/professional school	43 (28.5%)	10 (21.3%)	15 (28.3%)	18 (35.3%)	–	–
MACE sum score†, mean ± SD	8.6 ± 7.6	10.1 ± 7.5	11.1 ± 8.8	4.7 ± 4.5	χ^2*= 22.32	**.0001**[1,2]
Epidemic-pandemic impacts						
Negative impacts, mean ± SD	15.8 ± 6.0	14.6 ± 7.2	17.4 ± 5.9	15.2 ± 4.5	$F = 3.09$	**.048**[(3)]
Positive impacts, mean ± SD	7.2 ± 3.7	7.8 ± 4.2	7.1 ± 3.6	6.6 ± 3.3	$F = 1.21$	.300
PCL-5 score†, mean ± SD	18.5 ± 18.9	26.0 ± 20.0	24.7 ± 19.4	5.3 ± 6.5	χ^2* = 47.09	**.0001**[1,2]
(B) Intrusive symptoms	1.2 ± 1.7	1.9 ± 2.0	1.6 ± 1.8	0.3 ± 0.9		
(C) Avoidance	0.6 ± 0.9	0.8 ± 0.9	0.8 ± 0.9	0.2 ± 0.6		
(D) Cognition & mood	1.8 ± 2.3	2.6 ± 2.5	2.6 ± 2.3	0.3 ± 0.8		
(E) Arousal & reactivity	1.5 ± 1.9	2.1 ± 2.0	2.1 ± 1.9	0.3 ± 0.7		
PTSD diagnosis††, no. (%)	29 (19.2%)	15 (31.9%)	14 (26.4%)	0 (0.0%)	$\chi^2 = 21.37$	**.0003**
DES-II score†, mean ± SD	12.3 ± 13.5	17.9 ± 16.6	15.5 ± 12.3	3.9 ± 4.6	χ^2*= 44.45	**.0001**[1,2]
Severely dissociative†††, no. (%)	20 (13.3%)	10 (21.3%)	9 (17.0%)	0 (0.0%)	$\chi^2 = 13.94$	**.007**
CAPE-P15 score†, mean ± SD	4.7 ± 6.7	9.4 ± 9.3	4.3 ± 4.2	0.9 ± 1.2	χ^2*= 47.39	**.0001**[1,2,3]
Persecutory ideation	2.4 ± 3.0	3.9 ± 3.9	2.6 ± 2.5	0.8 ± 1.1		
Bizarre experiences	1.4 ± 2.9	3.2 ± 4.2	1.1 ± 1.8	0.1 ± 0.4		
Perceptual abnormalities	0.9 ± 1.8	2.3 ± 2.6	0.6 ± 0.9	0 ± 0		

GED = general education diploma; MACE = Maltreatment and Adversity Chronology of Exposure; PCL-5 = PTSD Checklist for DSM-5; PTSD = post-traumatic stress disorder; DES-II = Dissociative Experiences Scale, second version; CAPE-P15 = Community Assessment of Psychic Experiences- Positive 15-items scale.
†Data for MACE, PCL-5, DES-II, and CAPE-P15 missing for one SZ participant; therefore, data analyzed with *n* = 46 SZ.
††Provisional PTSD diagnosis made when at least 1 criterion B, 1 C, 2 D, and 2 E items met.
†††DES-II score ≥ 30.
*Conducted the Kruskal-Wallis equality of proportions nonparametric test, as data did not follow a normal distribution.
[1]SZ vs HC significantly different in post-hoc pairwise comparisons.
[2]BP vs HC significantly different in post-hoc pairwise comparisons.
[3]SZ vs BP significantly different in post-hoc pairwise comparisons.
[(3)]Trend-level difference between SZ vs BP in post-hoc pairwise comparisons.

data, 31.9% of SZ, 26.4% of BP, and no HC participants met criteria for a provisional PTSD diagnosis. Using the DES-II score ≥30 as the cutoff, 21.3% of SZ, 17.0% of BP, and no HC participants had severely dissociative symptoms.

Do the Negative Impacts of the COVID-19 Pandemic Differ by Diagnosis?

We found a main effect of diagnosis on the EPII-neg score ($F_{2,149} = 3.09$, $P = .048$). Post-hoc comparisons revealed a trend for the BP group to have a higher mean number of negative impacts compared to SZ ($P = .059$ with Sidak correction); the differences between each patient group and HC were not statistically significant.

