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The COVID-19 anxiety syndrome and selective attentional bias towards COVID-19-related stimuli in UK residents during the 2020-2021 pandemic

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Abstract

The psychological and social effects of the COVID-19 pandemic are pervasive and there is potential for a long-lasting impact on mental health. In the current study we sought to provide, in a representative sample of UK residents during the third COVID-19 lockdown in February 2021, further evidence for the validation of the COVID-19 anxiety syndrome construct. We did this by evaluating the COVID-19 anxiety syndrome against measures of personality, health anxiety and COVID-19 anxiety in predicting levels of generalised anxiety and depression, and by examining whether increased health anxiety and COVID-19 psychological distress (COVID-19 anxiety and COVID-19 anxiety syndrome) scores were associated with increased attentional bias to COVID-19-related stimuli. A series of correlation analyses revealed that neuroticism, health anxiety, COVID-19 anxiety and COVID-19 anxiety syndrome scores were positively and significantly correlated with generalised anxiety and depression scores, and that the perseveration component of the COVID-19 anxiety syndrome predicted generalised anxiety and depression scores independently of age, gender, conscientiousness, openness, health anxiety and COVID-19 anxiety. Furthermore, results indicated that only the total COVID-19 anxiety syndrome score, and the scores on the avoidance and perseveration components, were positively and significantly correlated with attentional bias indices. More specifically, the general attentional bias index was only shown to be positively and significantly correlated with the total COVID-19 anxiety syndrome score and its perseveration component, while slowed disengagement was only shown to be negatively and significantly correlated with the total COVID-19 anxiety syndrome score and its avoidance component. The implications of these findings are discussed.

Keywords: attentional bias; COVID-19 anxiety; COVID-19 anxiety syndrome; depression; generalised anxiety; health anxiety; personality traits.

Key practitioner message:

- The perseveration component of the COVID-19 anxiety syndrome predicts generalised anxiety and depression scores independently of all other variables, including health anxiety and COVID-19 anxiety.
- No variable, aside from the total COVID-19 anxiety syndrome score, and the scores on the avoidance and perseveration components, were correlated with attentional bias indices.
- Possible psychological interventions aimed at tackling the COVID-19 anxiety syndrome are presented.

The COVID-19 anxiety syndrome and selective attentional bias towards COVID-19 stimuli in UK residents during the 2020-2021 pandemic.

The psychological and social effects of the COVID-19 pandemic are pervasive and there is potential for a long-lasting impact on mental health (Holmes et al., 2020). There has been a clear surge of pandemic-related psychological distress including fear (Ahorsu et al., 2020), anxiety (Lee, 2020; Lee et al., 2020a), perceived threat (Conway, Woodard, & Zubrod, 2020), depression (Fancourt, Steptoe & Bu, 2020), stress (Taylor et al., 2020), and an anxiety syndrome characterised by avoidance, checking, worrying and threat monitoring (Nikčević & Spada, 2020). In the UK, for example, in the first few months of the pandemic about a quarter of the population experienced moderate to severe anxiety and a third reported moderate to severe depressive symptoms in response to COVID-19 (Fancourt, Steptoe & Bu, 2020). Similar findings were reported in China (Wang et al., 2020). Furthermore, those suffering from COVID-19-related psychological distress tend to exhibit elevated levels of post-traumatic stress, health anxiety, and suicidality (Chong et al., 2004; Wheaton et al., 2012; Wu et al., 2009) which may last well beyond the course of the COVID-19 pandemic. Understanding individual differences in the types of psychological distress related to COVID-19, as well as identifying behaviours that may hinder psychological adaptation, is of paramount importance in developing effective rehabilitation programmes for the post COVID-19 pandemic phase.

The COVID-19 anxiety syndrome

Recently, Nikčević and Spada (2020) developed the COVID-19 Anxiety Syndrome Scale (C-19ASS) to enable researchers and clinical practitioners to assess individual differences in COVID-19-related avoidance, checking, worrying and threat monitoring. Work using this scale has already established solid psychometric properties of the C-19ASS. The C-19ASS has been found to predict generalised anxiety and depression independently of age,

gender, employment and risk status, personality traits, health anxiety and COVID-19 anxiety in a US community sample (Nikčević et al., 2021).

The ease of the pandemic and eventual return to normal societal functioning will inevitably entail exposure to environments associated with a greater risk of infection, such as public transport, offices, cinemas, and theatres. Nikčević and Spada (2020; 2021) have argued that such return to normal functioning may be hindered in individuals who display maladaptive forms of coping, as captured by the C-19ASS, and characterised by perseveration and avoidance of COVID-19-related threat and stimuli. Thus, rehabilitative efforts could focus on reducing such maladaptive coping and in promoting alternative behaviours and styles of thinking that would attenuate the perception of threat and enhance psychological re-adjustment.

Further establishment of the construct validity of the COVID-19 anxiety syndrome through the investigation of attentional biases to threat-related stimuli

At this stage of the COVID-19 pandemic we think further evidence regarding the construct validity of the COVID-19 anxiety syndrome (as measured by the C-19ASS) is needed. One source of validating evidence is to examine known factors that are likely to differentiate those with elevated from those with decreased levels of psychological distress. We argue that because one characteristic of elevated levels of psychological distress is an attentional processing bias for relevant threat-related stimuli (Bar-Haim et al., 2007; Cisler & Koster, 2010) (i.e., attentional bias), the manner in which individuals attend to such cues may prove a good candidate.

