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The immediate and long-term impacts of the COVID-19 pandemic on patients with obsessive-compulsive disorder: A one-year follow-up study

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ABSTRACT

Several recent publications have revealed that obsessive-compulsive disorder (OCD) patients were adversely affected during coronavirus disease 2019 (COVID-19); however, how long this negative impact will last is unclear. Our study aimed to investigate the impact of the COVID-19 pandemic on OCD patients after one year. Online questionnaires were administered, and clinical interviews were conducted to assess OCD symptoms, depression, anxiety, information about COVID-19 and mental resilience at baseline (1 December 2019–1 January 2020), during early COVID-19 (26 February–25 March 2020) and at the one-year follow-up (26 February–25 March 2021). A total of 110 OCD patients were enrolled. Our findings showed that OCD, depressive and anxiety symptoms worsened during early COVID-19, and the negative impact persisted at the one-year follow-up. Multivariate analysis showed that female gender, concern about COVID-19 and OCD symptom severity at baseline were risk factors for exacerbation of OCD symptoms during early COVID-19, while optimism, as one composite factor of resilience, was a protective factor against exacerbation of OCD symptoms both during early COVID-19 and at follow-up. Our study showed that COVID-19 had immediate and long-term impacts on the exacerbation of OCD symptoms, and interventions targeted at improving resilience are recommended.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic, initially detected in December 2019, has caused widespread social and economic disruption. Strict control measures such as quarantine, lockdown, and physical distancing were universally launched during the worst phase of the epidemic, which might have negatively affected mental health in those with depression, anxiety, or obsessive-compulsive disorder (OCD) (Pan et al., 2021). A number of studies have reported that the COVID-19 pandemic could induce new-onset obsessive-compulsive symptoms and exacerbate preexisting OCD symptoms (Abba-Aji et al., 2020; Davide et al., 2020; Khosravani et al., 2021). Many studies have found significant increases in contamination and cleaning symptoms of OCD during the pandemic period (Jelinek et al., 2021; Rajkumar, 2020; Samuels et al., 2021; Tanir et al., 2020). In addition, OCD symptoms in other dimensions related to hoarding, concerns about symmetry, responsibility for harm and unacceptable thoughts were reported to be exacerbated (Khosravani et al., 2021).

However, most evidence has focused on the impact of COVID-19 shortly after the outbreak of the pandemic, and few studies have investigated the mental status of OCD patients in the later stages. Since the outbreak, China was hit hard by the pandemic for a long time, a lockdown was imposed on Wuhan on 23 January, and later, the lockdown was extended to other cities. Since April 8, 2020, the date that Wuhan reopened, China has almost got the situation under control, where economic and social activities were gradually brought back on track, despite some temporary regional lockdowns because of sporadic occurrence and the occasional limited transmission of infection. Therefore, the data from China can provide an exploration of the long-term impact of the COVID-19 pandemic on OCD patients, which might provide other countries with a valuable reference.

Many risk factors might have contributed to exacerbating symptoms of OCD during COVID-19, and the evaluated factors have varied across studies, including reduced mobility, interpersonal conflicts, baseline insight, insomnia symptoms, family history of psychiatric disorders, higher severity of prepandemic OCD symptoms, and worsening of

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anxiety and depressive symptoms (Cox and Olatunji, 2021; Jelinek et al., 2021; Nissen et al., 2020). Resilience is defined as the ability to adapt to changing environments and recover from stressful situations (Block and Kremen, 1996). Individuals among the public with high levels of mental resilience would have lower levels of anxiety and depression during the COVID-19 pandemic (Song et al., 2020). OCD patients had lower dispositional resilience scores than control groups, and resilience was negatively associated with OCD symptoms (Holm et al., 2019). Studies have found that resilience is associated with many psychosocial factors, such as active coping and performance, cognitive flexibility, a feeling of control, harm avoidance and social support (Eley et al., 2013; Iacoviello and Charney, 2014). These factors might also be relevant for OCD patients and might indicate an indirect link between resilience and OCD. Cognitive flexibility in OCD patients has been shown to be impaired, which has been associated with increased levels of obsessive beliefs (Şahin et al., 2018). A higher desire for control and a lower sense of control were associated with higher levels of OCD-related beliefs and symptoms (Moulding et al., 2008). Both OCD patients and their unaffected first-degree relatives showed elevated levels of harm avoidance compared to healthy control subjects, and their findings supported the notion that harm avoidance represents a potential endophenotype of OCD (Bey et al., 2017). Based on these data, a negative relation between OCD and resilience could be expected. Thus, we hypothesized that mental resilience may be a significant predictive factor for the exacerbation of OCD symptoms during the COVID-19 pandemic, which needed further study for verification. Our hypothesis was that COVID-19 had immediate and long-term impacts on the exacerbation of OCD symptoms. In addition, we speculated that mental resilience may be a protective factor for OCD patients to cope with the COVID-19 pandemic. This study aimed to investigate the impact of COVID-19 on OCD patients shortly after the pandemic and its long-term effects at a one-year follow-up and explore related factors associated with OCD in these patients.

