

# Dysfunctional coronavirus anxiety in nonpsychotic psychiatric outpatients during the COVID-19 pandemic: A network analysis

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## Abstract

**Background:** The 2019 coronavirus disease (COVID-19) pandemic has had a profound impact on the mental health of people worldwide. This study examined dysfunctional coronavirus anxiety in nonpsychotic psychiatric outpatients during the pandemic using the coronavirus anxiety scale (CAS) and examined the relationship between coronavirus anxiety and clinical symptoms using network analysis.

**Methods:** In this cross-sectional study, 192 patients who first visited the psychiatric outpatient clinic of Severance Hospital during the COVID-19 pandemic with chief complaints of depressed mood, anxiety, somatic symptoms, or insomnia were included. We compared the clinical characteristics of patients with and without dysfunctional coronavirus anxiety. Network analysis was conducted to estimate the network of coronavirus anxiety and depressive, anxious, and hypochondriacal psychopathology.

**Results:** The results showed that 7.8% of patients exhibited dysfunctional coronavirus anxiety (CAS  $\geq$  5). Patients with dysfunctional coronavirus anxiety showed higher levels of health worry, somatic preoccupation, and subjective anxiety compared to patients without dysfunctional coronavirus anxiety. In the network analysis, the health worry node (Item 6 of the WI) showed the greatest number of connections with coronavirus anxiety nodes.

**Conclusions:** These findings suggest that health worry may be an important bridge symptom that connects coronavirus anxiety and other clinical psychopathology. Patients with elevated health worries should be carefully monitored during the COVID-19 pandemic for exacerbation of previous symptoms and COVID-19-related psychopathology. Understanding the psychological factors in the face of the pandemic and their relationships with clinical psychiatric symptoms would help people prevent and overcome mental health problems during the pandemic.

## KEYWORDS

anxiety, anxiety disorders, coronavirus, COVID-19, depressive disorders, somatoform disorders

## 1 | INTRODUCTION

The 2019 coronavirus disease (COVID-19) has quickly spread across the globe since the virus was first identified in 2019 (Sohrabi et al., 2020). The COVID-19 pandemic has had a profound impact not only on physical health but also on the mental health of people around the world. The 2020 global burden of disease study showed that there were an additional 53.2 million (44.8–62.9) cases of major depressive disorder globally (an increase of 27.6% [25.1–30.3]), and an additional 76.2 million (64.3–90.6) cases of anxiety disorders globally (an increase of 25.6% [23.2–28.0]) due to the COVID-19 pandemic (Santomauro et al., 2021). In another meta-analysis including 65 studies, there was a significant increase in symptoms of anxiety and depression during the COVID-19 pandemic compared to the prepandemic levels (Robinson et al., 2022).

Patients with mental health conditions may be more vulnerable to the psychological impact of the pandemic, due to their high susceptibility to stress compared to the general population (Yao et al., 2020). Specifically, for depressive disorder patients, the pandemic and lockdown may serve as a major source of stress that jeopardizes daily routine and leads to the exacerbation of depressive symptoms (Chatterjee et al., 2020). For anxiety and somatic symptom disorder patients, any simple flu-like symptom and media report on COVID-19 may increase anxiety (Chatterjee et al., 2020). Notably, depression, anxiety, and somatization are the most common mental disorders in primary care (Toft et al., 2005), and they are associated with substantial functional impairment and elevated healthcare costs (Löwe et al., 2008). Therefore, it is important to examine the impact of the COVID-19 pandemic on patients suffering from these disorders.

Much is still unknown regarding the mental health impact of the COVID-19 pandemic on people with pre-existing psychiatric illnesses. While most of the included studies were online or telephone surveys, a systemic review and meta-analysis of 15 heterogeneous studies including people with pre-existing mental diseases during pandemics (including COVID-19) showed that pandemics exacerbate mental health problems in people with pre-existing mental illnesses (Neelam et al., 2021). In this review, while there was no evidence of worsening of psychotic symptoms in people with schizophrenia, people with mental illnesses, such as eating disorders showed deterioration in mental health and worsening of previous symptoms during the pandemic. In a study of a 1068 population-representative sample based on self-reported psychiatric diagnosis, people with pre-existing primary anxiety disorders showed higher COVID-19-related stress levels compared to those with primary mood disorders and no mental health diagnosis (Asmundson, Paluszek, et al., 2020). To this date, how COVID-19-related factors, in the context of the pandemic, affect psychiatric symptoms in individuals with mental disorders remains unclear. One recent online survey of the general population in Germany suggested a possible role of trait health anxiety as a risk factor for coronavirus anxiety (Jungmann & Withhöft, 2020).

