



# State and Trait Risk and Resilience Factors Associated with COVID-19 Impact and Obsessive–Compulsive Symptom Trajectories

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## Abstract

The COVID-19 pandemic may exacerbate common symptoms of obsessive–compulsive disorder, such as fears of contamination or causing harm to others. To investigate the potential impact of COVID-19 on obsessive–compulsive (OC) symptoms, we utilized a frequent sampling prospective design to assess changes in OC symptoms between April 2020 and January 2021. We examined in a broad clinical and non-clinical sample whether baseline risk (e.g., emotion dysregulation, anxiety sensitivity, intolerance of uncertainty) and protective (e.g., resilience) factors would predict OC symptom changes, and whether coping strategies would mediate week-to-week changes in COVID-19 impact and OC symptoms. Emotion dysregulation was associated with greater likelihood of OC symptom worsening, whereas resilience was associated with lower likelihood. Longitudinal mediation analyses revealed that coping strategies were not significant mediators; however, changes in adaptive coping were associated with subsequent-week OC symptom reductions. Regardless of perceived COVID-19 impact, implementing adaptive coping strategies may prospectively reduce OC symptoms.

**Keywords** COVID-19 · Obsessive–compulsive disorder · Coping · Emotion dysregulation · Anxiety sensitivity · Intolerance of uncertainty

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## Introduction

Without question, the COVID-19 pandemic has deleteriously impacted mental health around the globe (Sheridan Rains et al., 2020). In the United States (US) alone, the Center for Disease Control (CDC) reported that symptoms of depression and anxiety increased at a significantly higher rate between April and June 2020, when compared to the same interval in Spring 2019 (Czeisler et al., 2020). Furthermore, Gallagher and colleagues (2020) found that in a large US sample, one-third of respondents met the clinical cut-off for an anxiety or depressive disorder, and the likelihood of crossing the diagnostic threshold significantly increased for those with direct (e.g., personally diagnosed with COVID-19) or indirect (e.g., knew someone who was diagnosed with, or died from, COVID-19) exposure. In addition to the broad effects of the pandemic on mental health outcomes, quarantining is also associated with increased post-traumatic stress symptoms, confusion, and anger (Brooks et al., 2020). This pattern of results is not surprising because the consequences of quarantining (e.g., social isolation and loneliness) are known risk factors for poor mental health outcomes (Leigh-Hunt et al., 2017; Palgi et al., 2020).

Although evaluating the impact of COVID-19 on anxiety and mood symptoms is critically important, research must also attend to a group at high risk for deterioration during a pandemic—those with obsessive–compulsive disorder (OCD; Benatti et al., 2020; Darvishi et al., 2020; Davide et al., 2020). Indeed, common symptoms of OCD, such as contamination concerns or a fear of being responsible for harm coming to others (Abramowitz et al., 2010), are exacerbated by COVID-19, with contamination symptoms associated with greater worsening (Benatti et al., 2020; Davide et al., 2020; Munk et al., 2020; Tanir et al., 2020). Given emerging evidence on obsessive–compulsive (OC) symptom exacerbation during the pandemic, and the ongoing threat of the virus, there is a critical need to better understand the characteristics that escalate OC symptom severity, as well as the factors that promote resilience and psychological adjustment. Identifying such modifiable risk and resilience factors can inform individually tailored prevention or intervention programs that alter developmental trajectories (Cicchetti, 2018).

In service of this goal, we investigated four transdiagnostic trait characteristics that may prospectively influence OC symptoms based upon the unique challenges of the pandemic. Specifically, we theorized that *emotion dysregulation*—difficulty modulating emotions in response to internal and external demands (Gross, 1998)—may lead to a reliance on ritualistic behaviors (e.g., reassurance seeking) that reduce the intensity of uncomfortable emotions associated with a COVID-related obsession (e.g., fear of transmitting the virus to one's family). *Intolerance of uncertainty* (IU)—a dispositional inability to manage a lack of sufficient information (Carleton, 2016)—may make tolerating the ambiguous risk of contracting COVID-19 while engaging in routine activities (e.g., grocery shopping) unbearable, thereby leading to maladaptive regulatory behaviors, such as increased checking or avoidance. *Anxiety sensitivity* (AS)—a propensity to perceive anxiety symptoms as intolerable or dangerous (Reiss & McNally, 1985;

Taylor, 1995)—may enhance hypervigilance to the physical symptoms of anxiety which are likely occurring at greater intensities and for longer durations. Given increased somatosensory responsiveness in those with OCD (Rossi et al., 2005), these individuals may elaborate upon rituals to prevent themselves from becoming overwhelmed by their sensory experience (Dar et al., 2012). Finally, *resilience*—adaptability in the face of adversity (Luthar, 2006)—may impact an individual's ability to cope with inflated levels of anxiety and uncertainty. Importantly, ample research demonstrates that elevated emotion dysregulation, IU, and AS, as well as low levels of resiliency, are significantly associated with heightened OC symptom severity (e.g., Berman et al., 2018; Gentes & Ruscio, 2011; Holm et al., 2019; Wheaton et al., 2012a, 2012b) and have been shown to exacerbate internalizing symptoms over time in longitudinal designs (Heffer & Willoughby, 2018; Krebs et al., 2020; McLaughlin et al., 2011; Pozza et al., 2019). Therefore, we anticipated that higher baseline ratings on each risk factor would be associated with worsening OC symptoms, whereas higher baseline resilience ratings would be associated with less worsening OC symptoms, in the early stages of COVID-19.

