Psychological distress in the context of the COVID-19 pandemic: The joint contribution of intolerance of uncertainty and cyberchondria

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Abstract

Objective: To explore the direct and indirect associations between intolerance of uncertainty, health anxiety (HA), and psychological distress through problematic internet use (PIU) and cyberchondria, both before and during the first months of the COVID-19 pandemic.

Design: Two Italian samples were enrolled via an online questionnaire. Sample 1 (N=556; 69.3% females, M_{age} 29.6 years, SD=13.2) was recruited in non-pandemic times, whereas Sample 2 (N=575; 74% females, M_{age} 31.9 years, SD=13.4) was recruited during the COVID-19 lockdown.

Main outcome measures: Self-report measures assessing HA and psychological distress.

Results: Two distinct path analyses showed that intolerance of uncertainty was directly associated with HA and psychological distress in both samples. Moreover, cyberchondria partially mediated the relationship between intolerance of uncertainty and HA and PIU partially mediated the relationship between intolerance of uncertainty and psychological distress in both samples. The link between cyberchondria and psychological distress was significant in Sample 2 but non-significant in Sample 1. The model accounted for a substantial variance of HA and psychological distress in both samples.

Conclusion. Our findings suggest that problematic online behaviors might exacerbate the negative consequences of intolerance of uncertainty in terms of higher levels of HA and psychological distress both in pandemic and non-pandemic contexts.

Keywords: Intolerance of uncertainty; health anxiety; psychological distress; cyberchondria; problematic Internet use.

Introduction

Uncertainty is unpleasant in most circumstances, with many people likely to feel uncomfortable with this state. However, individuals with difficulties tolerating uncertainty typically experience negative emotions, negatively interpret uncertain situations, and enact dysfunctional behaviors in the attempt to control or avoid uncertainty (Freeston et al., 1994). Intolerance of uncertainty is a trans-diagnostic vulnerability factor underlying several psychopathologies, in particular anxiety disorders, such as generalized anxiety disorder and health anxiety (HA) (e.g., McEvoy et al., 2019; Shihata et al., 2016) and it is defined as the "individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (Carleton, 2016, p.31). People high in intolerance of uncertainty usually rely on a variety of uncertainty-reducing strategies (Sankar et al., 2017), such as: (1) under-engagement behaviors, aiming at avoiding future uncertain situations by means of distraction or procrastination; and (2) over-engagement behaviors, whose goal is to increase certainty about future uncertain outcomes through, for example, overpreparation and excessive information seeking. These behaviors are not dysfunctional *per se*, but they may negatively reinforce intolerance of uncertainty if they are performed in an inflexible manner (Bottesi et al., 2019a; Sankar et al., 2017).

Growing evidence suggests that people may problematically use the Internet (i.e., problematic internet use, PIU) as a way to regulate negative emotions (e.g., Akbari, 2017; Spada, 2014; Spada & Marino, 2017) and it may represent a reassurance seeking and/or avoidance behavior enacted to reduce also uncertainty. Indeed, Caplan (2010) defined PIU as the interplay between 4 dimensions: (i) the preference for online social interactions instead of face-to-face ones; (ii) mood regulation, that is using the Internet to alleviate distress and negative feeling; (iii) deficient self-regulation in terms of compulsive online behavior (i.e. the inability to regulate Internet use) and cognitive preoccupation (i.e. obsessive thinking about the Internet); and (iv) negative consequences for daily life resulting from Internet use. To date, the relationship between intolerance of uncertainty and PIU

has been barely explored. For example, a recent study outlined that intolerance of uncertainty is associated with problematic smartphone use via non-social smartphone use (Rozgonjuk et al., 2019) and Faghani and colleagues (2020) showed a positive correlation between intolerance of uncertainty and PIU. Interestingly, findings from a cross-temporal meta-analysis showed that self-reported intolerance of uncertainty levels have increased across time (from 1999 to 2014) and that such increases are positively correlated with increases in mobile phone penetration and Internet usage (Carleton et al., 2019). According to the authors, this result possibly suggests that increasing connectivity may reduce everyday exposures to uncertainty, since mobile phones may act as continuously available safety cues (i.e., they facilitate over-engagement). This mechanism may partially account for the well-documented relationship between intolerance of uncertainty, HA, and cyberchondria (e.g., Bajcar & Babiak, 2020; Fergus, 2013; 2015; Norr et al., 2015). Cyberchondria refers to tendency to excessively search for Internet health information notwithstanding the distress deriving from it (Starcevic & Berle, 2013), and it is strongly associated with HA (McMullan et al., 2019). In addition, also intolerance of uncertainty has been linked to HA (e.g., Fergus & Valentiner, 2011; Wright et al., 2016), which is unsurprising given that illness uncertainty pertains to "whether an individual has or will develop a particular condition; how that condition will evolve; to what extent a particular treatment is beneficial; and whether a patient is receiving the right care, in the right place, at the right time, from the right people" (Hillen et al. 2017, p. 62). There is evidence to suggest that intolerance of uncertainty is highly related to cyberchondria, especially its distress dimension (Fergus, 2015; Norr et al., 2015), and that it moderates the association between the frequency of online searches for medical information and HA (Fergus, 2013). Within such a framework, individuals with high intolerance of uncertainty should engage in excessive Internet searches for medical information to attain certainty about their symptoms.

