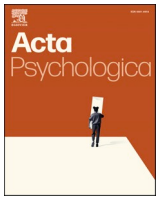
Acta Psychologica 244 (2024) 104179

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy



COVID-19 anxiety and its relation to anxiety-related disorder symptoms and mechanisms

Layton J. Byam, Alexander M. Penney *

MacEwan University, Department of Psychology, Edmonton, AB, Canada

ARTICLE INFO

Keywords:
Health anxiety
Obsessive compulsive disorder
Panic disorder
Anxiety sensitivity
Disgust
Intolerance of uncertainty

ABSTRACT

The COVID-19 pandemic had a significant impact on the mental health of individuals, particularly in the area of anxiety-related disorders. Anxiety regarding COVID-19 has been associated with health anxiety, panic disorder, and obsessive-compulsive disorder symptoms. Additionally, COVID-19 anxiety has been associated with anxiety sensitivity, disgust, maladaptive metacognitions, and intolerance of uncertainty. While researchers have established that anxiety disorders and anxiety-related mechanisms were associated with COVID-19 anxiety, which specific anxiety-related symptoms and mechanisms are primarily associated with COVID-19 anxiety needs to be more extensively explored. The current study sought to further this area by examining which particular anxiety-related disorder symptoms and mechanisms were uniquely associated with COVID-19 anxiety. A non-clinical sample of 593 Canadian undergraduate participants (*M*age = 21.13 years; 67.7 % female) completed this cross-sectional study between September 2020 and February 2021. Participants completed online questionaries assessing anxiety-related disorder symptoms and mechanisms in addition to multiple scales of COVID-19 anxiety. When examining symptoms, health anxiety (*prs* = 0.17–0.29) and obsessive-compulsive disorder (*prs* = 0.16–0.35) symptoms had the strongest unique associations with COVID-19 anxiety. Among the anxiety-related mechanisms, disgust sensitivity (*prs* = 0.14–0.16) and health anxiety-specific intolerance of uncertainty (*prs* = 0.12–0.30) had the strongest unique associations with COVID-19 anxiety. Individuals experiencing these disorders and anxiety-related mechanisms may be at a heightened vulnerability to experiencing heightened anxiety during future pandemics. Mental health professionals should discuss COVID-19 anxiety with individuals experiencing health anxiety or obsessive-compulsive disorder symptoms. Lastly, the study highlights the significance of considering a variety of specific anxiety-related disorder symptoms and mechanisms when working to understand pandemic anxiety.

1. Introduction

1.1. COVID-19 anxiety

COVID-19 is a highly contagious illness that was first identified in China in late 2019. Since then, COVID-19 has spread globally, creating an international health crisis. The effects of the COVID-19 pandemic could be seen in the medical and health field, as well as the world's sociopolitical and economic climates. Despite the development of various vaccines and improvements in treatment, the virus caused challenges for many countries' medical systems. As of July 2023, more than 767 million cases of COVID-19 have been reported, and the virus has caused approximately 6.9 million deaths worldwide (World Health Organization, 2023). The ever-changing nature of the pandemic, especially during the first year of the pandemic, caused many individuals to feel anxiety and worry as the future remained uncertain.

From the beginning of the pandemic, researchers have explored anxiety in relation to COVID-19. A study of New Jersey university students conducted in April and May of 2020 found that approximately half reported increased health anxiety and generalized anxiety levels due to the COVID-19 pandemic (Kibbey et al., 2021). In a sample of 4379 students in Italy, approximately 50 % of participants developed anxiety symptoms during the pandemic, and among individuals who were already affected by anxiety, 60 % had their anxiety worsened (Busetta et al., 2021). Additionally, Tull et al. (2020) found that individuals who reported a more significant impact on their lives attributable to COVID-19 reported greater anxiety and worry.

Multiple scales were developed to measure anxiety and fear related

* Corresponding author at: MacEwan University, 10700-104 Street, Department of Psychology, Edmonton, AB T5J 4S2, Canada.
E-mail address: alexander.penney@macewan.ca (A.M. Penney).

https://doi.org/10.1016/j.actpsy.2024.104179
Received 12 July 2023; Received in revised form 22 December 2023; Accepted 5 February 2024

to COVID-19. Four scales of note have been widely used: the COVID Stress Scale (Taylor et al., 2020), the Coronavirus Anxiety Scale (Lee, 2020), the Coronavirus 19 Phobia Scale (Arpaci et al., 2020) and the Fear of Coronavirus Scale (Ahorsu et al., 2020). A review of COVID-19 anxiety scales found that all four of these scales are psychometrically sound (Panteleimon et al., 2021). While few studies have included multiple COVID-19 anxiety measures, the COVID Stress Scale has been found to be strongly correlated with the Fear of Coronavirus Scale and the Coronavirus 19 Phobia Scale (Khosravani et al., 2021). Yet, it is important to note that these measures of COVID-19 anxiety were not created to measure the same aspects of COVID-19 anxiety (Mertens et al., 2021). For example, the COVID Stress Scale measures six different facets that contribute to COVID-19 anxiety, such as fear of contracting the virus, compulsive checking, and traumatic stress. In comparison, the Fear of Coronavirus Scale measures the self-reported body responses and fearful thoughts that are connected to COVID-19. The differences between these scales merit using multiple scales when examining COVID-19 anxiety and the need for further research regarding these instruments.

Researchers have extensively examined the pandemic's broad effect on the population's mental health. Still, there needs to be further attempts to determine if specific anxiety-related disorders, or the proposed specific mechanisms that underlie these disorders, are uniquely associated with COVID-19 anxiety. Previous research has looked at many anxiety-related variables in relation to COVID-19 anxiety (Zvolensky et al., 2022), but individual studies have generally not examined several anxiety-related variables in a single dataset. Therefore, third variable problems may have influenced prior literature. The objective of this study is to address this issue by including a range of previously explored and unexplored variables. Our present study explored if COVID-19 anxiety is associated with symptoms of specific anxiety-related disorders. This is important because individuals who experienced these symptoms may also have experienced greater negative pandemic outcomes due to their anxiety symptoms. In addition, we explored the relationship COVID-19 anxiety has with specific anxiety-related mechanisms. This is important to examine so that we may understand the thoughts and beliefs that helped to maintain COVID-19 anxiety.

It is also essential to explore this further because individuals who experience high COVID-19 anxiety along with the underlying anxiety-related symptoms and mechanisms may be at greater risk for adverse outcomes as the pandemic ends. In addition, individuals with these anxiety-related symptoms and mechanisms may need treatment that is specific to pandemic anxiety. Understanding which anxiety disorders result in the most adverse outcomes in a pandemic can help clinicians better prepare their clients for potential future pandemics. Further, if future pandemics emerge, the present study may allow for a quick and more comprehensive response to the mental health challenges that coincide with a pandemic. Lastly, the key mechanisms most associated with fear of a virus must be identified. This knowledge will provide government officials, mental health clinicians, and healthcare providers greater insight into what will be most associated with the fear of a virus in future pandemics.

1.2. COVID-19 anxiety and anxiety-related disorders

Multiple research teams have been exploring the relationship between COVID-19 and various aspects of anxiety (Zvolensky et al., 2022). Asmundson et al. (2020) found that individuals with a pre-existing anxiety disorder reported higher levels of COVID-19 anxiety than those with no mental health diagnosis. A follow-up to this study found that those with an anxiety-related diagnosis reported higher levels of anxiety throughout the pandemic (Asmundson et al., 2022).

Health anxiety has been specifically studied in previous pandemics and continues to be thought of as a major contributor to various aspects of pandemic behaviour (Taylor, 2019). Multiple studies have found that health anxiety is a unique predictor of COVID-19 anxiety (Jungmann & Witthöft, 2020; Mertens et al., 2020; Warren et al., 2021). COVID-19 anxiety has been consistently and prominently associated with health anxiety (Kibbey et al., 2021).

In addition to health anxiety, obsessive-compulsive disorder symptoms have been strongly associated with COVID-19 anxiety. It has been found that individuals with obsessive-compulsive disorder had a higher stress reaction to COVID-19 than individuals diagnosed with other anxiety-related disorders, except for generalized anxiety disorder and panic disorder (Khosravani et al., 2021). A six-month longitudinal study found that obsessive-compulsive disorder symptoms predicted COVID-19 anxiety consistently during the study (Meşterelu et al., 2021). In a meta-review, Grant et al. (2021) found that many obsessive-compulsive patients experienced worse symptoms during the pandemic. Specifically, contamination fears and washing behaviours were associated with worse symptoms. In addition, Grant et al. (2021) found that obsessive-compulsive symptoms in the general population were related to an increase in COVID-19 related stress.

As mentioned previously, researchers have found that individuals with generalized anxiety disorder, panic disorder, or obsessive-compulsive disorder had a higher stress reaction to COVID-19 than individuals diagnosed with other anxiety-related disorders (Khosravani et al., 2021). This warranted including measures of generalized anxiety disorder and panic disorder, in addition to measures of obsessive-compulsive disorder. Further, though limited research has directly explored COVID-19 anxiety in relation to social anxiety, individuals with social anxiety were found to be experiencing unique stressors related to the pandemic (Saint & Moscovitch, 2021). For this reason, a measure of social anxiety was also included to provide a comprehensive analysis of anxiety-related symptoms.

Together, these studies of anxiety-related disorder symptoms show a connection between anxiety disorders and COVID-19 anxiety, with health anxiety and obsessive-compulsive disorder symptoms appearing to have the strongest association with COVID-19 anxiety. Given the preoccupation with becoming ill found in individuals with excessive health anxiety, and the heightened fears of becoming contaminated by unseen pathogens found in many individuals with obsessive-compulsive disorder (American Psychiatric Association, 2013), it is not surprising that individuals experiencing symptoms of health anxiety and obsessive-compulsive disorder would be particularly prone to COVID-19 anxiety. Based on both the theoretical associations and the existing literature, we hypothesized that health anxiety and obsessive-compulsive disorder symptoms would have the strongest unique associations with COVID-19 anxiety.

1.3. COVID-19 anxiety and anxiety-related mechanisms

Given that research have shown that health anxiety (Jungmann & Witthöft, 2020; Mertens et al., 2020; Warren et al., 2021), obsessive-compulsive disorder (Grant et al., 2021; Meşterelu et al., 2021), generalized anxiety disorder (Khosravani et al., 2021), panic disorder (Khosravani et al., 2021), and social anxiety (Saint & Moscovitch, 2021) to be related to COVID-19 anxiety, it is not surprising that mechanisms that underlie these disorders are also associated with COVID-19 anxiety. The mechanisms that have been explored more extensively, among other mechanisms (such as attentional bias; Albery et al., 2021), include anxiety sensitivity, disgust sensitivity and propensity, metacognitions, and intolerance of uncertainty.

