Empirical Article

Relationships between fear of COVID-19, cyberchondria, intolerance of uncertainty, and obsessional probabilistic inferences: A structural equation model

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The study was set out to explore the structural relationships between fear of COVID-19, cyberchondria, intolerance of uncertainty, and obsessional probabilistic inferences. The data were recruited online from a community population (n = 1,049) subjected to a confirmatory factor analytic procedure. The structural model specified according to the previous findings in the literature showed that a general tendency to negative expectations in terms of probabilistic thinking was significantly associated with both COVID-19-related-fear and intolerance of uncertainty. Fear of COVID-19 was significantly associated with cyberchondria. Probabilistic thinking style and intolerance of uncertainty contributed to cyberchondria through fear of COVID-19 as well. We concluded that a tendency to engage in a probabilistic thinking style and intolerance of uncertainty seems to play role in the etiology of fear of infection and cyberchondria.

Key words: fear of infection, health behaviors, online addiction, probabilistic thinking, health psychology.

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INTRODUCTION

The burden of the globally challenging infectious disease novel coronavirus 2019 (2019-nCoV) has become the most crucial worldwide public health concern. Extremely high transmission and high morbidity and mortality rates are likely to make individuals more prone to pondering about the probability of contamination and the consequences of probable cases. Fear of contamination is common in place (Lin, 2020) which may lead to other psychosocial strains such as stigmatization and discrimination (Pappas, Kiriaze, Giannakis & Falagas, 2009). Although the attempts to take control over the infection have largely focused on decreasing the infection rates, the psychological aspects of the COVID-19 pandemic are still yet elusive. Addressing the individual’s anxious concerns about the pandemic, a readily used brief and valid instrument of the Fear of COVID-19 Scale (FCV-19S) was developed by Ahorsu, Lin, Imani, Saffari, Griffiths & Pakpour (2020). In the initial validation study of the FCV-19S, the overall scores had dose-response relationships with depression and anxiety, as well as perceived vulnerability to diseases. In a national survey of 2019-nCoV-related-fear in a sample of 1,304 community Turkish adults, Satici, Goçet-Tekin, Deniz and Satici (2021) showed that fear of contamination significantly contributed to life dissatisfaction via increased anxiety and depression. In another survey of 1,772 Turkish adults aged from 18 to 73 demonstrated that significant association between intolerance of uncertainty and mental well-being was mediated by 2019-nCoV-related-fear and rumination (Satici, Saricali, Satici & Griffiths, 2020).

An increasing number of users for health-related applications and websites is indicative that the Internet may have become the most prominent source of health-related information (Kamel Boulos, Brewer, Karinkhani, Buller & Dellavalle, 2014; Starcevic & Berle, 2015). That is, using the Internet as an instrument to search health-related information for novel coronavirus pandemics might admittedly be commonplace (Dadaczynski et al., 2021; Neely, Eldredge & Sanders, 2021). On the other hand, fear of infection, excessive levels of uncertainty, and financial insecurities may raise the levels of distress which, in turn, reinforce maladaptive engagement in unduly use of information and communication technologies, particularly a sizable minority are at higher risk of developing problematic use patterns (Kiraly, Potenza, Stein et al., 2020). Although the health-related information on the Internet is abundant and conflicting, individual differences in users of online health-related information seem to significantly vary owing to their emotional and behavioral responses to their online searches. People more prone to experience over arousal during health-related online searches for even mild complaints are likely to manifest increased worry and anxiety which, in turn, leads to treatment-seeking and further online searches (Starcevic & Berle, 2015). Deterioration of health-related anxiety as a result of medical research on the Internet is termed as “cyberchondria” (Taylor & Asmundson, 2004).

The phenomenon has been conceptualized on a continuum ranging from daily health-related information seeking on websites to more pathological forms representing an online version of hypochondriasis. The prevailing notion on the phenomenon posited that primarily excessive anxiety and worry underlie cyberchondria, or at least it is an integral aspect of health-related apprehensions that triggers incentives for seeking self-soothing.
THE ROLE OF INTOLERANCE OF UNCERTAINTY AND PROBABILISTIC THINKING

The COVID-19 pandemic has brought out ambiguities in daily life experiences, which increased psychological distress as a function of individual differences in tolerance to uncertainty and probabilistic thinking style. Intolerance of uncertainty simply refers to a tendency of fear of the unknown. Individuals less likely to tolerate uncertainty might experience excessive feeling of distress and engage in safety behaviors (Carleton, 2016). These psychological mechanisms might presumably take place during COVID-19 pandemic. More recent studies presented significant contribution of intolerance of uncertainty on mental health that fear of COVID-19 mediated the relationship between intolerance of uncertainty and psychological well-being (Deniz, 2021; Satici, Saricalı, et al., 2020) and depression (Pak, Süsen, Deniziç Nazlıgil & Griffiths, 2021; Voitsidis, Nikopoulos, Holeva et al., 2021).

