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# Clinically significant fear and anxiety of COVID-19: A psychometric examination of the Coronavirus Anxiety Scale



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## ABSTRACT

The present study examined the psychometric properties of the Coronavirus Anxiety Scale (CAS) using an online survey of 398 adult Amazon MTurk workers in the U.S. Confirmatory factor analyses demonstrated that the CAS measures a reliable ( $\alpha = 0.92$ ), unidimensional construct with a structure that was shown to be invariant across gender, race, and age. Construct validity was demonstrated with correlations between CAS scores and demographics, coronavirus diagnosis, history of anxiety, coronavirus fear, functional impairment, alcohol/drug coping, religious coping, hopelessness, suicidal ideation, as well as social attitudes (e.g., satisfaction with President Trump). The CAS also demonstrated solid discrimination ability for functional impairment (AUC = 0.88), while the original cut score of  $\geq 9$  (76% sensitivity and 90% specificity) showed the strongest diagnostic effectiveness among scores. Overall, these findings are largely consistent with the results of the first CAS investigation and support the validity of this mental health screener for COVID-19 related research and practice.

## 1. Introduction

A novel viral pneumonia originating from China was announced to the World Health Organization on December 31, 2019 (World Health Organization, 2020b). As of March 26, 2020, there were 465,915 confirmed cases and 21,031 confirmed deaths from this coronavirus disease (COVID-19) across the globe (World Health Organization, 2020a). This pandemic has rapidly and profoundly affected every part of daily life, from the way people work, live, shop, socialize, and plan for the future. Although the psychological impact of these changes has been well documented by the media, the mental health care needs of those suffering from this crisis have been relatively neglected (Xiang et al., 2020). This is surprising, given that research on previous global disease outbreaks has shown that people suffering from pandemic-related anxiety tend to exhibit elevated levels of post-traumatic stress, general stress, anxiety, health anxiety, and suicidality (Chong et al., 2004; Wheaton et al., 2012; Wu et al., 2009; Yip et al., 2010). Therefore, the Coronavirus Anxiety Scale (CAS; Lee, 2020) was recently created to help identify those particularly affected by the fear and uncertainty of this growing pandemic crisis (see Table 1).

The CAS is a 5-item mental health screener designed to efficiently and effectively aid healthcare professionals and researchers identify probable cases of dysfunctional anxiety associated with the COVID-19 crisis (Lee, 2020). Each item of the CAS taps a distinct physiologically-

based fear or anxiety reaction to coronavirus related thoughts or information. It is important to note that coronavirus anxiety has also been referred to as “coronaphobia” in this emerging line of research (Asmundson and Taylor, 2020). The CAS was developed using online data of 775 adults who experienced significant anxiety over the infectious disease outbreak. In the study, the CAS demonstrated solid reliability ( $\alpha_s = 0.93$  for both an exploratory factor analysis subsample and a confirmatory factor analysis subsample), validity (i.e., factorial and construct-related), and measurement equivalence across age, race, and gender. CAS scores were found to be correlated with coronavirus diagnosis, impairment, alcohol/drug coping, religious coping, hopelessness, suicidal ideation, as well as attitudes toward President Trump and Chinese food/products. These correlations support the CAS as a measure of mental health because coronavirus anxiety was related to clinically significant disturbances across psychological, interpersonal, and behavioral processes (Lee, 2020). The CAS exhibited good diagnostic properties (AUC = 0.94,  $p < .001$ ) and with an optimized cut score of  $\geq 9$ , it has been able to accurately distinguish between persons with and without dysfunctional anxiety (90% sensitivity and 85% specificity). Although these findings are promising, there have been no other studies to date that examined the reliability of these results. Independent studies investigating the psychometric properties of the CAS are absolutely essential for establishing the scientific legitimacy of this instrument. Thus, the purpose of this study was to examine the

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**Table 1**  
Coronavirus Anxiety Scale.

