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The role of base-rate neglect in cyberchondria and health anxiety

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ABSTRACT

Cyberchondria is characterized by excessive health-related online search behavior associated with an unfounded escalation of concerns about common symptomatology. It often co-occurs with health anxiety. We investigated whether base-rate neglect–the cognitive bias to ignore a priori probabilities (e.g., of serious diseases)–plays a significant role in cyberchondria and health anxiety. 368 participants were randomly assigned to eight experimental conditions, manipulating the base-rate (30 % vs. 70 %), the judgment domain (health-neutral versus health-related), and the salience of base-rate information (low vs. high) in a 2×2×2 between-subjects design when asking them for probability judgments with versus without disease relevance. We found that high salience decreased base-rate neglect in participants with low, but not in those with elevated levels of either cyberchondria or health anxiety. Under low salience conditions, however, both cyberchondria and health anxiety severity were uncorrelated with base-rate neglect. These effects were independent of whether health-related or health-neutral problems were evaluated. Our findings suggest a domain-general probabilistic reasoning style that may play a causal role in the pathogenesis of cyberchondria and health anxiety.

1. Introduction

The Internet is often the first place to go for many people when it comes to health issues (Scantlebury, Booth, & Hanley, 2017). Health portals, health communities, and other medical content websites provide a wealth of information about symptoms and diseases (Chung, 2013; Koch-Weser, Bradshaw, Gualtieri, & Gallagher, 2010). For many symptoms, the "compatible" disease can be found on the World Wide Web. Indeed, health information is one of the most frequently sought topics on the Internet (McMullan, 2006; Nicholas, Huntington, Gunter, Withey, & Russell, 2003). According to an EU-wide survey (European Commission, 2014), six out of ten Europeans search for health information online. In a national survey by the Pew Research Center's Internet & American Life Project (Fox & Duggan, 2013), 72 % of U.S. Internet users stated that they had searched online for health and medical information in the past year, 77 % of them said their Internet search had started with a general search engine. In Germany, about 46 % of respondents stated that they regularly search the Internet for health information (Marstedt, 2018).

Whereas online health information-seeking can be helpful in many cases (Cline & Haynes, 2001; Tan & Goonawardene, 2017; Van Riel, Auwerx, Debbaut, Van Hees, & Schoenmakers, 2017), online searches may also raise health concerns (Eysenbach, Powell, Kuss, & Sa, 2002; McElroy & Shevlin, 2014; Ybarra & Suman, 2006). For instance, an experimental study showed that online searches for symptoms of personal concern lead to increased health concerns (Pollklas, Widemann, Lochschmidt, Plakhuta, & Gerlach, 2020). The effect was moderated by negative affectivity such that the more negative affectivity was reported at baseline, the stronger the increase in health concerns after the online search. Similarly, using a weblog-based analysis of online search behavior for medical information, White and Horvitz (2009) have shown that Internet search for medical information has certain characteristics that can promote fear of serious illness. Their results also suggest that online health information-seeking can quickly escalate by increases in the severity of the health-relevant search terms entered within a single search session. This escalation often leads to false self-diagnoses. Harmless headaches turn into incurable brain tumors, abdominal pain into intestinal cancer, or mild cough into pneumonia. According to White and Horvitz (2009), cyberchondria refers to "the unfounded escalation of concerns about common symptomatology, based on the review of search results and literature on the web" (White & Horvitz, 2009, p. 1). Such escalation is estimated to occur in about 20 % of individuals who search for medical information online (White & Horvitz, 2009).

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Cyberchondria can have a negative impact on the daily life and the quality of life of the person affected (Mathes, Norr, Allan, Albanese, & Schmidt, 2018). Individuals prone to cyberchondria spend a lot of time online (Starcevic & Berle, 2013), suffer from fear of having a serious illness, and excessively search the Internet for medical information to find relief (McMullan, Berle, Arnáez, & Starcevic, 2019; Vismara et al., 2020a). Their search is compulsive, repetitive, and associated with feelings of increasing anxiety and distress, rather than reassurance or relief (Starcevic, 2017a; Starcevic, Berle, & Arnáez, 2020; Vismara et al., 2020b). Since descriptions on the Internet often point directly to specific diseases, they quickly believe to suffer from a particular disease which may result in unnecessary time-consuming and expensive consultations, diagnostic procedures, and interventions (Barke, Bleichhardt, Rief, & Doering, 2016; White & Horvitz, 2009).

Cyberchondria is closely related, yet distinct from health anxiety (Schenkel, Jungmann, Gropalis, & Witthöft, 2021; Starcevic, Baggio, Berle, Khazaal, & Viswasam, 2019), which is characterized by excessive concerns about physical health in the absence of organic pathology (Mathes et al., 2018; McMullan et al., 2019; Tyrer, 2018). Individuals with health anxiety, just like individuals with cyberchondria, tend to search the Internet for health information and respond with distress to information about diseases (Baumgartner & Hartmann, 2011; Singh, Fox, & Brown, 2016). However, increased levels of health anxiety are not necessarily a prerequisite for health-related online searches (Starcevic, 2017b). Factors such as curiosity or the appearance of a new symptom, for example, can motivate health-related online searches and subsequently lead to increased health anxiety (Starcevic, 2017b; Te Poel, Baumgartner, Hartmann, & Tanis, 2016). Nevertheless, given the fuzzy boundaries between cyberchondria and health anxiety (Mathes et al., 2018; McMullan et al., 2019; Te Poel et al., 2016) and given that controversy still exists as to whether cyberchondria is a distinct construct (Schenkel et al., 2021) or a subtype of another disorder such as health anxiety (Vismara et al., 2020b), we consider both cyberchondria and health anxiety in the present manuscript.

Reasons for the escalation of health concerns following health-related online searches include the way people search for symptoms and diseases online (White & Hassan, 2014) and how search engines work (White & Horvitz, 2009). Simply put, individuals tend to click on captions that contain potentially-alarming medical terms such as “heart attack” or “medical emergency” (White & Horvitz, 2013), an increased number of clicks leads to a higher ranking of search results (White & Horvitz, 2013), and top-ranking search results are again preferred by web users (Starcevic & Berle, 2013). For medical online search, this means that the likelihood to receive information on a rare, serious condition increases by the number of times the website is accessed (i.e., the number of “clicks”) and by characteristics of specific search engine algorithms (White & Horvitz, 2009). This appears to be particularly problematic in light of the finding that almost 78 % of the respondents in a survey of individuals’ health-related online search experiences stated that they have at least once mistaken the ranking of web search results with the likelihood of a specific disease (White & Horvitz, 2009). In addition, medical information on the Internet is often incomplete (Eysenbach et al., 2002; Zhang, Sun, & Xie, 2015). If a specific symptom occurs in both a common and a rare disease, it is comparatively more likely that a person showing such a symptom suffers from the more common disease. However, information about the base rate of the disease (incidence, prevalence) required to adequately assess symptoms or test results is often lacking (Burkell & Campbell, 2005).