In addition to evaluating trait risk and resilience factors, we used theoretical and empirical methods (see details in the Methods section) to identify six state-based coping strategies that may influence the trajectory of OCD symptoms during the pandemic. Based upon decades of evidence, the following five coping strategies should promote resiliency in the face of the virus: *positive reframing* (i.e., changing one's perspective by focusing on the positive; Beck, 2011), *acceptance* (i.e., accepting reality as is, without trying to change it; Hayes et al., 1999), *active coping* (i.e., focusing efforts on actively changing a stressful situation; e.g., using problem-solving skills [Billings, & Moos, 1981; Lazarus & Folkman, 1984]), *instrumental support* (i.e., tangible assistance from others for problem-solving purposes; Semmer et al., 2008), and *planning* (i.e., thinking about how to best deal with a stressor). Accordingly, research suggests that these strategies are associated with less distress (e.g., Carver et al., 1989; Muller, & Spitz, 2003; Yu et al., 2020), are considered adaptive strategies in response to uncontrollable stressors or national crises (like COVID-19; e.g., Baral and Bhagawati, 2019; Bei et al., 2013; Butler et al., 2005; Khurana & Romer, 2012; Silver et al., 2002; Updegraff et al., 2008; Xu and He, 2012), and may prospectively reduce symptoms of psychopathology over time (e.g., Horwitz et al., 2018; Lambert et al., 2012). In contrast to these five strategies, relying on self-blame (e.g., criticizing or blaming oneself; Carver et al., 1989) to cope with COVID-19 would theoretically worsen OC symptoms by reinforcing dysfunctional beliefs regarding an exaggerated sense of responsibility (e.g., Salkovskis, 1985). Not surprisingly, past research suggests that self-criticism in response to major stressors elevates psychopathology over time (e.g., Cox et al., 2009; Lassri et al., 2013).

Taken together, the current study examined how four trait-based risk and resilience factors and six state-based coping strategies influenced the trajectory of OC symptoms during the Spring surge of COVID-19 (which occurred between April 03, 2020 and June 17, 2020) and the Fall/Winter surge (between November 27, 2020 and March 16, 2021) in the Northeast region of the US, based on > 30 deaths per day within a 7-day average (Hawkins et al., 2020; Lennon et al., 2020; Reale et al.,

2021). Data also indicate that the week of the surge peak period was between April 15, 2020 and April 21, 2020 (Krieger et al., 2020), which coincided with the first week that the study was launched. Study participants completed a baseline assessment of OC symptoms and trait risk and resilience factors, followed by five weekly assessments (“acute” assessment period) and three additional assessments at the 1-, 3-, and 6-month time points (“follow-up” assessment period) evaluating their OC symptoms and coping strategies. Based upon the extant literature, we predicted that higher baseline levels of emotion dysregulation, IU, and AS would be associated with worsening OC symptoms, whereas higher baseline resiliency would be associated with less worsening, over the full assessment period (Hypothesis 1). We operationalized OC symptom worsening based on a reliable increase in self-reported OC symptoms using a calculation of a reliable change index to foster clinical interpretability (Jacobson & Truax, 1991). To examine the specificity of these risk factors in predicting OC symptom worsening in Hypothesis 1, we assessed changes in weekly depressive and OC symptoms during the assessment window, as well as whether changes in COVID-19 impact moderated these relationships. COVID-19 impact was measured by a newly developed self-report scale to assess the psychological impact of the pandemic. We also anticipated that greater use of adaptive coping strategies (e.g., positive reframing, acceptance, active coping, instrumental support, and planning) and less use of maladaptive coping strategies (e.g., self-blame) would prospectively mediate the relationship between changes in COVID-19 impact and OC symptoms over the six-week window (Hypothesis 2).

## Methods

### Participants

Participants were recruited from a hospital-affiliated outpatient OCD specialty program in Massachusetts through its volunteer research registry and by direct clinician referral. Inclusion criteria were intentionally broad (adults at least 18 years of age, fluent in English, and willing to provide implied consent) in order to sample the entire spectrum of OC symptoms across healthy and clinical volunteers. Our sampling strategy therefore recruited individuals both with a previous diagnosis of OCD or another psychiatric condition (63%), and without, as many participants reported no previous history of psychiatric illness or current psychiatric distress (37%, see Table 1 for details on sample composition). Out of the 393 volunteers contacted, 278 (70.7%) did not respond, 5 (1.3%) declined study participation, and 110 (28.0%) consented to participate. Of the consented participants, 9 (8.2%) did not complete the baseline survey; the remaining 101 (91.8%) were considered enrolled study participants. Three of the enrolled participants were withdrawn after baseline because they were participants in an active treatment study; these participants were not included in longitudinal or drop-out analyses. The enrolled participants completed their baseline surveys between April 10, 2020 and June 1, 2020 (95% completed the baseline survey by April 27, 2020, coinciding with the pandemic-related surge) and their sixth weekly survey between May 16, 2020 and July 06, 2020. Follow-up

**Table 1** Baseline characteristics split by baseline OC symptom severity

Demographics	DOCS $\geq$ 18 ( <i>n</i> = 61)		DOCS < 18 ( <i>n</i> = 40)		<i>p</i>
	Mean/%	(SD/ <i>n</i> )	Mean/%	(SD/ <i>n</i> )	
Age	31.2	(11.2)	30.6	(10.9)	0.7725
Sex at birth (% female)	90.2	(55)	72.5	(29)	0.0291
Gender minority (% minority)	9.8	(6)	0.0	(0)	0.0785
Race (in %)					0.8073
White	80.0	(48)	80.0	(32)	
Asian	13.3	(8)	10.0	(4)	
Other or unknown	6.7	(4)	10.0	(4)	
Hispanic (in %)	8.3	(5)	2.5	(1)	0.3973
No religion/unaffiliated (in %)	44.3	(27)	62.5	(25)	0.1032
Marital status (in %)					0.9585
Single/never married	59.0	(36)	62.5	(25)	
Married (incl. common law)	23.0	(14)	22.5	(9)	
Other	18.0	(11)	15.0	(6)	
Living situation (in %)					0.5270
Roommate	44.3	(27)	45.0	(18)	
Spouse/partners/children	29.5	(18)	37.5	(15)	
Other	26.2	(16)	17.5	(7)	
Education (in %)					0.3800
High school or less	1.6	(1)	2.5	(1)	
Some college	19.7	(12)	10.0	(4)	
BA/BS or higher	78.7	(48)	87.5	(35)	
Psychiatric history					
Diagnosed with a psychological condition (% yes)	72.1	(44)	50.0	(20)	0.0344
[if diagnosed] Significant distress/interference within the past 3 months	88.6	(39)	80.0	(16)	0.4434
DOCS contamination subscale > 6	46.5	(47)	6.9	(7)	< .0001
Trait characteristics					
IUS-12 total score	39.4	(9.1)	28.4	(8.4)	< .0001
DERS-SF total score	46.3	(13.4)	34.0	(11.1)	< .0001
SSASI total score	7.6	(5.3)	3.3	(4.0)	< .0001
BRS total score	16.3	(5.2)	20.8	(5.2)	< .0001
Current clinical characteristics					
DOCS total score	32.3	(11.3)	8.2	(4.9)	< .0001
DOCS contamination subscale	8.7	(3.9)	4.1	(2.6)	< .0001
PHQ-2 total score	2.7	(1.9)	1.5	(1.6)	0.0017
Brief COPE coping strategies					
Self distraction	6.5	(1.3)	5.6	(1.7)	0.0047
Active coping	5.2	(1.7)	4.9	(1.5)	0.3781
Denial	2.9	(1.3)	2.1	(0.3)	< .0001
Substance use	2.8	(1.2)	2.8	(1.4)	0.9485