CAS	How often have you experienced the following activities over the last 2 weeks?				
	Not at all	Rare, less than a day or two	Several days	More than 7 days	Nearly every day over the last 2 weeks
1. I felt dizzy, lightheaded, or faint, when I read or listened to news about the coronavirus.	0	1	2	3	4
2. I had trouble falling or staying asleep because I was thinking about the coronavirus.	0	1	2	3	4
3. I felt paralyzed or frozen when I thought about or was exposed to information about the coronavirus.	0	1	2	3	4
4. I lost interest in eating when I thought about or was exposed to information about the coronavirus.	0	1	2	3	4
5. I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus.	0	1	2	3	4
Column Totals	±	±	±	±	±
Total Score	_____				

Note. The CAS was created by Sherman A. Lee, PhD. (2020) and originally published in the journal *Death Studies*, 44(7). <https://doi.org/10.1080/07481187.2020.1748481>

**Table 2**  
Characteristics of participants.

Characteristic	Number (%)
Age	
18 to 29	138 (34.7%)
≥ 30	260 (65.3%)
Gender	
Male	207 (52%)
Female	191 (49%)
Race	
White	286 (71.9%)
Black	47 (11.8%)
Asian	36 (9.0%)
Hispanic	26 (6.5%)
Other	3 (0.8%)
U.S. Region	
South	150 (37.7%)
Northeast	93 (23.4%)
West	84 (21.1%)
Midwest	71 (17.8%)
Education	
Less than a Bachelor's degree	145 (36.4%)
Bachelor's degree or higher	253 (63.6%)
Diagnosed with coronavirus	
No	364 (91.5%)
Yes	34 (8.5%)
History of Anxiety	
No	264 (66.3%)
Yes	134 (33.7%)
Total	398 (100%)

reliability and validity of the CAS using an online sample of 398 adults.

## 2. Methods

### 2.1. Design

Online survey data from 398 adults that were collected from March 23 to 24, 2020, were used in this IRB approved study. The participants were recruited through Amazon MTurk in exchange for payment (\$0.50) and were eligible if they provided consent, complete information, and followed the directions to a validity item.

### 2.2. Participants

The study's sample consisted of 207 men and 191 women with a combined mean age of 35.91 (*SD* = 11.73) years (see Table 2). Most of the participants were White (*n* = 286; 71.9%), resided in the South region of the U.S. (*n* = 150; 37.7%), educated with a Bachelor's degree or higher (*n* = 253; 63.6%), had not been diagnosed with coronavirus (*n* = 364; 91.5%), and reported that they had never suffered from or sought treatment for anxiety (*n* = 264; 66.3%).

Over the past two weeks, most of the participants spent 7 hours or more (*n* = 169; 42.5%), followed by 1 to 3 hours (*n* = 76; 19.1%), 5 to 7 hours (*n* = 72; 18.1%), 3 to 5 hours (*n* = 61; 15.3%), and less than 1 hour (*n* = 20; 5.0%) thinking about and/or watching media about the coronavirus. In terms of significant anxiety, fear, or worry about the coronavirus during the past two weeks, most of the participants spent several days feeling elevated anxiety (*n* = 133; 33.4%), followed by nearly every day feeling elevated anxiety (*n* = 86; 21.6%), less than a day or two feeling elevated anxiety (*n* = 82; 20.6%), more than seven days feeling elevated anxiety (*n* = 70; 17.6%), and never feeling elevated anxiety (*n* = 27; 6.8%).

### 2.3. Measures

#### 2.3.1. Basic information

Participants were asked to report their age, gender, ethnicity, education, current residency, coronavirus diagnosis, and history of anxiety.

### 2.3.2. Inattention

Participants were asked to choose, using a 5-point time anchored scale (0 = *not at all* to 4 = *nearly every day over the last 2 weeks*), the rating of "2" as the item response. To ensure quality data, twelve participants were eliminated from the study for not appropriately attending to the directions of this item (Barger et al., 2011).

### 2.3.3. Psychological effects

Participants were asked to rate, using a 5-point time anchored scale (0 = *not at all* to 4 = *nearly every day over the last 2 weeks*), how often they experienced the psychological effects of the coronavirus outbreak. Coronavirus preoccupation ( $M = 3.74$ ;  $SD = 1.32$ ) was measured by the item, "Over the last 2 weeks, how much time did you spend thinking about and/or watching media about coronavirus?" Coronavirus fear ( $M = 3.27$ ;  $SD = 1.20$ ) was measured by the item, "Over the last 2 weeks, how often have you experienced significant anxiety, fear, or worry about coronavirus?" Extreme hopelessness ( $M = 1.31$ ;  $SD = 1.26$ ) was measured by the item, "After thinking about the coronavirus, I felt extremely hopeless about the future." Passive suicidal ideation ( $M = 0.75$ ;  $SD = 1.18$ ) was measured by the item, "I wished I was already dead so I did not have to deal with the coronavirus."