Internet searches for health-related information may sometimes result in erroneous perceptions that even innocuous signs of corporeal symptoms might be attributed to serious medical conditions, thereby leading to serious distress and sequential over-catastrophizing inferences (White & Horvitz, 2009). Scholars articulated that the search of medical information on the Internet can be best conceptualized from the view of safety behaviors or harm avoidance to gain reassurance (Baumgartner & Hartmann, 2011; Muse, McManus, Leung, Meghebliani & Williams, 2012). In a semi-structured interview survey of patients in a medical setting, the basic incentives for online review of information were uttered as a need for acknowledgement, gaining perspective and reduction of uncertainty as a function of a sense of self-responsibility and having opportunity to use the Internet (Caiata-Zufferey, Abraham, Sommerhalder & Schulz, 2010). However, online review of medical information may pose more ambiguity by means of the abundance of knowledge and presentation of the content instead of reassurance. The interaction between trustworthiness of health-related information and health anxiety was associated with negative consequences of health-rated information seeking. Individuals with health anxiety were more likely to get worried in response to information from a trustworthy website (Baumgartner & Hartmann, 2011).

Even though there is no consensus on the definition of intolerance of uncertainty (Carleton, 2012; Grenier, Barrette & Ladouceur, 2005), it may be defined as an inclination for an individual to consider in a way that the possibility of a negative event occurring as threatening, irrespective of the probability of its occurrence (Dugas & Robichaud, 2007). The construct was suggested to be best represented by cognitive appraisals about uncertainty that infers “prospective anxiety” and behavioral avoidance from uncertain situations that infers “inhibitory anxiety” (Carleton, 2012). Only a few studies have addressed the potential role of intolerance of uncertainty in relation to cyber safe seeking and reassurance seeking. In a community sample of healthy adults, scholars identified that the frequency of online medical searches was significantly associated with an increase in health anxiety insofar as these reviews lead to a decrease in one’s tolerance to a sense of uncertainty (Fergus, 2013). More specifically, after controlling for shared variances among anxiety
sensitivity dimensions, intolerance of uncertainty dimensions, and health anxiety, inhibitory intolerance of uncertainty and physical anxiety sensitivity were found to be significant associates of various dimensions of cyberchondria in a normative adult sample (Fergus, 2015). In a similar vein, anxiety sensitivity, health anxiety and inhibitory intolerance of uncertainty contributed to anxious arousal emerged from health-related online searches, particularly inhibitory intolerance of uncertainty was significantly associated with mistrust of medical professionals (Norr, Albanese, Oglesby, Allan & Schmidt, 2015). A more recent community survey of cyberchondria pointed out significant relationships with emotional stability; whereas, in the second study, the potential influence of the neuroticism dimension of the big-five personality construct fell short of significance after the covariates intolerance of uncertainty and defensive pessimism were evaluated along with personality, in which each covariate exerted a significant main effect on cyber health anxiety (Bajcar & Babiak, 2020).

Obsessional probabilistic thinking style refers to a disposition to make more negative inferences in relation to contamination, making errors, causing harm, and religious and sexual issues. The obsessional probabilistic thinking style as indexed by the Obsessional Probabilistic Inferences Scale was found to be associated with obsessive–compulsive symptoms, obsessive beliefs and depression among clinical samples compared to healthy controls (Guleç, Deveci, Besiroğlu, Boysan, Kalafat & Oral, 2014). In a more recent structural equation study, Boysan, Yıldırım and Ökmen (2022) identified that obsessional probabilistic thinking contributed to obsessive–compulsive symptoms and dissociation in which the relationships of obsessionality and dissociation with metacognitions were mediated by obsessional probabilistic thinking as well.

