The Role of Health Anxiety in the Relationship Between E-Health Literacy and Cyberchondria

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Abstract

In recent times, the expansion of digital health information sources has significantly influenced individuals' health-related concerns and their activities in seeking medical information. This situation underscores the need for a more detailed investigation into the relationships between e-health literacy, cyberchondria, and health anxiety. This study investigated the role of health anxiety in the relationship between individuals' e-health literacy and the severity of cyberchondria. To achieve this objective, data were collected through an electronic survey administered to 385 participants aged 18 to 65 residing in Istanbul. The study utilized the e-Health Literacy Scale (eHEALS), the Cyberchondria Severity Scale (CSS), and the Health Anxiety Inventory (HAI) as data collection instruments. To assess the structural validity of the dataset, normality analysis, confirmatory factor analysis (CFA), and reliability analysis were conducted. Hypothesis testing was performed using correlation analysis, while path analysis and mediation testing were conducted through Structural Equation Modeling (SEM). The research findings indicate that health anxiety plays a mediating role in the relationship between e-health literacy and cyberchondria. Accordingly, individuals with high e-health literacy experience reduced health anxiety, which in turn leads to a decrease in their cyberchondria levels. The integration of these three variables within the model has facilitated an enhanced understanding of their interaction dynamics, providing a significant methodological contribution to the literature. Furthermore, the research offers a valuable guide for healthcare professionals and policymakers, suggesting that enhancing e-health literacy can encourage individuals to adopt healthier behaviors during the digital health information search process.

Keywords: E-Health Literacy, Cyberchondria, Health Anxiety.

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E-Sağlık Okuryazarlığı ile Siberkondri Arasındaki İlişkide Sağlık Anksiyetesinin Rolü

Özet

Günümüzde dijital sağlık bilgi kaynaklarının yaygınlaşması, bireylerin sağlıkla ilgili kaygılarını ve bilgi arama davranışlarını önemli ölçüde etkilemektedir. Bu durum, e-sağlık okuryazarlığı, siberkondri ve sağlık anksiyetesi arasındaki ilişkilerin daha derinlemesine incelenmesini gerekli kılmaktadır. Bu araştırmada, bireylerin e-sağlık okuryazarlığı ile siberkondri ciddiyeti arasındaki ilişkide sağlık anksiyetesinin rolü incelenmiştir. Bu amaç doğrultusunda, İstanbul'da yaşayan 18-65 yaş aralığındaki 385 katılımcıya elektronik anket yöntemiyle ulaşılarak veriler toplanmıştır. Araştırmada veri toplama aracı olarak E-Sağlık Okuryazarlığı Ölçeği (eHEALS), Siberkondri Ciddiyet Ölçeği (CSS) ve Sağlık Anksiyetesi Envanteri (HAI) kullanılmıştır. Elde edilen verilerin yapısal geçerliliğini belirlemek amacıyla normallik analizi, doğrulayıcı faktör analizi (DFA) ve güvenirlik analizi uygulanmıştır. Hipotezlerin test edilmesi için korelasyon analizi gerçekleştirilmiş; yol analizi ve aracılık etkisinin incelenmesi için Yapısal Eşitlik Modellemesi'nden (YEM) yararlanılmıştır. Araştırma bulguları, sağlık anksiyetesinin e-sağlık okuryazarlığı ile siberkondri arasındaki ilişkide aracı bir değişken olarak rol oynadığını ortaya koymaktadır. Buna göre, yüksek e-sağlık okuryazarlığına sahip olan bireylerin sağlık anksiyetesi düzeyleri azalmakta ve bu durum bireylerin siberkondri eğilimlerini düşürmektedir. Model kapsamında bu üç değişkenin birlikte ele alınması, aralarındaki etkileşim dinamiklerinin anlaşılmasını sağlamış ve literatüre önemli bir metodolojik katkı sunmuştur. Ayrıca, araştırma sağlık profesyonelleri ve politika yapıcılar için e-sağlık okuryazarlığının artırılmasının, bireylerin dijital sağlık bilgi arayışı süreçlerinde daha sağlıklı davranışlar sergilemelerine katkı sağlayabileceğine dair önemli bir rehber niteliği taşımaktadır.

Anahtar Kelimeler: E-Sağlık Okuryazarlığı, Siberkondri, Sağlık Anksiyetesi.

1. INTRODUCTION

In recent years, the digitalization of healthcare information and services has made the concept of "health literacy" increasingly vital to the effective functioning of healthcare systems (Pang et al., 2016; Sentell et al., 2020). Individuals can now easily access health information through the internet, mobile applications, social media, and other digital platforms. Various international studies have demonstrated that around 80% of internet users engage with the internet for scheduling medical appointments (Andreassen et al., 2007; Aiken et al., 2012; Fox and Duggan, 2013; Powell et al., 2011; Sun et al., 2022; Tonsaker et al., 2014; Van De Belt et al., 2010). Additionally, 50% of users rely on search engines like Google to research symptoms and draw health-related conclusions before consulting a healthcare professional (Farnood et al., 2020; McDaid and Park, 2011). While these findings highlight the growing influence of digital platforms on health-related decision-making (Maftei and Holman, 2020), they also highlight concerns regarding the accuracy of health information available on the internet and the potential risks associated with the spread of misinformation. In this context, e-health literacy has become a crucial competency in individuals' health-related decision-making processes.

