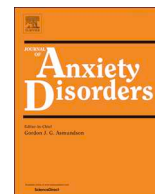




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Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety?



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ARTICLE INFO

Keywords:

Cyberchondria
COVID-19
Emotion regulation
Health anxiety
Virus anxiety

ABSTRACT

According to cognitive-behavioral models, traits, triggering events, cognitions, and adverse behaviors play a pivotal role in the development and maintenance of health anxiety. During virus outbreaks, anxiety is widespread. However, the role of trait health anxiety, cyberchondria, and coping in the context of virus anxiety during the current COVID-19 pandemic has not yet been studied. An online survey was conducted in the German general population ($N = 1615$, 79.8 % female, $M_{\text{age}} = 33.36$ years, $SD = 13.18$) in mid-March 2020, which included questionnaires on anxiety associated with SARS-CoV-2, trait health anxiety, cyberchondria_{pandemic} (i.e. excessive online information search), and emotion regulation. The participants reported a significantly increasing virus anxiety in recent months (previous months recorded retrospectively), especially among individuals with heightened trait health anxiety. Cyberchondria_{pandemic} showed positive correlations with current virus anxiety ($r = .09-.48$), and this relationship was additionally moderated by trait health anxiety. A negative correlation was found between the perception of being informed about the pandemic and the current virus anxiety ($r = -.18$), with adaptive emotion regulation being a significant moderator for this relationship. The findings suggest that trait health anxiety and cyberchondria serve as risk factors, whereas information about the pandemic and adaptive emotion regulation might represent buffering factors for anxiety during a virus pandemic.

1. Introduction

The current coronavirus (SARS-CoV-2) COVID-19 pandemic is causing considerable psychological and physical stress and high morbidity and mortality rates worldwide since its outbreak in December 2019 (Rosenbaum, 2020; Sohrabi et al., 2020; Tanne et al., 2020; Wang et al., 2020). Previous studies of past epidemics and pandemics (e.g., Ebola 2014/2016, H1N1 2009/2010, avian influenza 2006, SARS 2003) have shown that anxiety, health worries, and safety behavior are widespread in these times (Jalloh et al., 2018; Lau, Griffiths, Choi, & Tsui, 2010; Main, Zhou, Ma, Luecken, & Liu, 2011; Saadatian-Elahi, Facy, Del Signore, & Vanhems, 2010). Studies have found that up to over 50 % of respondents report worries or anxiety during virus-induced epidemics or pandemics (Bults et al., 2011; Goulia, Mantas, Dimitroula, Mantis, & Hyphantis, 2010; Jalloh et al., 2018; Lau et al., 2010). Recently, some studies have begun to investigate anxiety and other emotional symptoms during the current COVID-19 pandemic (Cao et al., 2020; Huang & Zhao, 2020; Lai et al., 2020; Qiu et al., 2020; Wang et al., 2020; Xiao, Zhang, Kong, Li, & Yang, 2020a, 2020b; Zhang

& Ma, 2020). Following models for the development of health anxiety (Brown, Skelly, & Chew-Graham, 2019; Williams, 2004; Witthöft & Hiller, 2010), however, there is currently still a lack of research on specific factors of vulnerability (e.g., trait health anxiety), amplification (e.g., cyberchondria), and coping (e.g., emotional regulation) regarding health anxiety in the context of the COVID-19 pandemic (Asmundson & Taylor, 2020; Rajkumar, 2020; Zhang & Ma, 2020).

Recent studies among students and the general population in China found that about 25–35 % of respondents suffer from anxiety symptoms or psychological stress during the COVID-19 pandemic (Cao et al., 2020; Huang & Zhao, 2020; Qiu et al., 2020; Wang et al., 2020). More than half of the respondents from the Chinese general population stated that they had concerns in general about the COVID-19 pandemic or that family members could be infected with SARS-CoV-2 (Wang et al., 2020; Zhang & Ma, 2020). When examining specific samples, recent studies found that medical staff and people affected by quarantine (themselves or someone they know) in particular suffer from anxiety and distress (Lai et al., 2020; Lei et al., 2020; Xiao et al., 2020a). Health concerns and anxiety associated with epidemics/pandemics can have a

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<https://doi.org/10.1016/j.janxdis.2020.102239>

Received 19 April 2020; Received in revised form 13 May 2020; Accepted 13 May 2020

Available online 20 May 2020

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significant psychological impact (e.g., stress, negative intrusive thoughts, avoidance), can be related to ineffective or unfavorable preventive behavior (e.g., behavior that from a scientific point of view has no preventive benefit but is disadvantageous for the user, e.g., time-consuming and/or fear-increasing), and can have adverse longer-term consequences such as persistent pessimism (Gaygisiz, Gaygisiz, Ozkan, & Lajunen, 2012; Peng et al., 2010; Qiu et al., 2020; Wang et al., 2020).

People's responses (including health anxiety) to epidemics/pandemics can vary from one individual to another (Gaygisiz et al., 2012). The investigation of possible influencing factors and moderators can help to better understand the development and maintenance of anxiety and to develop possible preventive measures and therapeutic interventions (Asmundson & Taylor, 2020; Blakey & Abramowitz, 2017). Health anxiety—i.e., worries and anxiety due to a perceived threat to health—is conceptualized as a dimensional construct that can range on a continuum from absent health awareness to pathological health anxiety or hypochondriasis (Abramowitz & Braddock, 2008; Bailer et al., 2016; Ferguson, 2009). Cognitive-behavioral models of health anxiety and hypochondriasis (Warwick, 1989; Witthöft & Hiller, 2010) assume that bodily sensations or benign symptoms are interpreted as threatening and as signs of a serious illness which can lead to health anxiety and subsequently to an increase in bodily sensations.