Given the associations of intolerance of uncertainty with OCD and other anxiety-related disorders (Gentes & Ruscio, 2011), probabilistic reasoning may be used as a maladaptive coping strategy to deal with the uncertainty rather than handling with doubt. Consistent with this premise, Wheaton, Messner, and Marks (2021) revealed that obsessive–compulsive symptoms increased the intolerance of uncertainty, which, in turn, lead to escalating the COVID-19 anxiety. Moreover, previous studies indicated that inflated estimates of threat probability are associated with intolerance of uncertainty (Dugas et al., 2005; Pepperdine, Lomax & Freeston, 2018). In a clinical investigation among individuals with anxiety disorders and non-anxious controls, Jacoby, Abramowitz, Buck and Fabricant (2014) used the Beads Task as a behavioral measure of uncertainty that induces probabilistic reasoning processes and found that uncertainty-induced probabilistic reasoning was significantly associated with draws to decision and heightened distress in the anxious group. Given the prevailing notion considering previous findings, it was speculated that individuals more prone to a tendency to obsessional probabilistic inferences might reveal less tolerance to uncertainty and more proneness to fear of COVID-19, which, in turn, lead to more severe cyberchondria.

PRESENT STUDY

Health-related online information searches seem to be likely to engender health-related anxious arousal that, in turn, leads to unduly compulsive Internet use, but this is not the case for all individuals. While approximately one-third of the individuals reported increased anxiety in response to online health information (Fergus & Dolan, 2014; White & Horvitz, 2009), respondents with no change in their anxious arousal during online searches were less prone to engage in problematic Internet use as compared to individuals who manifest relief (Fergus & Dolan, 2014). Recent studies about health-related information seeking indicated that increased anxious arousal is probably invoked by fear of infection that may underlie the maladaptive Internet use in terms of cyberchondria. For instance, perceived severity and perceived susceptibility of COVID-19 infection were significantly associated with cyberchondria after controlling for age and gender (Laato et al., 2020). Increased anxiety for the disease and a sense of insecurity may push people towards compulsive checking of health-related online information which, in turn, escalates health anxiety (Jokic-Begic, Lauri Korajlija & Mikac, 2020; Maftci & Holman, 2020). In a more recent investigation by Bottesi, Marino, Vieno, Ghisi and Spada (2021), intolerance of uncertainty significantly contributed to both cyberchondria and problematic Internet use that, in turn, aggravated health anxiety and psychological distress. By this token, after controlling for age and gender, Satici, Saricali, et al. (2020) identified significant direct contribution of intolerance of uncertainty to fear of COVID-19, and the indirect linkage between these variables was mediated by rumination as well. In this vein, substantial direct relationship between intolerance of uncertainty and fear of COVID-19 was replicated by Deniz (2021) in which self-compassion was significantly associated with well-being of participants through both intolerance of uncertainty and fear of COVID-19. Accumulated evidence concerned with substantial relationships between cyberchondria, intolerance of uncertainty and fear of COVID-19 have emerged. However, although studies showed the potential influence of reasoning processes on obsessions and intolerance of uncertainty (e.g. Jacoby et al., 2014; O’Connor, 2002), the associations among obsessional probabilistic thinking, cyberchondria, intolerance of uncertainty and fear of COVID-19 have not been explored. Given the extant literature, as depicted in Fig. 1, we speculated that probabilistic thinking as indexed by the Obsessional Probabilistic Inference Scale has both a direct contribution to fear of COVID-19 and an indirect contribution through intolerance of uncertainty. On the other hand, fear of COVID-19 would be associated with cyberchondria severity. The structural associations between the variables of interest were set out to be tested by using structural equation modeling.

METHOD

Participants and procedure

Participants were 1,049 community individuals recruited online in April 2020. Of the sample, 64.25% consisted of women (n = 674,) and the age of the participants ranged from 18 to 62 (Mean = 25.41, SD = 7.54). All participants were briefly informed about the purposes and procedures of the current investigation. Then written informed consent was taken online. The purposes and procedures of the study were granted approval from the local ethical committee of the university.
The Cyberchondria Severity Scale – Short Form (CSS-12) was found to have high internal consistency with alphas ranging from 0.78 to 0.94. In the present study, the Turkish properties with a Cronbach’s alpha of 0.88 (Ahorsu et al., 2020). The Turkish version of the FCV-19S, adapted by Gulec et al. (2014), was correlated with FCV-19S (McElroy et al., 2019). In the structural equation modeling, we used the items of the FCV-19S and the subscales of the CSS-12 and IUS-12 as observed indicators of respective latent variables. Following Russell, Kahn, Spoth and Altmaier’s (1998) factor loading ranking procedure, we performed an exploratory factor analysis and formed four parcels for the OPIS. Based on the theoretical considerations we specified the relationships between the variables of interest. In addition adhering to model generating approach (Joreskog, 1993) through model fit indices and modification indices, we specified additional parameters between error covariances. Maximum likelihood estimation with robust standard errors was used as the estimation method (Satorra & Bentler, 1994). The following goodness of fit indexes and thresholds were applied to the structural equation model being tested (Bentler, 1990; Bentler & Bonett, 1980; Hooper, Coughlan & Mullen, 2008; Hu & Bentler, 1999; Steiger, 1990; Wen, Hau & Herbert, 2004): χ2 / df [1; 4], root mean square error of approximation (RMSEA) [0.05; 0.08], standardized root mean square residual (SRMR) [0.05; 0.08], Tucker–Lewis index (TLD) [0.90;0.95], and comparative fit index (CFI) [0.90;0.95].

