

New challenges in facing Cyberchondria during the COVID-19 pandemic

Matteo Vismara^{1,2}, Alberto Varinelli^{1,2}, Luca Pellegrini^{3,4,5}, Arun Enara⁶, Naomi A. Fineberg^{3,4,7}

¹ University of Milan, Department of Mental Health, Department of Biomedical and Clinical Sciences Luigi Sacco, Milan, Italy

² “Aldo Ravelli” Center for Neurotechnology and Brain Therapeutic, University of Milan, Milan, Italy

³ School of Life and Medical Sciences, University of Hertfordshire, Hatfield, United Kingdom

⁴ Hertfordshire Partnership University NHS Foundation Trust, Welwyn Garden City, United Kingdom

⁵ Centre for Psychedelic Research, Imperial College London, London, UK

⁶ Specialist Registrar, Camden and Islington NHS Foundation Trust, London, United Kingdom

⁷ University of Cambridge School of Clinical Medicine, Cambridge, United Kingdom

Corresponding Author:

Matteo Vismara

Luigi Sacco University Hospital

Via G.B. Grassi, 74

20157 Milan, Italy

Tel +390239042904

Email: matteo.vismara@unimi.it

Words count:

Manuscript: 3443

Abstract: 174

Tables: 1

References: 59

Abstract

Cyberchondria (CYB) is characterized by excessive online searching for medical information and is associated with increasing levels of distress, anxiety and interference with daily activities. As the use of digital devices and the Internet as a source of everyday information has increased, particularly during the current COVID-19 pandemic, so has CYB, becoming an object of interest to clinicians and researchers. The present review will provide an overview of the latest updates in CYB research. Emerging evidence draws attention to various vulnerability factors for developing CYB, including personal characteristics such as female gender, younger age, or a history of mental disorder, as well as engagement in particular forms of online behaviour such as increased use of social media, increased acceptance of online information, information overload. Additionally, recent studies suggest CYB may itself act as a mediating factor for increased COVID-19-related psychological burden. However, the data is still very sparse. Knowledge gaps include a universally accepted definition of CYB, severity thresholds to help differentiate non-pathological online health searches from CYB, as well as robustly evidence-based interventions.

Highlights:

- Cyberchondria is a compulsive form of Internet searching for health-related information.
- Females, younger individuals, a history of mental disorder or increased use of social media, increased acceptance of online information, or information overload represent risk factors for cyberchondria.
- Promising preventative and therapeutic approaches need to be validated in definitive randomised clinical trials.

1. Introduction

The Internet has become the most frequently used popular resource for queries about health. In recent surveys of the general population, up to 90% of participants used the Internet for this purpose [1,2]. Online provision of health-related information has many theoretical advantages, representing a convenient and potentially cost-effective method for educating and empowering people about their health, especially those who are poorly served by medical services, providing them with useful information about symptoms to aid clinical help-seeking, as well as anonymous access to medical information for those who are reluctant to see a clinician in person [3]. On the other hand, information available online is often overabundant, conflicting or ambiguous, and not all the information online is trustworthy or verified, with a potential risk of harm resulting from self-diagnosis and treatment. A recent systematic review and meta-analysis including more than 11.000 websites delivering medical or health-related information reported that none received a category of “excellent” in quality, 37–79% were rated as “good”, and the rest were rated as “poor quality” [4]. Additionally, online health-related information is often ambiguous, sometimes contradictory, and not easy to understand by someone without a clinical background.

Most people using the Internet to search for health-related information do so in a non-pathological or even in an adaptive way, however a subgroup searches online repeatedly and excessively and experiences a significant increase in distress or anxiety as a consequence of these searches. This behavior has been described as cyberchondria (CYB) [5]. The current COVID-19 pandemic raises new and obvious challenges in relation to this problem. As large sections of the global population were instructed to self-isolate at home and access to health professionals became more difficult, the Internet remained the only rational information source

for many people to answer questions about health. Indeed, in the early stages of the COVID-19 outbreak, the Internet became an essential conduit for vital public health and safety information. However, by increasing Internet exposure, under conditions of great uncertainty and risk, the pandemic is likely to have exposed greater numbers of people to the risk of developing CYB. As the Internet becomes ever more deeply integrated in our daily life (for communicating, working, etc), users should be made properly aware of the potential risks of using medical platforms for self-diagnosis and treatment and guidance on how to use these resources safely.

In this paper, we will summarize the accumulating knowledge about the measurement of CYB, its natural history, the impact of the COVID-19 pandemic on CYB risk, and new evidence for prevention and therapeutic strategies.

2. Measurement of cyberchondria

A few instruments have been developed for detecting CYB; the Cyberchondria Severity Scale (CSS, [6]) is the most frequently used. The CSS is a self-reported scale that can be used as a screening tool to assess CYB symptom severity. It provides a quantitative measure of the extent of the behaviour, but no reliable scale cut-off has been thus far proposed to distinguish adaptive online health searches from CYB.

