



2019-nCOV distress and depressive, anxiety and OCD-type, and eating disorder symptoms among postpartum and control women

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Abstract

This study compared postpartum and control women on depressive, anxiety, and OCD-type symptoms, and eating disorder symptoms during the 2019-nCOV pandemic and evaluated if associations between 2019-nCOV distress and these mental health symptoms differed for postpartum compared to control women. A community sample of women, ages 18–39, who had either given birth in the past 12 months ($n = 232$) or had no pregnancy history ($n = 137$; controls), was recruited to complete an online survey about their depressive, anxiety, OCD, and eating disorder symptoms. Postpartum women reported greater OCD-type symptoms related to concerns about both contamination and responsibility for harm ($ps < .05$) compared to controls. After controlling for general stress and mental health history, the association between 2019-nCOV distress and OCD-type symptoms related to concerns about contamination was stronger among postpartum compared to control women ($ps < .002$). For all women, 2019-nCOV distress was positively related to general anxiety symptoms, total OCD-type symptoms, and OCD-type symptoms related to concerns about responsibility for harm after controlling for general stress and mental health history ($ps < .03$). Data are first to suggest postpartum women may be at elevated risk for OCD-type symptoms during 2019-nCOV pandemic, and pandemic distress is associated with anxiety and OCD-type symptoms among postpartum women more so than control women.

Keywords Coronavirus · Postpartum women · Depressive symptoms · Anxiety · OCD-type symptoms · Eating disorder

The World Health Organization (WHO) designated the 2019 novel coronavirus (2019-nCOV) a global pandemic on March 11, 2020. As of January 17, 2021, the US Centers for Disease Control estimated more than 23 million people have tested positive for 2019-nCOV and more than 394,000 people have died (Centers for Disease Control and Prevention 2021). In recent weeks, experts have begun calculating long-term predictions suggesting the pandemic is likely to continue through 2021 (McNeil 2020). Calls for research have been made to identify specific mental health symptoms and populations that may be most at risk during the pandemic (Bao et al. 2020; Shigemura et al. 2020; Xiang et al. 2020).

To date, few published studies have evaluated mental health symptoms during the 2019-nCOV pandemic. A

survey in China from February 6 through 9, 2020 (Wang et al. 2020) found 6.3% of adults reported anxiety symptoms and 17.7% reported depressive symptoms. In contrast, pre-morbid epidemiological data from 2013 to 2015 estimated prevalence rates were approximately 5.0% for anxiety and 3.6% for depression (Huang et al. 2019). Additionally, a survey in Iran found fear of getting 2019-nCOV was correlated with depression, anxiety, and contamination concerns among adults (Ahorsu et al. 2020). A study in the USA suggests adults may be eight times more likely to meet criteria for a serious mental illness now compared to 2018 (Twenge and Joiner 2020). Although these data are limited, they may be indicative of increases in mental health concerns.

One specific population that may be at greater risk for mental health concerns during the 2019-nCOV pandemic is postpartum women. The postpartum period (defined here as the first 12 months following birth) is a window of vulnerability to depressive, anxiety, and eating disorder symptoms. Data indicate nearly 10–15% of new mothers experience postpartum depression (Beck et al. 2006) compared to the point prevalence of major depressive disorder among US

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adult women, 9.2% (Barsha 2020). Furthermore, nearly two-thirds of women experienced their first depressive episode during the perinatal period, and 5.7% had a new onset of depression during the postpartum period (Banti et al. 2011). Point prevalence rates of postpartum anxiety disorders are estimated to be between 8.7% and 16.8%, with the incidence rate of new cases estimated at 10.3% (Stuart et al. 1998), compared to a 12-month prevalence rate of between 3.1% and 7.7% for anxiety disorders among adult women (Kinrys and Wygant 2005). Finally, given the many dramatic changes that occur to a woman's body weight and shape during pregnancy and after birth, researchers believe the postpartum period may also be a time of increased risk of eating disorder symptoms (Hawkins and Gottlieb 2013; Thompson 2020; Watson et al. 2016). Evidence suggests the risk of a full-threshold eating disorder almost triples from 5.3% prepartum to 12.8% postpartum (Pettersson et al. 2016). More than 60% of postpartum women report feeling dissatisfied with their body weight and shape (Nunes et al. 2014). Qualitative studies indicate that body dissatisfaction, often considered a symptom of eating disorders (Cooper and Fairburn 1987; Garner and Garfinkel 1979), may arise in response to postpartum depressive and anxiety symptoms related to the motherhood transition (Clark et al. 2009; Earle 2003; Patel et al. 2005) suggesting the postpartum period may be a window of vulnerability for symptoms of all three disorders.

