



Are Non-Adherence to COPD Treatment, Cyberchondria, and Health Anxiety Interrelated?

KOAH Tedaviye Uyum Bozukluğu, Siberkondri ve Sağlık Anksiyetesi Birbirleriyle İlişkili Midir?

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Are Non-Adherence to COPD Treatment, Cyberchondria, and Health Anxiety Interrelated?

ABSTRACT

Objective: Patients with chronic obstructive pulmonary disease (COPD) commonly experience psychological problems such as anxiety, which may impair treatment adherence and worsen prognosis. With the increasing use of the Internet for health information, cyberchondria has emerged as a potential factor influencing health-related anxiety. This study aimed to investigate the relationship between health anxiety and cyberchondria in COPD patients.

Material and Method: This cross-sectional study included 52 stable COPD patients aged 18–65 years who presented for follow-up at the pulmonary outpatient clinic. Sociodemographic and clinical data were obtained, and treatment adherence was verified through hospital records, pharmacy data, and the national health database (e-Nabız). Health anxiety was evaluated using the Health Anxiety Inventory, while cyberchondria was assessed with the Cyberchondria Severity Scale.

Results: The mean age of the patients was 57.9±10.6 years, and 38.5% were female. The mean health anxiety score was 21.3±10.0, while the mean cyberchondria score was 28.3±10.0. A significant positive correlation was observed between health anxiety and cyberchondria ($r=0.382$, $p=0.005$). Regression analysis showed that higher cyberchondria scores ($B=0.360$, $p=0.014$) and non-adherence to treatment ($B=-8.625$, $p=0.002$) were independent predictors of elevated health anxiety. Demographic variables such as age, education, income, and disease duration were not significantly associated. Patients living in urban areas had significantly higher cyberchondria scores compared to those in rural areas (31.8±9.4 vs. 22.8±8.4, $p=0.007$).

Conclusion: Health anxiety in COPD patients is strongly influenced by cyberchondria and treatment adherence rather than demographic factors. These findings highlight the importance of integrating digital health literacy assessment and interventions targeting online health information use into routine COPD management.

Keywords: COPD, Cyberchondria, Digital health literacy, Health anxiety, Treatment adherence.

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ÖZ

Amaç: Kronik obstrüktif akciğer hastalığı (KOAH) olan hastalar sıklıkla anksiyete gibi psikolojik sorunlar yaşamakta, bu da tedaviye uyumu bozarak prognozu kötüleştirebilmektedir. Sağlık bilgisi için internet kullanımının artmasıyla birlikte, siberkondri sağlıkla ilişkili anksiyeteyi etkileyebilecek potansiyel bir faktör olarak ortaya çıkmıştır. Bu çalışmanın amacı, KOAH hastalarında sağlık anksiyetesi ile siberkondri arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntem: Bu kesitsel çalışmaya, göğüs hastalıkları polikliniğinde takip için başvuran, 18–65 yaş arası stabil 52 KOAH hastası dahil edildi. Sosyodemografik ve klinik veriler kaydedildi, tedaviye uyum hastane kayıtları, eczane verileri ve ulusal sağlık veri tabanı (e-Nabız) üzerinden doğrulandı. Sağlık anksiyetesi, Sağlık Anksiyetesi Envanteri ile; siberkondri ise Siberkondri Şiddet Ölçeği ile değerlendirildi.

Bulgular: Hastaların yaş ortalaması 57,9±10,6 yıl olup %38,5'i kadındı. Ortalama sağlık anksiyetesi skoru 21,3±10,0; ortalama siberkondri skoru ise 28,3±10,0 bulundu. Sağlık anksiyetesi ile siberkondri arasında anlamlı pozitif korelasyon saptandı ($r=0,382$, $p=0,005$). Regresyon analizinde, daha yüksek siberkondri skorları ($B=0,360$, $p=0,014$) ve tedaviye uyumsuzluk ($B=-8,625$, $p=0,002$) bağımsız olarak yüksek sağlık anksiyetesi ile ilişkiliydi. Yaş, eğitim, gelir düzeyi ve hastalık süresi gibi demografik değişkenler anlamlı ilişki göstermedi. Kentsel bölgelerde yaşayan hastaların siberkondri skorları, kırsal bölgelerde yaşayanlara göre anlamlı derecede yüksekti (31,8±9,4 vs. 22,8±8,4, $p=0,007$).