For the purpose of understanding the relationship between COVID-19 pandemic and psychiatric symptoms, a new analytic technique using network analysis can be useful, as it enables visualization and quantification of complex associations among different symptom dimensions (Borsboom & Cramer, 2013). In contrast to the traditional approach to mental illnesses that involve summing up symptoms to establish diagnoses, in the network analytic approach, it is assumed that psychiatric disorders stem from a causal interplay between psychiatric symptoms, and focus specifically on the symptoms and their complex associations. According to the cognitive-behavioral model of health anxiety, many factors play a role in the development and maintenance of health anxiety (Taylor et al., 2020), and network analysis would provide important information on the relationship between such factors. In addition, network analysis identifies core symptoms and bridge symptoms, which may serve as potential targets for clinical intervention (Contreras et al., 2019; McNally, 2016). Considering these features, network analysis can help us understand the complex interaction between COVID-19 related anxiety and clinical psychopathology during the pandemic.

The present study aimed to examine the proportion of patients with dysfunctional coronavirus anxiety among outpatients with nonpsychotic mental illness. In addition, we examined the relationship between coronavirus anxiety and clinical symptoms, such as depressive, anxiety, and hypochondriacal psychopathology, using network analysis.

## 2 | METHODS

### 2.1 | Participants

In this cross-sectional study, patients aged 18 years and above who first visited the psychiatric outpatient clinic of Severance Hospital with chief complaints of depressed mood, anxiety, or somatic symptoms from May 2020 to April 2021 were considered for participation. Patients who were diagnosed with psychotic disorders or intellectual disabilities; had a history of brain injury, epilepsy, or other neurological diseases; had a history of COVID-19; or had other physical or psychiatric disabilities that hindered them from answering the questionnaires were excluded from the study. All of the participants were assessed and diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) by trained psychiatrists. Based on the DSM-5, 78 patients were diagnosed with anxiety-related disorders, 46 were diagnosed with somatic symptom and related disorders, 38 were diagnosed with depressive disorders, 17 were diagnosed with trauma- and stressor-related disorders, 10 were diagnosed with sleep-wake disorders, 2 were diagnosed with personality disorders, and 1 was diagnosed with obsessive-compulsive and related disorders. Considering the frequency of diagnoses in this sample, the patients were divided into the following four groups: somatic symptom and related disorder group, depressive disorder group, anxiety disorder group, and others

group. The study protocol was approved by the Institutional Review Board (IRB) of Severance Hospital, and all procedures of this study were conducted in accordance with the approved guidelines. The IRB approval number was 4-2021-0383.

## 2.2 | Assessment

All participants were asked to answer standardized questions on social-demographic characteristics. They were also asked to answer the following standardized questionnaires: the Beck anxiety inventory (BAI), the Beck depression inventory (BDI), and the Whiteley index-6 (WI-6). To measure each patient's coronavirus anxiety, the coronavirus anxiety scale (CAS) was completed.

## 2.3 | Clinical characteristics

### 2.3.1 | Beck depression inventory

To measure each patient's depression, the BDI was administered. BDI is a 21-item scale and each item is scored from 0 to 3, with higher scores indicating more severe depressive symptoms (Beck et al., 1996). BDI comprises negative attitude, performance difficulty, and physiological manifestations factors (Tanaka & Huba, 1984). The psychometric properties of the Korean version of BDI have been validated (Song et al., 2012).

### 2.3.2 | Beck anxiety inventory

To measure each patient's anxiety, the BAI was administered. BAI contains 21 questions and each item is scored from 0 to 3 (i.e., not at all–severely), with higher scores indicating more severe anxiety symptoms (Beck et al., 1988). BAI comprises the somatic symptom factor, and the subjective anxiety and panic symptom factor. The Korean version of BAI has been shown to be a valid and reliable measure of anxiety (Lee et al., 2016).

