Metacognitions About Health in Relation to Coronavirus Anxiety: The Mediating Role of Cognitive Attentional Syndrome and Distress Tolerance

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Abstract

The current study aimed to investigate the mediating role of cognitive attentional syndrome (CAS) and distress tolerance in the relationship between health-related metacognitions and coronavirus anxiety. The sample of this study consisted of 462 participants (381 female). Participants voluntarily completed self-report questionnaires on each of the variables mentioned above. The results of the structural modeling analysis showed that health-related metacognitions have a significant effect on the mediator variable of distress tolerance and CAS. Also, health-related metacognitions had a direct effect on coronavirus anxiety. Also, based on the results of the bootstrap test, it can be argued that health-related metacognitive beliefs, apart from their direct effect, play an important role in coronavirus anxiety, with CAS acting as a mediator. This study provides insights into the relationships among metacognitive beliefs, coronavirus anxiety, CAS, and distress tolerance. In particular, dysfunctional metacognitive beliefs, including an individual's beliefs about the uncontrollability of disease-related thoughts, are risk factors that could negatively affect mental health, leading to coronavirus anxiety. In addition, the association of dysfunctional beliefs with maladaptive behaviors resulting from the cognitive attentional syndrome is also involved in predicting and causing coronavirus anxiety. Given the insignificant role of emotional distress tolerance in the psychopathology of COVID-19 anxiety, the findings emphasize the importance of cognitive factors in this context.

Keywords Health-related metacognitions · Coronavirus anxiety · Cognitive attentional syndrome · Distress tolerance

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Introduction

In late 2019, an outbreak of COVID-19 (caused by the coronavirus SARS-CoV-2) was observed in Wuhan, China. The infection quickly spread to other areas of China (Chen et al., 2020; Zhao & Chen, 2020; Zhu et al., 2020) and triggered a global public health emergency (Enitan et al., 2020; Lai et al., 2019; World Health Organization, 2020a). Iran is now one of the most impacted countries experiencing the Sixths pandemic wave (Tehran Times, 2022). According to official data, there were 2,396,204 confirmed cases of COVID-19 and 69,574 fatalities in Iran between 3rd January 2020 and 26th April 2021 (World Health Organization, 2020b).

According to the present body of knowledge on COVID-19, some psychological elements are stronger at causing and intensifying anxiety associated with this coronavirus (ADAA, 2020; Chi tam et al., 2020; Jungmann & Witthöft, 2020), which can result in major health concerns (Gallagher et al., 2020; Lee, Jobe, et al., 2020; Mazza et al., 2020; McKay et al., 2020). As mental strain is expected to persist throughout the pandemic, more studies on pandemic-related psychological issues are needed (Lee, Mathis, et al., 2020). A recent study conducted during the fourth wave of the pandemic by using a national survey (Akbari et al., 2021c, 2021d) revealed that Iranians had experienced psychological distress due to the COVID-19. The authors have found that distress intolerance has predicted psychological distress, partially mediated by psychological flexibility. The significant mediation was independent of demographic factors (age, gender, marital status, and educational level) and fear of COVID-19, mindfulness, and satisfaction with life. The authors concluded that despite the mentioned variables, accepting and using unpleasant emotions as fuel to achieve valued goals rather than avoiding them would mitigate the psychological distress during the pandemic.

Some researchers have found that fear and anxiety about COVID-19 are associated with higher rates of anxiety and depression symptoms (Ahmed et al., 2020; Ahorsu et al., 2020; Jungmann & Witthoft, 2020; Lee, Mathis, et al., 2020; Lee, 2020b; Taylor & Asmundson, 2020; Wang et al., 2020; Akbari et al., 2021d). The heightened anxiety and depressive symptoms are associated with health anxiety (HA; Nikčević et al., 2021). It refers to psychological distress when a person thinks he/she is ill or will become ill (Creed et al., 2018). This is a constant anxiety that most people will experience during the pandemic. This state can be affected by metacognitions about health, which reflect one's cognitions regarding health-related cognitions responsible for various emotional disorders (Leahy et al., 2018; Yilmaz et al., 2015). Metacognitive beliefs concerning uncontrollability and danger of thoughts can predict symptoms of health anxiety (Brown et al., 2019; Gutierrez et al., 2020; Rachor & Penney, 2020); suggesting that beliefs about the power of thoughts to cause illness and a feeling of inability to stop the thinking would elevate the health anxiety through threat interpretation of thoughts (Melli et al., 2018).