RESULTS
The means, standard deviations, and Cronbach’s alphas for the psychometric instruments and correlations between scale scores are presented in Table 1.

The structural model fit indices indicated that specified model fit the data: Satorra–Bentler χ²(137) = 540.051, p < 0.0001; RMSEA = 0.053 p = 0.145 (90% Confidence Interval = 0.048–0.058); CFI = 0.952; TLI = 0.940; and SRMR = 0.046. In the structural model, age was positively associated with the FCV-19S (β = 0.115, t = 3.810, p < 0.001) and inversely associated with the OPIS (β = −0.117, t = −3.842, p < 0.001), IUS (β = −0.143, t = −4.780, p < 0.001) and CSS (β = −0.064, t = −2.240, p = 0.025). Being female was positively associated with the FCV-19S (β = 0.288, t = 9.262, p < 0.001) and IUS (β = 0.177, t = 5.971, p < 0.001). On the other hand, males were more prone to CSS (β = −0.081, t = −2.488, p = 0.013).

Considering the associations between latent variables, the OPIS significantly contributed to IUS (β = 0.354, t = 11.706, p < 0.001) and FCV-19S (β = 0.092, t = 2.544, p = 0.011). IUS was correlated with FCV-19S (β = 0.306, t = 8.255, p < 0.001).

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Table 1. Descriptive statistics for the psychological instruments

|                      | 1       | 2       | 2.1      | 2.2      | 2.3      | 2.4      | 3       | 3.1      | 3.2      | 4       | 4.1      | 4.2      | 4.3      | 4.4      |
|----------------------|---------|---------|----------|----------|----------|----------|---------|----------|----------|---------|----------|----------|----------|----------|
| 1. Fear of COVID-19 scale |        |         |          |          |          |          |         |          |          |         |          |          |          |          |
| 2. Cyberchondria severity scale | 0.30** |         |          |          |          |          |         |          |          |         |          |          |          |          |
| 2.1 Compulsions       | 0.27**  | 0.73**  |          |          |          |          |         |          |          |         |          |          |          |          |
| 2.2 Distress          | 0.32**  | 0.81**  | 0.61**   |          |          |          |         |          |          |         |          |          |          |          |
| 2.3 Excessiveness     | 0.17**  | 0.77**  | 0.33**   | 0.45**   |          |          |         |          |          |         |          |          |          |          |
| 2.4 Reassurance       | 0.17**  | 0.81**  | 0.35**   | 0.49**   | 0.76**   |          |         |          |          |         |          |          |          |          |
| 3. Intolerance of uncertainty scale | 0.33** | 0.23**  | 0.20**   | 0.24**   | 0.15**   | 0.13**   |         |          |          |         |          |          |          |          |
| 3.1 Prospective anxiety | 0.30** | 0.21**  | 0.18**   | 0.22**   | 0.15**   | 0.13**   | 0.95**  |          |          |         |          |          |          |          |
| 3.2 Inhibitory Anxiety | 0.32**  | 0.22**  | 0.21**   | 0.24**   | 0.14**   | 0.12**   | 0.93**  | 0.78**   |          |         |          |          |          |          |
| 4. Obsessional probabilistic inference scale | 0.16** | 0.16**  | 0.19**   | 0.12**   | 0.11**   | 0.06*    | 0.31**  | 0.28**   | 0.31**   |         |          |          |          |          |
| 4.1 OPIS 1            | 0.16**  | 0.12**  | 0.17**   | 0.09**   | 0.10**   | 0.07**   | 0.25**  | 0.22**   | 0.25**   | 0.87**   |          |          |          |          |
| 4.2 OPIS 2            | 0.16**  | 0.20**  | 0.21**   | 0.16**   | 0.14**   | 0.10**   | 0.31**  | 0.28**   | 0.31**   | 0.82**   | 0.61**   |          |          |          |
| 4.3 OPIS 3            | 0.16**  | 0.15**  | 0.21**   | 0.13**   | 0.08**   | 0.03     | 0.25**  | 0.21**   | 0.26**   | 0.82**   | 0.61**   | 0.60**   |          |          |
| 4.4 OPIS 4            | 0.06    | 0.07*   | 0.12**   | 0.05     | 0.05     | 0.01     | 0.23**  | 0.21**   | 0.22**   | 0.80**   | 0.53**   | 0.56**   | 0.62**   |          |
| Mean                  | 18.56   | 31.62   | 5.71     | 8.01     | 9.90     | 9.50     | 39.67   | 23.78    | 15.90    | 28.10    | 31.88    | 30.90    | 24.83    | 23.18    |
| Standard deviation    | 5.59    | 8.12    | 2.45     | 2.62     | 2.79     | 2.67     | 9.74    | 5.53     | 4.80     | 13.55    | 16.15    | 17.60    | 15.93    | 15.58    |
| Cronbach’s alpha      | 0.877   | 0.872   | 0.804    | 0.710    | 0.842    | 0.712    | 0.890   | 0.787    | 0.839    | 0.914    | 0.834    | 0.770    | 0.780    | 0.784    |