The original CSS (33 items) evaluates behaviours and emotions generated from a review of the contemporary literature on CYB and similar anxiety disorders and provides scores on five-dimensional subscales: compulsion, distress, excessiveness, reassurance, and mistrust of medical professionals. The CSS-33 showed a very good to excellent reliability and validity and has been

translated into several languages [7]. The CSS-33 has been used mostly to measure CYB symptom severity in general population surveys – and to evaluate severity in patients seeking treatment for psychiatric disorders [8]. The CSS-33 has also demonstrated sensitivity to change in CYB severity in a randomized controlled trial (RCT) [9]. Modifications of the original version have been introduced to refine its conceptual foundation (mainly omitting the “mistrust of medical professionals” subscale, which may not assess the same overarching construct of CYB as the other CSS subscales) and to improve its utility in clinical and research setting, by making it shorter (with 30, 15, and 12 items) [7]. The reliability and validity of the shortened versions remain to be established with certainty.

3. Natural history of cyberchondria

CYB is a relatively new phenomenon and consequently research is still in its infancy. It is still debated whether CYB represents a new and independent form of mental disorder or whether it is simply a contemporary manifestation of hypochondriasis – a disorder currently classified with the obsessive-compulsive and related disorders (OCDs) in the last edition of the International Classification of Diseases (ICD-11). ICD-11 hypochondriasis is defined as the persistent preoccupation or fear about the possibility of having one or more serious, progressive, or life-threatening illnesses and is characterised by compulsive checking for evidence of illness, spending inordinate amounts of time searching for information about the feared illness, and repeatedly seeking reassurance. Compulsivity refers to a tendency toward repetitive, habitual actions, repeated despite adverse consequences [10]. In the case of OCDs, compulsions, such as repetitive checking, are stereotyped behaviours, performed according to rigid rules and designed to reduce or avoid unpleasant consequences, such as relieving distress or anxiety (as

opposed to gaining a reward) [11]. However, in reality, the compulsive behaviours do not provide the intended relief and instead, by undermining healthy habituation of anxiety, promote further compulsive engagement. This model can also be applied to CYB, whereby repetitive checking online for medical information designed to achieve relief or reassurance about one's health status instead increases anxiety and promotes further fruitless checking. The correlation with CYB and health anxiety, broadly defined, is corroborated by recent systematic reviews and meta-analyses [12,13]. However, a core preoccupation or fear of serious, progressive, or life-threatening illnesses is not always associated with CYB. In some circumstances, CYB is driven by symptoms more consistent with obsessive-compulsive disorder (OCD), as repeated searches for medical information may function as a safety behaviour designed to alleviate obsessive responsibility for preventing harm, somatic obsessions, or other contamination concerns. Additionally, the need for certainty, or the need for things to be "perfect" or "done right", which drives some forms of CYB, may reflect an underlying obsessive-compulsive personality disorder, which has been reported to accompany hypochondriasis. Lastly, in some other circumstances, online health searches may be compulsively performed without the aim of detecting a specific feared health outcome (describing subjects with a low degree of insight, akin to "poor-insight" OCD). In the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the concept of hypochondriasis is partly reflected in illness anxiety disorder and partly in somatic symptom disorder, two separate disorders within the grouping of somatic symptom and related disorders (for an additional focus on the differences between the ICD-11 and DSM-5 conceptualisation of hypochondriasis, we suggest the paper from van den Heuvel and colleagues [14]). This nosological classification and definition is somehow confusing as the role of somatic symptoms is not completely clear in the conceptualization of hypochondriasis

(illness anxiety disorder) in DSM-5. The ICD-11, on the contrary, took a different approach by keeping the name “hypochondriasis” and by including this disorder in the OCRDs grouping for its compulsive nature and its negative reinforcement. We believe that the ICD-11 classification is more useful than the DSM-5 one both for diagnosis and treatment and for research purposes. The prominence of somatic symptoms may be not predominant nor present in CYB. Additionally, the DSM-5 criteria require high level of anxiety about health and the individual to be easily alarmed about personal health status. Though somatic symptoms may drive CYB in some cases, investigations have showed that excessive online searches and clinically significant CYB is also associated with low level of health-anxiety in subjects not worried about their health before engaging in online searches [15,16]. Hence, for some cases of CYB, a diagnosis of ICD-11 hypochondriasis or DSM-5 illness anxiety disorder may not apply.

