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Psychosocial determinants of anxiety about the COVID-19 pandemic

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Abstract

Pandemic health threats can cause considerable anxiety, but not all individuals react similarly. To understand the sources of this variability, we applied a theoretical model developed during the H1N1 pandemic of 2009 to quantify relationships among intolerance of uncertainty, stress appraisals, and coping style that predict anxiety about the COVID-19 pandemic. We surveyed 1579 U.S. Amazon Mechanical Turk workers in April 2020. Using structural equation modeling, we found that individuals who were more intolerant of uncertainty reported higher appraisals of threat, stress, and other-control, which predicted higher anxiety when emotion-focused coping was engaged, and lower anxiety when problem-focused coping was engaged. Political affiliation moderated these effects, such that conservatives relied more on self-control and other-control appraisals to mitigate anxiety than independents or liberals. These results show that how people appraise and cope with their stress interacts with political ideology to shape anxiety in the face of a global health threat.

How individuals think about and deal with uncertain stressors can have strong emotional consequences. Some individuals respond to threatening situations with high levels of distress while others remain emotionally resilient. Over time, these patterns of behavior can influence mental health outcomes and overall well-being (Penley et al., 2002). Examining cognitive, social, and affective factors that influence anxiety in response to a stressor can help explain why some people feel more anxious than others in the face of uncertain threats, which may illuminate new strategies to help people maintain resilience during stressful times.

Pandemic health threats present a unique opportunity to study the psychosocial factors that influence anxiety in response to a real-world uncertain stressor in a large sample of individuals at the same time, with relatively high intensity, and personal relevance, and for a prolonged duration. Health threats posed by novel pandemics can be particularly stressful because of the lack of knowledge surrounding the illness, the uncertain nature of contagious disease, and rapidly changing information

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about the event. Such characteristics of pandemics contribute to the overall uncertainty of the threat, which consequently elicits higher levels of anxiety (Grupe and Nitschke, 2011; Lake and LaBar, 2011).

These characteristics were particularly salient in the context of the novel coronavirus disease (COVID-19) pandemic. The first known case of COVID-19 in the United States was documented on January 20 2020, and quickly spread to approximately 4.7 million cases and 155,000 deaths by July 2020 (Holshue et al., 2020; CDC, *Corona virus disease 2019 (COVID-19): Cases in the U.S.*, 2020). The pandemic caused widespread societal disruption, and local governments enacted restrictions on interpersonal contact through temporary closures of non-essential businesses, recreational activities, and schools. These regulations, the economic impact of the pandemic, and personal experience with the illness itself, left many individuals personally affected. The scale and severity of the COVID-19 pandemic was also accompanied by a rise in anxiety symptoms (CDC, Mental Health Household pulse survey 2020). Understanding the factors that contribute to anxiety about the pandemic is important for developing targeted public health messaging and for identifying methods to help individuals cope with mental health struggles during this unprecedented event.

To optimally predict anxiety in the face of an uncertain stressor, theoretical models that account for the relationships among multiple psychosocial factors are needed. Taha et al. (2014) developed such a model to predict anxiety about the H1N1 pandemic of 2009. The researchers postulated that prior to appraising a potential threat, trait psychological characteristics may bias individuals toward certain appraisals. Specifically, intolerance of uncertainty (IU)—a trait characteristic that reflects an individual's level of tolerance for uncertain outcomes—is associated with greater threat appraisals, or the judgment of how threatening an event is, which predicts state anxiety across a variety of contexts (Dias et al., 2012; Ringeisen et al., 2019; Skinner and Brewer, 2002). Then,

building upon the transactional model of stress (Folkman et al., 1986), Taha et al. (2014) linked threat appraisals to subsequent coping behaviors. Emotion-focused coping strategies are centered around dealing with the emotional reaction to a stressor, whereas problem-focused coping strategies focus on managing the stressor itself (Lazarus and Folkman, 1984). Though the adaptiveness of coping strategies is likely context-specific, studies have generally found greater emotion-focused coping to be predictive of higher state anxiety, and greater problem-focused coping strategies to be predictive of lower state anxiety in response to a stressor (Ben-Zur, 2005; Endler et al., 2000; Iida et al., 2017).

Accordingly, the theoretical model developed by Taha and colleagues tested how trait IU influences state anxiety about the 2009 H1N1 pandemic through the effects of both appraisals and coping behaviors. Utilizing structural equation modeling (SEM), the authors found that greater IU was associated with lower appraisals of self-control and other-control, which was subsequently related to lower levels of problem-focused coping, and higher H1N1-related anxiety. Higher IU was also associated with greater threat appraisals and subsequently greater emotion-focused coping. Greater use of emotion-focused coping predicted higher H1N1 anxiety, while greater use of problem-focused coping predicted lower H1N1 anxiety. The model that included both appraisals and coping strategies achieved the best fit to the data when compared to alternative models that excluded either or both constructs. These results demonstrate that IU, appraisals, and coping strategies are all critical factors that influence anxiety responses to an uncertain threat.

The COVID-19 pandemic presented a unique opportunity to test the reliability of this theoretical model in the context of a different pandemic event. We conducted a pre-registered study, using the Taha et al. (2014) psychosocial model, on self-report data collected during the initial wave of U.S. coronavirus cases in April, 2020. We hypothesized that, as with the findings from Taha and colleagues, stress appraisals, and coping strategies would sequentially influence the

relationship between IU and pandemic-related anxiety. We conducted both hypothesis-testing analyses and planned exploratory analyses to examine the relationships in the model and further our understanding of the contextual factors that may impact them. Specifically, we hypothesized that higher IU would generate greater threat appraisals, which would lead to greater endorsement of emotion-focused coping and consequently higher COVID-19 anxiety. In contrast, lower IU would generate greater self-control and other-control appraisal, which would predict more problem-focused coping and lower COVID-19 anxiety.

To expand on this model in novel ways, we conducted pre-registered planned analyses to explore how political affiliation, trait anxiety, and personal experiences related to the COVID-19 pandemic moderate these directional effects. There is empirical evidence demonstrating that political ideology is related to health behaviors and attitudes toward health policies during the COVID-19 pandemic in the U.S. (Christensen et al., 2020; Gadarian et al., 2021). For example, Rothgerber et al. (2020) found that greater political conservatism predicted lower engagement in social distancing. Conservatives also tended to report lower concern about COVID-19, which was found to be related to political beliefs more so than direct experience with effects of the pandemic or exposure to conservative messaging (Conway et al., 2021). These studies demonstrate a critical need for public health messaging to be able to communicate information effectively across political lines. A deeper characterization of how political affiliation may influence the psychosocial determinants of anxiety about the COVID-19 pandemic may facilitate the development of more precisely targeted public health messaging. One example is to frame health recommendations with respect to psychological variables that are central to different political affiliation's responses to the pandemic health threat.