A plethora of work has shown that humans orient their attentional resources to salient stimuli in their environment (e.g., van Rooijen, Ploeger, & 2017) with threat-related stimuli being particularly prominent and attention grabbing (Mathews & MacLeod, 1985; Carlson & Fang, 2020). The prioritization of these resources has been labelled attentional bias and is

functional to the extent that individuals can “prepare” for adaptation to the threat posed (Öhman & Mineka, 2001).

The dot probe task has been the most commonly used method to measure attentional bias (Macleod, Matthews & Tata, 1986). In this task two stimuli (one threat-related and the other neutral) are presented simultaneously on opposite sides of a computer screen for a brief period. One of these stimuli is then replaced by a target “dot” and respondents are tasked to react as quickly as possible to the position of the dot (left or right, top or bottom) by pressing the relevant key. If attention is directed to the location of the threat-related stimulus, participants should be quicker to respond to a dot occurring at the location previously occupied by the threatening stimulus (i.e., congruent trials) in comparison to a dot which replaces the neutral stimulus (i.e., incongruent trials).

A robust finding in work using the dot probe suggests that the operation of attentional bias covaries with increased anxiety (see Bar-Haim et al., 2007 and Goodwin, Yiend & Hirsch, 2017 for meta-analyses; Cisler, Bacon & Williams, 2009) and may be rooted in an exaggerated amplitude in the P3 event-related potential wave (Gupta, Kujawa & Vago, 2019). Whilst COVID-19-related psychological distress has not been examined specifically in relation to attentional biases during the current pandemic, one study has examined the effects of health anxiety and fear of COVID-19 on attentional biases to related picture stimuli in an Italian sample (Cannito et al., 2020). Findings suggest that increased bias was associated with generic levels of health anxiety and that this effect was also mediated by fear-based expectancy formulations (i.e., beliefs about the chances of becoming contaminated and the severity of any anticipated outcomes of contamination).

Findings in the wider attentional bias literature suggest a differentiation between the key stages of attentional allocation in those experiencing psychological distress. Specifically, it has been argued that anxious individuals show a pattern of vigilance toward a threat during

immediate threat processing and may switch to an attentional pattern consistent with threat avoidance during a later, more strategic stage (see Zvielli, Bernstein, & Koster, 2014; Kruijt, Field, & Fox, 2016; Koster et al., 2004; Taylor, Cross, & Amir, 2016; see Bar-Haim et al., 2007 for metaanalysis). In other words, individuals, when encountering a threat-related stimulus (in our case, those consistent with COVID-19), may be more likely to be both vigilant for processing the threat immediately and to be slower to disengage their attention from the threat source. As originally formulated, the difference between reaction times to congruent and incongruent trials, whilst showing preferential attention, did not consider the vigilance and disengagement explanatory phases in the attentional allocation cycle. In response, by including a series of neutral-neutral trials into the procedure and comparing response times to congruent and incongruent trials separately, researchers have been able to measure threat vigilance (faster reaction times on congruent vs. neutral-neutral trials) and difficulty in disengagement from the stimulus (slower reaction times on incongruent vs. neutral-neutral trials) (see Koster et al., 2004).

Importantly, these effects of initial orientation to a threat and decreased capacity to move one's attention away from the threat are likely to be exacerbated as a function of increasing psychological distress. In this way, psychologically distressed individuals should show a different pattern of attentional allocation relative to those who are not psychologically distressed (Mogg & Bradley, 2016; Cisler & Koster, 2010; McNally, 2019) and this should be discernible from measures of health anxiety, COVID-19 anxiety and the COVID-19 anxiety syndrome as included in the present study. On this basis we predict that attentional bias for COVID-19-related stimuli (including measures of vigilance and disengagement) should be magnified as a function of health anxiety, COVID-19 anxiety and the COVID-19 anxiety syndrome.

Aims of the current study

In summary, the aims of the current study are two-fold. First, to provide further evidence for the validation of the COVID-19 anxiety syndrome (as measured by the C-19ASS) against measures of personality, health anxiety and COVID-19 anxiety in predicting levels of generalised anxiety and depression for the first time in a UK sample. Secondly, to examine whether increased health anxiety, COVID-19 anxiety, and COVID-19 anxiety syndrome (as measured by the C-19ASS) scores are associated with increased attentional bias to COVID-19-related stimuli, and whether this effect is best explained by vigilance to threat (early phase) and/or inability to disengage (late phase). We also hypothesise that adults at ‘high-risk’ (e.g., age, health-related), and those who have had threat enhancing (e.g., death of a close person) or threat reducing (e.g., vaccination) associated experiences with will respectively exhibit increased and decreased attentional bias to COVID-19-related stimuli.

Method

Participants

Sample size calculation. Assuming 80% power, an effect size of 0.38 for high vs low psychological distress group differences (two-tailed) (based on Bar-Haim et al.’s 2007 meta-analysis), an alpha is .05 and an allocation ratio of 2:1 (low psychological distress: high psychological distress) (based on circa 40% of population experiencing significantly elevated psychological distress related to COVID-19 (ONS, 2020)), a sample size of 248 was required. Assuming a 20% attrition rate a final sample size of 298 was determined.

Sample achieved. A representative¹ sample of two hundred and ninety-eight UK-based adults aged 18 + stratified by age, gender, and ethnicity was achieved via the Prolific (www.prolific.co) crowd sourcing platform (mean age = 46.27, sd = 15.27; 150 (50.3%)

¹ See <https://researcher-help.prolific.co/nc/en-gb/articles/360019238413> for details of generating representative samples in the Prolific system.

females, 148 (49.7%) males. Once outliers in responses to the dot probe task (responses times (RTs) less than 250 ms and greater than 1000 ms) were removed (see Rodebaugh et al., 2016), as well as participants who recorded greater than 20% errors (invalid and incorrect responses, $n = 12$), a final sample of 286 participants, comprising 142 (49.7%) females and 144 (50.3%) males (mean age 46.34 years, $SD = 15.21$, range = 18 - 76) was achieved for analysis (see Table 1 for sample demographics).