Taken together, the above-mentioned considerations appear to support the notion that Internet use may serve as a strategy to manage uncertainty which, in turn, is capable of potentiating psychological distress by increasing intolerance of uncertainty.

The current study

The Coronavirus (COVID-19) was first identified in December 2019 in Wuhan, China, and its spread as a pandemic was officially recognized on 11 March 2020 as Italy, Iran, South Korea, and Japan reported surging numbers of cases (World Health Organization, 2020). The COVID-19 pandemic and its impacts on daily life has caused elevated levels of post-traumatic stress, general stress, fear, anxiety, HA, and suicidality (e.g., Casagrande et al., 2020; Qiu et al., 2020; Wang et al., 2020); similar findings were reported in the context of prior outbreaks, such as SARS (e.g., Cheng et al., 2004) and H1N1 swine flu (Rubin et al., 2009; Wheaton et al, 2012).

In times of pandemics, actual and perceived uncertainties - along with actual and perceived threats – appear to crucially contribute to psychological distress (Freeston et al., 2020). There are many unknowns about COVID-19 including the unclear and unpredictable nature of the virus, its spread and progression, how it can be contained and managed, and its short- and long-term impact on individual and public health, livelihood, and the economy (Bakioğlu, Korkmaz, & Ercan, 2020). Moreover, as soon as one piece of information appears to have reached 'certain status' in official information (e.g., government briefings), a new uncertainty emerges. As such, the continuous availability and constant access to multiple, often contrasting, online information can partly explain why both PIU and cyberchondria may emerge as risk factor for psychological distress during COVID-19 (e.g., Jungmann & Witthöft, 2020). Since the COVID-19 pandemic began, people worldwide are receiving a large quantity of information, with authors observing a dose-response relationship between COVID-19 media exposure and anxiety and depressive symptoms (Yao et al., 2020). Wathelet et al. (2020) explored the association between a wide range of predictors and several mental health outcomes (suicidal thoughts, distress, perceived stress, depression, and anxiety) in a large sample of French undergraduates during quarantine. They found that the more time (minutes per day) they spent accessing COVID-19 information, the more likely they were to report at least one mental health outcome; moreover, lower quality information was associated with referring at least one outcome. Excessive Internet use increases the availability of conflicting or

ambiguous information from different sources: this information may be more or less helpful, may vary in quality, and may further promote perceived threats and uncertainties, thus heightening psychological distress (Freeston et al., 2020). Indeed, the Internet – social media in particular - allows an extremely rapid dissemination of several kinds of information about specific topics (i.e., "infodemics"), which fuels the spread of disinformation and misinformation at extraordinary speeds and amplifies uncertainty (Vaezi & Javanmard, 2020). Therefore, the quality of information clearly assumes a relevant role in the association between excessive internet searches and uncertainty.

Beyond online searches for COVID-19-related information, the Internet have simultaneously played positive and negative roles during the pandemic. On one hand, online platforms allowed social connection, relationships maintenance, smart-working, "online" physical activity, and entertainment (Király et al. 2020). Moreover, online activities were used as putative coping strategies in order to alleviate the negative consequences of lockdown, such as isolation and psychological distress. On the other hand, constant connectivity might have favored, for a minority of users, the engagement in addictive behaviors, such as problematic gaming, social media, shopping, pornography use, and gambling (e.g., King et al., 2020; Mestre-Bach et al., 2020). Indeed, "being always online" might contribute to the development of PIU, in terms of preoccupation, emotion dysregulation, compulsive use of technological devices and negative consequences for daily life (e.g., Islam et al., 2020).

The current study was designed to explore the direct and indirect associations between intolerance of uncertainty, HA, and psychological distress through PIU and cyberchondria (see Figure 1). *[FIGURE 1 HERE]*

In line with extant literature, we expected (hypothesis 1) both PIU and cyberchondria to mediate the relationships between intolerance of uncertainty and psychological distress given that they may act as maladaptive uncertainty-reducing behaviors ultimately increasing psychological distress (Bottesi et al., 2019a). We also expected (hypothesis 2) to confirm the role of cyberchondria as a maintenance factor involved in the path from intolerance of uncertainty and HA (e.g., Fergus,

2013). Moreover, we expected (hypothesis 3) that PIU would mediate the relationship between intolerance of uncertainty and psychological distress, as intolerance of uncertainty and PIU are positively associated (e.g., Faghani et al., 2020) and the role of PIU in worsening the levels of psychological well-being is well established (e.g., Ho et al., 2014). The COVID-19 outbreak gave us the unique opportunity to test the same hypotheses in circumstances characterized by pervasive and enduring uncertainty. Therefore, we investigated the associations between these constructs in two large non-clinical samples of Italian individuals, the first one recruited in non-pandemic times and the second one during the Italian COVID-19 lockdown.