Anxiety sensitivity is the belief that anxiety symptoms will cause harm to the individual experiencing them (Reiss et al., 1986) and has been established as a transdiagnostic factor that influences a wide range of anxiety-related disorders (Taylor et al., 2007). Most commonly anxiety sensitivity is associated with panic disorder, post-traumatic stress disorder, social anxiety disorder, and generalized anxiety disorder (Boswell et al., 2013). It is characterized by the fear of bodily symptoms of anxiety (i.e., anxiety sensitivity physical concerns), fear of the loss of cognitive control due to anxiety (i.e., anxiety sensitivity cognitive

concerns), and fear of being observed as experiencing anxiety (i.e., anxiety sensitivity social concerns; Taylor et al., 2007). As expected, researchers found that anxiety sensitivity is a predictor of COVID-19 fear (Hashemi et al., 2020; Warren et al., 2021). In particular, the physical concerns aspect of anxiety sensitivity was associated with the highest degree of COVID-19 anxiety (Ojalehto et al., 2021; Paluszek et al., 2021; Warren et al., 2021). In the present study, we anticipated that the physical concerns aspect of anxiety sensitivity would be uniquely associated with COVID-19 anxiety because of the increased attention individuals gave to their bodily sensations during the pandemic.

Considered a basic emotional response, disgust serves to protect the body from potential contamination or uncleanliness (Rozin et al., 2000). In prior research, disgust has been most associated with obsessive-compulsive disorder but, like anxiety sensitivity, disgust appears to be a transdiagnostic factor that influences various anxiety-related symptoms (Olatunji, Cisler, et al., 2007). In anxiety disorder-related research, disgust is most often measured using two constructs: disgust propensity and disgust sensitivity. Disgust propensity is the frequency that someone experiences the emotion, while disgust sensitivity refers to the tendency to perceive disgust as negative or aversive (Olatunji, Cisler, et al., 2007). Disgust has been found to correlate with COVID-19 fear (McKay et al., 2020; Waqas et al., 2020). Additionally, researchers found that disgust propensity and sensitivity moderated the relationship between anxiety sensitivity and COVID-19 anxiety (McKay et al., 2020; Paluszek et al., 2021). We predicted in this study that both disgust propensity and disgust sensitivity would be uniquely associated with COVID-19 anxiety because individuals were primed to consciously think about staying clean and healthy during the pandemic.

Metacognitive beliefs are a group of dysfunctional beliefs related to how thoughts are interpreted, controlled, and modified (Wells & Cartwright-Hatton, 2004). Several general, and disorder-specific, maladaptive metacognitive beliefs appear to be significant contributors to generalized anxiety disorder, obsessive-compulsive disorder, social anxiety disorder, and health anxiety (Bailey & Wells, 2016; Deleurme et al., 2023; Grøtte et al., 2016; Nordahl & Wells, 2017; Penney et al., 2020). Using a measure of general maladaptive metacognitive beliefs, Aydın et al. (2021) found that COVID-19 anxiety was associated with the metacognitive belief that worries are uncontrollable and dangerous and with the metacognitive belief that the individual is constantly aware of their own thoughts. While Aydın et al. (2021) established a connection between maladaptive metacognitions and COVID-19 anxiety, it is reasonable to expect that maladaptive metacognitions specific to health anxiety would have a stronger association with COVID-19 anxiety than the more general metacognitions. Therefore, a measure of maladaptive metacognitions specific to health anxiety (Bailey & Wells, 2015) was included in the present study. This scale was chosen over a more general scale due to COVID-19 anxiety, which reflects concerns and fears about one's health, being the main focus of the current study. Therefore, the Metacognition Questionnaire-Health Anxiety (Bailey & Wells, 2015) is the more suitable scale. Maladaptive metacognitions specific to health anxiety were anticipated to be uniquely associated with COVID-19 anxiety in this study because individuals who believe that it is beneficial to have negative thoughts about their health and who report difficulty controlling those negative thoughts about their health would be expected to worry about catching pathogens, such as the virus behind COVID-19.

Lastly, intolerance of uncertainty is defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (Carleton, 2016, p. 31). Intolerance of uncertainty was originally developed as part of a model of generalized anxiety disorder (Dugas & Koerner, 2005) but has since been found to be a transdiagnostic mechanism associated with disorders such as social anxiety disorder, obsessive-compulsive disorder, panic disorder, and health anxiety (Wright et al., 2016). Unsurprisingly, intolerance of uncertainty has been associated with COVID-19 anxiety in multiple studies (Bakioğlu et al., 2021; Satici et al., 2020). Additionally, intolerance of uncertainty was found to predict the fear of COVID-19 spreading in the population (Wheaton et al., 2021). However, disorder-specific conceptualizations of intolerance of uncertainty have not been examined in association with COVID-19 anxiety. We propose that health anxiety-specific intolerance of uncertainty would have a stronger association with COVID-19 anxiety, and therefore included a measure of disorder-specific conceptualizations of intolerance of uncertainty (Thibodeau et al., 2015) in the present study, rather than a broader measure of intolerance of uncertainty. While the Disorder-Specific Intolerance of Uncertainty Scales (Thibodeau et al., 2015) measures aspects of intolerance of uncertainty that are specific to social anxiety and panic disorder, for example, since the present study sought to explore the association of anxiety-related mechanisms and COVID-19 anxiety, a health-related concern, it stands to reason that health anxiety-specific intolerance of uncertainty would have the strongest association. Lastly, the pandemic brought a great deal of uncertainty into people's lives, especially uncertainty around their health, which is why we predicted that health anxiety-specific intolerance of uncertainty would be uniquely associated with COVID-19 anxiety in this study.

2. Methods and materials

2.1. Participants and procedure

Data was collected from a non-clinical sample of undergraduate students at a Canadian undergraduate university. The institution's Research Ethics Board (File Number 101846) approved this study on September 14, 2020. A total of 593 participants completed the study online. The study, which was advertised as "Anxiety and COVID-19", was available to all individuals in the psychology participant pool, and students could self-select to enroll in the study. Students who participated in the study were eligible to receive up to a 2 % course credit for a psychology course. The sample was predominantly female (67.7 %). The sample was also predominantly Caucasian (56.1 %), though it also included individuals from diverse racial backgrounds, such as Southeast Asian (10.7 %), Israeli (5.3 %), Black (4.0 %), and Indigenous (1.8 %). Lastly, most of the sample was single (59.7 %) young adults (M_{age} = 21.13 years, SD = 4.49).

This study was made available to participants from September 18, 2020, to December 11, 2020, and again from January 8, 2021, to February 8, 2021, and participants could complete the study once during either of those periods. This period of time included multiple waves of the pandemic. During this first Fall and Winter of the pandemic, most university classes were delivered online, and a work-from-home order was in place. Dine-in restaurants were restricted to take-out, masking was enforced, and most public spaces were highly controlled. Some of these restrictions were added or removed during different periods of data collection, but most pandemic mandates were kept at strict levels. Additionally, all data was collected before vaccines for the virus were publicly available. It is important to note that while the transmission rates of the virus that causes COVID-19 may have changed during this time, the political climate around COVID-19 remained stable. In addition, though there were fluctuations in COVID-19 cases, the relationship between each variable should not change with these trends. If the severity of the populations' anxiety-related symptoms and mechanisms changed due to public messaging, then theoretically, COVID-19 anxiety would have moved with them. This combined movement should leave the overall relationship between the variables unchanged despite the changing COVID-19 numbers.

2.2. Measures (See Table 1)

2.2.1. COVID Stress Scale (Taylor et al., 2020)

The COVID Stress Scale is a 36-item scale that measures COVID-19 distress related to fear of becoming infected or encountering

Table 1
Scale properties.

Measure	Subscales	Number of Items	Observed Range	Mean	Standard Deviation	Cronbach's Alpha
COVID Stress Scale		36	0–111	35.38	24.75	0.96
Coronavirus Anxiety Scale		5	0–9	1.52	2.42	0.87
Coronavirus 19 Phobia Scale		20	20–94	44.60	16.64	0.95
Fear of Coronavirus Scale		7	7–34	16.15	6.22	0.89
Patient Health Questionnaire-15		15	0–27	9.42	5.85	0.85
Short Health Anxiety Index		18	0–41	16.57	8.25	0.91
Generalized Anxiety Disorder-7		7	0–21	8.59	5.88	0.92
Obsessive-Compulsive Inventory-Revised		18	0–61	20.09	13.62	0.92
Social Interaction Anxiety Scale		20	0–78	33.84	17.88	0.94
Social Phobia Scale		20	0–80	26.17	19.62	0.96
Panic Disorder Severity Scale-Self Report		7	0–19	4.28	4.96	0.90
Anxiety Sensitivity Index-3		18				
	ASI-P	6	0–24	6.61	5.86	0.88
	ASI-C	6	0–24	6.30	6.28	0.91
	ASI-S	6	0–24	9.36	6.19	0.85
Disgust Propensity and Sensitivity Scale-Revised		16				
	DPSS-DP	8	8–39	21.02	6.28	0.89
	DPSS-DS	8	8–37	18.12	6.35	0.84
Metacognition Questionnaire-Health Anxiety		14				
	MCQ-BT	5	5–20	6.67	2.14	0.81
	MCQ-I	5	5–20	8.56	3.19	0.78
	MCQ-U	4	4–16	7.12	2.67	0.76
Disorder-Specific Intolerance of Uncertainty scales		24				
	DSIU-GAD	3	0–12	5.47	3.57	0.89
	DSIU-SAD	3	0–12	5.38	3.67	0.89
	DSIU-OCD	3	0–12	5.91	3.20	0.81
	DSIU-HA	3	0–12	4.26	3.37	0.86
	DSIU-PTSD	3	0–12	4.92	3.77	0.91
	DSIU-MDD	3	0–12	4.15	3.77	0.89
	DSIU-PD	3	0–12	2.66	3.35	0.93
	DSIU-SP	3	0–12	4.41	3.44	0.87

Note. Observed Range = Range of participants' scores.

contaminated stimuli, socio-economic consequences, disease-related xenophobia, traumatic stress, and compulsive checking and reassurance seeking. Each item is rated on a scale from 0 to 4. All the scores are combined to create a total score between 0 and 144. A higher score on the scale represents more self-reported COVID-19 stress. This is one of the most used measures of COVID-19 anxiety and was used as a dependent variable. The scale has demonstrated high internal consistency, in addition to convergent and discriminant validity (Montano & Acebes, 2020; Taylor et al., 2020).

