Is cyberchondria a new transdiagnostic digital compulsive syndrome? A systematic review of the evidence

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ABSTRACT

Background: Cyberchondria (CYB) has been described relatively recently as a behaviour characterized by excessive online searching for medical information that is associated with increasing levels of health anxiety. Although CYB has received some attention from researchers, there is no consensus about many of its aspects.
Aims: We describe one of the first reported cases of a treatment-seeking patient with CYB. We review the published literature on the definition of CYB, its assessment, epidemiology, cost and burden, psychological models and mechanisms associated with CYB, relationships between CYB and mental disorders and prevention and treatment strategies.
Methods: Systematic review of all peer-reviewed papers published within the PubMed, PsycINFO, and Cochrane Library databases.
Results: 61 articles were selected. Nearly all the studies were descriptive and cross-sectional recruiting sample mainly from the general/university student population and collecting self-report data via online surveys. Data on epidemiology, clinical features, course, comorbidity and therapeutic interventions were scarce. CYB showed a self-reported association with health anxiety, hypochondriasis and obsessive-compulsive disorder (OCD) as well as other forms of problematic usage of the internet (PUI) The psychological mechanisms associated with CYB include low self-esteem, anxiety sensitivity, intolerance of uncertainty, pain catastrophizing and certain meta-cognitive beliefs.
Conclusion: A working definition of CYB includes excessive online health searches that are compulsive and may serve the purpose of seeking reassurance, whilst leading to a worsening of anxiety or distress and further negative consequences. CYB represents a clinically relevant transdiagnostic compulsive behavioural syndrome, closely related to PUI and usually presenting in association with health anxiety, hypochondriasis and/or OCD. CYB is clearly in need of further study and we identify key areas for future research.

Contents

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1. Case report

A 30-year-old male with no past psychiatric history referred himself to a primary care cognitive behaviour therapy (CBT) service. Nine months before, after ingesting 3,4-methylenedioxymethamphetamine (MDMA), he experienced a panic attack. Subsequently, he had been experiencing intrusive thoughts that the MDMA had damaged his brain causing schizophrenia. He had become hypersensitive to sounds and movements and misinterpreted them as evidence of psychopathology. He coincidentally developed worries that he might have inherited heart disease from his parents and misinterpreted his heart rhythm as irregular. He engaged in compulsive pulse-checking and repeatedly visited his general practitioner, resulting in two normal ECGs and reassurance that he does not suffer with schizophrenia. He attended a counsellor looking for further reassurance he was not psychotic. Lately, he had started compulsively searching the Internet for information about MDMA-induced brain damage or physical disorders, visiting many medical websites and patient forums, ultimately spending several hours a day doing this, which adversely affected his work. He reported the online searching for medical information made him more anxious and increased vigilance, bodily checking, panic symptoms and medical consultation behaviour. He self-medicated with vitamin-D, magnesium, fish oil and multivitamins and reported feeling 75% better, but admitted to residual medical reassurance-seeking that had prompted the self-referral. On psychometric evaluation, he scored 29/54 on the Short Health Anxiety Inventory [1], 44/60 on the Cyberchondria Severity Scale (12 items; [2]) and 18/72 on the Obsessive-Compulsive Inventory-Revised (OCI-R; [3]). On an Internet Severity and Activities Addiction Questionnaire (developed from Young's Internet Addiction Test, [4]), he scored in the severe range for online gaming, moderate for pornography use and severe for video streaming. However, he denied that these online activities were distressing or functionally disabling. Therefore, a sole diagnosis of ICD-11 hypochondriasis (DSM-5 illness anxiety disorder) was made. His preferred treatment was to undergo cognitive behavioural therapy (CBT) involving elements of exposure and response prevention targeting compulsive online health searches and reassurance-seeking. After the assessment, he initially reported feeling better and asked to be discharged without further treatment but six months later, re-presented with a recurrence of similar symptoms.

2. Background

Medical information is nowadays widely available and easily accessible on the Internet, even in low-income countries. In a survey of >12,000 people across 12 different countries, 12% to 40% of the population searched the Internet frequently for medical information, with nearly one in two doing so to make a self-diagnosis [5]. A 2010 general population poll revealed that 88% of Internet users in the United States searched for medical information online and 62% of users searched for such information in the past month [6]. Another survey carried out in the United Kingdom reported an increase in all Internet activities from 2007 to 2016, at which point 82% of adults (41.8 million) used the Internet every day or almost every day. Whereas reading online news, newspapers or magazines showed the largest increase over this period, using the Internet to look for health-related information had reportedly increased by 33% to 51% of those surveyed [7].

Accessing medical information online represents a rational strategy for the public, as the information is readily accessible, searches are anonymous, convenient and thereby potentially cost-effective. When accessing evidence-based and trustful sources of information, online health searches may potentially have an empowering effect on users, helping them to make better-informed choices about their health and healthcare, and help specific population groups such as those in lower- and middle-income countries with difficulties accessing face-to-face healthcare services [5,8]. However, online searching for medical information also presents challenges, because Internet users may be vulnerable to becoming overwhelmed with conflicting, ambiguous or inaccurate advice when facing a preponderance of unregulated, poor-quality information. Furthermore, the information returned by popular search engines may be biased toward sensational, rare or potentially life-threatening conditions, thus unnecessarily heightening perceived risk [9–14]. It is therefore not surprising that the Internet is a fertile ground for those with elevated medical concerns who conduct detailed online investigations into their perceived conditions. Moreover, the Internet has increased patients' inclination to self-diagnose, which has

been associated to heightened anxiety in patients and interferences with doctor-patient relationship [15]. Of note, the proposed ICD-11 is expected to include a new definition of hypochondriasis (mostly corresponding to illness anxiety disorder in DSM-5) for which "information seeking" related to the preoccupation with or fear of having a serious disease represents a core diagnostic feature [16].

Cyberchondria (CYB) is closely related to online searching for medical information. The name was coined in the mid-1990s by the UK press from a combination of the terms "cyber" and "hypochondriasis" [17]. Over the following several years the term CYB was widely used in the popular media and later in the scientific publications, referring to anyone seeking information about health or illness on the Internet or denoting a definable mental disorder. CYB currently denotes a recognizable but incompletely defined syndrome characterized by repetitive online searches for medical information associated with an increase in health anxiety [18]. While some authors consider the Internet as simply a modern conduit for medical checking [13,18,19], others underline the clinical importance of CYB as a potentially novel form of compulsive digital behaviour. Compulsions may be defined as stereotyped behaviours, performed according to rigid rules and designed to reduce or avoid unwanted consequences [20]. In this context, digital health related checking is thought to have a specific reinforcing effect on CYB, increasing symptom severity, levels of distress, functional impairment and healthcare utilization, with significant public health implications [21,22].