**Table 1** (continued)

Demographics	DOCS $\geq$ 18 ( <i>n</i> = 61)		DOCS < 18 ( <i>n</i> = 40)		<i>p</i>
	Mean/%	(SD/ <i>n</i> )	Mean/%	(SD/ <i>n</i> )	
Use of emotional support	5.3	(1.7)	5.5	(1.7)	0.6006
Use of instrumental support	4.9	(1.7)	4.2	(1.7)	0.0403
Behavioral disengagement	3.4	(1.5)	2.5	(1.0)	0.0005
Venting	4.7	(1.4)	3.9	(1.5)	0.0162
Positive reframing	4.9	(1.8)	4.8	(1.6)	0.8170
Planning	5.4	(1.7)	4.8	(1.7)	0.0844
Humor	4.4	(2.1)	4.3	(1.8)	0.8801
Acceptance	5.9	(1.4)	6.4	(1.4)	0.0493
Religion	3.4	(1.7)	3.0	(1.5)	0.2674
Self-blame	4.6	(1.8)	2.8	(1.0)	<.0001
COVID-19 Impact Scale total score	3.5	(0.7)	2.8	(0.7)	<.0001

*DOCS*, Dimensional Obsessive–Compulsive Scale; *IUS-12*, Intolerance of Uncertainty–Short Form; *DERS-SF*, Difficulties in Emotion Regulation Short Form; *SSASI*, Short Scale Anxiety Sensitivity Index; *BRS*, Brief Resilience Scale; *PHQ-2*, Patient Health Questionnaire

surveys (assessing responses up to 6 months after the acute assessment period) were completed between June 17, 2020 and January 06, 2021.

## Questionnaires

We designed a battery of self-report questionnaires that have been validated for the purpose of screening OC and depressive symptoms, as well as measures that are designed to assess our hypothesized predictors and mediators.

### Demographic Questionnaire

To characterize the sample, we assessed the following demographic characteristics: age, sex, gender identity, race, ethnicity, religion, marital status, education level, occupational status, and living situation.

#### *Intolerance of Uncertainty Short Form* (IUS-12; Carleton et al., 2007).

The IUS-12 is a 12-item, self-report trait measure of responses to uncertainty, ambiguous situations, and the future. The measure has good convergent and discriminant validity, as well as internal consistency, in total score, and subscale scores (Carleton et al., 2007; McEvoy & Mahoney, 2011). The IUS-12 was administered at baseline. Cronbach's  $\alpha$  in the current sample was 0.92.

#### *Difficulties in Emotion Regulation Short Form* (DERS-SF; Kaufman et al., 2016).

The DERS-SF is an 18-item, self-report trait measure designed to assess four dimensions of emotion regulation: awareness and understanding of emotions,

acceptance of emotions, ability to engage in goal-directed behavior and refrain from impulsive behavior when experiencing negative emotions, and access to emotion regulation strategies perceived as effective. This measure has excellent psychometric properties (Kaufman et al., 2016). The DERS-SF was administered at baseline. Cronbach's  $\alpha$  in the current sample was 0.92.

**Short Scale Anxiety Sensitivity Index** (SSASI; Zvolensky et al., 2018).

The SSASI is a 5-item self-report scale that assesses trait AS (i.e., a fear of anxiety and arousal-related sensations). The measure has good internal consistency and strong associations with the original longer version, the ASI-3 (Wheaton et al., 2012a, 2012b). The SSASI was administered at baseline. Cronbach's  $\alpha$  in the current sample was 0.87.

**Brief Resilience Scale** (BRS; Smith et al., 2008).

The BRS is a 6-item self-report measure that assesses one's ability to recover from stress. It has been shown to reliably measure a unitary construct of resilience across analog and clinical samples (Smith et al., 2008). The BRS was administered at baseline as a trait measure of resilience. Cronbach's  $\alpha$  in the current sample was 0.93.

### COVID-19 Impact Measure

This 10-item self-report measure was developed for the purpose of the present study to assess the psychological impact of the COVID-19 pandemic. Participants were asked to self-report their perceived preoccupation (e.g., "I followed the news about COVID-19 closely, spending most of my day reading, listening, or discussing updates"), stress (e.g., "I experienced significantly greater work stress, family stress, or stress at home due to the COVID-19 pandemic"), and distress (e.g., "I found it difficult to tolerate the uncertainty about whether I or a loved one would contract COVID-19") across various domains of their life associated with the pandemic. This measure was administered at every assessment. Examination of the internal consistency of this measure revealed that two items had weak factor loadings (see Analysis section for more details). The revised 8-item version of the scale was used in all analyses. Cronbach's  $\alpha$  for the 8-item scale was 0.83 at baseline.