There is strong empirical evidence demonstrating positive correlations between threat and uncertainty sensitivity and conservatism (Jost et al., 2003). More recently, researchers have

questioned the unidimensionality of this relationship and sought to understand whether different kinds of threats are related differently to conservatism. The Compensatory Political Behavior model, in particular (Crawford, 2017), has asserted that conservatives are particularly sensitive to physical threats, an account which has been supported empirically (Brandt et al., 2020). Importantly, this line of research has primarily been focused on self-reported responses to threat, demonstrating that these effects of political ideology may impact threat appraisal specifically. In the U.S., the COVID-19 pandemic yielded politically divergent responses. Decisions about lockdown measures, economic aid, and social contact regulations became points of discord across party lines, promulgated by politically-oriented news outlets and social media, that could influence how individuals appraised the threat of the pandemic. Consequently, we explored the moderating effects of political affiliation on the relationship between IU and appraisals of the pandemic.

Moreover, trait anxiety and IU are considered to be independent constructs and are both commonly implicated in anxiety disorders (Carleton, 2012), and trait anxiety also influences stress appraisals (Jerusalem, 1990). In light of this, we aimed to explore whether trait anxiety would moderate the relationships between IU and appraisals. Finally, although the COVID-19 pandemic presents a health threat to the entire population being studied, there is variability in the amount of personal life disruption experienced by individuals depending on the degree to which pandemic-related restrictions impacted specific aspects of their lives. For example, some individuals lost their jobs or shifted to remote work, took on additional childcare responsibilities as schools shut down, or became caretakers for vulnerable family members, while others may not have had to undergo such changes. Sudden drastic changes in lifestyle, such as decreased mobility and limits on social interactions, may cause additional distress when coupled with the looming threat of pandemic illness. Additionally, these limitations may decrease the availability of previously relied-upon coping behaviors, such as

getting out to see friends or going to the gym, resulting in engagement of coping strategies that are less effective at reducing anxiety. In particular, we were interested in whether the level of life disruption would influence the relationship between coping styles and anxiety about the COVID-19 pandemic, given that the severity of stressful events may moderate the efficacy of coping strategies on resulting anxiety.

Methods

Pre-registration

The design and analysis plans for the study were pre-registered through the Open Science Framework (OSF) and can be accessed at https://osf.io/7zafk. The data and statistical code to run the structural equation models have been made publicly available via OSF and can be accessed at https://osf.io/mh7re/.

Participants

Individuals over 18 years old were recruited on Amazon's Mechanical Turk (MTurk) online research platform (www.mturk.com). Participants provided informed consent on-line, and the study was approved by the Institutional Review Board. Participants were U.S. residents, had a worker approval rating (proportion of completed tasks that were approved by the researcher) of 90% or higher, and had previously completed a minimum of 100 tasks. These selection criteria helped to ensure the data quality and integrity by filtering out fraudulent responders (e.g. from automated "bot" programs or international respondents masking location with virtual private servers) and individuals with a history of poor quality or unreliable work (Peer et al., 2014). A total of 1579 individuals participated in this study. The sample size was determined in advance to be concordant with that of Taha et al. (2014) ($N=1027$), in which a replication of their power analysis of the full model showed that a minimum of 700 participants would be needed to detect a small effect size (0.1) at a power level of 0.80 (Soper, 2021). Data were included for analysis from this total

sample if the survey was complete, all three attention checks were passed (see *Procedure*), total survey duration was no less than 8 minutes (one standard deviation below the mean survey completion time of 15 minutes), and question responses were not the same on every question within any measure. No data analysis was conducted prior to the completion of data collection.

After filtering for these criteria, the final analyzed sample consisted of 1186 participants. The age range of the final sample was 18–76 years old ($M=38$, SD $=11$). The final sample included 59.7% ($n=708$) male participants, 40.2% ($n=477$) female participants, and 0.08% non-binary participants ($n=1$). The sample included 75.3% ($n=893$) Caucasian/White participants, 12% ($n=143$) Black or African American participants, 6.2% ($n=73$) Asian participants, 3.5% ($n=42$) multi-race participants, 1.4% ($n=17$) participants who identified as a race not included in this list, 0.3% ($n=4$) of participants of unknown race, and 0% ($n=0$) Native Hawaiian or other Pacific Islander participants. Participants reported their highest level of education, and 48.9% ($n=580$) had completed their Bachelor's degree or equivalent, 14.1% ($n=167$) had completed their Master's degree or equivalent, 13.6% ($n=161$) had completed some college or university, 11.7% ($n=139$) had completed an Associate's degree or equivalent, 8.9% ($n=105$) had completed high school obtained their GED, 1.4% ($n=17$) had completed their Doctorate or equivalent, 1.3% ($n=15$) had completed some graduate school, and 0.2% ($n=2$) had completed some high school. Participants also self-reported their yearly income, and 8.3% ($n=99$) made less than \$12,500, 12% ($n=142$) made between \$12,500 and \$24,999, 18% ($n=213$) made between \$25,000 and \$37,499, 16.2% ($n=192$) made between \$37,500 and \$49,999, 15.7% ($n=186$) made between \$50,000 and \$62,499, 10.5% ($n=125$) made between \$52,500 and \$74,999, 8.3% ($n=99$) made between \$75,000 and \$87,499, 4.4% ($n=52$) made between \$87,500 and \$99,999, and 6.5% ($n=78$) made \$100,000 or more. The political distribution of our sample was comprised of

38.3% (*n*=454) conservatives, 14.4% (*n*=171) independents, and 47.3 % (*n*=561) liberals.

Measures

Intolerance of uncertainty. The Intolerance of Uncertainty Scale (IUS) (Buhr and Dugas, 2002) measures an individual's trait-level intolerance of uncertainty. Participants respond to 27 statements indicating how much each statement describes them on a 5-point Likert scale, ranging from 1 (not at all representative) to 5 (completely representative). A total score per participant was calculated by using the mean rating across all items.

Stress appraisal measure. The Stress Appraisal Measure (SAM) (Peacock and Wong, 1990) captures an individual's cognitive appraisals of a stressor on seven subscales: threat (potential for future harm/loss), stressfulness (overall perceived stress), challenge (potential for future gain/growth), centrality (perceived importance for well-being), self-control (extent that the event is in one's control), other-control (extent that the event is in others' control), and uncontrollability (extent that the event is uncontrollable by anyone). The SAM has 28 questions that are answered with a 5-point Likert scale using the response labels "not at all," "slightly," "moderately," "considerably," and "extremely." Instructions were modified to direct participants to answer these questions in regards to their current ". . .thoughts about various aspects of the COVID-19 pandemic." Subscale scores were calculated by taking the mean rating across items in each subscale.