The extent to which CYB represents a new, separate and autonomous disorder or a common phenomenological manifestation present in a range of established psychiatric disorders, remains under investigation [18,23]. Various manifestations of CYB share phenomenology with a variety of psychiatric disorders. For example, CYB appears to be repetitive, compulsive and time-consuming, similar to the compulsions of obsessive-compulsive disorder (OCD). Alternatively, CYB may constitute a reassurance-seeking safety behaviour, motivated by either a heightened state anxiety, similar to an anxiety disorder such as generalized anxiety disorder or panic disorder, or driven by doubt and uncertainty about having a serious disease, suggestive of hypochondriasis. Furthermore, the need for certainty, which drives some forms of CYB, may reflect an underlying obsessive-compulsive personality disorder, which has been reported to accompany hypochondriasis [24,25], or CYB may represent a somatic compulsion integral to OCD. Importantly, CYB also manifests characteristics in common with an emerging group of disorders involving problematic usage of the Internet (PUI), such as Internet gaming disorder [26] or gaming disorder [27] that are currently conceptualized within a framework of behavioural addiction and for which the distressing loss of control over online activity, resulting in time-consuming, compulsive behaviour, represents a major source of interference with functioning.

3. Aims

The present study first aims to review several aspects of CYB: its definition, assessment, epidemiology (prevalence, age, gender distribution, and course), cost and burden, relevant psychological models and mechanisms, prevention, and treatment strategies. The study also reviews the relationships between CYB and other psychopathological correlates. Following this, we propose a working definition of CYB, identify limitations of the research conducted thus far, draw conclusions based on the available evidence and suggest directions for further research that are likely to advance the field.

4. Methodology

A systematic literature review of all online published papers (until September 2019) on CYB was conducted on PubMed, PsycINFO, and Cochrane databases using the keywords "Cyberchondria" and "Cyberchondriasis". Inclusion criteria were: 1) articles written in English; 2) articles in which the concept of CYB was named or specifically defined and addressed. The Authors considered as exclusion criteria: 1) articles without an abstract; 2) articles with incomplete information (e.g., no authors listed); 3) articles that broadly described "search on the Internet for health-related information" without describing CYB. To augment the search, the reference lists of selected articles were also screened, using the same inclusion and exclusion criteria.

We additionally assessed the quality of the articles presenting original data ($n = 36$) using the Appraisal Tool for Cross-Sectional Studies (AXIS tool) [28]. This scale is designed for non-experimental research and consists of 20 items (coded as "yes", "no" or "do not know/comment") that measure aspects of study quality including appropriateness of study design for stated aims, justification of sample size, representativeness of the sample, reliability of survey instruments, description of statistical methods, and reporting of funding and conflicts of interest.

Informed consent was obtained from the patient for publication of this anonymised case report.

5. Results

5.1. Published studies about CYB

Fig. 1 and Table 1 show the search results in detail. In total, 61 publications about CYB were selected for review. These included 36 original articles, 6 reviews, 16 others (book chapter, dissertation, editorial), 1 case report, and 2 methodological descriptions of randomized controlled treatment trials, both still underway.

Considering a general overview of the search results, nearly all the published studies were descriptive and cross-sectional in design. There was only one experimental study in which participants were assessed before, during and after monitored online health searches [29]. Nearly all study-samples were recruited from the general or university student population, mainly via online surveys. Only two studies recruited a clinical sample, one consisting of outpatients from two general hospitals [30] and the second including outpatients from two orthopaedic clinics [31]. In the first study participants were assessed with self-report questionnaires only, while in the latter study subjects were approached by a research assistant.

Considering selected articles, no characterization of CYB in clinical samples of patients with mental disorders was present. However, there was one case report of a 31-year-old male who presented with chronic pain and arrived at the wrong self-diagnosis and implemented inadequate self-treatment as a consequence of extensive online searching for medical information [32].

With respect to the quality of selected studies, the AXIS tool does not include a numerical scale that can be used to produce quality assessment score, but a greater number of positive answers ("yes") and a correspondingly higher score on the AXIS tool reflects a lower risk of bias (higher study quality) (see Supplementary Table 1). Overall, the quality of the studies appeared to be moderate (mean score = 14.8 ± 2.3). Twenty-three studies (64%) [2,10,21,22,29,31,33–49] met most of the AXIS tool criteria (scores ≥15 out of 20), suggesting high quality. Twelve articles (33%) showed moderate quality (scores between 10 and 14 out of 20) [13,30,50–59] and only one study [60] showed poor quality (score < 10).

5.2. Definition of cyberchondria

Although the phenomenology of CYB has been described, there is as yet no consensus on the definition of CYB [61]. CYB is not specifically mentioned in the DSM-5 but is obliquely referred to in the description of the diagnostic features of Illness Anxiety Disorder, where it is stated that patients "research their suspected disease excessively (e.g., on the Internet)" [21,p.,316]. In the proposed ICD-11, CYB is not specifically addressed, but "information seeking" is listed as one of the behaviours that
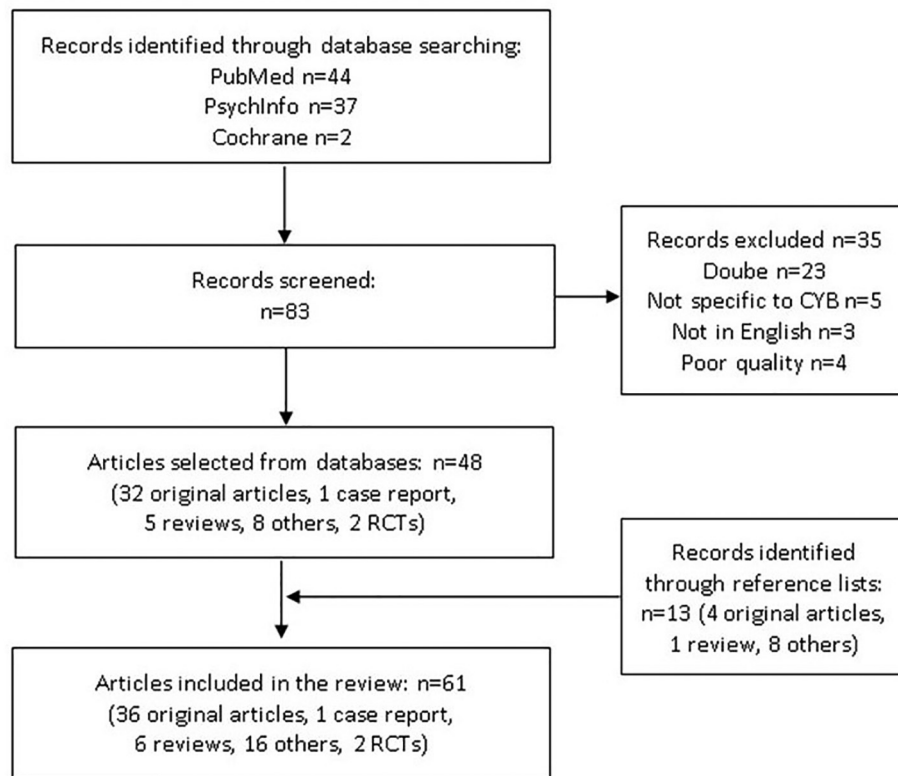
Fig. 1. flowchart of selected articles.

occur in relation to the preoccupation or fear of having a disease within the core diagnostic features of hypochondriasis [27].