2.2.2. Coronavirus Anxiety Scale (Lee, 2020)

The Coronavirus Anxiety Scale is a 5-item self-report questionnaire of COVID-19 anxiety that was used as a dependent variable in the current study. Specifically, this scale measures the cognitive, behavioural, emotional, and physiological outcomes of COVID-19 anxiety. Each item is rated on a scale from 0 to 4, with total scores ranging from 0 to 20. Higher scores indicate higher levels of COVID-19 anxiety. The Coronavirus Anxiety Scale was the first measure of COVID-19 anxiety developed and remains commonly used. Evaluations of the Coronavirus Anxiety Scale indicated that the scale has high reliability, along with good content, convergent, and discriminant validity (Lee, 2020).

2.2.3. Coronavirus 19 Phobia Scale (Arpaci et al., 2020)

The Coronavirus 19 Phobia Scale is a 20 item self-report questionnaire with each item rated on a scale from 1 to 5 for total scores from 20 to 100. The scale measures the psychological, psycho-somatic, economic, and social factors of fear of COVID-19. It was used as a dependent variable. The Coronavirus 19 Phobia Scale is a regularly used measure of COVID-19 anxiety and has shown good convergent and discriminant validity and good internal consistency (Arpaci et al., 2020).

2.2.4. Fear of Coronavirus Scale (Ahorsu et al., 2020)

The Fear of Coronavirus Scale is a 7-item scale with total scores ranging from 7 to 35. Higher scores represent greater COVID-19 fear. It measures the self-reported bodily reactions to fear of COVID-19, such as a racing heart, and fearful thoughts related to COVID-19, such as the fear of losing one's life. The Fear of Coronavirus Scale is a common measure of COVID-19 anxiety and was used as a dependent variable. The scale has been shown to have high internal consistency and concurrent validity (Ahorsu et al., 2020; Perz et al., 2020).

2.2.5. Patient Health Questionnaire-15 (PHQ-15; Kroenke et al., 2002)

The PHQ-15 measures the perceived severity of 15 common somatic symptoms. The scale is a measure of somatic symptoms commonly associated with those who experience health anxiety. It was included to distinguish between being bothered by the somatic symptoms that might be experienced by those who experience COVID-19 anxiety and the worry about health that marks health anxiety. The scale was used as a predictor variable. Each item is scored from 0 to 2, to generate total scores from 0 to 30, based on how much the participant has been bothered by each symptom over the past four weeks. The scale has excellent internal reliability and has demonstrated both convergent and discriminant validity (Han et al., 2009; Kroenke et al., 2002).

2.2.6. Short Health Anxiety Index (SHAI; Salkovskis et al., 2002)

The SHAI is a measure of excessive worry specifically about to one's health or concern that one might become ill, otherwise known as health anxiety. It contains 18 items that each have four responses (scored 0 to 3) for participants can choose from, with higher scores representing higher health anxiety. Total scores can range from 0 to 54. The SHAI is the most common measure of health anxiety and was used as a predictor

variable. The scale has been demonstrated to have good internal consistency and criterion validity (Alberts et al., 2013; Salkovskis et al., 2002).

2.2.7. Generalized Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006)

The GAD-7 is a 7-item brief self-report measure of generalized anxiety disorder symptoms, with total scores ranging from 0 to 21. High scores represent high generalized anxiety disorder symptoms, and each item is rated from 0 to 3. The scale is one of the most commonly used measure of generalized anxiety disorder and was used as a predictor variable. Evaluations of the GAD-7 have shown the scale to have strong internal consistency and strong content, convergent, and discriminant validity (Löwe et al., 2008; Spitzer et al., 2006).

2.2.8. Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002)

The OCI-R measures obsessive-compulsive disorder symptoms and is regularly used to measure obsessive-compulsive disorder. It uses 18 items in total, each rated from 0 to 4, and was used a predictor variable. The scale measures six common obsessive-compulsive disorder symptoms, including washing, obsessing, hoarding, ordering, checking, and neutralizing. Total scores range from 0 to 72, with higher scores representing high obsessive-compulsive disorder symptoms. The scale has good convergent and discriminant validity and excellent internal consistency (Foa et al., 2002; Hajcak et al., 2004).

2.2.9. Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998)

The SIAS measures fear of social interaction with 20-items, and is commonly used to measure social anxiety. Each item is rated on a scale from 0 to 4, for total scores from 0 to 80, with higher scores signifying higher social anxiety. It was used as a predictor variable in the current study. The scale has high internal consistency and discriminant validity. (Mattick & Clarke, 1998; Osman et al., 1998).

2.2.10. Social Phobia Scale (SPS; Mattick & Clarke, 1998)

The SPS is a 20-item scale with each item rated on a scale from 0 to 4, to generate total scores from 0 to 80. The scale measures individuals' fear of being criticized for executing everyday activities. It is a commonly used measure of social anxiety, was developed to be used in conjunction with the SIAS, and was used as a predictor variable. The scale has strong internal consistency and discriminant validity (Mattick & Clarke, 1998; Osman et al., 1998).

2.2.11. Panic Disorder Severity Scale-Self Report (PDSS; Houck et al., 2002)

The PDSS includes 7 items rated from 0 to 4 and measures frequency, distress, fear of, and impairment because of panic attacks. It is a frequently used measure of panic disorder and was used as a predictor variable. Total scores can range from 0 to 28, with higher scores representing greater panic disorder symptoms. The scale has high internal consistency and discriminant validity (Houck et al., 2002).

2.2.12. Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007)

Using three subscales, each with 6 items, the ASI-3 measures an individual's fear related to sensations that result from anxious arousal. The subscales include physical concerns (ASI—P), cognitive concerns (ASI—C), and social concerns (ASI—S). Each item is rated between 0 and 4, with scores on each subscale ranging from 0 to 24. It is the gold standard measure for anxiety sensitivity, and each subscale was used as a predictor variable. The ASI-3 has been shown to have high criterion, convergent, and discriminant validity, along with strong internal consistency (Taylor et al., 2007; Wheaton et al., 2012).

2.2.13. Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; Olatunji, Cisler, et al., 2007)

The DPSS-R is a 16-item scale, with each item ranging from 1 to 5. It is a commonly used measure of disgust. The DPSS-R has two subscales, which were used as predictor variables. Disgust propensity (DPSS-DP) measures how often an individual experiences disgust, while disgust sensitivity (DPSS-DS) examines the emotional effect of disgusting experiences. Each subscale has eight items, with scores ranging from 16 to 80. The scale has strong internal consistency and has good convergent and discriminant validity (Fergus & Valentiner, 2009; Olatunji, Cisler, et al., 2007).

2.2.14. Disorder-Specific Intolerance of Uncertainty scales (DSIU; Thibodeau et al., 2015)

The DSIU measures intolerance of uncertainty specifically related to generalized anxiety disorder (DSIU-GAD), social anxiety disorder (DSIU-SAD), obsessive-compulsive disorder (DSIU-OCD), health anxiety (DSIU-HA), post-traumatic stress disorder (DSIU-PTSD), panic disorder (DSIU-PD), specific phobia (DSIU-SP), and depression (DSIU-MDD). Each subscale has 3 items, with each self-reported item on a scale from 0 to 4, for possible scores from 0 to 12. Each subscale was used as a predictor variable. It was chosen because it is the only measure of disorder-specific intolerance of uncertainty. The scale has been shown to have good internal consistency and criterion validity (Thibodeau et al., 2015).

2.2.15. Metacognition Questionnaire-Health Anxiety (MCQ-HA; Bailey & Wells, 2015)

The MCQ-HA includes three subscales of metacognitive beliefs related to health anxiety, with 14 self-reported items being scored between 1 and 4. The beliefs that thoughts can cause illness (MCQ-C) and the beliefs about biased thinking regarding one's health (MCQ-BT) subscales each have 5 items with subscale scores ranging from 5 to 20. The belief that thoughts about one's health are uncontrollable (MCQ-U) subscale has 4 items with a subscale score ranging from 4 to 16. Each subscale was used as a predictor variable, and the scale itself is considered the gold standard for metacognitive beliefs related to health anxiety. Higher scores indicate greater negative metacognitions related to health anxiety. The scale has good internal consistency along with discriminant and convergent validity (Bailey & Wells, 2015; Dai et al., 2018).

2.3. Data analysis

All analyses were conducted using IBM SPSS 28.0. A total of 20 participants were removed from the dataset due to excessive missing data. An additional 24 participants were removed from the dataset due to high scores on an infrequency items scale (Morey, 1991), which was distributed across the study questionnaires. The infrequency items scale was taken from the Personality Assessment Inventory (Morey, 1991), and is an 8-item validated scale used to identify random responding in participants. Each item is rated on a four-point Likert-type scale; the total scale scores range from 0 to 24. Participants who did not pass the check, a raw cut-off score of 9 or above, were removed from the study, as the rest of their answers were assumed to be invalid. The total number of participants used in the analyses was 549. The skewness and kurtosis of all scales were also examined. Several scales were positively skewed. These scales included the COVID Stress Scale, SHAI, OCI-R, SPS, PDSS, ASI—P, ASI—C, DSIU-PD, MCQ-C, MCQ-BT, and MCQ-U. Further, the Coronavirus Anxiety Scale was positively skewed and displayed positive kurtosis. As would be expected for these scales, substantially more participants reported scores closer to 0 or 1 than closer to the high-end of the scale. However, these violations of normality are to be expected when using scales of pathological symptoms and dysfunctional beliefs, and provided that the sample size is not small, simulation studies (e.g., Edgell & Noon, 1984; Hayes, 1996) have shown that these violations do not affect the validity of statistical inferences (Hayes, 2018).

Pearson product-moment correlations were conducted. The first set of correlations assessed the relationships between scores on the COVID-19 anxiety scales and the scales that measured the anxiety-related symptoms: the PHQ-15, SHAI, GAD-7, OCI-R, SIAS, SPS, and PDSS.

The second set of correlations assessed the relationships between scores on COVID-19 anxiety scales and the scales that measure anxiety-related mechanisms: the subscales of the ASI-3, DPSS-R, DSIU, and MCQ-HA.

A series of multiple regressions were then conducted. Each set had four separate multiple regressions conducted, one for each of the four COVID-19 anxiety measures: the COVID Stress Scale, the Coronavirus Anxiety Scale, the Fear of Coronavirus Scale, and the Coronavirus 19 Phobia Scale. The first set used each of the COVID-19 anxiety measures scores as the dependent variables to explore the association with the anxiety-related symptom measures scores. The second set used each of the scores of the COVID-19 measures as the dependent variables to examine the association with anxiety-related mechanisms scores.

Due to multiple regression analyses being performed, a Bonferroni correction was used to control the number of false positives that can occur (Tabachnick & Fidell, 2013). The Bonferroni correction is a widely used method to maintain the overall Type I error rate when multiple statistical tests are performed on the same set of data (Tabachnick & Fidell, 2013). In this study, the corrected significance level was set to $0.05/8 = 0.00625$ due to performing eight multiple regression analyses. This means that for any overall analysis and specific predictor variable to be considered statistically significant, it must yield a p-value less than 0.00625, as opposed to the usual threshold of 0.05. Performing this correction reduces the likelihood of potential false claims but comes with the trade-off of an increased risk of false negatives (Tabachnick & Fidell, 2013).