E-health literacy, a form of traditional health literacy tailored to digital technologies, aims to enhance individuals' awareness of their health status and improve their ability to access health services more effectively. However, the reliability, accuracy, and relevance of the information individuals obtain from digital platforms are largely determined by their levels of e-health literacy. While the World Health Organization (WHO) recognizes health literacy as a fundamental determinant of individual health (Fleary et al., 2018), multiple studies emphasize a widespread deficiency in e-health literacy across diverse populations (Brørs et al., 2020; Dadaczynski et al., 2021; Jung, 2004; McMullan et al., 2019; Paige, 2020).

Norman and Skinner (2006) describe e-health literacy as the ability to search for, locate, comprehend, and assess health information from digital sources, as well as the capacity to apply this information to address health-related concerns. High e-health literacy enables individuals to effectively manage their health data, make informed health decisions, and reduce the risk of medical errors. Furthermore, individuals with high e-health literacy are better able to monitor their health status by communicating more effectively with healthcare providers (Norman and Skinner, 2006; Van der Vaart et al., 2019). Despite this, individuals with limited e-health literacy face difficulties in accessing health information through digital platforms (Paige, 2020) and face challenges in understanding and correctly applying the information they access without support (Brørs et al., 2020). These individuals are especially vulnerable to information pollution and face the risk of encountering inaccurate, misleading, or incomplete information online, which could jeopardize their health (Benigeri and Pluye, 2003). As a result, this situation generates unnecessary workload and strain on healthcare institutions and professionals (Baker et al., 2007; Weiss and Palmer, 2004).

According to the literature, e-health literacy is a critical skill that impacts a broad spectrum of health-related outcomes. Studies indicate that low levels of e-health literacy can elevate individuals' health anxiety (Kwon and Oh, 2023; Tran et al., 2022) and contribute to negative health behaviors, such as cyberchondria (Kobryn and Duplaga, 2024; Lin and Xu, 2024; Mayukh, 2024; Mohammed et al., 2024; Zhu et al., 2023). Individuals with insufficient e-health literacy may be prone to making incorrect self-diagnoses or seeking unnecessary medical interventions due to their inability to accurately evaluate digital health information, a behavior linked to cyberchondria (Tran et al., 2022). Accordingly, the negative consequences of internet use related to health are central to the concept of cyberchondria (McMullan et al., 2019;

Starcevic and Berle, 2013). However, it is important to note that seeking information about symptoms does not always signify cyberchondria. It is common for individuals to have concerns about their health. However, when excessive information seeking and persistent worry about illness begin to negatively affect individuals' daily lives, they become problematic (Bati et al., 2018). Doherty-Torstrick et al. (2016) suggest that cyberchondria is a condition that intensifies health anxiety and may evolve into a personality trait over time.

This study aims to examine how the relationship between e-health literacy and cyberchondria is affected by health anxiety. In the existing literature, the relationships between these three variables have generally been examined separately, and studies in which the three variables are examined together and the mediating effect of health anxiety is investigated are limited. Therefore, this study is expected to make a unique contribution to the literature by proposing a model for individuals' behavioral health attitudes. Additionally, the research offers important recommendations for health policymakers in developing data-driven strategies to design digital health platforms more effectively and reliably.

2. THEORETICAL BACKGROUND AND HYPOTHESES

With the expansion of online information access in recent years, people have increasingly turned to internet-based resources to seek solutions to their health-related queries. In this context, the ability to access accurate information and interpret it appropriately has become a critical competency. Individuals with low e-health literacy are more susceptible to being influenced by unreliable sources or to misinterpret the information they encounter online. Research indicates that individuals with inadequate e-health literacy may be at increased risk for cyberchondria, a condition characterized by excessive anxiety related to health (Kobryn and Duplaga, 2024; Lin and Xu, 2024; Mayukh, 2024; Mohammed et al., 2024; Zhu et al., 2023). Accordingly, a negative correlation has been identified between e-health literacy and cyberchondria. This study aims to expand the research line in this field and contribute to the academic literature on the subject, based on the findings in the literature on the relationship between e-health literacy and cyberchondria. This aim of the study is hypothesized as follows:

H1: *E-health literacy has a significant and negative effect on cyberchondria.*

The lack of e-health literacy in individuals emerges as a key factor that both triggers and sustains health anxiety. Health anxiety is characterized by a persistent preoccupation with one's health, accompanied by an excessive fear of being afflicted with a serious illness (American Psychiatric Association, 2013; Anderson et al., 2011). Vozikis et al. (2014) suggest that individuals with low health literacy levels are more likely to have a pessimistic view of their health. Increased health anxiety, driven by inaccurate information, arises from the inability of individuals with low e-health literacy to properly evaluate health information on digital platforms (Brørs et al., 2020; Paige, 2020). Specifically, the act of searching for health symptoms online can lead to increased anxiety by amplifying fears of serious illnesses in individuals (Starcevic & Berle, 2013). In contrast, individuals with high e-health literacy are able to evaluate digital health information critically, which helps reduce anxiety by enabling them to discern reliable information from inaccurate or misleading content. The literature indicates that improving e-health literacy can enable individuals to make more informed and healthier decisions by effectively managing their health anxiety (Kwon and Oh, 2023). Based on previous research results, it is assumed that there is a positive relationship between e-health literacy and health anxiety. In this context, the hypothesis of the research was developed as follows:

H2: *E-health literacy has a significant and negative effect on health anxiety.*

Individuals who experience persistent health-related worry and suffer from significant illness-related anxiety may be more prone to engaging in frequent and indiscriminate online health searches. However, online searches often produce ambiguous or misleading results, which can intensify individuals' health anxiety and trigger a vicious cycle. Studies have shown that health anxiety functions as both a cause (Abdelsattar et al., 2021; Bajcar and Babiak, 2021; Eastin and Guinsler, 2006; Jungmann and Witthöft, 2020; Mathes et al., 2018; McMullan et al., 2019; Menon et al., 2020; Muse et al., 2012; Nadeem et al., 2022; Nor et al., 2015) and a consequence (Doherty-Torstrick et al., 2016; Fergus and Dolan, 2014; Fergus and Russell, 2016) of cyberchondria. Consequently, individuals with heightened health anxiety are more likely to engage in excessive and unregulated online searches for health information, potentially exacerbating pre-existing health anxiety. Based on these findings, one of the study's objectives was to examine the impact of health anxiety on cyberchondria. In this context, the hypothesis of the research was developed as follows:

H_3: *Health anxiety has a significant and positive effect on cyberchondria.*

According to the aforementioned research, strong e-health literacy skills can help individuals reduce health anxiety, which may, in turn, alleviate the severity of cyberchondria. The relationships between e-health literacy, cyberchondria, and health anxiety have typically been explored independently in the literature, and no study in Turkish culture has simultaneously addressed these three variables while examining the mediating role of health anxiety. Therefore, this study aimed to explore whether health anxiety mediates the relationship between e-health literacy and cyberchondria. The following hypothesis is proposed to address this objective:

H_4: *Health anxiety has a mediating role in the effect of e-health literacy on cyberchondria.*

2.1. Research Framework

In line with the literature reviewed in the study and the proposed hypotheses, the research model has been established within the framework of Structural Equation Modeling (SEM) to determine the relationships among the variables. The model delineates three distinct relationships: (1) the relationship between e-health literacy and cyberchondria, (2) the relationship between e-health literacy and health anxiety, and (3) the relationship between health anxiety and cyberchondria. Additionally, in the model, health anxiety has been identified as a mediating variable in the relationship between e-health literacy and cyberchondria. Figure 1 presents a conceptual model that visually represents these relationships.

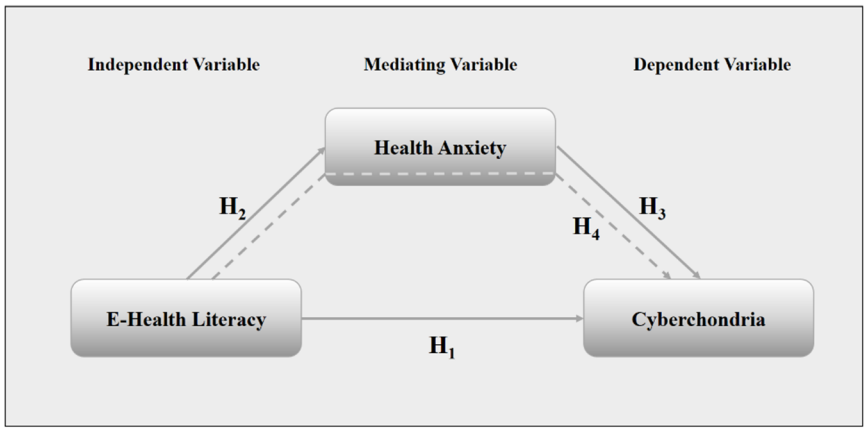

Figure 1. Research Model

3. METHODOLOGY

This study utilized a quantitative research method to explore the relationships between the variables. In this study, the relationships between the variables of e-health literacy, cyberchondria, and health anxiety were analyzed using data collected from individuals residing in Istanbul. Within this context, the primary objective of the research is to examine how the relationship between e-health literacy and cyberchondria is influenced by individuals' health anxiety levels. The study also seeks to explore individuals' behaviors when searching for health-related information in the digital environment and the health anxiety that arises during this process. Furthermore, the research aims to determine whether health anxiety functions as a protective (buffer) factor or as a risk-increasing factor in this context.

The data collected for this study were analyzed using the SPSS and AMOS software programs. In the analysis process, preliminary analyses were first conducted to assess the suitability of the data for further examination, and the dataset was subsequently prepared for analysis. Subsequently, the reliability levels of the scales used were assessed, and basic descriptive statistics were computed. Confirmatory Factor Analysis (CFA) was conducted to assess the structural validity of the scales. Furthermore, correlation analysis was conducted to explore the relationships among the variables identified in the study. To test the research hypotheses, structural equation modeling (SEM) was employed. The results of this analysis revealed both the direct and indirect effects between the variables considered in the study.

3.1. Population and Sample of the Research

The target population of this research comprises individuals residing in Istanbul, aged between 18 and 65 years. The primary rationale for selecting this population is the demographic, socioeconomic, and digital infrastructure diversity present in Istanbul. This approach enables the study to generate more comprehensive and widely applicable findings. Due to these considerations, a convenience sampling technique was employed to select the sample, prioritizing both high representativeness and the ease of data collection from the target population.