2. Methods

2.1. Participants

The participants in this study were recruited from among patients with OCD who had been diagnosed and treated at Peking University Sixth Hospital, the National Clinical Research Center for Psychiatric and Mental Disorders in China. They joined the group through “WeChat” (a popular communication application in China that is similar to Facebook, Skype, etc.), and they had close connections to their psychologist and/or psychiatrist. From 26 February–25 March 2020, a questionnaire was sent to a total of 993 patients, and a total of 127 (12.8%) patients responded to the questionnaire. Then, all participants completed a detailed telephone interview by one of four experienced psychiatrists, confirming the diagnosis of OCD based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria (Regier et al., 2013) and assessing comorbidities. To reduce the recall bias of information before the COVID-19 pandemic as much as possible, we encouraged patients to provide information based on previous medical records and/or seek help from family members.

The enrollment criteria for the OCD patients included (a) a diagnosis of OCD based on DSM-5 criteria; (b) an age between 18 and 60 years old; and (c) an education level ≥ 6 years. The study was approved by the institutional ethics committee of the Peking University of Sixth Hospital (2020–2–21–4). All participants provided verbal informed consent prior to their enrollment.

2.2. Measures

The structured questionnaires covered six areas: demographic data, information about COVID-19, disease characteristics of OCD, severity of OCD symptoms, severity of depression and anxiety, and mental

resilience. The severity of OCD symptoms, depression and anxiety were assessed at three time periods, namely, BASELINE (pre-COVID, 1 December 2019–1 January 2020) and EARLY COVID-19 (26 February–25 March 2020) and one-year FOLLOW-UP (26 February–25 March 2021). Information about COVID-19 was assessed both at EARLY COVID-19 and one-year FOLLOW-UP.

2.2.1. Demographic data

The participants reported their age, gender, education, residential location, and number of members in the household during the COVID-19 outbreak.

2.2.2. Information about COVID-19

The participants were asked to report their COVID-19 contact history, level of concern about COVID-19 and experience of quarantine. The level of concern about COVID-19 was evaluated by self-designed scales that included items such as “Surfing the internet for the information about the COVID-19 outbreak has become an important part of my life.” Each item was rated on a five-point Likert-type scale, with scores ranging from 1 (‘not at all’) to 5 (‘extremely’); higher scores indicated a greater focus on COVID-19.

2.2.3. Disease characteristics of OCD

The participants were asked to report their age at OCD onset, duration of illness, current treatment, and whether they were seeking medical services through outpatient, telephone or internet platforms at EARLY COVID-19 and one-year FOLLOW-UP.

2.2.4. OCD symptoms

OCD symptoms were evaluated with the Obsessive Compulsive Inventory-Revised (OCI-R) (Foa et al., 2002), and the reliability and validity of the Chinese version of the OCI-R met psychometric standards (He et al., 2012). Each item was rated on a five-point Likert-type scale, with scores ranging from 0 to 4 (from ‘not at all’ to ‘extremely’), and higher scores reflected more severe symptoms.

2.2.5. Depressive and anxiety symptoms

The Self-Rating Depression Scale (SDS) and Self-Rating Anxiety Scale (SAS) were used to assess depressive and anxiety symptoms (Zung, 1965, 1971).