### 2.3.3 | Whiteley index-6

To measure each patient's health anxiety, the WI-6 was administered. WI-6 consists of two factors that assess health worry and bodily/somatic preoccupation, respectively (Asmundson et al., 2008). WI-6 has been extensively validated and is a widely used measure of health anxiety (Seok, 2018). For our data, Cronbach's  $\alpha$  was .916.

### 2.3.4 | Coronavirus anxiety scale

To measure each patient's anxiety associated with the COVID-19 pandemic, the CAS was administered. CAS is a five-item scale, and

each item is scored from 0 to 4 (i.e., not at all–nearly every day) based on experiences over the past 2 weeks (Lee, 2020a). Patients with CAS scores greater than or equal to 5 were considered to be dysfunctionally anxious (or functionally impaired by their coronavirus anxiety) (Lee, 2020b). The psychometric properties of the Korean version of CAS have been validated, and it has also been shown to be a reliable measure of anxiety associated with the COVID-19 pandemic (Choi et al., 2020).

## 2.4 | Statistical analysis

Statistical analysis was completed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (SPSS Inc.) and R (R Core Team 2013). Sociodemographic and clinical characteristics were compared using analysis of variance with a Bonferroni post hoc test for variables with significant differences ( $p < .05$ ). In addition, the  $\chi^2$  test was performed to compare categorical variables. An independent group t-test or Mann-Whitney  $U$  test (for non-normally distributed variables) was performed to test for differences in the clinical characteristics between patients with and without dysfunctional coronavirus anxiety.

### 2.4.1 | Network estimation

The statistical software R was used to perform network analysis (R Core Team, 2013). Using the R-package *qgraph* (Epskamp et al., 2012), we estimated the network structure of depressive, anxiety, and hypochondriacal symptoms as well as coronavirus anxiety. In a network, variables are referred to as “nodes,” and “edges” are partial correlations between two nodes after controlling for all the other nodes in the network (Epskamp et al., 2012). The model was regularized by running the graphical least absolute shrinkage and selection operator since a network with many parameters may lead to false-positive connections (Friedman et al., 2008). Trivial, small, partial correlations are driven to zero, revealing only relevant edges (Epskamp & Fried, 2018).

### 2.4.2 | Centrality

To examine the importance of each node in the network, centrality indices were calculated. The most commonly used centrality indices are strength, closeness, and betweenness. Strength centrality, which is arguably the most stable (Gijzen et al., 2021), computes the sum of all edge weights a node is directly connected to (Bringmann et al., 2019). Closeness centrality is the inverse of the weighted sum of distances between a particular node and other nodes in the network, and it measures the degree to which a node is indirectly connected to other nodes (Bringmann et al., 2019; Galderisi et al., 2018). Betweenness centrality calculates the number of times that a node lies on the shortest path length between any two other

nodes. The R-package *bootnet* was used to quantify the stability of centrality indices, which gives the correlation stability (CS) coefficients for each centrality index. It has been suggested that the CS-coefficient should not be below 0.25, and preferably above 0.5 (Epskamp et al., 2018). In this study, we only interpreted centrality indices with CS coefficients of more than 0.25.

## 2.5 | Missing data

Missing data were handled using SPSS 25.0. Missing value analysis was performed using the expectation-maximization (EM) algorithm (Enders, 2001). The EM imputation provides unbiased parameter estimates when a very small portion of data is missing, completely at random. Variables with missing values below 5% were imputed using the EM estimates. Twenty participants had less than 5% missing value out of all variables, and their missing data were handled with the EM algorithm.

## 3 | RESULTS

A total of 205 patients visited the psychiatric outpatient clinic at Severance Hospital for the first time between May 2020 to April 2021. Out of 205 patients, four patients were excluded due to diagnoses of psychotic disorders, six were excluded due to psychiatric disability that hindered them from answering the questionnaires (OBS), one patient was excluded due to lack of psychiatric diagnosis, one patient was excluded because of age, and one patient was excluded due to the lack of data. Finally, a total of 192 patients were included for analysis.