Limited data have evaluated these symptoms in relation to world events. A systematic review on the effects of disasters (e.g., September 11th) on perinatal mental health worldwide found significant increases in depressive and anxiety symptoms among postpartum women following the event compared to prior (Harville et al. 2010). Additionally, exposure to television and internet coverage of the 2011 earthquake in Japan was associated with general eating pathology (e.g., dieting) among non-Japanese adults living in distant countries (Rodgers et al. 2012).

An additional aspect to the 2019-nCoV pandemic that may contribute to a variety of mental health concerns is the implementation of local lockdowns. It is possible lockdown policies ordering people to stay in their homes could contribute to depressive symptoms (related to feelings of isolation and lack of social support), obsessive–compulsive-type symptoms (related to concerns about keeping one's home sterile and protected), and eating pathology (being less active, having access to one's home kitchen and food all day).

Postpartum women are especially important to examine in considering the impact of the pandemic given the potential negative effects not only on them but also on their children. Data evaluating postpartum mental illnesses demonstrate negative impacts on infant social and behavioral development (Murray 1992) and mother–child attachment (Ohoka et al. 2014). Additionally, evidence suggests children of

mothers who experienced postpartum mental illnesses are at increased risk of developing their own emotional, behavioral, or cognitive problems (Bauer et al. 2015).

Thus, the overall aim of the current study is to evaluate specific mental health symptoms among postpartum women during the 2019-nCoV pandemic, using descriptive and inferential statistics. We predicted that a high percentage of participants would exceed clinical cutoffs for mental health symptoms and postpartum women would report greater levels of depressive, anxiety, and eating disorder symptoms compared to control women who have never been pregnant (aim 1). We also predicted that 2019-nCoV distress would be more strongly and positively associated with depressive, anxiety, and eating disorder symptoms among postpartum women compared to control women even after controlling for general stress (not 2019-nCoV-specific) and mental health history (aim 2).

Methods

Participants and procedure

The current analyses are part of a larger study examining psychosocial factors that relate to body image and disordered eating during the postpartum period. However, to not bias recruitment sampling, women were recruited to take part in a survey of postpartum women's experiences broadly (with no emphasis on body image or disordered eating) from November 1, 2019, through June 6, 2020. Women, age 18–39, who either gave birth since 2019 or received an annual Well-Woman gynecological check-up within the University of North Carolina at Chapel Hill Healthcare system were e-mailed a recruitment letter with the survey link. For those with no email address listed, letters were mailed to addresses on record. The mailing lists included 937 women potentially eligible for the postpartum group and 3000 women potentially eligible for the control group. Additionally, recruitment flyers were posted in local health settings, ads were shared on social media, and emails were sent over listservs. Women were eligible if they self-reported as having been pregnant and given birth within the past 12 months (postpartum group) or if they had never been pregnant (control women), were age 18–39, and identified as female. Postpartum women did not have to be primipara and could have older children of any age. Additionally, they were not excluded if they experienced miscarriage, infant loss, or terminated their pregnancy. Given the focus of the study on postpartum women who have already given birth, pregnant women were excluded from participating. However, they were invited to recontact the research team after they gave birth if they were interested in participating.

Given the study link was shared on all recruitment materials (i.e., emails, letters, flyers), we cannot know how many potential participants did not self-select to participate, including those with incorrect addresses or emails. A total of 1565 respondents clicked on the survey link; however, 812 individuals did not make it past the initial screening questions and study instructions (potentially due to lack of interest and/or ineligibility). Of the 753 total eligible participants (both postpartum and control women), 306 postpartum women and 153 control women completed the study, resulting in a completion rate of approximately 61% ($n=459$).

Participants provided electronic consent before completing the survey which included questions about mental health symptoms. As compensation, they had the option to enter into a gift card drawing. The study was approved by the institutional review board of UNC.

In total, 306 postpartum and 153 control women completed the study. Given the focus on mental health during the pandemic, we focused on 232 (75.8%) postpartum and 137 control women (89.5%) who participated after the WHO declared a global pandemic to address aim 1, comparing postpartum and control women on symptoms. Additionally, given that 2019-nCoV distress items were added to the survey on April 3, 2020, of those that participated during the pandemic, only 89 (38.4%) postpartum and 110 (80.3%) control women received these items and were included in addressing aim 2, examining the relationship between 2019-nCoV distress and mental health symptoms. Demographic information for participants who participated during the pandemic are presented in Table 1. In terms of race and ethnicity, about 92.7% of postpartum women identified as White ($n=215$), 3.4% as biracial or multiracial ($n=8$), 1.7% as Black ($n=4$), and 0.4% as Asian ($n=1$). Among control women, 83.2% identified as White ($n=114$), 5.8% as Asian ($n=8$), 5.1% as Black ($n=7$), 3.6% as biracial or multiracial ($n=5$), and 1.5% as other ($n=2$). These demographics are slightly less diverse than the local population according to the 2010 US Census with approximately 72% of residents

identifying as White (United States Census Bureau 2010). Postpartum women gave birth an average of 21.97 weeks ($SD=14.01$; range 1–52) prior to participation, and approximately 62.4% were primipara.