In previous work, our group tentatively proposed a “working” definition of CYB [17] – based on existing definitions of CYB - reflecting three key components: 1) the compulsive nature of online health searching; 2) an increase in anxiety or distress during or after the searching; 3) the negative impact on other online and offline activities. This definition reflects a conceptualization of CYB as a compulsive form of Problematic Usage of the Internet (PUI) [18,19], an emerging group of disorders that are currently conceptualized within a framework of behavioural addiction and in which framework loss of inhibitory cognitive control over impulsive as well as compulsive responding is emphasized. Indeed, CYB and PUI share in common the distressing loss of control over urge-driven online activity, resulting in time-consuming, compulsive behaviour, that is continued despite acknowledgement of negative consequences and that ultimately causes distress or impairs functioning. Indeed, CYB shares phenomenological

similarities with a subgroup of problematic use of the Internet in which individuals spend excessive amounts of time seeking information in the online context, usually news or documentary related information. A recent investigation dubbed this behaviour as “online news addiction” that emerged to be associated with high level of future anxiety and with low level of interpersonal trust, two factors that could likely predispose also CYB [20]. Exploratory investigations supported by the relationship between CYB and symptom severity of Internet addiction or PUI [21,22], even stronger than the one between CYB and health anxiety [23]. Although in some circumstances CYB might resemble a behavioural addiction, it seems not to manifest the full set of potential diagnostic criteria for these disorders, in particular symptoms of tolerance or withdrawal that have been proposed in the DSM-5 prototype definition of Internet gaming disorders. Importantly, however, tolerance and withdrawal are not considered essential criteria for a diagnosis of behavioural addiction in the ICD-11[24].

Thus far, mostly cross-sectional investigations have reported an association between CYB symptom severity and various sociodemographic and clinical variables, mainly based on studies of the general or university student population. Female gender showed a higher expression of CYB in some studies [25–29], but not all [8,30,31], while younger individuals also seem more predisposed to CYB [28,32,33] - though this might simply reflect increased use of electronic devices in this age group. Indeed, as many as 23.3% of university students reported a significant CYB (score on the CSS-33 above the 75th percentile) in a survey-based study conducted before the COVID-19 pandemic [30]. Another recent investigation reported CYB in 16.3% of 300 outpatients attending two general hospitals (this study considered the presence of any CSS factors as being indicative of CYB) [34]. Additional investigations are needed to determine the age of onset and the influence of culture or geography on CYB. Furthermore, the course of CYB is not well understood as there have been no prospective long-term studies.

A few studies have investigated CYB in clinical samples. In a recent study performed by our group [8], CYB was investigated in a sample of 77 outpatients with various psychiatric disorders including OCD, anxiety disorders, and major depressive disorder. CYB, when defined using the three criteria listed above, was present in just 1.3% of the sample. However, if a less restrictive definition was applied (omitting the disability criterion), CYB was reported in 10% to 20% of patients, with a slightly higher (not significant) rate in patients with anxiety disorders (19.2%) than major depressive disorder (15.4%) or OCD (12%). The sample size was admittedly small and therefore the study may not have been powered sufficiently to show a statistical difference.

Taken together, these data suggest CYB represents a relatively common transdiagnostic syndrome, occurring in population based and clinical samples, including, but not exclusively, those with a range of mental disorders such as OCD, anxiety, or major depressive disorder. The broad range of clinical syndromes associated with CYB implies a multifactorial etiology and it is reasonable to hypothesise that variable subtypes of CYB might manifest. Indeed, CYB is sometimes driven by symptoms more consistent with hypochondriasis, sometimes with OCD, sometimes with a form of behavioural addiction involving PUI. Future studies investigating latent phenotypes may provide a greater understanding of the underpinning psychobiological mechanisms. For example, prominence of latent phenotypes reflecting perfectionism and cognitive inflexibility may indicate a close relationship with OCD, whereas phenotypes denoting poor impulse control may indicate a closer relationship to behavioural addiction.

4. Cyberchondria during the COVID-19 pandemic

Starcevic and colleagues [35] proposed a theoretical five-factor model to describe how the current pandemic may have affected CYB. Factors include: 1) heightened perception of threat and fear of a newly identified and poorly understood disease; 2) difficulty coping with uncertainty associated with the pandemic; 3) lack of authoritative and trustworthy sources of relevant health information; 4) difficulty coping with abundance of information that is often confusing, conflicting, unverified and constantly updated, along with a decreased ability to filter out unnecessary information; and 5) inability of excessive online health information seeking to provide the necessary information and deliver reassurance. This model could help to understand the hypothesized rise in CYB during public health emergencies and to formulate a framework for prevention of CYB and effective responding to it, however it needs to be further validated in subjects manifesting pathological levels of CYB during the pandemic.

Recently, researchers have investigated CYB during the COVID-19 outbreak, however, the results remain preliminary and inconclusive. A recent online survey of 300 students reported exceptionally high rates of CYB - only 1.3% scored within the normal range in all the five constructs of the CSS-15, while the remaining 98.7% were either moderately or severely affected by one or the other constructs of CYB [36]. Another investigation of 674 community residents in China showed that 21.9% scored at or above the 75th percentile on the CSS-12, again reflecting increased severity of CYB [37]. However, these investigations are cross-sectional and adopted an arbitrary cut-off on less well validated versions of the CSS to define rates of CYB. Therefore, studies with stronger methodology and more data are needed before we can confidently compare rates of CYB in studies conducted before and after the pandemic.