Demographic and clinical characteristics in the four diagnostic groups of somatic symptom and related disorder, depressive disorder, anxiety disorder, and others are presented in Table 1. Dysfunctional coronavirus anxiety, reflected by a CAS score of higher than or equal

to 5, was present in 7.8% ( $n = 15$ ) of all participants. There was no difference in the demographic and clinical characteristics among the groups, except for BDI. In post hoc analysis, there was a statistically significant difference in BDI between the depressive disorder group and anxiety disorder group ( $p = .02$ ). There was no significant difference in the average CAS score ( $p = .158$ ) and the proportion of patients with dysfunctional coronavirus anxiety ( $p = .482$ ).

The comparison of clinical characteristics between patients with and without dysfunctional coronavirus anxiety is presented in Table 2. Patients with dysfunctional coronavirus anxiety showed higher scores in the subjective anxiety and panic symptom factor of the BAI, the health worry factor of the WI, and the bodily/somatic preoccupation factor of the WI.

The network of depression, anxiety, and hypochondriasis symptoms, and coronavirus anxiety is shown in Figure 1, with 55 edges being nonzero out of 120 possible edges. CS coefficients of the network were 0.438 for strength, 0.052 for closeness, and 0 for betweenness. As the CS coefficients of closeness and betweenness were inadequate, we interpreted strength as the primary index of centrality, which showed acceptable stability. The standardized estimate of strength centrality is presented in Figure 2. Item 5 of the CAS ("I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus") showed the highest strength centrality index ( $Z = 1.62$ ), followed by negative attitude dimension of the BDI ( $Z = 1.11$ ), Item 1 of the WI ( $Z = 1.06$ ) ("Do you often worry about the possibility that you have got a serious illness?"), and subjective anxiety and panic symptom dimension of the BAI ( $Z = 0.86$ ). Regarding edges between the coronavirus anxiety nodes and the depression, anxiety, and hypochondriasis psychopathology nodes, the strongest edge was found between Item 1 of the CAS ("I felt dizzy, lightheaded, or faint when I read or listened to news about the coronavirus") and Item 6 of the WI ("Are you afraid of illness?") (edge weight = 0.046), followed by the edge between Item 2 of the CAS ("I had trouble falling or staying asleep because I was thinking about the coronavirus") and Item 6 of the WI (edge

**TABLE 1** Demographic and clinical characteristics of participants

	All ( $n = 192$ )	Soma ( $n = 46$ )	Depression ( $n = 38$ )	Anxiety ( $n = 78$ )	Other ( $n = 30$ )	$p^*$
Age	45.62 ± 17.05	45.61 ± 17.33	45.39 ± 18.54	45.36 ± 15.33	46.60 ± 19.49	.989
Male/female, $n$	48/144	13/33	10/28	15/63	10/20	.425
BDI	20.97 ± 12.46	19.65 ± 13.48	26.63 ± 10.29	19.44 ± 10.27	19.8 ± 16.50	<b>.019**</b>
BAI	23.23 ± 14.93	20.83 ± 14.83	25.28 ± 13.83	24.41 ± 13.88	21.24 ± 18.67	.405
WI	10.31 ± 6.81	11.39 ± 7.19	9.41 ± 5.88	10.33 ± 6.43	9.77 ± 8.24	.574
CAS	1.26 ± 3.09	0.70 ± 1.36	0.82 ± 1.69	1.45 ± 3.09	2.17 ± 5.42	.158
CAS ≥ 5/CAS < 5, $n$	15/177	2/44	2/36	7/71	4/26	.482

Note: Boldface values are those with  $p < 0.05$ .

Abbreviations: ANOVA, analysis of variance; BAI, Beck anxiety inventory; BDI, Beck depression inventory; CAS, coronavirus anxiety scale; other, others group; Soma, somatic symptom and related disorders; WI, Whiteley index.

\* $p$  values are from ANOVA or  $\chi^2$  test of the four diagnostic groups. The means (standard deviations) are presented for age, BDI, BAI, WI, and CAS.

\*\*Bonferroni adjustment for ANOVA was performed, and depression group and anxiety group showed a statistically significant differences in BDI ( $p = .02$ ).

weight = 0.030). Item 6 of the WI was the depression, anxiety, and hypochondriasis psychopathology node, which showed the greatest number of connections with coronavirus anxiety nodes, with connections to Items 1, 2, and 4 of the CAS.