Exploration of the EPII-neg subscores revealed that the difference in negative experiences was driven by three subdomains: work and employment ($\chi^2 = 20.13$, $P = 1.0 \times 10^{-4}$), emotional health ($\chi^2 = 31.49$, $P = 1.0 \times 10^{-4}$), and non-COVID-19 physical health ($\chi^2 = 7.46$, $P = .024$) (figure 1). Post-hoc comparisons indicated that SZ patients were less negatively impacted in work/employment compared to BP ($P = .012$) and HC ($P < 1.0 \times 10^{-5}$); there was also a trend for a difference between BP and HC ($P = .059$), with the pandemic having a more negative impact on HC. For the emotional health subscore, BP had greater impacts relative to both SZ ($P < 1.0 \times 10^{-5}$) and HC ($P < 1.0 \times 10^{-5}$); there was no difference between SZ vs HC ($P = .632$). Post-hoc analysis of the non-COVID-19 physical health subdomain showed BP to have more physical health impacts compared to HC ($P = .009$); there were no pairwise differences between SZ and HC ($P = .378$) or between SZ and BP ($P = .143$).

Notably, only one participant (BP) in the entire sample reported a positive COVID test result. The rate of self-reported suspected COVID (unconfirmed by lab testing) was 9.3% for the entire sample and did not significantly

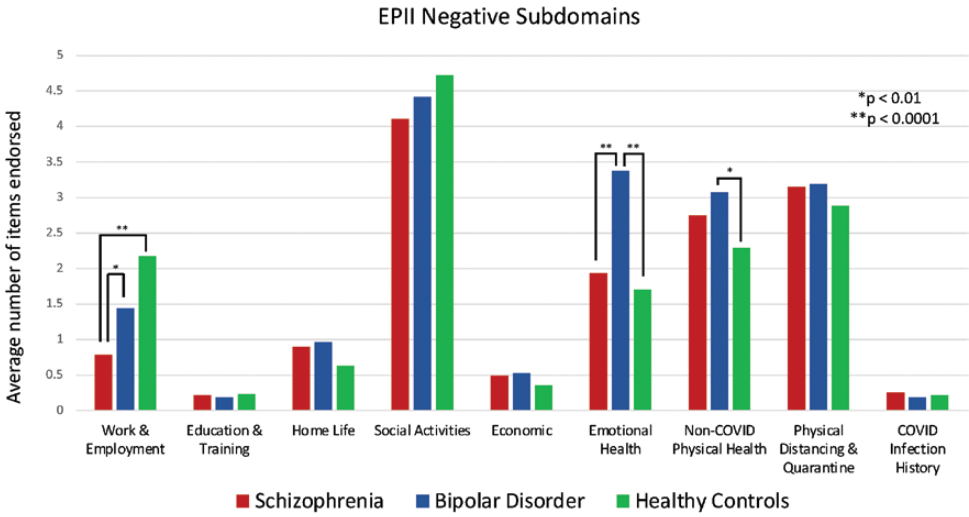

Fig. 1. Negative impact subdomains of the Epidemic-Pandemic Impacts Inventory (EPII) by diagnostic group. Schizophrenia (SZ) patients were less negatively impacted in work/employment compared to psychotic bipolar disorder (BP) ($P = .012$) and healthy control (HC) participants ($P < 1.0 \times 10^{-5}$). BP patients reported more pandemic-related emotional health problems relative to SZ ($P < 1.0 \times 10^{-5}$) and HC ($P < 1.0 \times 10^{-5}$), and more non-COVID physical health problems during the pandemic relative to HC ($P = .009$).

differ by group (8.5% of SZ, 7.6% of BP, 11.8% of HC; $\chi^2 = 0.60$, $P = .742$).

Is There a Relationship Between the Pandemic's Negative Impacts and Symptoms?