*p < 0.05, **p < 0.01.
Finally, FCV-19S was significantly linked to CSS ($\beta = 0.405$, $t = 10.672$, $p < 0.001$).

Turning on to the indirect relationships, the OPIS significantly contributed to the FCV-19S through the IUS ($\beta = 0.108$, $t = 6.488$, $p < 0.001$). The substantial indirect relationships between the OPIS and CSS were mediated by both the FCV-19S ($\beta = 0.037$, $t = 2.451$, $p = 0.014$) and IUS ($\beta = 0.044$, $t = 5.372$, $p < 0.001$). Lastly, the IUS contributed to the CSS through the FCV-19S ($\beta = 0.124$, $t = 6.394$, $p < 0.001$). Findings are presented in Fig. 2.

**DISCUSSION**

In the current study, we sought to further our understanding of the associations between cyberchondria, fear of COVID-19, intolerance of uncertainty and a tendency to make negative probabilistic inferences. Results from the current research replicated and expanded the previous findings in the literature. Our main findings were that probabilistic thinking was a significant antecedent of both intolerance of uncertainty and fear of COVID-19, whereas fear of COVID-19 exacerbated the cyberchondria severity.

A factor analytic investigation of health-related information seeking as indexed by the CSS and health anxiety symptoms as indexed by the Short Health Anxiety Inventory supported the assertion that these two constructs represent distinct behavioral patterns. The former was strongly associated with functional impairment; on the other hand, the latter was moderately linked to a significant decrease in quality of life (Mathes, Norr, Allan, Albanese & Schmidt, 2018). In a similar vein, a network analysis of cyberchondria symptoms in relation to health anxiety, obsessive–compulsive disorder, problematic internet use, anxiety, depression, and somatic symptoms showed that health-related online information enquiry that results in anxious arousal is a relatively exclusive psychological construct with distinct characteristics and interrelated symptoms (Starcevic, Baggio, Berle, Khazaal & Viswasam, 2019). An investigation into the meta-analytic linkages between cyberchondria and health anxiety in a sample of 20 relevant studies identified a medium sized positive relationship within these constructs which can be interpreted as experienced health anxiety may be one of the risk factors underlying cyberchondria to an extent; nevertheless, there should be more psychological mechanisms taking place in unduly online health-related information seeking (McMullan, Berle, Arnaez & Starcevic, 2019). Those individuals high in intolerance of uncertainty, particularly inhibitory anxiety were more likely to experience health-related anxious arousal and cyberchondria (Bajcar & Babiak, 2020; Fergus, 2013). Inhibitory anxiety was found to significantly contribute to escalation in online health-related inquiries that lead to increased distress after controlling for health anxiety (Fergus, 2015; Norr et al., 2015). However, research showed that tentative influence of intolerance of