The ethnic background of this sample was as follows: 79.8% White; 6.4% Black; 8.5% Asian, 5%, Mixed Race, and 0.4% Other. The majority of the sample was educated at University level (64.5%), married, co-habiting or in a civil partnership (59.2% vs. 29.4% single), and employed or retired (79.4%). Approximately one half (48.6%) reported no religious affiliation (vs. 44.1% Christian). About one third of the sample (36.7%) had been tested for COVID-19 (of which 9.5% had tested positive) and 22% considered themselves to be at 'high-risk' from the disease, with 65.6% of sample reporting a health problem as the justification. Thirty respondents (10.5%) had experienced the loss of someone close to them as a consequence of COVID-19 and nearly a fifth (19.6%) had received the COVID-19 vaccination. The sample displayed a normal distribution of scores (based on skewness and kurtosis measures) on the Patient Health Questionnaire Anxiety and Depression Scale (Kroenke et al., 2016) with over half of the sample (55.2%) scoring below the threshold of 10 indicating the presence of mild psychological distress.

Design

A 2 (Word Type: Covid, neutral) x 2 (Word Position: left, right) x 2 (Probe Position; congruent, incongruent) x 2 (Block: block 1, block 2) x 2 (Presentation Order: dot probe-questionnaires, questionnaires-dot probe) mixed factorial design was used. Word Type, Word Position, Probe Position and Block were within-participants factors and Presentation Order a between-participants factor.

Materials

Sociodemographic variables. Participants were asked to state their age, gender, ethnicity, education level, religious affiliation (if any) and employment status.

COVID-19 risk status measures. Participants were asked whether they considered themselves to be at ‘high-risk’ health-wise should they contract COVID-19 (yes, no) and to provide a reason from the following categories: current health problem, older age, pregnancy, disability, or other. Participants were also asked whether they had had a COVID-19 test, a positive COVID-19 test, a COVID-19 vaccine and whether someone close has died as a result of COVID-19 (yes, no).

Big Five Inventory-10 (BFI-10; Rammstedt & John, 2007). This self-report measure includes 10 items, loading on five factors, assessing the personality domains, extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Participants are asked to rate how well statements describe their personality by marking on a 5-point Likert scale (1 = Strongly disagree to 5 = Strongly agree). Scores range between 2-10 for each of the five factors with increased scores indicating higher levels of a given personality trait. The BFI-10 has shown good reliability and validity across numerous samples (Rammstedt & John, 2007). Given two items per scale, no internal reliability test was performed (e.g., Soto & John, 2017).

Whiteley Index 7 (WI-7; Fink et al., 1999). This self-report measure assessing health anxiety includes seven items, loading on a single factor, (e.g., “Do you think there is something seriously wrong with your body?”). Participants are asked to rate to what degree each statement applies to them. The original response format (yes or no) was adapted using a 5-point Likert scale (1 = “Not at all” to 5 = “A great deal”), (see Welch, Carleton & Asmundson, 2009; Nikčević et al., 2021). Scores range between 7-35 with higher scores indicative of increasing levels of a health anxiety. The WI-7 has demonstrated good

reliability and validity across many sample groups (Fink et al., 1999; Welch, Carleton & Asmundson, 2009). In the current study the Cronbach $\alpha = .89$.

Coronavirus Anxiety Scale (CAS; Lee, 2020). This self-report measure comprises five items, loading on a single factor, assessing physiologically based symptoms that are aroused with COVID-19-related information and thoughts (e.g., “I felt dizzy, lightheaded, or faint, when I read or listened to news about the Coronavirus”). Participants rate how frequently they experience each symptom by marking a 5-point time anchored scale (0 = Not at all to 4 = Nearly every day over the last 2 weeks). Scores range between 0-20 with increased scores indicative of higher levels of a COVID-19 anxiety. The CAS has demonstrated good reliability and validity (Lee et al., 2020b). In the current study the CAS had a Cronbach $\alpha = .81$.

COVID-19 Anxiety Syndrome Scale (C-19ASS; Nikčević & Spada, 2020). This self-report measure includes nine items, loading on two factors, assessing features of the anxiety syndrome linked to COVID-19. These are: (1) avoidance (e.g., of public transport because of the fear of contracting COVID-19); (2) checking (e.g., of symptoms of COVID-19); (3) worrying (e.g., researching symptoms of COVID-19 at the cost of other activities); and (4) threat monitoring (e.g., paying close attention to others displaying possible symptoms of COVID-19. Items relating to checking, worrying and threat monitoring load on the first factor (‘perseveration’) with a second factor comprising avoidance items (‘avoidance’). Participants are asked to rate how frequently they experience each feature of the anxiety syndrome using a 5-point time anchored scale (0 = “Not at all” to 4 = “Nearly every day over the last 2 weeks”). Scores range between 0-36. with higher scores indicative of increased levels of the anxiety syndrome. The C-19ASS has demonstrated good reliability and validity (Nikčević & Spada, 2020). In the current study the Cronbach $\alpha = .82$.