A consensus definition constitutes an important first step toward allowing standardized investigation to take place. In this review, we were unable to find reports of expert consensus statements or studies aiming to achieve consensus on a definition of CYB, e.g., via Delphi methodology. Considering the 59 papers that reported a definition of CYB (the two RCTs were excluded since no extended manuscript was available), all considered "use of the Internet" and 53 (89.8%) considered "increase in anxiety" to be fundamental criteria for CYB. "Compulsive or repetitive behaviour" was a commonly cited criterion by 39 authors (66.1%); "reassurance-seeking behaviour" was cited by 20 authors (33.9%), "time-consuming activity" by 5 authors (8.5%), and "inability to be reassured" by 6 authors (10.2%) (see Table 1 and Supplementary Table 2 for the extended definition of CYB).

Some of the first reported definitions of CYB focused exclusively on anxiety following the use of the Internet in searching for health-related information [62–65]. According to Taylor and Asmundson [66], CYB is difficult to stop because it produces a temporary reduction in anxiety, and over time may become a habitual response. A large-scale study of 515 individuals' health-related search experiences concluded that CYB could be defined as "an unfounded escalation of concerns about common symptomatology based on the review of search results and literature on the Web" [13]. More specifically, the authors found that searching for common, likely innocuous symptoms, could escalate into the search of more serious, rare, conditions that are linked to the common symptoms. Moreover, they reported that this escalation was associated with the distribution of medical content viewed by users, the presence of escalatory terminology in online pages visited, and a user's predisposition to escalate versus to seek more reasonable explanations for the illness. Lastly, the authors demonstrated the persistence of short- and long-term post-session anxiety following escalations and unnecessary costs in time, distraction, and engagements with medical professionals. However, this sample consisted of online volunteers, without reference to the level of anxiety or other psychiatric

characteristics, and the study did not use psychometrically validated clinical instruments, making it unclear how to evaluate the reported severity of illness anxiety or change in anxiety with Internet usage.

Starcevic and Berle [18,61] further developed the concept of CYB and attempted to obtain a consensus on the definition by reviewing the literature published so far. CYB was conceptualized as "an excessive or repeated search for health-related information on the Internet, driven by distress or anxiety about health, which only amplifies such distress or anxiety". Compared to the definition of White and Horvitz [13], the authors underlined a characteristic obsessive-compulsive behavioural pattern involving preoccupation with somatic concerns coupled with compulsive searching that is recurrent and time-consuming. They also drew attention to the fact that CYB is not an activity that people engage in because it is directly rewarding (in contrast to people who search on the Internet for health-related information and feel relieved after it). On the contrary, CYB is associated with negative emotional states, often in the form of heightened anxiety or distress persisting after searching.

Contemporaneously, McElroy and Shevlin [42] described CYB as a multi-dimensional construct reflecting elements of both anxiety and compulsiveness, involving "an increase in anxiety about one's own health status, as a result of excessive reviews of online health information" that includes the two main cognitive-emotional domains: excessiveness and heightened anxiety. They suggested that online medical information seeking in CYB was motivated in part by compulsivity, defined as a drive to conduct online medical searches that interrupts other activities, as well as anxiety related to physical symptoms. In a more recent paper, some of the same authors suggested re-conceptualising CYB as a distinct syndrome [22], as although subjects with health anxiety are more likely to search for health-related information on the Internet, even individuals with no prior health anxiety may experience distress as a result of such searches [12].

Taking the available data into account and combining the most recent published conceptualizations, we tentatively propose a working definition for CYB (see Fig. 2), which may be useful for future research and should be refined as new data become available. The time-

Table 1
Articles included in the review* and the criteria used for defining Cyberchondria.

Author	Country	Type of article	Use of the Internet	Increase in anxiety	Compulsive or repetitive behavior	Reassurance seeking behavior	Time consuming activity	Inability to be reassured
Bajcar B et al., 2019 [52]	PL	OA	Yes	Yes	Yes (excessive)	Nr	Nr	Nr
Bajcar B and Babiak J, 2019 [46]	PL	OA	Yes	Yes	Yes	Yes	Nr	Nr
Blackburn J et al., 2019 [31]	US	OA	Yes	Yes	Yes	Nr	Nr	Nr
Eichenberg C and Schott M, 2019 [53]	AT	OA	Yes	Yes	Yes (excessive)	Yes	Nr	Yes
Gibler RC et al., 2019 [54]	UK	OA	Yes	Yes	Yes	Yes	Nr	Yes
Makarla S et al., 2019 [47]	IN	OA	Yes	Yes	Yes	Yes	Yes (compromises important everyday activities)	Yes
McElroy E et al., 2019 [2]	UK	OA	Yes	Yes	Yes	Nr	Yes	Nr
McMullan RD et al., 2019 [77]	AU ES	R	Yes	Yes	Yes	Nr	Yes	Nr
Starcevic V et al., 2019 [22]	AU	OA	Yes	Yes	Yes	Yes	Yes	Nr
Tyrer P et al., 2019 [55]	UK	OA	Yes	Yes	Yes	Nr	Nr	Nr
Wijesinghe CA et al., 2019 [30]	IN	OA	Yes	Yes	Yes	Nr	Nr	Yes
Bati AH et al., 2018 [48]	TR	OA	Yes	Yes	Yes (excessive)	Nr	Nr	Nr
Batigun AD et al., 2018 [56]	TR	OA	Yes	Yes	Yes	Nr	Nr	Nr
Fergus TA and Spada MM, 2018 [49]	US	OA	Yes	Yes	Yes (inability to refrain or terminate)	Nr	Nr	Nr
Mathes BM et al., 2018 [21]	US	OA	Yes	Yes	Yes	Yes	Nr	Nr
Selvi Y et al., 2018 [57]	TR	OA	Yes	Yes	Nr	Yes	Nr	Nr
Tyrer P, 2018 [87]	UK	R	Yes	Nr	Yes (excessive)	Nr	Nr	Nr
Tyrer P and Tyrer H, 2018 [89]	UK	R	Yes	Nr	Yes	Nr	Nr	Nr
Uzun SU and Zencir M, 2018 [58]	TR	OA	Yes	Yes	Yes	Nr	Nr	Nr
Zielinska, OA, 2018 [118]	US	OT	Yes	Yes	Yes	Nr	Nr	Nr
Fergus TA and Spada MM, 2017 [33]	US	OA	Yes	Yes	Yes	Nr	Nr	Nr
Jutel A, 2017 [15]	NZ	OT	Yes	Yes	Nr	Nr	Nr	Nr
Starcevic V, 2017 [12]	AU	OT	Yes	Yes	Yes	Nr	Yes	Nr
Barke A et al., 2016 [34]	DE	OA	Yes	Yes	Yes	Yes	Nr	Nr
da Silva FG et al., 2016 [60]	BR	OA	Yes	Yes	Yes	Nr	Nr	Nr
Doherty-Torstrick ER et al., 2016 [10]	US	OA	Yes	Nr	Yes	Nr	Nr	Yes
Fergus TA and Russell LH, 2016 [35]	US	OA	Yes	Yes	Yes	Yes	Nr	Nr
te Poel F et al., 2016 [59]	NL	OA	Yes	Yes	Nr	Nr	Nr	Nr
Fergus TA, 2015 [36]	US	OA	Yes	Yes	Yes	Yes	Nr	Nr
Holyoake DD and Searle K, 2015 [8]	UK	OT	Yes	Yes	Yes (excessive)	Nr	Nr	Nr
Norr AM, Albanese BJ et al., 2015 [37]	US	OA	Yes	Yes	Yes	Nr	Nr	Nr
Norr AM, Allan NP et al., 2015 [38]	US	OA	Yes	Yes	Nr	Nr	Nr	Nr
Norr AM, Oglesby ME et al., 2015 [39]	US	OA	Yes	Yes	Yes	Yes	Nr	Nr
Singh K and Brown RJ, 2015 [29]	UK	OA	Yes	Yes	Yes (excessive)	Yes	Nr	Nr
Starcevic V and Aboujaoude E, 2015 [23]	US	OT	Yes	Yes	Yes	Yes	Nr	Nr
Starcevic V and Berle D, 2015 [61]	AU	OT	Yes	Yes	Yes	Yes	Nr	Nr
Aiken M and Kirwan G, 2014 [80]	UK	OA	Yes	Yes	Nr	Nr	Nr	Nr
Anandkumar S, 2014 [32]	IN	CR	Yes	Yes	Yes (excessive)	Nr	Nr	Nr
Bodoh-Creed JA, 2014 [19]	US	OT	Yes	Nr	Nr	Nr	Nr	Nr
Fergus TA, 2014 [41]	US	OA	Yes	Yes	Yes	Nr	Nr	Nr
Fergus TA and Dolan SL, 2014 [50]	US	OA	Yes	Yes	Yes	Nr	Nr	Nr
McElroy E and Shevlin M, 2014 [42]	UK	OA	Yes	Yes	Yes	Nr	Nr	Nr
McManus F et al., 2014 [43]	UK	OA	Yes	Yes	Yes	Yes	Nr	Nr
Fergus TA, 2013 [44]	US	OA	Yes	Yes	Nr	Nr	Nr	Nr
Ivanova E, 2013 [51]	BJ	OA	Yes	Yes (concerns)	Nr	Nr	Nr	Nr
Loos A, 2013 [17]	US	OT	Yes	Nr	Nr	Yes	Nr	Nr
Starcevic V and Berle D, 2013 [18]	AU	OT	Yes	Yes	Yes	Yes	Nr	Nr
Aiken M et al., 2012 [40]	UK	R	Yes	Yes (concerns)	Nr	Nr	Nr	Nr
Muse K et al., 2012 [45]	UK	OA	Yes	Yes	Nr	Nr	Nr	Nr
Hart J and Björgvinsson T, 2010 [86]	US	R	Yes	Nr	Nr	Yes	Nr	Nr