Metacognitive beliefs can activate and maintain what Wells and Matthews (1994) refer to as the Cognitive Attentional Syndrome (CAS), which is one of the

factors that contribute to an increase in anxiety and depression symptoms (Fergus et al., 2012; Fergus & Scullin., 2017; Kowalski et al., 2019). The CAS consists of three components: rumination and worry, repetitive negative thinking, and focusing attention on threats, as well as coping behaviors and strategies (e.g., thought suppression, thought and situation avoidance, or substance and alcohol use; Papageorgiou & Wells, 2009; Sica et al., 2007; Spada et al., 2015; Wells, 2009).

Typically, the CAS is activated to address unwanted negative intrusive thoughts (Wells, 2009); in COVID, *what if I got infected?* The CAS is made up of chains of verbal thought, such as excessive worry about getting sick; a pattern of putting the focus on the threat, which includes scanning the body for signs of illness and excessive body checking; and coping strategies that have negative consequences, such as looking up illnesses on the internet or trying to block out thoughts of illness. Rather than putting an end to negative thinking, the CAS encourages it, leading to the perception that illness is present. COVID-19 anxiety also can be harmonized with this perspective as a form and an indication of health anxiety.

Frequent activation of the CAS by catastrophic misinterpretations of physical symptoms can underlie sustained worry (Bailey & Wells, 2015a), which causes the persistence of negative emotions and negative self-appraisal in some individuals (Fergus & Bardeen, 2013; Fergus et al., 2012), cumulating the levels of anxiety and depression (Fergus et al., 2013; Kowalski et al., 2019). As this deplorable state persists, not all people may be able to bear and endure it, which refers to an individual's perceived ability to endure negative emotions and is one of the cognitive-emotional factors that influence the development of mental and emotional distress (Ranney et al., 2020), namely, distress tolerance (DT; Leyro et al., 2016).

Research shows that lower levels of DT are associated with a higher risk for clinically-relevant levels of depression (Felton et al., 2019;), anxiety (Lee et al., 2018), anxiety sensitivity (Sauer et al., 2020), and symptoms of PTSD (Liu et al., 2020; Wright et al., 2020; Zegel et al., 2020). These findings suggest that DT may play a key role in developing anxiety in general (Laposa et al., 2015). Associated behaviors with low DT may lead to persistent anxiety symptoms (Wright et al., 2020), triggered by the COVID-19 pandemic eternity (Sauer et al., 2020; Wright et al., 2020); People with low DT who feel inefficacy to tolerate negative internal state, for example, by thinking that COVID-19-related thoughts are uncontrollable and dangerous, are motivated to escape from internal states which intensifies anxiety.

Although several studies support the prominent role of distress tolerance in anxiety, this construct has received little exploration in the literature on health anxiety (Fergus et al., 2015; Keough et al., 2010; Sauer et al., 2020). Overall, we consider COVID-19 anxiety as an indication of health anxiety; thus, we believe that the anxiety of being infected with COVID-19 can be influenced by metacognitions about health, such as I cannot get rid of thinking about COVID-19 and I cannot stop it. However, we hypothesized that distress tolerance could mediate this path, as people who cannot tolerate the caused distress by the mentioned metacognitions may feel a higher level of COVID-19 anxiety. Moreover, we hypothesized that cognitive attentional syndrome could mediate the relationship between metacognitions about health and COVID-19 anxiety, given that fixed attention on the metacognitions would elevate the level of COVID-19 anxiety.

Methods

Participants

This study used a convenience sample of 462 participants. 82.5% were female (381 females; *Mean* age = 33.31, *SD* = 9.88) and 17.5% were male (81 males; *Mean* age = 34.62, *SD* = 9.72). In terms of education, 5% had some undergraduate education, 16% had a diploma, 27.18% had a bachelor's degree, 43.7% had a master's degree, and 12% had a doctoral degree. Concerning employment status, 54% were employed, 39% were unemployed, and 7% had lost their jobs because of the COVID-19 pandemic.