Based on the population of Istanbul, which is 15,655,924 (Turkish Statistical Institute, 2024), the sample size was calculated to be 384 individuals, ensuring a 95% confidence level and a ±5 margin of error. This calculation was made using the table of acceptable sample sizes for specific populations (Yazıcıoğlu & Erdoğan, 2004). Another source suggests that an ideal sample size should be at least five and at most ten times the number of items in the survey (Bryman & Cramer, 1999). Based on this recommendation, and considering the number of items in the study (38), the target sample size was set to be ten times the number of items. The data for the research were collected through an electronic survey method from individuals residing in Istanbul, who participated on a voluntary basis, between August 1 and November 10, 2024. A total of 413 individuals were initially reached using the convenience sampling technique. However, 23 participants were excluded from the analysis due to their responses to the control question in the survey, and 5 participants were excluded due to extreme responses that did not conform to a normal distribution. As a result, the analysis included data from 385 participants.

An examination of the demographic characteristics of the study participants revealed that 70.1% (259) were female, while 29.9% (116) were male, based on gender distribution. An analysis of the age group distribution showed that the largest group of participants were between the ages of 18-24 (168 individuals). This was followed by participants aged 25-34 (99

individuals), 35-44 (63 individuals), 45-54 (29 individuals), and 55-65 (26 individuals). The participants in the study represented a diverse range of professional groups, including academicians, lawyers, judges, engineers, architects, doctors, nurses, laboratory technicians, teachers, housewives, police officers, government employees, freelancers, and hairdressers. An analysis of the participants' professional experience revealed that 46.1% of them have between 1 and 5 years of work experience. Finally, it was found that 26.8% of the participants used the internet for an average of 2-3 hours per day, 24.2% for more than 5 hours, 18.7% for 1-2 hours, 17.4% for 3-4 hours, and 12.8% for 4-5 hours.

3.2. Measurement Tools

In the study, three different scales were used in their original form: the E-Health Literacy Scale, the Health Anxiety Inventory, and the Cyberchondria Severity Scale. Additionally, five questions were included to determine the demographic characteristics of the participants, and one control question was used to assess their attention and identify random or inconsistent responses.For the administration of the survey, Ethics Committee Approval was obtained from the Istanbul Beykent University Social and Human Sciences Ethics Committee with the letter numbered E-45778635-050.99-173358. Detailed information about the scales used in the study is provided follows:

The e-Health Literacy Scale, developed by Norman and Skinner (2006), is designed to evaluate individuals' abilities to access, comprehend, assess, and apply health-related information from digital platforms. The scale consists of 8 items in total and is organized into a single sub-dimension. A 5-point Likert scale is employed to measure the items, with response options ranging from "1: Strongly disagree" to "5: Strongly agree." The Turkish adaptation of the scale was conducted by Tamer Gencer (2017). The scale exhibited strong internal consistency, with reliability assessments yielding a Cronbach's Alpha coefficient of 0.89. Examples of items on the scale include: "I know where to find useful health resources on the Internet," "I know how to use health information I find on the Internet to help me," and "I can distinguish high-quality from low-quality health resources on the Internet."

The Health Anxiety Inventory, developed by Salkovskis et al. (2002), is designed to assess the extent to which an individual interprets normal bodily sensations negatively, even in the absence of a medical condition. The inventory consists of 18 items in total and is divided into two sub-dimensions: the bodily dimension and another dimension that addresses the perceived negative outcomes. A four-point Likert scale is used to assess the items in the inventory. Its Turkish adaptation was conducted by Aydemir et al. (2013). The inventory showed a high degree of internal consistency, as indicated by a Cronbach's Alpha coefficient of 0.91 in the reliability analyses. Examples of items on the inventory include: "I frequently worry about my health," "I am constantly aware of sensations or changes in my body," and "I am unable to relax, even when my doctor reassures me that nothing is wrong."

The Cyberchondria Severity Scale, developed by McElroy and Shevlin (2014), is designed to assess the negative consequences of excessive health-related internet use. Later, the original form of the scale was modified into a shorter version by McElroy et al. (2019), making it more concise while maintaining its effectiveness in measuring the severity of cyberchondria. The scale consists of 12 items in total and is divided into four sub-dimensions: excessiveness, distress, reassurance, and compulsion. A 5-point Likert scale is used to score the items, with response options ranging from "1: Never" to "5: Always." The adaptation of the Cyberchondria Severity Scale to Turkish was conducted by Söyler et al. (2021). The reliability analysis

revealed a high level of internal consistency for the scale, reflected by a Cronbach's Alpha coefficient of 0.86. Examples of items on the Cyberchondria Severity Scale include: "Researching symptoms of illness/conditions related to my body on the Internet interferes with other activities I do on the Internet," "I search for the same symptoms of illness on the Internet more than once," and "I feel more anxious after researching symptoms of illness/conditions related to my body on the Internet."

4. RESULTS

4.1. Validity and Reliability Analysis of Scales

To evaluate the reliability levels of the measurement tools used in the study, Cronbach's Alpha coefficient, a widely utilized method in the literature, was calculated (Saruhan & Özdemirci, 2011). In this context, the Cronbach's Alpha coefficients and descriptive statistics for all scales and their sub-dimensions used in the study are presented in Table 1.