Table 1 (*continued*)

Author	Country	Type of article	Use of the Internet	Increase in anxiety	Compulsive or repetitive behavior	Reassurance seeking behavior	Time consuming activity	Inability to be reassured
Recupero PR, 2010 [64]	US	OT	Yes	Yes (fears)	Nr	Nr	Nr	Nr
White RW and Horvitz E, 2009 [13]	US	OA	Yes	Yes (concerns)	Nr	Nr	Nr	Nr
Harding KJ et al. 2008 [63]	US	R	Yes	Yes	Nr	Nr	Nr	Nr
Ravdin LD, 2008 [84]	US	OT	Yes	Yes	Nr	Yes	Nr	Nr
Ryan A and Wilson S, 2008 [65]	UK	OT	Yes	Yes	Nr	Nr	Nr	Nr
Belling CF, 2006 [62]	US	OT	Yes	Yes	Nr	Nr	Nr	Nr
Taylor S and Asmundson GJG, 2004 [66]	CA	OT	Yes	Yes	Nr	Yes	Nr	Yes
Stone J and Sharpe M, 2003 [14]	UK	OT	Yes	Yes	Yes (excessive)	Nr	Nr	Nr
Taylor H, 1999 [73]	US	OT	Yes	Nr	Nr	Nr	Nr	Nr

Legend: AT: Austria; AU: Australia; BJ: Bulgaria; BR: Brazil; CA: Canada; DE: Germany; ES: Spain; IN: India; NL: The Netherlands; NZ: New Zealand; PL: Poland; TR: Turkey; UK: United Kingdom; USA: United States. CR: case report; OA: original article; OT: other design; R: review. Nr: not reported. *: the 2 Randomized Controlled Trials are not reported in Table 1 because both are still underway and only methodological description is published.

consuming nature of CYB has been suggested in some articles, although without criteria for the frequency or duration of online health searches. Following the ICD-11 approach to defining gaming disorder and other forms of behavioural addiction [67], we have proposed additional criteria for CYB that involve impaired control over online health searches, increasing priority given to this behaviour over other activities to the extent that online health searches take precedence over other interests and daily activities, and continuation or escalation of online health searches despite their negative consequences.

Our vignette demonstrates some of the features of this proposed definition. Thus, the patient reported compulsively searching the Internet for medical information aiming for reassurance that he was not suffering from a serious disease. The searching interfered with his functioning and was continued despite his awareness of the negative consequences in terms of heightened anxiety, distress and further checking behaviours.

5.3. CYB measurement - assessment tools

In 2014, McElroy and Shevlin produced the first self-report measure for CYB [42]. The *Cyberchondria Severity Scale* (CSS) was designed as a continuous severity measure. The original version consisted of 43 items describing behaviours and emotions generated from a review of existing literature on CYB and conceptually similar anxiety disorders. After an exploratory factor analysis (on 190 subjects), 10 items of low factor loading were removed. The final version of the CSS included 33 statements with a 5-point scale response (1 - Never, 2 - Rarely, 3 - Sometimes, 4 - Often, 5 - Always). The CSS is divided into five factors or subscales: (1) Compulsion, describing how excessive online medical research impedes both online and offline activities; (2) Distress, associated with researching health information online; (3) Excessiveness, describing the extent of the multiple and repeated research for medical information; (4) Reassurance, indicated by the resulting increased anxiety and need to consult with a medical professional about the information acquired from the Internet; (5) Mistrust of Medical Professionals, reflecting greater confidence in medical information from the Internet than from the doctor. The authors found that CSS total scale reported good internal consistency (Cronbach's $\alpha = 0.94$) and significantly correlated with symptoms of depression ($r = 0.24$), anxiety ($r = 0.43$), and stress ($r = 0.37$), assessed using the short form version of the Depression, Anxiety and Stress Scale (DASS-21) [68].

Other authors have assessed the validity of the 33-items CSS, with a particular focus on the last factor ("Mistrust of Medical Professionals"). Fergus [41] took a community sample of 539 adults, whose data were collected via the Internet and found that the "Mistrust of medical professionals" factor did not assess the same construct as the other factors of the CSS on a second-order confirmatory factor analysis (CFA). Therefore, Fergus [41] proposed that this factor should be excluded from the

CSS total score. However, "Mistrust of Medical Professionals" did correlate with health anxiety as measured by the Short Health Anxiety Inventory (SHAI [1];) and Fergus [41] hypothesized that the mistrust factor of the CSS might be better conceptualized as assessing dysfunctional beliefs related to health anxiety, rather than CYB per se. In a community sample of 526 adults whose data were collected online, Norr and colleagues [38] reported that a "Mistrust of Medical Professionals" factor and a separate General Cyberchondria factor, with orthogonal "Compulsion", "Distress", "Excessiveness", and "Reassurance" factors, provided a superior fit to the data. Moreover, compared to the study by Fergus [41], no correlation between "Mistrust of medical professionals" and SHAI-assessed health anxiety was found. These data have generated controversy, with authors considering how the "Mistrust of Medical Professionals" factor should best be evaluated [38]. For this reason, in several consequent studies the CSS was used without the "Mistrust of Medical Professionals" factor and McElroy and colleagues further developed a shortened version of the CSS (CSS-12) using just 12 items (3 question for each of the 4 of the original factors, omitting the "Mistrust of Medical Professionals" factor) [2]. This version was validated in a sample of 661 undergraduates and demonstrated good psychometric properties overall, with excellent internal consistency (Cronbach's $\alpha = 0.90$). Confirmatory bi-factor modelling indicated that the CSS-12 is best scored as a unidimensional scale. Construct validity was assessed by examining associations with the SHAI and GAD-7 [69], with stronger correlations found between the CSS-12 and SHAI, compared to the GAD-7.