2.2.6. Mental resilience

Resilience is a multidimensional variable that relates to cultural background, social conditions, and demographic characteristics (Wu et al., 2017). In our study, resilience was evaluated by the Chinese version of the Connor-Davidson Resilience Scale (CD-RISC). The reliability coefficient of the Chinese version of the CD-RISC was 0.91 (Yu et al., 2007). The scale consists of 25 self-reported questions, and each question was rated on a 5-point scale from 0 to 4 (from ‘not at all’ to ‘extremely true’) with the highest possible total score of 100; higher scores reflected greater resilience. The scale assessed the three factors of tenacity, strength and optimism based on exploratory factor analysis among the Chinese population. Tenacity describes an individual’s perseverance under situations of hardship and challenge. The strength represents becoming strong after a setback. Optimism measures one’s positive thinking with regard to resisting adverse events.

2.3. Statistics

The data were analyzed in SPSS 22.0 (IBM Corp). Frequencies and percentages are presented for categorical variables. Continuous variables are presented as the mean (standard deviation). Intergroup comparisons were performed by using Student’s *t*-tests or Kruskal-Wallis tests for continuous variables and chi-square tests for categorical variables. Comparisons used a two-sided significance level of 0.05.

Linear mixed-effects models (LMM) were used to compare the

severity of OCD, depressive and anxiety symptoms at three time points. Symptom scores were treated as the dependent variables, the three levels of time were treated as fixed factors, and the subject was treated as a random factor. Akaike Information Criterion (AIC) was used to evaluate the LMM (Shek and Ma, 2011). Associations between total OCD severity scores and possible predictor variables were analyzed by univariate linear regression models. Variables entered into the model included demographic and clinical characteristics, information about COVID-19, and SAS, SDS and OCI-R scores at BASELINE. Second, multivariate linear regression analyses were used to explore the potential risk factors that were independently predictive of OCD symptoms at EARLY COVID-19 pandemic and the one-year FOLLOW-UP, and variables were selected based on univariate analyses. Variables with a *p*-value <0.05 were included in the analysis.

3. Results

3.1. Survey respondents

In total, 127 participants completed the questionnaires. Seventeen participants were excluded: 4 did not participate in a phone interview, 12 did not meet the diagnostic criteria of OCD, and 1 was younger than 18 years old. Finally, 110 OCD patients were recruited in the study. At the one-year FOLLOW-UP, 64 patients responded to the survey.

3.2. Demographic and clinical characteristics of ocd patients

Demographic and clinical data are shown in Table 1. During EARLY COVID-19, among the 110 patients, no patients had confirmed diagnoses of COVID-19, one hundred seven (97.27%) OCD patients had no COVID-19 contact history, one patient was suspected of having COVID-19, and two patients had a contact history with a person confirmed to have COVID-19. The mean age of the OCD patients was 29.88±9.33 years. The mean age of OCD onset for the sample population was 18.81±7.96 years, and the mean duration of illness was 10.13±8.37 years. During EARLY COVID-19, 6.36% (*n* = 7) of patients reported living alone, 55.45% (*n* = 61) reported taking medications regularly, and 39.09% (*n* = 43) reported having received medical aid by visiting psychological clinics or online consulting.

Table 1
Demographic and clinical characteristics of OCD patients.

| Characteristics | During pandemic (<i>n</i> = 110) | One-year follow-up (<i>n</i> = 64) | <i>t</i> -value | <i>p</i> -value |
|---|-----------------------------------|-------------------------------------|-----------------|-----------------|
| Age (years) | 29.88±9.33 | 30.22±9.42 | -0.229 | 0.819 |
| Gender male <i>n</i> (%) | 53(48.18) | 38(59.37) | 2.032 | 0.154 |
| Education (years) | 15.22±2.67 | 15.22±2.68 | -0.300 | 0.764 |
| Onset age (years) | 18.81±7.96 | 18.61±7.67 | 0.162 | 0.872 |
| Duration (years) | 10.13±8.37 | 10.32±8.25 | -0.142 | 0.887 |
| Comorbidities | | | | |
| Depression <i>n</i> (%) | 23(20.90) | 14(21.88) | 0.023 | 0.881 |
| Anxiety/panic/phobia <i>n</i> (%) | 32(29.09) | 21(32.81) | 0.425 | 0.514 |
| Bipolar disorder <i>n</i> (%) | 12(10.90) | 7(10.94) | 0.040 | 0.842 |
| Schizophrenia <i>n</i> (%) | 6(5.45) | 4(6.25) | 0.047 | 0.828 |
| Concern about COVID-19 | 12.02±4.77 | 11.75±4.43 | 0.367 | 0.714 |
| Living alone <i>n</i> (%) | 7(6.36) | 5(7.8) | 0.132 | 0.716 |
| Visiting psychiatrics <i>n</i> (%) | 43(39.09) | 22(34.38) | 0.385 | 0.535 |
| Taking medications regularly <i>n</i> (%) | 61(55.45) | 38(59.37) | 0.254 | 0.615 |
| CD-RISC total score | 50.90±15.67 | 49.78±15.60 | 0.455 | 0.650 |
| Tenacity | 25.21±8.19 | 25.64±8.49 | -0.331 | 0.741 |
| Strength | 17.39±5.51 | 17.59±5.78 | -0.230 | 0.818 |
| Optimism | 8.30±3.03 | 8.59±2.88 | -0.628 | 0.531 |