Bodily sensations and their perception and interpretation can be significantly influenced by triggering events (e.g., media reports, physiological arousal). The vicious circle of bodily sensations, cognitions, and anxiety may be more likely to occur in the case of certain predisposing factors (e.g., general vulnerability to anxiety) and may be maintained by illness behavior (e.g., safety-seeking behavior such as Internet research or visits to the doctor) in the sense of negative reinforcement (Williams, 2004; Witthöft & Hiller, 2010). Regarding interpretation and attribution processes, it is probably more likely in times of a virus outbreak that body sensations or symptoms are interpreted according to this context (e.g., "I'm breathing faster, I may have been infected by the coronavirus"; Blakey & Abramowitz, 2017). Studies of earlier pandemics (e.g., SARS) found that overestimation of the threat is associated with increased anxiety (Blakey & Abramowitz, 2017; Xie, Stone, Zheng, & Zhang, 2011).

Concerning triggering events and maintaining factors, the media might play a central role in epidemics/pandemics (e.g., excessive COVID-19-related Internet use as safety-seeking behavior; Garfin, Silver, & Holman, 2020; Hansen, 2009). The use of media can both itself represent a safety-seeking behavior (e.g., researching whether symptoms are a sign of a virus infection) and, due to possible disturbing information, can trigger or reinforce further safety-seeking behavior (e.g., further/excessive Internet use, visits to the doctor) (Brown et al., 2019; Garfin et al., 2020; Jungmann, Brand, Kolb, & Witthöft, 2020; Starcevic & Berle, 2013). Cyberchondria, repeated and/or excessive health-related Internet search associated with emotional stress (especially anxiety), is a common safety-seeking behavior that can increase and/or maintain worries and anxiety (Brown et al., 2019; Starcevic & Berle, 2013). During virus outbreaks, media reports are increasingly consumed, which often use emotional language and address emotional content that catches people's attention (Bao, Sun, Meng, Shi, & Lu, 2020; Garfin et al., 2020; Hansen, 2009; Klemm, Das, & Hartmann, 2016; Tausczik, Faasse, Pennebaker, & Petrie, 2012). Hansen (2009), for example, conducted a detailed narrative analysis of media reports in Norway during the SARS pandemic of 2003 and concluded that the media stir up anxiety among the population, e.g., by reporting selectively negative individual cases or inappropriate comparisons (e.g., Black Death in 14th century in Europe) and by using emotional and dramatic language. Studies during previous pandemics and the current COVID-19 pandemic found that media consumption is positively associated with anxiety (Gao et al., 2020; Moghanibashi-Mansourieh, 2020; Purohit et al., 2018; Roy et al., 2020). However, the results are inconsistent with regard to the exact relationship between knowledge about the virus and health anxiety (Blakey & Abramowitz, 2017; Goulia

et al., 2010; Lei et al., 2020; Wang et al., 2020). While Blakey and Abramowitz (2017) and Lei et al. (2020) found that a higher level of knowledge about the virus is associated with increased anxiety, Goulia et al. (2010) found that perceived knowledge is associated with less worry. In the study by Wang et al. (2020), there was no significant correlation between knowledge about the virus and anxiety, but the desire for additional information was associated with less anxiety. However, little research exists on possible factors contributing to the links between media consumption and knowledge about the virus and anxiety (Garfin et al., 2020). Probably, the relationships depend on the type, content, source, intention and/or extent of media consumption (e.g., accurate vs. ambiguous, Internet research as safety-seeking behavior, concrete information on preventive measures; Gao et al., 2020; Garfin et al., 2020; Purohit et al., 2018).

In addition to the above-mentioned factors for the development and maintenance of health anxiety, the role of coping processes and emotional regulation in health anxiety has been increasingly investigated in recent years (Bailer, Witthöft, Erkić, & Mier, 2017; Görden, Hiller, & Witthöft, 2014). The study of emotional and coping processes can contribute to the extension of existing models of health anxiety and to the development of possible preventive and interventional approaches. Previous studies have shown positive correlations between dysfunctional emotion regulation strategies such as rumination and catastrophization and health anxiety (Görden et al., 2014; Marcus, Hughes, & Arnau, 2008). Fergus and Valentiner (2010) found that a higher level of cognitive reappraisal can predict lower disease convictions. In the context of the research on epidemics/pandemics, the term "coping" is used more frequently, whereby there is a considerable overlap between the definition of coping ("... changing cognitive and behavioral efforts to manage specific external/internal demands ...", Lazarus & Folkman, 1984, p. 141) and emotion regulation ("... processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions ...", Gross, 1998, p. 275) as well as regarding individual strategies (e.g., acceptance, distraction). For example, Garnefski, Kraaij, and Spinhoven (2001) also conceptualize "coping as an aspect of emotion regulation" (p. 1312). In dealing with an epidemic, avoidant coping strategies (i.e., denying and disengagement) were associated with psychological complaints, while active coping strategies (e.g., planning, positive interpretation, and acceptance) were associated with subjective well-being (Main et al., 2011). In the study by Taha, Matheson, Cronin, and Anisman (2014), strategies such as self-blame, rumination, and passive resignation were grouped as emotion-focused coping strategies, which were positively associated with anxiety in relation to the H1N1 pandemic in 2009.