**Brief COPE** (Carver, 1997).

The Brief COPE is a 28-item self-report measure designed to assess 14 coping strategies including: self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. It has been studied extensively with valid and reliable psychometric properties in healthy and clinical samples, as well as samples recovering from stressful events, such as Hurricane Andrew (Carver, 1997). The Brief COPE was administered at every assessment time point. Cronbach's  $\alpha$  for subscales representing the six putative mediators in the current sample ranged from 0.67 (acceptance) to 0.86 (instrumental support) at baseline.

**Dimensional Obsessive Compulsive Scale** (DOCS; Abramowitz et al., 2010).

The DOCS is a 20-item self-report measure of OC symptoms associated with common concerns about contamination, harm, unacceptable thoughts, and

symmetry. It has been shown to have strong psychometric indices of reliability and validity, sensitivity to treatment change over time, and diagnostic sensitivity, with a total score  $\geq 18$  differentiating individuals with OCD from psychiatric controls (Abramowitz et al., 2010). The DOCS was administered at every assessment. Cronbach's  $\alpha$  in the current sample was 0.94 at baseline.

**Patient Health Questionnaire-2** (PHQ-2; Kroenke et al., 2003).

The PHQ-2 is based on the original 9-item self-report Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) and shown to be a valid screening measure for depression by assessing depressed mood and anhedonia in the past 2 weeks. The PHQ-2 was administered at every assessment. Cronbach's  $\alpha$  in the current sample was 0.84 at baseline.

## Procedure

The study utilized a prospective survey design to examine longitudinal associations between COVID-related impact, coping strategies, and OC symptoms. The entire study occurred over the course of 7.5 months and involved two time periods: an acute assessment period consisting of six weekly surveys, and a follow-up assessment period, consisting of surveys at 1-, 3-, and 6-months after the acute assessment phase. Interested participants were sent unique links to an online questionnaire battery through REDCap. REDCap is a secure web application for building and managing online surveys and databases hosted through an institutional server (Harris et al., 2009). Once the baseline questionnaire battery was completed, participants received automatic links to complete all follow-up surveys, which were identical, and were asked to complete the questionnaires within 72 h of receiving the link. The study was approved by the institutional review board prior to the start of study procedures.

## Analytic Strategy

### Data preparation

First, we examined which items of our COVID-19 Impact Scale could be used to estimate overall impact derived from pandemic-related worries, stressors, and distress by conducting a principal components analysis ( $n=101$ ). The scree plot method showed that our scale had only one principal factor. Two items (items 1 and 9) did not load on the single factor (factor loadings  $< 0.28$ , final communality estimates  $< 0.1$ ), so we removed them from the factor analysis and subsequent scale mean score calculations. The single factor explained 86.7% of the variation in the final model; factor loadings and final communality estimates are presented in Supplementary Table 1. To reduce the number of coping strategies examined as mediators in subsequent analyses, we also used a principal components analysis of the 14 coping strategies resulting from the Brief COPE scoring. The scree plot method identified 3 factors (self-reliant adaptive coping: active coping, planning, acceptance, positive reframing, self-distraction, religion, humor; maladaptive coping: denial, behavioral disengagement, self-blame, substance use; and other-reliant



adaptive coping: use of instrumental support, use of emotional support, venting) to be extracted, and we used the oblique promax rotation to optimize subsequent factor loadings. To identify a representative coping strategy from each of the 3 coping factors, we chose variables with the highest factor loading from each of the 3 principal components, with the additional constraint that the baseline median scores for those coping strategies were not equal to the scale minimum. The resulting coping strategies chosen were “planning” to represent the first factor of self-reliant adaptive coping, “self-blame” to represent the second factor of maladaptive coping, and “use of instrumental support” for the third factor of other-reliant adaptive coping (see Supplementary Table 2).

## Analyses

Baseline sample characteristics were assessed for differences between individuals with and without OCD (based on the DOCS clinical cutoff score  $\geq 18$ ) using *t* tests for continuous variables and Fisher’s exact tests for categorical variables. Due to the relatively high rate of drop-out over the 7.5-month survey period, we examined whether baseline demographic characteristics, trait risk and resilience characteristics, or symptom severity predicted drop-out in a series of univariate logistic regression models. All univariate model *p* values were adjusted for false discovery rate.

To test Hypothesis 1, we first examined whether the baseline risk (IUS-12, DERS-SF, SSASI) and resilience (BRS) factors predicted OC symptom severity (DOCS total scores) at baseline in simple linear regression models, again adjusting *p* values for false discovery rate. We then used a follow-up multiple regression model to see which of the trait characteristics was the strongest predictor of baseline OC symptom severity. Given that 95% of baseline assessments were completed by April 27, 2020, coinciding with the surge period, participants may have already gotten worse by the time the study began, and our baseline assessment of OC symptoms may not reflect an accurate baseline. We therefore examined both reliable worsening as well as reliable improvement of OC symptoms and depressive symptoms across the full assessment period. We assessed the same four baseline trait characteristics (IUS-12, DERS-SF, SSASI, BRS) as predictors of reliable worsening or improvement of OC (DOCS) or depressive (PHQ-2) symptoms at any point during the following 5-week assessment and 6-month follow-up window in separate logistic regression models. Reliable change indices (Jacobson & Truax, 1991) were calculated based on baseline and week 1 DOCS (for OC symptoms) or baseline and week 1 PHQ-2 (for depressive symptoms) standard deviations and test–retest correlations between the 2 weeks; for both outcomes, reliable worsening was defined as any occurrence of a reliable change index greater than 1.96, while reliable improvement was defined as any occurrence of a reliable change index less than  $-1.96$ . The multiple logistic regression models to predict symptom worsening or improvement used one standardized risk/resilience factor at a time, COVID-19 impact change score (based on week of reliably worsened/improved DOCS compared to baseline), and an interaction of COVID-19 impact change and the risk/resilience factor as predictors to account for the direct impact of COVID-19 on symptom changes, as well as the moderating effect COVID-19 impact changes might have on the impact of the

risk/resilience factors. Odds ratios for the logistic regressions of symptom worsening and symptom improvement were calculated to represent a single standard deviation change in the corresponding predictor.

