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**An assessment of the psychometric properties and psychological correlates of the**

**Greek COVID-19 anxiety syndrome scale (C-19ASS)**

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**Declaration**

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**Abstract**

In Greece, the COVID-19 pandemic was associated with social isolation, economic crisis, considerable unemployment, and an escalation of psychological distress. Given the potential of COVID-19 to engender a long-lasting impact on mental health, validating the COVID-19 Anxiety Syndrome Scale (C-19ASS) may be beneficial in determining if fear-based behaviors may persist post-pandemic. This is a psychometric study examining the C-19ASS features across a general sample of Greeks (*n* = 912; female = 78%; Mean age = 32.35, ±9.25). The Greek C-19ASS demonstrated a two-factor structure consistent with the original scale's perseveration and avoidance subscales. This structure was supported by Confirmatory Factor Analysis, which demonstrated a strong fit and robust reliability along with good divergent and convergent validity evidenced by correlational analyses. The incremental validity test revealed that the Greek C-19ASS predicted functional impairment and COVID-19 anxiety independently of health anxiety, generalized anxiety, and depressive symptoms, the Big-Five personality traits, pandemic-related factors, and demographic variables. The findings were discussed using a self-regulatory executive function model as a theoretical background to discuss this pandemic-related phenomenon.

***Keywords*:** Greece, COVID-19 Anxiety Syndrome Scale, psychometric, pandemic.

**Practitioners key messages**

* The COVID-19 pandemic has the potential to have long-lasting psychological and social consequences.
* The COVID-19 Anxiety Syndrome Scale was validated among a large sample of Greeks.
* Perseveration and avoidance were identified as two components of the COVID-19 anxiety syndrome.
* The Greek C-19ASS demonstrated sound concurrent and incremental validity.
* It is advisable to maintain ongoing surveillance of individuals for the presence of the COVID-19 anxiety syndrome in the post-pandemic period in order to ascertain its potential existence.

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**Introduction**

COVID-19 was declared a pandemic and the sixth international public health emergency by the World Health Organization (WHO; Mahase, 2020). The pandemic causes panic and distress among people and has significant economic consequences worldwide (Hossain et al., 2020). Many countries have enacted lockdowns, social distance, and self-isolation to contain the virus due to its rapid spread, severe consequences, and high mortality rate (Brooks et al., 2020). A key change brought by the COVID-19 pandemic has been a worldwide increase of pandemic-related psychological distress, including worry, anxiety, depression, burnout, post-traumatic stress disorder, worry, restlessness, lonliness, attention and concentration difficulties (Mansueto et al., 2021; Javier et al., 2021; Emmelkamp, 2021; Akbari, Seydavi, et al., 2021; Brailovskaia et al., 2022). Furthermore, a recent review on 17 longitudinal studies examining changes in mental health during the pandemic revealed increases in anxiety, mood disorders, alcohol use, sedentary behavior, and Internet use and a decrease in physical activity (Buizza et al., 2022).

In Greece, there have been approximately three million and a half cases confirmed of COVID-19 infection since 2020 (Fouda et al., 2020; WHO, 2022), and nearly thirty thousand deaths have been reported since the outbreak began in April 2022 (Dianeosis, 2022). It is evident from information obtained in Greece that COVID-19 management strategies inevitably resulted in social isolation, financial stress, and psychological distress, as well as fueling negative coping mechanisms, such as substance use (van Gelder et al., 2020). The interruption of tourism during the pandemic was associated with an increase in unemployment; In addition, there was an approximately fourteen percent decline in jobs in the major sectors of employment (Mariolis et al., 2020). The Greek public has a very pessimistic view of the pandemic-related financial crisis, with 79.9% of respondents predicting it will last at least two years (IE, 2021). Given the global burden of the pandemic, as well as the serious impacts the pandemic has had on Greece, it is of paramount importance to validate tools that can be used to quantify COVID-19-related psychological impacts such as COVID-19 anxiety syndrome (Nikčević & Spada, 2020).

**Definition and evidence of COVID-19 Anxiety Syndrome**

The chronic and intense anxiety associated with COVID-19 is termed COVID-19 anxiety(Arpaci et al., 2020; Lee et al., 2020a). It is characterized by symptoms such as problems with concentration, feelings of tension, low moods, low self-esteem, sleep issues, lethargy, decreased occupational performance, reduced job-related satisfaction and interest, and recurrence of absenteeism (Pedrosa et al., 2020; Rodrguez-Hidalgo et al., 2020; Porter et al., 2021), and is associated with psychopathology, such as depression, anxiety, and stress (Lai et al., 2020; Satici et al., 2020; Wang et al., 2020; Fitzpatrick et al., 2020; Paolini et al., 2020).

 The term 'COVID-19 anxiety syndrome' was coined by Nikčević and Spada (2020) after observing that individuals tend to acquire a unique constellation of behaviors concerning the fear of the COVID-19 virus. As a result, the authors created the COVID-19 Anxiety Syndrome Scale (C-19ASS), which includes two components: perseveration in checking symptoms in self and others, worrying about loss of family members, monitoring infection signs due to fear or threat of COVID-19, and avoidance of interacting with public-related activities due to the fear of contracting COVID-19. Aligned with its components, COVID-19 anxiety syndrome is defined by maladaptive attempts at controlling the fear of the COVID-19 virus through avoidance of public settings and worry-based safety behaviors (such as excessive hand washing and checking (e.g., the news). There is a possibility that maladaptive control attempts may be sustained for a long period of time after the disease has been controlled (Nikčević et al., 2020).