![Fig. 2. Structural model of associations between cyberchondria, intolerance to uncertainty, probabilistic thinking, and fears of COVID-19. CSS = Cyberchondria Severity Scale, css1 = Compulsions, css2 = Distress, css3 = Exessiveness, css4 = Reassurance, IUS = Intolerance of Uncertainty Scale, ius1 = Prospective Anxiety, ius2 = Inhibitory Anxiety, OPIS = Obsessional Probabilistic Inference Scale, opis1 = Parcel 1, opis2 = Parcel 2, opis3 = Parcel 3, opis4 = Parcel 4, FCV-19S = Fears of COVID-19 Scale.](image-url)
uncertainty on general cyberchondria fell short of significance after controlling for metacognitive beliefs (Fergus & Spada, 2017, 2018; Marino et al., 2020). Moreover, at the time of the pandemic, research has indicated that fearful attributions related to COVID-19 infection was a significant predictor of health-related problematic Internet use (Laato et al., 2020). Another investigation by Wu et al. (2021) in a sample of community participants showed that COVID-19-related fear and anxiety significantly contributed to cyberchondria as well as indirectly through intolerance of uncertainty. On the other hand, in a two-wave longitudinal investigation suggested that safety behaviors concerned with COVID-19 infection were induced by cyberchondria (Jokic-Begic et al., 2020). Our findings are in line with previous data that fear of COVID-19 which was significantly induced by intolerance of uncertainty was significantly associated with increased cyberchondria severity. Additionally, a tendency to generate probabilities of threat and harm which results in development and maintenance of obsessive-compulsive disorder (Boysan et al., 2022; Gulce et al., 2014; O’Connor & Aardema, 2011) was significantly tied to intolerance of uncertainty and fear of COVID-19. Moreover, participants more prone to negativistic attributions in terms of obsessional probabilistic inferences reported higher scores on the CSS and IUS through increased fear of COVID-19 infection. These relationships should be interpreted with caution that the data were cross-sectional. More investigations with longitudinal research design should warrant these findings in the future.

**Limitations and implications**

Bearing in mind some limitations of the current study, the present data should be interpreted with caution. First and foremost, the use of a normative sample relatively limits the generalizability of the current data to patients with clinically severe psychopathology. Therefore, studies can be carried out to investigate how the negative effects of the COVID-19 pandemic are observed in people with psychological or psychiatric diagnoses and similar subgroups (OCD, panic disorder, etc.). In addition, the participants were recruited through online crowdsourcing that such an online population may particularly more receptive given the cyberchondria. Finally, given the cross-sectional research design of the present study, a longitudinal research design could have provided with more profound information about the causal relationships between the variables of interest. Notably, however, given the paucity of the data on potential influences of 2019-nCov breakout that has dominated worldwide health concerns, this investigation may be regarded as a preliminary contribution to further our understanding of health-related-fear peculiar to infection and general health anxiety in relation to escalated online health-related inquiry, intolerance of uncertainty, and probabilistic inferences.

Our findings have critical clinical implications. Obsessional probabilistic inferences seem to be a transdiagnostic vulnerability factor that is robustly associated with intolerance to uncertainty, fear of COVID-19, and cyberchondria. These findings are particularly important in understanding determinants of mental health during the COVID-19 pandemic. That is, assessment and interventions concerned with negativistic reasoning processes along with intolerance of uncertainty can be incorporated into mental health practices with respect to infection anxiety and cyberchondria.

Moreover, because of the uncertain nature of COVID-19, people perform online information-seeking behaviors more frequently and intensely to protect themselves from the disease (Du, Yang, King, Yang & Chi, 2020). A study carried out in China with a general sample revealed that 95.3% of the participants refer to the Internet as a source of information about COVID-19 (Wang et al., 2020). Considering the cognitive behavioral nature of health anxiety, cyberchondria, and similar health-related concepts, and the fact that these conditions come out frequently during the process of COVID-19 pandemic, it can be inferred that the need for intervention programs became obvious. Cognitive Behavioral Therapy (CBT) intervention is an effective approach in reducing health anxiety in individuals. Moreover, it is possible for similar positive effects to occur when this intervention is carried out on the Internet. Newby, Mewton, Williams, and Andrews (2014) applied Internet-delivered cognitive behavioral treatment (iCBT) in ten-week online intervention study including six lessons with 16 participants meeting the DSM-5 Illness Anxiety Disorder or Somatic Symptom Disorder diagnostic criteria. The findings revealed that the intervention was effective in reducing health anxiety of the participants. In addition, a 12-week iCBT intervention program consisting of six lessons was implemented by Newby and McElroy (2020) with 45 participants who met the diagnostic criteria of Illness Anxiety Disorder (IAD) or Somatic Symptom Disorder (SSD) in DSM-V. This program was found to be effective in reducing the cyberchondria behaviors and health anxiety of the participants in the experimental group. For this reason, the iCBT approach can be used in intervention programs to be applied for anxiety, health anxiety, and cyberchondria behaviors brought about by the process of the COVID-19 pandemic and its uncertainties. The approach is effective in dealing with such problems, and it can also be considered as a useful and economical approach since it is applied online.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**REFERENCES**

Ahorsu, D.K., Lin, C.Y., Imani, V., Saffari, M., Griffiths, M.D. & Pakpour, A.H. (2020). The fear of COVID-19 scale: Development and initial validation. International Journal of Mental Health and Addiction, 1–9. https://doi.org/10.1007/s11469-020-00270-8

Bajcar, B. & Babiak, J. (2020). Neuroticism and cyberchondria: The mediating role of intolerance of uncertainty and defensive pessimism. Personality and Individual Differences, 162, 1–9. https://doi.org/10.1016/j.paid.2020.110006.