3. Results

The correlations between each of the variables were examined (see Table 2 and Table 3). As expected, the COVID-19 anxiety scales were strongly correlated (*r*s from 0.59 to 0.77), but did not show evidence of multicollinearity (Tabachnick & Fidell, 2013), warranting the use of all four scales in further analyses. Each of the anxiety-related disorder symptom scales were moderately associated with the measures of COVID-19 anxiety (*r*s from 0.31 to 0.60) and moderately or strongly correlated with the other anxiety-related disorder symptoms (*r*s from 0.31 to 0.78; see Table 2). In addition, the COVID-19 anxiety measures significantly correlated with the anxiety-related mechanisms (*r*s from 0.29 to 0.61; see Table 3). Each anxiety-related mechanism also moderately to strongly correlated with the other anxiety-related mechanisms (*r*s from 0.27 to 0.74).

A series of multiple regression analyses were conducted to examine which anxiety-related disorder symptom measures, and which anxiety-related mechanism measures, were uniquely associated with each COVID-19 anxiety measure. The first four regression analyses examined which anxiety-related disorder symptoms were significantly associated with COVID-19 anxiety across the four scales (see Table 4). The anxiety-related disorder symptoms were significantly associated with scores on the COVID Stress Scale, F (7, 523) = 58.65, $p < .001$, the Coronavirus Anxiety Scale, F (7, 527) = 42.25, $p < .001$, the Coronavirus 19 Phobia Scale, F (7, 528) = 64.89, $p < .001$, and the Fear of Coronavirus Scale, F (7, 528) = 38.15, $p < .001$. Across all four COVID-19 anxiety scales, scores on the SHAI (*pr*s = 0.17–0.29) and OCI-R (*pr*s = 0.16–0.35) were significantly uniquely associated with COVID-19 anxiety. In other words, health anxiety and OCD symptoms had the most consistent associations with COVID-19 anxiety. In addition, PDSS scores, which measures panic disorder symptoms, were significantly related to COVID-19 anxiety as measured by the Coronavirus Anxiety Scale (*pr* = 0.26), the Coronavirus 19 Phobia Scale (*pr* = 0.13), and the Fear of Coronavirus Scale (*pr* = 0.15). No other symptom measure accounted for unique variance in the COVID-19 anxiety measures.

Four regression analyses examined if anxiety-related mechanisms were significantly associated with COVID-19 anxiety (see Table 5). The anxiety-related mechanisms were significantly associated with scores on the COVID Stress Scale, F (16, 491) = 29.75, $p < .001$, the Coronavirus Anxiety Scale, F (16, 496) = 64.27, $p < .001$, the Coronavirus 19 Phobia Scale, F (16, 497) = 32.34, $p < .001$, and the Fear of Coronavirus Scale, F (16, 497) = 22.03, $p < .001$. Across all four scales of COVID-19 anxiety, the anxiety-related mechanism scales that emerged as being consistently uniquely associated with COVID-19 anxiety were the DPSS-DS (*pr*s = 0.14–0.16) and the DSIU-HA (*pr*s = 0.12–0.30). In other words, disgust sensitivity and health anxiety-related intolerance of uncertainty had the most consistent associations with COVID-19 anxiety. MCQ-BT scores, which measure beliefs about biased thinking regarding one's health, were also significantly associated with scores on the COVID Stress Scale (*pr* = 0.19) and the Coronavirus Anxiety Scale (*pr* = 0.15). Finally, the physical concerns subscale of the ASI-3 was significantly associated with COVID Stress Scale scores (*pr* = 0.13), and the cognitive concerns subscale of the ASI-3 was significantly associated with Coronavirus Anxiety Scale scores (*pr* = 0.12).

4. Discussion

The present study found robust, unique associations between COVID-19 anxiety and health anxiety and obsessive-compulsive disorder symptoms. Some support was also found that there is a unique association between panic disorder symptoms and COVID-19 anxiety. Additionally, the study also found robust, unique associations between COVID-19 anxiety and health anxiety-specific intolerance of uncertainty and disgust sensitivity. The present study also found some support that beliefs about thinking about one's health and anxiety sensitivity have a unique association with COVID-19 anxiety. These findings contribute to a deeper understanding of the factors that influenced the heightened anxiety experienced during the pandemic and offer implications for clinical practice and directions for future research.

Table 2
Bivariate correlations: COVID-19 anxiety and anxiety-related disorder symptoms.

Measure	CSS	CAS	CP19-S	FCV-19S	PHQ-15	SHAI	GAD-7	OCI-R	SIAS	SPS
CSS	–									
CAS	0.60**	–								
CP19-S	0.77**	0.63**	–							
FCV-19S	0.69**	0.59**	0.77**	–						
PHQ-15	0.40**	0.39**	0.45**	0.35**	–					
SHAI	0.54**	0.47**	0.59**	0.53**	0.51**	–				
GAD-7	0.48**	0.46**	0.51**	0.44**	0.62**	0.57**	–			
OCI-R	0.60**	0.47**	0.58**	0.45**	0.47**	0.54**	0.59**	–		
SIAS	0.37**	0.30**	0.41**	0.31**	0.46**	0.45**	0.52**	0.51**	–	
SPS	0.48**	0.40**	0.49**	0.38**	0.52**	0.51**	0.62**	0.61**	0.78**	–
PDSS	0.47**	0.51**	0.51**	0.45**	0.58**	0.54**	0.62**	0.48**	0.46**	0.58**

Note. CSS = COVID Stress Scale; CAS = Coronavirus Anxiety Scale; CP19-S = Coronavirus 19 Phobia Scale; FCV-19S = Fear of Coronavirus Scale; PHQ-15 = Patient Health Questionnaire-15; SHAI = Short Health Anxiety Index; GAD-7 = Generalized Anxiety Disorder-7; OCI-R = Obsessive-Compulsive Inventory-Revised; SIAS = Social Interaction Anxiety Scale; SPS = Social Phobia Scale; PDSS = Panic Disorder Severity Scale-Self Report.
* $p < .01$, ** $p < .001$.

Table 3
Bivariate correlations: COVID-19 anxiety and anxiety-related mechanisms.

Measure	CSS	CAS	CP19-S	FCV-19S	ASI-P	ASI-C	ASI-S	DPSS-DP	DPSS-DS	MCQ-BT	MCQ-C	MCQ-U	DSIU-GAD	DSIU-SAD	DSIU-OCD	DSIU-HA	DSIU-PTSD	DSIU-MDD	DSIU-PD
ASI-P	0.55**	0.46**	0.54**	0.49**	–														
ASI-C	0.49**	0.44**	0.48**	0.37**	0.67**	–													
ASI-S	0.47**	0.39**	0.50**	0.39**	0.65**	0.70**	–												
DPSS-DP	0.39**	0.31**	0.42**	0.34**	0.45**	0.37**	0.45**	–											
DPSS-DS	0.52**	0.43**	0.53**	0.46**	0.59**	0.45**	0.54**	0.73**	–										
MCQ-BT	0.47**	0.39**	0.42**	0.36**	0.41**	0.39**	0.39**	0.28**	0.33**	–									
MCQ-C	0.35**	0.30**	0.34**	0.29**	0.37**	0.34**	0.27**	0.29**	0.33**	0.44**	–								
MCQ-U	0.51**	0.39**	0.52**	0.41**	0.55**	0.49**	0.49**	0.39**	0.47**	0.59**	0.47**	–							
DSIU-GAD	0.49**	0.37**	0.55**	0.46**	0.61**	0.61**	0.67**	0.40**	0.51**	0.33**	0.32**	0.56**	–						
DSIU-SAD	0.39**	0.30**	0.42**	0.32**	0.49**	0.58**	0.72**	0.39**	0.44**	0.27**	0.19**	0.44**	0.74**	–					
DSIU-OCD	0.38**	0.26**	0.41**	0.29**	0.47**	0.48**	0.54**	0.39**	0.40**	0.28**	0.31**	0.40**	0.68**	0.63**	–				
DSIU-HA	0.57**	0.43**	0.61**	0.56**	0.62**	0.53**	0.56**	0.46**	0.55**	0.40**	0.37**	0.60**	0.69**	0.57**	0.57**	–			
DSIU-PTSD	0.35**	0.29**	0.39**	0.33**	0.49**	0.54**	0.59**	0.38**	0.42**	0.25**	0.26**	0.42**	0.64**	0.64**	0.53**	0.54**	–		
DSIU-MDD	0.43**	0.37**	0.48**	0.37**	0.51**	0.66**	0.63**	0.36**	0.41**	0.37**	0.27**	0.55**	0.77**	0.72**	0.58**	0.60**	0.69**	–	
DSIU-PD	0.42**	0.39**	0.43**	0.39**	0.55**	0.61**	0.57**	0.29**	0.42**	0.36**	0.29**	0.50**	0.60**	0.54**	0.44**	0.51**	0.56**	0.61**	–
DSIU-SP	0.40**	0.33**	0.49**	0.40**	0.52**	0.49**	0.57**	0.44**	0.45**	0.35**	0.27**	0.46**	0.63**	0.59**	0.48**	0.55**	0.52**	0.58**	0.51**

Note. CSS = COVID Stress Scale; CAS = Coronavirus Anxiety Scale; CP19-S = Coronavirus 19 Phobia Scale; FCV-19S = Fear of Coronavirus Scale; ASI-P = Anxiety Sensitivity Index-Physical Concern Subscale; ASI-C = Anxiety Sensitivity Index-Cognitive Concern Subscale; ASI-S = Anxiety Sensitivity Index-Social Concern Subscale; DPSS-DP = Disgust Propensity and Sensitivity Scale-Disgust Propensity; DPSS-DS = Disgust Propensity and Sensitivity Scale-Disgust Sensitivity; MCQ-BT = Metacognition Questionnaire-Health Anxiety-Biased Thinking; MCQ-I = Metacognition Questionnaire-Health Anxiety-Illness Beliefs; MCQ-U = Metacognition Questionnaire-Health Anxiety-Uncontrollability; DSIU-GAD = Disorder-Specific Intolerance of Uncertainty Scales-Generalized Anxiety Disorder; DSIU-SAD = Disorder-Specific Intolerance of Uncertainty Scales-Social Anxiety Disorder; DSIU-OCD = Disorder-Specific Intolerance of Uncertainty Scales-Obsessive-Compulsive Disorder; DSIU-HA = Disorder-Specific Intolerance of Uncertainty Scales-Health Anxiety; DSIU-PTSD = Disorder-Specific Intolerance of Uncertainty Scales-Post-Traumatic Stress Disorder; DSIU-MDD = Disorder-Specific Intolerance of Uncertainty Scales-Depression; DSIU-PD = Disorder-Specific Intolerance of Uncertainty Scales-Panic Disorder; DSIU-SP = Disorder-Specific Intolerance of Uncertainty Scales-Specific Phobia.
* $p < .01$, ** $p < .001$.