1.1. Aims of the study

Until now, there has been little research on the relevant factors associated with health anxiety according to cognitive-behavioral models and previous research (e.g., cyberchondria) in the context of virus outbreaks. In particular, there are hardly any studies on the current COVID-19 pandemic. For example, it was assumed that people with pre-existing health anxiety or hypochondriasis would be particularly vulnerable to anxiety and adverse behaviors during pandemics such as COVID-19, but there is little empirical research on this (Asmundson & Taylor, 2020).

The aim of this study was to investigate the links between trait health anxiety, cyberchondria, and virus anxiety during the COVID-19 pandemic. It was hypothesized that trait health anxiety moderates the level of virus anxiety (i.e., a stronger increase in virus anxiety when there is a stronger pre-existing health anxiety) and the relationship between cyberchondria and the current virus anxiety. Regarding emotion regulation, we assumed that dysfunctional emotion regulation has a positive relationship and adaptive emotion regulation a negative relationship with the current virus anxiety. In terms of favorable coping with the pandemic, we expected that the combination of favorable

factors (feeling well informed and adaptive emotion regulation) should be associated with low virus anxiety (i.e., adaptive emotion regulation as a moderator in the relationship between being informed and current virus anxiety).

2. Methods

2.1. Participants and procedure

Between 15 and 22 March 2020, persons from the German general population were recruited via press releases (print, online, local, and national), social media (e.g., Twitter), e-mail distribution lists of student councils at universities and via our department's website to participate in the online survey "How are you dealing with the coronavirus pandemic?" In addition to information on the study (type, content, duration, lottery of gift vouchers as compensation for participation), the announcements included a link to the online study. The survey was available in German language only.

In Germany, the first cases of SARS-CoV-2 infections became known at the end of January 2020. On 15 March, the number of infected cases in Germany was about 5000, including 12 deaths (worldwide: 154,000 infections), and on 22 March about 19,000 cases of infection, including 55 deaths (worldwide: 294,100 infections) (Robert Koch Institut, 2020a, 2020b; Statista, 2020). The online survey took place relative to the beginning of the virus outbreak in Germany (in comparison, at the beginning of April there were over 90,000 infections in Germany; Robert Koch Institut, 2020c).

The inclusion criteria of the study were an age of at least 16 years and informed consent. In total, the link to the online survey had $N = 5178$ clicks, $N = 2273$ people have started the study (most dropouts on the first pages), and $N = 1616$ participants have fully completed the study. One person was excluded because an age of "2" was entered. Of the 1615 participants, 79.8 % were female, 19.8 % male, and 0.4 % diverse. The average age was $M = 33.36$ years ($SD = 13.18$; range: 16–81 years). With regard to education/profession, 3.8 % were secondary school students or undergoing training, 39.4 % were students (36.0 % of them psychology students), 34.2 % were employees, 4% civil servants, 5% self-employed, 2.4 % job-seekers, 4% pensioners, 4.3 % housewife/househusband or on parental leave, and 2.8 % other. Among all participants, 10.0 % stated that they worked in the fields of health, medicine, or psychotherapy. As country of birth, 93.4 % of the participants named Germany, 3.8 % another European country, 0.7 % North America, 0.4 % South America, 2.3 % Asia, and 0.2 % Africa. With regard to SARS-CoV-2 infection, 0.1 % of the participants stated that they were infected themselves, 3.5 % reported knowing people with an infection in their close social environment (family or friends), 19.1 % reported knowing someone in their wider social environment (e.g., acquaintances or in the same place of residence), and 77.4 % reported not knowing anyone currently infected. Of the participants, 4.5 % reported themselves to be in quarantine, 20.6 % reported knowing someone in their close social environment, and 28.2 % reported knowing someone in their wider social environment who was in quarantine at the time of the survey (the remaining 46.7 % reported not knowing anyone).

The study protocol was approved by the local ethics committee of the Department of Psychology.

2.2. Measures

2.2.1. Trait health anxiety

The Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick, & Clark, 2002) is an 18-item self-report instrument based on the cognitive model of health anxiety and hypochondriasis (Warwick & Salkovskis, 1990), which assesses health anxiety over the past 6 months using a multiple choice format (each with four possible statements and coding 0–3). Two subscales are distinguished: (a) health anxiety and the

feared likelihood of becoming ill (14 Items) and (b) the feared negative consequences if the illness occurs (4 Items). This study used a validated German version of the SHAI (Bailer et al., 2013). The SHAI has shown good reliability and validity in previous studies (Alberts, Hadjistavropoulos, Jones, & Sharpe, 2013; Bailer et al., 2013; Salkovskis et al., 2002). In a meta-analysis of the SHAI (Alberts et al., 2013), an average total score (18 items, item coding: 0–3) of $M = 12.41$ ($SD = 6.81$) was found in non-clinical samples ($n = 10$ studies) and an average total score of $M = 32.58$ ($SD = 9.57$) in samples with patients with hypochondriasis ($n = 5$ studies). In the current study, the internal consistency (Cronbach's alpha) was $\alpha = .87$ for the total scale, $\alpha = .87$ for the subscale of health anxiety and feared likelihood of illness, and $\alpha = .69$ for the subscale of negative consequences of illness.