Patient Health Questionnaire Anxiety and Depression Scale (PHQ-ADS; Kroenke et al., 2016). This self-report measure assesses the severity of generalised anxiety

and depression symptoms. The PHQ-ADS combines the Generalized Anxiety Disorder 7-item (GAD-7; Spitzer et al., 2006) and the PHQ-9 (Kroenke, Spitzer & Williams, 2001) self-report measures. The combined PHQ-ADS is a reliable and valid composite measure with (see Kroenke et al., 2016) with higher scores indicative of increased symptoms of generalised anxiety and depression. In the current study the Cronbach $\alpha = .95$.

Attentional bias measure. To measure preferential allocation of attention to COVID-19-related stimuli the dot probe task was utilised. The stimuli used consisted of 24 COVID-19-related words and 24 neutral words arranged into two blocks of 12 pairs (Block 1: hands-white, clean-offer, social-league, cough-decor, fever-rocky, temperature-newspaper, mask-fold, glove-lakes, symptoms-objective, wash-bell, handwash-mudflat, close-story; Block 2: distance-computer, hospital-election, ventilator-antiquity, oxygen-tunnel, lungs-rhyme, infection-sculpture, virus-coral, lockdown-pontoon, pandemic-sopranos, shielding-fairways, isolation-equation, lonely-package).

Each trial word was generated initially by requiring 12 individuals (six males and six females) to rate how representative each of 32 COVID-19-related words were on seven-point scales with poles labelled “Not at all representative” (scored 1) and “Completely representative” (scored 7). Only words achieving mean ratings above 5.42 and a SD less than 0.8 were selected to ensure that words were representative of the relevant category and that there was minimum variability in responses across individuals. Each COVID-19-related word was then paired with a neutral word to form the 24-word pairs. COVID-19-related and neutral words were matched in terms of word length, number of syllables and frequency of use using Subtlex-UK (Van Heuven et al., 2014) such that mean frequencies were shown not differ across word type, $p = .38$. In addition, 8 matched pairs of neutral words (4 pairs per block) were also generated to act as filler stimuli and to enable the calculation of vigilance to threat and delayed disengagement indices (see below) (Block 1: author-concert, opticians-

sultanas, bill-feet, object-valley; Block 2: dollhouse-coffee-pot; town-stand, picnic-buses, lecture mammals).

Each trial comprised a fixation cross presented in the middle of the screen. After 750 – 1100 ms the fixation cross disappeared and was replaced by the two-word stimuli, one on the left and one on the right of the screen. These stimuli disappeared after 500 ms and were replaced by a dot or “probe” that appeared at the same location as one of the stimuli (i.e., either left or right) for a maximum of 1500 ms or until a response was made. Participants were instructed to press either the ‘f’ key (left) or the ‘j’ key (right) to indicate the location of the probe as quickly and as accurately as possible.

Procedure

All data was generated between 15-17th February 2021². After initially consenting, participants were presented with the demographic and COVID-19 information questions and then randomly assigned such that order for completion of either the dot probe or self-report (questionnaires) first was counterbalanced across participants (half dot-probe followed by self-report, half self-report followed by dot-probe).

For the dot probe, participants were seated in front of a computer screen, presented with task instructions and then eight practice trials comprising pairs of letter strings (e.g., AAAA-VVVV). Having completed practice trials, the experimental phase comprised two blocks (see above) of 48 trials for 12 COVID-19 neutral word pairs with Word Position (left, right) and Probe Position (congruent, incongruent) counterbalanced across participants and eight trials of four neutral-neutral word pairs. [Trials in which probes replaced COVID-19-related words paired with neutral words were congruent trials while those which replaced neutral words opposite COVID-19-related words were incongruent]. Prior to each block participants were reminded of the task instructions. In total participants completed 120 trials

² The UK was in the midst of its third pandemic lockdown.

(8 practice + 96 COVID-19 neutral + 16 neutral-neutral trials). All word pairs were randomly presented within each block.

Participants were presented with the BFI-10, WI-7, CAS, C-19ASS, and PHQ-ADS in that order with accompanying questionnaire-specific instructions. On completion of the study participants were debriefed. All procedures were subject to ethical approval by the Kingston University Research Ethics Committee in December 2020.

Results

Analysis outline

Data were analysed in phases. The first phase concerned how protective and vulnerability factors predicted levels of generalised anxiety and depression. The second phase tested whether self-report measures (all questionnaires) were associated with differences in the three attentional bias indices.

Protective and vulnerability factors in predicting generalised anxiety and depression

Initial Pearson's r correlation coefficients between potential predictors and PHQ-ADS [criterion] were calculated to ascertain significant associations for inclusion in subsequent analyses. Of the demographic and COVID-19 experiential factors, age ($r = -.32, p < .001$), gender ($r = .18, p < .01$), COVID-19 vaccination (1 = yes, 2 = no) ($r = .13, p < .05$), and COVID-19 death of a person close (1 = yes, 2 = no) ($r = -.12, p < .05$) were shown to correlate significantly with PHQ-ADS scores. Correlations involving personality, WI-7, CAS, C-19ASS-Total, C-19ASS-Avoidance and C-19ASS-Perseveration with PHQ-ADS were all shown to be positive and significant (all $ps < .01$) (see Table 1).

Table 1 about here

Prior to analyses data were subject to assumption testing. First, a sample size of 286 is sufficient given 13 predictor variables. Collinearity statistics were within acceptable limits for multicollinearity (Tolerance range, .54 - .96; VIF range, 1.05 – 1.80). Mahalanobis

distance scores, Cook's distance and centred leverage scores identified no significant multivariate outliers and residual analysis (including Loess line fitting and Q-Q plots) and scatterplots showed normality, linearity and homoscedasticity assumptions were adhered to.