Bajcar, B., Babiak, J. & Ochłowska-Kotala, A. (2019). Cyberchondria and its measurement. The Polish adaptation and psychometric properties of the cyberchondria severity scale CSS-PL. Psychiatria Polska, 53, 49–60. https://doi.org/10.12740/PP/81799.
Psychiatry, 100, 152180. https://doi.org/10.1016/j.comppsych.2020.152180.
Laato, S., Islam, A.K.M.N., Islam, M.N. & Whelan, E. (2020). What drives unverified information sharing and cyberchondria during the COVID-19 pandemic? European Journal of Information Systems, 29, 288–305. https://doi.org/10.1057/s41806-020-00763-7.
Lin, C.-Y. (2020). Social reaction toward the 2019 novel coronavirus (COVID-19). Social Health and Behavior, 3(1), 1–2. https://doi.org/10.4103/shb.shb_11_20.
Mafei, A. & Holman, A.C. (2020). Cyberchondria during the coronavirus pandemic: The effects of neuroticism and optimism. Frontiers in Psychology, 11, 567345. https://doi.org/10.3389/fpsyg.2020.567345.
Marino, C., Fergus, T.A., Vieno, A., Bottesi, G., Ghisi, M. & Spada, M.M. (2020). Testing the Italian version of the cyberchondria severity scale and a metacognitive model of cyberchondria. Clinical Psychology & Psychotherapy. 27, 581–596. https://doi.org/10.1002/cpp.2444.
Mather, B.M., Norr, A.M., Allan, N.P., Albanese, B.J. & Schmidt, N.B. (2020). Health information seeking, and cyberchondria: Systematic review and meta-analysis. Journal of Affective Disorders, 245, 270–278. https://doi.org/10.1016/j.jad.2018.11.037.
McElroy, E., Shevlin, M., Elder, S., Eldredge, C. & Sanders, R. (2021). Health information seeking behaviors on social media during the COVID-19 pandemic among American social networking site users: Survey study. Journal of Medical Internet Research, 23, e29802. https://doi.org/10.2196/29802.
McElroy, E. & Shevlin, M. (2014). The development and initial validation of the cyberchondria severity scale (CSS). Journal of Anxiety Disorders, 28, 259–265. https://doi.org/10.1016/j.janxdis.2013.12.007.
McMullan, R.D., Berle, D., Arnaez, S. & Starcevic, V. (2019). The relationships between health anxiety, online health information seeking, and cyberchondria: Systematic review and meta-analysis. Journal of Affective Disorders, 245, 270–278. https://doi.org/10.1016/j.jad.2018.11.037.
Muse, K., McManus, F., Leung, C., Meghrabiian, B. & Williams, J.M. (2012). Cyberchondriasis: Fact or fiction? A preliminary examination of the relationship between health anxiety and searching for health information on the internet. Journal of Affective Disorders, 26, 189–196. https://doi.org/10.1016/j.janxdis.2011.11.005.
Muthén, L.K. & Muthén, B.O. (1990-2017). Mplus user’s guide. Eighth edition. Los Angeles, CA: Muthén & Muthén.
Neely, S., Eldredge, C. & Sanders, R. (2021). Health information seeking behaviors on social media during the COVID-19 pandemic among American social networking site users: Survey study. Journal of Medical Internet Research, 23, e29802. https://doi.org/10.2196/29802.
Newby, J.M. & McElroy, E. (2020). The impact of internet-delivered cognitive behavioral therapy for health anxiety on cyberchondria. Journal of Anxiety Disorders, 69, 102150. https://doi.org/10.1016/j.janxdis.2019.102150.
Newby, J.M., Mewton, L., Williams, A.D. & Andrews, G. (2014). Effectiveness of transdiagnostic internet cognitive behavioral treatment for mixed anxiety and depression in primary care. Journal of Affective Disorders, 165, 45–52. https://doi.org/10.1016/j.jad.2014.04.037.
Norr, A.M., Albanese, B.J., Ogleby, M.E., Allan, N.P. & Schmidt, N.B. (2015). Anxiety sensitivity and intolerance of uncertainty as potential risk factors for cyberchondria. Journal of Affective Disorders, 174, 64–69. https://doi.org/10.1016/j.jad.2014.11.023.