Table 4
Regression analyses – COVID-19 anxiety and anxiety-related disorder symptoms.

Measure	COVID Stress Scale					Measure	Coronavirus Anxiety Scale				
	R	R^2	*β*	*t*	*pr*		*R*	R^2	*β*	*t*	*pr*
Step 1	0.66	0.44				Step 1	0.60	0.36			
PHQ-15			0.02	0.09	0.00	PHQ-15			0.01	0.65	0.03
SHAI			0.72	5.49**	0.23	SHAI			0.05	3.99**	0.17
GAD-7			0.11	0.49	0.02	GAD-7			0.01	0.39	0.02
OCI-R			0.69	8.46**	0.35	OCI-R			0.04	4.32**	0.19
SIAS			−0.12	−1.61	−0.07	SIAS			−0.01	−1.70	−0.07
SPS			0.13	1.76	0.08	SPS			0.01	0.92	0.04
PDSS			0.51	2.21	0.09	PDSS			0.15	6.06**	0.26

Measure	Coronavirus 19 Phobia Scale					Measure	Fear of Coronavirus Scale				
	R	R^2	*β*	*t*	*pr*		*R*	R^2	*β*	*t*	*pr*
Step 1	0.68	0.46				Step 1	0.58	0.34			
PHQ-15			0.12	0.99	0.04	PHQ-15			−0.04	−0.85	−0.04
SHAI			0.62	7.16**	0.29	SHAI			0.25	6.84**	0.29
GAD-7			0.06	0.45	0.02	GAD-7			0.09	1.44	0.06
OCI-R			0.36	6.78**	0.28	OCI-R			0.08	3.62**	0.16
SIAS			0.00	0.06	0.00	SIAS			−0.01	−0.25	−0.01
SPS			0.02	0.29	0.01	SPS			−0.01	−0.35	−0.02
PDSS			0.46	3.05*	0.13	PDSS			0.22	3.52**	0.15

Note. pr = Partial correlation; PHQ-15 = Patient Health Questionnaire-15; SHAI = Short Health Anxiety Index; GAD-7 = Generalized Anxiety Disorder-7; OCI-R = Obsessive-Compulsive Inventory-Revised; SIAS = Social Interaction Anxiety Scale; SPS = Social Phobia Scale; PDSS = Panic Disorder Severity Scale-Self Report.
* $p < .00625$.
** $p < .001$.

4.1. Anxiety-related disorders associated with COVID-19 anxiety

We predicted that health anxiety and obsessive-compulsive disorder symptoms would have the strongest unique associations with COVID-19 anxiety. Based on the findings, this prediction has been confirmed. Health anxiety was uniquely associated with COVID-19 anxiety across all four COVID-19 anxiety measures. This is in line with earlier research into COVID-19 anxiety (Jungmann & Witthöft, 2020; Mertens et al., 2020; Warren et al., 2021), and is similar to research conducted by Mertens et al. (2021) that found health anxiety to be associated with multiple scales of COVID-19 anxiety. These findings also align with early research on the pandemic by Mertens et al. (2020), who collected data for their study three days after the World Health Organization officially declared COVID-19 a pandemic. This shows that health anxiety continues to be associated with pandemic anxiety throughout a pandemic. Additionally, prior research has shown a connection between a publicized pandemic and a rise in health anxiety among the general population (Taylor & Asmundson, 2004). It is unsurprising that individuals with significant anxiety surrounding their health were the most strongly affected by a significant global health crisis. Given the ongoing nature of the pandemic and its continued influence on the population, individual with high health anxiety may continue to report significant COVID-19 anxiety.

Obsessive-compulsive disorder symptoms were also found to be uniquely associated with COVID-19 anxiety. This was similar to the results in the cross-sectional study done by Grant et al. (2021), which found that obsessive-compulsive disorder was associated with COVID-19 stress in the general population. Contamination fears, which are prevalent in obsessive-compulsive disorder, have been previously found to be a predictor of illness-preventive behaviours, such as hand washing, during the COVID-19 pandemic (Knowles & Olatunji, 2021). Further, an elevated level of COVID-19 anxiety may have been found in those with obsessive-compulsive disorder symptoms due to a fear of becoming infected with COVID-19, or with infecting others knowingly or unknowingly (Fontenelle & Miguel, 2020; Wheaton et al., 2021). Individuals who have contamination fears may continue to experience COVID-19 anxiety even as the pandemic draws to a close.

Additionally, though not anticipated, panic disorder symptoms were uniquely associated with COVID-19 anxiety on three of the four measures. This could be due to individuals with panic disorder being more attuned to physical sensations in their bodies, which could increase their psychological distress and fear of panic-like symptoms during the pandemic (Perna & Caldirola, 2020). These individuals may have attended more readily to any potential symptoms associated with COVID-19, which caused them more significant anxiety. Additionally, these individuals may have misinterpreted the respiratory symptoms of COVID-19 as the start of a panic attack and vice versa. This could have increased their overall COVID-19 anxiety and their panic disorder symptoms during the pandemic (Perna & Caldirola, 2020). Lastly, although we did not anticipate that panic disorder symptoms would be uniquely associated with COVID-19 anxiety when controlling for the symptoms of other anxiety disorder symptoms, this finding does align with the results of a recent publication that found that individuals with a primary diagnosis of panic disorder reported increased COVID-19 anxiety throughout the pandemic (Asmundson et al., 2022).

Generalized anxiety disorder symptoms and social anxiety symptoms did not emerge as unique predictors of COVID-19 anxiety. Previous research had provided some limited evidence that both generalized anxiety disorder and social anxiety disorder may be related to COVID-19 anxiety (Khosravani et al., 2021; Saint & Moscovitch, 2021). However, those studies had not measured as many anxiety-related disorder symptoms as were included in the present study. Overall, when accounting for health anxiety and obsessive-compulsive disorder symptoms, it does not appear that generalized anxiety disorder and social anxiety disorder are particularly associated with COVID-19 anxiety.

4.2. Anxiety-related mechanisms associated with COVID-19 anxiety

Concerning anxiety-related mechanisms, we hypothesized that the physical concerns aspect of anxiety sensitivity, disgust propensity and sensitivity, maladaptive metacognitive beliefs about health, and health anxiety-specific intolerance of uncertainty would each be uniquely associated with COVID-19 anxiety. Overall, health anxiety-specific intolerance of uncertainty and disgust sensitivity had the strongest unique associations with COVID-19 anxiety. Health anxiety-specific intolerance of uncertainty being strongly associated with increased

Table 5
Regression analyses – COVID-19 anxiety and anxiety-related mechanisms.

Measure	COVID Stress Scale					Measure	Coronavirus Anxiety Scale				
	R	R^2	*β*	*t*	*pr*		*R*	R^2	*β*	*t*	*pr*
Step 1	0.70	0.49				Step 1	0.59	0.35			
ASI-P			0.16	2.92*	0.13	ASI-P			0.15	2.46	0.11
ASI-C			0.09	1.72	0.08	ASI-C			0.16	2.61*	0.12
ASI-S			−0.02	−0.37	−0.02	ASI-S			−0.02	−0.37	−0.02
DPSS-DP			−0.04	−0.87	−0.04	DPSS-DP			−0.05	−0.98	−0.04
DPSS-DS			0.19	3.63**	0.16	DPSS-DS			0.21	3.41**	0.15
MCQ-BT			0.19	4.45**	0.19	MCQ-BT			0.16	3.46**	0.15
MCQ-C			0.02	0.38	0.02	MCQ-C			0.05	1.11	0.05
MCQ-U			0.04	0.89	0.04	MCQ-U			−0.07	−1.23	−0.06
DSIU-GAD			0.04	0.63	0.03	DSIU-GAD			−0.00	−0.05	−0.00
DSIU-SAD			−0.01	−0.18	−0.01	DSIU-SAD			−0.05	−0.71	−0.03
DSIU-OCD			0.00	0.00	0.00	DSIU-OCD			−0.07	−1.367	−0.06
DSIU-HA			0.25	4.86**	0.21	DSIU-HA			0.16	2.74*	0.12
DSIU-PTSD			−0.05	−0.93	−0.04	DSIU-PTSD			−0.05	−0.96	−0.04
DSIU-MDD			0.02	0.26	0.01	DSIU-MDD			0.08	1.22	0.06
DSIU-PD			0.01	0.11	0.01	DSIU-PD			0.06	1.17	0.05
DSIU-SP			−0.00	−0.03	−0.00	DSIU-SP			0.02	0.35	0.02

Measure	Coronavirus 19 Phobia Scale					Measure	Fear of Coronavirus Scale				
	R	R^2	*β*	*t*	*pr*		*R*	R^2	*β*	*t*	*pr*
Step 1	0.71	0.51				Step 1	0.64	0.42			
ASI-P			0.08	1.43	0.06	ASI-P			0.14	2.40	0.12
ASI-C			0.05	1.02	0.05	ASI-C			−0.01	−0.23	−0.01
ASI-S			0.08	1.37	0.06	ASI-S			−0.01	−0.21	−0.01
DPSS-DP			−0.02	−0.32	−0.01	DPSS-DP			−0.03	−0.61	−0.03
DPSS-DS			0.16	3.05*	0.14	DPSS-DS			0.17	2.91*	0.13
MCQ-BT			0.10	2.46	0.11	MCQ-BT			0.09	2.09	0.09
MCQ-C			0.02	0.58	0.03	MCQ-C			0.02	0.50	0.02
MCQ-U			0.05	1.02	0.05	MCQ-U			−0.05	−1.03	−0.05
DSIU-GAD			0.09	1.53	0.07	DSIU-GAD			0.16	2.24	0.10
DSIU-SAD			−0.09	−1.51	−0.07	DSIU-SAD			−0.11	−1.72	−0.08
DSIU-OCD			−0.01	−0.28	−0.01	DSIU-OCD			−0.11	−2.26	−0.10
DSIU-HA			0.30	6.03**	0.26	DSIU-HA			0.38	6.98**	0.30
DSIU-PTSD			−0.04	−0.84	−0.04	DSIU-PTSD			−0.01	−0.10	−0.01
DSIU-MDD			0.03	0.50	0.02	DSIU-MDD			−0.04	−0.55	−0.03
DSIU-PD			−0.02	−0.43	−0.02	DSIU-PD			0.07	1.35	0.06
DSIU-SP			0.03	2.21	0.09	DSIU-SP			0.08	1.55	0.07

Note. pr = Partial correlation; ASI-P = Anxiety Sensitivity Index-Physical Concern Subscale; ASI-C = Anxiety Sensitivity Index-Cognitive Concern Subscale; ASI-S = Anxiety Sensitivity Index-Social Concern Subscale; DPSS-DP = Disgust Propensity and Sensitivity Scale-Disgust Propensity; DPSS-DS = Disgust Propensity and Sensitivity Scale-Disgust Sensitivity; MCQ-BT = Metacognition Questionnaire-Health Anxiety-Biased Thinking; MCQ-I = Metacognition Questionnaire-Health Anxiety-Illness Beliefs; MCQ-U = Metacognition Questionnaire-Health Anxiety-Uncontrollability; DSIU-GAD = Disorder-Specific Intolerance of Uncertainty Scales-Generalized Anxiety Disorder; DSIU-SAD = Disorder-Specific Intolerance of Uncertainty Scales-Social Anxiety Disorder; DSIU-OCD = Disorder-Specific Intolerance of Uncertainty Scales-Obsessive-Compulsive Disorder; DSIU-HA = Disorder-Specific Intolerance of Uncertainty Scales-Health Anxiety; DSIU-PTSD = Disorder-Specific Intolerance of Uncertainty Scales-Post-Traumatic Stress Disorder; DSIU-MDD = Disorder-Specific Intolerance of Uncertainty Scales-Depression; DSIU-PD = Disorder-Specific Intolerance of Uncertainty Scales-Panic Disorder; DSIU-SP = Disorder-Specific Intolerance of Uncertainty Scales-Specific Phobia.