2.2.2. Cyberchondria related to the COVID-19 pandemic (Cyberchondria_{pandemic})

The German short version of the Cyberchondria Severity Scale (CSS-15; Barke, Bleichhardt, Rief, & Doering, 2016; McElroy & Shelin, 2014) uses 15 items to assess five dimensions of cyberchondria: "compulsion" (interruption of everyday activities due to health-related Internet research), "distress" due to Internet research, "excessiveness", "seeking reassurance", and "mistrust of medical professionals". In previous studies, the subscale "mistrust" tended to be a separate construct, so that this subscale was excluded in the present study as well as in previous studies (Fergus, 2014; McElroy et al., 2019; Norr, Allan, Boffa, Raines, & Schmidt, 2015). This version with four subscales is also equivalent to the English short version with 12 items (CSS-12; McElroy et al., 2019). For the current study, the items have been slightly modified so that the Internet research refers to the COVID-19 pandemic (e.g., "I panic when I read online that a symptom I have might be related to the coronavirus pandemic"). The statements are answered using a five-point Likert scale from 1 = never to 5 = always. The CSS proved to be reliable and showed a positive correlation with the mSHAI ($r = .57$, $p < .001$, Barke et al., 2016). Barke et al. (2016) found no association of CSS with age, but women showed higher values than men on the subscales excessiveness ($M_{women} = 2.7$, $SD = 0.8$; $M_{men} = 2.4$, $SD = 0.9$), reassurance ($M_{women} = 2.3$, $SD = 0.8$; $M_{men} = 2.0$, $SD = 0.9$), and distress ($M_{women} = 1.8$, $SD = 0.8$; $M_{men} = 1.6$, $SD = 0.7$; no gender difference for compulsion: $M_{women} = 1.5$, $SD = 0.6$; $M_{men} = 1.4$, $SD = 0.7$). In the present study, the internal consistencies were $\alpha = .86$ (compulsion), $\alpha = .75$ (distress), $\alpha = .68$ (excessiveness), $\alpha = .66$ (seeking reassurance), and $\alpha = .81$ for the total scale.

2.2.3. Emotion regulation

The Short Cognitive Emotion Regulation Questionnaire (CERQ-short; Garnefski & Kraaij, 2006) measures cognitive emotion regulation strategies in coping with negative life events. The CERQ-short consists of 18 items; two items each are used to assess the following strategies: self-blame, blaming others, rumination, catastrophization, acceptance, refocus on planning, positive refocusing, positive appraisal, and putting into perspective. The first four strategies can be summarized as maladaptive strategies and the last five as adaptive strategies (Legerstee, Garnefski, Verhulst, & Utens, 2011). The answers are given on a five-point Likert scale (from 1 = almost never to 5 = almost always). The CERQ-short was shown to be reliable and valid (Garnefski & Kraaij, 2006). For this study, the internal consistencies were $\alpha = .76$ (self-blame), $\alpha = .84$ (catastrophization), $\alpha = .75$ (acceptance), $\alpha = .57$ (rumination), $\alpha = .74$ (positive refocusing), $\alpha = .67$ (refocus on planning), $\alpha = .75$ (positive reappraisal), $\alpha = .72$ (putting into perspective), $\alpha = .70$ (other blame), $\alpha = .83$ (summarized adaptive strategies), and $\alpha = .76$ (summarized maladaptive strategies).

2.2.4. Questions specific to the COVID-19 pandemic

Specifically for the pandemic context, anxiety (0–100) related to the coronavirus was surveyed at three time points (retrospectively in December 2019 and at the end of January 2020, and currently, during

the survey from 15 to 22 March: "Please rate your anxiety about the coronavirus: (a) in December 2019 = outbreak/first reports in China, (b) end of January first case of coronavirus infection in Germany, and (c) today."). In addition, the participants were asked to indicate their subjective perception of being informed on various aspects related to the virus outbreak (transmission routes, symptoms, dangerousness, prevention, survival time of the virus on surfaces, availability of drugs, capacities of medical care, 0–100), as well as their current behaviors related to the pandemic (multiple choice format; Internet research, visits to doctors, increased shopping for hygiene products/food, purchase of face mask, increased washing of hands, increased use of disinfection, wearing a face mask, taking food supplements, avoiding crowds > 100 people, avoiding major events > 1000 people, avoiding travel within/outside Germany, the respondents have stolen hygiene products/face masks from a hospital or other institution).