Survey of coping profiles endorsed. The Survey of Coping Profiles Endorsed (SCOPE) (Matheson and Anisman, 2003) measures an individual's coping strategy use in response to a specific stressor. Participants respond to 50 questions with a 5-point Likert scale (ranging from "never" to "almost always") about the extent they use a particular behavior to cope with that stressor. Instructions were modified to prompt participants to answer questions about their coping strategies for ". . .problems or stresses related to the COVID-19 pandemic." The SCOPE includes 14 subscales. Although the factors of this instrument have been previously determined (Matheson and Anisman, 2003), this factor structure may vary across situations due to contextual restraints on available or appropriate coping strategies (Folkman and Lazarus, 1980). Following the approach of Taha et al. (2014), we performed a principal components analysis with varimax rotation on the subscale mean ratings to confirm which subscales group into emotion-focused and problem-focused factors. A subscale was included in a factor if its factor loading was >0.40. The cognitive distraction subscale had a >0.40 factor loading for both factors (0.516 and 0.404, respectively), so it was included in the factor with the higher loading of the two (emotion-focused coping). Emotion-focused strategies included self-blame, other-blame, rumination, emotional expression, emotional containment, cognitive distraction (denial), passive resignation, and wishful thinking. Problem-focused strategies included social support seeking, active distraction (activity), cognitive restructuring, problem solving, religiosity, and humor. A total score per factor was calculated by taking the mean rating of all items from subscales in that factor. The subscale groupings were identical as in Taha et al. (2014), with the exception of the addition of the religiosity subscale in our problem-focused coping group. Moreover, these groupings match those initially observed by Matheson and Anisman (2003), whereby emotion-focused coping strategies aim to avoid the stressor and regulate one's emotional response (e.g. blame, denial, and rumination), whereas problem-focused coping strategies reframe the problem (cognitive restructuring, problem solving, and humor) and facilitate an active response to the stressor (active distraction, social support seeking, and religiosity).

State-trait anxiety inventory. The State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1983) measures an individual's level of current anxiety (state anxiety) and general anxiety (trait anxiety).

Participants respond to 40 total statements (20 state, 20 trait) and indicate to what extent that statement describes how they feel on a 5-point Likert scale ranging from "not at all" to "very much so." The STAI-state instructions were modified to prompt participants to respond with how they felt about the ". . .COVID-19 pandemic right now, that is, at this current moment." A total score representing COVID-19 anxiety was calculated by taking the mean rating across all items in the STAI-state questionnaire.

COVID-19 experience. Participants completed 15 questions about aspects of their personal experience during the COVID-19 pandemic (Anet et al., 2020). Questions included thoughts about the pandemic (worry, likelihood of catching the virus, economic impact of the pandemic, predicted length of shutdown measures) and behaviors (social distancing, hand washing). In addition to these questions, participants also completed a checklist of disruptive life changes that they may have experienced since the pandemic began (i.e. lost a job, became responsible for more childcare, had to cancel a major life event) (full checklist available online; see Open Practices Statement). The total number of checked items comprised a COVID-19 life disruption score.

Political affiliation. Within the demographics section of the survey, participants self-identified their political affiliation by responding to the prompt: "Please select the political leaning/affiliation that you most identify with." The response options consisted of "Extremely conservative," "Somewhat conservative," "Neither liberal nor conservative," "Somewhat liberal," and "Extremely liberal." For our analyses, the "Extremely" and "Somewhat" responses were binned together.

Procedure

All data were collected between April 16th, 2020 and April 30th, 2020—around the initial wave of the COVID-19 pandemic in the U. S., and after many states had enacted stay-at-home orders. Upon electing to participate, the participants first completed an online informed consent form and then followed a link to our study, hosted on Qualtrics (Qualtrics, Provo, UT). Participants then completed a captcha, and read general instructions indicating that they should pay attention and answer honestly when completing the questionnaires. The STAI-state questionnaire was administered first in order to capture state anxiety at baseline without any potential influence from other measures. The next set of measures was randomized to help control for order effects: STAI-Trait, SAM, SCOPE, and IUS. After this randomized block of measures, participants then completed the COVID-19 experience questionnaire and demographics questions. One attention check question was included in the randomized block ("Please select 3 to indicate that you are paying attention"), and a final attention check question was completed at the end of the survey ("Do you feel that you paid attention, avoided distractions, and took this survey seriously?") (Stanley et al., 2019). Participants were assured that their answer to the final attention check would not affect their payment or eligibility for future studies. Participants were paid $4.00 for completion of the study.

Statistical analysis

Structural equation modeling. An observed-variable structural equation model (SEM) analysis was performed. As was done by Taha et al. (2014), we tested a full model, which included paths through four appraisal constructs and the two coping constructs, as well as two sub-models, one in which the coping constructs were removed and another in which the appraisals were removed. Replicating this iterative testing approach allows us to confirm whether the full model as specified in Taha et al. (2014) is still the best suited to our dataset. Path coefficients were initially estimated using the PROCESS macro (Hayes, 2017) in the IBM SPSS Statistics Software. Bootstrapped 95% confidence intervals for each path coefficient were estimated using 10,000 bootstrap iterations and were used

for statistical inference of path and indirect effect significance (Preacher and Hayes, 2008).

Models were also estimated in R (R Core Team, 2020) using the lavaan software package (Rosseel, 2012) in order to calculate model fit indices. Model specification in lavaan was done in a step-wise fashion in order to optimize handling of covariances between the various constructs that were in parallel in the model. To begin, none of the residual variances of any of the appraisal constructs were allowed to covary with those of the other appraisal constructs. Similarly, the residual variances of the two coping mechanism constructs were not allowed to covary. The residual covariance structure of this model was evaluated to identify any model-predicted covariances that differed from the observed covariances. This information was then used in the specification of the next step model; when the absolute value of the covariance error between two constructs was greater than 0.1, the residual variances of these two constructs were allowed to correlate in the subsequent model.

Models. The same full model used in Taha et al. (2014) was applied here to estimate the direct and indirect effects of IU on COVID-related anxiety. Briefly, parallel paths from IU to threat appraisal, stressfulness appraisal, self-control appraisal, and other-control appraisal fed into parallel paths of emotion-focused coping and problem-focused coping, which fed into COVID-related anxiety. In addition to the serial paths, the path coefficients from each appraisal construct to anxiety and the direct effect of IU to anxiety were included in the model. Following Taha et al. (2014), we also tested an appraisal-only model that was identical to the full model except that the coping mechanism constructs were excluded. Similarly, we tested a coping-only model that was identical to the full model except that the appraisal constructs were excluded. Comparing model fits between the full model and these alternative models allowed us to determine the relative importance of appraisals and coping styles in the relationship between IU and pandemic anxiety.

Exploratory moderation analyses. Using the full model setup, four separate models were run with each of our exploratory moderation variables included—political affiliation, trait anxiety, and life disruption. Specifically, in the first model political affiliation was included as a moderator on the paths between IU and the appraisals. In the second model trait anxiety was a moderating variable on the paths between IU and the appraisals. In the third model life disruption was set as a moderating variable on the paths between the coping styles and pandemic anxiety. And finally, the fourth model included both trait anxiety (moderating the paths between IU and the appraisals) and life disruption (moderating the paths between coping styles and the anxiety). These moderated path analyses were conducted with the PROCESS macro.

Results

Descriptive statistics

Sample mean ratings and standard deviations for the measures included in the full model are provided in Table 1. We first assessed the relative contribution of all appraisal dimensions (stressfulness, threat, self-control, other control, uncontrollability, centrality, and challenge) to COVID-19 anxiety. In agreement with Taha et al. (2014), we found that only threat ($b=0.18$, SE$=0.03$, $p<0.001$), stressfulness ($b=0.34$, SE$=0.03$, $p<0.001$), self-control ($b=-0.17$, SE$=0.03$, $p<0.001$), and other control ($b=-0.04$, SE$=0.02$, $p=0.04$) were predictive of anxiety, $R^2=0.50$, $F(7, 1178)=169.5$, $p<0.001$. Thus, these subscales were the only appraisal measures used in subsequent analyses.