Measures

Demographics Self-reported demographic data for age, level of education, race, and ethnicity were collected via a set of questionnaires created for this study. Body mass index was calculated using self-reported height and weight. Postpartum women provided time since birth (weeks).

Mental health history Participants indicated if they had ever sought treatment for or been diagnosed with depression (including postpartum depression), an anxiety disorder (including OCD), or an eating disorder.

Depressive symptoms The Center for Epidemiological Studies Depression Scale (CES-D; Radloff 1977) measured frequency of depressive symptoms in the past week with a clinical cutoff of 16 indicating a likely current depressive episode (Weissman et al. 1977). The CES-D has good internal consistency ($\alpha=0.88$) and discriminant validity ($r_s=-0.43-0.57$; Knight et al. 1997) and has been normed in perinatal samples (Campbell and Cohn 1991; Logsdon and McBride 1994; Marcus et al. 2003). Coefficient alpha for the current sample was 0.91.

Anxiety symptoms The Anxiety subscale of the Depression Anxiety Stress Scale-21 (DASS-21; Lovibond and Lovibond 1995) assessed symptoms associated with physical arousal in response to fear in the past week. The anxiety subscale creates a score comparable to the full DASS-42 (Lovibond and Lovibond 1995). The DASS-21 has demonstrated good convergent validity ($\eta_p^2=0.21$) and reliability ($\alpha=0.78$; Norton 2007). Coefficient alpha for the current sample was 0.79.

Table 1 Descriptive statistics and group comparisons for demographic variables

Variable	Control women ($n=137$)	Postpartum women ($n=232$)	<i>t</i> -test	95% confidence interval of mean difference	Chi-square
Age	29.76 (4.29)	30.24 (4.17)	$t(366)=-1.06, p=.288$	-1.37, 0.41	–
Highest level of education	16.82 (2.27)	16.12 (2.43)	$t(367)=2.75, p=.006$	0.20, 1.21	–
Race (% identifying as white)	83.2%	92.7%	–	–	$\chi^2(1, N=366)=8.77, p=.003$
Ethnicity (% identifying as Latina/Hispanic)	8.8%	8.2%	–	–	$\chi^2(1, N=366)=.05, p=.852$
Body mass index (kg/m ²)	27.23 (7.02)	26.78 (5.44)	$t(360)=.57, p=.570$	-0.92, 1.66	–

Descriptive statistics are presented as means (standard deviations) or percentages. Confidence intervals are presented as lower, upper bounds for the mean differences at 95% level. The highest level of education is presented in years (e.g., 10=did not graduate high school, 12=high school graduation, 16=4 year college, 18=Masters, 21=PhD or MD)

The Dimensional Obsessive–Compulsive Scale (DOCS; Abramowitz et al. 2010) assessed severity of obsessive–compulsive disorder-type (OCD) symptoms in the last month across four dimensions: Concerns about Germs and Contamination; Concerns about being Responsible for Harm, Injury or Bad Luck; Unacceptable Thoughts; and Concerns about Symmetry, Completeness, and the Need for Things to be “Just Right.” The DOCS has a clinical cutoff of 18 indicating the likely presence of an anxiety disorder (Abramowitz et al. 2010) and has demonstrated good to excellent internal consistency ($\alpha = 0.83–0.96$) and convergent validity ($r_s = 0.54–0.71$; Abramowitz et al. 2010). Coefficient alphas for the current sample were 0.87, 0.90, 0.93, and 0.93 for each subscale respectively, and 0.93 for the total score.

Eating disorder symptoms The Eating Attitudes Test – 26 (EAT-26; Garner and Garfinkel 1979) assessed broad eating pathology with a clinical cutoff of 20 indicating the likely presence of an eating disorder (King 1991). The EAT-26 is highly correlated with the EAT-40 ($r = 0.98$) and has demonstrated excellent internal consistency (Garner and Garfinkel 1979). Coefficient alpha for the current sample was 0.88.

The Eating Disorder Examination-Questionnaire-6 (EDE-Q-6; Fairburn and Beglin 1994) measured specific eating pathology in the past 28 days. The four subscales (dietary restraint, eating concerns, shape concerns, and weight concerns) demonstrate adequate to excellent internal consistency ($\alpha = 0.78–0.93$; Luce and Crowther 1999) and good concurrent validity ($r_s = 0.68–0.84$; Mond et al. 2004). Consistent with past research (Peterson et al. 2007), weight and shape concerns were evaluated together as a single construct, body image concerns. Coefficient alphas for the current sample were 0.85 for dietary restraint, 0.83 for eating concerns, and 0.95 for shape and weight concerns.