Materials and Methods

Participants and Procedure

Two distinct samples were used for the purpose of the present study. Sample 1 was recruited before the Italian COVID-19 lockdown via an online questionnaire, available from September 2019 to February 2020. A total of 567 adults participated in this study. Five participants were excluded as they did not complete the questionnaire. Six participants were excluded as they reported to have a serious disease (such as, cancer and multiple sclerosis). Therefore, the final sample comprised 556 participants (69.3% females, M_{age} 29.6 years, SD=13.2, range 18-72). The 12.9% of the sample reported a common health condition, such as arthritis, hypothyroidism, and asthma. 45% of respondents were university students and 41% workers, whereas the remaining were unemployed, housewife or retired. With regards to marital status, 26.1% of the sample reported to be married, 70.5% to be single, and the remaining were divorced or widowed.

Sample 2 was recruited during the Italian COVID-19 lockdown via an online questionnaire, available from March 2020 to May 2020. A total of 582 adults participated in this study. Four participants were excluded as they did not complete the questionnaire. Four participants were excluded as they reported to have a serious disease (such as, cancer and genetic disease). Therefore, the final sample comprised 575 participants (74% females, M_{age} 31.9 years, SD=13.4, range 18-81). The 20.1% of the sample reported a common health condition, such as asthma,

arthritis, hypothyroidism, and polycystic ovary. 42% of respondents were university students and 33.2% workers, whereas the remaining were unemployed, housewife, or retired. With regards to marital status, 32.2% of the sample reported to be married, 63.7% to be single, and the remaining were divorced or widowed.

The two distinct samples were recruited online by sharing the questionnaire links in social network sites groups and platforms (Facebook, Twitter, Instagram, and WhatsApp). All participants entered the study on a voluntary basis and no incentives were offered for participation. Participants were asked to give their consent in the first page of the study website, which explained the purpose of the study and assured the confidentiality of the responses. Participants were then directed to a second page containing demographic information and a series of self-report scales. The same questionnaire was completed by the two distinct samples. However, additional questions about COVID-19 experience were added to the questionnaire completed by Sample 2 (see Measures section).

The original study received formal approval by the Ethics Committee for Psychological Research at the local University. The same Committee subsequently approved the inclusion of additional questions about COVID-19 experience. This research was conducted in accordance with the Declaration of Helsinki.

Measures

Intolerance of Uncertainty. The Italian revised version of the IUS-12 (IUS-Revised, IUS-R; Bottesi et al., 2019b) was used to assess intolerance of uncertainty. It consists of 12 items rated on a 5-point scale (from (1) "not at all agree" to (4) "completely agree"). The Cronbach's alpha for the scale was $\alpha = .86$ [95% CI .84-.88]) for Sample 1 and .89 [95% CI: .87-.90] for Sample 2. A confirmatory factor analysis (CFA) was performed using DWLS estimator (Jöreskog & Sörbom, 1993) to test for the construct validity of the measure. The CFA confirmed an adequate fit to the data for Sample 1 ($\chi^2_{(54)} = 232.93$, $p < .001$; CFI = .96; NNFI = .95; RMSEA = .077, 90% CI [.067,

.088]) and Sample 2 ($\chi^2_{(54)}$ = 207.90, p < .001; CFI = .97; NNFI = .97; RMSEA = .071, 90% CI [.061, .081]).

Cyberchondria. The Italian revised version of the Cyberchondria Severity Scale (CSS 2-item 24 and mistrust factor removed; Marino et al., 2020; original scale by McElroy & Shevlin, 2014) comprises 29 items used to assess cyberchondria. Participants were asked to rate the frequency of each item on a 5-point scale (from (1) "never" to (5) "always"). Higher scores on the scale indicate higher levels of cyberchondria. The Cronbach's alpha for the CSS 2 was .95 [95% CI: .95-.96] for Sample 1 and .95 [95% CI: .94-.95] for Sample 2. The CFA confirmed an adequate fit to the data for Sample 1 ($\chi^2_{(377)}$ = 961.05, p < .001; CFI = .97; NNFI = .97; RMSEA = .054, 90% CI [.049, .058]) and Sample 2 ($\chi^2_{(377)}$ = 962.38, p < .001; CFI = .97; NNFI = .97; RMSEA = .053, 90% CI [.049, .058]).