Table 1. Descriptive Statistics and Reliability Analysis Results

Scales	Mean	Skewness	Kurtosis	Number of Items	C.Alpha
E-Health Literacy	3.708	-0.468	0.524	8	0.882
Cyberchondria	2.536	0.317	-0.075	12	0.804
Health Anxiety	1.830	0.985	1.397	18	0.849

Higher values of the Cronbach's Alpha coefficient, ranging from 0 to 1, indicate greater internal consistency among the items in the scale (İslamoğlu and Alnıaçık, 2009). An examination of Table 1 were found Cronbach's Alpha values of 0.882 for the E-Health Literacy Scale, 0.804 for the Cyberchondria Severity Scale, and 0.849 for the Health Anxiety Inventory. These findings support the idea that all the scales in the study demonstrate a high level of reliability.

The normality assumption of the scale items in the study was assessed by evaluated by examining the skewness and kurtosis values. Kline (2015) suggests that skewness and kurtosis values should fall between ±3 and ±10 for the data to be considered normally distributed. Upon reviewing Table 1, it is observed that the skewness values range from -0.468 to 0.985, and the kurtosis values range from -0.075 to 1.397. Since these values lie within the acceptable range of ±3 to ±10, it can be concluded that the research data follow a normal distribution.

The individuals' e-health literacy scores ($\overline{x}$=3.708) are at a high level, while their cyberchondria severity ($\overline{x}$=2.536) is at a moderate level. These scores are based on the mean values of the variables, using a 5-point Likert scale for both the E-Health Literacy and Cyberchondria Scales, where the highest score is 5 and the lowest is 1. In contrast, the participants' health anxiety levels ($\overline{x}$=1.830) are considered low, based on the Health Anxiety Inventory's 4-point Likert scale, where the highest score is 4 and the lowest is 1.

The study used Confirmatory Factor Analysis (CFA) to assess the structural validity of the measures. Table 2 presents a detailed summary of the CFA's goodness-of-fit indices, all of which were found to be statistically significant.

Table 2. CFA Results

Fit Indices	X^2/df	GFI	CFI	AGFI	RMSEA
Excellent Fit	$0 \leq \chi^2/df \leq 3$	$0.95 \leq GFI \leq 1$	$0.95 \leq CFI \leq 1$	$0.90 \leq AGFI \leq 1$	$0 < RMSEA \leq 0.05$
Adequate Fit	$3 \leq \chi^2/df \leq 5$	$0.85 \leq CFI < 0.95$	$0.90 \leq CFI < 0.95$	$0.85 \leq AGFI < 0.90$	$0.05 < RMSEA \leq 0.08$
E-Health Literacy	3.197	0.913	0.927	0.856	0.083
Cyberchondria	1.874	0.965	0.972	0.937	0.048
Helth Anxiety	1.739	0.939	0.946	0.919	0.044

The E-Health Literacy Scale, Cyberchondria Severity Scale, and Health Anxiety Inventory used in the study were subjected to first-order multi-factor Confirmatory Factor Analysis (CFA) separately. As a result of the factor analyses, no items were excluded from the analysis, as the factor loadings for all three scales were found to exceed the 0.50 threshold (Hair et al., 2014). To improve the obtained goodness-of-fit indices and bring them within more acceptable limits, relationships were established between the errors of item pairs by introducing several covariances. Examining Table 2, it can be observed that the goodness-of-fit indices for the E-Health Literacy Scale (χ^2/df= 3.197, GFI= 0.913, CFI= 0.927, AGFI= 0.856, and RMSEA= 0.083), the Cyberchondria Severity Scale (χ^2/df= 1.874, GFI= 0.965, CFI= 0.972, AGFI= 0.937, and RMSEA= 0.048), and the Health Anxiety Inventory (χ^2/df= 1.739, GFI= 0.939, CFI= 0.946, AGFI= 0.919, and RMSEA= 0.044) fall within the range of both perfect fit and acceptable fit criteria. Based on these results, it was concluded that the scales demonstrated structural validity (Browne & Cudeck, 1992; Byrne, 2001; Byrne & Campbell, 1999; Hooper et al., 2008; Hu & Bentler, 1999; Kayacan & Gültekin, 2012; Kline, 2023; Meydan & Şeşen, 2011; Schermelleh-Engel & Moosbrugger, 2003; Steiger, 2007).

4.2. Correlation Analysis of the Relationship Between Scales

In order to test the research model and hypotheses, it is first necessary to determine whether there are significant correlation relationships among the variables. The results of the Correlation Analysis conducted for this purpose are presented in Table 3.

Table 3. Correlation Coefficients

Factors	1	2	3	4	5	6	7	8	9
1. E-Health Literacy	1	0.027 0.594	0.190** 0.000	-0.161** 0.002	0.083 0.106	-0.044 0.395	-0.103* 0.043	-0.084 0.101	-0.107* 0.036
2. Cyberchondria		1	0.680** 0.000	0.744** 0.000	0.743** 0.000	0.670** 0.000	0.493** 0.000	0.482** 0.000	0.310** 0.000
3. Excessiveness			1	0.337** 0.000	0.361** 0.000	0.191** 0.000	0.273** 0.000	0.266** 0.000	0.175** 0.001
4. Distress				1	0.329** 0.000	0.427** 0.000	0.478** 0.000	0.438** 0.000	0.372** 0.000
5. Reassurance					1	0.391** 0.000	0.296** 0.000	0.315** 0.000	0.124* 0.015
6. Compulsion						1	0.355** 0.000	0.352** 0.000	0.209** 0.000
7. Health Anxiety							1	0.954** 0.000	0.686** 0.000
8. Core Dimension								1	0.436** 0.000
9. Supplementary Dimension									1

Note: *p<0.05, **p<0.01

The findings of the correlation analysis, presented in Table 3, reveal both significant positive and negative relationships between the overall and sub-dimensions of the scales used in the study. In particular, a low-level negative correlation was found between e-health literacy and health anxiety ($r=-0.103$, $p<0.05$). A moderate-level and positive significant correlation ($r=0.493$, $p<0.05$) was found between health anxiety and cyberchondria severity. No significant correlation was observed between e-health literacy and cyberchondria severity ($r=0.027$, $p>0.05$). However, significant correlation were found between e-health literacy and the extcessiveness ($r=0.190$, $p<0.05$) and distress ($r=-0.161$, $p<0.05$) sub-dimensions of cyberchondria.