## 4 | DISCUSSION

In this study, we examined the proportion of dysfunctional coronavirus anxiety in psychiatric outpatients with depressive, anxious, or somatic complaints, and examined the relationship between

coronavirus anxiety and depressive, anxious, and hypochondriacal psychopathology. Dysfunctional coronavirus anxiety was present in 7.8% of the patients, and there was no difference among the four groups. In addition, the results showed that psychiatric patients with high coronavirus anxiety exhibit high levels of subjective anxiety, health worry, and somatic preoccupation; and that health worry is an important bridge symptom that connects coronavirus anxiety to other clinical psychopathology.

Notably, in the present network model, the health worry item (Item 6 of the WI: "Are you afraid of illness?") was the clinical psychopathology node with the strongest connections to coronavirus anxiety nodes. Healthy worry, the excessive awareness of somatic sensations, and the tendency to attribute them to a severe medical illness have been suggested to influence responses to viral pandemics (Asmundson & Taylor, 2020; Wang et al., 2020). A previous study in the German general population showed that coronavirus anxiety was significantly associated with health worry (Jungmann & Witthöft, 2020). During the pandemic, people are exposed to excessive information about the virus through the media, which may exacerbate anxiety (Gao et al., 2020; Garfin et al., 2020). People with high health worry may be at a higher risk, as they may misinterpret somatic sensations, such as coughing, and attribute them to COVID-19 (Asmundson & Taylor, 2020). In addition, elevated health worry may be a potential treatment target, as improvement in health worry may be accompanied by deactivation of the interactions with coronavirus anxiety and other psychopathology.

Interestingly, within the overall network, gastrointestinal (GI) symptom-related coronavirus anxiety (Item 5 of the CAS: "I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus") was the most central symptom in terms of node strength centrality. There have been reports of increased prevalence of GI symptoms during the COVID-19 lockdown, and it has been shown that the increase in GI symptoms was associated with anxiety (Abenavoli et al., 2021;

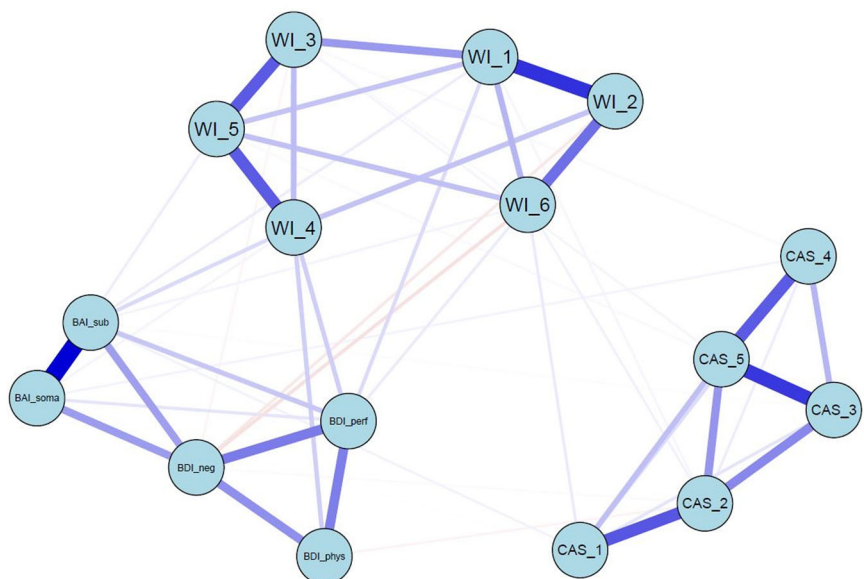
**TABLE 2** Clinical characteristics of patients with and without dysfunctional coronavirus anxiety