General stress The Perceived Stress Scale-4 (Cohen 1988) was used as a measure of general stress to assess the degree to which participants view general situations in their lives (not specific to 2019-nCOV) as stressful in the past 4 weeks (Cohen et al. 1983). The four-item scale has demonstrated acceptable reliability ($\alpha = 0.79$) and convergent validity with measures of depression ($r = 0.67$) among a sample of pregnant women (Karam et al. 2012). Coefficient alpha for the current sample was 0.80.

2019-nCOV distress Four items assessing distress specific to 2019-nCOV were added to the survey on April 3, 2020. Visual analogue scales were used where 0 = *not at all* and 100 = *extremely* for the prompts: (1) *In the past two weeks... (1) How anxious has COVID-19 made you feel?;* (2) *How stressed has your life felt due at least in part to COVID-19?;* (3) *How worried have you been that you or someone you love might get COVID-19?;* and (4) *In general, how*

distressed have you felt because of COVID-19? Items were averaged to create a mean score. Only 89 postpartum and 110 control women both completed the survey during the 2019-nCOV pandemic (defined as after March 11, 2020) and received the 2019-nCOV distress items. Coefficient alpha for the current sample was 0.89.

Data analysis

T-tests and chi-square analyses compared postpartum and control women on demographic variables. Correlations between demographic and outcome variables were also performed. Any demographic variable that both differed by group and was significantly correlated with an outcome variable was used as a covariate in analyses for that outcome.

For aim 1, descriptive statistics were calculated to determine the percentage of participants who exceeded clinical cutoffs for depressive, OCD-type, and eating disorder symptoms. Multivariate analysis of variance (MANOVA) models compared participants across the set of eating disorder symptoms (broad eating pathology, dietary restraint, eating concerns, and body image concerns) and the set of general anxiety and OCD-type symptoms. An ANOVA model compared participants on depressive symptoms. For all models, group (coded 0 = control women and 1 = postpartum women) was the independent variable, with the set of eating disorder symptoms, the set of anxiety and OCD-type symptoms, and depressive symptoms evaluated as dependent variables. If covariates were deemed necessary, analyses were multivariate analysis of covariance (MANCOVA) and analysis of covariance (ANCOVA).

For aim 2, in the subsample with data on 2019-nCOV distress ($n = 89$ postpartum and $n = 110$ control women), hierarchical linear regression models were evaluated. Mental health history, general stress, and any demographic variables were entered into the first step as covariates, and 2019-nCOV distress and group were entered into the second step. The third step included the interaction between 2019-nCOV distress and group. All models were evaluated separately for dependent variables (i.e., depressive, anxiety and OCD-type, and eating disorder symptoms). Significant interactions were probed using the PROCESS (Hayes 2013) macro for SPSS to analyze simple slopes. For any models in which the two-way interaction was non-significant, main effects were evaluated collapsing across groups.

Given the large number of analyses run, we used the Benjamini–Hochberg procedure to correct for multiple comparisons using a false discovery rate of 0.05 (Benjamini and Hochberg 1995; Thissen et al. 2002). Statistical analyses were conducted using IBM SPSS Statistics version 26.

Results

Results indicated the subsample of women who received the 2019-nCoV distress items did not differ across demographic or outcome variables from those who completed the survey during the pandemic before the items were added ($ps > 0.053$). Significant results reported below are those that remain significant after adjusting for multiple comparisons using the Benjamini and Hochberg (1995) procedure.

For measures with clinical cutoffs (CES-D, DOCS, and EAT-26), results indicated a high percentage of women were likely to exceed clinical cutoffs suggesting a current diagnosis of a current major depressive episode ($n = 92$, 24.9%), an anxiety disorder ($n = 132$, 35.8%), or an eating disorder ($n = 30$, 8.1%) compared to epidemiological data and perinatal norms prior to the 2019-nCoV pandemic (American Psychiatric Association 2013; Campbell and Cohn 1991; Logsdon and McBride 1994) suggesting that rates of these disorders during the pandemic may be increasing for women broadly.

Group comparisons of demographic variables as evaluations of potential covariates are presented in Table 1. Only level of education and race differed by group as postpartum women had less education and were more likely to identify as white compared to control women. Pearson's r correlations between education, race, and all outcomes revealed significant correlations between education and depressive symptoms ($r = -0.15$, $p = 0.004$), general anxiety ($r = -0.16$, $p = 0.002$), OCD symptoms related to unacceptable thoughts ($r = -0.12$, $p = 0.027$), dietary restraint ($r = -0.13$, $p = 0.016$), and body image concerns ($r = -0.14$, $p = 0.009$), and between race and general anxiety ($r = -0.12$, $p = 0.023$), with white women more likely to report anxiety symptoms. Therefore, for the ANCOVA model evaluating depressive symptoms, and the MANCOVA model for eating disorder symptoms, education was a covariate. For the MANCOVA model evaluating anxiety symptoms, education and race were covariates.