But even if base-rate information is provided, most individuals – independent of the severity of cyberchondria or health anxiety – fail to consider this information appropriately (Doherty-Torstrick, Walton, & Fallon, 2016). Humans generally tend to underestimate the effect of the base rate on the probability of events, that is, they display base-rate neglect by systematically failing to adjust their probability estimates to the given base rates (Kahneman & Tversky, 1972). For example, in the classic engineer-lawyer task (Kahneman & Tversky, 1973), participants read stereotypical personality sketches. One group was told that the person portrayed was randomly drawn from a population of 70 engineers and 30 lawyers, whereas the other group was told that the population comprised 30 engineers and 70 lawyers. Participants in both conditions assigned an equally high probability to an individual being an engineer if the description (the so-called individuating information) matched the stereotype of an engineer (e.g., “Jim enjoys working on his model railway installation”). In other words, their judgment was based solely on the prototype of an engineer, regardless of the base rate. Thus, individuals tend to neglect base-rate information in probabilistic judgments when other (typically intuitive/stereotypical) individuating information is available (Kahneman & Tversky, 1973; Tversky & Kahneman, 1974).

The use of base-rate information in probabilistic judgments is influenced by several factors, including the salience of the base-rate information (Gigerenzer, Hell, & Blank, 1988). Krosnick, Li, and Lehman (1990) showed that base-rate information tends to be ignored when it is presented before the individuating information (as done by Kahneman & Tversky, 1973), but attended to when it is presented after the individuating information. Correspondingly, increasing the salience of the base-rate information by presenting it after the individuating information and immediately preceding the probability judgment can reduce the extent to which base rates are neglected.

The base-rate neglect phenomenon may provide an explanation for the development of both, cyberchondria and health anxiety, as corresponding individuals might show a stronger neglect of low a priori probabilities of severe diseases when searching for symptoms on the Internet, that is, even when the actual (low) base-rate information happens to be salient on some web pages. Thus, affected individuals might *always* underuse base-rate information and, by implication, overestimate the likelihood that the symptoms they experience are caused by a severe disease (Haenen, de Jong, Schmidt, Stevens, & Visser, 2000; Marcus & Church, 2003; Marcus, 1999; White & Horvitz, 2009). Importantly, however, the development of either cyberchondria or health anxiety can only be explained by a pre-existing general cognitive bias towards base-rate neglect if this bias is not limited to health-related probability judgments. Such a bias should rather be generally more pronounced in affected individuals, irrespective of the thematic content of probability judgment tasks. To our knowledge, neither of these predictions has been empirically tested so far.

1.1. The present investigation

This study aims to test three hypotheses on the relation between base-rate neglect and cyberchondria and health anxiety, respectively. The first hypothesis addresses the effects of the salience of base-rate information. In general, an increase in the salience of the base-rate information (by presenting it after the individuating information and immediately prior to the probability judgment) also increases the likelihood of integrating the base-rate information into participants’ judgments, thus diminishing base-rate neglect (Gigerenzer et al., 1988; Krosnick et al., 1990). However, if cyberchondria or health anxiety are associated with a general failure to consider available base-rate information, then the base-rate neglect should generalize beyond standard Kahneman-Tversky tasks in which salience of base rates is low to other probabilistic reasoning tasks in which salience of base rates is high. Correspondingly, it is hypothesized that individuals with a tendency towards cyberchondria or health anxiety will be more resistant to a weakening of the base-rate neglect by increasing the salience of the base-rate information (H1).

The second hypothesis focuses on standard probability reasoning tasks as employed by Kahneman and Tversky (1973). Beyond being more resistant to a weakening of the base-rate neglect, cyberchondria or health anxiety severity might also occur as a result of a generally more pronounced base-rate neglect. If this is the case, corresponding individuals should exhibit a stronger base-rate neglect bias also in standard Kahneman-Tversky tasks in which salience of base rates is low (H2).

The effects of the thematic content of the probability reasoning task are considered in a third hypothesis (H3). It is well possible that the hypothesized probabilistic reasoning style – ignoring base rates even if they are salient – among individuals prone to cyberchondria or health anxiety only occurs in the evaluation of health-related (compared to health-neutral) information (Haenen et al., 2000). We thus investigate both a health-related and a health-neutral condition, expecting that individuals prone to cyberchondria or health anxiety will display a stronger propensity to base-rate neglect and/or a stronger resistance to a weakening for health-related information.

2. Method

The data, materials, and analyses scripts are available at the Open Science Framework (OSF) at https://osf.io/fng43/?view_only=7b3e330764c04bf5ae5d89198427bc0b.

2.1. Participants

Participants were recruited through University mailing lists, the psychology participant pool of the University, online social media (such as Facebook and Instagram), and study platforms (www.zpid.de, www.psychologie-heute.de). The study link has also been posted in various German Internet forums on health and illness (www.onmeda.de, www.med1.de, www.psychic.de). As an incentive, the participants had the chance to win gift vouchers (value €20) for a popular online store.

The sample consisted of $N = 368$ individuals who responded to all base-rate problems. Sixty-one percent of the participants were female. The mean age was 31 years (SD = 12.96, range = 18–76). The majority of participants (83.7 %) had completed Year 12 high school or equivalent. Approximately half (56.5 %) of the participants were married or in a relationship with a partner. 83.9 % of the participants stated that they used the Internet daily between 0 and 5 h, 16.1 % spent more than 5 h per day on the Internet.

2.1.1. Design

A 2 × 2 × 2 between-subjects design was used, manipulating the domain of the probability judgment problem – health-neutral (computer scientist/lawyer) versus health-related (brain tumor/tension headache) –, the base-rate level – low (30 %) vs. high (70 %) –, and the salience of base-rate information – low: base rate presented before (as part of the cover story) vs. high: base rate presented after the problems. Participants were randomly assigned to one of the eight experimental conditions (see Table 1 for the distribution of participants across conditions).

2.2. Procedure

The study was conducted online in German language. After providing informed consent and demographic information, participants received a cover story about either the health-neutral or the health-related problems, emphasizing either a low (30 %) or a high (70 %) base rate for half of the participants (for the exact wording, see below). Thereafter, following the procedure employed by Kahneman and Tversky (1973), participants received the base-rate problems (see below) in random order. For the other half of the participants, the low (30 %) vs. high (70 %) base rates were emphasized right after the personality/symptom description (salient condition). Note that base rates, problem domain (i.e., health-neutral or health-related), and salience condition were kept constant across all six problems processed by each participant and varied between participants only. Following the presentation of each problem and associated base-rate information, participants were asked to estimate the probability that the person in the scenario was a computer scientist or that the diagnosis was a brain tumor, respectively, on a scale of 0–100. Finally, participants completed three self-report measures assessing cyberchondria, health anxiety, and depression (as described below) presented in a randomized order. On average, participants required about 13 min to complete the study.

2.3. Measures

2.3.1. Demographic characteristics

Six items were included: gender, age, marital status, educational level, number of hours per day spent on the Internet.

2.3.2. Cyberchondria

Cyberchondria was assessed using a German version of the Cyberchondria Severity Scale (CSS-15; Barke et al., 2016). The CSS-15 is a 15-item self-report measure with five subscales (compulsion, excessiveness, mistrust doctors, reassurance, distress). The CSS-15 has good internal consistency (Cronbach's $\alpha = 0.82$). Construct validity was supported by significant correlations with both health anxiety and depression. Cronbach's α was.89 in our study.