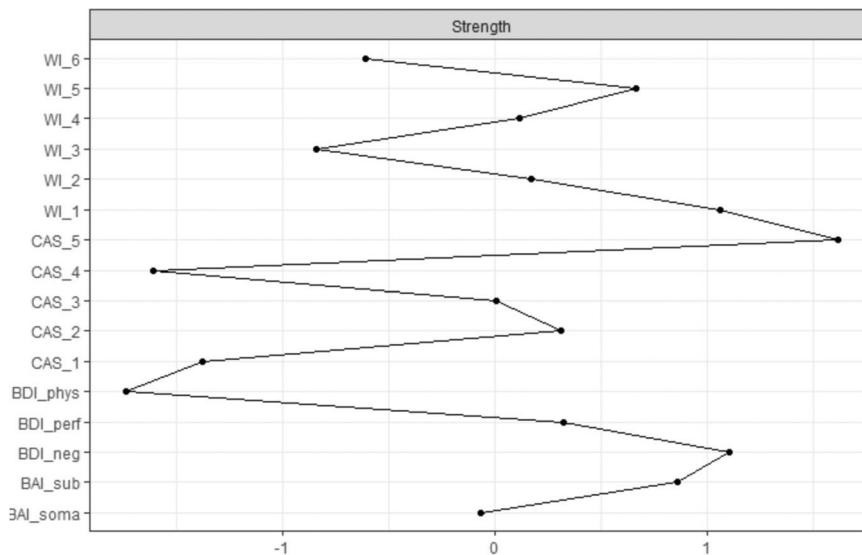
	CAS $\geq$ 5 (n = 15)	CAS < 5 (n = 177)	p
BAI_soma	14.40 (9.00, 24.00)	10.00 (5.00, 17.50)	.098
BAI_sub	15.00 (12.00, 17.00)	10.00 (5.00, 17.00)	<b>.038</b>
BDI_neg	11.00 (6.00, 16.28)	9.00 (5.00, 17.00)	.668
BDI_perf	7.00 (5.00, 12.00)	7.00 (5.00, 9.00)	.313
BDI_phys	3.00 (1.00, 5.00)	2.00 (1.00, 4.00)	.507
WI_soma	8.00 (4.00, 12.00)	4.00 (1.50, 7.00)	<b>.006</b>
WI_wry	9.00 (4.00, 12.00)	5.00 (3.00, 8.00)	<b>.002</b>

Note: Boldface values are those with  $p < 0.05$ . The median (Q1, Q3) is presented for each scale.

Abbreviations: BAI\_soma, somatic symptom factor of Beck anxiety inventory; BAI\_sub, subjective anxiety and panic symptom factor of Beck anxiety inventory; BDI\_neg, negative attitude factor of Beck depression inventory; BDI\_perf, performance difficulty factor of Beck depression inventory; BDI\_phys, physiological manifestations factor of Beck depression inventory; CAS, coronavirus anxiety scale; WI\_soma, bodily/somatic preoccupation of Whiteley index; WI\_wry, health worry of Whiteley index.

**FIGURE 1** Network of depression, anxiety, and hypochondriasis symptoms and coronavirus anxiety. BAI\_soma, somatic symptom factor of Beck anxiety inventory; BAI\_sub, subjective anxiety and panic symptom factor of Beck anxiety inventory; BDI\_neg, negative attitude factor of Beck depression inventory; BDI\_perf, performance difficulty factor of Beck depression inventory; BDI\_phys, physiological manifestations factor of Beck depression inventory; CAS\_1, CAS\_2, CAS\_3, CAS\_4, CAS\_5, Items 1–5 of the coronavirus anxiety scale; WI\_1, WI\_2, WI\_3, WI\_4, WI\_5, WI\_6, Items 1–6 of the Whiteley index





**FIGURE 2** Standardized estimate of strength centrality. BAI\_soma, somatic symptom factor of Beck anxiety inventory; BAI\_sub, subjective anxiety and panic symptom factor of Beck anxiety inventory; BDI\_neg, negative attitude factor of Beck depression inventory; BDI\_perf, performance difficulty factor of Beck depression inventory; BDI\_phys, physiological manifestations factor of Beck depression inventory; CAS\_1, CAS\_2, CAS\_3, CAS\_4, CAS\_5, Items 1–5 of the coronavirus anxiety scale; WI\_1, WI\_2, WI\_3, WI\_4, WI\_5, WI\_6, Items 1–6 of the Whiteley index

Nakov et al., 2021). In this study, the high centrality of GI symptoms in the network adds to the knowledge of the connection between the GI tract and the nervous system, also known as the “gut-brain axis.”