The original CSS was subsequently translated and validated in Polish [52], Turkish [57,70], and German [34], and translated in Portuguese [60]. The Mistrust of Medical Professionals items were excluded from the Polish version of the CSS, while demonstrating a poor consistency in the Turkish version [57]. The German version found a high internal consistency for the CSS even with the Mistrust of Medical Professionals items included [34], and the same authors developed a shorter version with 15 items (consisting of 3 items that in the original version loaded highest on each of the 5 factors).

A different self-report scale, the *Cyberchondria Scale*, has been developed and validated in Turkey [56]. This scale consists in 27 items with a 1–5 Likert type scoring and includes 5 factors: "Increasing Anxiety", "Compulsion/Hypochondria", "Decreasing Anxiety", "Doctor-Patient Interaction", and "Dysfunctional Internet Use". Although this questionnaire might potentially be an alternative assessment tool to measure CYB, further studies are needed to confirm its psychometric properties and to extend its use to other samples.

In conclusion, cross-culturally validated self-rated assessment tools have been developed for measuring CYB severity in non-clinical cases. Although there are arguments in favour of removing the "Mistrust of Medical Professionals" items from the original CSS to improve internal consistency, studies of the original 33-item CSS and a shortened 15-item version that included all 5 factors (compulsivity, distress,

Working Definition of Cyberchondria

A pattern of excessive searching on the Internet for medical or health-related information with the following features:

- Searching is compulsive, hard to resist and serves the purpose of seeking reassurance;
- Initial relief, if obtained, through online searching is short-lived and anxiety or distress usually worsens during these searches and persists afterwards;
- Online searching takes precedence over other interests or daily activities and continues or escalates despite the occurrence of negative consequences associated with the searching.

Fig. 2. Working definition of cyberchondria.

excessiveness, reassurance, mistrust of professionals) have nevertheless shown adequate construct validity. Shortened versions of the scale are likely to be more useful for clinical and research application. However, none so far have been tested to evaluate the full range of severity in patients seeking treatment for psychiatric disorders, whose scores arguably may fall at the more severe end of the range, or have demonstrated sensitivity *to change in severity*, which is an essential ingredient for a treatment study. Arguably, while the nosological status and definition of CYB remain controversial, a version of the CSS that retains the "Mistrust" items might be more suitable in the clinical practice but has still to be tested.

5.4. Epidemiology of CYB

5.4.1. Prevalence of CYB

Interned use is a widespread phenomenon, with an estimated 4.5 billion Internet users worldwide (June 2019), mostly located in Asia (50.7%), followed by Europe (16%) and Africa (11.5%). However, North America has the greatest Internet penetration rate (% of population using the Internet) at 89.4%, with Europe at 87.7%. The world average Internet penetration rate is 58.8%, indicating that the Internet has become the established medium for the dissemination of targeted messages to a huge audience [71]. Due to the considerable amount of information available online and its accessibility, searching on the Internet for health-related information has become common. Different national and international surveys reported that 70% to 80% of Internet users used the web specifically for health advice, support and/or in preparation for a medical appointment [5,6,40,72,73]. The Internet has become in some occasions a substitute for medical professionals, as reported in a survey of >12,000 individuals across 12 countries showing that nearly half of participants used the search engine "Google" for self-diagnosis [5]. In a survey conducted in Europe, younger subjects (aged 30–44 years) were reported as the most active users of the Internet for health information [74], but this might have reflected age-dependent patterns of general Internet usage. The majority of health information seekers (66%) started their searches using general search engines such as "Google" or "Yahoo", with 27% using a specific health-related website to start searching [75].

Since no consensus definition and no diagnostic criteria exist for CYB, no reliable data on the prevalence of CYB are present in the literature. In an online survey of 515 volunteers [13], escalation of concerns about common symptomatology, defined as the intensification of searching for common symptoms to serious concerns during online searching, and a relationship with anxiety and searching behaviours

were described. In those describing a low level of health anxiety at baseline, Web-based escalation of concerns occurred frequently ("Always" or "Often") in around 20% of participants, while 40% reported that interactions with the Web increased anxiety about medical problems. Moreover, 40% of participants reported experiencing behavioural changes related to online searches (increased searches, more web pages visited, more frequent engagement with physicians and medical specialists). To the best of our knowledge, this [13] is the only article that has reported prevalence data on CYB-related phenomena and behaviours in the general population. The results suggested that for a substantial proportion of the population, searching on the Internet for health-related information contributed to CYB. Interestingly, the same article reported that searching on the Internet for health-related information reduced anxiety in approximately one half of the sample.

In a recent investigation [30], 300 outpatients from two general hospitals in Sri Lanka were collected and assessed with self-reported questionnaires, including the CSS-33 items [42]. Authors reported a CYB prevalence rate of 16.3%. They considered the presence of any CSS factors as being indicative of CYB, however they did not specify the threshold they used to endorse the presence of any factors. In addition, the assessment was made using only self-report questionnaires and no characterization of anxiety disorder or other mental disorder was made.

Another recent investigation [47] recruited 205 employees working in various information technology companies in India. Participants were assessed via an online survey with the CSS-15 items [34] with the subsequent exclusion of the "Mistrust of medical professional" factor. Using a cluster analysis, two clusters emerged. Individuals with higher cluster scores centered on all the four CSS factors were classified as "cyberchondria". This cluster accounted for 55.6% of the total sample and was referred by the authors as CYB prevalence. Notably, since no consensus definition of CYB exist in the literature, these two studies arbitrarily used their own definition of CYB using two different methodologies. Moreover, neither the CSS-33 nor the CSS-15 has been thoroughly validated in the respective populations.

5.4.2. Age and gender distribution

In the absence of a consensus definition, data reliably linking CYB with sociodemographic variables including age and gender are scarce. Some articles found interesting correlations with CSS score. For example, in a sample consisting of 292 healthy adult subjects studied via an online survey, Barke and colleagues [34] reported that age was unrelated to the CSS total score but showed a small positive correlation with the subscale "Mistrust of health professionals" ($r = 0.21$), i.e., the older a person was, the more he or she mistrusted health professionals.