* $p < .00625$.

** $p < .001$.

anxiety would be expected in a large-scale health crisis like a pandemic. Health anxiety-specific intolerance of uncertainty represents the distress that an individual may experience due to not knowing for sure if they will be, or are currently, sick. Much of the uncertainty that individuals were experiencing during early stages of the pandemic was uncertainty about their health status (e.g., "is my sore throat a sign of COVID, or am I imagining it?") and the consequences of COVID-19 (e.g., "if I get COVID-19, will I experience symptoms long-term?"). Therefore, it stands to reason that we would see increased anxiety related to COVID-19 in individuals with dysfunctional beliefs related to health anxiety-specific intolerance of uncertainty. Additionally, there was also the fear that individuals could pass on the virus unknowingly when asymptomatic. For individuals high in health anxiety-specific intolerance of uncertainty, this lack of certainty could significantly increase their COVID-19 anxiety.

Disgust sensitivity, which is the emotional reaction that individuals experience in response to the sensations of disgust, was also found to be associated with COVID-19 anxiety. Similar results were found using a cross-sectional design with a university sample in Pakistan, suggesting these findings can be generalized to other populations outside of Canada (Waqas et al., 2020). This finding suggests that it is not how often individuals experience disgust, but rather their emotional response to disgust that is related to COVID-19 anxiety. It has been theorized that being high in disgust may cause an individual to avoid situations where they could be contaminated by a disease or illness (Deacon & Olatunji, 2007). Individuals with a heightened emotional response to a perceived disgusting circumstance would be expected to experience greater anxiety during a pandemic. This increase in anxiety could be due to the virus, which would have been perceived as disgusting, being constantly brought to their awareness through the media. Additionally, individuals who are high in disgust would be more aware of disgusting situations, such as an individual sneezing or coughing without covering their mouth, which is how the SARS-CoV-2 virus could transmit (Coelho et al., 2020). Being more disturbed by these disgusting situations would have

likely increased an individual's anxiety around contracting the virus.

The metacognitive beliefs regarding biased thinking regarding one's health, which is the beliefs that optimistic thinking about one's health is unhelpful while pessimistic thinking about one's health is helpful (Bailey & Wells, 2015), was associated with COVID-19 anxiety on two scales. When an individual believes that thinking pessimistically about their health is useful, they likely believe that worrying about developing COVID-19 will keep them from contracting the virus due to the worry encouraging them to take proactive steps to reduce the risk of spread. In this way, assuming the worst (i.e., engaging in pessimistic thoughts about their health) was viewed as a beneficial strategy. In addition, if a person holds the related belief that having an optimistic view of their health is detrimental, they may believe that assuming they are not infected with COVID-19 (i.e., optimistically disregarding possible symptoms) was risky. If one considers positive thinking about their health to be unhelpful, they would report more fears about COVID-19 because they would believe that people who were not afraid of COVID-19 were not taking enough precautions. On a societal level, during the pandemic, thinking optimistically about one's health was actively discouraged, and individuals were encouraged to assume that they had COVID-19 when presenting with any symptoms. The encouragement to think pessimistically about one's health could have reinforced this particular metacognitive belief in the general population. Thinking pessimistically about one's health could have actually served as a protective factor during the pandemic, as it may have led the person to engage in protective health behaviours, but this type of negative thinking likely also led to increased anxiety for many individuals as any subtle sign of ill health would have meant to them that they contracted COVID-19. And if this belief was rigidly held, it may have led to excessive anxiety that does not directly increase positive health behaviours.

Lastly, the physical aspect of anxiety sensitivity and the cognitive aspect of anxiety sensitivity were associated with COVID-19 anxiety on one scale each. This is of interest because the physical aspect of anxiety sensitivity has previously been clearly associated with COVID-19 anxiety (Ojalehto et al., 2021; Paluszek et al., 2021; Warren et al., 2021). It is possible that the inclusion of multiple mechanisms that were not previously examined with anxiety sensitivity weakened the relationship between anxiety sensitivity and COVID-19 anxiety in our study. Based on the findings of this study, anxiety sensitivity may play a limited role in COVID-19 anxiety. Still, the results suggest that health anxiety-specific intolerance of uncertainty and disgust sensitivity play larger roles in COVID-19 anxiety than anxiety sensitivity.

Based on our findings that health anxiety and obsessive-compulsive disorder symptoms are significantly associated with COVID-19 anxiety, it is not surprising that anxiety-related mechanisms that are directly related to these disorders were also uniquely associated with COVID-19 anxiety. Health anxiety-related metacognitive beliefs about biased thinking regarding one's health and health anxiety-specific intolerance of uncertainty are assumed to be dysfunctional beliefs that directly lead to health anxiety (Bailey & Wells, 2015; Thibodeau et al., 2015). Additionally, while disgust is related to various disorders, it appears to be particularly associated with obsessive-compulsive disorder (Knowles et al., 2018; Olatunji, Lohr, et al., 2007). Therefore, the results found in the two sets of analysis support each other. Specifically, the anxiety-related mechanisms that were most associated with COVID-19 anxiety (i.e., health anxiety-specific intolerance of uncertainty and disgust sensitivity) largely align with the specific anxiety-related disorder symptoms that were most associated with COVID-19 anxiety (i.e., health anxiety and obsessive-compulsive disorder symptoms).

4.3. Implications for clinical practice

Individuals with severe health anxiety, obsessive-compulsive disorder, or panic disorder symptoms may be at elevated risk for developing a high degree of anxiety regarding contracting COVID-19, and mental health outreach may wish to focus on individuals experiencing these symptoms in particular. Clinicians who work with clients with elevated health anxiety, obsessive-compulsive disorder, or panic disorder symptoms may wish to evaluate how the COVID-19 pandemic has affected these individuals and address these concerns in treatment. Addressing these specific concerns during treatment could help alleviate anxiety and improve overall wellbeing.

A therapist working with clients high in COVID-19 anxiety may also specifically wish to target health anxiety-related intolerance of uncertainty and disgust sensitivity. Some clients who continue expressing ongoing concerns about COVID-19 may also display problematic metacognitions about their health or elevated anxiety sensitivity. Targeting these mechanisms is likely to help reduce anxiety related to the pandemic.

4.4. Limitations and future directions

There are some limitations to the current study, which should be considered when interpreting the findings. A significant limitation of this study is that it makes use of convenience sampling. The sample was a university demographic, and most participants were young adults. It is possible that the challenges that caused anxiety for students during the COVID-19 pandemic were not the same in other populations. As a result, caution should be used when generalizing the results of this study to other populations. There is also the possibility the use of convenience sampling led to a bias in the results of this study. It is possible that those who experienced anxiety before and during the COVID-19 pandemic were more likely to participate in this study resulting in the high degrees of anxiety reported in the current sample. Future research could strive to use more diverse and representative sampling methods to ensure the broader application of the findings to the general population. In addition, future research should strive to use other sampling practices to reduce the potential for bias in the sample.

An additional limitation is that due to the study's cross-sectional nature, there is no way to determine if the anxiety-related disorder symptoms and anxiety-related mechanisms measured in this study were already present before the pandemic started or if they developed as a result of the pandemic. Future research could focus on the development of these anxiety symptoms and mechanisms over time as the nature of the pandemic changes. Ongoing longitudinal research on the effect of COVID-19 anxiety could be beneficial as the pandemic continues to impact the daily lives of individuals around the globe. Research that monitors individuals that have experienced high COVID-19 anxiety over time could help determine if they develop specific anxiety disorders in the future, which would provide insights into the lasting effect of the COVID-19 pandemic. In addition, during a future pandemic, researchers could adopt a longitudinal approach to track the development and trajectory of anxiety-related symptoms and mechanisms over time, to capture fluctuations in anxiety levels during different phases of the pandemic and beyond.

Another limitation of this study is that a measure of depression was not included despite it being found to have been associated with anxiety and COVID-19 anxiety in previous studies (e.g., Ahorsu et al., 2020; Bakioğlu et al., 2021). Although this was a purposeful choice, as the focus of the study was to explore anxiety and the study already included a large number of measures, it is possible that some of the effect sizes found would be smaller if a depression scale had been included as an additional measure. Lastly, a measure of posttraumatic stress symptoms was not included when looking at COVID-19 anxiety and anxiety-related disorder symptoms. Research has recently explored the mediating role of health anxiety in the relationship between posttraumatic stress symptoms and the COVID-19 pandemic (Coloma-Carmona & Carballo, 2021). Adding scales measuring these two constructs could help strengthen this research and provide more insight into the nature of pandemic anxiety. However, a related limitation is that because of the large number of scales that participants were asked to complete, it is

possible that some participants could have experienced fatigue. This may have resulted in some inaccuracies in participant data.

5. Conclusion

In summary, this study provides insights into the specific anxiety-related symptoms and mechanisms most strongly associated with heightened COVID-19 anxiety. It provides further evidence of the intersectional nature of pandemic-related anxiety. The findings emphasize the significance of health anxiety symptoms, obsessive-compulsive disorder symptoms, health anxiety-related intolerance of uncertainty, and disgust sensitivity in their association with COVID-19 anxiety and fear of contracting the virus.