The COVID-19 anxiety syndrome is aligned with the Self-Regulatory Executive Function (S-REF) model of psychopathology (Wells, 2011), which suggests that psychological disorders such as anxiety are the result of dysfunctional coping strategies (cognitive, behavioral, and attentional), also referred to as the Cognitive-Attentional Syndrome (CAS). In the CAS, three characteristics are present: (1) persistent concentration on danger, (2) repetitive negative thinking (rumination and worry), and (3) dysfunctional coping strategies for dealing with the first two components of the disorder (Kowalski & Dragan, 2019). Accordingly, the perseveration subscale of the C-19ASS measures continual monitoring of a threat due to dread or fear of COVID-19 and concern that infection may occur. To cope with the first two components of the CAS, the avoidance subscale of the C-19ASS assesses a person's inclination to avoid social settings (places, transportation, and touching objects) as a result of COVID-19 fear or anxiety. The C-19ASS can thus be viewed as a measure of dysfunctional coping strategies activated by vigilance and maladaptive reactivity to COVID-19 anxiety and danger (Mansueto et al., 2022; Akbari et al., 2022).

The COVID-19 anxiety syndrome is associated with a selective attentional bias to COVID-19-related stimuli, generalized anxiety and depressive symptoms, well-being anxiety, and COVID-19 anxiety (Akbari et al., 2022; Nikčević et al., 2021) and also acts as an independent predictor of pandemic-related psychological distress (Albery et al., 2021). Additionally, the perseveration factor of C-19ASS has been shown to influence obsessional thoughts as well as other types of perseveration (e.g., worry), which may lead to an escalation of COVID-19 anxiety and maladaptive coping behaviors (Lee et al., 2020b). Also, Mansueto et al. (2022) have found that C-19ASS demonstrated concurrent and incremental validity, and its perseveration subscale underlies the relationship between psychological symptoms (depression, generalized anxiety, and health anxiety) and emotional stability, thus, it is more detrimental than C-19ASS avoidance. Further, the total scale and its perseveration subscale were found to have a negative and significant relationship with extraversion and agreeableness, a positive relationship with neuroticism, but no significant linkage with openness or conscientiousness; however, the avoidance subscale demonstrated a less significant relationship with the Big-Five personality traits (only with extraversion) (Akbari et al., 2022). In this way, the legitimacy of the C-19ASS has been documented in the literature.

**Aim of the current study**

Since the C-19ASS was first published in English (Nikčević & Spada, 2020), several countries have welcomed it, including Iran (Persian; Akbari et al., 2022), Italy (Italian; Mansueto et al., 2022), Indonesia (Indonesian; Muthiah et al., 2022), and Brazil (Portuguese; Coelho et al., 2022), Saudi Arabia (Alhakami et al., 2023), and Canada (Seth et al., 2023). It has been shown, as a measure, to have a strong structure (confirmed two factors), convergent (with functional impairment as measured by work and social adjustment; Mundt et al., 2002), and divergent (from generalized anxiety, Akbari et al., 2022; negative affect and coronavirus anxiety scale; Lee et al., 2020b) validity and incremental validity in explaining additional variance in the work and social adjustment scale (Mundt et al., 2002), and coronavirus anxiety scale (Lee et al., 2020b). As there is no Greek version of the C-19ASS, and given that COVID-19 anxiety syndrome may persist long after the pandemic, the C-19ASS is an ideal candidate for measuring pandemic-related behaviors and dysfunctional coping in and post the pandemic. That is, the current study sought to evaluate the psychometrics and psychological correlates of C-19ASS among a sample of Greeks.

**Method**

This is a cross-sectional psychometric study conducted in Greece between August 2021 and December 2021 using an online survey and has been reported according to Gagnier et al. (2021) standards for psychometric studies.

**Translation**

In order to guarantee the precision and faithfulness of the translation, we have adhered to the subsequent procedures: In the beginning, we sought the aid of a professional translator to translate the measurements that were not available in Greek language including C-19ASS, Work and Social Adjustment Scale (Mundt et al., 2002), Coronavirus Anxiety Scale (Lee, 2020), and Whitley Index-7(Fink et al., 1999) from the English language to Greek. The translator possessed specialized knowledge in the translation of research materials and have demonstrated a high level of proficiency in both languages and. Upon receipt of the Greek translation, a thorough examination and comparison were conducted between the translated version and the original English version to ascertain congruity of content and semantic precision. Consequently, we performed a back translation by collaboration of another proficient translator who is fluent in both English and Greek. The translator was not provided with the original English version and had no prior familiarity with the study. A comparison was conducted between the back-translated version and the original English version to evaluate any disparities or variations in meaning, phrasing, or intention. Finally, it was determined that the Greek back-translated C-19ASS exhibited a close resemblance to the original English version.

**Participants**

As seen in Table 1, a total sample of 912 Greece residents (age range = 18-73; *M* = 32.35, *SD* = 9.25) took part in the study. Considering the gender proportion, the sample was predominantly female (78.8%). Half of the sample had educational attainment at university level (46.2%), single (50.1%), employed full-time (50.2%), and more than half of the sample considered themselves as Christians (69.3%). In regards to COVID-19-related infection and consequences, the majority of the sample were vaccinated against COVID-19 (78.7%), one-fifth of the sample (21.9%) were at 'high-risk' for COVID-19 infection, and 14.5% experienced a loss of someone close.