Sonuç: KOAH hastalarında sağlık anksiyetesi, demografik faktörlerden ziyade siberkondri ve tedavi uyumundan güçlü şekilde etkilenmektedir. Bu bulgular, rutin KOAH yönetimine dijital sağlık okuryazarlığının değerlendirilmesi ve çevrim içi sağlık bilgisi kullanımına yönelik müdahalelerin entegre edilmesinin önemini vurgulamaktadır.

Anahtar Sözcükler: Dijital sağlık okuryazarlığı, KOAH, Sağlık anksiyetesi, Siberkondri, Tedavi uyumu.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is widely recognized as a prevalent respiratory disorder, characterized by irreversible airflow limitation. COPD is recognized worldwide as a major public health problem in terms of both morbidity and mortality (1). In the advanced stages of the disease, limitations in daily living activities, loss of workforce, and decreased quality of life are observed; this situation facilitates the development of psychosocial problems, particularly anxiety (2).

The prevalence of anxiety disorders is considerably high among individuals with COPD. Studies have reported that the prevalence of anxiety disorders in COPD patients ranges between 10% and 55%; depression and anxiety negatively affect disease prognosis, reduce physical performance, and increase healthcare utilization (3, 4). Within this framework, health-related concerns stand out among the psychological symptoms frequently seen in COPD patients. Health anxiety is characterized by interpreting minor bodily sensations as signs of a serious illness, experiencing excessive fear of disease, and frequently feeling the need to seek healthcare services (5). The presence of chronic illness may increase the severity of this anxiety, impair treatment adherence, and reduce quality of life (6).

In COPD, persistent respiratory symptoms such as dyspnea, chronic cough, and hypoxia-related fatigue often lead to increased bodily awareness and fear of symptom worsening. Episodes of breathlessness may be catastrophically interpreted as life-threatening, contributing to heightened health anxiety (7, 8). Moreover, hypoxemia-induced irritability, sleep disturbances, and social isolation further exacerbate psychological distress and reinforce illness-related concerns (9, 10). These disease-specific characteristics may explain why COPD patients are particularly prone to anxiety about their health status and more likely to engage in repeated online health information searches (11).

With the widespread use of the internet, there has been a marked increase in individuals' health

information-seeking behavior. However, this may lead to uncritical acceptance of information and exacerbation of existing anxiety. In the literature, this phenomenon is defined as cyberchondria, which refers to anxiety triggered by online health searches (12). From a cognitive-behavioral perspective, health anxiety and cyberchondria share common mechanisms involving the catastrophic misinterpretation of bodily sensations as indicators of serious illness. Such maladaptive appraisals lead individuals to seek reassurance through repetitive online health searches, which may temporarily alleviate uncertainty but ultimately reinforce anxiety and symptom preoccupation (13, 14). Neurobiological research supports this model: functional imaging studies have demonstrated hyperactivation of the insula and amygdala, along with reduced prefrontal cortical regulation, in individuals with heightened health-related anxiety, reflecting impaired top-down control of emotional responses (15-17). These cognitive and neural processes together may explain the persistence of cyberchondria and health anxiety, particularly among patients with chronic diseases such as COPD. Various studies have reported a positive association between health anxiety and cyberchondria, and that factors such as health literacy may influence this relationship (18, 19).

Current evidence suggests that the strong relationship between health anxiety and cyberchondria may have significant effects on psychosocial processes in chronic diseases such as COPD. However, most of the research on this topic has been conducted in the general population, and this relationship has not been sufficiently investigated in COPD patients (18, 20). This study sought to evaluate the levels of health anxiety and cyberchondria in individuals with COPD and to examine the relationship between them. Therefore, this study was designed to investigate the interaction between health anxiety and cyberchondria among individuals with COPD. By addressing this underexplored relationship, the present research aims to fill an important gap in the literature and contribute to

a better understanding of the psychosocial dimensions of chronic respiratory diseases.