### 2.3.4. Maladaptive coping

Participants were asked to rate, using a 5-point time anchored scale (0 = *not at all* to 4 = *nearly every day over the last 2 weeks*), how frequently they engaged in maladaptive forms of coping with the coronavirus crisis. Negative religious coping ( $M = 0.90$ ;  $SD = 1.25$ ) was measured by the item, "After thinking about the coronavirus, I wondered if God was angry with or had abandoned some people." Alcohol/drug coping ( $M = 1.03$ ;  $SD = 1.30$ ) was measured by the item, "I used alcohol or other drugs to help me get through the fear and/or anxiety caused by the coronavirus."

### 2.3.5. Social attitudes

Participants were asked to rate, using a 5-point scale (1 = *very dissatisfied* to 5 = *very satisfied*), their satisfaction with President Trump ( $M = 2.82$ ;  $SD = 1.53$ ) by the item, "Overall, how satisfied are you with President Donald Trump's responses to coronavirus?" Participants were asked to rate, using a 5-point scale (1 = *very unlikely* to 5 = *very likely*), their likelihood of avoiding Chinese food/products ( $M = 2.54$ ;  $SD = 1.51$ ) by the item, "How likely will you avoid eating Chinese food or avoid purchasing Chinese products because of the coronavirus?" Participants were asked to rate, using a 5-point scale (1 = *very unlikely* to 5 = *very likely*), their likelihood of changing future plans ( $M = 4.07$ ;  $SD = 1.22$ ) by the item, "How likely will you change your future travel, vacation, or shopping plans because of the coronavirus?"

### 2.3.6. Functional impairment

An adapted version of Mundt, Marks, Shear, and Greist's (2002) Work and Social Adjustment Scale (WSAS) was used to measure functional impairment ( $\alpha = .88$ ). Participants were asked to rate five items of WSAS, using a 9-point severity scale (0 = *not at all* to 8 = *very severely*), how much impairment they experienced because of their fear or anxiety over the coronavirus [e.g., "Because of my fear or anxiety about coronavirus, my home management (cleaning, tidying, shopping, cooking, looking after home or children, paying bills) is impaired"]. According to Mundt et al., (2002) analysis, WSAS scores  $\geq 21$  suggest moderately severe or worse psychopathology. Therefore, using this cut score, 31.7% of the sample were classified as functionally impaired due to their fear or anxiety over the coronavirus.

### 2.3.7. Dysfunctional coronavirus anxiety

Dysfunctional coronavirus related fear and anxiety were measured using the five-item long, Coronavirus Anxiety Scale (CAS; Lee, 2020). The CAS items, which are based on the psychology of fear and anxiety literature (American Psychiatric Association, 2013; Barlow, 1991;

Cosmides & Tooby, 2000; Ekman, 2003; Ohman, 2000), measure physiologically-based symptoms that are aroused with coronavirus related information and thoughts. Using a 5-point time anchored scale (0 = *not at all* to 4 = *nearly every day over the last 2 weeks*), participants rated how frequently they experienced each anxiety symptom (e.g., "I felt dizzy, lightheaded, or faint, when I read or listened to news about the coronavirus").

## 2.4. Statistical Approach

A series of bootstrap (2000 samples) maximum likelihood confirmatory factor analyses (CFAs) were run on the CAS to test the instrument's factor structure and invariance across demographic groups. Conventional standards were used to determine goodness of fit and invariance (Brown, 2006; Byrne, 2001). Specifically, acceptable fit for a CFA model was defined by a standardized root-mean-square residual (SRMR) value  $\leq 0.05$ , root-mean-square-error of approximation (RMSEA) value  $\leq 0.10$ , and comparative fit index (CFI) and Tucker Lewis index (TLI) values  $\geq 0.90$ . Invariance was defined by acceptable model fit statistics as well as a non-significant value ( $p \geq .05$ ) on a chi-square difference test.