2.3.3. Health anxiety

Health anxiety was assessed using the German modified short form of the Health Anxiety Inventory (MK-HAI; Bailer & Witthöft, 2006). The MK-HAI consists of 14 items. Good convergent and discriminant validity have been reported (Bailer & Witthöft, 2006). Internal consistency in our study was $\alpha = 0.95$.

2.3.4. Depression

Because both cyberchondria and health anxiety have been shown to be positively associated with depression (Barke et al., 2016; Olatunji et al., 2009), depression was assessed as an additional control variable. We used the German version of the Patient Health Questionnaire-9 (PHQ-9; Löwe, Kroenke, Herzog, & Gräfe, 2004). The PHQ-9 consists of nine depressive symptoms each rated from 0 to 3 according to the severity of difficulty experienced. The ratings are summed to form a severity score that ranges from 0 to 27 (indicating no depression, minimal, mild, moderate, moderately severe, or severe depression).

Table 1
Design Matrix.

Factor			*n*	Predictor Variables						
Salience	Domain	BR		S	T_h	BR_h	T_h x BR_h	T_l	B_l	T_l x BR_l
High	Health	70	46	1	1	1	1	0	0	0
High	Health	30	55	1	1	-1	-1	0	0	0
High	Neutral	70	49	1	-1	1	-1	0	0	0
High	Neutral	30	52	1	-1	-1	1	0	0	0
Low	Health	70	44	-1	0	0	0	1	1	1
Low	Health	30	41	-1	0	0	0	1	-1	-1
Low	Neutral	70	50	-1	0	0	0	-1	1	-1
Low	Neutral	30	31	-1	0	0	0	-1	-1	1

Note: Predictors represent effect-codings of the Salience (S) main effect, the simple main effects of Domain Type (T_h), Base Rate (BR_h), and their interaction (T_hx BR_h) in the High-Salience condition, and the corresponding simple main effects and interactions in the Low-Salience condition (T_l, B_l, and T_l x BR_l, respectively).

Previous research has shown good reliability and validity (Gilbody, Richards, Brealey, & Hewitt, 2007; Kroenke, Spitzer, Williams, & Löwe, 2010; Wittkampf, Naeije, Schene, Huyser, & van Weert, 2007), as well as good sensitivity and specificity for detecting depressive disorders (Kroenke et al., 2010). Internal consistency of the PHQ-9 in our sample was $\alpha = 0.86$.

2.4. Materials

The instructions and base-rate problems were designed to mirror the classical lawyer-engineer problem developed by Kahneman and Tversky (1973). Two domains of base-rate problems were realized: health-neutral and health-related. For the health-neutral conditions, Tversky and Kahneman's (1973) engineer-lawyer problems were adopted with minor revisions (engineer targets were adjusted to computer scientist targets, as it was expected that stereotypes about computer scientists are more pronounced nowadays than stereotypes about engineers).

The base-rate problems in the health-related condition followed the same sentence structures as the base-rate problems in the health-neutral conditions. The decision to translate the engineer/lawyer problems into brain tumor/tension headache problems was based on the comparatively high awareness of the symptoms of both diseases in the general population. Moreover, symptoms of brain tumors can be clearly distinguished from symptoms of tension headaches.

For all base-rate problems, five personality/symptom descriptions and one uninformative control description were provided (see Appendix A for stereotypical scenarios in the neutral and the health-related condition, respectively; all scenarios are provided at the OSF, see the link indicated above). In the neutral condition, two descriptions included strong stereotypical information about computer scientists, two descriptions included strong stereotypical information about lawyers, and one did not include any specific stereotypical information. Analogously, in the health-related condition, two descriptions included strong diagnostic information about a brain tumor, two descriptions included strong diagnostic information about tension headache, and one did not include any specific diagnostic information. In both conditions, the uninformative description did not provide any information about the person or diagnosis, except that the person was randomly drawn from the underlying population (called null condition by Gigerenzer et al., 1988). For each base-rate problem, participants were required to estimate the chance (in percent) that the person/diagnosis described was a computer scientist/brain tumor, depending on the judgment domain.

The base-rate problems in both conditions were preceded by a cover story. In the health-related condition, the cover story reads as follows:

> “At the hospital's neurological ward, 100 magnetic resonance imaging (MRI) scans are performed annually if a brain tumor is suspected. Fortunately, not all MRIs can confirm the suspicion of a tumor, so some headaches are widespread stress headaches (including those caused by incorrect posture or insufficient exercise). Since MRI is a very complex and expensive procedure, the new chief physician wants to reduce the use of MRI. He analyzed the last 100 patient files and the corresponding results of the MRI, which led to either a diagnosis of "brain tumor" or "tension headache".”

In the low-salience condition, the cover story ended with the information about the base rate (which was 30 % in the low and 70 % in the high base-rate condition): “The analysis by the new chief physician showed that in 70 (30) of the 100 patients the suspected diagnosis "brain tumor" could be confirmed after the MRI examination. In 30 (70) of the 100 patients, the diagnosis was "tension headache".” In the high-salience condition, the information about the base rate was not included in the cover story but was shown after each personality/symptom description, immediately preceding the participant's probability judgment.

3. Results

The significance level was set to $\alpha = 0.05$ for all statistical tests. For the General Linear Model single-predictor t-tests reported here, $N = 368$ suffices to detect medium effects ($f = 0.25$) with a power of at least .99 given $\alpha = .05$ (Faul, Erdfelder, Buchner, & Lang, 2009). Following Gigerenzer et al. (1988) and Krosnick et al. (1990), we computed participant-specific probability estimates that the described person is a computer scientist (or received a brain tumor diagnosis, depending on condition), averaged across the five personality/symptom descriptions presented. These participant-specific mean judgments served as the main dependent variable in the following regression analyses (see Fig. 1).

3.1. Strength of the Base-Rate neglect

We first evaluated whether a base-rate neglect effect occurred across all participants and whether increasing the salience of the base-rate information weakens the base-rate neglect. Fig. 1 shows the estimated probabilities as a function of base-rate, domain of the problem, and the salience of the base rate. We performed a linear regression predicting the estimated probability by the effect-coded predictors base-rate ($-1 =$ low, $1 =$ high), domain of the problem ($-1 =$ neutral, $1 =$ health-related), and salience ($-1 =$ low, $1 =$ high) as well as their two- and three-way interactions. This yielded a significant main-effect of base-rate, $t(352) = 6.3$, $p < .01$, Cohen's $d = 0.69$, indicating that, as expected, participants in the low base-rate conditions provided lower probability estimates ($M = 41.8$, $SD = 13.8$) than those in the high base-rate conditions ($M = 51.8$, $SD = 15.2$). Importantly, however, note that these mean estimated probabilities significantly and substantially differed from the actual base-rates of 30 % and 70 %, $t(165) = 11.0$, $p < .01$ and $t(201) = -16.9$, $p < .01$, respectively, showing that a base-rate neglect occurred.[1] Moreover, a significant interaction between base-rate and salience emerged, $t(352) = 3.6$, $p < .01$. The effect of base-rate was approximately twice as large in the high salience condition ($M = 40.9$ vs $M = 55.3$, Cohen's $d = 0.92$) as in the low salience condition ($M = 42.8$ vs $M = 48.4$, Cohen's $d = 0.44$), showing that the base-rate neglect was reduced when the base-rate information was presented last, in turn increasing its salience. In addition, although the estimated probabilities were generally smaller for health-related problems, $t(352) = -9.4$, $p < .01$, the absence of any further significant interaction shows that the general pattern did not change as a function of the domain of the base-rate problem.