Overall mean trait anxiety was 2.06 (SD 0.66), and mean life disruption was 1.98 (SD 1.64). Self-reported political affiliation yielded $N=454$ conservatives, N$=171$ independents, and $N=561$ liberals (see Methods for grouping details). Mean COVID-19 anxiety was 2.21 (SD 0.67) for conservatives, 2.06 (SD 0.72) for independents, and 2.25 (SD 0.71) for liberals. A one-way ANOVA comparing mean COVID-19 anxiety between

these three political affiliations showed a statistically significant effect ($p=0.0065$). A follow-up Tukey's test revealed significantly lower COVID-19 anxiety in independents than both conservatives ($p=0.04$) and liberals ($p=0.004$). There was no significant difference in mean COVID-19 anxiety between conservatives and liberals (0.6). Further, a one-way ANOVA comparing mean COVID-19 anxiety between all five political affiliation levels produced a significant result ($p=0.0021$). A follow-up Tukey's test showed significantly lower COVID-19 anxiety in independents when compared to extremely conservative individuals ($p=0.005$) and somewhat liberal individuals ($p=0.02$). There were no significant differences in COVID-19 anxiety between the "extremely" and "somewhat" groups within conservatives and liberals.

Table 1. Means (*M*), standard deviations (SD), and ranges (in parentheses) of the behavioral measures.

	M	SD
Intolerance of uncertainty (1–5)	2.77	0.95
COVID-19 Appraisals (1–5)		
Threat	3.19	0.97
Stressfulness	3.06	0.95
Self-control	3.42	0.89
Other-control	3.18	0.99
Coping Styles (1–5)		
Emotion-focused	2.73	0.78
Problem-focused	3.04	0.67
COVID-19 anxiety (1–4)	2.21	0.70

Structural equation modeling

Model fit evaluation. Model fit metrics were generated with the lavaan software package for *R*. The covariance residuals (observed data covariances minus model covariances) from the step-wise optimization approach for the full model, appraisal-only model, and coping-only model are shown in the Supplemental Materials. Optimization of the full model required allowing the covariances between the following pairs of variables to correlate: emotion-focused coping and problem-focused coping; threat appraisal and stress appraisal; stress appraisal and other-control; self-control and other-control. Optimization of the appraisal-only model required allowing the following covariances to correlate: threat appraisal and stress appraisal; stress appraisal and other-control; self-control and other-control. Optimization of the coping-only model required allowing the covariance between emotion-focused coping and problem-focused coping to correlate.

The final fit metrics for the final full model, appraisal-only model, and coping-only model are shown in Table 2. The full model metrics (Chi-Sq.$=24.4$, CFI$=0.996$, NNFI$=0.964$, RMSEA$=0.078$) and the appraisal-only metrics (Chi-Sq.$=24.4$, CFI$=0.994$, NNFI$=0.968$, RMSEA$=0.078$) suggested both models were good fits to the data. The final coping-only model retained zero degrees of freedom and thus exactly fit the data (Chi-Sq.$=0$, CFI$=1$, NNFI$=1$, RMSEA$=0$). This constitutes a saturated

Table 2. Step-wise model fit indices.

Model	Covariances included	DF	Chi-square	CFI	NNFI	RMSEA	AIC	BIC
Full	No	28	1695.6	0.694	−0.224	0.451	16,801	16,944
Full	**Yes**	**3**	**24.4**	**0.996**	**0.964**	**0.078**	**15,138**	**15,301**
Appraisal-only	No	6	1470.2	0.557	−0.108	0.454	13613	13684
Appraisal-only	**Yes**	**3**	**24.4**	**0.994**	**0.968**	**0.078**	**12,173**	**12,260**
Coping-only	No	1	296.9	0.851	0.106	0.499	5989	6030
Coping-only	Yes	0	0	1	1	0	5694	5740

Bold rows indicate the best fits among the included models.
DF: degrees of freedom; CFI: comparative fit index; NNFI: non-normed fit index; RMSEA: root mean square of approximation; AIC: Akaike information criterion; BIC: Bayesian information criterion.
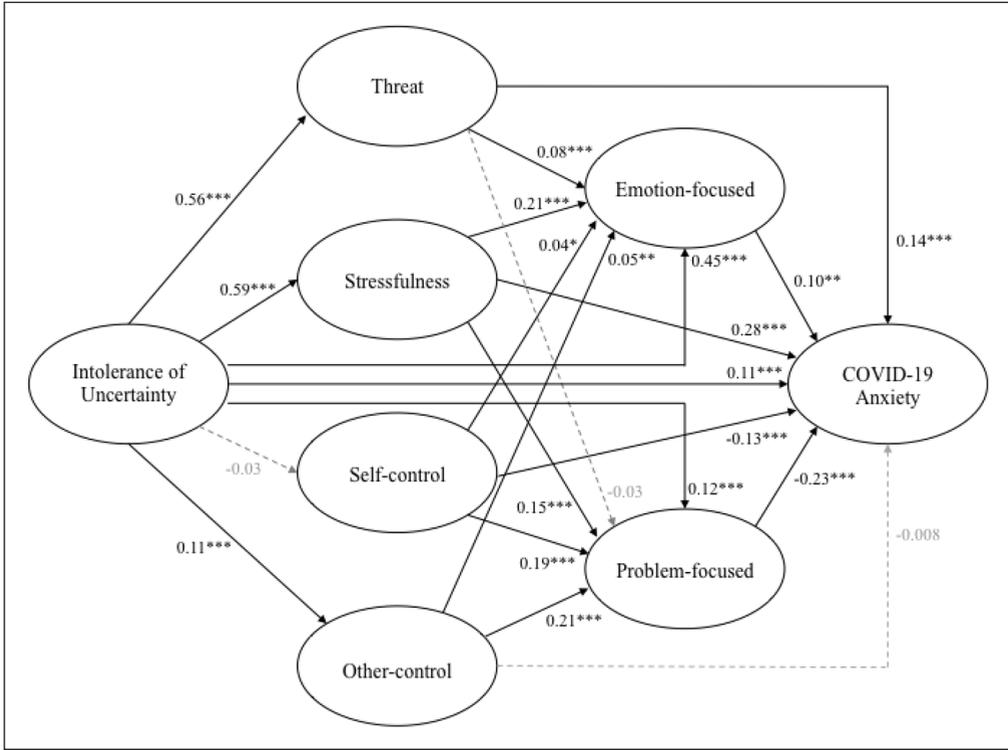
Figure 1. Full model: Direct effects.
Direct effects of the full model with sequential paths of stress appraisals and coping strategies. Numbers above pathways indicate unstandardized regression coefficients for that path. All solid lines indicate statistical significance at the following thresholds: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Dashed lines indicate non-significance.

model, and thus model parameter estimates may not have accurate predictive value.