**2.2. Questionnaires**

*2.2.1. Big-Five Inventory-10* (BFI‐10; Rammstedt & John, 2007; Greek version: Goula, 2011)

The BFI-10 contains ten items, rated on a 5-point Likert-type format, anchord by 1: Disagree strongly to 5: Agree strongly, concerned with the Big-Five personality traits: extraversion, agreeableness, conscientiousness, neuroticism, and openness, which has demonstrated good reliability and validity (Satow, 2021). Calculating the McDonald’s omega or Cronbach’s alpha for the BFI-10 was not applicable given that numer of items in each subscale is only two. According to the developers, the reliability of BFI-10 could be better reached by re-test examination. In their study, Rammstedt and John (2007) found that the BFI-10 subscales captured 70% of the full BFI variance and retained 85% of the retest reliability.

*2.2.2. Coronavirus Anxiety Scale* (CAS; Lee, 2020)

The CAS contains five items, rated on a 5-point Likert-type format, anchored by 0: Not at all to 4: Nearly every day, concerned with the physiologically-based symptoms provoked by COVID-19-related information and thoughts. It has good reliability and validity (Nikčević & Spada, 2020). The McDonald’s omega for the Greek version of the CAS was .84 in the present study.

*2.2.3. COVID-19 Anxiety Syndrome Scale* (C-19ASS; Nikčević & Spada, 2020)

The C-19ASS contains nine items, rated on a 5-point Likert-type format, anchord by 0: Not at all to 4: Nearly every day over the last two weeks, concerned with the anxiety syndrome associated to COVID-19 including checking (e.g., of symptoms of COVID-19), worrying (e.g., if love ones are infected) and threat monitoring (e.g., paying close attention to others displaying possible symptoms of COVID-19). It is comprised of two factors: 'perseveration' and avoidance' and has demonstrated good reliability and validity (Nikčević & Spada, 2020).

*2.2.4. Generalized Anxiety Disorder-7* (GAD-7; Spitzer et al., 2006; Greek version: Vogazianos et al., 2022)

The GAD-7 contains seven items, rated on a 4-point Likert-type format, anchord by 0: Not at all to 3: Nearly every day, concerned with anxiety, worry, irritability, difficulty concentrating, sleep disorders, and fatigue. The validity and reliability of the GAD-7 have been confirmed in a vast collection of studies (Williams et al., 2014). The McDonald’s omega for the Greek version of GAD-7 was .93 in the present study.

*2.2.5. Patient Health Questionnaire-9* (PHQ-9; Kroenke et al., 2001; Greek version: Hyphantis et al., 2011)

The PHQ-9 contains nine items, rated on a 4-point Likert-type format, anchord by 0: Not at all to 3: Nearly every day, concerned with depressive symptoms. And its validity and reliability have been confirmed in a wide array of studies (Kroenke et al., 2001). The McDonald’s omega for the Greek version of PHQ-9 was .90 in the present study.

*2.2.6. Whiteley Index-7* (WI-7; Fink et al., 1999)

The WI-7 contains seven items, rated on a 5-point Likert-type format, anchord by 1: Not at all to 5: Severe, concerned with the health anxiety and its validity and reliability of the WI-7 have been confirmed in a wide array of studies (Lee et al., 2011). The McDonald’s omega for the Greek version of WI-7 was .84 in the present study.

*2.2.7. Work and Social Adjustment Scale* (WSAS; Mundt et al., 2002)

The WSAS contains five items, rated on an 8-point Likert-type format, anchord by 0: Not at all, 2 = Slightly, 4 = Definitely, 6 = Markedly, and 8 = Very severely, concerned with the work and social functionality and its validity and reliability have been confirmed in a wide array of studies (Mundt et al., 2002). The McDonald’s omega for the Greek version of WSAS was .80 in the present study.

**Procedure and data analysis**

The online survey was conducted under Qualtrics website for data collection following the ethical approval from London Southbank Univerisity, and the study was advertized on social media (Facebook and Instagram) to ensure a higher chance of taking part in the study. To be eligible, participants should have at least 18 years of age, self-report residence in Greece, and being able to provide participation consent. Participants were debriefed regarding the study and available online psychologist in case of any queries.

The analyses were performed using SPSS and Amos (version 26). Both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used to explore the structure of the Greek C-19ASS. The sample was randomly divided into halves. Half of the data was used for an EFA with principal axis factoring and rotated with Oblimin with the Kaiser normalization method, and the remaining half of the sample was used for a CFA using maximum likelihood estimation. Also, the parallel analysis determined the number of EFA factors (Horn, 1965). As suggested by Hu and Bentler (1999), fit indices were evaluated, including comparative fit index (CFI; good fit ≥0.90), root mean square error of approximation (RMSEA; good fit ≤0.08), and standardized root mean square residual (SRMR; good fit ≤0.08). After that, tests of measurement invariance using multigroup confirmatory factor analysis were performed to examine the structural invariance of Greek C-19ASS across gender. The construct validity was examined using EFA and CFA procedures, concurrent validity was examined using correlation analysis, and incremental validities were examined using hierarchical regression analyses, and the reliability was calculated usingtraditional methods (Cronbach’s alpha and McDonald’s omega; good reliability > .70), and also CFA-based reliability analyses (Fornell & Larcker, 1981) including average variance extracted (good reliability > .50), composite reliability (reliability > .60), and maximum reliability (good reliability > .70).