In a second step, we included the problem type (with two levels: personality/symptom problems vs. uninformative control problem) as an additional within-subject factor into the analysis. The corresponding regression analysis (see OSF for details) yielded a significant interaction between base-rate and problem type in addition, thereby indicating a stronger base-rate neglect in the personality/symptom problems as compared to the uninformative control problem. Results for all other effects showed the same pattern as in the first regression analysis. We thus refrain from considering the uninformative control condition in the following analyses, again following Gigerenzer et al. (1988).

In sum, the design was effective in inducing a pronounced base-rate neglect in personality/symptom problems and also in weakening the base-rate neglect by increasing the salience of the base-rate information. This pattern was observed for both health-neutral and health-related judgmental problems.

3.2. Effect of cyberchondria severity on the base-rate neglect

We next evaluated whether cyberchondria severity is associated with

[1] The presence of a base-rate neglect in a Bayesian sense was further verified using the approach proposed by Wells and Harvey (Wells & Harvey, 1978).

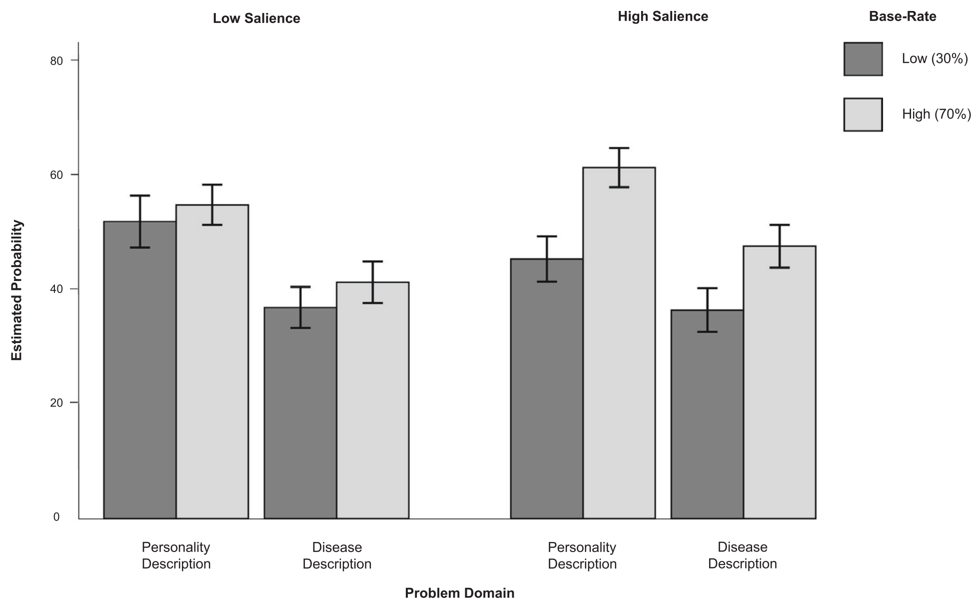

Fig. 1. Mean estimated probabilities for personality/symptom description tasks, by Salience, Base-Rate, and Problem Domain. Error bars indicate 95 % Confidence Intervals.

stronger resistance to a weakening of the base-rate neglect (H1) and/or with a generally stronger base-rate neglect (H2), potentially depending on the type of base-rate problem (H3). To test these hypotheses, we computed a linear regression predicting the estimated probability by the contrast coded-predictor variables as defined in the design matrix shown in Table 1 and the (standardized) CSS-15 score (along with all interaction terms). The contrast variables that are of particular importance for the present hypotheses are B_h (contrasting the effect of base-rate in the high salience conditions) and B_l (contrasting the effect of base-rate in the low salience conditions). The regression results are shown in Table 2.

In line with H1, there was a negative interaction between CSS and the B_h-contrast, $t(352) = -2.4, p = .02$, indicating that participants high in CSS showed significantly stronger base-rate neglect than participants low in CSS when salience of base-rate information was high. However, disconfirming H2, no significant interaction was observed between CSS and the B_l-contrast, $t(352) = 0.7$, $p = .48$. Thus, cyberchondria severity interacted with the base-rate information when salience was high, but not when salience was low. Notably, no interaction between cyberchondria severity and the domain of the base-rate problem reached significance, thus disconfirming H3. In other words, the observed effects of cyberchondria severity were independent of whether neutral or health-related problems were evaluated.

The simple slope plots displayed in the upper panel of Fig. 2 show the joint effect of base-rate and cyberchondria severity on the estimated probabilities, separately for the low and high salience conditions, respectively. It is evident that increasing the salience of the base-rate information greatly reduced the base-rate neglect for participants scoring 2 standard deviations (SD) below the mean CSS score (simple slopes $b = 0.20, p = .93$, vs. $b = 11.58, p < .01$). Indeed, the probability estimates of those participants approached the factual base-rates in this condition. In contrast, increasing the salience of the base-rate information had no effect on the estimated probabilities of participants scoring 2 SD above the mean CSS score, who still exhibited strong base-rate neglect (simple slopes $b = 3.01$, $p = .18$, vs. $b = 2.24$, $p = .30$). In sum, this pattern confirms the first hypothesis that cyberchondria severity is associated with greater resistance against base-rate neglect weakening information.

Table 2
Regression results for cyberchondria severity as moderator.

Variable	*B*	*SE*	*t*	*p*
S	0.52	0.69	0.76	.447
T_h	-5.77	0.97	-5.96	< .001
B_h	6.93	0.97	7.16	< .001
T_h x BR_h	-0.70	0.97	-0.73	.467
T_l	-7.20	0.98	-7.35	< .001
BR_l	1.60	0.98	1.63	.103
T_l x B_l	0.11	0.98	0.11	.914
CSS	0.86	0.70	1.22	.222
CSS x S	-0.52	0.70	-0.74	.461
CSS x T_h	0.60	0.98	0.61	.540
CSS x B_h	-2.34	0.98	-2.39	.017
CSS x T_h x BR_h	0.20	0.98	0.20	.841
CSS x T_l	1.70	1.00	1.70	.090
CSS x BR_l	0.70	1.00	0.70	.488
CSS x T_l x BR_l	0.21	1.00	0.21	.832

Note. Linear regression results predicting the estimated probability by the contrast-coded predictor variables (see Table 1) and the standardized Cyberchondria Symptom Severity Score (CSS). $R^2 = .34$.
S = main effect of Salience, T_h and BR_h = simple main effects of Domain Type and Base Rate, respectively, in the high-Salience condition; T_l, and B_l = simple main effects of Domain Type and Base Rate, respectively, in the low-Salience condition; T_h x BR_h and T_l x BR_l = Domain Type * Base Rate interaction in the High and Low-Salience conditions, respectively.