CYB has impacted public mental health under coronavirus in several ways. CYB has been reported as a contributing factor for “Coronavirus anxiety” [38], “fear of COVID-19” [39], and

in a correlation analysis was associated with greater COVID-19 related concerns and safety behaviours [40]. In a recent study of 486 participants recruited from the general population, CYB was also found to partially mediate the association between perceived severity of COVID-19 and depression, anxiety, and stress [41]. Moreover, during the COVID-19 pandemic, higher expression of CYB was associated with a poorer quality of life, directly [28] or indirectly, mediated by stress and fear of COVID-19 [42].

During the pandemic, the subjects most at risk of manifesting increased expression of CYB were females [26,28,29], younger individuals, who were living alone, and those suffering from a physical/psychiatric illness [8]. Having contracted the virus was not associated with greater expression of CYB [28,29]. Moreover, greater expression of CYB seemed to be related to trust and acceptance of online information [26,43], information overload [26,31], and perceived vulnerability to COVID-19 [31]. The use of social media as the main source of information and the time spent on these platforms also reflected higher CYB symptom severity [43,44]. Recently, CYB has been associated with COVID-19 vaccine hesitancy, as investigations have outlined a mediating role for CYB in the relationship between information overload and vaccine scepticism [45] and between problematic social media use and intention to get a COVID-19 vaccine [46]. These data underline the need to improve online health information literacy among the public and suggest that targeting CYB represents a rational goal for preventative public health strategies.

5. Prevention of Cyberchondria

Conceptualising CYB as a public health problem, most of the available literature recommends strategies rooted in primary preventative approaches. However, it must be noted that these

preventive strategies lack a robust evidence base and remain largely conjectural, also in the field of CYB. The overarching focus has been to improve online health information literacy among the public as a whole, in order to reduce vulnerability in “at-risk” groups. Of particular relevance during the pandemic era, a key goal is to ensure medical information is accessed from reliable, reputable and trustworthy sites. It has been suggested, for example, that guidance to distinguish between trustworthy and non-trustworthy sites for the population as a whole should be developed by public health or academic organisations [47]. The content of this guidance should be simple and non-technical in order to be available for diverse educational and cultural backgrounds. Educational strategies that help patients critically appraise online health information and understand the impact of such information on the likelihood of performing further searches may also be of value [17]. However, it needs to be noted that, despite considerable investment, popular prevention programs involving educational interventions directed at young people with compulsive substance-use behaviours resulting in addiction have to date not on the whole proved efficacious in driving behaviour change [48]. Therefore, there is a strong argument for investigating the effectiveness of such programs in CYB prevention.

Another approach has been to target “at risk” individuals. It has been suggested, for example, that self-diagnosis should be discouraged. Providing better access to primary care health physicians and general practitioners, especially for those identified at high risk of CYB, to filter information, provide a reliable and trustworthy diagnosis alongside reassurances that are clear, unequivocal and evidence based, may be helpful, in some individuals, to limit compulsive online searching. Moreover, the public should also be advised to recognise and resist the urge to repeatedly check the internet for reassurance, as this is often responsible for maintaining the illness behaviour. However, there have been no studies of these interventional approaches and so

it remains uncertain as to whether they are efficacious or cost effective, and for whom they might work best. Alternative theoretical approaches designed to identify and intervene in those at high risk, before they develop CYB, also remain untested.

6. New treatment approaches

Little research has been conducted on treatment for CYB, and so interventions used for other forms of PUI (e.g., motivational approaches, cognitive behavioural therapy (CBT) for behavioural addiction) adapted for CYB have been proposed [49]. Alternatively, as “health anxiety” and hypochondriasis have been subject to systematic research, this work could also provide a rational basis for the development of therapeutic interventions. The reclassification of hypochondriasis as an OCD in ICD-11 may help in this respect. In a recent meta-analysis [50], hypochondriasis or health anxiety were found to respond to CBT. The magnitude of the effect size depended upon the choice of control condition [51,52]. Exposure and response prevention appeared at least as effective as other forms of CBT [53–55] and in one study, the residual effect of CBT endured for at least 2 years [56] although in this study CBT lacked cost-effectiveness.