On the other hand, unlike the expectation that patients with mental disorders may have high anxiety responses to the pandemic, the overall proportion of patients with dysfunctional coronavirus anxiety (7.8%,  $CAS \geq 5$  and 3.6%,  $CAS \geq 9$ ) was comparable or lower than the findings in Korean patients with cancer (online survey, 9.5%,  $CAS \geq 5$ ) (Ahn et al., 2020), in a Korean general population (online survey, 3.3%,  $CAS \geq 9$ ) (Choi et al., 2020), and in the prior study of US workers by Lee (2020b) who has developed the CAS (online survey, 25.4%,  $CAS \geq 9$ ). As the present study was conducted at an onsite clinic in patients receiving in-person psychiatric care during the pandemic, our sample may not include psychiatric patients with severe coronavirus anxiety who may be reluctant to hospital visits. A prior study done by our group showed that the daily visit rates for anxiety and depressive disorder patients were significantly related to the daily number of newly confirmed cases of COVID-19, suggesting that high concerns related to potential exposure to COVID-19 in psychiatric patients may lead to hospital avoidance (Seo et al., 2021). In addition, COVID-related anxiety in a clinical sample with the mental disorder might be underrepresented due to accompanying prominent psychiatric symptoms and preoccupation with the symptoms. The different findings of dysfunctional coronavirus anxiety among studies may also result from differences in COVID-19 situation at the assessment time point, population characteristics, and research design, including healthcare setting (i.e., tertiary hospital vs. community), and study setting (i.e., clinical vs. at-risk people vs. population-based).

There was no difference among the diagnostic groups in the average CAS score and the proportion of patients with dysfunctional coronavirus anxiety. This was in line with a previous study of CAS in psychiatric outpatients, in which there was also no difference in the average CAS score among different diagnostic groups (Karahmet et al., 2021). These results indicate that clinically significant

impairment due to coronavirus anxiety is not limited to certain diagnostic groups, but is present across the spectrum of depressive, anxious, and somatoform disorders.

Studies using different scales to measure the psychological effects of COVID-19 have also shown that people with pre-existing mental health conditions may be more vulnerable to the psychological burden posed by the pandemic. One study showed that people with mental illness scored significantly higher on a single item regarding COVID-19-related fear compared to healthy controls and people with a single medical illness, but did not differ from people with multiple medical illnesses (Skoda et al., 2020); COVID-19-related fear is thus very high in people with mental illnesses since they are medically healthy yet exhibit similar level of fear with those who COVID-19 may actually be a threat to their lives. Another study showed that the psychological impact of the COVID-19 pandemic measured by the COVID stress scale was more pronounced in people with anxiety-related or mood disorders than those without a mental disorder (Asmundson, Paluszek, et al., 2020); the anxiety disorder group exhibited higher overall distress compared to the mood disorder and the control groups, and the mood disorder group exhibited higher traumatic stress symptoms and fear about socio-economic consequences than the control group. These studies suggest that people with mental illnesses are more vulnerable to COVID-specific psychopathology compared to the general population and that mental health interventions that target such psychopathology are needed.

There are some study limitations that should be noted. First, since this was a cross-sectional study, we could not discuss causality among different symptoms. Future longitudinal studies should examine the directionality in the relationship between coronavirus anxiety, health anxiety, and depression. Second, the scales used in this study were self-reported, and self-reports may produce answers that are affected by various biases, such as the social desirability bias. Third, the number of daily confirmed cases of COVID-19 in Korea during the study period was around 320 cases on average, and the

level of coronavirus anxiety may be lower compared to countries with a higher number of confirmed cases. Fourth, the proportion of patients with dysfunctional coronavirus anxiety may have been underrepresented in our sample, since they may have been reluctant to visit the hospital due to fear of contracting COVID-19. Fifth, while we were able to achieve a correlation between the "true" and estimated networks above 0.9 for edge weights and strength, and above 0.7 for sensitivity and specificity with our available sample size, it was still insufficient to obtain stable coefficients for closeness and betweenness centralities.

## 5 | CONCLUSION

Our findings suggest that health worry may be an important bridge symptom that connects coronavirus anxiety to depressive, anxious, and hypochondriacal psychopathology. Patients with elevated health worries should be carefully monitored during the COVID-19 pandemic for exacerbation of previous symptoms and COVID-19-related anxiety. Understanding the COVID-19-related psychological factors and their relationships with clinical psychiatric symptoms would help individuals prevent and overcome mental health problems in the face of the pandemic. Further research in patients with mental illness as well as general populations is needed regarding the relationships between pandemic anxiety, various psychological vulnerability factors, and psychiatric symptoms.

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### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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### PEER REVIEW

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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