A hierarchical multiple regression was performed predicting PHQ-ADS scores from age, gender (1 = male; 2 = female), COVID-19 vaccination (1 = yes, 2 = no), and COVID-19 death of a person close (1 = yes, 2 = no) [step 1], the addition of the BFI-10 subscales [step 2], WI-7 (step 3), CAS [step 4] and C-19ASS-Avoidance and C-19ASS-Perseveration [step 5] (see Table 2).

Results showed that on step 1, age, gender, COVID-19 vaccination, and COVID-19 death of a close person together significantly predicted PHQ-ADS scores, $F(4, 285) = 13.21$, $p < .001$. Introducing the BFI-10 subscales (step 2) resulted in a significant regression equation, $F(9, 285) = 15.86$, $p < .001$, explaining an additional 18% of variance in PHQ-ADS scores, $\Delta F(5, 276) = 15.27$, $p < .001$. The addition of WI-7 (step 3) also resulted in a significant equation, $F(10, 285) = 22.23$, $p < .001$, accounting for a further 11% of variance explained in PHQ-ADS scores, $\Delta F(1, 275) = 52.91$, $p < .001$. Adding the CAS in step 4 again produced a significant equation, $F(11, 285) = 28.19$, $p < .001$, explaining an additional 8% of variability in PHQ-ADS scores, $\Delta F(1, 272) = 48.95$, $p < .001$. Finally, the introduction of the two subscales of the C-19ASS (step 5) resulted in a significant equation, $F(13, 285) = 26.87$, $p < .001$, and accounting for an extra 3% of variance in PHQ-ADS scores, $\Delta F(2, 272) = 9.74$, $p < .001$. This final model (step 5) showed that variability in PHQ-ADS scores was significantly predicted by age, gender, conscientiousness, and openness, WI-1, CAS, and C-19ASS-Perseveration (all $ps < .05$) and accounted for a total of 56% of variance in PHQ-ADS scores (see Table 2).

Table 2 about here

Attentional bias for COVID-19-related stimuli

Analyses are restricted to mean correct responses (mean percentage error rates = 1.67, $sd = 2.48$) to congruent, incongruent, and neutral trials.

An initial three-way ANOVA with Trial Type (congruent, incongruent) and Word Block (block 1, block 2) as within participants factors and Presentation Order (dot probe-questionnaires, questionnaires-dot probe) as a between participants factor was applied. Results showed a significant main effect for Trial Type, $F(1, 284) = 11.28, p < .001, \eta_p^2 = .04$, indicating that RTs (ms) for congruent trials were significantly faster than for incongruent trials. All other main and interaction effects for block type and presentation order were not significant (all $ps > .05$) (see Table 3). Furthermore, the effects of factors hypothesised to increase threat (i.e., high risk status, COVID-19-related death in family) and/or reduce threat (i.e., vaccination) were also not significant.

Table 3 about here

Attentional bias indices

An aggregated mean index for attentional bias was calculated by subtracted mean RTs for congruent trials from mean RTs for incongruent trials (see MacLeod, Matthews & Tata, 1986) [positive values indicating increasing attentional bias for congruent trials]. Aggregated mean indices for vigilance to threat (mean RTs for congruent trials were subtracted from mean RTs for neutral-neutral trials) [positive values equal increasing vigilance] and slowed disengagement from threat (mean RT for incongruent trials subtracted from mean RTs for neutral-neutral trials) [negative values equal increasing slowed disengagement] were also calculated (see Koster et al., 2004) (see Table 3).

Pearson's r correlation coefficients between attentional bias indices, demographics and COVID-19 experiential factors (i.e., high risk status, COVID-19-related death in family) showed *no* significant associations (all $ps > .23, -.01 < rs < .11$). Correlations between all the

questionnaires scores and attentional bias indices were also calculated (see Table 4). Only C-19ASS-Total and the component subscales, C-19ASS-Avoidance, and C-19ASS-Perseveration, were shown to positively, and significantly, correlate with attentional bias indices. More specifically, the general attentional bias index was *only* shown to be positively and significantly correlated with C-19ASS-Total and C-19ASS-Perseveration scores while slowed disengagement was *only* shown to be negatively and significantly correlated with C-19ASS-Total and C-19ASS-Avoidance scores ($ps < .05$).

Table 4 about here.

Discussion

The aims of the current study were to provide further evidence, in a representative sample of UK residents during the third COVID-19 lockdown in February 2021, towards construct validity of the C-19ASS. Correlational analyses revealed that personality traits, health anxiety, COVID-19 anxiety, C-19ASS-Total and its two subscales, were positively and significantly correlated with generalised anxiety and depression. These findings provide additional support for the concurrent validity of the C-19ASS. In addition, the C-19ASS-Perseveration subscale was found to predict generalised anxiety and depression scores independently of age, gender, conscientiousness, openness, health anxiety and COVID-19 anxiety. This finding confirms that the COVID-19 anxiety syndrome is a separate (therefore ‘standalone’) predictive entity of psychological distress during the COVID-19 pandemic. The C-19ASS-Avoidance subscale was not found to predict psychological distress. This may be due to the fact that the United Kingdom was in national lockdown, and the opportunity to purposefully avoid public places and transport, for example, was removed. It is plausible to assume that the lifting of lockdown may bring to prominence avoidance behaviour associated with the COVID-19 anxiety syndrome.