Mental health professionals should be prepared to address these symptoms, especially during the initial stages of future pandemics, to support vulnerable individuals facing pandemic-related anxiety. Moving forward, clinicians should consider evaluating clients' COVID-19 anxiety and its impact on their overall wellbeing at the start of interventions. This understanding can help tailor effective strategies for managing anxiety-related disorders during and beyond pandemics. By addressing these challenges, clinicians will enhance mental health support and resilience in the face of future global health crises.

Beyond the clinical implications, the findings of this study contribute to the growing body of knowledge about the complex relationships between pandemic-related anxiety and anxiety-related symptoms and mechanisms. This study also supplies further empirical support for the theoretical base of anxiety mechanism contributing to individuals' experience of anxiety, particularly intolerance of uncertainty and disgust. This study better equips mental health professionals for future pandemics and increases our understanding of how anxiety may manifest during pandemics.

Role of funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval and informed consent

The study was approved by the [*redacted for anonymity*] Research Ethics Board. All participants were shown an online consent form detailing the nature of the study prior to the completion of the questionnaires.

CRediT authorship contribution statement

Layton J. Byam: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Alexander M. Penney:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare no competing interest.

Data availability

The datasets and/or analyses used during this study are available from the corresponding author upon reasonable request.

References

Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction, 20*, 1537–1545. https://doi.org/10.1007/s11469-020-00270-8

Alberts, N. M., Hadjistavropoulos, H. D., Jones, S. L., & Sharpe, D. (2013). The short health anxiety inventory: A systematic review and meta-analysis. *Journal of Anxiety Disorders, 27*(1), 68–78. https://doi.org/10.1016/j.janxdis.2012.10.009

Albery, I. P., Spada, M. M., & Nikčević, A. V. (2021). The COVID-19 anxiety syndrome and selective attentional bias towards COVID-19-related stimuli in UK residents during the 2020–2021 pandemic. *Clinical Psychology & Psychotherapy, 28*(6), 1367–1378. https://doi.org/10.1002/cpp.2639

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Arpaci, I., Karataş, K., & Baloğlu, M. (2020). The development and initial tests for the psychometric properties of the COVID-19 Phobia Scale (C19P-S). *Personality and Individual Differences, 164*, Article 110108. https://doi.org/10.1016/j.paid.2020110108

Asmundson, G. J., Paluszek, M. M., Landry, C. A., Rachor, G. S., McKay, D., & Taylor, S. (2020). Do pre-existing anxiety-related and mood disorders differentially impact COVID-19 stress responses and coping? *Journal of Anxiety Disorders, 74*, Article 102271. https://doi.org/10.1016/j.janxdis.2020.102271

Asmundson, G. J., Rachor, G., Drakes, D. H., Boehme, B. A., Paluszek, M. M., & Taylor, S. (2022). How does COVID stress vary across the anxiety-related disorders? Assessing factorial invariance and changes in COVID stress scale scores during the pandemic. *Journal of Anxiety Disorders*. , Article 102554. https://doi.org/10.1016/j.janxdis.2022.102554

Aydın, O., Balıkçı, K., Arslan, Y., Ünal-Aydın, P., Müezzin, E., & Spada, M. M. (2021). The combined contribution of fear and perceived danger of COVID-19 and metacognitions to anxiety levels during the COVID-19 pandemic. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 40*(3), 603–617. https://doi.org/10.1007/s10942-021-00429-9

Bailey, R., & Wells, A. (2015). Development and initial validation of a measure of metacognitive beliefs in health anxiety: The MCQ-HA. *Psychiatry Research, 230*(3), 871–877. https://doi.org/10.1007/s10608-015-9701-9

Bailey, R., & Wells, A. (2016). Is metacognition a causal moderator of the relationship between catastrophic misinterpretation and health anxiety? A prospective study. *Behaviour Research and Therapy, 78*, 43–50. https://doi.org/10.1016/j.brat.2016.01.002

Bakioğlu, F., Korkmaz, O., & Ercan, H. (2021). Fear of COVID-19 and positivity: Mediating role of intolerance of uncertainty, depression, anxiety, and stress. *International Journal of Mental Health and Addiction, 19*, 2369–2382. https://doi.org/10.1007/s11469-020-00331-y

Boswell, J. F., Farchione, T. J., Sauer-Zavala, S., Murray, H. W., Fortune, M. R., & Barlow, D. H. (2013). Anxiety sensitivity and interoceptive exposure: A transdiagnostic construct and change strategy. *Behavior Therapy, 44*(3), 417–431. https://doi.org/10.1016/j.beth.2013.03.006

Busetta, G., Campolo, M. G., Fiorillo, F., Pagani, L., Panarello, D., & Augello, V. (2021). Effects of COVID-19 lockdown on university students' anxiety disorder in Italy. *Genus, 77*(1), 1–16. https://doi.org/10.1186/s41118-021-00135-5

Carleton, R. N. (2016). Into the unknown: A review and synthesis of contemporary models involving uncertainty. *Journal of Anxiety Disorders, 39*, 30–43. https://doi.org/10.1016/j.janxdis.2016.02.007

Coelho, C. M., Suttiwan, P., Arato, N., & Zsido, A. N. (2020). On the nature of fear and anxiety triggered by COVID-19. *Frontiers in Psychology, 11*, Article 3109. https://doi.org/10.3389/fpsyg.2020.581314

Coloma-Carmona, A., & Carballo, J. L. (2021). Predicting PTSS in general population during COVID-19 pandemic: The mediating role of health anxiety. *Journal of Affective Disorders, 294*, 329–336. https://doi.org/10.1016/j.jad.2021.07.032

Dai, L., Bailey, R., & Deng, Y. (2018). The reliability and validity of the Chinese version of the metacognitions about health questionnaire in college students. *Quality of Life Research, 27*, 1099–1108. https://doi.org/10.1007/s11136-017-1780-5

Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behaviour Research and Therapy, 45*(9), 2110–2120. https://doi.org/10.1016/j.brat.2007.03.008

Deleurme, K. A., Parkinson, S. A., & Penney, A. M. (2023). Generalized anxiety disorder: Does the emotion dysregulation model predict symptoms beyond the metacognitive model? *Journal of Rational-Emotive & Cognitive Behavior Therapy, 41*, 710–726. https://doi.org/10.1007/s10942-022-00479-7

Dugas, M. J., & Koerner, N. (2005). Cognitive-behavioral treatment for generalized anxiety disorder: Current status and future directions. *Journal of Cognitive Psychotherapy, 19*(1), 61–81. https://doi.org/10.1891/jcop.19.1.61.66326

Edgell, S. E., & Noon, S. M. (1984). Effect of violation of normality on the *t* test of the correlation coefficient. *Psychological Bulletin, 95*(3), 576–583. https://doi.org/10.1037/0033-2909.95.3.576

Fergus, T. A., & Valentiner, D. P. (2009). The disgust propensity and sensitivity scale–revised: An examination of a reduced-item version. *Journal of Anxiety Disorders, 23*(5), 703–710. https://doi.org/10.1016/j.janxdis.2009.02.009

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The obsessive-compulsive inventory: Development and validation of a short version. *Psychological Assessment, 14*(4), 485–496. https://doi.org/10.1037/1040-3590.14.4.485

Fontenelle, L. F., & Miguel, E. C. (2020). The impact of COVID-19 in the diagnosis and treatment of obsessive-compulsive disorder. *Depression and Anxiety, 37*(6), 510–511. https://doi.org/10.1002/da.23037

Grant, J. E., Drummond, L., Nicholson, T. R., Fagan, H., Baldwin, D. S., Fineberg, N. A., & Chamberlain, S. R. (2021). Obsessive-compulsive symptoms and the COVID-19 pandemic: A rapid scoping review. *Neuroscience & Biobehavioral Reviews.*. https://doi.org/10.1016/j.neubiorev.2021.10.039

Grøtte, T., Solem, S., Myers, S. G., Hjemdal, O., Vogel, P. A., Güzey, I. C., … Fisher, P. (2016). Metacognitions in obsessive-compulsive disorder: A psychometric study of