To test Hypothesis 2, we used a structural equation modeling approach to longitudinal mediation modeling to test whether COVID-19-related impact was associated with subsequent changes in OC symptom severity (2 weeks later), and whether this association was mediated by the use of coping strategies (1-week lag each between predictor and coping strategy as well as between coping strategy and outcome). These analyses were conducted only for the acute assessment time period, because lags between assessments were consistently weekly, whereas lags varied significantly in the follow-up assessment time period. Our primary outcome measure was DOCS total scores at each of the five weekly time-points. Hypothesized primary mediators were planning, instrumental support, and self-blame; and exploratory mediators were positive reframing, active coping, and acceptance. We used a simple longitudinal mediation model that did not allow for any reverse causation effects (e.g., model 5 in Cole and Maxwell (2003)) of OC symptom severity on the mediators (coping strategies) or predictor (COVID-19 Impact). Additionally, we constrained model parameters to be equal between assessment waves, though the error variances of OC symptom severity were allowed to differ between assessment waves. We also added time-invariant latent variables to the model to control for any unmeasured confounders. Due to a high, significant covariance between the latent variable associated with the outcome (DOCS) and the mediator (coping strategies) that led to Heywood cases during model estimation, we fixed the latent variables affecting both variables to be equal. Model fit was evaluated through root mean square error of approximation (RMSEA), where values of 0.01, 0.05, and 0.08 indicate excellent, good, and mediocre fit, respectively, as well as the Bentler Comparative Fit Index (BCFI) and Bentler-Bonett Non-normed Index (BBNNI), where higher values (range: 0–1) indicate better fit and values over 0.90 or over 0.95 are considered acceptable model fit. All statistical analyses were performed in SAS version 9.4 for Windows.

## Results

### Sample Characteristics

Table 1 provides a full description of participant characteristics split by baseline OC symptom severity. There were no demographic differences between the groups, except that those with greater OC symptom severity were more likely to be female. As expected, participants with greater OC symptom severity at baseline were more likely to have been diagnosed previously with a psychological condition and were more likely to report significant contamination concerns, as compared to those with lower OC symptom severity. Participants with greater baseline OC symptom severity also displayed worse clinical characteristics (i.e., greater depression, greater COVID-19 impact), less use of adaptive coping strategies, and greater use

of potentially maladaptive coping strategies than participants with low OC symptom severity (see Table 1).

### Study Drop-out

Participants completed on average 6.1 assessments (out of 9 total), with median of 7 and mode of 9. Exactly half of participants ( $n=49$ ) discontinued participation before the 6-month follow-up survey. None of the baseline demographics (i.e., age, racial, ethnic, or gender identity), trait characteristics (IUS-12, DERS-SF, SSASI, BRS), or current clinical characteristics (i.e., DOCS total, DOCS-contamination subscale, PHQ-2, and COVID-19 impact) predicted study drop-out (all  $p$ 's  $> 0.12$ , adj.  $p > 0.84$ ).

### Trait Predictors of OC Symptoms at Baseline

All four of the baseline traits examined were significantly associated with OC symptom severity at baseline, and each accounted for 21.5–29.1% of the variance in OC symptoms (Table 2). IU, difficulties in emotion regulation, and AS were associated with higher OC symptom severity, while resiliency was associated with less severe OC symptom severity. The follow-up multiple regression model with all four trait characteristics accounted for 38.1% of the variance in OC symptoms; in this model, the effect size of each predictor was decreased due to multicollinearity between predictors (VIF range: 1.62–2.47), and only IU ( $b=0.39$ , 95% CI: [0.06, 0.72], std.  $b=0.27$ ,  $p=0.0214$ ) and AS ( $b=0.83$ , 95% CI: [0.25, 1.40], std.  $b=0.29$ ,  $p=0.0055$ ) emerged as significant predictors of more severe OC symptoms. The correlations between all four baseline trait characteristics were moderately strong, ranging from  $r=-0.42$  (SSASI and BRS) to  $r=-0.66$  (DERS-SF and BRS).

### Trait Predictors of Subsequent Reliable Worsening of OC and Depressive Symptoms

Out of the 87 participants who completed surveys after the baseline assessment, 11 (12.6%) reported reliable worsening of OC symptoms, and 22 (25.3%) reported reliable worsening of depression symptoms during at least one of the subsequent five weekly and three follow-up assessments. One of the three hypothesized risk factors, DERS-SF, was significantly associated with the occurrence of subsequent OC symptom worsening, and our hypothesized resilience factor (BRS) was significantly associated with less subsequent OC symptom worsening (all  $p$ 's  $< 0.05$ ; Table 2). The DERS-SF risk factor more than doubled the odds of OC symptom worsening for each standard deviation increase in the measure, while a standard deviation increase in resilience more than halved the odds of OC symptom worsening. In addition, a significant moderation effect emerged: although baseline AS did not predict reliable worsening of OC symptoms as a main effect, this relationship was moderated by changes in COVID-19 impact when they were perceived to be greater (e.g., worse impact), suggesting that at higher levels of change in COVID-19 impact (rather than

**Table 2** Risk and protective traits as predictors of obsessive-compulsive (OC) symptom severity and subsequent OC symptom and depression worsening and improvement