Measures

Coronavirus Anxiety Scale (CAS)

The Coronavirus Anxiety Scale (CAS) is a valid, unidimensional scale developed by Lee (2020a) that assesses the physiological responses of dysfunctional fear and anxiety associated with the COVID-19 virus. It is validated in Persian (Mohammadpour et al., 2020) and demonstrated good psychometric properties with Chronbach's alpha of 0.82. This scale consists of five items (e.g., "I felt paralyzed or frozen when I thought about or was exposed to information about the coronavirus"). Then, participants were assessed according to the 5-point scale (0 = none/never, 4 = almost every day for the past two weeks) on how often each anxiety symptom occurred (e.g., "I had trouble falling or staying asleep because I was thinking about the coronavirus"). Also, this scale has acceptable internal consistency reliability, structure, and concurrent validity. The cut score of this scale is ≥ 9, with 90% sensitivity and 85% specificity. The Cronbach's alpha in the original study was 0.92 and for the current study was 0.79.

The Metacognitions about Health Questionnaire (MCQ-HA; Bailey & Wells, 2015a, 2015b)

This tool was developed based on the widely-used, 30-item Metacognitions Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004). Unlike the MCQ-30, the MCQ-HA assesses the metacognitive beliefs associated with health anxieties. This scale consists of 14 items with a 4-point Likert response from 1 ("I do not agree") to 4 ("I strongly agree"). Based on the initial analysis by the parent study (Bailey and Wells, 2015a; 2015b), the following items were created: (1) beliefs about biased thinking (e.g., "Thinking the worse about symptoms will keep me safe"); (2) beliefs that thoughts cause illness ("Worrying about illness is likely to make it happen"); (3) beliefs about the uncontrollability of thoughts (e.g., "Dwelling on thoughts of illness is uncontrollable"). Studies have shown that this scale has acceptable internal consistency and discriminant and convergent validity. In the study by Bailey and Wells (2015c), the internal consistency of subscales with alpha scores is significant:

beliefs that thoughts cause illness = 0.82, beliefs about biased thinking = 0.81, and beliefs that thoughts are uncontrollable = 0.80. The Persian version of MCQ-HA (Akbari, 2019) has shown good internal consistency of 0.87. Also, in the current study, Cronbach's alphas of the total scale were 0.74.

The Cognitive Attentional Syndrome Scale (CAS-1; Wells, 2009)

The CAS-1 is a 16-item scale developed to assess the activation of cognitive-attentional symptoms (Wells, 2009). This scale measures the frequency of persistent thinking styles, dysfunctional coping strategies, and the extent of metacognitive beliefs about these strategies (Fergus et al., 2012, 2013). The first two items are questions about the frequency of rumination, worry, and threat monitoring. These are rated on a scale of 0 to 8. The other six items are related to maladaptive behaviors used to cope with negative emotions and thoughts (e.g., "I could make myself sick by worrying") and are rated from 0 to 8. The final subscale (8 items) assesses individuals' metacognitive beliefs about the CAS. However, to avoid inflation of associations between variables (metacognitions about health and CAS), the positive and negative generic metacognitions embedded in CAS-I were removed from the analysis. A high score of CAS-1 indicates an increase in the level of CAS activation. Additionally, CAS-1 has high internal compatibility (Cronbach's alpha = 0.86; Fergus et al., 2012). The Persian version (Farrokhi & Sohrabi, 2017) also has shown good psychometric properties with Chronbach's alpha of 0.82; the latter in the current study for the whole scale was 0.88.

Distress Tolerance Scale (DTS; Simmons & Gaher, 2005)

This questionnaire is a 15-item distress tolerance self-assessment index. The DTS is scored on a 5-point scale: (5) strongly disagree, (4) mildly disagree, (3) agree and disagree equally, (2) mildly agree, and (1) strongly agree. The items in this scale measure distress tolerance based on an individual's ability to cope with emotional distress, mental assessment of distress, attention to negative emotions if they occur, and regulatory actions to relieve distress. High scores on this scale indicate high distress tolerance. Alpha coefficients for these subscales in the original study were 0.72, 0.82, 0.78, 0.70, and 0.82 for the whole scale. This scale has also been found to have good standard validity and initial convergence (Simmons & Gaher, 2005). The Persian version (Akbari et al. 2021b) has demonstrated sound psychometric properties with Chronbach's alpha of 0.89, and in the current study, it is for the whole scale was 0.80.