2.3. Statistical analyses

Spearman's correlation coefficients were calculated, because most of the variables were not normally distributed. Repeated measures analyses of variance (rANOVA) were calculated for the course of the virus anxiety (the Greenhouse-Geisser adjustment was used to correct for violations of sphericity). The role of trait health anxiety for the virus anxiety course was investigated using a repeated measures analyses of covariance (rANCOVA) with the centered covariate trait health anxiety. For checking the hypotheses on moderation, we used the PROCESS macro in SPSS (Hayes, 2017), including bootstrap method with 5000 reiterations. In the moderation analyses, the total scores of the self-report measures were used (for health anxiety, the main subscale with 14 items). For all tests, the alpha level was set at .05 (5 %). Partial eta-squared (η_p^2) was calculated as effect size for rANOVA and rANCOVA ($\eta^2 \geq 0.01$ small effect; $\eta^2 \geq 0.06$ medium effect; $\eta^2 \geq 0.14$ large effect) and Cohen's *d* for (post-hoc) *t*-tests ($d \geq 0.30$ small, $d \geq 0.50$ medium, $d \geq 0.80$ large). For correlation analyses, the effect size conventions are: $r \geq |.10|$ small; $r \geq |.30|$ medium, $r \geq |.50|$ large (Cohen, 1992).

3. Results

3.1. Participants characteristics and anxiety related to SARS-CoV-2

Table 1 shows the participant characteristics with regard to questions specific to the COVID-19 pandemic and the self-report measures SHAI, CSS_{pandemic}, and CERQ-short. First, the characteristics of trait health anxiety (SHAI) and cyberchondria (CSS_{pandemic}) were examined to describe the sample. Compared with a meta-analysis on the SHAI (Alberts et al., 2013), the average score of the total SHAI in this study ($M = 14.68$, $SD = 6.58$) was slightly higher with a small effect than the average score found in non-clinical samples according to the meta-analysis ($M = 12.41$, $SD = 6.81$; $d = 0.34$), but considerably lower compared to individuals with hypochondriasis ($M = 32.58$, $SD = 9.57$; $d = 2.18$). Compared to an earlier study in the German general population (Barke et al., 2016; see average scores in the method), in this study women and men reported higher scores in the subscale "compulsion" ($M_{\text{women}} = 1.85$, $SD = 0.96$; $M_{\text{men}} = 1.82$, $SD = 0.91$) with low to medium effect sizes ($d = 0.38 - 0.67$) and lower scores in the subscales "excessiveness" ($M_{\text{women}} = 2.15$, $SD = 0.91$; $M_{\text{men}} = 1.95$, $SD = 0.82$) and "reassurance" ($M_{\text{women}} = 1.62$, $SD = 0.76$; $M_{\text{men}} = 1.66$, $SD = 0.83$) with low to medium effect sizes ($d = 0.40 - 0.74$).

Anxiety in relation to the virus showed a significant increase over the three measurement dates ($F(1.47, 2374.32) = 2386.04$, $p < .001$, $\eta_p^2 = .60$), both from December 2019 to January 2020 ($t(1614) = |27.85|$, $p < .001$, $d = 0.59$) and especially strong from January 2020 to March 2020 ($t(1614) = |46.14|$, $p < .001$, $d = 1.16$; the anxiety in December 2019 and January 2020 was assessed retrospectively). About half of the respondents stated that they suffer from moderate to severe anxiety associated with SARS-CoV-2 at the current time (March 2020), with about

Table 1

Participant characteristics with regard to questions specific to the COVID-19 pandemic and the self-report measures SHAI, CSS_{pandemic}, and CERQ-short ($N = 1615$).

	<i>M</i>	<i>SD</i>	<i>N</i>	%
State Anxiety related to SARS-CoV-2 (0–100)				
Virus anxiety December 2019*	8.30	15.39		
Virus anxiety January 2020*	19.00	19.72		
Virus anxiety March 2020	47.18	27.12		
Perceptions of being informed (0–100)				
Transmission	72.66	24.06		
Symptoms	65.50	24.71		
Dangerousness	64.10	26.33		
Prevention	70.61	25.70		
Survival time of the virus	45.33	29.47		
Availability of drugs	56.67	33.17		
Capacities of medical care	48.39	27.95		
Behaviors in response to the COVID-19 pandemic (Yes/No; <i>N</i>/% for Yes answers)				
Internet research			1376	85.2
Visits to doctors			39	2.4
Increased shopping for hygiene products			145	9.0
Increased shopping for food			372	23.0
Purchase of face mask			42	2.6
Increased washing of hands			1529	94.7
Increased use of disinfection			842	52.1
Wearing a face mask			46	2.8
Taking food supplements			252	15.6
Avoiding crowds > 100 people			1484	91.9
Avoiding major events > 1000 people			1520	94.1
Avoiding travel within Germany			1294	80.1
Avoiding travel outside Germany			1445	89.5
Hygiene products/masks stolen from e.g., hospital (the responders themselves)			27	1.7
Self-report measures				
Health Anxiety (SHAI) total (sum: 0–54)**	14.68	6.58		
Health Anxiety (SHAI) subscale health anxiety (mean: 0–3)**	0.84	0.40		
Health Anxiety (SHAI) subscale neg. consequences (mean: 0–3)**	0.73	0.50		
Cyberchondria (CSS _{pandemic}) total (sum: 12–60)**	22.45	7.28		
Cyberchondria (CSS _{pandemic}) compulsion (mean: 1–5)**	1.85	0.95		
Cyberchondria (CSS _{pandemic}) distress (mean: 1–5)**	1.90	0.85		
Cyberchondria (CSS _{pandemic}) excessiveness (mean: 1–5)**	2.11	0.90		
Cyberchondria (CSS _{pandemic}) seeking reassurance (mean: 1–5)**	1.63	0.78		
Maladaptive emotion regulation (CERQ-short; 8–40)	20.37	5.14		
Adaptive emotion regulation (CERQ-short; 10–50)	33.78	6.69		

Notes: SHAI = Short Health Anxiety Inventory; CSS_{pandemic} = Cyberchondria related to the COVID-19 pandemic; CERQ-short = short version of the Cognitive Emotion Regulation Questionnaire. *The anxiety in December 2019 and January 2020 was assessed retrospectively. ** For comparability with previous studies, the average sum scores were calculated for the total scales, and for the subscales the mean scores of the scoring of the response categories.