**Results**

**Greek C-19ASS: Exploratory factor analysis**

For the EFA, the first half randomly divided sample (*n* = 456, F = 76.5%; age = 32.48, ±9.21) was utilized. The Kaiser-Meyer-Olkin (KMO = 0.822, *p* < .001) and Bartlett's test of sphericity (X2 = 797.21, df = 36, *p* = 0.001) indices for the Greek C-19ASS indicated that correlations across C-19ASS items were considerable, laying the ground to perform factor analysis. Prior to this, parallel analysis was used to generate random Eigenvalues to compare with the observed data (Horn, 1965), which demonstrated that the observed Eigenvalues (i.e., 3.15 and 1.27) were higher than the generated random Eigenvalues (i.e., 1.21 and 1.14), signifying two-factor solution. Consequently, the EFA was done with a two-factor solution aligned with the parent study (Nikčević & Spada, 2020).

The standardized factor loadings for the two subscales of Greek C-19ASS are represented in Table 2, with no significant cross-loadings (≥ .30) and the inter-correlation of r = .33 between subscales, suggesting separability and moderate shared variance. Please see Table 2 for further details on the items' psychometrics.

**Greek C-19ASS: Confirmatory factor analysis**

The second half randomly splitted sample was used for the CFA (n = 456, F = 81.1%, age = 32.22, ±9.28). For the CFA procedure, one model as an alternative model with one latent variable and all nine items as its indicators and one model as a two-factor model derived from the EFA were specified and evaluated. In this regard, no cross-loadings or correlated errors and no modification indices were recommended to improve model fit (please see Table 3 for the fit indices). The two-factor model (*χ2 =* 75.589*, df =* 26*, χ2/df =* 2.90*, SRMR =* 0.038*, RMSEA =* 0.065*, GFI =* 0.964*, CFI =* 0.970*, NFI =* 0.955*, TLI =* 0.958*, IFI =* 0.970) had the best model fit. Likelihood ratio tests supported that the two-factor solution model fits the data better than the alternative model *(χ2 =* 23.889*, df =* 1*, p <*  .01*),* supported by the expected cross-validation index *(*ECVI), which was lower for the two-factor model solution model (ECVI = 0.250 [0.201, 0.315]) as compared with the alternative model (ECVI = 0.298 [0.239, 0.374]). Figure 1 displays the two-factor solution model with standardized factor loadings.

**3.3. Greek C-19ASS measurement invariance model**

Similar to the CFA, no cross-loadings or correlated errors were specified for the measurement invariance model using multigroup confirmatory factor analysis (MGCFA) to determine whether the Greek C-19ASS structure is invariant across genders. The configural invariance (where items load on the same factors across genders freely) was supported by good fit indices (*χ2* = 154.191, *df* = 52, *χ2/df* = 2.96, *RMSEA* = 0.047, *SRMR* = 0.049, *GFI* = .961, *CFI* = .953). However, metric invariance (where the factor loadings are constrained to be equal across genders) partially supported by good fit indices (*χ2* = 171.7, *df* = 61, χ2/*df* = 2.81, *RMSEA* = 0.045, *SRMR* = 0.072, *GFI* = .957, *CFI* = .949). The Δ*CFI* = 0.004, Δ*SRMR* = 0.023, and Δ*RMSEA* < 0.026, suggesting that each item partially contributes to the latent construct across gender.

Also, scalar invariance (where item intercepts were constrained to be equal across genders) was partially supported, considering the chi-square difference test between unconstrained and constrained item intercepts was significant (χ2 = 19.945, df = 9, p = .01). Modification indices suggested that item number 9 varied across genders, with a higher intercept for females. Once item 9 become unconstrained, the differences become insignificant (χ2 = 4.975, df = 8, p = .76), suggesting that mean differences in the Greek C-19ASS could not capture all mean differences in the shared variance of the items. Thus, Although the correlations between Greek C-19ASS scores and other variables are comparable across males and females, their mean scores on the Greek C-19ASS should be interpreted with caution.

**Greek C-19ASS: Reliability**

The reliability and validity analyses were conducted on the total sample (*n* = 912). The reliability for the Greek C-19ASS total scale was .81, and it was .79 and .67 for perseveration and avoidance subscales, respectively, which is satisfactory. Further, the reliability ( by one-item removed) ranged from .61 to .78, which is not higher than estimated for the total scale or subscale scores. Moreover, the reliability (internal consistency) was corroborated by McDonald's omega (ω; where the correlations between the items have been taken into account), and it was .82, .78, and .68 for the total scale, preservation, and avoidance subscales, respectively. This suggests that the items' variance contributions are reliable, and all should be reserved.

A 2-factor CFA model using the total sample was used to examine model-based reliabilities. For the Greek C-19ASS, the average variance extracted (AVE) was large (.75), suggesting that the items explain 75% of the variances of Greek C-19ASS. The composite reliability also was large (.86), suggesting that 86% of the C-19ASS total score variance was explained by its two factors. Additionally, the maximum reliability (MaxR (H)) was large (.87), suggesting that the reliability is at its highest possible level.

**Greek C-19ASS: concurrent validity**

As seen in Table 4, the total Greek C-19ASS and its subscales demonstrated a negative and significant association with extraversion; And only the total Greek C-19ASS and the perseveration subscale were positively and significantly associated with neuroticism. However, the association between Greek C-19ASS and its subscales with agreeableness, conscientiousness, and openness was insignificant. In addition, the C-19ASS and its subscales were significantly and positively associated with PHQ-9, WSAS, GAD-7, WI-7, and CAS.

**Greek C-19ASS: Incremental validity**

Prior to hierarchical regression analysis, the following assumptions were tested and met: lack of multicollinearity, multivariate outliers, existence of normality, linearity, and homoscedasticity. Incremental validity was conducted using hierarchical regression analysis (stepwise method) to examine whether Greek C-19ASS would explain WSAS and CAS beyond other study variables. All variables in Table 1 and Table 4 were included in Model 1 and Model 2 using the stepwise method to see which predictors are significant; Consequently, only significant predictors were included in the analysis to avoid pseudo-variance.