3.3. *Effect of health anxiety on the base-rate neglect*

We next considered health anxiety severity, based on the standardized MK-HAI scores (which exhibited a strong correlation of $r = 0.72$ to the CSS scores). The regression results, also relying on the contrast variables (Table 1), are shown in Table 3. Mirroring the results obtained for cyberchondria severity, the MK-HAI scores exhibited a negative interaction with the B_h-contrast, $t(352) = -3.5$, $p < .01$, but neither a significant interaction with the B_l-contrast. $t(352) = 0.3$, $p = .79$, nor with the Domain Type contrasts. Correspondingly, the simple slope plot plots shown in the lower panel of Fig. 2 are remarkably similar to those obtained with the CSS. If anything, the interaction effect based on the MK-HAI was slightly more pronounced, thus showing that elevated health anxiety severity is also associated with a resistance to a weakening of the base-rate neglect by increasing the salience of the base-rate information. In sum, the results concerning health anxiety severity were virtually identical to those obtained for cyberchondria.

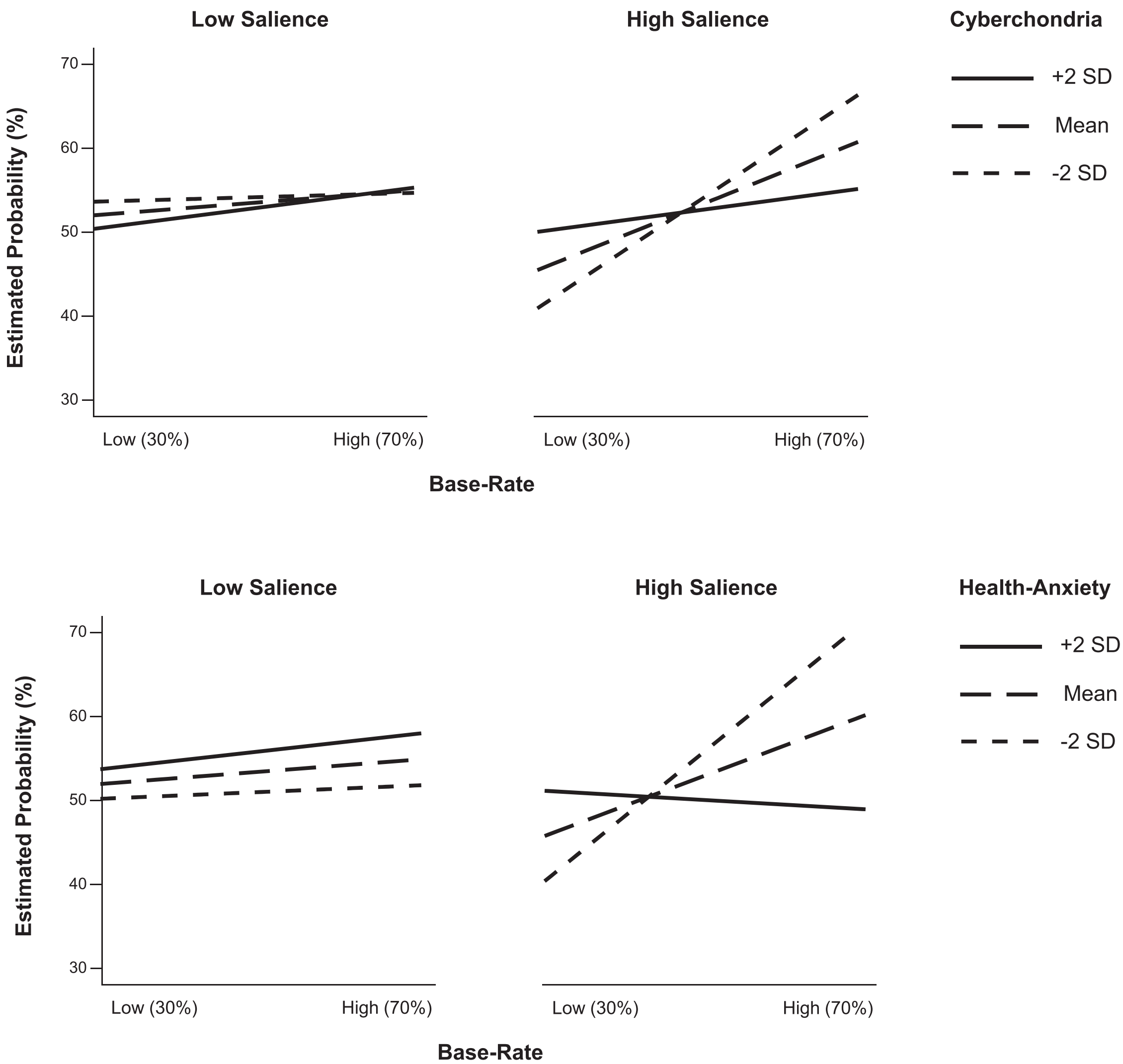

Fig. 2. Mean estimated probabilities by Salience condition, Base-Rate condition, and Cyberchondria severity (top) and Health Anxiety severity (bottom), respectively. Simple slopes for Base-Rate in low (−2 SD), medium, and high (+2 SD) Cyberchondria severity in the low Salience condition were $b = 0.20$ ($p = .93$), $b = 1.60$ ($p = .10$), and $b = 3.01$ ($p = .18$), respectively, whereas those in the high Salience condition were $b = 11.58$ ($p < .01$), $b = 6.91$ ($p < .01$), and $b = 2.24$ ($p = .30$), respectively. Simple slopes for Base-Rate in low (−2 SD), medium, and high (+2 SD) Health Anxiety in the low Salience condition were $b = 1.33$ ($p = .53$), $b = 1.84$ ($p = .06$), and $b = 2.35$ ($p = .27$, respectively, whereas those in the high Salience condition were $b = 13.58$ ($p < .01$), $b = 6.54$ ($p < .01$), and $b = -0.49$ ($p = .82$), respectively.

3.4. Controlling for individual differences in depression

We finally considered whether the same pattern of results emerges when controlling for depression (using PHQ scores, respectively). However, the PHQ failed to showed any significant effect over and above the CSS and the MK-HAI scores, respectively, when additionally included in the regression model, nor did this predictor otherwise affect the results. Results obtained while controlling for depression thus generally mirrored those reported above.

4. Discussion

Cyberchondria describes a behavioral pattern of performing excessive health-related online searches that may lead to an unfounded escalation of concerns about common symptomatology, a symptom which is also often observed for individuals with health anxiety. It has been argued that the failure to consider the base rate of a disease may play a significant role in cyberchondria and health anxiety, such that corresponding individuals overestimate the likelihood that the symptoms they experience are caused by a severe, but rare disease (Marcus & Church, 2003; Marcus, 1999; White & Horvitz, 2009). However, this assumption has yet not been directly tested, so this is the first study to investigate whether individuals prone to cyberchondria or health anxiety are not only more susceptible to base-rate neglect, but also more resistant to potential weakening of base-rate effects by increasing the salience of the base-rate information (Krosnick et al., 1990). More specifically, the present study directly tested whether (a) increasing the salience of the base-rate information reduces the base-rate neglect in individuals prone to cyberchondria or health anxiety to a similar extent than in those without such tendencies, (b) stronger base-rate neglect in individuals prone to cyberchondria or health anxiety occurs even when the salience of base-rate information is low, and (c) these effects vary as a function of the type of information provided (health-related versus neutral).