Material and Method

This study included adult COPD patients who were admitted for routine follow-up to the outpatient pulmonary clinic between January 2024 and July 2024, were in a stable phase of the disease, met the inclusion criteria, and voluntarily agreed to participate. A total of 86 patients were evaluated during the study period; however, 34 patients who did not complete the questionnaires were excluded. The inclusion criteria were as follows: individuals aged 18–65 years, with a diagnosis of COPD for at least 6 months, in a stable phase of the disease, capable of using the internet, and providing informed consent. Patients who were illiterate, had severe physical comorbidities unrelated to COPD (such as cancer or advanced heart failure), had a history of severe psychiatric or neurological illness, or were experiencing an exacerbation at the time of the study were excluded. Demographic data (age, sex, marital status, education level, occupation, and income status) and clinical data (disease duration, smoking status, presence of comorbidities, and number of medications used) were collected from all participants. Hospital records, pharmacy information, and e-Nabız, the national electronic health system, were used to document treatment adherence. In parallel, the Health Anxiety Inventory (HAI) was employed to evaluate health anxiety, and the Cyberchondria Severity Scale (CSS) was used to assess cyberchondria.

Health Anxiety Inventory (HAI)

To assess participants' levels of health-related anxiety, the Health Anxiety Inventory (HAI) was used. The HAI, developed by Salkovskis et al., is a valid and reliable instrument designed to measure the severity of health anxiety as well as individuals' illness-related thoughts and concerns (21). The scale has the ability to distinguish between hypochondriacal anxiety and normal health concerns. Its short form consists of 18 items, each scored on a 0–3 scale. Higher scores indicate increased levels of health anxiety. The

Turkish version of the scale was validated by Aydemir and colleagues, who found a Cronbach's alpha coefficient of 0.91, indicating high internal consistency (22).

Cyberchondria Severity Scale (CSS)

To evaluate participants' anxiety levels associated with health information-seeking behavior on the internet, the Cyberchondria Severity Scale (CSS) was employed. The CSS, originally created by McElroy and Shevlin, is designed to measure the anxiety, insecurity, compulsive searching, and excessive reassurance-seeking behaviors experienced during online health-related searches (23). The short form of the CSS, which includes 12 items scored on a 5-point Likert scale ranging from 1 ("never") to 5 ("always"), was applied. Total scores range between 12 and 60, with higher values indicating greater severity of cyberchondria. The instrument has a five-factor structure encompassing compulsion, distress, reassurance-seeking, excessiveness, and mistrust of medical professionals. The Turkish adaptation and validation of the scale were performed by Selvi et al., who reported high internal consistency (Cronbach's $\alpha = 0.91$). (24).

Treatment Adherence Assessment

Treatment adherence was evaluated using a combination of hospital prescription records, pharmacy dispensing data, and the national electronic health system (e-Nabız). Patients were considered *adherent* if they had obtained at least 80% of their prescribed medications within the last six months. Those who failed to meet this criterion were classified as non-adherent. This objective verification approach is consistent with previous studies assessing medication adherence in chronic respiratory diseases.

Statistical Analysis and Ethics Approval

This study was approved by the Hitit University Faculty of Medicine Ethics Committee (Decision No: 2023-166, Date: December 26, 2023). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all

participants. The sample size was determined based on a power analysis conducted with the GPower 3.1 software, using the findings of Özyıldız and Alkan (25), who investigated the relationship between health anxiety and cyberchondria among academicians. Assuming a correlation coefficient of $r = 0.45$, a 5% significance level, and 80% test power, the required sample size was calculated as 36 participants. Since 52 individuals were included in the present study, the statistical power was adequate. Data were analyzed using IBM SPSS Statistics version 22. Descriptive statistics were expressed as mean, standard deviation, and percentages. For group comparisons, the independent samples t test was applied when parametric assumptions were met, and the Mann-Whitney U test was used otherwise. The relationship between health anxiety and cyberchondria was examined using Pearson correlation analysis. Multiple linear regression analyses were performed to identify variables affecting health anxiety and cyberchondria levels. A p -value <0.05 was considered statistically significant.

Results

A total of 52 individuals were included in the study. The mean age of the participants was 57.9 ± 10.6 years, and 38.5% ($n=20$) were female. Six participants (11.5%) were single. Regarding education level, 71.2% ($n=37$) were primary school graduates, and 28.8% ($n=15$) had completed high school or higher education. Among the participants, 44.2% ($n=23$) were actively employed, while 55.8% ($n=29$) were not working. In terms of place of residence, 38.5% ($n=20$) lived in rural/town areas, and 61.5% ($n=32$) lived in urban areas. The mean monthly income was 9762 ± 7930.1 TRY. The mean health anxiety score was 21.3 ± 10.0 , and the mean cyberchondria score was 28.3 ± 10.0 . The mean disease duration was 7.1 ± 5.7 years. Twenty-four participants (46.2%) were smokers, while 28 (53.8%) were non-smokers. Treatment adherence was observed in 61.5% ($n=32$) of the participants.