To date, only one RCT has been conducted on treatments specifically addressing CYB [9]. In this study, the authors analysed secondary data from a RCT comparing Internet-delivered CBT (N=41) to an active control involving psychoeducation, monitoring, and clinical support (N=41) in patients with a DSM-5 diagnosis of Illness Anxiety Disorder and/or Somatic Symptom Disorder. The CBT group showed a significantly greater reduction in CYB compared to the control group, with large differences at post-treatment on the CSS (Hedges’g = 1.09), and the compulsion, distress, excessiveness subscales on the CSS (Hedges’g = 0.8-1.13). Mediation

analyses showed improvements in health anxiety (measured through the Short Health Anxiety Inventory) in the CBT group were mediated by improvements in all of the CSS subscales, except for the mistrust of medical professional subscale.

Other work in hypochondriasis suggests medication with a selective-serotonin reuptake inhibitor (SSRI) might be effective in CYB. There have been three positive RCTs [57–59] showing SSRI reduces symptoms of hypochondriasis with some preliminary evidence of an advantage for combining SSRI with CBT and for higher SSRI dosages [59]. However, CYB was not specifically measured in these studies.

7. Conclusions and future directions.

CYB, manifesting as distressing and time-consuming repetitive online searching, affects certain vulnerable groups and appears to have increased under the COVID-19 pandemic, though the evidence is as yet inconclusive. The impact of CYB on functioning remains poorly defined, but emerging evidence links CYB as a risk factor for poor quality of life, both directly and indirectly, and may represent one of the mechanisms whereby fear of COVID-19 increases stress, depression, and anxiety. As digitalization continues apace and the number of people opting for digital forms of healthcare provision increases in tandem, it is expected that rates of CYB will rise in the near future. Despite the growing research interest in CYB, robust evidence is still very sparse. There are no firmly established evidence-based interventions, though one positive RCT suggests online CBT is effective. Looking to the future, Table 1 highlights some of the key research goals expected to advance the field.

Table 1: future research goals in facing cyberchondria

Future Research Goals
<ol style="list-style-type: none">1. Improve CYB conceptualisation and adopt a universally accepted definition2. Reach consensus on the optimal screening and severity rating scales3. Define a threshold to distinguish adaptive from problematic online searching for medical information4. Identify frequency, course and impact of CYB across sociodemographic groups in longitudinal studies5. Identify risk factors including latent phenotypes to aid early recognition and intervention6. Develop and validate effective preventive strategies (e.g., methods for teaching generic skills to distinguish reliable and unreliable health-information)7. Test the effectiveness of new therapeutic interventions (e.g., CBT with ERP, SSRI) in a definitive randomised controlled trial

Disclosure

Drs Vismara, Varinelli, Pellegrini, and Enara have nothing to disclose related to the present work. Prof. Fineberg declares that in the past 3 years she has held research or networking grants from the UK NIHR, EU H2020; she has accepted travel and/or hospitality expenses from the BAP, ECNP, RCPsych, CINP, International Forum of Mood and Anxiety Disorders, World Psychiatric Association; she has received payment from Elsevier for editorial duties; She has accepted a paid speaking engagement in a webinar sponsored by the Global Mental Health Academy. Previously, she has accepted paid speaking engagements in various industry supported symposia and has recruited patients for various industry-sponsored studies in the field of OCD treatment. She leads an NHS treatment service for OCD. She holds Board membership for various registered charities linked to OCD. She gives expert advice on psychopharmacology to the UK MHRA.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author's contribution

All authors were involved in drafting the manuscript and agreed to its publication. All authors read and approved the final version of the manuscript.

Reference list

*: annotated references

1. AlMuammar SA, Noorsaeed AS, Alafif RA, Kamal YF, Daghistani GM: **The Use of Internet and Social Media for Health Information and Its Consequences Among the Population in Saudi Arabia.** *Cureus* 2021, **13**.
2. Bujnowska-Fedak MM, Waligóra J, Mastalerz-Migas A: **The Internet as a Source of Health Information and Services.** *Adv Exp Med Biol* 2019, **1211**:1–16.
3. Laugesen J, Hassanein K, Yuan Y: **The Impact of Internet Health Information on Patient Compliance: A Research Model and an Empirical Study.** *J Med Internet Res* 2015, **17**:e143.
4. Daraz L, Morrow AS, Ponce OJ, Beuschel B, Farah MH, Katabi A, Alsawas M, Majzoub AM, Benkhadra R, Seisa MO, et al.: **Can Patients Trust Online Health Information? A Meta-narrative Systematic Review Addressing the Quality of Health Information on the Internet.** *J Gen Intern Med* 2019, **34**:1884–1891.
5. Starcevic V, Berle D: **Cyberchondria: Towards a better understanding of excessive health-related Internet use.** *Expert Rev Neurother* 2013, **13**:205–213.
6. McElroy E, Shevlin M: **The development and initial validation of the cyberchondria severity scale (CSS).** *J Anxiety Disord* 2014, **28**:259–65.
7. * Starcevic V, Berle D, Arnáez S, Vismara M, Fineberg NA: **The Assessment of Cyberchondria: Instruments for Assessing Problematic Online Health-Related Research.** *Curr Addict Reports* 2020, **7**:149–165. *: review on measurement tools for CYB.
8. * Vismara M, Benatti B, Ferrara L, Colombo A, Bosi M, Varinelli A, Pellegrini L, Viganò C, Fineberg NA, Dell'Osso B: **A preliminary investigation of Cyberchondria and its correlates in a clinical sample of patients with obsessive-compulsive disorder, anxiety and depressive disorders attending a tertiary psychiatric clinic.** *Int J Psychiatry Clin Pract* 2021, doi:10.1080/13651501.2021.1927107. *: first investigation of CYB in patients with psychaitric disorders
9. * Newby JM, McElroy E: **The impact of internet-delivered cognitive behavioural therapy for health anxiety on cyberchondria.** *J Anxiety Disord* 2020, **69**:102150. *: clinical trial on cognitive behavioural therapy for CYB.
10. Robbins TW, Gillan CM, Smith DG, de Wit S, Ersche KD: **Neurocognitive endophenotypes of impulsivity and compulsivity: towards dimensional psychiatry.** *Trends Cogn Sci* 2012, **16**:81–91.
11. Fineberg NA, Apergis-Schoute A, Vaghi M, Banca P, Gillan C, Voon V, Chamberlain S, Cinosi E, Reid J, Shahper S, et al.: **Mapping Compulsivity in the DSM-5 Obsessive Compulsive and Related Disorders: Cognitive Domains, Neural Circuitry, and**