4.3. Path Analysis and Mediation Testing for Effect Hypotheses

To assess the effect hypotheses, separate path analyses were first conducted between the variables in this section of the study. Path analysis is a robust statistical technique used to identify both direct and indirect relationships between variables. This approach utilizes the mediator variable to explore how the independent variable in a model influences the dependent variable. Path analysis allows for the evaluation of the validity of the model's theoretical framework by illustrating the direction and strength of the relationships between variables. In this regard, Table 4 presents the results of the path analysis conducted to test the effect hypotheses within the framework of structural equation modeling.

Table 4. Results Related to The Effect Hypotheses

Effect	(β)	Standard Error	t	p	Result
E-Health Literacy → Cyberchondria	-0.015	0.041	-0.370	0.711	Not Accept
E-Health Literacy → Health Anxiety	-0.120	0.043	-2.760	***	Accept
Health Anxiety → Cyberchondria	1.416	0.373	3.793	***	Accept

Note: ***p<0.001

According to Table 4, e-health literacy did not have a statistically significant impact on the severity of cyberchondria ($p>0.05$). Therefore, the study's H_1 hypothesis *(E-health literacy has a significant and negative effect on cyberchondria)* was rejected. E-health literacy appears to have a negative ($\beta=-0.120$) and statistically significant ($p<0.05$) effect on health anxiety. Accordingly, for every one-unit increase in e-health literacy, individuals' health anxiety will decrease by 0.120 units. Therefore, the study's H_2 hypothesis *(E-health literacy has a significant and negative effect on health anxiety)* was supported. Lastly, it was found that health anxiety had a positive ($\beta=1.416$) and statistically significant ($p<0.05$) effect on cyberchondria. Accordingly, an individual's level of cyberchondria will increase by 1.416 units for every one-unit increase in health anxiety. Therefore, the study's H_3 hypothesis *(Health anxiety significantly and positively effect on cyberchondria)* was supported.

According to Baron and Kenny's (1986) approach, for a mediation effect to be established, each condition proposed in the model (H_1, H_2, and H_3) had to be met sequentially and step by step. If a condition in one step was not satisfied (i.e., if the relationship between the variables mentioned in that step was not significant), the next step could not be performed, leading to the conclusion that the proposed mediating variable did not have a mediation effect in the suggested model. However, the contemporary validity of Baron and Kenny's (1986) traditional method has been subject to debate. Instead, modern statistical techniques such as Structural Equation

Modeling (SEM) and Bootstrap are reported to provide more reliable results in mediation analysis (Gürbüz and Bayık, 2021). This new approach suggests that a mediation effect may be significant even when the total effect (the effect of the independent variable on the dependent variable) is not statistically significant (Cerin and MacKinnon, 2009; Cesur et al., 2018; Fritz and MacKinnon, 2007; Haspolat and Şendağ, 2018; Hayes, 2009; Kenny and Judd, 2014; Rucker et al., 2011; Zhao et al., 2010).

When the model was tested using this new approach, the H_1 hypothesis (i.e., the effect of e-health literacy on cyberchondria) was found to be non-significant; however, the mediation effect was considered significant within the Bootstrap confidence interval. The model illustrating the mediating role of health anxiety in the relationship between e-health literacy and cyberchondria is presented in Figure 2.