The results revealed that increasing the salience of the base-rate information reduced the base-rate neglect only among individuals without symptoms of cyberchondria or health-anxiety. Replicating previous research with nonclinical groups (Gigerenzer et al., 1988; Krosnick et al., 1990), participants low in cyberchondria or health-anxiety were more successful in integrating the base-rate information in their

Table 3
Regression results for health anxiety severity as moderator.

Variable	*B*	*SE*	*t*	*p*
S	0.63	0.68	0.93	.352
T_h	-5.53	0.95	-5.79	< .001
B_h	6.56	0.95	6.88	< .001
T_h x BR_h	-0.70	0.95	-0.73	.464
T_l	-7.26	0.97	-7.51	< .001
BR_l	1.83	0.97	1.90	.059
T_lxB_l	0.35	0.97	0.36	.720
HA	0.04	0.68	0.06	.945
HA x S	-1.57	0.68	-2.31	.022
HA x T_h	-0.06	0.98	-0.06	.953
HA x BR_h	-3.54	0.98	-3.62	< .001
HA x T_h x BR_h	0.65	0.98	0.66	.507
HA x T_l	0.38	0.95	0.41	.684
HA x BR_l	0.26	0.95	0.27	.785
HA x T_l x BR_l	-0.08	0.95	-0.08	.935

Note. Linear regression results predicting the estimated probability by the contrast-coded predictor variables (see Table 1) and the standardized MK-HAI Score as a measure of health anxiety (HA). $R^2 = .35$.
S = main effect of Salience, T_h and BR_h = simple main effects of Domain Type and Base Rate, respectively, in the high-Salience condition; T_l, and B_l = simple main effects of Domain Type and Base Rate, respectively, in the low-Salience condition; T_h x BR_h and T_l x BR_l = Domain Type * Base Rate interaction in the High and Low-Salience conditions, respectively.

judgments if the base-rate information was provided after the base-rate problems so that the strength of the base-rate neglect was greatly diminished. However, in agreement with the first hypothesis, increasing the salience of the base-rate information had no effect on participants with elevated cyberchondria or health anxiety, who still displayed strong base-rate neglect even when base-rate information was obvious when providing judgments.

Although the results provided strong evidence for the presence of base-rate neglect in our sample, the strength of the base-rate neglect was - contrary to the second hypothesis– unrelated to the symptom severity of either cyberchondria or health-anxiety for standard Kahneman-Tversky-type problems in which salience of base rates is low. This result is most likely due to a floor effect: Under conditions that elicit almost uniform base-rate neglect in all participants, there is no option to decrease base-rate neglect even further – resulting in a null correlation between cyberchondria or health anxiety severity and base-rate neglect under such conditions.

We also found that all these effects were independent of whether health-related or health-neutral information was evaluated. The absence of a moderating effect of the problem domain indicates that individuals prone to cyberchondria or health anxiety are generally more resistant to conditions that typically reduce the base-rate neglect, irrespective of whether health-related or health-unrelated probability judgments are required. Hence, both cyberchondria and health anxiety appear to be linked to a domain-independent probabilistic reasoning style that is characterized by a failure to integrate base-rate information in probability assessments even if the salience and judgmental relevance of base-rate information are high. Ignoring base rates even if they are salient, irrespective of judgment domain, might reflect a general dysfunction of probabilistic reasoning that is more likely an antecedent in the development of cyberchondria and health anxiety rather than a consequence or by-product of thinking about health-related problems as typically associated with cyberchondria and health anxiety. However, a temporal precedence of this dysfunction needs to be considered in future research.

In summary, the results of this study indicate that individuals prone to cyberchondria or health anxiety exhibit strong base-rate neglect even under conditions that typically weaken the base-rate neglect. Given that the present study used both health-related and health-neutral base-rate problems, the results point to a more general dysfunction in judgmental reasoning in individuals prone to cyberchondria or health anxiety.

Finally, the present study also adds to the literature concerning the relation between cyberchondria and health anxiety (Mathes et al., 2018). Our results confirmed that cyberchondria and health anxiety symptom severity are closely related, and also that both share a specific probabilistic judgment pattern. Hence, the base-rate-ignoring judgmental style appears to be a feature of both cyberchondria and health-anxiety.

4.1. Limitations

There are some limitations of the current study. First, our results provide evidence that cyberchondria and health anxiety severity are associated with a domain-general probabilistic reasoning style characterized by a general failure to integrate base-rate information even if its salience is high. However, our results do not tell us whether this failure is due to (a) not attending to the base rates despite their salience, (b) overlooking their relevance for the probabilistic judgment task or (c) not combining the base rates appropriately with the individuating information at hand. Identification of the mediating mechanism responsible for base rate integration failure should be one goal for future research. Insights along these lines will also help design effective psychotherapeutic intervention techniques specifically targeting cyberchondria and health anxiety.

Second, the cross-sectional design of the study limits strong causal inferences. Future research using longitudinal study designs will be necessary to determine whether and how the base-rate-ignoring reasoning style hypothesized here really causes and thus precedes the development of cyberchondria and health anxiety.

Third, the use of an Internet-based convenience sample, even if acquired by many different online communication channels, may limit the generalizability of the findings. In spite of this limitation, researchers have supported the use of the Internet for data collection especially when cyberchondria or health-anxiety are concerned (Norr et al., 2015). As can be seen from the demographics of the sample, our sample may not be representative as females and highly educated participants are over-represented (see also Norr et al., 2015). However, it appears that women are more likely to seek health information online (Rice, 2006), so this over-representation of women could potentially be representative of online health information seekers. In the absence of fully conclusive epidemiological studies on cyberchondria in particular, it is difficult to assess the representativeness of the sample on the basis of demographic characteristics because nothing is known about the demographic factors associated with it. Further studies replicating these findings in different populations are needed.

5. Conclusion

In summary, the current study sought to take the first steps towards the investigation of the cognitive mechanisms underlying cyberchondria and health anxiety. The findings of this study indicate that individuals prone to cyberchondria or health anxiety respond poorly to methods that usually weaken the base-rate neglect. This pattern of results holds for both health-related and health-neutral information, thereby pointing towards a general (content-unspecific) deficit in information integration. Thus, specific training on how to avoid base-rate errors could become a target of behavioral interventions. However, further studies are needed to understand cyberchondria in terms of epidemiology, psychopathology, clinical characteristics, and therapeutic interventions. In particular, future research should investigate optimal ways to provide and encourage the effective processing of base-rate information so that individuals affected by cyberchondria or health anxiety also benefit from this information.

Conflict of interest

None.

Appendix A

English translations of a neutral and a health-related, respectively, stereotypical probabilistic judgment problem used in the study (see OSF for all scenarios used). Base-rate information (70 % vs. 30 % or 30 % vs. 70 % of computer scientists vs. lawyers or brain tumors vs. tension headaches, depending on condition) was presented either before the scenario (low salience condition) or after the scenario and immediately preceding the probability judgment (high salience condition).