Problematic Internet Use. The Italian version (Fioravanti, Primi, & Casale, 2013) of the Generalized Problematic Internet Use Scale 2 (GPIUS2; Caplan, 2010) contains 15 items that assess problematic Internet use in terms of preference for online social interactions, mood regulation, compulsive use, cognitive preoccupation and negative consequences due to Internet use. Participants were asked to answer each item on a 8-point scale (from (1) "definitely disagree" to (8) "definitely agree"). The Cronbach's alpha for the GPIUS2 was .90 [95% CI: .89-.91] for Sample 1 and .90 [95% CI: .88-.91] for Sample 2. The CFA confirmed an adequate fit to the data for Sample 1 ($\chi^2_{(90)}$ = 235.20, p < .001; CFI = .97; NNFI = .97; RMSEA = .054, 90% CI [.046, .063]) and Sample 2 ($\chi^2_{(90)}$ = 462.56, p < .001; CFI = .94; NNFI = .94; RMSEA = .085, 90% CI [.078, .093]).

Psychological Distress. The Italian version (Bottesi et al., 2015) of the Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) comprises 21 items used to assess psychological distress. Participants were asked to answer each item on a 4-point scale (from (0) "never" to (3) "almost always") thinking about the last 7 days. The Cronbach's alpha for the DASS-21 was .95 [95% CI: .94-.96] for Sample 1 and .95 [95% CI: .94-.95] for Sample 2. The CFA confirmed an adequate fit to the data for Sample 1 ($\chi^2_{(189)}$ = 324.82, p < .001; CFI = .99; NNFI =

.99; RMSEA = .036, 90% CI [.030, .043]) and Sample 2 ($\chi^2_{(189)}$ = 383.88, p < .001; CFI = .99;

NNFI = .99; RMSEA = .043, 90% CI [.037, .049]).

Health Anxiety. The Italian version (Melli, Coradeschi, & Smurra, 2007) of the HAQ

(Lucock & Morley, 1996) comprises 21 items used to assess health anxiety. Participants were asked

to answer each of them on a 4-point scale (from (1) "never or rarely" to (5) "most of the time"). The

Cronbach's alpha for the HAQ was .92 [95% CI: .91-.93] for Sample 1 and .94 [95% CI: .93-.94]

for Sample 2. The CFA confirmed an adequate fit to the data for Sample 1 ($\chi^2_{(189)}$ = 459.64, p <

.001; CFI = .98; NNFI = .98; RMSEA = .051, 90% CI [.045, .057]) and Sample 2 ($\chi^2_{(189)}$ = 414.06,

p < .001; CFI = .99; NNFI = .99; RMSEA = .046, 90% CI [.040, .052]).

For each measure, items were summed to obtain a total score for each construct and higher

scores represent higher levels of each variable.

[Sample 2 only] COVID-19 *experience.* 16 ad-hoc questions were gathered and adapted from

the survey used in one of the first published studies on COVID-19 in China (Wang et al., 2020; see

Table 1). Questions covers several aspects related to the COVID-19 outbreak: (1) Physical

symptoms in the past 14 days; (2) Contact history with COVID-19 in the past 14 days; (3) Concerns

about COVID-19; and (4) Additional information required with respect to COVID-19.

Statistical Analysis

First, for Sample 2, frequencies were calculated for each COVID-19-related question in order

to provide a description of participants' health status, contact history and main concerns during the

COVID-19 outbreak (Table 1).

Second, in order to explore the associations between the variables of the study in each sample,

correlation analyses were conducted. Then, the pattern of relationships specified by our theoretical

model (Figure 1) was tested twice, using the two distinct samples separately. Two path analyses

were run, using the Lavaan package (Rosseel, 2012) of software R (R Development Core Team

2013). A single observed score for each construct included in the model was used. The Robust

Maximum Likelihood method estimator was used and the Sobel test (Baron & Kenny, 1986; Hayes,

2009) was used to test for mediation. R^2 of each endogenous variable and the Total Coefficient of Determination (TCD; Bollen, 1989; Jöreskog & Sörbom, 1996) were considered in order to evaluate the goodness of fit of the model. In the tested model, HA and psychological distress were the outcome variables, cyberchondria and PIU were the mediators, and intolerance of uncertainty was the independent variable, whereas age, gender, having reported a health condition were included as control variables on the two outcomes (Figure 1). Moreover, in the model tested on Sample 2, two additional control variables were added, namely quarantine in the previous 14 days ("no"/ "yes") and frequency of online searching for COVID-19 related information and news (rated on a 4-point scale (from (1) "never or rarely" to (4) "most of the time").