The present study also showed there was an attentional bias towards COVID-19-related stimuli. In other words, individuals were faster to respond to probes replacing threat-related stimuli (i.e., COVID-19-related) [congruent trials] compared to matched neutral words [incongruent trials]. This suggests when presented with a pair of stimuli, one COVID-19-related and the other non-COVID-19-related, individuals' attention is oriented towards the COVID-19-related stimuli. Why should this be the case? One suggestion is that our attentional system is attuned to process stimuli that are salient in terms of potential harm (with threat-related potential) in such a way as to allow us to prepare to act to buffer the anticipated harm (Cisler & Koster, 2010; Bar-Haim et al, 2007). Given the timing of the study, it is of little surprise that we have shown this generic effect across the sample given the indirect/direct prominence of COVID-19-related experiences.

This generic bias was also not shown to vary as a function of factors that may be thought to moderate the operation of our attentional preferences. For example, *a priori* we might have expected that factors such as one's age and whether or not one had received a vaccination, a positive COVID-19 test or knew of someone close who had died as a result of COVID-19, would have resulted in threat-related stimuli being processed differently (increasing or decreasing bias, dependent upon experiential/demographic factor). The argument is that experiential/demographics that are presumed to put one at increased/decreased risk of infection should make COVID-19-related stimuli more salient resulting in a differential pattern of attentional bias. As this was not shown to be the case such potential moderators are not important in describing how one's attentional system processes relevant stimuli. We did however observe that both increasing age, and the experience of knowing a person who had died as a result of COVID-19, were shown to be significant predictors of generalised anxiety and depression (as measured by the PHQ-ADS), but that generalised anxiety and depression were not associated with attentional bias. This

highlights the importance of experiential factors in psychological well-being but not for cognitive makers in the processing of related threat.

Results also indicated that this attentional bias towards COVID-19-related stimuli was *only* positively and significantly correlated with the C19-ASS. In other words, increased COVID-19 anxiety syndrome scores were positively and significantly correlated with the size of the bias. This suggests that increasing attentional bias is a cognitive marker for increasing COVID-19 anxiety syndrome as measured by the C19-ASS and is not associated with either COVID-19 anxiety (as measured by the CAS) or health anxiety (as measured by the WI-7 Index). That this pattern is also shown for the perseveration subscale of the C19-ASS (positive and significant correlation with attentional bias) adds to this observation. In other words, participants' preferential attention towards COVID-19-related stimuli is associated with a number of factors which have been shown to be important in predicting psychological distress (e.g., increased obsessive thinking, perseverative worry, checking and threat monitoring) (Nikčević & Spada, 2020; Nikčević et al, 2021; Jungmann & Witthöft, 2020). This points to the idea that how individuals use their attentional systems in interacting with threat-related stimuli may serve as a specific marker of this type of thinking. This is of importance to the extent that perseverative thinking may lead to an escalation in obsessional thinking about COVID-19 and the emergence of anxiety and maladaptive coping (Lee, 2020; Nikčević & Spada, 2020; Nikčević et al, 2021). The coping captured by C19-ASS therefore represents a strategy that leads to amplification rather than diminishment of distress in relation to the COVID-19-related stimuli.

In addition, our results suggest that an increasing slowing of the capacity for an individual to shift their attention away from the stimulus (to disengage attention) is of particular importance in describing characteristics of anxiety associated with COVID-19. More specifically, it appears that (a) increasing attentional bias is explained better by

detriments in the attentional system to disengage than increased threat vigilance, (b) increasing COVID-19 anxiety syndrome scores in general are significantly correlated with a slowing of disengagement, and (c) that aspect of the COVID-19 anxiety syndrome associated with an individual's "need" to take avoidant action against the threat is of primary importance. That increased avoidant behaviours are associated with an increasing likelihood of being slower to shift attention away from COVID-19 stimuli suggests that psychological distress, as operationalised via the C-19ASS, is best articulated as a late-stage attentional processing deficit. That none of the C-19ASS measures were associated with vigilance to threat adds to this reasoning suggesting that inflated syndrome scores are specific to those aspects of attentional allocation characterised more by a deficit in disengagement than by vigilance to the threat per se. Individuals who show an inflated slowing in their ability to disengage from the stimulus word also report a propensity to avoid situations which are likely to expose them to the threat, and it is this cognitive-behavioural relationship that may form the core of the psychological distress experienced.

Whilst this reasoning may be accepted, understanding the causal relationship between inflated COVID-19 anxiety syndrome features and the observation that individual's attentional systems are biased towards the threat source cannot be specified. It could be argued that frequency of exposure to COVID-19-related threat creates the attentional bias demonstrated in this study which manifests itself as a component of a related syndrome. Alternatively, it could reasonably be argued that the observed attentional bias is the result of any increased experienced syndrome. These observations point to the idea that the relationships observed between (a) the operation of the attentional bias in general with increasing perseverative thinking, and (b) detriments in disengaging from the COVID-19 threat being associated with increased avoidant thinking, are either components of and/or markers of a COVID-19 anxiety syndrome.

In showing that increased attentional bias, and in particular slowed disengagement, is associated with C19-ASS total and subscales scores, whereas other candidate factors, such as health anxiety and COVID-19 anxiety are not, points to the significance of the COVID-19 anxiety syndrome (as measured by the C-19ASS) as providing a useful understanding of psychological distress experienced during the COVID-19 pandemic. It appears that perseverative thinking and avoidant intentions are particularly important in detailing how individuals attend in a biased manner to COVID-19 threat-related material.