A receiver operating characteristic (ROC) analysis was used to examine the diagnostic accuracy of the CAS to identify functionally impaired adults and test whether or not the cut-off value of  $\geq 9$  proposed by the original CAS investigation (Lee, 2020) continues to be an optimal score for psychiatric screening. Based on the results of previous psychiatric screening tests (Spitzer et al., 2006; van Dam et al., 2013; Weinstein et al., 1989) and diagnostic criteria (Schisterman et al., 2005; Simundic, 2009), the following guidelines were used: (1) area under the curve (AUC) value  $\geq .70$ , (2) a convex shaped ROC curve, and (3) the optimal cut-score should have a sensitivity value  $\geq 80\%$ , specificity value  $\geq 70\%$ , and yield the highest Youden index, which is a commonly used measure of overall diagnostic effectiveness. All of the statistical analyses were calculated using SPSS version 26.0, except for the CFAs, which were run using AMOS version 25.0.

## 3. Results

### 3.1. Confirmatory factor analyses

A preliminary screening of the data suggested that the CAS items were suitable for factor analysis (Tabachnick & Fidell, 2001). Specifically, the data did not have issues pertaining to sample size, missing data, nonnormality, multicollinearity, or singularity. Moreover, the correlation matrices were deemed factorable (Bartlett's test of sphericity =  $p < .001$ ; Kaiser-Meyer-Olkin test = 0.88).

A CFA was run to test whether or not the five symptoms identified in the original CAS investigation (Lee, 2020) cohered together into a single, coronavirus anxiety construct. The current study's results were consistent with the original CAS investigation findings (Lee, 2020) by demonstrating that the single-factor model was highly reliable ( $\alpha = 0.92$ ) and yielded excellent fit [ $\chi^2(5) = 25.20$ ,  $p < .001$ ] for all of the indices [CFI = .99; TLI = .99; SRMR = 0.02; RMSEA = 0.10 (.06, .14; 90% CI)].

Multigroup CFAs were run to examine if the coronavirus anxiety construct was being measured the same way across the demographic variables of gender (women vs. men), age (18 to 29 vs. 30 and older), and race (Whites vs. non-Whites). The results demonstrated no gender differences, which were evidenced by excellent model fit [ $\chi^2(10) = 34.48$ ,  $p < .001$ ] for all of the indices [CFI = .98; TLI = 0.97; SRMR = 0.02; RMSEA = 0.08 (.05, .11; 90% CI)] and a non-significant increase in  $\chi^2$  value [ $\Delta\chi^2(5) = 8.02$ ,  $p = 0.16$ , *ns*] between the models. The results demonstrated no age differences, which were evidenced by excellent model fit [ $\chi^2(10) = 35.33$ ,  $p < .001$ ] for all of the indices [CFI = 0.98; TLI = 0.96; SRMR = 0.02; RMSEA = .08 (0.05, .11; 90% CI)] and a non-significant increase in  $\chi^2$