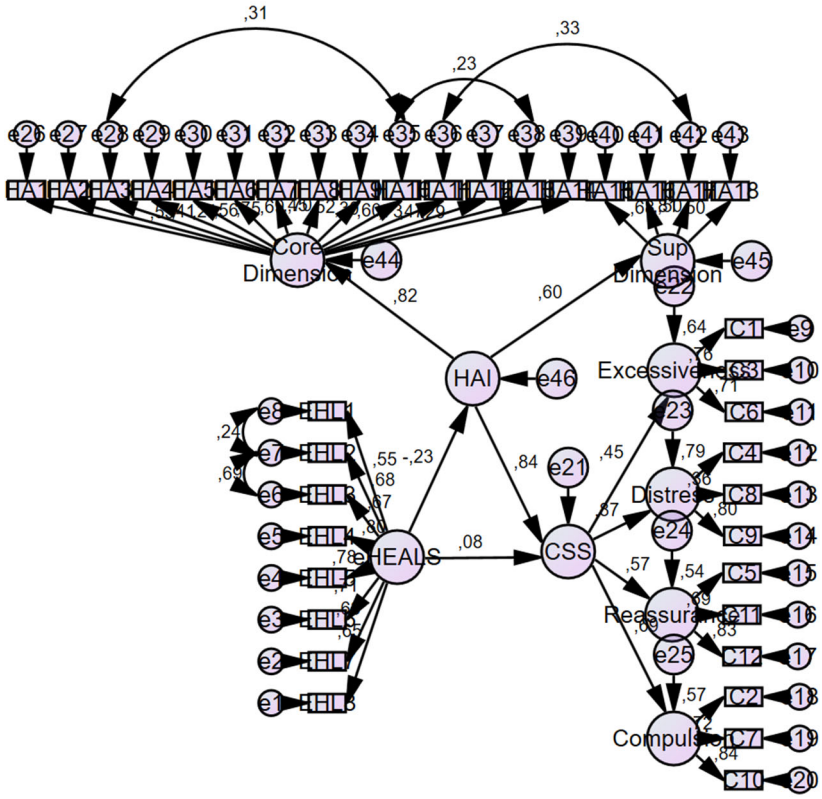

Figure 2. Structural Equation Model (SEM) and Standardized Path Coefficients

The Bootstrap confidence interval and the goodness-of-fit indices of the model, formed by including health anxiety as a mediating variable in the path analysis, are presented in Table 5.

Table 5. The Mediating Role of Health Anxiety in the Effect of E-Health Literacy on Cyberchondria

Effect		β	Standard Error	t	p	Result
E-Health Literacy → Cyberchondria		-0.015	0.041	-0.370	0.711	Not Accept
E-Health Literacy → Health Anxiety → Cyberchondria	*Direct Effect*	0.085	0.032	1.323	0.186	Not Significant
	Indirect Effect	-0.194	Confidence Interval (-0.346, -0.069)			(Mediation)

Table 5. The Mediating Role of Health Anxiety in the Effect of E-Health Literacy on Cyberchondria(Continued)

Fit Indicisies	Model Estimates	Recommended Values
CMIN/DF	1.980	≤5
RMSEA	0.051	≤0.08
GFI	0.909	≥0.90
AGFI	0.888	≥0.85
CFI	0.937	≥0.90
TLI	0.968	≥0.95

According to the contemporary approach, after the mediating variable was included in the model, the Bootstrap confidence interval was used to determine the significance of the indirect effect. Accordingly, since the confidence interval (-0.346, -0.069) does not include zero, it is accepted that the mediation effect is significant. Therefore, the study's H_4 hypothesis (Health anxiety has a mediating role in the effect of e-health literacy on cyberchondria) was supported. Additionally, it is observed that the fit indices meet the recommended values (Browne and Cudeck, 1992; Byrne, 2001; Hu and Bentler, 1999; Kline, 2023; Meydan and Şeşen, 2011; Schermelleh-Engel and Moosbrugger, 2003; Steiger, 2007).

5. DISCUSSION

In this study, the relationship between e-health literacy and cyberchondria, as well as the role of health an^{x}iety in this relationship, were examined. In accordance with the conceptual relationships outlined in the theoretical framework of the research, the measurement model offers a comprehensive structure for evaluating individuals' behaviors when searching for health-related information on digital platforms, considering these behaviors from a multidimensional perspective. The model seeks to theoretically integrate various components involved in the processes by which individuals access, evaluate, and utilize health-related information. In the research measurement model constructed using the Structural Equation Model, e-health literacy is designated as the central variable. Within the framework of this model, the relationships between individuals' e-health literacy levels and psychological and behavioral outcomes, such as health anxiety and cyberchondria, were systematically analyzed. This approach seeks to elucidate the direct and indirect interactions among the variables.

The findings firstly indicate that individuals' e-health literacy levels have a negative effect on health anxiety (β=-0.120, $p<0.05$). This finding aligns with previous research indicating that higher e-health literacy can reduce individuals' health anxiety (Kwon and Oh, 2023; Xie et al., 2022). Tran et al. (2022) found that nursing students with higher e-health literacy scores tended to exhibit lower levels of health anxiety. Rostami et al. (2024) demonstrated that e-health literacy significantly reduced health anxiety levels among older women living in Canada. The study emphasized that e-health literacy plays a crucial role in alleviating health-related anxiety by enhancing individuals' ability to evaluate and effectively utilize online health information. This finding highlights the potential of digital health literacy to enhance the health-related emotional well-being of vulnerable populations, such as older adults. In the study by Fang and Mushtaque (2024), it was found that health literacy among Pakistani individuals moderated the negative relationship between health anxiety and emotional regulation. The research highlights that health literacy facilitates individuals in managing health-related anxiety and using emotional regulation strategies more effectively. Based on these research findings, individuals with high e-health literacy are able to make more informed decisions when seeking health-related information, which helps reduce their excessive health anxiety. As these individuals

develop the ability to assess the accuracy of the information they encounter on digital platforms and adopt a critical stance towards misinformation, they can prevent the triggering of health anxiety. This result underscores the importance of e-health literacy as a key protective factor in managing individuals' health anxiety.