25 % of the respondents choosing a score between 50–75 and about 25 % a score between 75 and 100 (0–100, 100 = very severe anxiety).

The current level of anxiety about the virus (March 2020) showed no significant correlations with age or education ($r \leq .03$, $p \geq .32$). However, when considering age categories (16–29, 30–59, and over 60 years of age) we found a significant effect of the age category ($F(2, 1612) = 5.82$, $p = .003$, $\eta_p^2 = .01$) with 30–59 year-olds differing significantly from the younger and older age groups ($t(172.67) \geq 2.10$, $p \leq .037$, $d \geq 0.22$), the latter showing no significant difference ($t(152.28) = 0.67$, $p = .51$, $d = 0.07$). Women ($M = 49.47$, $SD = 27.00$) reported a significantly higher virus anxiety than men ($M = 43.04$, $SD = 27.08$; $t(1606) = 3.81$, $p < .001$, $d = 0.24$). College students and participants employed in a health profession (e.g., psychology, medicine, physiotherapy, nursing; $M = 45.40$, $SD = 24.99$) reported a significantly lower virus anxiety compared to the other participants ($M = 49.59$, $SD = 28.06$; $t(1246.09) = 2.95$, $p = .003$, $d = 0.16$). With

Table 2

Spearman's correlations among current virus anxiety (March 2020), health anxiety, cyberchondriasis_{Pandemic}, the perception of being informed, and emotion regulation ($N = 1615$).

	1	2	3	4	5	6	7	8	9	10	11
1. Virus anxiety (March 2020)	1										
2. SHAI health anxiety	.34***	1									
3. SHAI neg. consequences	.22***	.29***	1								
4. CSS _p total	.39***	.35***	.23***	1							
5. CSS _p compulsion	.24***	.19***	.18***	.68***	1						
6. CSS _p distress	.48***	.40***	.29***	.74***	.44***	1					
7. CSS _p excessiveness	.26***	.29***	.16***	.72***	.30***	.40***	1				
8. CSS _p seeking reassurance	.09***	.12***	.02	.56***	.14***	.26***	.28***	1			
9. Being informed (sum)	-.18***	-.17***	-.19***	-.24***	-.16***	-.28***	-.19***	-.05*	1		
10. CERQ _s maladaptive	.17***	.33***	.31***	.27***	.19***	.32***	.19***	.06*	-.16***	1	
11. CERQ _s adaptive	-.06*	-.13***	-.24***	-.02	-.01	-.10***	-.01	.05*	.09**	-.05*	1

Notes: SHAI = Short Health Anxiety Inventory; CSS_{Pandemic}/CSS_p = Cyberchondria related to the COVID-19 pandemic; CERQ-short/CERQ_s = short version of the Cognitive Emotion Regulation Questionnaire. *** $p < .001$, ** $p < .01$, * $p < .05$.

the exception of a very small significant correlation between the current virus anxiety and a SARS-CoV-2 infection in the wider social environment ($r = .07$, $p = .007$), no significant correlations between the current virus anxiety and a SARS-Cov-2 infection or the quarantine situation (self, others) were observed ($r \leq .05$, $p \geq .06$).

Ratings of being well informed about the virus/pandemic varied according to the topic surveyed. Participants reported being best informed about the transmission routes of the virus ($M = 72.66$, $SD = 24.06$, 0–100) and possibilities of prevention ($M = 70.61$, $SD = 25.70$, 0–100) and least informed about medical capacities ($M = 48.39$, $SD = 27.95$, 0–100). Regarding behaviors in response to the COVID-19 pandemic, three topics were affirmed by more than 90 % of participants (increasing hand washing, avoiding crowds > 100 people, avoiding major events > 1000 people).

3.2. Correlational analyses

Table 2 shows the relationships between the current virus anxiety, health anxiety, cyberchondria_{Pandemic}, the perception of being informed, and emotion regulation. Current virus anxiety showed positive relationships with trait health anxiety ($r = .34$, $p < .001$), cyberchondria_{Pandemic} (especially distress caused by Internet research, $r = .48$, $p < .001$), and maladaptive emotion regulation ($r = .17$, $p < .001$), and a negative relationship with the perception of being well informed ($r = -.18$, $p < .001$). Trait health anxiety correlated positively with cyberchondria (especially distress, $r = .40$, $p < .001$) and maladaptive emotion regulation ($r = .33$, $p < .001$), and negatively with the perception of being well informed ($r = -.17$, $p < .001$) and adaptive emotion regulation ($r = -.13$, $p < .001$). The better-informed the participants felt, the less cyberchondria was reported ($r = -.24$, $p < .001$).