ROC Curve

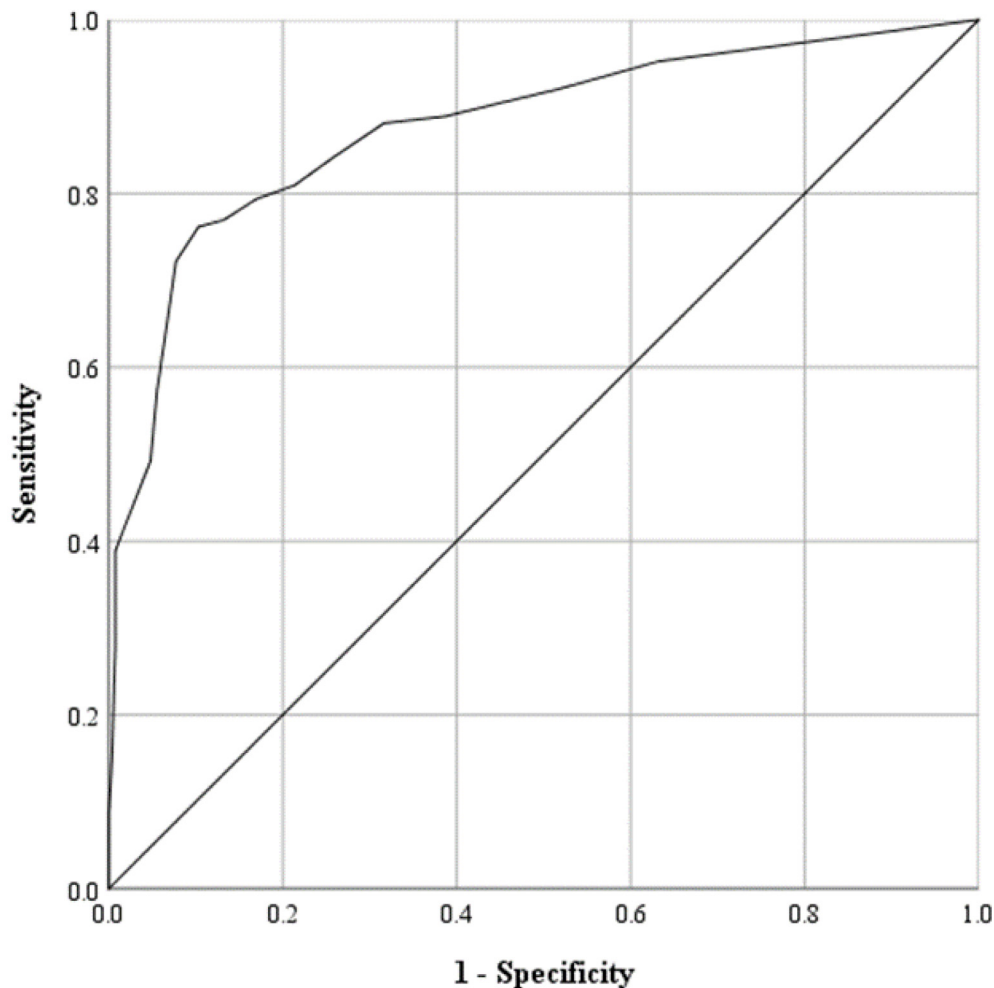


Fig. 1. ROC curve.

value [ $\Delta\chi^2(5) = 9.90, p = 0.08, ns$ ] between the models. The results demonstrated no race differences, which were evidenced by excellent model fit [ $\chi^2(10) = 28.31, p < .01$ ] for all of the indices [CFI = 0.99; TLI = .97; SRMR = 0.02; RMSEA = 0.07 (.04,.10; 90% CI)] and a non-significant increase in  $\chi^2$  value [ $\Delta\chi^2(5) = 2.97, p = 0.71, ns$ ] between the models. These results confirmed the findings of the original CAS investigation which showed that the CAS factor structure was invariant across race, gender, and age.

3.2. Receiver operating characteristic analyses

Receiver operating characteristic (ROC) analyses were used to evaluate the diagnostic viability of the CAS as a mental health screening tool, as well as determine a cut score that best distinguishes individuals who experience clinically significant impairment because of coronavirus anxiety (individuals who scored  $> 20$  on the WSAS) from those who were not impaired by this form of anxiety. The ROC graph displayed the convex pattern that is indicative of good discrimination ability (see Figure 1), while the area under the curve (AUC) demonstrated solid diagnostic accuracy for the CAS (AUC = .88,  $p < .001$ ).

The results of the ROC analysis also showed that the CAS score  $\geq 9$ , which is based on the results of the original CAS investigation, yielded the highest Youden index among cut scores (see Table 3). However, this cut score also yielded a sensitivity of 76%, which was below the 80% proposed guideline, and a specificity of 90%, which exceeded both the

Table 3

Operating characteristics of various CAS cutpoints for diagnosing functional impairment.

CAS total score	Sensitivity (%)	Specificity (%)	Youdon Index
4	88	68	56
5	84	74	58
6	81	79	60
7	79	83	62
8	77	87	64
9	76	90	66
10	72	92	64
11	57	93	50

Note.  $N = 398$ . Area under the curve value is .88.

proposed criterion of 70% and original CAS investigation finding of 85%. Although the sensitivity of the  $\geq 9$  cut score was just below the recommended criterion, the overall diagnostic superiority of this cut-point over the other CAS scores, coupled with its excellent false positive rate of 10%, continues to make this the optimal score to use for classifying individuals with functional impairment due to coronavirus related anxiety.