Notes: CD-RISC: Connor-Davidson Resilience Scale.

At the one-year FOLLOW-UP, 64 patients completed the survey, and no patients had confirmed diagnoses of COVID-19 or had a COVID-19 contact history. Six patients lived in high-risk areas, 11 patients lived in medium-risk areas, 21 patients lived in low-risk areas, and 26 patients lived in no-risk areas; 27 patients experienced quarantine, and the duration of quarantine was 61.41±39.74 days.

We found no significant differences in age, gender, education level, age of onset, duration, comorbidities, or treatment of participants between the two time points, i.e., during EARLY COVID-19 and at the one-year FOLLOW-UP.

3.3. Differences between OCD, depression, and anxiety symptoms in OCD patients at three time points

By using LMM, we found that the OCD symptom total scores and depressive and anxiety symptoms were significantly different across the three time points (*p* = 0.005; *p*<0.001; *p*<0.001). The patients with OCD experienced aggravated OCD, depressive and anxiety symptoms during EARLY COVID-19 compared to BASELINE (*p* = 0.028; *p*<0.001; *p*<0.001). The total scores for OCD, depressive and anxiety symptoms at the one-year FOLLOW-UP were significantly higher than the scores at BASELINE (*p* = 0.002; *p* = 0.001; *p* = 0.012). The results are shown in Table 2 and Fig. 1.

3.4. Predictive factors of OCD symptoms during early COVID-19 and at the one-year follow-up by multivariate linear regression analyses

By using univariate linear regression analyses, we defined the OCD symptom total scores during EARLY COVID-19 as the dependent variable, and the predictor factors included age, gender, education level, age of onset, duration, comorbidities, treatment, concern about COVID-19 score, living alone, SAS, SDS and OCI-R scores at BASELINE, and CD-RISC and its three factors scores. We found that female gender, concern about COVID-19 score, SAS, SDS and OCI-R scores at BASELINE, and CD-RISC score and scores for its three factors had significant associations with OCD scores during EARLY COVID-19 (Table S1); these factors were chosen as candidate predictors for multivariate linear regression analyses. The results of the final model are exhibited in Table 3. The model identified OCD symptoms severity at BASELINE ($\beta=0.923$; $CI=0.860, 0.970$; *p*<0.001), female gender ($\beta=1.507$; $CI=0.119, 2.896$; *p* = 0.034), and concern about COVID-19 ($\beta=0.281$; $CI=0.127, 0.437$; *p*<0.001) as risk factors for the exacerbation of OCD symptoms during EARLY COVID-19. Optimism, one of the composite factors of resilience, was a protective factor and decreased the odds of the exacerbation of OCD symptoms ($\beta=-0.250$; $CI=-0.494, -0.005$; *p* = 0.045). The *R*² of the multivariate linear regression was 0.921.

At the one-year FOLLOW-UP, by using univariate linear regression analyses, the SAS, SDS and OCI-R scores at BASELINE and the CD-RISC total, strength and optimism scores were chosen as candidate predictors (Table S2). Multivariate linear regression analyses showed that OCD symptoms severity at BASELINE were a risk factor for ($\beta=0.662$; $CI=0.401, 0.923$; *p*<0.001) and optimism was a protective factor against ($\beta=-1.470$, $CI=-2.367, -0.574$, *p* = 0.002) exacerbation OCD symptoms at the one-year FOLLOW-UP (Table 4). The *R*² of the multivariate linear regression was 0.399.