The mean health anxiety and cyberchondria scores were compared according to categorical variables such as gender, education level, smoking status, treatment adherence, and place of residence. Both health anxiety (14 ± 11 vs. 24.5 ± 14 ; $p=0.003$) and cyberchondria scores (32.5 ± 10.6 vs. 25.7 ± 8.7 ; $p=0.017$) were significantly higher in participants who were non-adherent to treatment compared to those who were adherent. Furthermore, participants living in urban areas had significantly higher cyberchondria scores than those living in rural/town areas (31.8 ± 9.4 vs. 22.8 ± 8.4 ; $p=0.007$). No statistically significant differences in health anxiety or cyberchondria scores were observed according to gender, education level, or smoking status (Table I).

Table I. Comparison of Health Anxiety and Cyberchondria Scores According to Demographic and Clinical Variables

Variable	Groups	Health Anxiety Score	p -value	Cyberchondria Score	p -value
Gender	Female	21.2 ± 9.9	0.948 ^b	27.9 ± 10.2	0.816 ^b
	Male	21.4 ± 10.2		28.6 ± 9.9	
Education	Primary school	21 ± 18	0.298 ^a	30 ± 14	0.087 ^a
	High school+	14 ± 10		24 ± 7	
Smoking status	Yes	22 ± 20	0.298 ^a	27 ± 10	0.367 ^b
	No	19.5 ± 13		29.5 ± 9.9	
Treatment adherence	Yes	14 ± 11	0.003 ^a	25.7 ± 8.7	0.017 ^b
	No	24.5 ± 14		32.5 ± 10.6	
Place of residence	Rural/town	16 ± 20	0.706 ^a	22.8 ± 8.4	0.001 ^b
	Urban	21 ± 13		31.8 ± 9.4	

^a Mann-Whitney U test; data presented as median (IQR)

^b Independent samples t-test; data presented as mean \pm SD

The relationships among health anxiety score, cyberchondria score, age, disease duration, and income level were examined using Pearson correlation analysis. A significant positive correlation was found between health anxiety and cyberchondria scores ($r=0.382$, $p=0.005$), indicating a moderate positive relationship between the two variables (Figure I). However, age, disease duration, and income level were not

significantly correlated with either variable (Table II).

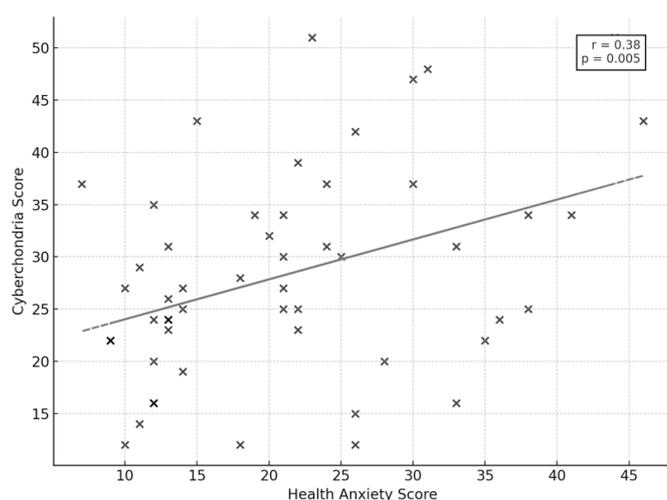


Figure I. Correlation between Health Anxiety and Cyberchondria Scores

Table II. Correlation Analysis of Health Anxiety and Cyberchondria Scores

Correlations	Health Anxiety Score	Cyberchondria Score	Age	Disease Duration (years)	Income Status
Health Anxiety Score - Pearson Correlation	1	0.382**	-0.053	0.194	-0.044
Sig. (2-tailed)		0.005	0.709	0.169	0.757
N	52	52	52	52	52
Cyberchondria Score - Pearson Correlation	0.382**	1	0.087	0.041	0.073
Sig. (2-tailed)	0.005		0.540	0.772	0.609
N	52	52	52	52	52
Age - Pearson Correlation	-0.053	0.087	1	0.165	-0.067
Sig. (2-tailed)	0.709	0.540		0.241	0.637
N	52	52	52	52	52
Disease Duration (years) - Pearson Correlation	0.194	0.041	0.165	1	0.221
Sig. (2-tailed)	0.169	0.772	0.241		0.115
N	52	52	52	52	52
Income Status - Pearson Correlation	-0.044	0.073	-0.067	0.221	1
Sig. (2-tailed)	0.757	0.609	0.637	0.115	
N	52	52	52	52	52