3.3. Mean differences analyses

An analysis of variance (ANOVA) showed that there was a race



**Table 4**  
Zero-order correlations.

Variables	CAS
Age	-0.17**
Gender	0.16**
Race (Whites)	-0.00
Race (Blacks)	-0.14**
Race (Hispanics)	-0.13**
Race (Asians)	-0.01
Race (Other)	-0.03
Education	0.23***
Diagnosis	0.34***
Anxiety	0.17**
Fear	0.35***
Preoccupation	-0.06
Impairment	0.73***
Alcohol	0.55***
Religious	0.72***
Hopelessness	0.68***
Suicidal	0.71***
Trump	0.22***
Chinese	0.34***
Plans	-0.01

Note.  $N = 398$ ; CAS = Coronavirus Anxiety Scale total score; Gender (0 = male; 1 = female); Race (0 = non-race group; 1 = race group); Education (0 = Less than a Bachelor's degree; 1 = Bachelor's degree and higher); Diagnosis (0 = not diagnosed with coronavirus; 1 = diagnosed with coronavirus); Anxiety (0 = no history of anxiety; 1 = history of anxiety); Fear = frequency of fear, anxiety, or worry about coronavirus during the past 2 weeks; Preoccupation = frequency of time spent thinking about and/or watching media about coronavirus during the past 2 weeks; Impairment = WSAS total score; Alcohol = alcohol or drug coping; Religious = negative religious coping; Hopelessness = extreme hopelessness; Suicidal = passive suicidal ideation; Trump = satisfaction with President Trump's responses; Chinese = likelihood of avoiding Chinese food/products; Plans = likelihood of changing future plans (e.g., vacation).

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$

difference in CAS scores,  $F(4,393) = 3.35, p < .05$ . Post hoc analysis using the Games-Howell criterion for significance indicated that Blacks ( $M = 7.26$ ;  $SD = 5.71$ ) had significantly higher CAS scores than Asians ( $M = 3.11$ ;  $SD = 3.70$ ). This pattern was opposite from what was found in the original CAS investigation where Asians had higher CAS scores than Blacks and Whites. No other race differences were found in CAS scores.

Independent samples  $t$ -tests revealed that those who were diagnosed ( $M = 11.06$ ;  $SD = 4.13$ ) with coronavirus had higher CAS scores than those who were not diagnosed ( $M = 4.76$ ;  $SD = 5.04$ ) with the infection,  $t(42.74) = 8.35, p < .001$ , while those who had a history of anxiety ( $M = 6.56$ ;  $SD = 5.24$ ) had higher CAS scores than those who did not ( $M = 4.65$ ;  $SD = 5.17$ ),  $t(264.24) = 3.45, p < .01$ . Women ( $M = 6.19$ ;  $SD = 5.19$ ) had higher CAS scores compared to men ( $M = 4.46$ ;  $SD = 5.20$ ),  $t(393.55) = 3.32, p < .01$ , while correlation analysis (see Table 4) showed that younger adults and people with higher education reported higher CAS scores than their counterparts. All of these patterns were consistent with the findings of the original CAS investigation, except for the small gender and history of anxiety effects, which were not found previously.

### 3.4. Correlations

Correlation analyses were also used to examine the relationships

between CAS scores and measures of impairment, psychological distress, and maladaptive coping. CAS scores were found to be positively correlated with functional impairment, worry about coronavirus, alcohol or drug coping, negative religious coping, extreme hopelessness, passive suicidal ideation, approval of President Trump's responses to the coronavirus outbreak, and likelihood of avoiding Chinese food and products in the future. There were no relationships found between CAS scores and frequency thinking about or being exposed to coronavirus information, and likelihood of changing future plans. Overall, these patterns were generally consistent with the results of the original CAS investigation and support the construct validity of the instrument.

## 4. Discussion

The purpose of this study was to reevaluate the psychometric properties of the Coronavirus Anxiety Scale (CAS), which is, to the best of our knowledge, the first published measure of COVID-19 related psychopathology (Lee, 2020). In the original investigation of the CAS, the instrument was shown to be highly reliable ( $\alpha = .93$ ), with a stable and invariant factor structure (Lee, 2020). Moreover, the diagnostic qualities of the CAS were shown to be comparable to other psychiatric screening tests (Spitzer et al., 2006; van Dam et al., 2013; Weinstein et al., 1989). The results of the present study largely confirm the findings of the original investigation of the CAS, which demonstrated that the CAS is a scientifically valid and practical, mental health screener for dysfunctional coronavirus related fear and anxiety.