We saw a positive correlation between EPII-neg and PCL-5 ($r_s = .29$, $P = 3.0 \times 10^{-4}$; figure 2). At the Bonferroni-corrected alpha level of .016, EPII-neg was not significantly correlated with either DES-II ($r_s = .16$, $P = 0.058$) or CAPE-P15 ($r_s = .19$, $P = .019$). See figure 4 for conceptual model summarizing the study findings. In regression models that included diagnosis, age, sex, and college education as covariates, EPII-neg remained significantly associated with PCL-5 ($\beta = .840$, 95% CI 0.359–1.321, $P = .001$; Cohen's $f^2 = 0.101$). EPII-neg was not significantly associated with DES-II ($\beta = .237$, 95% CI –0.199–0.673, $P = .284$; Cohen's $f^2 = 0.014$) or CAPE-P15 ($\beta = .227$, 95% CI 0.006–0.448, $P = .044$; Cohen's $f^2 = 0.059$) when controlling for diagnosis, age, sex, and college education. See Supplementary table 1 for adjusted and unadjusted models.

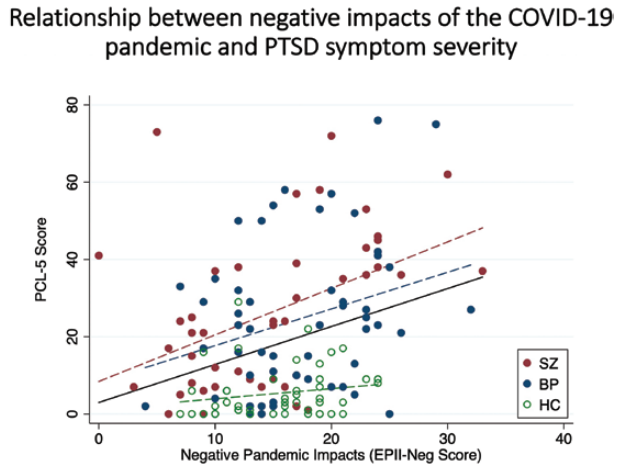

Fig. 2. Relationship between negative impacts of the COVID-19 pandemic (EPII-neg score) and severity of PTSD (PCL-5 score) symptoms in schizophrenia (SZ), psychotic bipolar disorder (BP), and healthy control (HC) participants. The solid black line shows the line of best fit for all participants ($n = 150$). The dashed lines show the lines of best fit for each of the three diagnostic groups.

Is There a Relationship Between Childhood Trauma Severity and Symptoms During the Pandemic?

As expected, the MACE sum score was significantly correlated with PCL-5 ($r_s = .60$, $P = 3.84 \times 10^{-16}$), DES-II ($r_s = .40$, $P = 3.978 \times 10^{-7}$), and CAPE-P15 ($r_s = .39$, $P = 9.014 \times 10^{-7}$) (figure 4). The association between MACE and PCL-5 remained significant in multiple regression analyses controlling for age, sex, college education, and diagnosis ($\beta = .870$, 95% CI 0.503–1.237, $P = 6.4 \times 10^{-6;}$ Cohen's $f^2 = 0.161$).

The association between MACE and DES-II was not significant when controlling for these covariates ($\beta = .269$, 95% CI –0.036–0.575, $P = .084$); however, there was a significant association when controlling for age, sex, and college education but not diagnosis ($\beta = .484$, 95% CI 0.193–0.775, $P = .001$; Cohen's $f^2 = 0.084$). Similarly, the association between MACE and CAPE-P15 was not significant in a regression model including age, sex, education, and diagnosis ($\beta = .041$, 95% CI –0.091–0.173, $P = .540$), but was significant when diagnosis was excluded from the model ($\beta = .159$, 95% CI 0.040–0.278, $P = .009$; Cohen's $f^2 = 0.03$). See Supplementary table 2 for adjusted and unadjusted models.

Is There a Relationship Between Childhood Trauma Severity and Experience of the Pandemic?

The MACE sum score was positively correlated with the EPII-neg score (r_s = .26, P = .001; figures 3 and 4). In a linear regression model, this association remained significant even after adjusting for age, sex, diagnosis, and college education (β = .200, 95% CI 0.064–0.335, P = .004; Cohen's f^2 = 0.060). See Supplementary table 3 for the adjusted and unadjusted models.

Is the Pandemic's Impact on Symptoms Moderated by Childhood Trauma Severity?

We regressed each of the three symptom severity outcome measures against the EPII-neg score, MACE sum score, and their interaction, along with demographic covariates. The EPII-neg × MACE interaction term was not significant in predicting PCL-5 (β = –.051, 95% CI –0.101 to –0.002, P = .041; Cohen's f^2 = .029), DES-II (β = –.012, 95% CI –0.073–0.049, P = .690; Cohen's f^2 = 0.003), or CAPE-15 (β = .004, 95% CI –0.014–0.022, P = .665; Cohen's f^2 = .001). See Supplementary table 4 for adjusted and unadjusted models.