Regarding aim 1, results revealed no group differences for depressive symptoms, general anxiety symptoms, total OCD-type symptoms, or any of the eating disorder symptoms (see Table 2). However, postpartum women reported significantly greater OCD-type symptoms related to concerns about contamination and concerns about being responsible for harm compared to control women (see Table 2).

Regarding aim 2, after controlling for mental health history and general stress, results revealed a significant two-way interaction between group and 2019-nCoV distress for OCD-type symptoms related to concerns about contamination ($\Delta R^2 = 0.03$, $b = 0.06$, $t(191) = 2.74$, $p = 0.007$,

95% CI [0.02, 0.10]). Upon probing the nature of the interaction using PROCESS (Hayes 2013) to analyze slopes, the association between 2019-nCoV distress and OCD-type symptoms related to contamination was significantly positive for both groups, yet was significantly stronger for postpartum women ($b = 0.11$, $t(191) = 6.26$, $p < 0.001$, 95% CI [0.07, 0.14]) compared to control women ($b = 0.05$, $t(191) = 3.32$, $p = 0.001$, 95% CI [0.02, 0.08]; see Fig. 1).

Controlling for general stress and mental health history, no significant two-way interactions were found for the following: depressive symptoms; general anxiety symptoms; total OCD-type symptoms; OCD-type symptoms related to concerns about responsibility for harm, unacceptable thoughts, or concerns about symmetry; broad eating pathology; dietary restraint; eating concerns; or body image concerns ($ps > 0.097$). Therefore, main effects were calculated among postpartum and control women together. Controlling for general stress and mental health history, results indicated significant and positive main effects for 2019-nCoV distress on general anxiety ($\Delta R^2 = 0.04$, $\beta = 0.21$, $t(192) = 3.20$, $p = 0.002$, 95% CI [0.02, 0.10]), total OCD-type symptoms ($\Delta R^2 = 0.11$, $\beta = 0.35$, $t(191) = 5.49$, $p < 0.001$, 95% CI [0.10, 0.22]), and OCD-type symptoms related to concerns about responsibility for harm ($\Delta R^2 = 0.11$, $\beta = 0.35$, $t(192) = 5.25$, $p < 0.001$, 95% CI [0.03, 0.08]; see Fig. 2a–c). Main effects were non-significant for 2019-nCoV distress and depressive symptoms, OCD-type symptoms related to unacceptable thoughts, OCD-type symptoms related to concerns about symmetry, broad eating pathology, dietary restraint, eating concerns, and body image concerns ($ps > 0.096$) among all women after controlling for general stress and mental health history.

Discussion

Data suggested no group differences in depressive symptoms, total OCD-type symptoms, or any eating disorder symptoms between postpartum and control women during the 2019-nCoV pandemic; however, postpartum women reported significantly greater OCD-type symptoms related to concerns about contamination and concerns about being responsible for harm. These data are in accordance with CDC public health messages addressing the spread of the 2019-nCoV virus by emphasizing washing and sanitizing hands (Centers for Disease Control and Prevention 2020b) and this attention to contamination may have been heightened with a baby in the home. Additionally, the OCD symptoms related to concerns about responsibility for harm for postpartum women may be indicative of concern for protecting one's infant from 2019-nCoV. In contrast to group differences for OCD-type symptoms, null findings regarding general anxiety symptoms may reflect the

Table 2 Descriptive statistics and group comparisons for depressive, anxiety, and eating disorder symptoms