We have shown that individuals respond faster to congruent versus incongruent trials, indicative of an attentional bias towards COVID-19-related stimuli presented for 500 ms. Whilst this is consistent with other work which has shown this effect using the same presentation threshold in individuals with elevated trait anxiety, work has also shown that at presentation speeds of circa 1200 ms individuals show a pattern of responding indicative of attentional avoidance (e.g., Koster, Crombez & Verschuere, 2006; Mogg et al., 2004). In other words, at increased stimulus durations individuals are slower to respond to congruent versus incongruent trials because their attention is elsewhere to avoid any threat posed. Our work is limited to the extent that we cannot rule out the possibility that individuals may deliberately avoid the stimuli when they are given sufficient time to and that this is influential in terms of any potential association with C-19ASS subscales. Future work should examine this alternative.

The interpretation of our findings is also limited to the extent that, although we have used a single well-established measure of attentional bias, which shows consistent variability with measures associated with anxiety and depression (see Cisler & Koster, 2010), a more comprehensive picture necessitates further validation and replication of COVID-19 anxiety syndrome indices with other relevant measures (e.g., eye tracking technology, gaze contingency task, Posner cueing task, visual search task, etc).

A further limitation concerns the idea that we have provided a “snapshot” of the relationship between the measures in our study and attentional bias. This is interesting to the extent that we can generalise in terms of how individuals may respond to similar pandemics in the future. However, to derive a better understanding of how individuals adapt to such threat over time requires measurement at different points during the pandemic experience. Future work should detail the possible changing relationship between the measures in our study and attentional biases to establish the pervasiveness and generalisability of effects over time. Furthermore indicative cut offs of severity for the COVID-19 anxiety syndrome should be delineated as well as determining of the presence of such syndrome exists *de novo* in those without prior depression or anxiety.

Implications for interventions

Our findings align themselves to important emerging research in the field of COVID-19 psychological distress. For example, items on the C-19ASS-Perseveration subscale tap into obsessive thinking and other forms of perseveration (worry) which may be associated, as recently argued by Lee and colleagues (2020b), to an exacerbation of a maladaptive form of coping (e.g., addictive behaviours). Other items of the C-19ASS-Perseveration tap into constructs which have been found to be of central importance in COVID-19 psychological distress, including safety behaviours (Lee et al., 2020b; Taylor et al., 2020) and excessive online information searching (Jungmann & Witthöft, 2020).

The capacity of being able to identify the COVID-19 anxiety syndrome (avoidance, worry, checking and threat monitoring) may be of value during and post the current health crisis (Asmundson & Taylor, 2020). For example, interventions aimed at interrupting perseverative thinking (e.g. Metacognitive Therapy; Wells, 2000), reducing checking, safety behaviours and avoidance (e.g. graded exposure and response prevention; Barlow et al., 2014) as well as training and re-calibrating attention (e.g. attention training technique; Wells, 2000)

may serve to weaken the COVID-19 anxiety syndrome and possibly reduce the longer-term occurrence of psychological distress which is typically linked to pandemic events, in particular post-traumatic stress, general stress, anxiety, health anxiety, and suicidality (Chong et al., 2004; Lee et al., 2020b; Wheaton et al., 2012; Wu et al., 2009; Yip et al., 2010).

Summary

This study has shown, in a representative sample of UK residents during the third national lockdown, the importance of the COVID-19 anxiety syndrome in predicting both generalised anxiety and depression, as well as attentional biases towards COVID-19-related stimuli. In order to improve the generalizability of the findings, the replication of this study to include participants from other countries as well as clinical samples would be of value.

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Table 1:

Descriptive statistics and inter-correlations for PHQ-ADS, BFI subscales, WI-7, CAS and C-19ASS (including subscales).

	X	SD	2	3	4	5	6	7	8	9	10	11
1. PHQ-ADS	10.47	10.43	-.18**	-.12*	-.29**	.47**	.24**	.46**	.52**	.44**	.20**	.51**
2. BFI-10-Ext	5.60	2.15		.20**	.10	-.30**	.17**	-.06	-.12*	-.07	-.07	-.05
3. BFI-10-Agr	7.12	1.65			.21**	-.22**	-.03	-.02	.02	.06	.05	.05
4. BFI-10-Con	7.62	1.70				-.30**	-.089	-.16**	-.12*	-.01	.07	-.07
5. BFI-10-Neu	5.70	2.20					.35**	.36**	.28**	.20**	.10	.23**
6. BFI-10-Ope	6.06	1.95						.20**	.14*	.04	-.01	.07
7. WI-7	13.72	5.54							.36**	.30**	.18**	.32**
8. CAS	0.84	1.85								.44**	.25**	.48**
9. C-19ASS-Total	13.36	7.31									.81**	.90**
10. C-19ASS-A	6.78	3.64										.48**
11. C-19ASS-P	6.58	4.85										

$n = 286$; * $p < .05$; ** $p < .01$.

Note: PHQ-ADS = Patient Health Questionnaire Anxiety and Depression Scale; BFI-10-Ext = Big Five Inventory-10-Extraversion; BFI-10-Agr = Big Five Inventory-10-Agreeableness; BFI-10-Com = Big Five Inventory-10-Conscientiousness; BFI-10-Neu = Big Five Inventory-10-Neuroticism; BFI-10-Ope = Big Five Inventory-10-Openness; WI-7 = Whitley Inventory 7; CAS = Coronavirus Anxiety Scale; C-19ASS-Total = COVID-19 Anxiety Syndrome Scale-Total; C-19ASS-A = COVID-19 Anxiety Syndrome Scale-Avoidance; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration.

Table 2.

Hierarchical regression statistics predicting PHQ-ADS scores.