the metacognitions Questionnaire-30. *Journal of Obsessive-Compulsive and Related Disorders, 11*, 82–90. https://doi.org/10.1016/j.jocrd.2016.09.002
Hajcak, G., Huppert, J. D., Simons, R. F., & Foa, E. B. (2004). Psychometric properties of the OCI-R in a college sample. *Behaviour Research and Therapy, 42*(1), 115–123. https://doi.org/10.1016/j.brat.2003.08.002
Han, C., Pae, C. U., Patkar, A. A., Masand, P. S., Kim, K. W., Joe, S. H., & Jung, I. K. (2009). Psychometric properties of the patient health questionnaire–15 (PHQ–15) for measuring the somatic symptoms of psychiatric outpatients. *Psychosomatics, 50*(6), 580–585. https://doi.org/10.1016/S0033-3182(09)70859-X
Hashemi, S. G. S., Hosseinnezhad, S., Dini, S., Griffiths, M. D., Lin, C. Y., & Pakpour, A. H. (2020). The mediating effect of the cyberchondria and anxiety sensitivity in the association between problematic internet use, metacognition beliefs, and fear of COVID-19 among Iranian online population. *Heliyon, 6*(10), Article e05135. https://doi.org/10.1016/j.heliyon.2020.e05135
Hayes, A. F. (1996). The permutation test is not distribution-free: Testing H_0: $\rho = 0$. *Psychological Methods, 1*(2), 184–198. https://doi.org/10.1037/1082-989X.1.2.184
Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). The Guilford Press.
Houck, P. R., Spiegel, D. A., Shear, M. K., & Rucci, P. (2002). Reliability of the self-report version of the panic disorder severity scale. *Depression and Anxiety, 15*(4), 183–185. https://doi.org/10.1002/da.10049
Jungmann, S. M., & Witthöft, M. (2020). Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety? *Journal of Anxiety Disorders, 73*, Article 102239. https://doi.org/10.1016/j.janxdis.2020.102239
Khosravani, V., Asmundson, G. J., Taylor, S., Bastan, F. S., & Ardestani, S. M. S. (2021). The Persian COVID stress scales (Persian-CSS) and COVID-19-related stress reactions in patients with obsessive-compulsive and anxiety disorders. *Journal of Obsessive-Compulsive and Related Disorders, 28*, Article 100615. https://doi.org/10.1016/j.jocrd.2020.100615
Kibbey, M. M., Fedorenko, E. J., & Farris, S. G. (2021). Anxiety, depression, and health anxiety in undergraduate students living in initial US outbreak "hotspot" during COVID-19 pandemic. *Cognitive Behaviour Therapy, 50*(5), 409–421. https://doi.org/10.1080/16506073.2020.1853805
Knowles, K. A., Jessup, S. C., & Olatunji, B. O. (2018). Disgust in anxiety and obsessive-compulsive disorders: Recent findings and future directions. *Current Psychiatry Reports, 20*(9), 1–10. https://doi.org/10.1007/s11920-018-0936-5
Knowles, K. A., & Olatunji, B. O. (2021). Anxiety and safety behavior usage during the COVID-19 pandemic: The prospective role of contamination fear. *Journal of Anxiety Disorders, 77*, Article 102323. https://doi.org/10.1016/j.janxdis.2020.102323
Kroenke, K., Spitzer, R. L., & Williams, J. B. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine, 64*(2), 258–266. https://doi.org/10.1097/00006842-200203000-00008
Lee, S. A. (2020). Coronavirus anxiety scale: A brief mental health screener for COVID-19 related anxiety. *Death Studies, 44*(7), 393–401. https://doi.org/10.1080/07481187.2020.1748481
Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., & Herzberg, P. Y. (2008). Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. *Medical Care, 44*(3), 266–274. https://doi.org/10.1097/mlr.0b013e318160d093
Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy, 36*(4), 455–470. https://doi.org/10.1016/S0005-7967(97)10031-6
McKay, D., Yang, H., Elhai, J., & Asmundson, G. J. (2020). Anxiety regarding contracting COVID-19 related to interoceptive anxiety sensations: The moderating role of disgust propensity and sensitivity. *Journal of Anxiety Disorders, 73*, Article 102233. https://doi.org/10.1016/j.janxdis.2020.102233
Mertens, G., Duijndam, S., Smeets, T., & Lodder, P. (2021). The latent and item structure of COVID-19 fear: A comparison of four COVID-19 fear questionnaires using SEM and network analyses. *Journal of Anxiety Disorders, 81*, Article 102415. https://doi.org/10.1016/j.janxdis.2021.102415
Mertens, G., Gerritsen, L., Duijndam, S., Salemink, E., & Engelhard, I. M. (2020). Fear of the coronavirus (COVID-19): Predictors in an online study conducted in March 2020. *Journal of Anxiety Disorders, 74*, Article 102258. https://doi.org/10.1016/j.janxdis.2021.102415
Meșterelu, I., Rîmbu, R., Blaga, P., & Stefan, S. (2021). Obsessive-compulsive symptoms and reactions to the COVID-19 pandemic. *Psychiatry Research, 302*, Article 114021. https://doi.org/10.1016/j.psychres.2021.114021
Montano, R. L. T., & Acebes, K. M. L. (2020). Covid stress predicts depression, anxiety and stress symptoms of Filipino respondents. *International Journal of Research in Business and Social Science, 9*(4), 78–103. https://doi.org/10.20525/ijrbs.v9i4.773
Morey, L. C. (1991). *The personality assessment inventory professional manual.* Psychological Assessment Resources.
Nordahl, H., & Wells, A. (2017). Testing the metacognitive model against the benchmark CBT model of social anxiety disorder: Is it time to move beyond cognition? *PLoS One, 12*(5), Article e0177109. https://doi.org/10.1371/journal.pone.0177109
Ojalehto, H. J., Abramowitz, J. S., Hellberg, S. N., Butcher, M. W., & Buchholz, J. L. (2021). Predicting COVID-19-related anxiety: The role of obsessive-compulsive symptom dimensions, anxiety sensitivity, and body vigilance. *Journal of Anxiety Disorders, 83*, Article 102460. https://doi.org/10.1016/j.janxdis.2021.102460
Olatunji, B. O., Cisler, J. M., Deacon, B. J., Connolly, K., & Lohr, J. M. (2007). The disgust propensity and sensitivity scale-revised: Psychometric properties and specificity in relation to anxiety disorder symptoms. *Journal of Anxiety Disorders, 21*(7), 918–930. https://doi.org/10.1016/j.janxdis.2006.12.005
Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Tolin, D. F. (2007). Multimodal assessment of disgust in contamination-related obsessive-compulsive disorder. *Behaviour Research and Therapy, 45*(2), 263–276. https://doi.org/10.1016/j.brat.2006.03.004
Osman, A., Gutierrez, P. M., Barrios, F. X., Kopper, B. A., & Chiros, C. E. (1998). The social phobia and social interaction anxiety scales: Evaluation of psychometric properties. *Journal of Psychopathology and Behavioral Assessment, 20*, 249–264. https://doi.org/10.1023/A:1023067302227
Paluszek, M. M., Asmundson, A. J., Landry, C. A., McKay, D., Taylor, S., & Asmundson, G. J. (2021). Effects of anxiety sensitivity, disgust, and intolerance of uncertainty on the COVID stress syndrome: A longitudinal assessment of transdiagnostic constructs and the behavioural immune system. *Cognitive Behaviour Therapy, 50*(3), 191–203. https://doi.org/10.1080/16506073.2021.1877339
Panteleimon, V., Dialechti, K. M., Aliki, N. V., Prodromos, T., Eleni, P., Vasiliki, H., & Ioannis, D. (2021). A systematic review of questionnaires assessing the psychological impact of COVID-19. *Psychiatry Research, 305*, Article 114183. https://doi.org/10.1016/j.psychres.2021.114183
Penney, A. M., Rachor, G. S., & Deleurme, K. A. (2020). Differentiating the roles of intolerance of uncertainty and negative beliefs about worry across emotional disorders. *Journal of Experimental Psychopathology, 11*(4), 1–22. https://doi.org/10.1177/2043808720970072
Perna, G., & Caldirola, D. (2020). COVID-19 and panic disorder: Clinical considerations for the most physical of mental disorders. *Brazilian Journal of Psychiatry, 43*, 110–111. https://doi.org/10.1590/1516-4446-2020-1235
Perz, C. A., Lang, B. A., & Harrington, R. (2020). Validation of the fear of COVID-19 scale in a US college sample. *International Journal of Mental Health and Addiction, 20*, 273–283. https://doi.org/10.1007/s11469-020-00356-3
Reiss, S., Peterson, R. A., Gursky, D. M., & McNally, R. J. (1986). Anxiety sensitivity, anxiety frequency and the prediction of fearfulness. *Behaviour Research and Therapy, 24*(1), 1–8. https://doi.org/10.1016/0005-7967(86)90143-9
Rozin, P., Haidt, J., & McCauley, C. R. (2000). Disgust. In M. Lewis, & J. M. Haviland (Eds.), *Handbook of emotions* (2nd ed., pp. 637–653). Guilford Press.
Saint, S. A., & Moscovitch, D. A. (2021). Effects of mask-wearing on social anxiety: An exploratory review. *Anxiety, Stress, & Coping, 34*(5), 487–502. https://doi.org/10.1080/10615806.2021.1929936
Salkovskis, P. M., Rimes, K. A., Warwick, H. M. C., & Clark, D. M. (2002). The health anxiety inventory: Development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological Medicine, 32*, 843–853. doi: 10.1017}S0033291702005822.
Satici, B., Saricali, M., Satici, S. A., & Griffiths, M. D. (2020). Intolerance of uncertainty and mental wellbeing: Serial mediation by rumination and fear of COVID-19. *International -Journal of Mental Health and Addiction, 15*, 1–12. https://doi.org/10.1007/s11469-020-00305-0
Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092
Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson Education.
Taylor, S. (2019). *The psychology of pandemics: Preparing for the next global outbreak of infectious disease.* Cambridge Scholars Publishing.
Taylor, S., & Asmundson, G. J. (2004). *Treating health anxiety: A cognitive-behavioral approach.* Guilford Press.
Taylor, S., Landry, C., Paluszek, M., Fergus, T. A., McKay, D., & Asmundson, G. J. (2020). Development and initial validation of the COVID stress scales. *Journal of Anxiety Disorders, 72*, Article 102232. https://doi.org/10.1016/j.janxdis.2020.102232
Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., … Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment, 19*(2), 176–188. https://doi.org/10.1037/1040-3590.19.2.176
Thibodeau, M. A., Carleton, R. N., McEvoy, P. M., Zvolensky, M. J., Brandt, C. P., Boelen, P. A., … Asmundson, G. J. (2015). Developing scales measuring disorder-specific intolerance of uncertainty (DSIU): A new perspective on transdiagnostic. *Journal of Anxiety Disorders, 31*, 49–57. https://doi.org/10.1016/j.janxdis.2015.01.006
Tull, M. T., Edmonds, K. A., Scamaldo, K. M., Richmond, J. R., Rose, J. P., & Gratz, K. L. (2020). Psychological outcomes associated with stay-at-home orders and the perceived impact of COVID-19 on daily life. *Psychiatry Research, 289*, Article 113098. https://doi.org/10.1016/j.psychres.2020.113098
Waqas, M., Hania, A., & Hongbo, L. (2020). Psychological predictors of anxious responses to the COVID-19 pandemic: Evidence from Pakistan. *Psychiatry Investigation, 17*(11), 1096. https://doi.org/10.30773/pi.2020.0167
Warren, A. M., Zolfaghari, K., Fresnedo, M., Bennett, M., Pogue, J., Waddimba, A., … Powers, M. B. (2021). Anxiety sensitivity, COVID-19 fear, and mental health: Results from a United States population sample. *Cognitive Behaviour Therapy, 50*(3), 204–216. https://doi.org/10.1080/16506073.2021.1874505
Wells, A., & Cartwright-Hatton, S. (2004). A short form of the metacognitions questionnaire: Properties of the MCQ-30. *Behaviour Research and Therapy, 42*(4), 385–396. https://doi.org/10.1016/S0005-7967(03)00147-5
Wheaton, M. G., Deacon, B. J., McGrath, P. B., Berman, N. C., & Abramowitz, J. S. (2012). Dimensions of anxiety sensitivity in the anxiety disorders: Evaluation of the ASI-3. *Journal of Anxiety Disorders, 26*(3), 401–408. https://doi.org/10.1016/j.janxdis.2012.01.002
Wheaton, M. G., Messner, G. R., & Marks, J. B. (2021). Intolerance of uncertainty as a factor linking obsessive-compulsive symptoms, health anxiety and concerns about the spread of the novel coronavirus (COVID-19) in the United States. *Journal of Obsessive-Compulsive and Related Disorders, 28*, Article 100605. https://doi.org/10.1016/j.jocrd.2020.100605

World Health Organization. (2023). WHO coronavirus (COVID-19) dashboard. Retrieved June 30, 2023, from https://covid19.who.int/.

Wright, K. D., Lebell, M. A. A., & Carleton, R. N. (2016). Intolerance of uncertainty, anxiety sensitivity, health anxiety, and anxiety disorder symptoms in youth. *Journal of Anxiety Disorders, 41*, 35–42. https://doi.org/10.1016/j.janxdis.2016.04.011

Zvolensky, M. J., Kauffman, B. Y., Garey, L., Viana, A. G., & Matoska, C. T. (2022). Interoceptive anxiety-related processes: Importance for understanding COVID-19 and future pandemic mental health and addictive behaviors and their comorbidity. *Behaviour Research and Therapy, 156*, Article 104141. https://doi.org/10.1016/j.brat.2022.104141