- Treatment.** *Int J Neuropsychopharmacol* 2018, **21**:42–58.
12. Schenkel SK, Jungmann SM, Gropalis M, Witthöft M: **Conceptualizations of Cyberchondria and Relations to the Anxiety Spectrum: Systematic Review and Meta-analysis.** *J Med Internet Res* 2021, **23**:e27835.
 13. McMullan RD, Berle D, Arnáez S, Starcevic V: **The relationships between health anxiety, online health information seeking, and cyberchondria: Systematic review and meta-analysis.** *J Affect Disord* 2019, **245**:270–278.
 14. van den Heuvel OA, Veale D, Stein DJ: **Hypochondriasis: Considerations for ICD-11.** *Rev Bras Psiquiatr* 2014, **36**:S21–S27.
 15. Tyrer P, Cooper S, Tyrer H, Wang D, Bassett P: **Increase in the prevalence of health anxiety in medical clinics: Possible cyberchondria.** *Int J Soc Psychiatry* 2019, **65**:566–569.
 16. White RW, Horvitz E: **Cyberchondria: Studies of the escalation of medical concerns in Web search.** *ACM Trans Inf Syst* 2009, **27**.
 17. Vismara M, Caricasole V, Starcevic V, Cinosi E, Dell’Osso B, Martinotti G, Fineberg NA: **Is cyberchondria a new transdiagnostic digital compulsive syndrome? A systematic review of the evidence.** *Compr Psychiatry* 2020, **99**.
 18. * Fineberg NA, Demetrovics Z, Stein DJ, Ioannidis K, Potenza MN, Grünblatt E, Brand M, Billieux J, Carmi L, King DL, et al.: **Manifesto for a European research network into Problematic Usage of the Internet.** *Eur Neuropsychopharmacol* 2018, **28**:1232–1246. *: list of critical and achievable research priorities of problematic usage of the Internet (regarding identification, prevention, and treatment) identified by experts in the field.
 19. Dell’Osso B, Di Bernardo I, Vismara M, Piccoli E, Giorgetti F, Molteni L, Fineberg NA, Virzì C, Bowden-Jones H, Truzoli R, et al.: **Managing Problematic Usage of the Internet and Related Disorders in an Era of Diagnostic Transition: An Updated Review.** *Clin Pract Epidemiol Ment Health* 2021, **17**:61–74.
 20. Shabahang R, Aruguete MS, Shim H: **Online News Addiction: Future Anxiety, Fear of Missing Out on News, and Interpersonal Trust Contribute to Excessive Online News Consumption.** *Online J Commun Media Technol* 2021, **11**:e202105.
 21. Batigun AD, Gor N, Komurcu B, Erturk IS: **Cyberchondria scale (CS): Development, validity and reliability study.** *Dusunen Adam* 2018, **31**:148–162.
 22. Durak-Batigun A, Gor N, Komurcu B, Erturk IS: **Cyberchondria scale (CS): Development, validity and reliability study.** *Dusunen Adam* 2018, **31**:148–162.
 23. Starcevic V, Baggio S, Berle D, Khazaal Y, Viswasam K: **Cyberchondria and its Relationships with Related Constructs: a Network Analysis.** *Psychiatr Q* 2019, **90**:491–505.
 24. Castro-Calvo J, King DL, Stein DJ, Brand M, Carmi L, Chamberlain SR, Demetrovics Z, Fineberg NA, Rumpf HJ, Yücel M, et al.: **Expert appraisal of criteria for assessing gaming disorder: an international Delphi study.** *Addiction* 2021, **116**:2463–2475.