Model	Variable	Control women (<i>n</i> = 137)	Postpartum women (<i>n</i> = 232)	ANCOVA	MANCOVA	95% confidence interval of <i>t</i> -statistic
Depressive symptoms	Depressive symptoms	12.01 (7.13) $\alpha = .90$	12.00 (7.03) $\alpha = .90$	$F(1,356) = .21$, $p = .645$, partial $\eta^2 = .001$	–	– 1.18, 1.90
Anxiety symptoms					$F(5,345) = 6.48$, Wilks' Lambda = .91, $p < .001$, partial $\eta^2 = .09$	
	General anxiety	6.34 (7.46) $\alpha = .84$	6.30 (6.32) $\alpha = .73$	$F(1,349) = .72$, $p = .398$, partial $\eta^2 = .002$	–	– 0.84, 2.10
	Total OCD ^a	14.03 (10.47) $\alpha = .90$	17.22 (11.73) $\alpha = .92$	$F(1,349) = 5.27$, $p = .022$, partial $\eta^2 = .02$		– 5.41, – 0.42
	OCD contamination	5.73 (3.83) $\alpha = .82$	7.27 (4.27) $\alpha = .87$	$F(1,349) = 10.74$, $p = .001$, partial $\eta^2 = .03$		– 2.43, – 0.61
	OCD responsibility for harm	2.86 (3.17) $\alpha = .87$	4.65 (4.27) $\alpha = .90$	$F(1,349) = 16.76$, $p < .001$, partial $\eta^2 = .05$		– 2.66, – 0.93
	OCD unacceptable thoughts	3.37 (4.28) $\alpha = .94$	3.40 (4.01) $\alpha = .92$	$F(1,349) = .15$, $p = .698$, partial $\eta^2 < .001$		– 0.72, 1.08
	OCD symmetry	2.07 (3.19) $\alpha = .92$	1.91 (3.01) $\alpha = .92$	$F(1,349) = .43$, $p = .514$, partial $\eta^2 = .001$		– 0.45, 0.91
Eating disorder symptoms					$F(6,341) = 3.24$, Wilks' Lambda = .95, $p = .004$, partial $\eta^2 = .05$	
	Broad eating pathology	7.55 (8.14) $\alpha = .85$	7.30 (7.75) $\alpha = .84$	$F(1,346) = .21$, $p = .651$, partial $\eta^2 = .001$	–	– 1.35, 2.15
	Dietary restraint ^a	1.55 (1.51) $\alpha = .80$	1.19 (1.56) $\alpha = .85$	$F(1,346) = 5.87$, $p = .016$, partial $\eta^2 = .02$	–	0.08, 0.76
	Eating concerns	0.82 (1.16) $\alpha = .85$	0.90 (1.16) $\alpha = .80$	$F(1,346) = .11$, $p = .738$, partial $\eta^2 < .001$	–	– 0.30, 0.21
	Body image concerns	2.47 (1.59) $\alpha = .94$	2.60 (1.77) $\alpha = .95$	$F(1,346) = .13$, $p = .721$, partial $\eta^2 < .001$	–	– 0.44, 0.31
2019-nCOV distress		55.08 (24.66) $\alpha = .89$	61.14 (24.22) $\alpha = .89$	$F(1,198) = 3.02$, $p = .084$, partial $\eta^2 = .02$	–	– 12.94, 0.82

Descriptive statistics are presented as means (standard deviations) with coefficient alphas. Confidence intervals are presented as lower, upper bounds of the parameter estimates from the *t*-statistic at 95% level. The MANCOVA model for anxiety symptoms controlled for education and race, and the MANCOVA model for eating disorder symptoms controlled for education. Depressive symptoms were measured by the Center for Epidemiological Studies Depression Scale 20 (possible range: 0–60; clinical cutoff: 16). General anxiety was measured by the Anxiety subscale of the Depression Anxiety Stress Scale-21 (possible range: 0–20). OCD symptoms were measured using the Dimensional Obsessive-Compulsive Scale. A total score (possible range: 0–64; clinical cutoff: 18) was calculated as the sum of the four domains: Concerns about Germs and Contamination; Concerns about being Responsible for Harm, Injury, or Bad Luck; Unacceptable Thoughts; and Concerns about Symmetry, Completeness, and the Need for Things to be “Just Right,” each with a possible range of 0–16. Broad eating pathology was measured by the Eating Attitudes Test-26 (possible range: 0–78; clinical cutoff: 20). Dietary restraint was measured by the Eating Disorder Examination-Questionnaire-6 (possible range: 0–6). Eating concerns were calculated by the Eating Disorder Examination-Questionnaire-6 (possible range: 0–6). Body image concerns were calculated from a combined score of the Weight Concerns and Shape Concerns subscales of the Eating Disorder Examination-Questionnaire-6 (possible range: 0–6). Descriptive statistics and group comparisons for 2019-nCOV distress were calculated in the subsample of participants who received these items (*n* = 89 postpartum women and *n* = 110 control women). 2019-nCOV distress was calculated as the mean of four visual analogue scales assessing different types of distress specific to 2019-nCOV (possible range: 0–100)

^aGroup differences for total OCD symptoms and dietary restraint became non-significant after adjusting analyses for multiple comparisons using a false discovery rate according to Benjamini and Hochberg (1995) procedures