Full model. All path coefficients with standard errors and corresponding *p*-value or confidence interval for both the direct and indirect effects are detailed in the Supplemental Materials. Path coefficients for direct effects in the Full Model are shown in Figure 1. Direct effects indicate the relationship between pairs of variables in the model while controlling for the other included variables in the model. IU positively predicted stressfulness, threat, and other-control appraisals but did not significantly predict self-control appraisal. IU also had a positive effect on COVID-related anxiety. Stressfulness, self-control, and other-control appraisals had positive effects on both emotion-focused and problem focused coping, while threat appraisal had a

positive effect only on emotion-focused coping. All appraisal and coping metrics had a positive effect on COVID-related anxiety, except for self-control appraisal, and problem-focused coping which had negative effects on COVID-related anxiety, and other-control, which did not significantly predict COVID-anxiety.

Indirect effects of IU on COVID-related anxiety are shown in Figure 2. Indirect effects indicate the relationship between IU and COVID-related anxiety through the included variables. Of the 14 pathways between IU and COVID-related anxiety, nine were significant as determined by bootstrapped 95% confidence intervals. All significant indirect effects through emotion-focused coping were positive, whereas all those through problem-focused coping were negative. All indirect effects through only a single appraisal (threat, stressfulness) were positive.
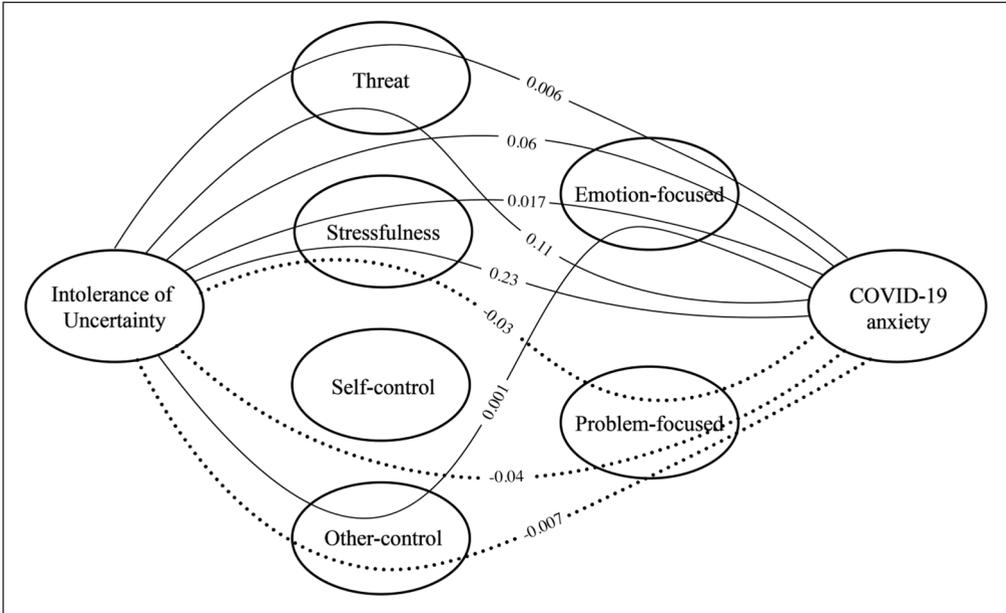
Figure 2. Full model: indirect effects.
Indirect effects of the full predictive model with sequential paths of stress appraisals and coping strategies. All visualized pathways indicate statistical significance using bootstrapped 95% confidence intervals. Unstandardized regression coefficients are included along paths. Solid lines indicate positive relationships and dotted lines indicate negative relationships.

Appraisal-only model. The model including only the four appraisal constructs had similar fit metrics to the full model. All direct path coefficients are shown in the Supplemental Materials. The direct effects indicated that IU positively predicts threat, stressfulness, and other-control appraisal, but does not significantly predict self-control appraisal. IU also has a positive direct effect on COVID-related anxiety. Threat and stressfulness appraisal positively predicted COVID-related anxiety, whereas self-control and other-control appraisal negatively predicted COVID-related anxiety. Three of the four indirect effects (all except the one through self-control appraisal) were significant. Paths through threat and stressfulness appraisals positively predicted anxiety, while the path through other-control negatively predicted anxiety.

Coping-only model. The model including only the two coping strategy constructs was ill-fit without allowing the residuals of the two constructs to correlate. However, including this

term in the model allowed no remaining degrees of freedom, precluding any comparison of model fit with the other models.

Model results summary. These results indicate that the included appraisals and coping styles are important factors in the paths from IU and COVID-19 anxiety. Both the full and appraisal-only models with covariances specified fit the data well, and had the best fit metrics of all the tested models (Table 2). The near equivalent fit statistics between these two models emphasizes the central role of appraisals in the relationship between IU and pandemic anxiety. The full model direct effects showed that greater stress and threat appraisals predict higher pandemic anxiety, whereas greater self- and other-control appraisals predict lower anxiety. Additionally, the direct effects show a strong positive relationship between emotion-focused coping and pandemic anxiety, and a strong negative relationship between problem-focused coping and pandemic anxiety. The indirect results further

emphasize the impact of coping style in that all paths through emotion-focused coping positively predicted anxiety, whereas all paths through problem-focused coping negatively predict anxiety, despite some paths passing through the same appraisals.

Planned exploratory analyses: Additional moderators

Political affiliation. We investigated the moderating influence of political affiliation on the pathways from IU to the appraisal measures in the full model. A significant moderating effect was observed on all appraisals—threat ($F_{2,1180} = 7.001$, $p < 0.001$), stress ($F_{2,1180} = 7.722$, $p < 0.001$), self-control ($F_{2,1180} = 15.507$, $p < 0.001$), and other-control ($F_{2,1180} = 16.819$, $p < 0.001$). Compared to participants who self-identified as liberal, those who self-identified as conservative exhibited a strengthened positive effect of IU on both stress and threat appraisals. Conservatives were also the only group to show a significant positive effect of IU on self- and other-control appraisals, while independents and liberals had a negative effect of IU on self- and other-control appraisals (Figure 3).

Examination of indirect effects revealed several moderated paths (Figure 4). The indirect effects of IU on anxiety through threat and stress appraisals, and sequential effects of threat and stress appraisals through emotion- and problem-focused coping strategies, were generally strengthened for conservatives compared to independents and liberals. This is explained by stronger positive relationships between IU and threat and stress appraisals for conservatives compared to the other groups. Moreover, the uniquely positive association of IU and control appraisals for conservatives resulted in a negative indirect effect on anxiety when the pathways passed through problem-focused coping, and only conservatives showed a negative indirect effect of IU on anxiety through self-control appraisals alone. In summary, compared to independents and liberals, conservatives' anxiety is more strongly increased through the effects of IU on threat and stressfulness appraisals, but more strongly decreased through strong positive relationships between IU and self- and other-control.

Trait anxiety and COVID-19 life disruption. Analyses including trait anxiety as a moderator on the paths between IU and appraisals, and COVID-19 life disruption as a moderator on the paths between coping styles and COVID-19 anxiety yielded no significant moderations.

Discussion

Consistent with predictions, we found that higher IU predicted greater threat and stressfulness appraisals of the pandemic, which were associated with greater pandemic-related anxiety. Greater self-control appraisal was directly associated with lower pandemic anxiety. Moreover, engaging problem-focused coping strategies was shown to mitigate pandemic anxiety, whereas emotion-focused coping predicted greater anxiety. These results largely replicate Taha et al. (2014)'s findings from the H1N1 pandemic, which demonstrates the robustness of the predictions across two global health threats. Our findings deviated from Taha et al. (2014), however, with regard to the role of self-control appraisal, and in generally stronger relationships between most variables and COVID-19 anxiety. These differences can be accounted for by greater overall anxiety associated with COVID-19 compared to H1N1 in the populations sampled, as well as by our discovery of the moderating influence of political affiliation on the relationships between IU and appraisals.