3.3. Trait health anxiety and current virus anxiety

Fig. 1 A shows the course of virus anxiety as a function of the level of health anxiety. The rANCOVA with the covariate trait health anxiety showed a significant main effect of time ($F(1.50, 2421.22) = 2559.27$, $p < .001$, $\eta_p^2 = .61$), and a significant interaction of time \times trait health anxiety ($F(1.50, 2421.22) = 118.18$, $p < .001$, $\eta_p^2 = .07$). The correlation between virus anxiety and trait health anxiety increased over time (December 2019: $r = .10$, $p < .001$; January 2020: $r = .23$, $p < .001$; March 2020: $r = .37$, $p < .001$).

In addition, we tested the hypothesis whether the relationship between cyberchondria and the current virus anxiety (March 2020) is moderated by trait health anxiety. Trait health anxiety was shown to be a significant moderator in the relationship between cyberchondria related to the COVID-19 pandemic and the current virus anxiety ($B = -.032$, $p = .004$; explanation of variance of the whole model $R^2 = 20.85$ %, $p < .001$). Fig. 1 B illustrates the moderation analysis.

3.4. Emotion regulation

Adaptive emotion regulation moderated the association between the perception of being well informed about SARS-CoV-2 and current virus anxiety ($B = .001$, $p = .032$; explanation of variance of the whole model $R^2 = 3.88$ %, $p < .001$; Fig. 2). When considering the individual adaptive strategies, acceptance ($B = .006$, $p = .015$; explanation of variance of the whole model $R^2 = 3.80$ %, $p < .001$) and putting into perspective ($B = .007$, $p = .004$; explanation of variance of the whole model $R^2 = 4.20$ %, $p < .001$) proved to be significant moderators. In contrast, maladaptive emotion regulation was not shown to be a significant moderator ($B < .001$, $p = .389$).

4. Discussion

The aim of the study was to investigate the links between health anxiety, cyberchondria, and virus anxiety in the context of the current COVID-19 pandemic. In particular, a possible unfavorable effect of a pre-existing health anxiety as well as favorable effects of information and positive emotion regulation were examined.

Overall, the results should be interpreted against the background of the situation in Germany at the time the study was conducted. The study took place from 15 to 22 March 2020, at the beginning of the virus outbreak in Germany (between 5000–19,000 SARS-CoV-2 infections in Germany; for comparison, there were over 90,000 infections in Germany at the beginning of April 2020). A study at the beginning of the virus outbreak can be helpful to better understand the development of anxiety and to promote possible identified preventive interventions (resilience factors) as the pandemic progresses.

Considering the sample characteristics, this sample reported a slightly higher trait health anxiety (SHAI) compared to the average in previous non-clinical samples, however overall, the level of health anxiety can be described as relatively low compared to individuals with hypochondriasis (Alberts et al., 2013). It is possible that participants in the COVID-19 pandemic may have reported higher scores in the SHAI, as the self-report also covers the last 6 months. Alternatively, previous studies in non-clinical samples have been conducted almost exclusively on student samples that differ from the sample examined here in terms of socio-demographic variables (e.g., younger average age, higher average educational level), which could possibly also explain (smaller) differences in the SHAI scores. In comparison to an earlier study on cyberchondria in the German general population (Barke et al., 2016), we found higher average scores in the subscale "compulsion" and lower average scores in the subscales "excessiveness" and "reassurance". Because we have adapted the CSS for the pandemic (e.g., search for symptoms associated with SARS-CoV-2 infection), the results are only comparable to a limited extent. It is possible that due to the current media presence of the COVID-19 pandemic (Gao et al., 2020), during