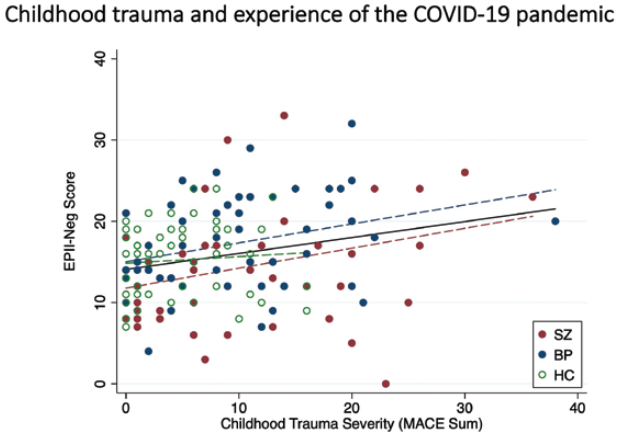

Fig. 3. Relationship between cumulative childhood trauma exposures (MACE sum score) and experience of the pandemic's negative impacts (EPII-neg score) in schizophrenia (SZ), psychotic bipolar disorder (BP), and healthy control (HC) participants. The solid black line shows the line of best fit for all participants (n = 150). The dashed lines show the lines of best fit for each of the three diagnostic groups.

Discussion

This cross-sectional survey explored the intersection between childhood trauma, experience of the COVID-19 pandemic, and trauma-related and psychotic symptoms in a sample of psychosis patients and healthy controls. We found some group differences in self-reported negative pandemic impacts; BP patients reported more negative impacts in emotional health relative to SZ and HC and in non-COVID physical health relative to HC, while SZ patients reported relatively *less* impact on work and employment. More importantly, we found that the pandemic's negative impacts were significantly associated with PTSD symptoms. Furthermore, we found that participants with more severe histories of childhood trauma experienced a greater number of negative impacts from the pandemic, and more severe symptoms during the pandemic.

Researchers have suggested that the pandemic, like other large-scale disasters, should be viewed from the perspective of trauma.[86] Our first set of findings— that BP patients had more pandemic-related adversities in the domains of emotional health and non-COVID physical health, and that both SZ and BP patients had higher severity of trauma-related and psychotic symptoms than healthy controls—is consistent with studies showing greater adversity, distress, and psychopathology in psychosis patients than healthy controls during the pandemic.[25–30,33] However, as with other studies that conducted

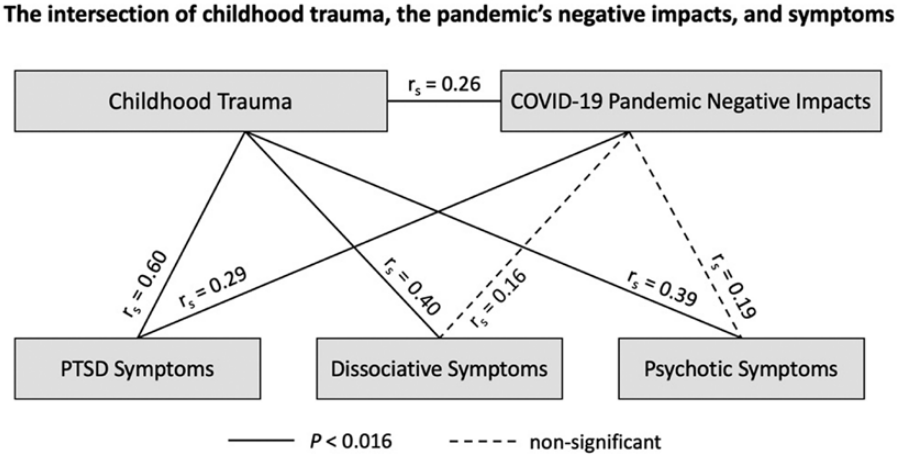

Fig. 4. Conceptual model summarizing the study results. The solid lines indicate Spearman rank correlations (r_s) that are statistically significant at P < .016 (alpha level of .05 Bonferroni-corrected for three symptom outcomes). Correlations that are not statistically significant are indicated with dashed lines.

only cross-sectional group comparisons, we are unable to determine from this set of group-wise results how much of the observed differences between patients and controls is attributable to the pandemic and how much reflects baseline differences in psychopathology.