O’Connor, K. (2002). Intrusions and infusions in obsessive compulsive disorder. Clinical Psychology & Psychotherapy, 9, 38–46. https://doi.org/10.1002/cpp.303.
O’Connor, K. & Aardema, F. (2011). Clinician’s handbook for obsessive compulsive disorder: Inference-based therapy. Chichester: Wiley.
Oniszczenko, W. (2021). Anxious temperament and cyberchondria as mediated by fear of COVID-19 infection: A cross-sectional study. PLoS One, 16, e0255750. https://doi.org/10.1371/journal.pone.0255750.
Pak, H., Süssen, Y., Denizci Nazlıgül, M. & Griffiths, M. (2021). The mediating effects of fear of COVID-19 and depression on the association between intolerance of uncertainty and emotional eating during the COVID-19 pandemic in Turkey. International Journal of Mental Health and Addiction. https://doi.org/10.1007/s11469-021-00489-z.
Pappas, G., Kiriazis, I.J., Giannakis, P. & Falagas, M.E. (2009). Psychosocial consequences of infectious diseases. Clinical Microbiology and Infection, 15(6), 743–747. https://doi.org/10.1111/j.1469-9822.2009.02047.x.
Pepperdine, E., Lomax, C. & Freeston, M.H. (2018). Disentangling intolerance of uncertainty and threat appraisal in everyday situations. Journal of Anxiety Disorders, 57, 31–38. https://doi.org/10.1016/j.janxdis.2018.04.002.
Russell, D.W., Kahn, J.H., Spoth, R. & Altmaier, E.M. (1998). Analyzing the initial stage of the 2019 coronavirus disease (COVID-19). https://doi.org/10.1207/s15327906mbr2502_4.
Pak, H., Süssen, Y., Denizci Nazlıgül, M. & Griffiths, M. (2021). The mediating effects of fear of COVID-19 and depression on the association between intolerance of uncertainty and emotional eating during the COVID-19 pandemic in Turkey. International Journal of Mental Health and Addiction. https://doi.org/10.1007/s11469-021-00489-z.
Pappas, G., Kiriazis, I.J., Giannakis, P. & Falagas, M.E. (2009). Psychosocial consequences of infectious diseases. Clinical Microbiology and Infection, 15(6), 743–747. https://doi.org/10.1111/j.1469-9822.2009.02047.x.
Pepperdine, E., Lomax, C. & Freeston, M.H. (2018). Disentangling intolerance of uncertainty and threat appraisal in everyday situations. Journal of Anxiety Disorders, 57, 31–38. https://doi.org/10.1016/j.janxdis.2018.04.002.
Russell, D.W., Kahn, J.H., Spoth, R. & Altmaier, E.M. (1998). Analyzing the initial stage of the 2019 coronavirus disease (COVID-19). https://doi.org/10.1207/s15327906mbr2502_4.
Wen, Z., Hau, K.-T. & Herbert, W.M. (2004). Structural equation model testing: Cutoff criteria for goodness of fit indices and chi-square test. *Acta Psychologica Sinica*, 36, 186–194.

Wheaton, M.G., Messner, G.R. & Marks, J.B. (2021). Intolerance of uncertainty as a factor linking obsessive-compulsive symptoms, health anxiety and concerns about the spread of the novel coronavirus (COVID-19) in the United States. *Journal of Obsessive-Compulsive and Related Disorders*, 28, 100605. https://doi.org/10.1016/j.jocrd.2020.100605.

White, R.W. & Horvitz, E. (2009). Cyberchondria: Studies of the escalation of medical concerns in web search. *ACM Transactions on Information Systems*, 27, 1–37. https://doi.org/10.1145/1629096.1629101.

Wu, X., Nazari, N. & Griffiths, M.D. (2021). Using fear and anxiety related to COVID-19 to predict cyberchondria: Cross-sectional survey study [original paper]. *Journal of Medical Internet Research*, 23, e26285. https://doi.org/10.2196/26285.

Yalçın, İ., Boysan, M., Eşkısu, M. & Çam, Z. (2022). Health anxiety model of cyberchondria, fears, obsessions, sleep quality, and negative affect during COVID-19. *Current Psychology* Advance online publication. https://doi.org/10.1007/s12144-022-02987-2.

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