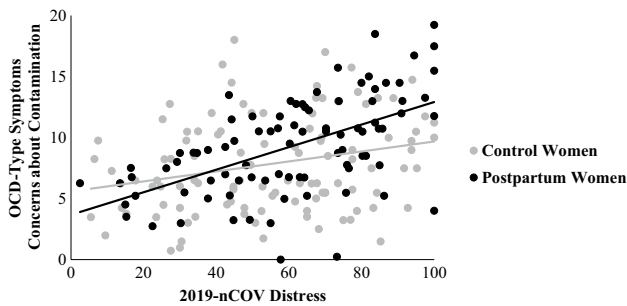


Fig. 1 Controlling for mental health history and general stress, a significant two-way interaction between 2019-nCoV distress and group ($n=89$ postpartum and $n=110$ control women) for OCD-type symptoms related to concerns about germs and contamination shows the association between 2019-nCoV distress and the outcome was significantly stronger among postpartum women compared to control women ($ps < .002$)

type of symptoms measured; the DASS (Lovibond and Lovibond 1995) assessed physiological symptoms of anxiety, whereas the DOCS (Abramowitz et al. 2010) assessed intrusive thoughts. Perhaps postpartum women are more prone to cognitive rather than somatic symptoms of anxiety compared to control women. Finally, results suggest that eating disorder symptoms in general may be increasing for all women during the pandemic compared to pre-pandemic norms; however, specific symptoms (i.e., dietary restraint, eating concerns, and body image concerns) do not appear to differ between postpartum and control women. This finding is consistent with eating disorder research arguing disruptions to daily routines (including sleeping patterns and working from home) in combination with constraints to outdoor and physical activities and exercise due to the 2019-nCoV pandemic are impacting people's eating behaviors and body image (Rodgers et al. 2020), not just postpartum women. Additionally, the 2019-nCoV distress items in the current study did not assess these potential behavioral and lifestyle changes associated with the pandemic which could explain the null findings regarding eating disorder symptoms.

Results further revealed 2019-nCoV distress was more strongly associated with OCD-type symptoms related to concerns about contamination among postpartum women compared to control women even after controlling for general stress and mental health history. These data suggest that 2019-nCoV distress may have a unique (and more harmful) effect on OCD-type symptoms related to fears of contamination for postpartum women. This finding is in contrast to pre-pandemic data demonstrating that postpartum women experience less severe OCD-type symptoms compared to non-postpartum control women (Uguz et al. 2007). Therefore, it is possible the current finding suggests 2019-nCoV distress may be driving the elevated level of OCD-type symptoms related to fear of contamination

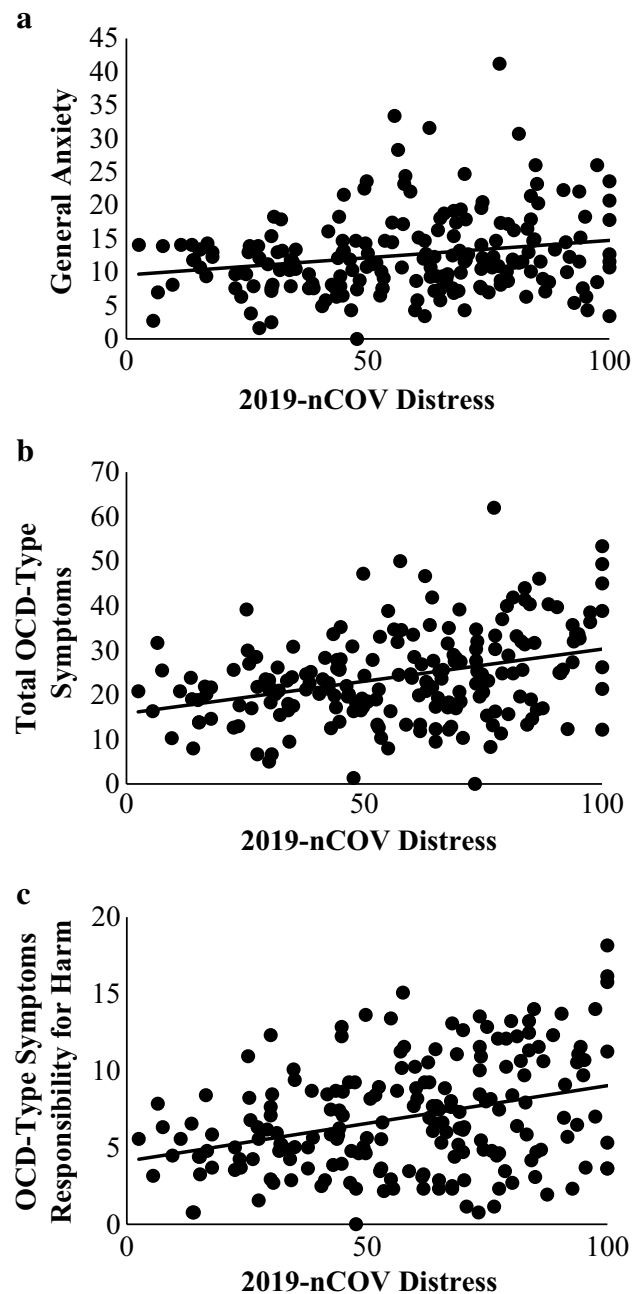


Fig. 2 Controlling for general stress and mental health history, main effects showed the association between 2019-nCoV distress and **a** general anxiety, **b** total OCD-type symptoms, and **c** OCD-type symptoms related to concerns about responsibility for harm among both control ($n=110$) and postpartum ($n=89$) women