Results

Table 1 shows that Sample 2 was mainly constituted from medically healthy community adults, respecting precautionary measures during the COVID-19 outbreak. About half of the participants reported moderate to extreme concern about their health, and higher than usual and frequent online searching for COVID-19 related information and news. Seventy percent of the sample considered media information reliable, with the vast majority of participants being aware of COVID-19 symptoms and route of transmission. *[TABLE 1 HERE]*

Table 2 shows the means, standard deviations, skewness, kurtosis. The two samples were compared with respect to scores obtained on all study measures. No differences emerged except for scores on the PIU ($t_{(1129)}$= -5.02, $p < .001$) and intolerance of uncertainty ($t_{(1129)}$= -2.63, $p = .009$): in both cases, Sample 2 scored significantly higher than Sample 1 (Table 2). *[TABLE 2 HERE]*

Table 3 shows the bivariate correlations between the variables included in the study for Sample 1 and Sample 2, respectively. *[TABLE 3 HERE]*

All of the study variables were correlated with each other in both Samples 1 and 2. Of note is that a large positive correlation was found between cyberchondria and HA ($r = .68$, $p < .001$ in both samples). Overall, the strongest correlations were observed between intolerance of uncertainty, the outcome variables, and mediators.

Results of the path analyses indicated that the hypothesized model is tenable in both samples (Figure 2). *[FIGURE 2 HERE]*

Specifically, in Sample 1, intolerance of uncertainty was directly associated with psychological distress ($\beta = .31$, $p < .001$) and indirectly via HA (indirect effect: $\beta = .06$, $p = .001$; association between HA and psychological distress: $\beta = .23$, $p < .001$). Moreover, intolerance of uncertainty was positively associated to cyberchondria ($\beta = .34$, $p < .001$), which in turn was positively associated with HA ($\beta = .60$, $p < .001$) but not with psychological distress ($\beta = -.04$, $p = .421$). Furthermore, intolerance of uncertainty was positively associated with PIU ($\beta = .43$, $p < .001$), which was in turn associated with psychological distress ($\beta = .21$, $p < .001$) but not with HA ($\beta = -.02$, $p = .604$) (hypothesis 1).

With regards to Sample 2, the paths were similar to the ones observed in Sample 1 with the exception of the association between cyberchondria and psychological distress, which was significant in Sample 2 ($\beta = .17$, $p < .01$) but non-significant in Sample 1. Moreover, the two COVID-19-related control variables (quarantine and frequency of online searching for COVID-19 information) were not associated with HA (quarantine: $\beta = .03$, $p = .412$; online searching for COVID-19 information: $\beta = .03$, $p = .405$) nor psychological distress (quarantine: $\beta = .01$, $p = .758$; online searching for COVID-19 information: $\beta = -.001$, $p = .971$).

As shown in Table 4, in both Samples 1 and 2, several indirect associations were found to be significant. As an example, results of the Sobel test supported the mediating role of cyberchondria in the association between intolerance of uncertainty and HA (Sample 1: $\beta = .20$, $p < .001$; Sample 2: $\beta = .21$, $p < .001$) (hypothesis 2) and the mediating role of PIU in the association between intolerance of uncertainty and psychological distress (Sample 1: $\beta = .09$, $p < .001$; Sample 2: $\beta = .06$, $p = .002$) (hypothesis 3). *[TABLE 4 HERE]*

With regards to model fit, in Sample 1, the model accounted for considerable amount of variance for the outcomes (i.e., 52% of the variance for health anxiety, 35% of the variance for psychological distress). As regard mediators, the model accounted for lower variance (11% for

cyberchondria and 18% of the variance for PIU). Similarly, in Sample 2, the model accounted for a considerable amount of variance for the outcomes (i.e., 55% of the variance for health anxiety, 34% of the variance for psychological distress). As regard mediators, the model accounted for lower variance (14% for cyberchondria and 16% of the variance for PIU). Finally, the total amount of variance explained by the model (Total Coefficient of Determination) in Sample 1 (TCD = .41) and in Sample 2 (TCD = .41) indicated a good fit to the observed data. Indeed, these TCD correspond to a correlation of r = .64, which can be considered medium to large effect sizes (Cohen, 1988).

Discussion

Overall current findings support the model under examination, as significant direct and indirect associations between intolerance of uncertainty, HA, and psychological distress through PIU and cyberchondria emerged in both samples. Conceptually, the personality dimension of neuroticism may account for the complex interplay between these constructs: indeed, intolerance of uncertainty is considered as a core predisposition originating from neuroticism (Carleton, 2016; Norton & Mehta, 2007), which is also strongly associated with PIU (Koronczai et al., 2019) and cyberchondria (Bajcar & Babiak, 2020). Consequently, our results are fully consistent with research documenting the role of intolerance of uncertainty as a transdiagnostic vulnerability factor spanning several clinical phenotypes (McEvoy et al., 2019; Shihata et al., 2016).

PIU mediated the path from intolerance of uncertainty to psychological distress both in non-pandemic times and during the COVID-19 lockdown. This finding confirms that increasing connectivity may facilitate the engagement with excessive Internet use to manage uncertainty, independently of real-life uncertain events (Carleton et al., 2019). However, it is to note that Sample 2 reported higher levels of PIU than Sample 1, in line with studies that showed increases in Internet and digital media use during local lockdowns (Cellini et al., 2020; Dixit et al., 2020). PIU is likely to function both as an under-engagement (e.g., online social interactions or online gaming to reduce and/or distract from uncertainty) and an over-engagement (e.g., online information seeking to gain certainty) uncertainty-reducing strategy (Sankar et al., 2017). Being always-on-and-connected

through mobile devices comes at a cost, since immediate uncertainty (and related distress) reductions may negatively reinforce both PIU and intolerance of uncertainty. In the long term this could result in the consolidation of a vicious cycle further increasing psychological distress.