Note. **Correlation is significant at the 0.01 level (2-tailed).**

Factors influencing health anxiety scores were further examined using linear regression analysis. The results demonstrated that only cyberchondria score and treatment adherence had statistically significant effects (Table III). Each one-unit

increase in the cyberchondria score was associated with an approximately 0.36-point increase in the health anxiety score ($B=0.360$, $p=0.014$). Conversely, the health anxiety scores of participants who were non-adherent to treatment were, on average, 8.6 points higher than those of adherent participants ($B=-8.625$, $p=0.002$). Education level, age, disease duration, income level, and place of residence were not found to have significant effects on health anxiety.

Table III. Linear Regression Analysis of Variables Affecting Health Anxiety Score

Variable	B (Coefficient)	Std. Error	Beta (Standardized)	t	p	95% CI Lower	95% CI Upper
Treatment adherence	-8.625	2.652	-0.423	-3.253	0.002	-13.969	-3.282
Education	-0.526	2.798	-0.024	-0.188	0.852	-6.165	5.113
Age	-0.146	0.115	-0.156	-1.278	0.208	-0.378	0.085
Disease duration	0.353	0.222	0.204	1.589	0.119	-0.095	0.800
Income status	0.000	0.000	-0.164	-1.255	0.216	-0.001	0.000
Place of residence	-4.833	2.846	-0.237	-1.698	0.097	-10.569	0.902
Cyberchondria	0.360	0.141	0.359	2.551	0.014	0.076	0.644

Discussion

In this study, health anxiety and cyberchondria levels were examined in patients with COPD, and the relationship between them was evaluated. Our findings demonstrated a significant positive association between health anxiety and cyberchondria. Furthermore, linear regression analysis revealed that the variables with the most pronounced effect on health anxiety were cyberchondria level and treatment adherence. Health anxiety was significantly higher in patients who were non-adherent to treatment, while an increase in cyberchondria scores was also associated with elevated health anxiety scores. In contrast, demographic factors such as age, education, income level, and disease duration were not found to have a significant impact on health anxiety.

The literature also strongly supports the relationship between health anxiety and cyberchondria. The systematic review by Christiansen et al. demonstrated that COPD-specific anxiety is maintained through internal, external, and behavioral factors from the patient's

perspective (26). A relationship between health anxiety and cyberchondria has been demonstrated in various chronic diseases (27). McMullan et al. reported that online health information searching amplifies pre-existing anxiety and fuels cyberchondria, with this effect being more pronounced in individuals with chronic conditions (18). Similarly, Schenkel et al. showed that cyberchondria is closely associated with the anxiety spectrum and has implications for clinical outcomes (20). Sansakorn et al. reported that low health literacy is linked to higher levels of both cyberchondria and anxiety (19). In line with this, individuals with low e-health literacy have also been found to display higher levels of cyberchondria and health anxiety (28). Moreover, Ayers et al. demonstrated that user trust in AI-based tools such as ChatGPT can surpass that of traditional sources, depending on the clarity, empathy, and completeness of the response, highlighting how presentation style and perceived credibility play crucial roles in shaping trust during health information seeking (29). These findings highlight that the relationship between health anxiety and cyberchondria is further shaped by the quality of digital information sources and the degree of user trust. Consistent with the current literature, our study also revealed that an increase in cyberchondria levels was associated with elevated health anxiety scores, and that patients who were non-adherent to treatment had higher anxiety levels.

However, different perspectives on this relationship are also present in the literature. For example, Doherty-Torstrick et al. reported that individuals with high levels of illness anxiety experienced increased anxiety after online symptom searches, whereas those with lower levels experienced relief (30). Furthermore, it has been noted that digital health applications in COPD not only facilitate symptom management but also have the potential to reduce anxiety and depression (31). Indeed, in a 4-week mobile application-based mindfulness intervention conducted by Park, participants demonstrated significant reductions in anxiety, depression, and stress levels (32). These findings suggest that

online health information seeking does not exert a unidirectional effect; instead, the outcomes may vary depending on individual differences, digital health literacy, and the psychosocial interventions applied. Therefore, in the follow-up and treatment of COPD patients, routine evaluation of digital information use and health literacy should be considered an essential component of comprehensive care.