Independent *t*-tests showed that women reported a higher CSS score (61.3 ± 15.1) than men (56.7 ± 16.6). Doherty-Torstrick and colleagues [10] conducted an online survey in 720 community and student volunteers. They did not characterize CYB specifically but divided the sample into low and high illness anxiety, using a cut-off on the Whiteley Index [76]. On continuous and dichotomous regression models, they found that older participants were less likely to experience worsening of anxiety during and after online searching for medical information than younger participants. Although there was a greater proportion of females in the total sample, gender was not a significant predictor of increased anxiety before or during online health searches. Similar results were reported by Bajcar and colleagues [52] who found no effect of gender, but a significant negative effect of age on the CSS scores. The authors suggested that this result could be explained by the likelihood of younger adults using the Internet more than older adults, though the amount of time spent on the Internet was not measured. Another investigation conducted on University students reported male's scores on "compulsion" and "mistrust of medical professional" factors to be higher compared to female gender, with no gender difference on total CSS score [48].

5.4.3. Course of CYB

The course of CYB is not well understood as there have been no prospective long-term studies. In our vignette, the patient reported a fluctuating course of CYB over at least 12 months. Different studies have reported the correlation between online health searches and subsequent anxiety [13,29,45,59,77–80]. The studies were not conducted in clinical samples, however, and the anxiety reported was largely measured retrospectively through survey questions [13,45]. In at least one study, CYB-associated anxiety was reported to be associated with impaired functioning. For example, in the survey by White and Horvitz [13], approximately 60% of respondents reported interruptions to both online and offline activities as a result of worrying about health searches. Moreover, health-related Internet use was found to be associated with small but reliable increases in depression over an 8-month period in one longitudinal study [81].

5.5. Cost and burden of CYB

In our vignette, the patient reported reduced work performance and increased health care utilization (frequent requests for medical consultation) related to excessive online health searches. However, no studies so far have directly measured the health-economic costs of online health searches. In contrast, there is robust evidence suggesting that those with higher health anxiety represent a significant economic burden. In the UK, direct and indirect costs associated with health anxiety amounted to an estimated £56 million a year [82]. Across Europe, direct and indirect costs of all somatoform disorders, the grouping where hypochondriasis were previously included, accounted for 21 billion € in 2010 [83]. CYB may be responsible for a significant proportion of this amount, as previous investigations reported that those who searched for health information online frequently ended their search sessions with queries about local healthcare services [13]. Moreover, general online health searches have been associated with deterioration in the doctor-patient relationship [84], which in turn may lead to unnecessary healthcare costs.

Barke and colleagues found that CYB (measured by the CSS) was moderately correlated ($r = 0.29$) with healthcare utilization, measured by the number of visits to GPs and a range of other health professionals during the previous year [34]. Nonetheless, whether this relationship with healthcare utilization is unique to CYB remains unclear since the result was not controlled for health anxiety. In a further study, Mathes and colleagues used the CSS to investigate the association between CYB and health anxiety and the relationship with impairment, quality of life, and service utilization in a sample of 462 community participants recruited via online crowdsourcing [21]. Subjects were administered a battery of self-report questionnaires assessing CYB, health anxiety and public health outcomes. Using structured equation modelling, the authors found that, when accounting for the overlap between CYB and health anxiety, CYB was strongly associated with greater functional impairment. This result suggests that CYB may specifically contribute to significant impairment, separate from the effect of health anxiety. Interestingly, when accounting for health anxiety, CYB was not associated with decreased quality of life. In interpreting these results, the authors proposed functional impairment and quality of life as distinct concepts (the former representing inability to engage in daily activities, the latter referring to an overall level of satisfaction in different areas of life) and speculated that individuals with CYB may be satisfied, but nevertheless functionally impaired. Interestingly, whereas total CSS scores were not associated with mental or physical healthcare utilization, the CSS domain "reassurance seeking" was strongly associated with physical healthcare utilization and was moderately associated with mental healthcare utilization. Moreover, the CSS "excessiveness" domain was negatively associated with mental healthcare utilization. The authors interpreted these results to indicate that subjects with CYB might have poor insight into their mental health status or perceive mental healthcare professionals unable to help them. Failure to seek appropriate medical care was recognised by the World Health Organisation as a harmful consequence of hypochondriasis [27]. The contribution that CYB makes to this problem, within the context of a full health economic analysis, merits further exploration.

5.6. Clinical comorbidity of CYB

5.6.1. Association with health anxiety and hypochondriasis

CYB has been terminologically and conceptually linked with health anxiety and hypochondriasis. Health anxiety, characterized by excessive concerns about physical health usually in the absence of organic pathology, is proposed to represent a continuum, spanning mild and non-pathological concerns about physical and mental health at one end of the spectrum and hypochondriacal preoccupation on the other [85–89]. A diagnosis of hypochondriasis (illness anxiety disorder in the DSM-5) can be made when preoccupations about health negatively impact on quality of life and functioning and specific diagnostic criteria are met [26,27]. This is the case in the vignette we report, where the patient showed a persistent (>6 months) preoccupation with having a disease (schizophrenia, heart disease), with high levels of anxiety about health and excessive health-related behaviours (checking his hearing and pulse, seeking medical reassurance). However, the published literature addressing the complex relationship between CYB, health anxiety and hypochondriasis often lacks coherence [18,61]. Indeed, all the studies included in the present review focused on the association between CYB and health anxiety, without considering the diagnosis of hypochondriasis. Therefore, we have scarce information on the link between CYB and this diagnosis.

Several studies have found that subjects with elevated health anxiety experience greater anxiety during and after online health searches and report more frequent and longer searches, compared to those with lower or normal levels of health anxiety [10,29,43,45,53,59]. Most of the studies measured health anxiety using the Whiteley Index [76] or various versions of the Health Anxiety Inventory (HAI; [1]). To better characterize this association, a literature review and meta-analysis of 20 studies, including 7373 participants, showed strong positive correlations between health anxiety and online health searches ($r = 0.34$), and between health anxiety and CYB ($r = 0.62$), although a high level of heterogeneity between the studies was found [77]. One interpretation is that CYB represents a reassurance-seeking behaviour integral to health anxiety and may therefore be unlikely to be a distinct construct [18].

Nonetheless, even individuals with low levels of health anxiety may experience increased anxiety when searching online [55,87]. This underlines the importance of other vulnerability factors, apart from health

anxiety, which may contribute to the development of CYB. For instance, online health searches in the absence of any significant anxiety could be a precursor to increased health anxiety that may in turn precipitate further or more detailed searches.

5.6.2. Association with other obsessive-compulsive or related disorders (OCRDs)

In our vignette, although the patient showed obsessive and compulsive features, he reported a low score on the OCI-R and did not qualify for a clinical diagnosis of OCD. His obsessive and compulsive symptoms were viewed instead as integral to hypochondriasis. In the forthcoming ICD-11 classification, hypochondriasis is included in the obsessive-compulsive or related disorders (OCRDs) grouping. Notwithstanding, OCD and hypochondriasis share a number of overlapping diagnostic criteria of relevance to CYB, including obsessive thoughts about illness and compulsive behaviours such as checking and reassurance seeking. However, people with hypochondriasis tend to treat their symptoms as authentically threatening and perceive their thoughts about illness and the accompanying urges to seek reassurance as reasonable (i.e., ego-syntonic), while those with OCD usually perceive their thoughts and urges as unfounded and senseless (i.e., ego-dystonic).