In the current study, despite the significant bivariate correlation between PIU and HA, PIU was not significant in the relationship between intolerance of uncertainty and HA in the path model, when considering the simultaneous role of cyberchondria, which significantly mediated this path in both samples. It could be that generalized high levels of emotion dysregulation due to Internet use, compulsive Internet use and obsessive thoughts about the Internet increase anxiety and obsessive-compulsive symptoms (e.g., Carli et al., 2013), which are often found to be associated with HA (e.g., Fergus & Russel, 2016). However, in the current study, PIU refers to a generalized problematic pattern of Internet use, whereas cyberchondria specifically refers to health-related online searches and can be considered a specific sub-type of PIU (e.g., Fergus & Dolan, 2014). Thus, when included in the same model, cyberchondria emerged as significant predictor of HA over PIU. According to our findings, and in line with literature (e.g., Fergus, 2013), cyberchondria may act as a specific maintenance factor in the association between intolerance of uncertainty and HA; indeed, Internet searches for health information frequently lead to the consideration of various medical possibilities, thus increasing uncertainty, intolerance of uncertainty, and HA. Once again, this link was observed both in non-pandemic times and during COVID-19 lockdown; therefore, it is reasonable to assume that these variables are strongly related independently of actual illness uncertainties. Indeed, the frequency of online searching for COVID-19 information was not associated with HA and psychological distress.

Cyberchondria was also found to mediate the path from intolerance of uncertainty to psychological distress only in Sample 2; in particular, its mediational effect was both simple and serial (i.e., through HA) during lockdown. This finding aligns itself to the vast body of recent literature demonstrating that excessive online searches for medical information are strongly related with psychological distress in the current COVID-19 pandemic (Farooq et al., 2020; Hashemi,

14

2020; Kouzy et al., 2020; Laato et al., 2020; Starcevic et al., 2020), and the combination of cyberchondria and HA is considered an important amplifier of COVID-19 anxiety (Jungmann & Witthöft, 2020). In both Sample 1 and Sample 2, mean scores on the DASS-21 and the IUS-R were within the normative ranges (Bottesi et al., 2015; 2019b). However, higher levels of intolerance of uncertainty were observed in Sample 2 compared to Sample 1. During the lockdown, people suddenly found themselves in a novel, unforeseen situation. Despite most of our participants reported being aware about what symptoms they needed to be on the alert for (97.5%) and COVID-19 route of transmission (99.7%), at this time other uncertainties may have emerged, for example, from not knowing whether and how they/their loved ones may have had contracted the virus and not having a clear idea about how the virus was spreading and how serious it was. In such circumstances, high intolerance of uncertainty would drive excessive health-related information seeking as a means of obtaining certainty about these issues. However, having constant access to an overwhelming amount of health-related information - often conflicting or ambiguous – does not decrease uncertainty. On the contrary, it may contribute to information overload and overconcern among individuals, which further increases not only HA, but also psychological distress. In their "Uncertainty Distress Model", Freeston et al. (2020) define *uncertainty distress* as "the subjective negative emotions experienced in response to the as yet unknown aspects of a given situation" (p. 3). Such a description appears to adequately capture the nature of the psychological distress related to COVID-19.

This study has several limitations that should be acknowledged. First, two different samples were used and were convenient self-selected community samples recruited online. Thus, future studies should replicate these findings using randomly selected participants and employing a longitudinal/experimental design. Second, despite the fact that path analyses might be suggestive of the directions of the associations among the studied variables (e.g., Bullock, Harlow, & Mulaik, 1994), the cross-sectional design of the study does not allow to draw a conclusive causal inference. Further longitudinal studies should monitor the changes in the variables of interest over time. As

mentioned above, the issue of directionality is particularly important as cyberchondria and PIU might also be maintaining factors exacerbating the levels of intolerance of uncertainty, thus establishing a vicious cycle. Third, the relatively modest sample sizes did not allow to use a traditional structural equation modelling approach and to run multi-group analyses. However, the present study showed a similar pattern of relationships for the two samples, which were overall comparable despite the higher levels of intolerance of uncertainty and PIU reported by Sample 2 who completed the study during the first months of the pandemic outbreak in Italy. Fourth, in our study we could not use a specific measure of COVID-19 psychological distress – as for example the recently developed Fear of COVID-19 Scale (Ahorsu et al., 2020), Coronavirus Anxiety Scale (Lee, 2020a, 2020b), COVID Stress Scales (Taylor et al., 2020), and COVID-19 Anxiety Syndrome Scale (Nikčević & Spada, 2020). Indeed, when we designed our study (before the COVID-19 outbreak) the DASS-21 represented the most suitable measure to assess psychological distress and given our purposes. Moreover, none of the above-mentioned questionnaires was translated into Italian at the time of Sample 2 enrollment. Furthermore, the research protocol did not include the frequency of specific online activities, thus future studies should ascertain which types of activities (such as, problematic social media use, exposure to negative news, etc.) are more likely to contribute to PIU. Lastly, cut-offs for the CSS and the GPIUS2 are currently unavailable. Future studies are warranted in order to establish cut-off values to facilitate the assessment of the prevalence of problematic online behaviors and allow practitioners to screen community adults at risk of cyberchondria and PIU in the context of COVID-19 pandemic.