4. Discussion

This study evaluated OCD, depressive, and anxiety symptom profiles and related risk factors at three time points, namely, BASELINE, during EARLY COVID-19 and at a one-year FOLLOW-UP in OCD patients. The findings of our study revealed that the severity of OCD, depressive and anxiety symptoms increased during EARLY COVID-19, and the effect persisted one year later. The data further indicated that female gender, concern about COVID-19, and higher OCD symptom scores at BASELINE were risk factors for the exacerbation of OCD symptoms during EARLY

Table 2
Symptoms of OCD, depression and anxiety in OCD patients at three time points by linear mixed-effects models.

| symptoms | BASELINE (n = 110) | EARLY COVID-19 (n = 110) | One-year FOLLOW-UP (n = 64) | Time effect | EARLY COVID-19 vs. BASELINE t-value and 95% C.I. | p-value | One-year FOLLOW-UP vs. BASELINE t-value and 95% C.I. | p-value | One-year FOLLOW-UP vs. EARLY COVID-19 t-value and 95% C.I. | p-value |
|-------------------|--------------------|--------------------------|-----------------------------|-------------|---|---------|---|---------|---|---------|
| OCI-R total score | 38.45±12.03 | 40.22±12.55 | 40.14±12.73 | 0.005 | 2.22(0.19 to 3.37) | 0.028 | 3.15(1.17 to 5.08) | 0.002 | -1.35(-3.29 to 0.62) | 0.178 |
| SAS score | 43.90±11.33 | 47.31±12.60 | 47.24±11.61 | <0.001 | 4.51(1.91 to 4.89) | <0.001 | 3.34(1.27 to 4.93) | 0.001 | 0.32(-1.54 to 2.13) | 0.749 |
| SDS score | 49.98±12.48 | 53.61±13.61 | 52.40±11.83 | <0.001 | 3.92(1.81 to 5.47) | <0.001 | 2.54(0.64 to 5.13) | 0.012 | 0.66(-1.50 to 3.00) | 0.511 |

Notes: OCI-R: Obsessive Compulsive Inventory Revised version; SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale; C.I.=confidence interval. Akaike Information Criterion (AIC) with OCI-R total score=2072; AIC with SAS score=2034; AIC with SDS score=2116.

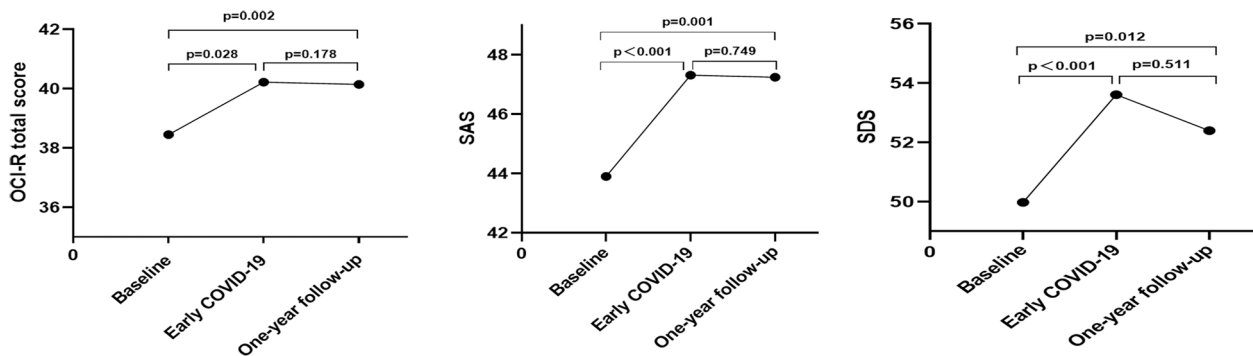


Fig. 1. Comparison of the severity of OCD and depressive and anxiety symptoms at three time points by linear mixed-effects models. Notes: OCI-R: Obsessive Compulsive Inventory Revised version; SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale.