Model type	Predictors	Baseline trait			COVID-19 impact change			Moderation effect						
		Est	95% CI	p	Adj. p	Est	95% CI	p	Adj. p	Est	95% CI	p	Adj. p	ES
Univariate linear regressions of baseline DOCS scores (n = 101)														
	IUS-12 total	0.79	[0.54, 1.03]	< .0001	< .0001									
	DERS-SF total	0.51	[0.32, 0.70]	< .0001	< .0001									
	SSASI total	1.47	[0.98, 1.96]	< .0001	< .0001									
	BRS total	-1.23	[-1.70, -0.76]	< .0001	< .0001									
Multivariate logistic regression of DOCS RCI worsening (n = 87, 11 events)														
	IUS-12 total	1.40	[0.70, 2.79]	0.34	0.38	0.81	[0.16, 4.17]	0.80	0.87	4.75	[0.74, 30.38]	0.14	0.19	0.61
	DERS-SF total	2.71	[1.27, 5.82]	<b>0.01</b>	<b>0.02</b>	0.37	[0.08, 1.65]	0.19	0.59	5.47	[0.64, 46.52]	0.45	0.45	0.79
	SSASI total	1.37	[0.68, 2.73]	0.38	0.38	1.16	[0.18, 7.38]	0.87	0.87	10.79	[2.01, 57.78]	<b>0.02</b>	0.08	0.70
	BRS total	0.31	[0.13, 0.76]	<b>0.01</b>	<b>0.02</b>	2.81	[0.40, 19.51]	0.30	0.59	2.50	[0.33, 18.81]	0.06	0.12	0.83
Multivariate logistic regression of PHQ-2 RCI worsening (n = 86, 22 events)														
	IUS-12 total	0.95	[0.56, 1.61]	0.85	0.98	2.09	[0.76, 5.70]	0.15	0.20	0.52	[0.12, 2.20]	0.31	0.04	0.62
	DERS-SF total	0.77	[0.44, 1.36]	0.37	0.98	1.92	[0.69, 5.35]	0.21	0.21	0.57	[0.14, 2.35]	0.59	0.59	0.61
	SSASI total	1.01	[0.59, 1.72]	0.98	0.98	2.14	[0.79, 5.81]	0.13	0.20	0.57	[0.16, 2.00]	0.25	0.41	0.62
	BRS total	1.07	[0.61, 1.89]	0.81	0.98	2.97	[0.87, 10.14]	0.08	0.20	3.88	[0.97, 15.46]	<b>0.02</b>	0.09	0.65
Multivariate logistic regression of DOCS RCI improvement (n = 87, 25 events)														
	IUS-12 total	2.55	[0.96, 6.77]	0.06	0.24	0.14	[0.05, 0.43]	< .001	< .001	3.66	[0.43, 30.88]	0.57	0.77	0.81
	DERS-SF total	1.82	[0.74, 4.51]	0.20	0.26	0.12	[0.04, 0.40]	< .001	< .001	1.50	[0.19, 11.98]	0.77	0.77	0.81
	SSASI total	1.88	[0.78, 4.52]	0.16	0.26	0.11	[0.03, 0.36]	< .001	< .001	0.87	[0.09, 8.62]	0.34	0.77	0.83
	BRS total	0.65	[0.28, 1.48]	0.30	0.30	0.14	[0.05, 0.41]	< .001	< .001	0.78	[0.13, 4.86]	0.74	0.77	0.80
Multivariate logistic regression of PHQ-2 RCI improvement (n = 87, 33 events)														
	IUS-12 total	2.00	[1.08, 3.69]	<b>0.03</b>	<b>0.05</b>	0.37	[0.15, 0.95]	<b>0.04</b>	<b>0.05</b>	2.98	[0.69, 12.83]	0.43	0.83	0.72
	DERS-SF total	1.72	[0.96, 3.08]	0.07	0.09	0.25	[0.08, 0.79]	<b>0.02</b>	<b>0.05</b>	0.41	[0.07, 2.61]	0.07	0.28	0.74

Table 2 (continued)

Model type	Predictors	Baseline trait			COVID-19 impact change			Moderation effect						
		Est	95% CI	<i>p</i>	Adj. <i>p</i>	Est	95% CI	<i>p</i>	Adj. <i>p</i>	Est	95% CI	<i>p</i>	Adj. <i>p</i>	ES
	SSASI total	1.10	[0.66, 1.86]	0.71	0.71	0.31	[0.11, 0.87]	<b>0.03</b>	<b>0.05</b>	0.83	[0.17, 4.05]	0.66	0.83	0.68
	BRS total	0.51	[0.29, 0.90]	<b>0.02</b>	<b>0.05</b>	0.40	[0.15, 1.08]	0.07	0.07	0.46	[0.12, 1.77]	0.83	0.83	0.73

*IUS-12*, Intolerance of Uncertainty-Short Form; *DERS-SF*, Difficulties in Emotion Regulation Scale Short Form; *SSASI*, Short Scale Anxiety Sensitivity Index; *BRS*, Brief Resilience Scale; *DOCS*, Dimensional Obsessive-Compulsive Scale; *PHQ-2*, Patient Health Questionnaire-2; *RCI*, Reliable Change Index; *CI*, confidence interval; *ES*, effect size

stable levels of COVID-19 impact), greater AS predicted a greater likelihood of OC symptom worsening. None of the baseline trait predictors was associated with reliable worsening of depressive symptoms in multiple logistic regression models (Table 2). However, baseline resilience showed a significant interaction with greater changes in COVID-19 impact (e.g., worse impact) in predicting reliable worsening of depressive symptoms, suggesting that baseline resilience was no longer protective under conditions when self-reported COVID-19 impact increased.

### **Trait Predictors of Subsequent Reliable Improvement of OC and Depressive Symptoms**

Out of the 87 participants who completed surveys after the baseline assessment, 25 (28.7%) reported reliable improvement of OC symptoms, and 33 (37.9%) reported reliable improvement of depression symptoms during at least one of the subsequent five weekly and three follow-up assessments. None of the four baseline trait characteristics was significantly associated with the occurrence of subsequent OC symptom improvement. However, increases in COVID-19 impact were associated with a lower likelihood of OC symptom improvement; we were unable to detect any moderating effects of COVID-19 impact change in the OC symptom improvement models. In terms of the likelihood of subsequent depressive symptom improvement, baseline resilience was significantly associated with a *reduced* likelihood of depressive symptom improvement, and greater baseline IU was associated with two times greater odds of depressive symptom improvement. Increases in COVID-19 impact were also significantly associated with reduced odds of depressive symptom improvement in 3 out of the 4 models. See Table 2 for a full summary of logistic regression models.