Table 5 represents the results for predicting functional impairment (as measured by WSAS) scores from age, COVID-19 death of a person close, Big Five personality traits (Extraversion, conscientiousness, and neuroticism), depressive symptoms, COVID-19 anxiety, and C-19ASS subscales. As seen, age and COVID-19 death of a close person together significantly predicted functional impairment scores, F (2, 907) = 4.649, p < .01. The addition of the Big-Five personality traits was significant, *F* (5, 904) = 23.286, *p* < .001, explaining additional 10.4% of the functional impairment scores variance, ∆F (3, 904) = 35.359, *p* < .001. Moreover, the addition of depressive symptoms and COVID-19 anxiety also was significant, F (7, 902) = 59.728, p < .001, explaining 20.3% of the functional impairment scores variance, ∆F (2, 902) = 133.736, p < .001. Lastly, the addition of C-19ASS subscales was a significant equation, F (9, 900) = 52.667, p < .001, explaining an additional 2.8% of the functional impairment scores variance, ∆F (2, 900) = 19.417, p < .001. This final model revealed that depressive symptoms, COVID-19 anxiety, and C-19ASS subscales significantly predicted functional impairment (R2 = 33.8). As seen in Table 5, the C-19ASS subscales predicted functional impairment scores above and beyond COVID-19 anxiety except for depressive symptoms. Also, it should be noted that Big-Five personality traits and the COVID-19 death of a person close were no longer significant predictors of functional impairment once the C-19ASS subscales were included in the model.

Table 6 represents the results for predicting COVID-19 anxiety scores from age, COVID-19 death of a person close, gender, Big-Five personality traits (extraversion and neuroticism), generalized anxiety, depressive symptoms, health anxiety, and C-19ASS perseveration subscale. The COVID-19 anxiety scores were significantly predicted by age, COVID-19 death of a person close, and gender, *F* (3, 906) = 4.738, p < .001. Also, the addition of extraversion and neuroticism scores was significant, *F* (5, 904) = 14.405, p < .001, and explained 5.8% of the COVID-19 anxiety scores variance, ∆*F* (2, 904) = 28.474, p < .001.

Moreover, the addition of generalized anxiety, depressive symptoms, and health anxiety was significant, F (8, 901) = 37.613, p < .001, explaining 17.7% more of COVID-19 anxiety scores variance, ∆F (3, 901) = 70.738, p < .001. Lastly, including the C-19ASS perseveration subscale was also significant F (9, 900) = 37.553, p < .001, and explained an additional 2.3% of COVID-19 anxiety scores variance, ∆F (1, 900) = 28.037, p < .001. The last model demonstrated that depressive symptoms, health anxiety, generalized anxiety, and C-19ASS perseveration significantly predicted COVID-19 anxiety scores variance, explaining 27.3% of the total variation in COVID-19 scores. In the last model, C-19ASS perseveration outperformed generalized anxiety, and health anxiety, except for depressive symptoms in predicting COVID-19 anxiety.

**Discussion**

Nikčević and Spada (2020) hypothesized that in reaction to the danger of COVID-19, some individuals might develop maladaptive and excessive forms of coping, which could trap the individual in a constant anxiety and threat state, affecting the resumption of regular psychological functioning. The authors term this the COVID-19 anxiety syndrome and operationalized these coping strategies under perseveration and avoidance factors, given the possible long-lasting psychological and social costs of the pandemic.

 The COVID-19 anxiety syndrome has been supported in this psychometric study in line with the other versions (Persian; Akbari et al., 2022; Italian; Mansueto et al., 2022; Indonesian; Muthiah et al., 2022; and Portuguese; Coelho et al., 2022). Similar to the parent study, the Greek C-19ASS demonstrated acceptable validity and structure aligned with the literature (Nikčević & Spada, 2020). The Greek C-19ASS proved to be a valuable instrument for studying COVID-19-related dysfunctional coping.

**The Greek C-19ASS: Structure and reliability**

Aligned with the literature on C-19ASS, the C-19ASS structure (perseveration and avoidance) is also supported in a Greek sample. The Greek C-19ASS items also showed configural invariance, suggesting that correlations and regression paths are comparable across males and females. However, given the partial support for metric and scalar invariance (caused by item 9), therefore, in comparing males and females on the Greek C-19ASS, it is wise to interpret the mean scores of the perseveration subscale with prudence. Regarding interpreting this discrepancy, guidelines on measurement invariance (Putnick & Bornstein, 2016), the higher intercept of item 9 among females suggests that they are more concerned about what would happen to the family if one of its members was infected or even died. These escalating intercepts are unrelated to increased levels of the corresponding latent concept across gender.