25. Barke A, Bleichhardt G, Rief W, Doering BK: **The Cyberchondria Severity Scale (CSS): German Validation and Development of a Short Form.** *Int J Behav Med* 2016, **23**:595–605.
26. * Laato S, Islam AKMN, Islam MN, Whelan E: **What drives unverified information sharing and cyberchondria during the COVID-19 pandemic?** *Eur J Inf Syst* 2020, **29**:288–305. *: proposed research model on factors contributing to unverified COVID-19 information sharing through social media.
27. Maftai A, Holman AC: **Cyberchondria During the Coronavirus Pandemic: The Effects of Neuroticism and Optimism.** *Front Psychol* 2020, **11**:2654.
28. Vismara M, Vitella D, Biolcati R, Ambrosini F, Pirola V, Dell’Osso B, Truzoli R: **The Impact of COVID-19 Pandemic on Searching for Health-Related Information and Cyberchondria on the General Population in Italy.** *Front psychiatry* 2021, **12**.
29. Kurcer MA, Erdogan Z, Cakir Kardes V: **The effect of the COVID-19 pandemic on health anxiety and cyberchondria levels of university students.** *Perspect Psychiatr Care* 2021, doi:10.1111/PPC.12850.
30. Akhtar M, Fatima T: **Exploring cyberchondria and worry about health among individuals with no diagnosed medical condition.** *J Pak Med Assoc* 2020, **70**:90–95.
31. Bala R, Srivastava A, Ningthoujam GD, Potsangbam T, Oinam A, Anal CL: **An Observational Study in Manipur State, India on Preventive Behavior Influenced by Social Media During the COVID-19 Pandemic Mediated by Cyberchondria and Information Overload.** *J Prev Med Public Health* 2021, **54**:22–30.
32. Doherty-Torstrick ER, Walton KE, Fallon BA: **Cyberchondria: Parsing Health Anxiety From Online Behavior.** *Psychosomatics* 2016, **57**:390–400.
33. Bajcar B, Babiak J: **Self-esteem and cyberchondria: The mediation effects of health anxiety and obsessive–compulsive symptoms in a community sample.** *Curr Psychol* 2019, doi:10.1007/s12144-019-00216-x.
34. Wijesinghe CA, Liyanage ULNS, Kapugama KGCL, Warsapperuma WANP, Williams SS, Kurupparachchi KALA, Rodrigo A: **“Muddling by googling” – Cyberchondria among outpatient attendees of two hospitals in Sri Lanka.** *Sri Lanka J Psychiatry* 2019, **10**:11.
35. * Starcevic V, Schimmenti A, Billieux J, Berle D, Wales S, South Wales N, Correspondence Vladan Starcevic A, Hospital N: **Cyberchondria in the time of the COVID-19 pandemic.** *Hum Behav Emerg Technol* 2021, **3**:53–62. *: proposed model on the factors contributing CYB during the COVID-19 pandemic.
36. Shailaja B, Shetty V, Chaudhury S, Thyloth M: **Exploring cyberchondria and its associations in dental students amid COVID-19 infodemic.** *Ind Psychiatry J* 2020, **29**:257.
37. Peng X-Q, Chen Y, Zhang Y-C, Liu F, He H-Y, Luo T, Dai P-P, Xie W-Z, Luo A-J: **The Status and Influencing Factors of Cyberchondria During the COVID-19 Epidemic. A Cross-Sectional Study in Nanyang City of China.** *Front Psychol* 2021, **12**:712703.