Neutral	Health-related
Jürgen is 45 years old. He is married and has four children. He prefers to spend his free time with one of his many hobbies such as playing online strategy games. He is not interested in politics and social issues. He met his wife at a comic fair. She generally describes him as conservative, painstaking, and ambitious. Next week he will be attending a math competition. The probability that Jürgen is a computer scientist is___.	Jürgen is 45 years old. He is married and has four children. He has had an uncomfortable throbbing over his left eye for several months. Conventional headache relievers hardly improve his pain. His wife is very worried about his sudden weight loss. She also notices that he often seems confused, irritable and off the track. For a week now, he experiences blurry vision in his left eye. The probability that Jürgen received a brain tumor diagnosis is___.

References

Bailer, J., & Witthöft, M. (2006). Modifizierte Kurzform des Health Anxiety Inventory (MK-HAI). The Health Anxiety Inventory—German modified short form of the Health Anxiety Inventory. In *ZUMA-Informationssystem. Elektronisches Handbuch sozialwissenschaftlicher Erhebungsinstrumente* (10. Aufl.). Zentrum für Umfragen, Methoden und Analysen.

Barke, A., Bleichhardt, G., Rief, W., & Doering, B. K. (2016). The Cyberchondria Severity Scale (CSS): German validation and development of a short form. *International Journal of Behavioral Medicine, 23*(5), 595–605. https://doi.org/10.1007/s12529-016-9549-8

Baumgartner, S. E., & Hartmann, T. (2011). The role of health anxiety in online health information search. *Cyberpsychology, Behavior, and Social Networking, 14*(10), 613–618. https://doi.org/10.1089/cyber.2010.0425

Burkell, J., & Campbell, D. G. (2005). "What does this mean?" How Web-based consumer health information fails to support information seeking in the pursuit of informed consent for screening test decisions. *Journal of the Medical Library Association, 93*(3), 363–373.

Chung, J. E. (2013). Patient-provider discussion of online health information: Results from the 2007 Health Information National Trends Survey (HINTS). *Journal of Health Communication, 18*(6), 627–648. https://doi.org/10.1080/10810730.2012.743628

Cline, R. J. W., & Haynes, K. M. (2001). Consumer health information seeking on the Internet: The state of the art. *Health Education Research, 16*(6), 671–692. https://doi.org/10.1093/her/16.6.671

Doherty-Torstrick, E. R., Walton, K. E., & Fallon, B. A. (2016). Cyberchondria: Parsing health anxiety from online behavior. *Psychosomatics, 57*(4), 390–400. https://doi.org/10.1016/j.psym.2016.02.002

European Commission. (2014). *Europeans becoming enthusiastic users of online health information.* 〈https://ec.europa.eu/digital-single-market/en/news/europeans-becoming-enthusiastic-users-online-health-information〉.

Eysenbach, G., Powell, J., Kuss, O., & Sa, E.-R. (2002). Empirical studies assessing the quality of health information for consumers on the world wide web: A systematic review. *JAMA, 287*(20), 2691. https://doi.org/10.1001/jama.287.20.2691

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Fox, S., & Duggan, M. (2013). Health Online 2013. *Pew Research Center: Internet, Science & Tech* . 〈https://www.pewinternet.org/2013/01/15/health-online-2013/〉.

Gigerenzer, G., Hell, W., & Blank, H. (1988). Presentation and content: The use of base rates as a continuous variable. *Journal of Experimental Psychology: Human Perception and Performance, 14*(3), 513–525. https://doi.org/10.1037/0096-1523.14.3.513

Gilbody, S., Richards, D., Brealey, S., & Hewitt, C. (2007). Screening for depression in medical settings with the Patient Health Questionnaire (PHQ): A diagnostic meta-analysis. *Journal of General Internal Medicine, 22*(11), 1596–1602. https://doi.org/10.1007/s11606-007-0333-y

Haenen, M.-A., de Jong, P. J., Schmidt, A. J. M., Stevens, S., & Visser, L. (2000). Hypochondriacs' estimation of negative outcomes: Domain-specificity and responsiveness to reassuring and alarming information. *Behaviour Research and Therapy, 38*(8), 819–833. https://doi.org/10.1016/S0005-7967(99)00128-X

Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive Psychology, 3*(3), 430–454. https://doi.org/10.1016/0010-0285(72)90016-3

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review, 80*(4), 237–251. https://doi.org/10.1037/h0034747

Koch-Weser, S., Bradshaw, Y. S., Gualtieri, L., & Gallagher, S. S. (2010). The Internet as a health information source: Findings from the 2007 Health Information National Trends Survey and implications for health communication. *Journal of Health Communication, 15*(Suppl 3), 279–293. https://doi.org/10.1080/10810730.2010.522700

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The patient health questionnaire somatic, anxiety, and depressive symptom scales: A systematic review. *General Hospital Psychiatry, 32*(4), 345–359. https://doi.org/10.1016/j.genhosppsych.2010.03.006

Krosnick, J. A., Li, F., & Lehman, D. R. (1990). Conversational conventions, order of information acquisition, and the effect of base rates and individuating information on social judgments. *Journal of Personality and Social Psychology, 59*(6), 1140–1152. https://doi.org/10.1037/0022-3514.59.6.1140

Löwe, B., Kroenke, K., Herzog, W., & Gräfe, K. (2004). Measuring depression outcome with a brief self-report instrument: Sensitivity to change of the Patient Health Questionnaire (PHQ-9). *Journal of Affective Disorders, 81*(1), 61–66. https://doi.org/10.1016/S0165-0327(03)00198-8

Marcus, D. K. (1999). The cognitive-behavioral model of hypochondriasis. *Journal of Psychosomatic Research, 47*(1), 79–91. https://doi.org/10.1016/S0022-3999(99)00008-2

Marcus, D. K., & Church, S. E. (2003). Are dysfunctional beliefs about illness unique to hypochondriasis? *Journal of Psychosomatic Research, 54*(6), 543–547. https://doi.org/10.1016/S0022-3999(02)00526-3

Marstedt, G. (2018). *Das Internet: Auch Ihr Ratgeber für Gesundheitsfragen. Bevölkerungsumfrage zur Suche von Gesundheitsinformationen im Internet und zur Reaktion der Ärzte. The Internet: Also your guide to health issues? Population survey to find health information on the Internet and the reaction of doctors.* (1. Aufl.). Bertelsmann Stiftung.