Except in the domains of emotional health and non-COVID physical health, psychosis patients did not experience significantly greater exposure to the pandemic's negative impacts. While 9.3% of our sample reported suspected COVID-19 illness, only one participant (with BP) reported lab-confirmed SARS-CoV-2 infection. This low infection rate in our sample contrasts with the findings of Wang and colleagues who showed a 7.3-fold higher odds of COVID-19 infection among individuals with SZ.[22] In fact, patients with SZ reported *less* negative impacts on work and employment compared to BP and HC. While the relative sparing of SZ patients in work and employment may be due to generally lower rates of engagement in work and employment among SZ patients at baseline, this finding, along with the lack of group differences in other EPII-neg subdomains, may suggest that having a psychotic disorder does not, in and of itself, increase susceptibility to the pandemic's negative impacts. Some studies have reported that patients with SZ have actually fared better compared to how they were doing before the pandemic,[31,32] and even compared to individuals with other psychiatric disorders such as depression and anxiety.[27,29,87,88] A well-designed study showed that even if patients with BP were more likely than healthy controls to report psychiatric disturbances during the pandemic, the increase in symptoms from pre-pandemic levels was less in BP than in healthy controls because of the already elevated pre-pandemic symptom levels in BP.[25]

The mixed findings in the literature point to the individual variability and heterogeneity of pandemic-related experiences among patients with psychotic disorders, and the need to more directly relate the total number of disaster-related exposures with symptom measures on a continuous scale. We did this and found a graded relationship between the EPII-neg score and PTSD symptom severity. That is, the higher the cumulative exposures to the pandemic's negative impacts, the greater the PTSD symptoms a participant has experienced. Despite the modest effect size, this relationship persisted even after controlling for age, sex, education, and diagnosis. Thus, what is important is not so much that patients have greater symptoms than healthy controls—as would be expected even in the absence of a pandemic—but rather that the severity of PTSD symptoms depends on cumulative exposure to the pandemic's negative impacts. The fact that we controlled for both SZ and BP diagnoses in our model indicates that the graded relationship between negative pandemic exposures and PTSD symptoms holds for both patients and healthy controls, even if SZ and BP diagnoses were also significant independent predictors of PTSD and psychosis symptom severity.

To test our hypothesis that childhood trauma might increase susceptibility to subsequent traumas, including pandemic-related stressors, we further related the experiences of the pandemic to participants' childhood trauma history, and found that individuals with more severe histories of childhood trauma tended to experience a greater number of negative impacts from the pandemic, and greater severity of PTSD, psychotic, and dissociative symptoms during the pandemic. To our knowledge, this is the first study examining the intersection of childhood trauma and experience of the pandemic in people with psychotic disorders. Nevertheless, our findings parallel prior findings regarding influence of childhood trauma on pandemic-related experiences in individuals with other or no psychiatric disorders. For example, our findings are consistent with a recent study of Chinese university students that found that greater severity of childhood trauma was associated with greater exposure to negative COVID-19 pandemic impacts.[35] Why might people with childhood trauma have higher exposure to subsequent traumatic stressors? Studies have shown that trauma in childhood increases the likelihood for multiple problems in adulthood; these include not only more adult psychiatric problems,[89] but also more physical health problems, worse educational and financial outcomes, more social/relationship problems, and higher rates of risky and/or criminal behavior in adulthood.[90–93] These adult outcomes, in turn, are major predisposing factors for exposure to repeated victimization and other traumatic stressors.[94,95] In the current study, the significant relationship between childhood trauma and the EPII-neg score is consistent with the notion of a vicious cycle in which "trauma begets trauma"[96]—in this case, the higher the cumulative number of childhood traumatic experiences an individual has had, the greater the number of negative COVID-19 pandemic impacts that person is likely to have experienced.