Another finding indicates that the level of e-health literacy does not have a significant effect on the severity of cyberchondria in individuals ($\beta=0.711$ $p>0.05$). The literature suggests that low e-health literacy may exacerbate the severity of cyberchondria in individuals (Kobryn and Duplaga, 2024; Lin and Xu, 2024; Mayukh, 2024; Mohammed et al., 2024; Zhu et al., 2023). The finding obtained in this study is inconsistent with previous findings suggesting that an increase in e-health literacy always leads to a reduction in cyberchondria. On the other hand, contrary to the findings in the aforementioned literature, a positive and moderate relationship was observed between e-health literacy and cyberchondria levels in the study conducted by Şahan and Purtul (2023). This finding suggests that e-health literacy may encourage individuals to engage more with digital health information, which could, in turn, lead to increased health anxiety and cyberchondria (El-Zayat et al., 2023; Potur et al., 2024). It implies that enhancing health literacy does not always prevent negative health behaviors; for some individuals, greater exposure to information may heighten anxiety levels rather than alleviate them. In this context, this study offers new insights into research on health-related Internet use and contributes to the ongoing debate regarding the potential antecedents of cyberchondria.

The final finding reveals that individuals' health anxiety levels positively affect the severity of cyberchondria ($\beta=1.146$, $p<0.05$). This result is consistent with the literature that supports a strong relationship between health anxiety and cyberchondria (Abdelsattar et al., 2021; Eastin and Guinsler, 2006; Jungmann and Witthöft, 2020; Mathes et al., 2018; McMullan et al., 2019; Menon et al., 2020; Muse et al., 2012). Various studies have shown that high levels of health anxiety increase individuals' cyberchondria behaviors (Fergus and Russell, 2016; Nadeem et al., 2022; Norr et al., 2015). Health anxiety can exacerbate cyberchondria, as individuals excessively worry about their health and frequently seek health information online, often leading to increased anxiety and a cycle of health-related concerns. In the study conducted by Bajcar and Babiak (2021), the psychological antecedents and potential consequences of cyberchondria were identified through bidirectional analyses, and possible mechanisms for explaining cyberchondria were discussed. The research highlights the mutual interaction between cyberchondria and health anxiety, demonstrating that these factors are in a dynamic, reciprocal relationship that influences one another. These findings suggest that cyberchondria not only triggers health anxiety but also reinforces it. This relationship aligns with previous studies in the literature that describe the complex interaction between cyberchondria and health anxiety (Starcevic and Berle, 2013).

The study found that, beyond these reciprocal relationships, health anxiety mediates the connection between e-health literacy and cyberchondria Accordingly, individuals with high e-health literacy skills are less likely to experience distress when conducting health-related research on the Internet, and health anxiety plays a shaping role by reinforcing this tendency. Therefore, high e-health literacy enables individuals to approach information critically, manage their anxiety levels, and seek guidance from health professionals. As a result, fostering e-health literacy is considered a crucial tool in preventing the negative effects of cyberchondria.

6. CONCLUSION

This study, which examined the use of digital health information among Istanbul residents aged 18 to 65, found that the effect of e-health literacy on the cyberchondria is fully mediated by health anxiety. The findings of the study suggest that enhancing e-health literacy can improve individuals' ability to utilize digital health information effectively, thereby reducing health anxiety and mitigating cyberchondria. Individuals with high e-health literacy are more effective in managing health anxiety, leading to a substantial reduction in the anxiety experienced in relation to cyberchondria. Thus, e-health literacy has been shown to play a pivotal role in mitigating the adverse psychological impacts of digital health information on individuals while fostering more rational health-related decision-making.

The study provides a comprehensive understanding of e-health literacy and presents an integrated framework that encompasses its various dimensions. Furthermore, the limited number of studies in the literature that simultaneously examine e-health literacy, cyberchondria, and health anxiety within a unified model underscores the potential of this study to make a significant contribution to the field. In this context, the research findings are anticipated to serve as a valuable reference for future studies, contributing significantly to both methodological and theoretical advancements.

Lastly, the study can serve as a valuable resource for policymakers and health practitioners, offering insights into how individuals access digital health information and the psychological implications of these processes. In this context, health professionals can design and implement training programs to educate individuals on the proper use of digital health information. Training programs can emphasize the importance of critically assessing online health information and provide guidance on how to identify reliable sources. Additionally, enhanced communication between patients and doctors may support patients in better managing their anxiety. Therefore, health professionals can play a crucial role in stress management and counseling, especially for individuals with elevated levels of health anxiety. Programs of this nature could help reduce the prevalence of cyberchondria among individuals. In the context of health policy, it can be recommended that the e-health literacy of the population be enhanced through public health campaigns. Special attention should be directed toward the risks of cyberchondria and misinformation. Existing digital platforms, such as e-Nabız, can be made more user-friendly, while enhancing their capacity to deliver reliable health information. Additionally, a mechanism for verifying accuracy could be incorporated into these platforms.

6.1. Limitations

The present study has several limitations. First, the study was conducted exclusively on individuals aged 18 to 65 residing in Istanbul. This limitation implies that the findings of the study are only applicable to the specific geographic and demographic group under investigation. It should be noted that individuals from different age groups, cultural backgrounds, or geographic regions may have different experiences with e-health literacy, cyberchondria, and health anxiety. Secondly, the study is based on individuals' self-reported answers e-health literacy, health anxiety, and concerning cyberchondria. Self-reported data may contain flaws, such as dishonesty or social desirability bias, that affect participants' answers, particularly when it comes to private subjects like health. Additionally, psychological and behavioral dimensions, such as health anxiety and cyberchondria, are challenging to measure accurately, and individuals' self-assessments may not fully capture these complex and subjective conditions. These limitations may restrict the generalizability of the study's findings to a broader

population. Future studies could yield more comprehensive results by incorporating diverse demographic groups and utilizing objective measurement tools.

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