Mathes, B. M., Norr, A. M., Allan, N. P., Albanese, B. J., & Schmidt, N. B. (2018). Cyberchondria: Overlap with health anxiety and unique relations with impairment, quality of life, and service utilization. *Psychiatry Research, 261*, 204–211. https://doi.org/10.1016/j.psychres.2018.01.002

McElroy, E., & Shevlin, M. (2014). The development and initial validation of the cyberchondria severity scale (CSS). *Journal of Anxiety Disorders, 28*(2), 259–265. https://doi.org/10.1016/j.janxdis.2013.12.007

McMullan, M. (2006). Patients using the Internet to obtain health information: How this affects the patient–health professional relationship. *Patient Education and Counseling, 63*(1), 24–28. https://doi.org/10.1016/j.pec.2005.10.006

McMullan, R. D., Berle, D., Arnáez, S., & Starcevic, V. (2019). The relationships between health anxiety, online health information seeking, and cyberchondria: Systematic review and meta-analysis. *Journal of Affective Disorders, 245*, 270–278. https://doi.org/10.1016/j.jad.2018.11.037

Nicholas, D., Huntington, P., Gunter, B., Withey, R., & Russell, C. (2003). The British and their use of the web for health information and advice: A survey. *Aslib Proceedings, 55*(5/6), 261–276. https://doi.org/10.1108/00012530310498842

Norr, A. M., Oglesby, M. E., Raines, A. M., Macatee, R. J., Allan, N. P., & Schmidt, N. B. (2015). Relationships between cyberchondria and obsessive-compulsive symptom dimensions. *Psychiatry Research, 230*(2), 441–446. https://doi.org/10.1016/j.psychres.2015.09.034

Olatunji, B. O., Wolitzky-Taylor, K. B., Elwood, L., Connolly, K., Gonzales, B., & Armstrong, T. (2009). Anxiety sensitivity and health anxiety in a nonclinical sample: specificity and prospective relations with clinical stress. *Cognitive Therapy and Research, 33*(4), 416–424. https://doi.org/10.1007/s10608-008-9188-8

Pollklas, M., Widemann, L., Lochschmidt, M., Plakhuta, A., & Gerlach, A. L. (2020). Cyberchondriasis: The effect of searching the internet on health concerns. *Zeitschrift für Psychologie, 228*(2), 110–118. https://doi.org/10.1027/2151-2604/a000404

Rice, R. E. (2006). Influences, usage, and outcomes of Internet health information searching: Multivariate results from the Pew surveys. *International Journal of Medical Informatics, 75*(1), 8–28. https://doi.org/10.1016/j.ijmedinf.2005.07.032

Scantlebury, A., Booth, A., & Hanley, B. (2017). Experiences, practices and barriers to accessing health information: A qualitative study. *International Journal of Medical Informatics, 103*, 103–108. https://doi.org/10.1016/j.ijmedinf.2017.04.018

Schenkel, S. K., Jungmann, S. M., Gropalis, M., & Witthöft, M. (2021). Conceptualizations of cyberchondria and relations to the anxiety spectrum:

Systematic review and meta-analysis. *Journal of Medical Internet Research, 23*(11), Article e27835. https://doi.org/10.2196/27835

Singh, K., Fox, J. R., & Brown, R. J. (2016). Health anxiety and Internet use: A thematic analysis. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 10*(2). https://doi.org/10.5817/CP2016-2-4

Starcevic, V. (2017aaa). Cyberchondria: Challenges of problematic online searches for health-related information. *Psychotherapy and Psychosomatics, 86*(3), 129–133. https://doi.org/10.1159/000465525

Starcevic, V. (2017bbb). Cyberchondria: Challenges of problematic online searches for health-related information. *Psychotherapy and psychosomatics, 86*(3), 129–133.

Starcevic, V., Baggio, S., Berle, D., Khazaal, Y., & Viswasam, K. (2019). Cyberchondria and its relationships with related constructs: A network analysis. *Psychiatric Quarterly, 90*(3), 491–505. https://doi.org/10.1007/s11126-019-09640-5

Starcevic, V., & Berle, D. (2013). Cyberchondria: Towards a better understanding of excessive health-related internet use. *Expert Review of Neurotherapeutics, 13*(2), 205–213. https://doi.org/10.1586/ern.12.162

Starcevic, V., Berle, D., & Arnáez, S. (2020). Recent insights into cyberchondria. *Current Psychiatry Reports, 22*(11), 56. https://doi.org/10.1007/s11920-020-01179-8

Tan, S. S.-L., & Goonawardene, N. (2017). Internet health information seeking and the patient-physician relationship: A systematic review. *Journal of Medical Internet Research, 19*(1), Article e9. https://doi.org/10.2196/jmir.5729

Te Poel, F., Baumgartner, S. E., Hartmann, T., & Tanis, M. (2016). The curious case of cyberchondria: A longitudinal study on the reciprocal relationship between health anxiety and online health information seeking. *Journal of Anxiety Disorders, 43*, 32–40. https://doi.org/10.1016/j.janxdis.2016.07.009

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Tyrer, P. (2018). Recent advances in the understanding and treatment of health anxiety. *Current Psychiatry Reports, 20*(7), 49. https://doi.org/10.1007/s11920-018-0912-0

Van Riel, N., Auwerx, K., Debbaut, P., Van Hees, S., & Schoenmakers, B. (2017). The effect of Dr Google on doctor–patient encounters in primary care: A quantitative, observational, cross-sectional study. *BJGP Open, 1*(2). https://doi.org/10.3399/bjgpopen17×100833

Vismara, M., Caricasole, V., Starcevic, V., Cinosi, E., Dell'Osso, B., Martinotti, G., & Fineberg, N. A. (2020aaa). Is cyberchondria a new transdiagnostic digital compulsive syndrome? A systematic review of the evidence. *Comprehensive Psychiatry, 99*, Article 152167. https://doi.org/10.1016/j.comppsych.2020.152167

Vismara, M., Caricasole, V., Starcevic, V., Cinosi, E., Dell'Osso, B., Martinotti, G., & Fineberg, N. A. (2020bbb). Is cyberchondria a new transdiagnostic digital compulsive syndrome? A systematic review of the evidence. *Comprehensive Psychiatry, 99*, Article 152167. https://doi.org/10.1016/j.comppsych.2020.152167

Wells, G. L., & Harvey, J. H. (1978). Naive attributors' attributions and predictions: What is informative and when is an effect an effect? *Journal of Personality and Social Psychology, 36*(5), 483–490. https://doi.org/10.1037/0022-3514.36.5.483

White, R. W., & Hassan, A. (2014). Content bias in online health search. *ACM Transactions on the Web (TWEB), 8*(4), 1–33. https://doi.org/10.1145/2663355

White, R. W., & Horvitz, E. (2009). Cyberchondria: Studies of the Escalation of Medical Concerns in Web Search. *ACM Transactions on Information Systems (TOIS), 27*(4), 1–37. https://doi.org/10.1145/1629096.1629101

White, R. W., & Horvitz, E. (2013). Captions and biases in diagnostic search. *ACM Transactions on the Web (TWEB), 7*(4), 1–28. https://doi.org/10.1145/2486040

Wittkampf, K. A., Naeije, L., Schene, A. H., Huyser, J., & van Weert, H. C. (2007). Diagnostic accuracy of the mood module of the Patient Health Questionnaire: A systematic review. *General Hospital Psychiatry, 29*(5), 388–395. https://doi.org/10.1016/j.genhosppsych.2007.06.004

Ybarra, M. L., & Suman, M. (2006). Help seeking behavior and the Internet: A national survey. *International Journal of Medical Informatics, 75*(1), 29–41. https://doi.org/10.1016/j.ijmedinf.2005.07.029

Zhang, Y., Sun, Y., & Xie, B. (2015). Quality of health information for consumers on the web: A systematic review of indicators, criteria, tools, and evaluation results. *Journal of the Association for Information Science and Technology, 66*(10), 2071–2084. https://doi.org/10.1002/asi.23311