Our finding of an association between childhood trauma and PTSD symptoms during the pandemic in psychosis patients also parallels the results found in studies of other, non-psychotic patient samples.[42,43] Thus, not only do traumatized individuals have a higher risk of exposure to stressful events during the pandemic, there is also a relationship between childhood trauma and distress such that the greater the number of different traumatic experiences an individual was exposed to during childhood, the more post-traumatic, dissociative, and psychotic symptoms they experienced during the pandemic. Our finding of a relationship between childhood trauma and psychosis symptoms in patients with psychotic disorders is interesting in light of a recent study of secondary school and college students in China which found that childhood trauma was among the factors predictive of new-onset psychotic experiences during the lockdown.[36] Childhood trauma is known to alter brain development[97,98] and to have an enduring

impact on the brain's ability to respond to stress.[99] While measures of brain development and brain response to stress were beyond the scope of this study, studies have shown that dysregulation of the systems involved in the stress response are thought to increase vulnerability to additional stress disorders[99] and physical health problems[90,100] in response to new stressors. The results of these studies, along with our findings, suggest that childhood trauma severity is an important source of variability in understanding an individual's experience of later adversities, including the negative impacts of the current pandemic.[99,101–104]

Our assessment of cumulative negative pandemic exposures together with information about childhood trauma severity and trauma-related symptoms in a psychosis sample is novel. The ability to verify diagnosis in the majority of our sample is also a strength of our study. Nevertheless, the results from this study should be interpreted in the context of several limitations. First, our sample size is modest, and replication in a larger sample is needed to confirm our findings. Second, our sample consisted of individuals who previously participated in research studies with us. It is possible that we unintentionally selected for healthier participants who were less affected by the pandemic and had the time and means to complete an online research study. The low number of lab-confirmed SARS-CoV-2 infections in our sample could reflect the relative inaccessibility of testing for SARS-CoV-2 in the general population early in the pandemic, but may also reflect issues related to the small sample size and representativeness of the sample. In addition, patients in this study (e.g., >20% with professional or graduate degrees) may have higher functioning than the general population of people with SMI, and this may also limit the generalizability of our findings.

Third, the study was cross-sectional and initiated after the start of the pandemic. As we did not collect the same self-report symptom measures (i.e., PCL-5, DES-II, CAPE-P15) prior to the pandemic, we could not make comparisons about how these measures changed from before to after the start of the pandemic. The cross-sectional design also limits our ability to determine the direction of certain effects; for example, though we suggest that higher exposure to the pandemic's negative impacts increases PTSD symptom severity, the converse could also be true (i.e., having greater PTSD symptoms also could place individuals at greater risk of exposure to the negative impacts of the pandemic). Fourth, this was a survey study that relied on participants' self-report of symptoms, and retrospective recall of trauma can be influenced by current levels of stress. Finally, our online survey study did not ask participants to identify the specific source(s) of the traumatic stress contributing to their PTSD and dissociative symptoms. Though we measured symptoms *during the pandemic*, prior and/or cumulative adverse life events may have also contributed to the severity of PTSD and dissociative symptoms.

In spite of these limitations, our results are informative in that they identify a high-risk group in whom cluster a range of concerns, including childhood trauma, greater COVID-related negative impacts, and PTSD symptoms. Though causal relationships cannot be inferred from this study, our results are suggestive of a priming effect that childhood trauma may have on individuals' experience of disasters, such as the COVID-19 pandemic, and in exacerbating post-traumatic stress among patients with psychosis. Our study also highlights that while patients with psychosis may have greater psychopathology than individuals without psychiatric illness during the pandemic, there is substantial heterogeneity of pandemic-related experiences across individuals, and childhood trauma history should be considered among the factors that can increase vulnerability to the pandemic's negative impacts.

It is worth noting that the current study was conducted during one subperiod of the pandemic. However, the pandemic is not yet over. As of this time, more than 52% of eligible individuals in the US are fully vaccinated.[105] Though the end of the pandemic seemed to be in sight in spring of 2021, the highly transmissible and more virulent delta variant has led to another surge in cases and greater restrictions. Thus, the cumulative exposure to the pandemic's negative impacts is likely ongoing. Even if society could achieve lower numbers of hospitalizations and deaths, the traumatic impacts of the pandemic are likely to be enduring and future studies should continue to monitor the mental health of people with psychosis, especially those with severe histories of childhood trauma.

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The authors have declared that there are no conflicts of interest in relation to the subject of this study.

Author Contributions

Lena Stone: Conceptualization, Investigation, Data curation, Writing – original draft preparation, Visualization; Zachary B. Millman: Writing – reviewing and editing, Methodology; Dost Öngür: Resources, Writing – reviewing and editing; Ann K. Shinn: Conceptualization, Methodology, Investigation, Formal analysis, Writing-original draft; Writing – reviewing and editing, Visualization, Supervision.

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