We found that U. S. political affiliation significantly moderated the direct effects between IU and appraisals, which consequently influenced indirect effects of IU on COVID-19 anxiety. That is, self-identified conservatives demonstrated stronger positive indirect effects from IU to COVID-19 anxiety through the threat and stress appraisals compared to independents and liberals. For conservatives, higher IU also predicted greater appraisals of self- and other-control, whereas for liberals and independents the opposite effect was observed. Additionally, conservatives were the only group
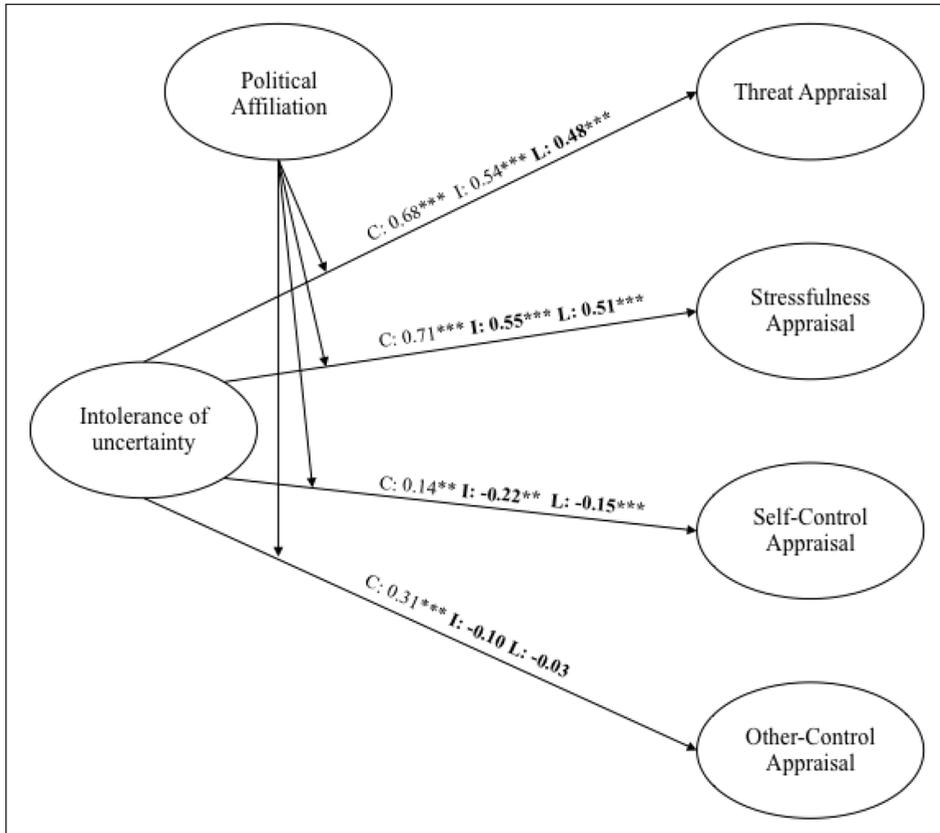
Figure 3. Moderation of direct effects by political affiliation.
Moderating effects of political affiliation on the paths between IU and the appraisals. Numbers along paths indicate unstandardized regression coefficients for conservatives (C), independents (I), and liberals (L). Bold numbers indicate a significant difference between that group and the reference group (conservatives). Asterisks indicate significant effects at the following thresholds: **$p < 0.01$; ***$p < 0.001$.

to demonstrate lower anxiety through self-control appraisal alone. These results suggest that compared to liberals, conservatives may rely more on feelings of control to mitigate anxiety in the face of uncertain stressors.

Our model results align with the uncertainty-threat model of political conservatism, which asserts that reducing uncertainty and managing threats are important predictors of conservatism (Jost et al., 2007). Conservatism generally associates with a more conscientious personality profile that encompasses higher appraisals of self-control (Carney et al., 2008), and this association is particularly evident in the presence of contextual threats (Briki and

Dagot, 2020) as exemplified by the COVID-19 pandemic. In contrast, the negative relationships between IU and control appraisals for independents and liberals match more closely with the overall model results from Taha et al. (2014), who sampled Canadian residents. This finding further illustrates that social group factors, such as political ideology, may influence the relationships between IU and appraisals, which has important implications for both public health messaging and mental health outcomes. Our other exploratory analyses testing trait anxiety and COVID-19 life disruption as moderators, however, yielded no significant findings.
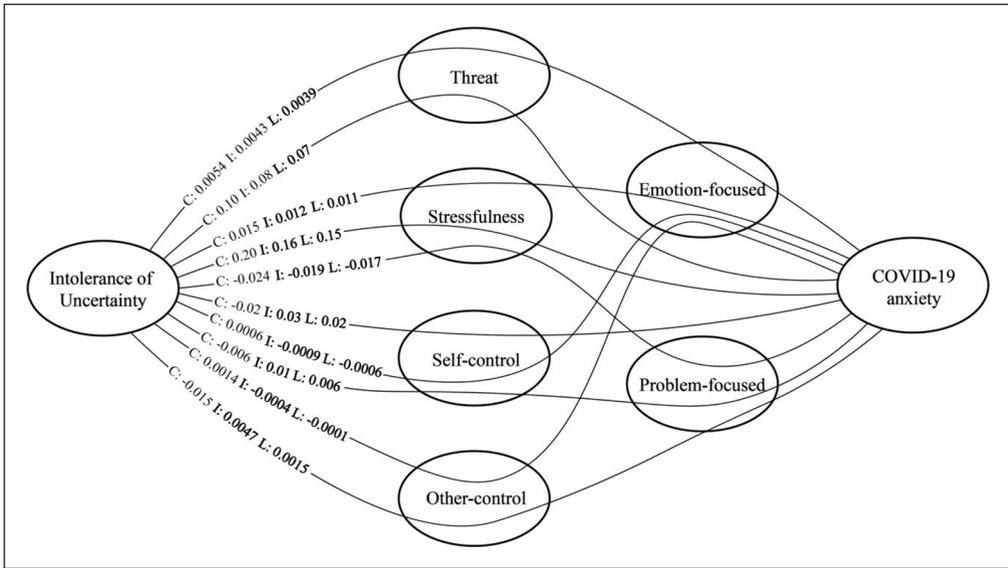
Figure 4. Indirect effects moderated by political affiliation.
Indirect effects of the full model with political affiliation moderating the relationship between IU and the appraisals. All visualized paths indicate significant moderated paths using bootstrapped 95% confidence intervals. Values along the path lines represent unstandardized regression coefficients for conservatives (C), independents (I), and liberals (L). All confidence intervals for each group are included in the Supplemental Materials. Bold values indicate significant difference between that group and the reference group (conservatives).