38. Jungmann SM, Witthöft M: **Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety?** *J Anxiety Disord* 2020, **73**:102239.
39. Seyed Hashemi SG, Hosseinnezhad S, Dini S, Griffiths MD, Lin CY, Pakpour AH: **The mediating effect of the cyberchondria and anxiety sensitivity in the association between problematic internet use, metacognition beliefs, and fear of COVID-19 among Iranian online population.** *Heliyon* 2020, **6**.
40. Jokic-Begic N, Korajlija AL, Mikac U: **Cyberchondria in the age of COVID-19.** *PLoS One* 2020, **15**:e0243704.
41. Han L, Zhan Y, Li W, Xu Y, Xu Y, Zhao J: **Associations Between the Perceived Severity of the COVID-19 Pandemic, Cyberchondria, Depression, Anxiety, Stress, and Lockdown Experience: Cross-sectional Survey Study.** *JMIR public Heal Surveill* 2021, **7**.
42. Rahme C, Akel M, Obeid S, Hallit S: **Cyberchondria severity and quality of life among Lebanese adults: the mediating role of fear of COVID-19, depression, anxiety, stress and obsessive–compulsive behavior—a structural equation model approach.** *BMC Psychol* 2021 *9* 2021, **9**:1–12.
43. Farooq A, Laato S, Najmul Islam AKM: **Impact of online information on self-isolation intention during the COVID-19 Pandemic: Cross-Sectional study.** *J Med Internet Res* 2020, **22**.
44. Yam FC, Korkmaz O, Griffiths MD: **The association between fear of Covid-19 and smartphone addiction among individuals: the mediating and moderating role of cyberchondria severity.** *Curr Psychol* 2021, **1**:1.
45. Honora A, Wang KY, Chih WH: **How does information overload about COVID-19 vaccines influence individuals' vaccination intentions? The roles of cyberchondria, perceived risk, and vaccine skepticism.** *Comput Human Behav* 2022, **130**:107176.
46. Ahorsu DK, Lin CY, Alimoradi Z, Griffiths MD, Chen HP, Broström A, Timpka T, Pakpour AH: **Cyberchondria, Fear of COVID-19, and Risk Perception Mediate the Association between Problematic Social Media Use and Intention to Get a COVID-19 Vaccine.** *Vaccines* 2022, *Vol 10, Page 122* 2022, **10**:122.
47. Sbaffi L, Rowley J: **Trust and Credibility in Web-Based Health Information: A Review and Agenda for Future Research.** *J Med Internet Res* 2017, **19**.
48. Van Den Broucke S: **Needs, norms and nudges: the place of behaviour change in health promotion.** *Health Promot Int* 2014, **29**:597–600.
49. Király O, Potenza MN, Stein DJ, King DL, Hodgins DC, Saunders JB, Griffiths MD, Gjoneska B, Billieux J, Brand M, et al.: **Preventing problematic internet use during the COVID-19 pandemic: Consensus guidance.** *Compr Psychiatry* 2020, **100**.
50. Axelsson E, Hedman-Lagerlöf E: **Cognitive behavior therapy for health anxiety: systematic review and meta-analysis of clinical efficacy and health economic outcomes.** *Expert Rev Pharmacoecon Outcomes Res* 2019, **19**:663–676.

51. Pellegrini L, Laws KR, Albert U, Reid J, Fineberg N a.: **Letter to the editor on “cognitive behavior therapy for health anxiety: systematic review and meta-analysis of clinical efficacy and health economic outcomes.”** *Expert Rev Pharmacoecon Outcomes Res* 2020, **20**:683–684.
52. Fineberg N, Pellegrini L, Drummond L, Clarke A, Laws K: **Meta-Analysis Of Cognitive Behaviour Therapy And Selective Serotonin Reuptake Inhibitors For The Treatment Of Hypochondriasis: Implications for Trial Design.** *Unpubl data* 2021,
53. Weck F, Neng JMB, Richtberg S, Jakob M, Stangier U: **Cognitive therapy versus exposure therapy for hypochondriasis (health anxiety): A randomized controlled trial.** *J Consult Clin Psychol* 2015, **83**:665–676.
54. Visser S, Bouman TK: **The treatment of hypochondriasis: exposure plus response prevention vs cognitive therapy.** *Behav Res Ther* 2001, **39**:423–442.
55. Hedman E, Axelsson E, Görling A, Ritzman C, Ronnheden M, El Alaoui S, Andersson E, Lekander M, Ljótsson B: **Internet-delivered exposure-based cognitive-behavioural therapy and behavioural stress management for severe health anxiety: randomised controlled trial.** *Br J Psychiatry* 2014, **205**:307–314.
56. Tyrer P, Cooper S, Salkovskis P, Tyrer H, Crawford M, Byford S, Dupont S, Finnis S, Green J, McLaren E, et al.: **Clinical and cost-effectiveness of cognitive behaviour therapy for health anxiety in medical patients: a multicentre randomised controlled trial.** *Lancet (London, England)* 2014, **383**:219–225.
57. Fallon BA, Petkova E, Skritskaya N, Sanchez-Lacay A, Schneier F, Vermes D, Cheng J, Liebowitz MR: **A double-masked, placebo-controlled study of fluoxetine for hypochondriasis.** *J Clin Psychopharmacol* 2008, **28**:638–645.
58. Greeven A, Van Balkom AJLM, Visser S, Merkelbach JW, Van Rood YR, Van Dyck R, Van Der Does AJW, Zitman FG, Spinhoven P: **Cognitive behavior therapy and paroxetine in the treatment of hypochondriasis: A randomized controlled trial.** *Am J Psychiatry* 2007, **164**:91–99.
59. Fallon BA, Ahern DK, Pavlicova M, Slavov I, Skritskaya N, Barsky AJ: **A randomized controlled trial of medication and cognitive-behavioral therapy for hypochondriasis.** *In American Journal of Psychiatry.* . 2017:756–764.