The most robust findings in this study were the results of the confirmatory factor analyses. Specifically, a CFA showed that the 5 physiologically-based reactions (e.g., tonic immobility) to coronavirus related thoughts or information that make up the CAS, cohere together into a stable, unidimensional factor structure. Multiple group CFAs also showed that the CAS measures coronavirus related fear and anxiety in a similar way across age, gender, and race groups. Not only did these results replicate the findings of the original CAS research, they were also in keeping with other factor invariance studies of anxiety measures as well (Bunnell et al., 2013; Kyriazos et al., 2018; Madrigal et al., 2018).

The ROC analyses also supported the diagnostic accuracy of the CAS. Specifically, the ROC curve displayed both the desired convex shape and an AUC score of .88 which are both indicative of a "good" test of discriminative power (Simundic, 2009). The cut-off value of  $\geq 9$  proposed by the original CAS investigation was also found to be an optimal score for psychiatric screening because it yielded the highest Youden index among the scores. This cut-off value also demonstrated a 10% false positive rate, which is better than the 15% rate reported in the original CAS investigation. However, the sensitivity rate of 76% was below the proposed guideline of 80% and much lower than the 90% found in the original CAS study.

This difference in sensitivity rates may be influenced by the fact that the sample in the original CAS study was restricted to anxious adults, while the current study was open to and received participants from the entire range of coronavirus related anxiety (i.e., none to nearly everyday anxiety). Consequently, the proportion of participants suffering from dysfunctional levels of coronavirus anxiety was much smaller for the current study (31.2%) than the original CAS study (54.8%; Lee, 2020). Despite this relative weaker detection rate, it is important to note that a 76% sensitivity rate is still comparable to values reported with other mental health screenings tests, such as the General Health Questionnaire (77% sensitivity; Weinstein et al., 1989), the Center for Epidemiological Studies Depression Scale (76.5% sensitivity; Shean and Baldwin, 2008), the State Trait Inventory for Cognitive and Somatic Anxiety (73% sensitivity; van Dam et al., 2013), and the Distress Thermometer (70% sensitivity; Jacobsen et al., 2005).

Because coronavirus anxiety, otherwise known as coronaphobia (Asmundson and Taylor, 2020), is an emotion construct based on fear and anxiety (APA, 2013; Barlow, 1991; Cosmides and Tooby, 2000;

Ekman, 2003; Ohman, 2000), CAS scores were expected to be associated with negative psychological effects and maladaptive coping with the COVID-19 crisis. The results supported these expectations with CAS scores being positively correlated with functional impairment, fear about coronavirus, alcohol or drug coping, negative religious coping, extreme hopelessness, and passive suicidal ideation. The only unexpected finding was the lack of correlation between the CAS scores and time spent thinking about and/or watching media about coronavirus. This may be due to the fact that the topic of coronavirus saturated media reports when the data for this study was collected (March 23<sup>rd</sup> and 24<sup>th</sup>, 2020). Despite this one discrepancy, the findings not only support the construct validity of the CAS by demonstrating clear links with indices of maladjustment and distress, but replicate the findings of the original CAS investigation as well.

The results of this study also revealed significant sociodemographic and background differences in CAS scores. Specifically, the participants who were younger, more educated, and were diagnosed with coronavirus, had higher CAS scores compared to their counterparts. These findings replicated the original CAS investigation results. Although the findings that women and those with a history of anxiety exhibited slightly higher CAS scores compared to their counterparts was not found in the original CAS investigation, these findings are understandable because they are known risk factors for various anxiety disorders (APA, 2013).