Notably, our results revealed a strong effect of coping style on COVID-19 anxiety, with greater use of emotion-focused coping leading to higher anxiety, and greater use of problem-focused coping leading to lower anxiety. Confirming the transactional model of stress, these results emphasize the benefit of coping strategies that reframe a stressful situation and promote active behaviors, such as social support seeking (Ben-Zur, 2005; Folkman et al., 1986). In contrast, strategies that ruminate on one's emotional response and promote avoidance behaviors, such as wishful thinking, perpetuate feelings of anxiety.

A recent paper by Rettie and Daniels (2021) examined the relationship between IU and mental health outcomes (generalized anxiety, health anxiety, and depression) during the COVID-19 pandemic in a UK sample ($N = 842$). This study, however, only investigated the role of coping strategies on these relationships. While the authors reported a partial effect of maladaptive coping on the relationship between IU and their outcome measures, they did not find evidence to support an influence of adaptive coping on any of these outcomes. These results stand in contrast to both Taha et al. (2014) and the present study. The transactional model of stress (Folkman et al., 1986) provides a theoretical explanation for this difference in that the Rettie and Daniels study failed to take into account the additional role of appraisals. Both Taha et al. (2014) and the present study conducted model comparisons and found that the inclusion of appraisals in the theoretical model improves the model fit. Other differences in the study characteristics include the fact that Rettie and Daniels had a smaller sample size; they sampled UK participants; their sample was 95% white and 80% female; they studied anxiety in a more general fashion rather than specifically about the pandemic itself; and they used the 28-item "brief coping orientation to problems experienced" (COPE) inventory (Carver, 1997) rather than the more comprehensive 50-item SCOPE to assay coping strategies.

In our sample, mean levels of anxiety about the COVID-19 pandemic were not significantly different between conservatives and liberals, which stands in contrast to other findings reporting a relationship between greater conservatism and lower concern about COVID-19 (e.g. Conway et al., 2020). These divergent results might be explained by differences in how anxiety or concern about the pandemic is measured. For example, our measure asked participants to report anxiety about the *COVID-19 pandemic*, which could include anxiety about broader societal impacts of the pandemic in addition to worry about the virus itself, whereas others measured perceived threat or anxiety about the *COVID-19 virus* specifically (Conway et al., 2020; Rothgerber et al., 2020). This may further highlight the importance of understanding how different aspects of the pandemic health threat (such as viral threat vs economic impact) may generate different psychological responses among individuals of varying political beliefs.

The present study has several limitations. Though SEM estimates directional relationships between variables in the model, we cannot conclude that these relationships are causal. Another limitation of this study is the use of online data collection methods via MTurk, which yields less data collection oversight by the researcher (i.e. the ability to control for distractions) and known sampling biases (Burnham et al., 2018). However, the inclusion of attention checks and a relatively large sample size helped control for these issues in the present study. Though our sample's racial demographics were representative of the U. S. population (United States Census Bureau, 2020), our sample's income distribution was not, with approximately 80% of individuals falling below the U. S. median income of $68,703 (United States Census Bureau, 2020). Lower income individuals have been disproportionately affected by the COVID-19 pandemic, and thus our results may be a better representation of how the included psychosocial factors influence anxiety in this population than in individuals with higher income. Further, the use of self-report questionnaires relies on introspective ability and, in

some cases, retrospective reports of behavior frequency (e.g. for the SCOPE), which may impact an individual's ability to answer questions accurately and may introduce memory biases in the data. Finally, it is unknown how well this model generalizes to other types of stressors beyond pandemics. The relative stability of the model across the H1N1 and COVID-19 pandemics, despite many differences in contextual factors between them, suggests that the model may be robust to other kinds of stressor parameters.

Responses to the COVID-19 pandemic have likely changed over the course of the pandemic, as people adapt to their altered environments. Although we only collected data at one time point, we captured these relationships at arguably the most uncertain point in the timecourse of the stressor. This allows us to draw conclusions about how the included psychosocial factors impact anxiety toward the onset of an uncertain stressor, prior to the influence of acclimation. Longitudinal research that examines how individuals adapt to similar stressors over time would be an important extension of this work.

The results of the current investigation highlight critical relationships among psychosocial factors that could become potential targets for helping individuals reduce anxiety for global health threats. The coping strategies that individuals use to deal with stressors are a crucial determinant in predicting their resulting anxiety. Public health officials and mental health professionals may benefit from promoting problem-focused coping strategies to help individuals deal with their anxiety during a pandemic. Particularly helpful may be the promotion of problem-focused coping strategies that are dually advantageous for reducing disease spread and reducing pandemic anxiety, such as safe (distant) avenues for seeking social support or active distractions that can take place at home. Additionally, framing actions that decrease viral spread (frequent hand-washing, social distancing, mask-wearing, etc.) as a form of problem solving may help individuals engage in such behaviors in order to reduce anxiety. It is crucial to note, however, that while reducing

excessive anxiety is beneficial for mental health outcomes, fear can be adaptive when it leads to behaviors that reduce the risk of getting infected or infecting others. For example, Harper et al. (2020) found that greater fear of COVID-19 predicted greater compliance with health recommendations. Maintaining a balance between managing maladaptive anxiety responses and maintaining appropriate caution is important to sustaining both mental and physical health during a pandemic health threat.

Our data also illustrate the central role of threat, stressfulness, self-control, and other-control appraisals of a stressor on the relationship between IU and an individual's resulting anxiety. Organizations involved in disseminating critical information about public health threats could leverage this knowledge when framing such information in ways that promote appraisals that are adaptive for instigating more problem-focused coping behaviors. In agreement with Taha et al. (2014), our results suggest that self- and other-control appraisals are more likely to result in engaging problem-focused coping behaviors, which is subsequently beneficial for reducing pandemic anxiety. This strategy may be especially useful for conservative individuals, for whom self- and other- control appraisals alone are uniquely capable of reducing pandemic-related anxiety associated with IU. By emphasizing aspects of the pandemic spread that are within an individual's control, such as the effectiveness of mask-wearing and social-distancing for reducing disease spread, people may feel more able to manage the pandemic threat. That being said, a more nuanced assessment of how specific components of self- and other-control appraisal (i.e. resource availability vs. preventative actions) contribute to a reduction in pandemic anxiety would be a useful next step in furthering our understanding of these relationships. Although our study used a single-item measure of self-reported political affiliation, future studies capturing more detailed measures of political ideology and identity (such as continuous scales of conservatism) could be important for understanding the role of politics in individual responses to pandemic health threats.

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Supplemental material

Supplemental material for this article is available online.

References

Anet, Pike and Robinson (2020) COVID questions. Questionnaire published on Open Science Framework. Available at: https://osf.io/wz9hv/

Ben-Zur H (2005) Coping, distress, and life events in a community sample. *International Journal of Stress Management* 12(2): 188–196.

Brandt MJ, Turner-Zwinkels FM, Karapirinler B, et al. (2020) The association between threat and politics depends on the type of threat, the political domain, and the country. *Personality and Social Psychology Bulletin* 47: 324–343.

Briki, W., & Dagot, L. (2020). Conservatives Are Happier than Liberals: the Mediating Role of Perceived Goal Progress and Flow Experience—a Pilot Study. *Current Psychology*, 1-12.