In our study, treatment adherence was found to be significantly associated with both health anxiety and cyberchondria and emerged as an independent factor in regression analysis. Previous investigations have also demonstrated comparable outcomes. Russell et al., in a qualitative systematic review, demonstrated that non-adherence in COPD patients may stem from unmet emotional and psychological needs—particularly frustration, depression, and anxiety—which act as major barriers (33). Zhao et al. showed that anxiety and depression in COPD patients not only worsen clinical outcomes but are also linked to poor adherence (34). Pumar et al. also highlighted that anxiety and depression negatively affect treatment adherence and completion rates of rehabilitation programs (6). Moreover, Er et al. reported that cyberchondria can exert both positive (enhancing preparedness) and negative (increasing anxiety when severe) effects during surgical preparation, while effective physician-patient communication may mitigate adverse outcomes (35). Similarly, Starčević et al. noted that cyberchondria can lead to negative interactions in the doctor-patient relationship and weaken trust in treatment (12). Therefore, when developing strategies to improve treatment adherence in COPD patients, it is important to also target cyberchondria behaviors and the associated anxiety mechanisms.

In our study, individuals residing in urban areas were found to have significantly higher levels of cyberchondria compared to those living in rural regions. This difference may be attributed to the widespread internet access in city centers and the more frequent engagement in online health information-seeking behaviors. Lin et al. showed that urban residents have easier access to online

health information, which can influence health behaviors such as self-medication (36). Furthermore, studies based on general population data have reported that rural areas experience disadvantages in telehealth and access to accurate information due to digital inequality and infrastructural limitations, which may contribute to variability in cyberchondria risk (37, 38). However, Lin and Xu reported that electronic health literacy strongly predicted cyberchondria in both rural and urban populations, with the effect being particularly pronounced in rural areas (39). This finding contrasts with our results, in which higher cyberchondria scores were observed among urban residents. Such discrepancies may be explained by differences in population characteristics, level of internet access, and cultural factors. Therefore, when assessing the risk of cyberchondria, not only the type of residence but also digital health literacy and access to reliable information should be taken into account.

No statistically significant links were observed between health anxiety or cyberchondria and demographic factors, including age, gender, educational background, smoking status, disease duration, and income. A potential explanation is that most participants in our sample were primary school graduates, which restricted the variability in education level. Al Karsaneh et al. reported that low education level was associated with higher anxiety and depression in patients with asthma (40). Similarly, Wu et al. demonstrated that low education level independently increased the risk of anxiety in COPD (41). Other studies have also indicated that female gender and younger age may be associated with higher anxiety in COPD patients (42, 43). These differing findings suggest that the lack of significant associations in our study may be due to limitations in sample size and distribution. Therefore, regardless of demographic characteristics, regular evaluation of health anxiety and cyberchondria levels in all COPD patients should be considered an essential component of a holistic care approach.

This study has several limitations. First, the relatively small sample size and the inclusion of a

patient group with a comparatively low sociocultural background may have limited the statistical power, thereby hindering the clear demonstration of associations between demographic variables and health anxiety/cyberchondria. In addition, as the majority of participants were primary school graduates, there was insufficient diversity in educational level, which restricted the evaluation of the relationship between education and psychological variables. Second, due to the cross-sectional design of the study, causal inferences cannot be drawn from the observed associations. Moreover, since data were collected through self-report measures, the possibility of response bias cannot be excluded. Although treatment adherence data were collected from hospital records, pharmacy data, and the national electronic health system (e-Nabız), these sources may not fully reflect patients' actual medication use behaviors. Finally, the study was conducted in a single center. Future studies conducted prospectively across multiple centers with broader and more varied samples are required to confirm and extend these findings.

Conclusion

The findings of this study indicate that, in the management of COPD, not only biomedical parameters but also psychosocial factors and digital health information-seeking behaviors should be taken into account. Accordingly, it is recommended that patients' levels of health anxiety and cyberchondria be regularly evaluated, that digital health literacy be promoted, and that interventions aimed at improving treatment adherence be implemented.

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