The Greek C-19ASS concurred with anxiety, depression, and social dysfunction measures in terms of construct validity (Table 4) reflecting psychopathology. In terms of incremental validity, the preservation subscale and particularly, the avoidance subscale, of the Greek C-19ASS outperformed age, COVID-19 close death, personality traits (extraversion, neuroticism, conscientiousness), and COVID-19 anxiety in predicting functional impairment scores. However, depressive symptoms outperformed all variables in this regard (see Table 5). Moreover, in predicting COVID-19 anxiety, only perseveration subscale outperformed age, gender, COVID-19 close death, personality traits (extraversion and neuroticism), health anxiety, and generalized anxiety. Again, depressive symptoms outperformed all variables in this regard (see Table 6). The finding that depressive symptoms outperformed all included variables in predicting functional impairment as measured by WSAS is in line with literature that even minor levels of depressive symptoms is associated with decrement in work function (Beck et al., 2011). Also, given that depressive symptoms outperformed all included variables in predicting COVID-19 anxiety as measured by CAS, it might be due to some shared variance between the CAS and depressive symptoms as CAS measures five domain of anxiety (Lee et al., 2020b) provoked by the pandemic (sleep Disturbances, tonic Immobility, appetite Loss, Dizziness, and abdominal Distress) that to some extent are also part of depressive symptoms (i.e., sleep disturbance, appetite loss).

Overall, in addition to depressive symptoms, the findings suggest that avoidance strategies are much more predictive of functional impairment, whereas perseveration strategies are much more predictive of COVID-19 anxiety. Along with the proven validity, in line with the literature, the Greek C-19ASS demonstrated acceptable reliability as estimated by several indices.

**COVID-19 anxiety syndrome and pandemic-related** **psychopathology**

The COVID-19 anxiety syndrome is a condition that encompasses excessive and maladaptive coping reactions to the COVID-19 perceived threat (Nikčević & Spada, 2020), a phenomenon that could be explained according to the S-REF model (Wells, 2011), suggesting that cognitive-attentional syndrome is crucial to the perseveration of distressed states such as COVID-19 anxiety syndrome. The positive linkage between C-19ASS scores and attentional bias to threats of COVID-19 suggests the potentiality of targeting such COVID-19 anxiety by modifying the attentional bias (Albery et al., 2021).

Future research should ascertain the extent and prevalence of this syndrome, specifically in the aftermath of the pandemic given that literature indicates the after effect of pandemic as it increased phobias, anxiety, clinginess, distraction, irritability, depression, mood lability, impaired social interaction, sleep disturbances, low self-esteem, substance use disorder, and suicide (Gogineni & Punnoose, 2022). This would assist with the identification of long-term control strategies that effectively balance the considerations of health in vulnerable populations, societal behavior, and economic impact (Gogineni & Punnoose, 2022) which is crucial for addressing future large-scale pandemics.

Individuals with elevated levels of COVID-19 anxiety syndrome have been observed to progressively reduce their reliance on maladaptive coping such as perseveration and avoidance following the end of the pandemic. This gradual reduction in dysfunctional coping strategies allows them to resume normal daily activities (Akbari et al., 2022). Thus, identifying the COVID-19 anxiety syndrome could be useful in and post-pandemic (Asmundson & Taylor, 2020). Considering the conceptualisation of this syndrome as centering on maladaptive cognitive control, Metacognitive Therapy (Wells, 2000) may be of use in targeting its core element of perseverative thinking, and exposure-response prevention may assist in reducing avoidance (Mansueto et al., 2022).

**Limitations and future directions**

The cross-sectional nature of this psychometric study tempers conclusions on temporality and the causative role of C-19ASS in pandemic-related distress. Moreover, the higher proportion of females who took part in the study may limit the applicability of the findings to men in a more confident way. In addition, the use of self-report questionnaires is open to recall bias and social desirability. In addition, our findings pave the path for future investigation. Scholars could evaluate the C-19ASS topographies with a more balanced gender proportion and also from the Item-Response Theory perspective for a deeper understanding. Furthermore, it is advisable to maintain ongoing surveillance of individuals for the presence of the COVID-19 anxiety syndrome in the post-pandemic period in order to ascertain its potential existence.

**Conclusion**

To sum up, the results support the conception of COVID-19 anxiety syndrome among Greeks. C-19ASS is an efficient instrument for evaluating coping reactions to the COVID-19 threat. In addition, the current data demonstrate that C-19ASS subscales are conceptually key factors of this syndrome that are specifically linked to psychopathology. Overall, the psychometric analyses revealed that the Greek C-19ASS is a tool for the assessment of COVID-19 anxiety syndrome for consideration in Greece.

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**Data availability statement**

The dataset analyzed during the current study is available from the corresponding author.

**Conflict of interests**

None.

**Ethical approval**

Ethical approval is provided by London South Bank University.

**Informed consent**

All participants who took part in the study provided informed consent.

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Figure 1:

*The two-factor solution model, confirmatory factor analysis of the Greek C-19ASS. A = Avoidance subscale; P = Perseveration subscale.*



Table 1:

*Demographic features and additional data of the sample (n = 912).*

|  |  |  |
| --- | --- | --- |
| Variable | *n* | *%* |
| *Gender* |   |   |
|     Female | 719 | 78.8 |
|     Male | 182 | 20.0 |
|     Prefer not to disclose | 7 | 0.8 |
|     Other | 4 | 0.40 |
|  |  |  |
| *Religion* |   |   |
|     Christian | 632 | 69.3 |
|     Muslim | 1 | 0.11 |
|     No religion | 255 | 28.0 |
|     Other | 24 | 2.60 |
|  |  |  |
| *Education* |   |   |
|     Primary School | 6 | 0.70 |
|     Secondary School | 84 | 9.20 |
|     Vocational Qualification | 130 | 14.2 |
|     University Undergraduate Degree | 421 | 46.2 |
|     University Postgraduate Degree | 246 | 27.0 |
|     University Doctorate Degree | 25 | 2.70 |
|  |  |  |
| *Marital Status* |   |   |
|     Single | 457 | 50.1 |
|     Married | 229 | 25.1 |
|     Cohabiting | 152 | 16.7 |
|     Civil Partnership | 18 | 2.0 |
|     Divorced | 41 | 4.50 |
|     Separated | 8 | 0.90 |
|     Widowed | 7 | 0.80 |
|  |  |  |
| *Employment* |   |   |
|     Employed full-time | 458 | 50.2 |
|     Employed part-time | 85 | 9.3 |
|     Student | 142 | 15.6 |
|     Self-employed | 94 | 10.3 |
|     Retired | 9 | 1.0 |
|     Unemployed due to health problems | 14 | 1.5 |
|     Care | 6 | 0.7 |
|     Looking after home or family | 38 | 4.2 |
|     Voluntary work | 5 | 0.55 |
|     Other | 61 | 6.7 |
|  |  |  |
| *COVID-19 Risk* |   |   |
|     Yes | 200 | 21.9 |
|     No | 712 | 78.1 |
|  |  |  |
| *Vaccination Status* |   |   |
|     Yes | 718 | 78.8 |
|     No | 194 | 21.5 |
|  |  |  |
| *Experienced a loss of someone close* |   |   |
|     Yes | 132 | 14.5 |
|     No | 780 | 85.5 |
|  |  |  |
|  |

Table 2:

Greek C-19ASS standardized factor loadings and item descriptive statistics (n = 456)*.*

|  |  |  |
| --- | --- | --- |
| **Exploratory Factor Analysis** |  | **Descriptive Statistics** |
| **No.** | **P** | **A** | **h2** | **I-T** | **I-Ts** |  | **Skewness** | **Kurtosis** | **M** | **SD** |
| ITEM 7 | **0.767** | -0.111 | .544 | .524 | .58 |   | .109 | -.881 | 2.74 | 1.23 |
| ITEM 8 | **0.681** | 0.000 | .484 | .56 | .57 |  | -.058 | -1.036 | 3.17 | 1.31 |
| ITEM 2 | **0.614** | -0.201 | .336 | .34 | .43 |  | -.086 | -.832 | 3.1 | 1.23 |
| ITEM 9 | **0.565** | 0.140 | .391 | .52 | .54 |  | -.080 | -1.102 | 3.13 | 1.38 |
| ITEM 4 | **0.394** | 0.252 | .285 | .46 | .42 |  | .542 | -.593 | 2.3 | 1.20 |
| ITEM 6 | **0.355** | 0.166 | .192 | .37 | .37 |  | 1.074 | .139 | 1.98 | 1.20 |
| ITEM 3 | 0.212 | **0.612** | .505 | .49 | .45 |  | .442 | -.865 | 2.5 | 1.34 |
| ITEM 1 | 0.000 | **0.493** | .243 | .25 | .33 |  | -.290 | -1.561 | 3.33 | 1.66 |
| ITEM 5 | 0.223 | **0.332** | .209 | 0.36 | .30 |  | -.362 | -1.240 | 3.46 | 1.45 |

*Note.* P = Perseveration; A = avoidance;h2 = communality;M = mean; SD = standard deviation; I-T = item–totalcorrelations; I-Ts = item-total correlations between each item and its subscale.

Table 3:

*Model fit indices of confirmatory factor analysis for the Greek C-19ASS (n = 456).*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **χ2** | **DF** | **χ2/df** | **SRMR** | **RMSEA** | **GFI** | **CFI** | **NFI** | **TLI** | **IFI** |
| **One-factor solution** | 99.748 | 27 | 3.69 | 0.041 | 0.077 | .950 | .956 | .941 | .941 | .956 |
| **Two-factor solution** | 75.589 | 26 | 2.90 | 0.038 | 0.065 | .964 | .970 | .955 | .958 | .970 |

*Note*. All the models were estimated with zero cross-loadings and correlated errors; χ2 = Chi-square Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; GFI = Goodness of Fit Index; CFI = Comparative Fit Index; NFI = Normed Fit Index; TLI = Tucker-Lewis Index; IFI = Incremental Fit Index.

Table 4:

*Means, standard deviations, ranges, and inter-correlations of variables: Construct validity of the Greek C-19ASS.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | M | SD | Range | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1. BFI-E | 5.78 | 1.81 | 2-10 | — |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. BFI-A | 6.42 | 1.78 | 2-10 | .08\* | — |  |  |  |  |  |  |  |  |  |  |  |
| 3. BFI-C | 7.20 | 1.90 | 2-10 | .09\* | .07\* | — |  |  |  |  |  |  |  |  |  |  |
| 4. BFI-N | 6.68 | 2.02 | 2-10 | -.10\* | -.27\* | -.15\* | — |  |  |  |  |  |  |  |  |  |
| 5. BFI-O | 6.40 | 1.47 | 2-10 | .47\* | **-.04** | **.01** | .07\* | — |  |  |  |  |  |  |  |  |
| 6.PHQ-9 | 17.56 | 6.01 | 0-27 | -.26\* | -.18\* | -.21\* | .43\* | **.02** | — |  |  |  |  |  |  |  |
| 7.WSAS | 15.24 | 6.41 | 0-40 | -.18\* | -.14\* | -.12\* | .28\* | **-.002** | .55\* | — |  |  |  |  |  |  |
| 8.GAD-7 | 14.85 | 5.44 | 0-21 | -.17\* | -.19\* | -.13\* | .51\* | .06\* | .79\* | .45\* | — |  |  |  |  |  |
| 9.WI-7 | 13.36 | 5.22 | 7-35 | -.16\* | -.15\* | -.15\* | .31\* | **.02** | .44\* | .31\* | .49\* | — |  |  |  |  |
| 10. CAS | 5.99 | 2.23 | 0-8 | -.11\* | -.07\* | **-.02** | .22\* | **.01** | .43\* | .32\* | .43\* | .38\* | — |  |  |  |
| 11. C-19ASS-P | 15.36 | 4.57 | 0-24 | -.10\* | **-.05** | **-.01** | .17\* | **.03** | .32\* | .32\* | .36\* | .44\* | .35\* | — |  |  |
| 12. C-19ASS-A | 8.58 | 3.26 | 0-12 | -.07\* | **-.02** | **-.003** | **.06** | **-.02** | .17\* | .26\* | .16\* | .27\* | .21\* | .55\* | — |  |
| 13. C-19ASS | 23.94 | 6.92 | 0-36 | -.10\* | **-.04** | **-.01** | .14\* | **.01** | .29\* | .34\* | .32\* | .41\* | .33\* | .91\* | .83\* | — |