Buhr K and Dugas MJ (2002) The intolerance of uncertainty scale: Psychometric properties of the English version. *Behaviour Research and Therapy* 40: 931–945.

Burnham MJ, Le YK and Piedmont RL (2018) Who is mturk? Personal characteristics and sample consistency of these online workers. *Mental Health Religion & Culture* 21(9-10): 934–944.

Carleton RN (2012) The intolerance of uncertainty construct in the context of anxiety disorders: Theoretical and practical perspectives. *Expert Review of Neurotherapeutics* 12(8): 937–947.

Carney DR, Jost JT, Gosling SD, et al. (2008) The secret lives of liberals and conservatives: Personality profiles, interaction styles, and the things they leave behind. *Political Psychology* 29(6): 807–840.

Carver CS (1997) You want to measure coping but your Protocol's too long: Consider the brief COPE. *International Journal of Behavioral Medicine* 4: 92–100.

CDC – National Center for Health Statistics – Corona virus disease 2019 (COVID-19): Cases in the U.S. Available at: https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html (accessed 4 August 2020)

CDC – National Center for Health Statistics – mental health: Household pulse survey. Available at: https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm (accessed 6 August 2020).

Christensen SR, Pilling EB, Eyring JB, et al. (2020) Political and personal reactions to COVID-19 during initial weeks of social distancing in the United States. *PLoS One* 15(9): e0239693.

Conway LG III, Woodard SR and Zubrod A (2020) Social psychological measurements of COVID-19: Coronavirus perceived threat, government response, impacts, and experiences questionnaires. *PsyArXiv*. DOI: 10.31234/osf.io/z2x9a

Company Name: Qualtrics, development company: Qualtrics, first release: 2005, copyright year: 2020, Provo, Utah, USA, Version: April 2020, Available at: https://www.qualtrics.com

Conway LG, Woodard SR, Zubrod A, et al. (2021) Why are conservatives less concerned about the Coronavirus (COVID-19) than liberals? Comparing political, experiential, and partisan messaging explanations. *Personality and Individual Differences* 183: 111124.

Crawford JT (2017) Are conservatives more sensitive to threat than liberals? It depends on how we define threat and conservatism. *Social Cognition* 35(4): 354–373.

Dias C, Cruz JF and Fonseca AM (2012) The relationship between multidimensional competitive anxiety, cognitive threat appraisal, and coping strategies: A multi-sport study. *International Journal of Sport and Exercise Psychology* 10(1): 52–65.

Endler NS, Speer RL, Johnson JM, et al. (2000) Controllability, coping, efficacy, and distress. *Efficacy, and Distress* 14(3): 245–264.

Folkman S and Lazarus RS (1980) An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior* 21: 219–239.

Folkman S, Lazarus RS, Dunkel-Schetter C, et al. (1986) Dynamics of a stressful encounter: Cognitive appraisal, coping, and encounter outcomes. *Journal of Personality and Social Psychology* 50: 992–1003.

Gadarian SK, Goodman SW and Pepinsky TB (2021) Partisanship, health behavior, and policy attitudes in the early stages of the COVID-19 pandemic. *PLoS One* 16(4): e0249596.

Grupe DW and Nitschke JB (2011) Uncertainty is associated with biased expectancies and heightened responses to aversion. *Emotion* 11: 413–424.

Harper CA, Satchell LP, Fido D, et al. (2020) Functional Fear predicts public health compliance in the COVID-19 pandemic. *International Journal of Mental Health and Addiction*. Epub ahead of print 27 April 2020. DOI: 10.1007/s11469-020-00281-5.

Hayes A (2017) *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Press.

Holshue ML, DeBolt C, Lindquist S, et al. (2020) First case of 2019 novel coronavirus in the United States. *New England Journal of Medicine* 382(10): 929–936.

Iida M, Gleason M, Green-Rapaport AS, et al. (2017) The influence of daily coping on anxiety under examination stress: A model of interindividual differences in intraindividual change. *Personality and Social Psychology Bulletin* 43(7): 907–923.

Jerusalem M (1990) Temporal patterns of stress appraisals for high- and low-anxious individuals. *Anxiety Research* 3: 113–129.

Jost JT, Glaser J, Kruglanski AW, et al. (2003) Political conservatism as motivated social cognition. *Psychological Bulletin* 129(3): 339–375.

Jost JT, Napier JL, Thorisdottir H, et al. (2007) Are needs to manage uncertainty and threat associated with political conservatism or ideological extremity? *Personality and Social Psychology Bulletin* 33(7): 989–1007.

Lake JI and LaBar KS (2011) Unpredictability and uncertainty in anxiety: A new direction for emotional timing research. *Frontiers in Integrative Neuroscience* 5: 55.

Lazarus RS and Folkman S (1984) *Stress, Appraisal and Coping*. New York: Springer.

Matheson K and Anisman H (2003) Systems of coping associated with dysphoria, anxiety and

depressive illness: A multivariate profile perspective. *Stress* 6: 223–234.

Peacock EJ and Wong PTP (1990) The stress appraisal measure (SAM): A multidimensional approach to cognitive appraisal. *Stress Medicine* 6(3): 227–236.

Peer E, Vosgerau J and Acquisti A (2014) Reputation as a sufficient condition for data quality on Amazon Mechanical Turk. *Behavior Research Methods* 46(4): 1023–1031.

Penley JA, Tomaka J and Wiebe JS (2002) The Association of coping to physical and psychological health outcomes: A meta-analytic review. *Journal of Behavioral Medicine* 25(6): 551–603.

Preacher KJ and Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 40: 879–891.

R Core Team (2020) *R: a Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing, https://www.R-project.org/

Rettie H and Daniels J (2021) Coping and tolerance of uncertainty: Predictors and mediators of mental health during the COVID-19 pandemic. *American Psychologist* 76(3): 427–437.

Ringeisen T, Lichtenfeld S, Becker S, et al. (2019) Stress experience and performance during an oral exam: The role of self-efficacy, threat appraisals, anxiety, and cortisol. *Anxiety, Stress, and Coping* 32(1): 50–66.

Rosseel Y (2012) "lavaan: AnRPackage for structural equation modeling. *Journal of Statistical Software* 48(2): 1–36.

Rothgerber H, Wilson T, Whaley D, et al. (2020) Politicizing the COVID-19 pandemic: Ideological differences in adherence to social distancing. DOI: 10.31234/osf.io/k23cv

Skinner N and Brewer N (2002) The dynamics of threat and challenge appraisals prior to stressful achievement events. *Journal of Personality and Social Psychology* 83(3): 678–692.

Soper DS (2021) A-priori sample size calculator for structural equation models [software]. Available from https://www.danielsoper.com/statcalc

Spielberger CD, Gorsuch RL, Lushene R, et al. (1983) *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Stanley ML, Yin S and Sinnott-Armstrong W (2019) A reason-based explanation for moral dumbfounding. *Judgment and Decision Making* 14(2): 120–129.

Taha S, Matheson K, Cronin T, et al. (2014) Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic. *British Journal of Health Psychology* 19(3): 592–605.

United States Census Bureau - Income and poverty in the United States: 2019. United States Census Bureau – quick facts United States. https://www.census.gov/quickfacts/fact/table/US/PST045219 (accessed August 20, 2020)