Procedure

The current research was carried out according to the Helsinki Declaration of 1989. Participants were invited to participate in the current study via advertisements on digital applications (WhatsApp and Telegram). A web link was sent to the mentioned applications. A link was supplied with information on the current study

purpose on the first page. After agreeing to participate, how to complete the surveys, demographic information, and a pack of questionnaires became available to the respondents by confirming the consent form. Individuals were required to be at least 18 years old to participate in this study. All participants volunteered and were not compensated; also, they were assured that their answers would be confidential as they could fill out the questionnaires anonymously.

Data Analysis

Data were analyzed using SPSS version 25 for Windows (IBM SPSS Statistics) and LISREL 8.80 (Jöreskog & Sörbom, 2006). Correlations were used to assess the relationships between the variables in the current study. Second, structural equation modeling was used to assess the proposed model. The bootstrap was also used to test the mediational path (iteration number = 2000). The model fit was evaluated through the Chi-square index ($\chi 2$), comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). An adequate fit was indicated by values < 5 for $\mathcal{X}^2$/df, values > 0.9 for CFI, NFI and IFI; in addition, values equal to or < 0.08 (values < 0.06 are more appropriate) for the RMSEA and SRMR represent an adequate fit (Kline, 2015).

Results

Descriptive Statistics

See Table 1 for descriptive statistics, including the mean, standard deviation, skewness, and the kurtosis of the research variables.

Assumptions of Structural Equation Modeling

Before evaluating the structural model of the research, the assumptions of structural equation modeling were first examined. The skewness of the variables is in

Table 1 Correlation matrix and descriptive indices of research variables

	Variables	1	2	3	4	M	SD	Skewness	Kurtosis
1	MCQ-HA	1				27.97	6.51	0.243	− 0.116
2	DTS	0.445**	1			46.52	10.92	− 0.144	− 0.251
3	CAS-1	0.502**	0.455**	1		87.16	29.44	− 0.559	− 0.117
4	Coronavirus Anxiety	0.425**	0.375**	0.462**	1	6.96	3.217	1.165	1.195

n = 461

MCQ-HA Metacognitions about Health Questionnaire, *DTS* The Distress Tolerance Scale, *CAS-1* The Cognitive Attentional Syndrome Scale

** $p < .001$

the range of 0.742 to 1.957, and kurtosis falls in the range of -1.100 to 4.743. Chou and Bentler (1995) consider the cut-off point of ± 3 to be appropriate for the amount of skewness. For the cut-off point of the kurtosis, values greater than ± 10 are problematic for this index (Kline, 2011). The relative multivariate kurtosis index, which is calculated to evaluate the assumption of multivariate normality, was 1.29. Bentler (1998) believes that multivariate normality is achieved if the value of this index is less than 3.

Preliminary studies showed that the data is suitable for structural equation modeling using the maximum likelihood estimation method (Table 1).

Measurement Model

Before evaluating the structural model, the fit indices for the measurement model were calculated. The measurement model identifies the relationship between the observable and latent variables. The evaluation was done using confirmatory factor analysis, and the fit indices of the measurement model presented in Table 2 show a very good fit. Thus, the evaluation of the structural model indicates an acceptable fit.

Structural Model

Figure 1 illustrates the structural model with standardized coefficients using bootstrapping technique. As can be seen, health-related metacognitive beliefs as an independent variable with standard coefficients of 0.65 and 0.67, respectively, significantly affect the mediator variable of distress tolerance and cognitive attentional syndrome. Also, with a standardized coefficient of 0.57, health-related metacognitive beliefs significantly affect coronavirus anxiety. On the other hand, distress tolerance as a mediator variable, with a standardized coefficient of -0.04, has no significant effect on coronavirus anxiety. Meanwhile, cognitive attentional syndrome as a mediator variable, with a standardized coefficient of 0.22, significantly affects the coronavirus anxiety variable (Fig. 1). Overall, these results indicate that the present model can explain 50% of the variance of coronavirus anxiety. Therefore, it can be concluded that health-related metacognitive beliefs significantly affect coronavirus anxiety directly and through the cognitive attentional syndrome (see Table 3).