Current definitions of CYB (e.g., Starcevic and Berle, 2013 [18]) emphasise an overlap in phenomenological features between OCD and CYB, including obsessive (intrusive, unwanted, distressing) thoughts about the catastrophic consequences of not checking on health and the consequent compulsive online health searches and checking aimed at neutralising these thoughts. In the context of OCD, repeated searches for medical information may function as a safety behaviour designed to alleviate obsessive responsibility for preventing harm, contamination concerns or other somatic obsessions (e.g., concerns about heart rate being irregular). The OCRDs grouping includes several other disorders, of which, based on phenomenology, CYB might contribute most to body dysmorphic disorder (BDD; preoccupation with disfigurement) and olfactory reference syndrome (ORS; preoccupation with smelling foul). Given the positively reinforcing effect of performing compulsions on obsessive-compulsive symptoms [90], CYB may further contribute to the development or maintenance of various OCRDs.

Several studies have tried to clarify the association between CYB and OCD [35,39,41,46,52]. However, none so far have investigated clinical samples of OCD or ORS or BDD patients but instead relied on OCD symptom scores, e.g., the Dimensional Obsessive-Compulsive Scale (DOCS; [91]) or the Obsessive-Compulsive Inventory Revised (OCI-R; [3]), which were correlated with CSS scores in the general population samples. For instance, Fergus [41] demonstrated a moderate correlation between the CSS and the DOCS total score ($r = 0.49$). Norr and colleagues [39] extended Fergus' study and found that CYB severity correlated with each of the four core DOCS dimensions (contamination, responsibility for harm, unacceptable thoughts, and symmetry) ($r = 0.28–0.55$). A subsequent study Fergus and Russell [35] used confirmatory factor analyses (CFAs) to investigate a degree of the relationship between CYB and OCD symptoms, with the two syndromes appearing distinct. Moreover, regression analyses showed that OCD symptoms did not share associations with CYB after accounting for negative affect and health anxiety, suggesting that CYB might share a closer relationship with depression, anxiety or health anxiety.

Thus, while emerging research indicates moderate to high symptom correlations among health anxiety, OCD and CYB, suggesting that CYB may represent a trans-diagnostic syndrome, there also appears to be a meaningful amount of non-overlapping variance between these constructs, suggesting that CYB may constitute a distinct entity [21,35,39].

5.6.3. Association with problematic usage of the Internet

Problematic usage of the Internet (PUI) is an umbrella term for an emerging range of behaviours characterized by the inability to control Internet use resulting in distress and disability. PUI in its various forms differentially involves addictive, obsessive-compulsive and impulsive behaviours and traits [92]. What appears increasingly clear is that the Internet is not just a passive conduit and may amplify PUI behaviour, especially in vulnerable individuals. Some forms of PUI can be integrated within established models of mental disorder (e.g., ICD-11 gambling disorder, hypochondriasis), while for others, PUI predominates as the defining diagnostic feature (e.g., ICD-11 gaming disorder) [92]. Both gambling disorder and gaming disorder are currently classified in the ICD-11 as disorders "due to addictive behaviours". CYB appears to be a particularly compulsive form of PUI focused on health concerns [50,51]. However, individuals with CYB may excessively use the Internet for other purposes as well [18]. For example, the patient in our vignette also reported excessive Internet gaming, pornography use and video streaming, supporting the notion that CYB may occur within a broader pattern of abnormal Internet use. Indeed, various exploratory studies have found a correlation between CSS and PUI severity [22,33,50,57]. These studies took participants from community samples and PUI was measured with different questionnaires, such as the Problematic Internet Use Questionnaire [93], Internet Addiction Test [4], and the Compulsive Internet Use Scale [94]. In the study by Fergus and Dolan [50], respondents who experienced increased health anxiety following online health searches reported greater PUI than respondents whose online health searches either decreased their health anxiety or had no impact on it. In other studies, a positive correlation between CYB and PUI, unaccounted for age, gender, current medical status, negative affect, or health anxiety was found ($r = 0.59$) [33], and the relationship between CYB and PUI was reported to be even stronger than the one between CYB and health anxiety [22]. Taken together, the results suggest a strong association between CYB and PUI, which merits further exploration in clinical samples using standardized assessment instruments.

5.7. Psychological models and mechanisms

Some authors have investigated the association between CYB and other psychological constructs, using online surveys and collecting self-report data from community samples, with the goal of determining who might be at increased risk.

5.7.1. Low self-esteem

Bajcar and Babiak [46] found a direct association between low self-esteem and higher severity of CYB (measured with the CSS). The direction of the associations remains unclear. Individuals with low self-esteem may be more likely to engage in CYB as an alternative to consulting a clinician face to face. Alternatively, CYB, as a form of PUI, may result in low self-esteem. Moreover, self-esteem was also found to predict CYB indirectly, through increased health anxiety and obsessive-compulsive symptoms. These findings suggest that low self-esteem may represent a vulnerability factor for CYB [46].

5.7.2. Anxiety sensitivity

Anxiety sensitivity is defined as a fear of anxiety-related sensations and symptoms based on beliefs that these sensations and symptoms have harmful physical, psychological, and/or social consequences [95]. Previous studies have suggested a potential role of anxiety sensitivity in the development of a number of anxiety disorders, such as panic disorder, post-traumatic stress disorder, and OCD [96–98]. In a recent investigation, individuals exposed to websites focused on symptoms of medical conditions had significantly higher anxiety sensitivity after website viewing compared to controls (exposed to general health and wellness website) [78]. Moreover, anxiety sensitivity has been linked to CYB, measured with the CSS [36,37]. These results depict anxiety sensitivity as a potential risk factors for the development of CYB. Individuals with elevated anxiety sensitivity may interpret anxiety-related bodily sensations as harmful, making it more likely for them to engage in online health searches in an attempt to reduce concerns about the cause of these sensations. Nonetheless, a further investigation [33] did not confirm these results, possibly because it accounted for the effects of a

greater number of covariates than did the prior studies. This finding raises some doubt about the specific contribution of anxiety sensitivity to CYB, calling for further research.

5.7.3. Intolerance of uncertainty

Intolerance of uncertainty is conceptualized as a cognitive bias whereby individuals consider the possibility of a negative event happening as unacceptable and threatening independently from the probability of its occurrence [99]. Intolerance of uncertainty has been found to be associated with various anxiety-related disorders, including OCD [100–104]. Moreover, Intolerance of uncertainty acts as a significant predictor of elevated health anxiety [105]. A recent investigation has reported a positive association between Intolerance of uncertainty and online searching for medical information [44]. However, other studies of the relationship between Intolerance of uncertainty and CYB (assessed with the CSS) did not produce consistent results [33,36,37], suggesting a need for further investigations to determine whether Intolerance of uncertainty is a risk factor for CYB or only its correlate.

5.7.4. Pain catastrophizing

Pain catastrophizing, conceptualized as a tendency to ruminate and worry about pain, overestimate the severity or feel hopeless when feeling pain [106], has been associated with chronic pain syndromes, and affected individuals are reported to search online for more information about their symptoms [107], resulting in disruption of daily functioning, escalations in health-related worry, excessive health-related checking behaviours and greater healthcare utilization. The association with CYB has been investigated in a single study of undergraduate students [54], resulting that pain catastrophizing is a unique cognitive and emotional factor that independently (accounting for health anxiety and negative affect) contributes to escalations in health-related distress that results from online health searches.