To our knowledge, the present study is the first to provide new insights on the combined role of intolerance of uncertainty, cyberchondria and PIU in predicting levels of HA and psychological distress before and during the COVID-19 outbreak. Indeed, findings suggested that intolerance of uncertainty is relevant to both in pandemic and non-pandemic contexts and should be considered in clinical contexts (e.g., cognitive-behavioral therapy) in order to tackle HA and psychological distress. Moreover, results of the current study suggest that problematic online behaviors (i.e.,

cyberchondria and PIU) might exacerbate the negative consequences of intolerance of uncertainty in terms of higher levels of HA and psychological distress. Thus, given the spread of both general and health-related Internet use, correct and clear information related to the "positive" use of the Internet for health searches and reassurance-seeking might be of value for targeted preventive practices. Lastly, in line with the recently proposed "Uncertainty Distress Model" (Freeston et al., 2020) and in accordance with our findings, helping people managing and rebalancing information, for example by reducing access to some types of information while potentially increasing access to others, may represent a starting point to address both cyberchondria and psychological distress in the context of the COVID-19 pandemic.

Declarations of interest: The authors report no conflict of interest.

Data availability statement: The data that support the findings of this study are available from the corresponding author, G. B., upon reasonable request.

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Table 1. Ad-hoc questions related to the COVID-19 outbreak (adapted from Wang et al., 2020); Sample 2; N=510 complete answers.

	N (%)
1. Physical symptoms in the past 14 days	
Consultation with doctor in the clinic	25 (4.9)
Visiting ER because of one or more flu-like symptoms	1 (0.2)
Quarantine	209 (41.1)
Testing for COVID-19 (swab)	5 (1%)
Diagnosis of coronavirus	1 (0.3)
2. Contact history with COVID-19 in the past 14 days	
Probability of close contact with an individual with confirmed infection with COVID-19 (from "likely" to "very much likely")	48 (9.5)
Probability of indirect contact with an individual with confirmed infection with COVID-19 (from "likely" to "very much likely")	91 (17.8)
Respecting precautionary measures	505 (99)
3. Concerns about COVID-19	
Concern about one's own health more than usual (from "moderately" to "extremely")	252 (49.4)
Concern about important others' health more than usual (from "moderately" to "extremely")	400 (78.5)
Frequency of online searching for COVID-19 related information and news ("often" and "most of the time")	259 (50.8)
4. Additional information required with respect to COVID-19	
Knowledge of symptoms (from "enough" to "extremely")	497 (97.5)

Trust in GP's ability to identify COVID-19 symptoms (from "enough" to "extremely")   423 (82.9)

Knowledge of COVID-19 route of transmission (from "enough" to "extremely")   508 (99.7)

Reliability of media information (from "enough" to "extremely")   361 (70.8)

Government precautionary measures are sufficient (from "enough" to "extremely")   419 (82.1)

Table 2. Means, standard deviations, range, skewness, kurtosis, and t-tests for the study variables of Sample 1 and Sample 2.

	M(SD)	Range (Min-Max)	Skewness (SE)	Kurtosis (SE)	$t_{(df)}$	p
Psychological distress						
Sample 1	20.57(13.97)	0-63	.77(.104)	.04(.207)	$.33_{(1129)}$	.740
Sample 2	20.30(13.62)	0-62	.66(.102)	-.04(.203)		
Health anxiety						
Sample 1	41.02(11.96)	21-80	.81(.104)	.17(.207)	$1.05_{(1129)}$	.295
Sample 2	40.26(12.34)	21-83	.79(102)	.12(.203)		
Cyberchondria						
Sample 1	50.20(19.87)	29-135	1.15(.104)	.99(.207)	$1.73_{(1107.11)}$	.085
Sample 2	48.26(17.84)	29-125	1.25(.102)	1.59(.203)		
Problematic internet use						
Sample 1	35.55(17.87)	15-118	1.28(.104)	1.93(.207)	$-5.02_{(1129)}$	<.001
Sample 2	40.88(17.87)	15-111	.79(.102)	.51(.203)		
Intolerance of uncertainty						
Sample 1	31.47(8.78)	12-60	.44(.104)	.03(.207)	$-2.63_{(1129)}$	.009
Sample 2	32.88(9.17)	12-60	.24(.102)	-.26(.203)		

Notes: Sample 1 N= 556; Sample 2 N= 575; *p<.05; **p<.01; ***p<.001.