Table 2 Fit indices for measurement and structural model

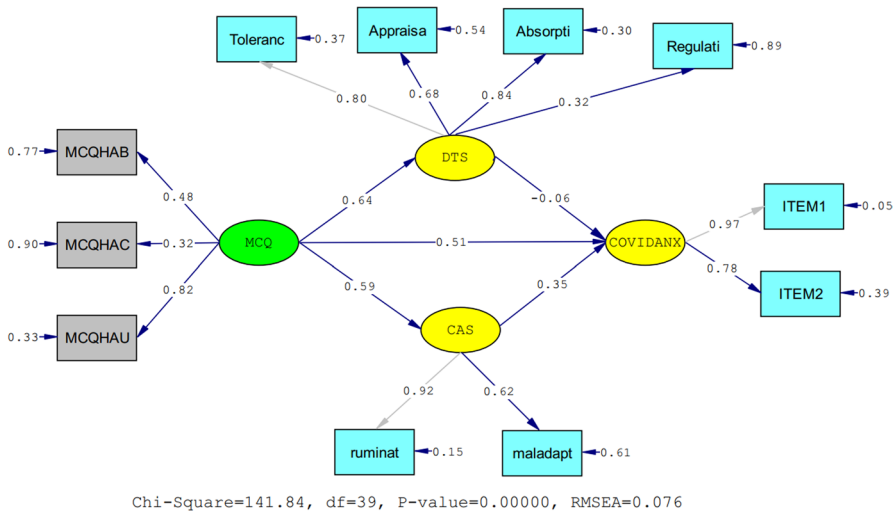|	Chi-square	DF	X2/DF	RMSEA	SRMR	CFI	NFI	GFI
Measurement model	182.66	55	3.32	0.068	0.056	0.97	0.97	0.94
Structural model	141.84	39	3.63	0.076	0.058	0.97	0.95	0.95

Fig. 1 Structural model of research with standardized coefficients. MCQ=Metacognitions About Health, CAS=Cognitive Attentional Syndrome Scale, DTS=Distress Tolerance Scale; CORANX=Coronavirus Anxiety Scale. ITEM 1 and ITEM 2 are created for coronavirus anxiety scale using item parceling method, so each one corresponds to the one parcel

Discussion

This study aimed to investigate the mediating role of the cognitive attentional syndrome and distress tolerance in the relationship between health-related metacognitive beliefs and coronavirus anxiety. The results showed that cognitive attentional syndrome, the maladaptive behaviors that people use to cope with their negative feelings and thoughts, has a high impact on the formation and development of coronavirus anxiety.

The present study's findings indicate that metacognitive beliefs related to health are important, influential factors in the development of COVID-19 anxiety. It suggests that the constant, repetitive ruminations around the potential development of disease are a strong predictor of coronavirus anxiety. This finding is consistent with previous research that has shown that metacognitive beliefs, especially the uncontrollability of thoughts that people have about their health, predict the symptoms of health anxiety (Barenbrügge et al., 2013; Brown et al., 2019; Hashemi et al., 2020; Kaur et al., 2011; Melli et al., 2018; Rachor & Penney, 2020; Ramos-Cejudo & Salguero, 2017; Wells, 2013).

Furthermore, the results suggest that metacognitive beliefs about health are partly involved in developing coronavirus anxiety in individuals through the activation and maintenance of the cognitive attentional syndrome. Coronavirus anxiety arises from repetitive negative thinking associated with worry, rumination, and inappropriate control strategies. According to the metacognitive model of health anxiety, this anxiety arises from repetitive negative thoughts about the disease. These results harmonize with previous studies that found that metacognitive beliefs are an important

Table 3 Bootstrap test results for mediator effects

Independent variable	Mediator variable	Dependent variable	Bootstrap limits		Standard error	Effect Size	p-value
			Upper limit	lower limit			
MCQ-HA	Distress tolerance	Coronavirus anxiety	0.043	− 0.122	0.050	− 0.039	0.431
MCQ-HA	Cognitive attentional syndrome	Coronavirus anxiety	0.269	0.145	0.038	0.207	0.001

factor in developing health anxiety and that metacognitions about biased thinking can independently affect health anxiety (Rachor & Penney, 2020); Thus, metacognitive beliefs about health are not only related to health anxiety in general, but also with coronavirus anxiety, as demonstrated by our findings.

Based on the result, it can be argued that health-related metacognitive beliefs, apart from their direct association with COVID-19 anxiety, have a significant indirect effect on the COVID-19 anxiety with the mediating role of the cognitive attentional syndrome; The first time being examined in the current study. Among the components of the CAS, rumination, worry, and other maladaptive behaviors and strategies that people adopt when faced with threats, also play a major part in coronavirus anxiety. These findings are consistent with studies by Bailey and Wells that showed that the CAS maintains and exacerbates the trend of worrying and ruminating about the potential disease that can predict health anxiety (Bailey and Wells, 2015a, 2015b); This is the same with metacognitive beliefs, CAS is not only related with health anxiety in general, but also with coronavirus anxiety, as shown by our findings.