Table 3
Multiple linear regression analysis of factors independently predictive of OCD symptoms during EARLY COVID-19.

| variables | β | S.E. | t-value | p-value | 95% C.I. |
|-------------------------------|---------|-------|---------|---------|------------------|
| OCI-R total score at BASELINE | 0.923 | 0.032 | 28.851 | <0.001 | 0.860 to 0.970 |
| Female gender | 1.507 | 0.700 | 2.152 | 0.034 | 0.119 to 2.896 |
| Concern about COVID-19 | 0.281 | 0.078 | 3.608 | <0.001 | 0.127 to 0.437 |
| Optimism | -0.250 | 0.123 | -2.025 | 0.045 | -0.494 to -0.005 |

Notes: OCI-R: Obsessive Compulsive Inventory Revised version; CD-RISC: Connor-Davidson Resilience Scale; β =coefficient; S.E.= standard error of estimated coefficient; C.I.=confidence interval. $R^2=0.921$.

Table 4
Multiple linear regression analysis of factors independently predictive of OCD symptoms at one-year FOLLOW-UP.

| variables | β | S.E. | t-value | p-value | 95% C.I. |
|-------------------------------|---------|-------|---------|---------|------------------|
| OCI-R total score at BASELINE | 0.662 | 0.130 | 5.076 | <0.001 | 0.40 to 0.923 |
| Optimism | -1.470 | 0.448 | -3.280 | 0.002 | -2.367 to -0.574 |

Notes: OCI-R: Obsessive Compulsive Inventory Revised version; CD-RISC: Connor-Davidson Resilience Scale; β =coefficient; S.E.= standard error of estimated coefficient. C.I.=confidence interval. $R^2=0.399$.

COVID-19, and high optimism was a protective factor in the short and long term, allowing OCD patients to cope with the COVID-19 pandemic.

During EARLY COVID-19, the OCD patients experienced worsening OCD symptoms in our study, and the immediate impact was consistent with previous studies (Davide et al., 2020; Khosravani et al., 2021). Davide et al. (2020) first assessed OCD symptoms at the time of the

COVID-19 outbreak, and their study showed significant increases in obsession and compulsion severity. The results indicated that the stress caused by COVID-19 aggravated OCD symptoms.

Moreover, our study further investigated the long-term effects on OCD patients at one-year FOLLOW-UP. We found that the total OCD symptom scores were still significantly higher than that at BASELINE, which showed that the negative impact of COVID-19 on OCD patients persisted after one year. This phenomenon may be related to the COVID-19 epidemic still going in the world and posing a global threat, and there was a slight increase in the numbers of contingent and sporadic cases in China. Lam et al., al.(2009) found that the mental impact of severe acute respiratory syndrome (SARS) persisted and remained apparent for up to 4 years of follow-up. In their study, 181 SARS survivors were assessed by a constellation of psychometric questionnaires and a clinical interview to determine the presence of psychiatric disorders at a 4-year follow-up: 77 SARS survivors had active psychiatric illness, and 15.6% (12/77) of SARS survivors had experienced OCD. Carmi et al., al.(2021) evaluated the six-month impact of COVID-19 on the symptoms of OCD patients who received combined exposure and response prevention (ERP) treatment with pharmacological treatment, and they found that 96% of the patients did not show a worsening of OC symptoms at the six-month follow-up. However, in our study, only 59.37% reported taking medications regularly, and 34.38% reported having received medical aid by visiting psychological clinics or online consulting, while no one received specific psychotherapy, which may explain why the symptoms persisted through the one-year follow-up in this study. Thus, the take-home message may be that active, comprehensive interventions for OCD patients are needed in a timely manner to prevent lasting effects of the pandemic.

Our results showed that OCD patients experienced worsening depressive and anxiety symptoms during EARLY COVID-19 and at the one-year FOLLOW-UP. OCD is characterized by substantial comorbidities, and the most common comorbidities are anxiety disorder and mood disorders (Ruscio et al., 2010). Compared with the general

population, OCD patients are more vulnerable to stress, so they are more likely to experience depressive and anxiety symptoms. This result was in line with a previous study where Nissen et al., al.(2020) found that participants experienced a worsening of their OCD, anxiety, and depressive symptoms during the COVID-19 pandemic. Shaw et al., al. (2017) evaluated the associations of OCD dimensions with depressive symptoms and cognitive styles, and they found a significant indirect effect of depressive cognitive styles (e.g., rumination and dampening) on the relationship between OCD and depressive symptoms.