Table 3. Bivariate correlations (Sample 1 below the diagonal; Sample 2 above the diagonal).

	1	2	3	4	5	6
1. Psychological distress	-	.43***	.39***	.35***	.49***	-.15***
2. Health anxiety	.42***	-	.68***	.25***	.49***	-.03
3. Cyberchondria	.32***	.68***	-	.23***	.35***	-.02
4. Problematic internet use	.39***	.31***	.37***	-	.39***	-.39***
5. Intolerance of uncertainty	.50***	.45***	.34***	.42***	-	-.16***
6. Age	-.12**	-.10*	-.12**	-.30***	-.16**	-

Notes: Sample 1 N= 556; Sample 2 N= 575; *p<.05; **p<.01; ***p<.001.

Table 4. Standardized indirect effects of the independent (intolerance of uncertainty) on the two outcomes (health anxiety, HA) and psychological distress) via the mediators (cyberchondria and problematic internet use, PIU).

| Independent	Mediators	Outcome							
		Health Anxiety				Psychological Distress			
		Beta	SE	*z*	*p*	Beta	SE	*z*	*p*
Sample 1									
Intolerance of uncertainty	Cyberchondria	.200	.037	7.331	<.001	-.013	.026	-.807	.419
	PIU	-.009	.024	-.511	.609	.088	.036	3.794	<.001
	Cyberchondria → Health Anxiety	-	-	-	-	.045	.019	3.723	<.001
	PIU → Health Anxiety	-	-	-	-	-.002	.006	-.508	.612
	Health Anxiety	-	-	-	-	.058	.026	3.478	.001
Sample 2									
Intolerance of uncertainty	Cyberchondria	.212	.039	7.322	<.001	.063	.032	2.936	.003
	PIU	.007	.020	.483	.629	.064	.031	3.074	.002
	Cyberchondria → Health Anxiety	-	-	-	-	.030	.017	2.574	.010
	PIU → Health Anxiety	-	-	-	-	.001	.003	.476	.634
	Health Anxiety	-	-	-	-	.041	.025	2.486	.013

Figure 1. Proposed theoretical model.
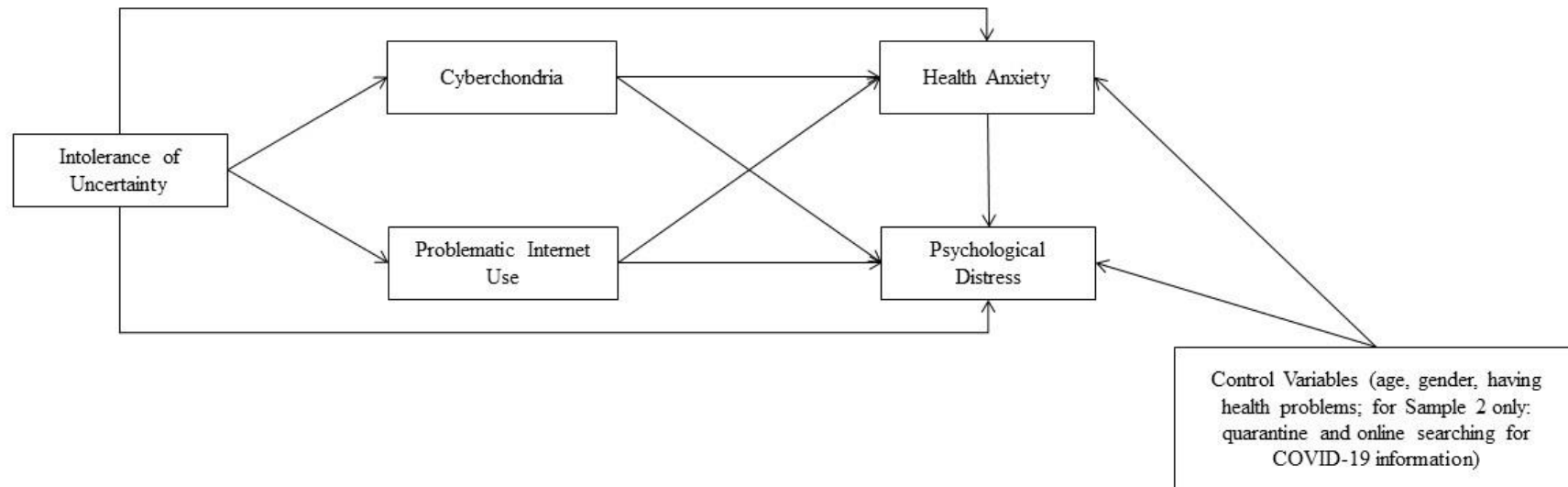
Figure 2. Model of the inter-relationships between the study variables.