However, health-related metacognitive beliefs mediated by distress tolerance had no significant effect on coronavirus anxiety which was against our proposed theoretical model. Some authors have argued that distress tolerance can play an important role in the formation and persistence of some mental disorders (Robinson et al., 2019). Also, studies on COVID-19 have suggested that lower distress tolerance is associated with an increased risk of depression, anxiety, and PTSD symptoms (Liu et al., 2020; Wright et al., 2020). Yet, our findings showed that distress tolerance did not significantly influence the formation of coronavirus-related anxiety. In particular, the current data are consistent with Sauer et al.'s (2020) findings, which showed that distress tolerance does not affect the development of health and coronavirus anxiety. Our study and Sauer et al.'s (2020) study both used a self-report measure of emotional DT; however, if a measure focusing on the behavioral component of DT was used, future research might find a significant pattern. However, our findings suggest that COVID-19 anxiety may develop regardless of how a person can tolerate negative emotional states; it is more cognitive and about persisting on chains of maladaptive thinking and worry. There may be another cause for the insignificant link between emotional DT and coronavirus anxiety in the tested model despite the significant bivariate correlation between these two variables. It may be due to the inclusion of metacognitive beliefs as a predictor of DT in the model. Considered as a whole, additional research is required to determine whether DT types (e.g., behavioral) would alter the results and, if not, whether metacognitive beliefs are more relevant than distinct types of DT.

To conclude, dysfunctional metacognitive beliefs, including an individual's beliefs about the uncontrollability of disease-related thoughts, act as a risk factor that has a detrimental effect on mental health and leads to anxiety disorders such as health anxiety (i.e., coronavirus anxiety). In addition, the association of dysfunctional beliefs with maladaptive behaviors resulting from cognitive attentional syndrome is also involved in predicting coronavirus anxiety. These results suggest that individuals with highly dysfunctional beliefs about their illness and health are more likely to ruminate. Subsequently, these individuals engage in destructive

maladaptive behaviors to eliminate dysfunctional thoughts, which increases their anxiety and entanglement in this cycle. Moreover, it should be noted that we have used emotional DT measures, which, by non-significant mediating role of DT, stress the importance of other types of DT (Akari et al., 2021a; for a review), such as tolerance of physical sensations, tolerance of ambiguity and uncertainty, and tolerance of frustration; by using any related measures to the different type of DT, future studies might shed light on different pattern than ours and extend on our understanding on the possible role of DT in the context of COVID-19.

Due to the widespread prevalence of this epidemic, the duration since its onset, the exhausting conditions of quarantine, and the problems it has caused (Cao et al., 2020; Fiorillo et al., 2020; Luo et al., 2020), paying special attention to COVID-19 anxiety during this period and even after is necessary. To alleviate psychological distress and reduce anxiety, we need to apply interventions to correct dysfunctional metacognitive beliefs, such as Metacognitive Therapy (Wells, 2009). The current study's significance would be in demonstrating that COVID-19 anxiety has more cognitive than emotional aspects; thus, clinicians may like to place a greater emphasis on the cognitive component of COVID-19 anxiety, as emotional distress tolerance was not found to underlie the association between metacognitions about health and COVID-19 anxiety. It appears that assisting clients in overcoming worry, maladaptive coping strategies, and maladaptive metacognition about health would reduce COVID-19 anxiety.

However, all findings should be interpreted in light of the limitations. The first limitation of this study is the self-report form of the scales, which does not allow comorbidities and acute psychological disorders to be investigated. Second, the present study has a cross-sectional design; thus, the reported results show relationships, and the causal relationships between variables cannot be concluded. Also, the overrepresentation of females in the current study may restrict the generalizations of the findings to males. Future studies might want to target the clinical population or a more gender-balanced sample using a longitudinal or multi-wave measurements design to overcome the mentioned limitations and to expand our understanding of the relationship between metacognitions about health and COVID-19 anxiety, with more focus on the maintaining and exacerbating role of the cognitive attentional syndrome as the underlying mechanism of the aforementioned.

Declaration

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

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