5.7.5. Metacognitive beliefs

Three sets of metacognitive beliefs are relevant to health-related thoughts: biased thinking (e.g., "Worrying about my health will help me cope"), thought-illness fusion (e.g., "Worrying about illness is likely to make it happen"), and beliefs about uncontrollability of thoughts (e.g., "Dwelling on thoughts of illness is uncontrollable") [108]. A link between metacognitive beliefs and PUI has been demonstrated [109]. In a cross-sectional study, a positive correlation between CYB (measured with the CSS) and each of these three metacognitive beliefs was found [33]. The authors proposed a metacognitive model of CYB whereby beliefs about uncontrollability of health-related thoughts may lead individuals to worry about their health and repeated online health searches in an attempt to reduce health anxiety. Nonetheless, these searches result in heightened health anxiety and thereby reinforce beliefs about the uncontrollability of health-related thoughts [33,108]. The same authors found a positive correlation between CYB and beliefs about rituals (i.e., the importance of controlling thoughts and emotional states) and stop signals (i.e., internal signals that indicate when to cease coping efforts) [49] which they included in a metacognitive model of OCD [110] of relevance for understanding of the relationship between OCD and CYB.

5.8. Therapeutic interventions

CYB is poorly recognised and no specific and evidence-based treatments are currently available. Indeed, we were unable to locate any published studies investigating any form of therapeutic intervention for a treatment-seeking sample of individuals with CYB. Nevertheless, given the high frequency of online health searches and their impact on health and wellbeing, medical professionals, especially those working in primary care, should be vigilant for CYB. This pertains particularly to patients presenting frequently with minor complaints or those who seem to avoid contact. If CYB is identified, clinicians should look for possible comorbid disorders (e.g., OCRDs, PUI) and treat these appropriately.

5.8.1. Psychological therapies

Only one randomized controlled trial of treatments for CYB is reported in the Cochrane library [111], but this study is still unpublished, and the results are not yet available. The investigation aimed to compare the effect of an Internet-delivered CBT approach (included components directly targeting excessive online health searches) versus psychoeducation, monitoring and clinical support in a sample of patients with DSM-5 illness anxiety disorder and/or somatic symptom disorder. Several other reports have proposed a cognitive-behavioural approach to managing CYB [18,50,61]. Some authors propose targeting OCD symptoms [35], PUI [50], Intolerance of uncertainty [36], or metacognitive beliefs [49], including obsessive thoughts about health, misinterpretation of bodily symptoms, fear of uncertainty, perfectionist tendencies, and ambivalence about what should be perceived as trustworthy advice. Additionally, behavioural approaches involving exposure and response prevention, found to be particularly helpful for treating OCD [112], may be of value in targeting reassurance-seeking behaviours and the urge to access the Internet.

5.8.2. Pharmacological therapies

As far as pharmacological treatments are concerned, no studies have directly addressed CYB. However, investigation of hypochondriasis has produced three positive randomized controlled trials showing an advantage for selective serotonin reuptake inhibitors (SSRIs) (two studies using fluoxetine and one study with paroxetine) versus placebo [113–115]. These studies used scales of relevance to CYB such as the Y-BOCS modified for hypochondriasis [116,117]. In each study, the largest benefit was seen using doses at the upper end of the therapeutic range. SSRIs used in higher doses also represent an evidence-based treatment for OCD. These data suggest that an off-label trial of SSRIs may be appropriate for patients with CYB, particularly if accompanied by symptoms of hypochondriasis or OCD.

5.8.3. Psychoeducation

In the absence of specific evidence-based interventions, patients may nonetheless benefit from psychoeducation. Based on the current evidence, if CYB is identified, patients should be informed that excessive or unnecessary online health searches are is likely to have negative consequences by increasing health concerns. Patients should also be advised to resist the urge to check the Internet further to help break the vicious cycle of reassurance seeking responsible for maintaining the illness behaviour. 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 [18,46].

5.8.4. Public health interventions

Public health interventions through policy-making may also be of value. Targeting the way medical information is presented on the Internet is a reasonable intervention since the way health information are presented online has an important role in escalation behaviours during online health searches and related heightened anxiety [13,118]. Possible approaches include the provision of more precise, user-friendly and unambiguous medical information and "technical" measures that reduce the likelihood of searches for medical information producing conflicting or misleading results. The latter can be achieved by avoiding the prioritisation of rare or dangerous diseases and by realistically presenting the probabilities of the links between certain symptoms and illnesses. These strategies could be expected to improve health information literacy, allowing Internet users to process this information without escalating worries about health or disease [18,46].

Future research priorities

- Reliable consensus-driven definition of CYB
- Description and characterization of CYB in clinical samples and in the presence/absence of various mental disorders
- Refinement of the CSS as an instrument for measuring the severity of CYB, including elucidation of a cut-off score to assist with screening and support the diagnosis
- Long-term studies to understand the clinical course and impact of CYB on health and wellbeing
- Identification of vulnerability factors for CYB, e.g., via personality traits, psychopathological mechanisms and genetics
- Clarification as to whether CYB is usually a part of another psychopathological entity or a relatively distinct construct
- Development and testing of prevention and management strategies for CYB

Fig. 3. Future research priorities.

5.8.5. Clinician-patient alliance

The clinician-patient relationship offers other creative possibilities for intervention. Clinicians should use their clinical judgement on a case-by case basis to deliver care they believe most likely to reduce reassurance-seeking behaviours. They can do so by increasing consistency and continuity of care, so the same professionals see the patient over time to reduce the anxiety associated with inter-clinician differences, scheduling regular but infrequent visits to reduce the need for emergency presentations, and avoiding unnecessary medical investigations or interventions.

6. Discussion and conclusion

Research on CYB is still in its infancy. A few studies have attempted to characterize CYB, but most of the existing data is cross-sectional in nature and derived from self-report instruments in community samples. The extent to which these findings can be generalized to the clinical setting remains unclear. Given the increasingly widespread use of the Internet and the potential negative effects of online health searches, CYB is likely to represent an increasing public health burden. Further investigations are needed to understand the longitudinal course and the impact of this phenomenon at an individual and societal level, but certain preliminary conclusions can be drawn as a basis for further research. Fig. 3 lists the research priorities that, based upon this review, can be expected to advance the field most.

Considering the available evidence, a working definition of CYB can be proposed (Fig. 2). Emerging research indicates a complex nosological relationship exists between CYB and, variously, anxiety disorders (e.g. health anxiety), OCRDs (e.g. hypochondriasis, OCD), and also digital disorders of behavioural addiction (e.g. gaming disorder), suggesting that CYB may represent a trans-diagnostic syndrome linked to all these disorder classes. Indeed, the underlying psychological mechanisms identified so far mostly include transdiagnostic factors linked to these disorders, such as low self-esteem, anxiety sensitivity, intolerance of uncertainty, pain catastrophizing and certain meta-cognitive beliefs.

At present, CYB usually presents to clinicians in association with health anxiety, hypochondriasis, PUI or OCD. Development of a reliable and valid rating scale for CYB presenting in the clinical population that is sensitive to measuring clinically relevant changes in severity is a priority and a prerequisite for developing treatment trials. Future studies in clinical samples of patients, including those presenting with health anxiety, hypochondriasis, OCD, or various forms of PUI, will help clarify the psychopathological underpinnings of CYB, its relationships with other mental disorders, psychobiology and nosological classification.

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