Another unexpected finding was that while Blacks had higher CAS scores than Asians in this study, Asians had higher CAS scores than Blacks in the original CAS investigation (Lee, 2020). This change in coronavirus anxiety may have to do with the fact that the coronavirus spread at a much higher and lethal rate in the Black community relative to other communities toward the end of March 2020, when this study was conducted (Johnson and Buford, 2020). Asians, on the other hand, did not show elevated rates of coronavirus in their communities during this period of time and therefore did not show signs of considerable coronavirus anxiety. The high coronavirus anxiety observed among Asians, living in the U.S. earlier in March 2020 when the coronavirus was beginning to spread in the U.S., may have reflected their greater sensitivity and awareness of this disease outbreak because of what they learned from their friends and relatives in Asia who were already living through the pandemic crisis. We anticipate that as this pandemic unfolds and affects different pockets of society, so too will the impact of coronavirus anxiety and the research findings for this construct.

CAS scores were also found to influence social attitudes in the same way as the original CAS investigation. Specifically, the positive association between CAS scores and approval of President Trump's responses to the coronavirus crisis was in accordance with the "conservative shifts" phenomenon, where people tend to become more conservative in their political attitudes during existential crises (Jost et al., 2017; Nail and McGregor, 2009). The positive correlation between CAS scores and avoidance of Chinese food and products also follow a trend that occurred during the 2003 SARS outbreak when the "Chinese disease" scare led to a mass avoidance of Chinese people and their businesses (Fang, 2020; Keil and Ali, 2006). In sum, these results support the construct validity of the CAS by demonstrating that this form of anxiety is not only associated with impairment and distress, but it also seems to permeate all facets of one's life from coping to social attitudes.

The clinical and research benefits of efficiently screening people for dysfunctional anxiety related to the coronavirus are immense given the magnitude of this growing health crisis (Asmundson and Taylor, 2020). For instance, healthcare employees need to be physically and mentally healthy to work effectively at the frontlines of combating the coronavirus outbreak. However, many healthcare workers around the globe feel the overwhelming strain of this pandemic as the number of infections and deaths rise and the medical resources become scarcer. In recent reports of hospital workers in China, a considerable proportion of them experience depression, anxiety, and insomnia, which is

believed to be attributable to many factors, such as a fear of being infected with the virus and spreading the disease to their friends and family (Lai et al., 2020; Liu et al., 2020).

Many American healthcare workers are also afraid of becoming infected with the virus and spreading it to their patients and loved ones because of the mass shortage of protective equipment in the U.S. (Stockman & Baker, 2020). If these healthcare workers are not identified and treated appropriately, they could put themselves and others at risk for health complications because they may be too overwhelmed by anxiety to be effective at their jobs. Moreover, as the results of this study and the original CAS investigation suggest, individuals with dysfunctional coronavirus anxiety engage in high levels of drug and alcohol coping and frequently experience suicidal ideation and hopelessness, all of which are extremely problematic in their own right. Therefore, the CAS could be used to alleviate this potential concern. And with the proven success rate of telehealth, particularly in the treatment of anxiety, the delivery of online psychotherapy may be a practical solution to this growing problem (Khatri et al., 2014).

This research has several limitations worth noting. First, the results of this study may not generalize to the population at large because the sample used was not based on a probabilistic sampling method. Instead, the sample used in this study were from MTurk's online labor market. However, systematic research on MTurk has demonstrated that MTurk participants are at least as diverse as typical internet and traditional methods, and the data derived from this source are of high quality (Buhrmester et al., 2011). Nonetheless, researchers should seek to verify this study's results using probabilistic sampling techniques. Second, the use of single-item scales in this study could have oversimplified the results because only one aspect of a construct was measured. Although single-item scales can have comparable psychometric properties as multi-item instruments (Bergkvist and Rossiter, 2007), future research should nonetheless reproduce this study using multi-item scales. Last, the use of only one validity item may not have effectively identified all of the participants who provided invalid answers due to inattention. Future research should incorporate multiple validity items that are scattered throughout the survey to obtain higher quality data. Despite these limitations, this study reports vital data that supports the scientific integrity of a mental health screener of COVID-19 related psychopathology.

### Ethical statement

Compliance with Ethical Standards: All procedures performed in this study were in accordance with the ethical standards of Christopher Newport University's institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent: Informed consent was obtained from all individual adult participants included in the study.

This manuscript is not under consideration for publication in any other journal, nor has any portion of the manuscript been published previously.

### Author statement

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The authors declare that they have no conflicts of interest.

## Supplementary materials

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