Predictor	β	t	sr^2	R	R^2	ΔR^2
Step 1				.40	.16	.16***
Age	-.32	5.57***	.09			
Gender	.19	3.46***	.04			
COVID-19 vaccine	.03	0.58	.00			
CCOVID-19 close death	-.13	2.32*	.02			
Step 2				.58	.34	.18***
Age	-.24	4.45***	.05			
Gender	.13	2.61*	.02			
COVID-19 vaccine	-.01	0.15	.00			
COVID-19 close death	-.14	2.81**	.02			
BFI-10-Ext	-.09	1.72	.01			
BFI-10-Agg	-.01	0.23	.00			
BFI-10-Con	-.15	2.94**	.02			
BFI-10-Neu	.28	4.44***	.05			
BFI-10-Ope	.13	2.37*	.01			
Step 3				.67	.45	.11***
Age	-.28	5.70***	.07			
Gender	.15	3.24**	.02			
COVID-19 vaccine	-.01	0.14	.00			
CCOVID-19 close death	-.10	2.30*	.01			
BFI-10-Ext	-.11	2.12*	.01			
BFI-10-Agg	-.03	0.69	.00			
BFI-10-Con	-.13	2.63**	.01			
BFI-10-Neu	.14	2.37*	.01			
BFI-10-Ope	.10	2.05*	.01			
WI-7	.36	7.27***	.11			
Step 4				.73	.53	.08***
Age	-.28	6.07***	.06			
Gender	.09	2.14*	.01			
COVID-19 vaccine	-.01	0.29	.00			
CCOVID-19 close death	-.07	1.62	.00			
BFI-10-Ext	-.08	1.73	.01			
BFI-10-Agg	-.05	1.15	.00			
BFI-10-Con	-.11	2.56*	.01			
BFI-10-Neu	.11	1.94	.01			
BFI-10-Ope	.09	1.87	.01			
WI-7	.26	5.60***	.05			
CAS	.33	6.99***	.08			

Step 5				.75	.56	.03***
Age	-.22	4.69***	.04			
Gender	.10	2.36*	.01			
COVID-19 vaccine	-.00	0.03	.00			
CCOVID-19 close death	-.06	1.33	.00			
BFI-10-Ext	-.09	1.90	.01			
BFI-10-Agg	-.06	1.46	.00			
BFI-10-Con	-.12	2.84**	.01			
BFI-10-Neu	.09	1.80	.01			
BFI-10-Ope	.10	2.19*	.01			
WI-7	.23	4.83***	.04			
CAS	.24	4.79***	.04			
C-19ASS-A	-.01	0.13	.00			
C-19ASS-P	.22	4.01***	.03			

$n = 286$; * $p < .05$; ** $p < .01$, *** $p < .001$

Note: Gender (1 = males, 2 = females); COVID-19 vaccine (1 = yes, 2 = no); COVID-19 close death (1 = yes, 2 = no); PHQ-ADS = Patient Health Questionnaire Anxiety and Depression Scale; BFI-10-Ext = Big Five Inventory-10-Extraversion; BFI-10-Agr = Big Five Inventory-10-Agreeableness; BFI-10-Com = Big Five Inventory-10-Conscientiousness; BFI-10-Neu = Big Five Inventory-10-Neuroticism; BFI-10-Ope = Big Five Inventory-10-Openness; WI-7 = Whitley Inventory 7; CAS = Coronavirus Anxiety Scale; C-19ASS-Total = COVID-19 Anxiety Syndrome Scale-Total; C-19ASS-A = COVID-19 Anxiety Syndrome Scale-Avoidance; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration.

Table 3.

Mean correct reaction times (ms) and standard deviations for congruent, incongruent, and neutral trials and attentional bias indices.

	Trial Type			Attentional Bias Indices		
	Congruent	Incongruent	Neutral	Attentional Bias – General	Vigilance to threat	Slowed Disengage
X	422.42	425.50	425.08	3.08	2.66	-0.42
SD	64.12	66.26	67.98	16.67	21.55	21.73

Note: Attentional Bias – General = Incongruent – Congruent; Vigilance to threat = Neutral – Congruent; Slowed Disengagement = Neutral – Incongruent.

Table 4.

Intercorrelations (Pearson's r) for attentional bias indices (general, vigilance, and disengagement), PHQ-ADS, BFI subscales, WI-7, CAS and C-19ASS (including subscales).

	Attentional Bias – General	Vigilance to threat	Slowed Disengagement
1. PHQ-ADS	.02	.03	.01
2. BFI-10-Ext	.06	.02	-.03
3. BFI-10-Agr	-.04	.04	.07
4. BFI-10-Con	-.03	-.07	-.05
5. BFI-10-Neu	.08	.04	-.03
6. BFI-10-Ope	.11	.04	-.04
7. WI-7	.11	-.03	-.11
8. CAS	.04	-.03	-.06
9. C-19ASS-Total	.13*	-.03	-.12*
10. C-19ASS-A	.09	-.06	-.12*
11. C-19ASS-P	.12*	-.01	-.10

$n = 286$; * $p < .05$.

Note: PHQ-ADS = Patient Health Questionnaire Anxiety and Depression Scale; BFI-10-Ext = Big Five Inventory-10-Extraversion; BFI-10-Agr = Big Five Inventory-10-Agreeableness; BFI-10-Com = Big Five Inventory-10-Conscientiousness; BFI-10-Neu = Big Five Inventory-10-Neuroticism; BFI-10-Ope = Big Five Inventory-10-Openness; WI-7 = Whitley Inventory 7; CAS = Coronavirus Anxiety Scale; C-19ASS-Total = COVID-19 Anxiety Syndrome Scale-Total; C-19ASS-A = COVID-19 Anxiety Syndrome Scale-Avoidance; C-19ASS-P = COVID-19 Anxiety Syndrome Scale-Perseveration.