Many risk factors might have been associated with the exacerbation of OCD symptoms during COVID-19 (Cox and Olatunji, 2021; Jelinek et al., 2021; Nissen et al., 2020). We found that female gender, concern about COVID-19, and OCD symptoms severity at BASELINE increased the odds of OCD symptoms worsening during EARLY COVID-19. Previous studies have found that females had higher levels of anxiety and depression during the COVID-19 pandemic (Fancourt et al., 2021; Song et al., 2020). In our study, female gender was a risk factor among OCD patients during EARLY COVID-19. In addition, excessive concern about COVID-19 may have caused anxiety and resulted in worsening OCD symptoms. Wheaton et al., al.(2021) found that concern about COVID-19 was moderately and positively correlated with both OCD and health anxiety symptoms in a large sample of community adults ($n = 738$) in the United States.

Furthermore, the results in this study showed that optimism, one factor of resilience, was a protective factor for OCD patients against the exacerbation of OCD symptoms during EARLY COVID-19 and at the one year FOLLOW-UP. However, studies on resilience in OCD patients are limited. In this study, we found that resilience levels in the OCD patients were lower than those in the general population (Yu et al., 2007), which was consistent with a previous study (Holm et al., 2019). Studies have found a negative association between resilience and negative emotion, and this correlation is mainly driven by optimism (Chen et al., 2018). Optimism was shown to be one of the protective factors against the development of depression and anxiety during COVID-19 (Song et al., 2020). Individuals with high optimism feel that good things will happen to them, hard times are controllable and difficult times will certainly pass. In contrast, OCD patients tend to overstate the threat and take the thought of danger as a fact, and thus feel worried, anxious and out of control and use compulsions to ease the worry. To face COVID-19, OCD patients may exaggerate the likelihood of infection for themselves or their family members, feel pessimistic about the future with regard to COVID-19, and even experience suicidal ideation more frequently (Benatti et al., 2020). Some strong evidence suggests that resilience can be increased by mindfulness-based training. A randomized controlled trial (RCT) showed that the provision of mindfulness training could be an effective intervention to increase resilience to stress in university students (Galante et al., 2018). Another RCT performed in active-duty marines also revealed that marines who received 8 weeks of mindfulness-based mind fitness training showed greater reactivity and enhanced recovery after stressful training (Johnson et al., 2014). Therefore, mindfulness-based interventions that primarily focus on increasing the resilience to cope with COVID-19 for OCD patients should be tried.

Our study also has several limitations. First, the baseline survey relied on online questionnaires and clinical interviews. Although we attempted to reduce recall bias by collecting information based on previous medical records and/or through reminders from family members, our approach might not have completely eliminated this bias. Considering that the outbreak of COVID-19 was a sudden, explosive, and unexpected event, it was unrealistic for us to prospectively collect potentially useful information before the pandemic, and yet, our findings can still provide beneficial knowledge for OCD patients. Second, only a portion of participants completed the follow-up survey after one year, while the analysis was mainly based on three time point comparisons within individuals. The results might still be valid; however, further verification is necessary. Third, we assessed concerns about

COVID-19 by a self-designed scale instead of published scales. The reason was that this study was initiated at the early stage of the pandemic, and evaluations of EARLY COVID-19 were performed from 26 February–25 March 2020. Unfortunately, no Chinese version of a relevant scale was available at that time.

In summary, the results of our study revealed that OCD symptoms and depressive and anxiety symptoms were exacerbated in OCD patients during early COVID-19, and the impact was sustained at the one-year follow-up. Additionally, OCD symptoms severity at baseline, female gender, and concern about COVID-19 were risk factors for the exacerbation of OCD symptoms in the short term, while optimism was a protective factor in both the short and long term. These results might provide beneficial knowledge to understand the psychological changes in OCD patients during the COVID-19 pandemic and identified targets for psychological interventions.

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CRediT authorship contribution statement

Jinmin Liao: Conceptualization, Investigation, Methodology, Writing – original draft, Data curation. **Lijun Liu:** Conceptualization, Investigation, Methodology, Formal analysis, Writing – review & editing. **Xiaoyu Fu:** Conceptualization, Investigation, Project administration, Writing – review & editing. **Yingying Feng:** Conceptualization, Investigation, Writing – review & editing. **Wei Liu:** Conceptualization, Investigation, Writing – review & editing. **Weihua Yue:** Conceptualization, Investigation, Writing – review & editing. **Jun Yan:** Conceptualization, Supervision, Resources, Writing – review & editing.

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Supplementary materials

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