*Note*. BFI-10-E = Big Five Inventory‐10-Extraversion; BFI-10-A = Big Five Inventory‐10-Agreeableness; BFI-10-C = Big Five Inventory‐10-Conscientiousness; BFI-10-N = Big Five Inventory‐10-Neuroticism; BFI-10-O = Big Five Inventory‐10-Openness; PHQ-9 = Patient Health Questionnaire-9; WSAS = Work and Social Adjustment Scale; GAD-7 = Generalized Anxiety Disorder-7; WI-7 = Whiteley Index-7; CAS = Coronavirus Anxiety Scale; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration; C-19ASS-A = COVID-19 Anxiety Syndrome Scale-Avoidance; C-19ASS = COVID-19 Anxiety Syndrome Scale. ⁎ p < .05. The correlations in bold are not significant.

Table 5:

*Hierarchical regression statistics predicting functional impairment (WSAS) scores: Incremental validity of the Greek C-19ASS.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor** | **β** | ***T*** | ***R*** | ***R*2** | **Adjusted *R*2** | **∆*R*2** |
| Step 1 |  |  | .101 | .010 | .008 | .010\*\* |
| AgeCOVID-19 Close Death | -.06-.07 | -2.00\*-2.34\* |  |  |  |  |
|  |  |  |  |
| Step 2 |  |  | .338 | .114 | .109 | .104\*\* |
| AgeCOVID-19 Close Death BFI-EBFI-CBFI-N | .02-.06-.15-.07.25 | .656-2.45\*-4.89\*-2.21\*7.92 |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Step 3 |  |  | .563 | .317 | .311 | .203\*\* |
| AgeCOVID-19 Close Death BFI-EBFI-CBFI-NPHQ-9CAS | .02-.03-.04-.01.05.46.10 | .76-1.14-1.67-.381.7513.55\*3.32\* |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Step 4 |  |  | .587 | .345 | .338 | .028\*\* |
| AgeCOVID-19 Close Death BFI-EBFI-CBFI-NPHQ-9CASC-19ASS-AC-19-ASS-P | .003-.01-.04-.01.051.43.06.12.07 | .12-.37-1.40-.551.6712.81\*2.04\*3.90\*2.17\* |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

*Note*: COVID-19 close death (1 = yes, 0 = no); BFI-E = Big Five Inventory‐10-Extraversion; BFI-C = Big Five Inventory‐10- Conscientiousness; BFI-N = Big Five Inventory‐10-Neuroticism; PHQ-9 = Patient Health Questionnaire-9; CAS = Coronavirus Anxiety Scale; C-19ASS-A = COVID-19 Anxiety Syndrome Scale-Avoidance; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration.

\*\**p* < .01. \**p* < .05.

Table 6:

*Hierarchical regression statistics predicting Coronavirus Anxiety Scale (CAS) scores: Incremental validity of the Greek C-19ASS.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor** | **β** | ***t*** | ***R*** | ***R*2** | **Adjusted *R*2** | **∆*R*2** |
| Step 1 |  |  | .124 | .015 | .012 | .015\*\* |
| AgeCOVID-19 Close DeathGender | .005-.09-.08 | .159-2.78\*-2.54\* |  |  |  |  |
|  |  |  |  |
| Step 2 |  |  | .272 | .074 | .069 | .058\*\* |
| AgeCOVID-19 Close DeathGenderBFI-EBFI-N | .06-.08-.05-.09.22 | 1.98\*-2.62\*-1.56-3.04\*6.66\* |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Step 3 |  |  | .50 | .25 | .24 | .177\*\* |
| AgeCOVID-19 Close DeathGenderBFI-EBFI-NPHQ-9WI-7GAD-7 | .05-.04-.04-.001-.01.22.19.16 | 1.86-1.48-1.55-.03-.344.68\*5.81\*3.20\* |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Step 4 |  |  | .522 | .273 | .266 | .023\*\* |
| AgeCOVID-19 Close DeathGenderBFI-EBFI-NPHQ-9WI-7GAD-7C-19ASS-P | .06-.02-.04.001-.002.22.14.13.17 | 2.02\*-.93-1.46.02-.054.61\*3.97\*2.59\*5.29\* |  |  |  |  |
|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

*Note*: Gender (1 = females, 0 = males); COVID-19 close death (1 = yes, 0 = no); BFI-E = Big Five Inventory‐10-Extraversion; BFI-N = Big Five Inventory‐10-Neuroticism; PHQ-9 = Patient Health Questionnaire-9; GAD-7: Generalized Anxiety Disorder-7; WI-7 = Whiteley Index-7; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration.

 \*\**p* < .01. \**p* < .05.