### **Changes in Coping Strategies as Longitudinal Mediators of the Relationship Between Changes in COVID-19 Impact and OC Symptom Severity**

Overall, the six longitudinal mediation models were unable to detect significant direct effects of changes in COVID-19 impact on changes in OC symptom severity over 2-week lags, nor significant mediated effects via the examined coping strategies. All a-paths with 1-week lag from COVID-19 impact to the coping strategy mediators were non-significant, as were all the c-paths with 2-week lag from COVID-19 impact to OC symptom severity (Table 3). By contrast, the b-paths with 1-week lag from the coping strategy mediators to OC symptom severity were significant for all coping strategies except self-blame (Table 3), indicating that week-to-week increases in the use of adaptive coping strategies (planning, instrumental support, acceptance, active coping, and positive reframing) were associated with reductions in OC symptom severity 1 week later. Model fit was just below mediocre for all models based on the RMSEA (range: 0.084 for mediator “planning” to 0.102 for mediator “self-blame”), but acceptable based on the BCFI and BBNNI fit indices.

**Table 3** Summary of longitudinal mediation models of the effect of COVID-19 impact on OC symptom severity, mediated by coping strategies

Mediator	Standardized path coefficients (week 2)												Model fit					
	<i>a</i>	SE	<i>a</i>	<i>p</i>	<i>b</i>	SE	<i>b</i>	<i>p</i>	<i>c</i>	SE	<i>c</i>	<i>p</i>	$\chi^2$	df	<i>p</i>	RMSEA	BCFI	BBNNI
Brief COPE: planning	-0.108	0.090	0.228	0.003	-0.067	0.022	0.003	0.003	0.026	0.025	0.301	<.0001	240.3	135	<.0001	0.088	0.94	0.93
Brief COPE: self-blame	-0.042	0.073	0.561	0.149	-0.037	0.025	0.149	0.029	0.029	0.025	0.245	<.0001	275.7	135	<.0001	0.102	0.93	0.92
Brief COPE: inst. support	-0.132	0.079	0.096	0.010	-0.055	0.021	0.010	0.019	0.025	0.025	0.456	<.0001	248.9	135	<.0001	0.091	0.94	0.93
Brief COPE: acceptance	-0.043	0.093	0.641	0.010	-0.054	0.021	0.010	0.039	0.026	0.124	0.124	<.0001	231.7	135	<.0001	0.084	0.94	0.93
Brief COPE: active coping	0.025	0.091	0.787	0.002	-0.068	0.022	0.002	0.039	0.026	0.131	0.131	<.0001	237.0	135	<.0001	0.087	0.94	0.93
Brief COPE: pos. reframing	-0.019	0.089	0.831	0.002	-0.070	0.022	0.002	0.039	0.026	0.125	0.125	<.0001	237.1	135	<.0001	0.087	0.94	0.93

SE, standard error; RMSEA, root mean square error of approximation; BCFI, Bentler Comparative Fit Index; BBNNI, Bentler-Bonett Non-normed Index

Of note, in the baseline data, there was a moderately strong positive correlation ( $r=0.60$ ) between COVID-19 impact scores and OC symptom severity (Supplementary Table 3), indicating that even though there was no evidence of a strong causal association between these two variables in the longitudinal mediation model with 1- to 2-week time lags, there is some evidence that they are associated cross-sectionally. The coping strategy of self-blame also showed moderate positive correlations with both OC symptoms and COVID-19 impact at baseline (Supplementary Table 3), which may indicate that the association between this coping strategy and OC symptom severity may have a stronger time-invariant component than the other coping strategies examined.

## Discussion

In a 7.5-month, frequent sampling prospective study that began during the peak of the COVID-19 pandemic in Spring 2020, we determined that one of our hypothesized baseline trait risk factors (emotion dysregulation) emerged as a predictor of reliable OC symptom worsening, and another predictor (AS) interacted with changes in perceived COVID-19 impact to predict reliable OC symptom worsening during the pandemic. Resilience also emerged as a trait protective factor that predicted a lower likelihood of subsequent OC symptom worsening. In contrast, our hypothesis regarding longitudinal mediation of the relationship between changes in COVID-19-related impact and OC symptoms by changes in coping strategies was not supported. In the longitudinal models, we found that previous-week increases in the use of adaptive coping strategies prospectively predicted subsequent-week reductions in OC symptoms, regardless of one's perceived COVID-19-related impact. Specifically, increased use of planning, instrumental support, acceptance, active coping, and positive reframing were prospectively associated with reductions in OC symptoms 1 week later.

Major strengths of our approach were sampling along the full dimension of OC symptoms (Abramowitz et al., 2014) and utilizing a prospective design. We were interested in understanding changes in OC symptoms experienced by those with and without histories of psychiatric diagnoses, given that the COVID-19 pandemic made those boundaries less clear. Sampling OC symptoms dimensionally and prospectively allowed us to examine trait risk and resilience factors that contributed to worsening OC symptoms in the entire sample during the most critical weeks following the pandemic-related surge and months later. Our risk factor hypothesis was partially supported. We confirmed previous findings that emotion dysregulation, AS (under certain conditions of perceived COVID-19 impact), and low resilience are associated with OC symptom severity (Berman et al., 2018; Holm et al., 2019; Khosravi et al., 2020; Yap et al., 2018). These results map onto clinical observations that the pandemic has not affected individuals uniformly—those who lack resources to recover quickly from stressful events or those who lack awareness of emotions and are less able to mount adaptive responses to them are at highest risk of deterioration. Our hypothesis that IU would pose as a risk factor for worsened OC symptoms was also not supported. It is possible that some IU regarding health-related outcomes



was adaptive during the pandemic, as the entire population grappled with uncertainty due to changing public policies to limit the spread of COVID-19 and conflicting news regarding its actual virulence (Rubin et al., 2009). We also sought to examine whether the relationships between trait risk and resilience factors and OC symptoms were specific to the pandemic by evaluating whether changes in COVID-19 impact moderated these relationships. Results indicated that AS was associated with greater odds of OC symptom worsening only under conditions of greater change in COVID-19 impact, which lends some support that at least one of our trait risk factors may confer greater risk for OC symptom worsening during the pandemic; however, no other moderation effects were detected. More research is needed to compare the effects of risk and resilience factors before or after the pandemic to better understand whether their impact is specific to COVID-19.