among postpartum women in our sample. It is notable that OCD-type symptoms related to concerns about germs and contaminations are the only outcome to be more strongly related to 2019-nCoV distress for postpartum women compared to controls. However, given some of the postpartum participants gave birth during the pandemic, it is possible their increased exposure to healthcare facilities and

providers (who presumably communicated public health messages to patients regarding 2019-nCoV contamination due to their pregnancy), in contrast to control participants, may explain this finding.

Considering public health campaigns emphasize methods of preventing exposure (e.g., using hand sanitizer and washing hands for at least 20 s), it is important to consider the context in which contamination fears occur; is the fear rational considering a global pandemic is likely to increase baseline contamination fears for the general population broadly or is the fear excessive to a clinical level? Clinical psychologists argue that fears rise to the level of OCD-type symptoms when they become “all-consuming” like “tunnel-vision” (McLean Hospital 2020). The current study used the DOCS to assess OCD-type symptoms which has items specifying “excessive washing, showering, cleaning, or avoidance behaviors” which cause one’s life to be “completely disrupted” to the point at which one “cannot function at all” (Abramowitz et al. 2010). Therefore, although it is likely that the general population baseline for fears about contamination has increased during the 2019-nCoV pandemic, the current data are more likely to reflect specific OCD-type symptoms which are clinically relevant, rather than rationally enhanced fears due to the pandemic.

Finally, among postpartum and control women together, 2019-nCoV distress was associated with general anxiety symptoms, total OCD-type symptoms, and OCD symptoms related to concerns about responsibility for harm and concerns about symmetry after controlling for general stress and mental health history. It is possible these data reflect distress related to the many changes in lifestyle that have accompanied the 2019-nCoV pandemic—including potential stress related to 2019-nCoV testing procedures and access (Shear et al. 2020), changes in governmental policies and rules due to physical distancing (Centers for Disease Control and Prevention 2020a), and fears of inadvertently spreading the virus to one’s friends and family members (Pew Research Center 2020). Overall, results demonstrate that postpartum women may be at increased risk for OCD-type symptoms related to concerns about both contamination and responsibility for harm compared to women who have never been pregnant; 2019-nCoV distress is associated with a variety of mental health concerns among women regardless of postpartum status; and for postpartum women, OCD-type symptoms related to concerns about contamination are more tied to 2019-nCoV distress compared to controls.

To our knowledge, this is the first study to evaluate 2019-nCoV distress and specific mental health symptoms among postpartum women; however, several limitations are of note. The large percentage of white and highly educated participants means the results may not generalize to more diverse populations. Second, the cross-sectional study design limits

our ability to evaluate change in symptoms over time. As the pandemic continues, people may habituate, and it is possible these mental health symptoms abate. Given the White House Coronavirus Task Force speculates the pandemic will be continuing for the coming months (Alba et al. 2020), it is also possible that 2019-nCoV distress will rise. Prospective research is needed to track changes in these symptoms over time. Additionally, given the survey study design, mental health history and diagnoses were assessed via self-report and were not confirmed by the research staff or medical records. Finally, the 2019-nCoV distress items were created by the research team in April 2020 for the purposes of this study and have not been formally validated during the pandemic. Considering there are now validated measures of 2019-nCoV stress (Taylor et al. 2020), future studies should consider using scales with established psychometrics.

These data have important clinical implications for healthcare providers working with women, particularly postpartum women. Clinicians should consider assessing distress related to 2019-nCoV, as well as OCD symptoms specifically related to concerns about contamination, given the linkages found in these data for postpartum women. Perinatal mental health experts suggest mindfulness-based apps or online videos, internet-delivered or telemedicine cognitive behavioral therapies including exposure and response prevention, or therapies combined with pharmacological interventions as specific approaches that may be particularly helpful for postpartum women experiencing mental health challenges during the 2019-nCoV pandemic (Chen et al. 2020).

In conclusion, the postpartum period presents a window of vulnerability for OCD-type symptoms associated with 2019-nCoV distress, and 2019-nCoV distress is associated with a variety of anxiety-related symptoms among adult women.

Author contribution Author KAT conducted literature searches, provided summaries of previous research studies, and wrote the manuscript. ABC and KAT designed the study. All authors contributed to and have approved the final manuscript.

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Declarations

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