Interestingly, our results suggest that none of our hypothesized trait risk factors predicted worsening of depressive symptoms and that emotion dysregulation, AS, and IU may represent risk factors specific to OC symptom worsening. Baseline resilience, however, displayed an unexpected relationship with depressive symptom worsening, as it was associated with an increased likelihood for worsened depressive symptoms when COVID-19 impact was perceived to increase. This may be due to limitations with our “trait” measure of resilience, as a state-based measure of resilience (e.g., Connor-Davidson Resilience Scale; Connor & Davidson, 2003) may better capture momentary symptomatic changes during the assessment period (e.g., Windle et al., 2011).

Contrary to our mediation hypothesis, none of our predicted coping strategies mediated the relationship between changes in COVID-19 impact and OC symptom severity over the 5-week acute assessment window. One potential explanation for this null finding is that our COVID-19 Impact Scale may have inadequately measured COVID-19-related impact and distress. However, this is unlikely given that the internal consistency of the final 8-item COVID-19 measure (Cronbach's  $\alpha=0.83$ ) suggested that we captured an interpretable single factor of COVID-19 impact, and given that COVID-19 impact correlated moderately strong with OC symptom severity cross-sectionally. When the study launched in early April, there were no brief measures specifically designed to assess COVID-19's effects on mental health. Since then, multiple instruments have been developed and tested to assess various aspects of COVID-19 impact in research (National Institute of Health Office of Behavioral & Social Sciences Research, 2020). Perhaps, a more likely conceptual explanation is that COVID-19 impact was not a major determinant of changes in coping strategies or OC symptoms (as evidenced by nonsignificant a- and c-paths in our model), even though changes in adaptive coping strategies led to changes in subsequent week OC symptoms, regardless of COVID-19 impact the week prior. An additional possibility is that changes in coping are not the mechanism by which changes in COVID-19 impact affects changes in OC symptoms, or that the week-to-week changes in each of these variables did not adequately capture the correct time lags between predictor, mediator, and outcome. Future research should examine other potential mediators, such as a perceived sense of safety, control/self-efficacy, and social connection, which have been theorized in the psychological first aid literature to have a major impact

on the mental health consequences of disasters (Brymer et al., 2006). Another empirical question is whether teaching the effective use of coping strategies leads to longer-term reductions in OC symptom severity.

There were several clinical implications of our findings. Individuals at highest risk and who require closer monitoring during the COVID-19 pandemic may be those who have lower resilience and higher emotion dysregulation or AS. Although we are conceptualizing these constructs as trait factors, we do not mean to imply that such dispositional factors are not malleable; resilience in particular has been shown to improve with treatment among people with OCD (Holm et al., 2019). In addition, several of the adaptive self-reliant coping strategies that predicted subsequent-week reductions in OC symptoms reflect skills that are taught during effective psychological treatments for OCD and depression, such as positive reframing (cognitive therapy; Wilhelm & Steketee, 2006), planning/active coping (behavioral activation; Lejuez et al., 2001), and acceptance (mindfulness; Twohig, 2009). Our findings highlight the importance of implementing such coping strategies for all individuals regardless of previous psychiatric history. Although “other-reliant” coping strategies, such as the use of instrumental support, reduced OC symptoms in our study, we caution against relying on others by accommodating rituals and safety behaviors (e.g., excessive handwashing or cleaning, heavy use of hand sanitizer), as this may exacerbate OC symptoms in the long-term especially for those with clinically significant OC symptoms.

Some limitations deserve mention. First, there were limitations associated with our sample size and composition. Our analyses were limited by a small sample size, especially for longitudinal mediation analyses within a structural equation model framework, where sample sizes of  $n > 200$  are desirable. We also did not assess previous treatment history, medication use, or active/future treatments for OCD. These factors may influence one’s potential for adaptive coping and represent important moderators of the relationship between risk and resilience factors and OC symptoms. Second, we were unable to capture a true “baseline” of OC symptoms prior to the peak of the pandemic in Spring 2020, as most participants completed their first set of questionnaires during the first couple of weeks of the surge period. Despite the lack of an accurate baseline, there was enough variability in OC symptoms after baseline to capture significant effects of our hypothesized trait characteristics in predicting OC symptom worsening. Furthermore, due to the unfunded nature of the study, participants received no compensation, which may have led to greater rates of attrition. Another limitation was the inability to demonstrate that our hypothesized relationships between trait risk and resilience factors and OC symptoms were specific to the COVID-19 pandemic. It therefore remains unknown whether our findings truly reflect specific effects of the COVID-19 pandemic, any pandemic in general, or the mere passage of time. Lastly, due to the relatively homogeneous racial and ethnic composition of our sample, it was not possible to examine the impact of racial stress or race-based discrimination on pandemic-related outcomes. Other reports indicate the multitude of ways that the COVID-19 pandemic has exacerbated mental and physical health disparities associated with marginalized group membership, especially among African American, Latinx, and Native American communities (Tai et al., 2020), suggesting that disadvantaged social groups that lack external

resources (e.g., access to healthcare, stable housing, financial means, and broadband access) may also be at higher risk.

Limitations notwithstanding, our study is one of the first to examine factors that prospectively mitigate and worsen OC symptoms during an unprecedented pandemic, when some degree of heightened attention to contamination and illness concerns is not only a shared experience, but also adaptive. Our findings shed light on potentially important intervention targets, as well as risk and protective factors, for people experiencing OCD or related disorder symptoms that can be scalable in the broader community.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s41811-021-00128-4>.

## Declarations

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