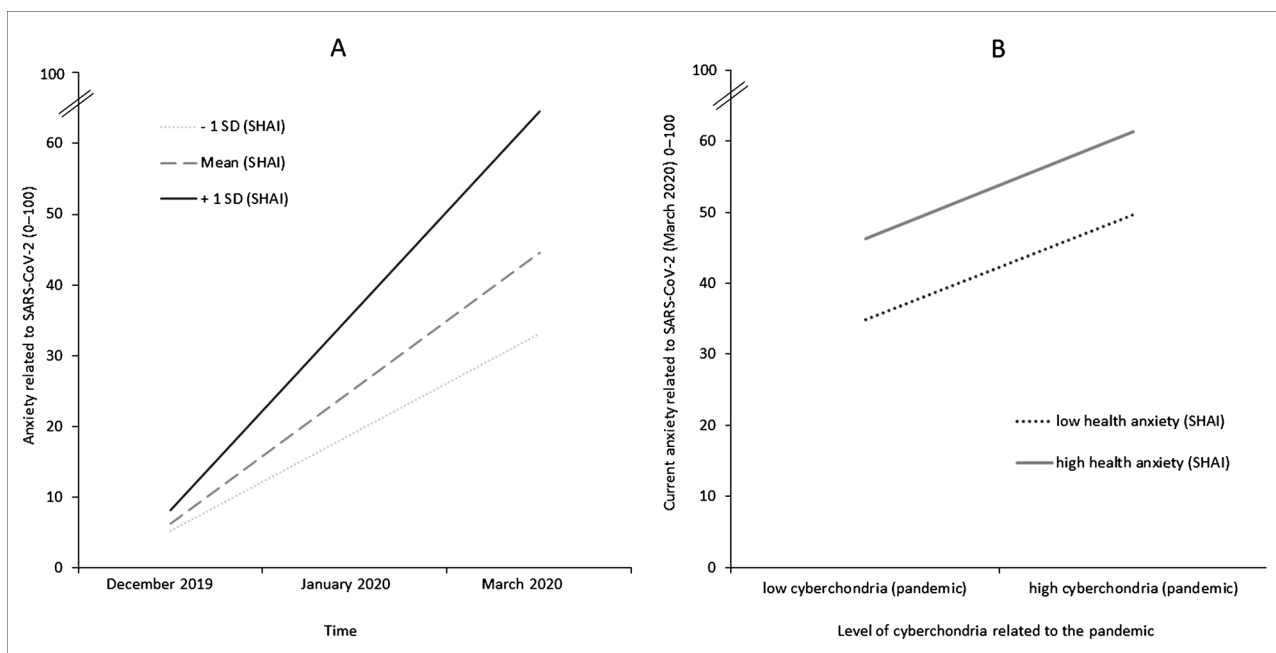


Fig. 1. The relationship between trait health anxiety and virus anxiety. A) The course of virus anxiety from December 2019 to March 2020 (December 2019 and January 2020 retrospectively recorded) depending on the level of health anxiety. B) The relationship between cyberchondria and the current virus anxiety (March 2020) is moderated by trait health anxiety. SHAI = Short Health Anxiety Inventory.

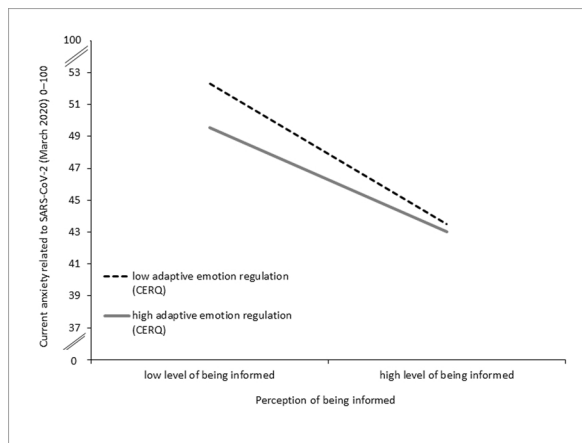


Fig. 2. Adaptive emotion regulation moderates the relationship between the perception of being well informed about SARS-CoV-2 and current virus anxiety (March 2020). CERQ = Cognitive Emotion Regulation Questionnaire.

the pandemic people may be more often distracted from their activities and occupations by this topic, which could explain the increased scores in the subscale "compulsion". With regard to the subscales "excessiveness" and "reassurance", the lower levels found here could be explained by the fact that possible symptoms of an infection are searched online less often compared to other topics of the pandemic, and that during the COVID-19 pandemic doctors are visited less often (Mehrotra, Chernew, Linetsky, Hatch, & Cutler, 2020).

In the current study, about half of the respondents reported moderate to severe anxiety associated with SARS-CoV-2, which is consistent with previous studies on anxiety in epidemics/pandemics (Goulia et al., 2010; Jalloh et al., 2018). However, direct comparability is difficult because of differences in the samples studied (e.g., general population, students, health-care workers), as well as in the measuring instruments and questions for assessing anxiety, which range from standardized self-report measures with no concrete reference to the epidemic/pandemic to concrete questions of concern about infecting oneself or a family

member (Cao et al., 2020; Goulia et al., 2010; Jalloh et al., 2018; Lai et al., 2020; Lau et al., 2010; Wang et al., 2020). In the context of the current COVID-19 pandemic, Wang et al. (2020) found in a survey of the Chinese general population, conducted at a similar time of the virus spread in the country (survey from 31 January to 2 February 2020, about 15,000 confirmed cases), that about 30 % reported anxiety symptoms in a standardized self-report measure without any concrete reference to the pandemic and 75 % were concerned that family members might get infected with SARS-CoV-2. Our result fits well into these findings, as we asked a more general question about anxiety associated with SARS-CoV-2.

In line with recent studies on the COVID-19 pandemic (Moghanibashi-Mansourieh, 2020; Qiu et al., 2020), we found that women report higher levels of anxiety associated with the pandemic, a finding that is also consistent with the higher prevalence of anxiety disorders (and corresponding vulnerability factors) in women (Li & Graham, 2017; Remes, Brayne, van der Linde, & Lafortune, 2016). As in the study by Moghanibashi-Mansourieh (2020), middle-aged people (in this study: 30–59 years) reported a stronger anxiety associated with the current COVID-19 pandemic, possibly because this age group is facing greater family and job concerns (e.g., financial worries). At first glance differing from previous studies (Lai et al., 2020; Xiao et al., 2020a), this study found that people who work in the health care sector report less virus anxiety. However, to date, hardly any studies have directly compared health care workers with employees in other sectors, and in contrast to other studies, this study has broadly defined the health care sector (e.g., including psychology, nutrition, physiotherapy) and specifically asked about the fear of the virus rather than more general anxiety symptoms. The result of this study could be explained by the fact that healthcare workers are more accurately informed about the virus and the pandemic and are confronted with this issue in their daily work, which could possibly lead to a habituation-like effect.

Concerning the perception of being informed about various issues of the COVID-19 pandemic, the highest approval rates were shown for the transmission routes and possibilities of prevention, which is in line with previous findings and intentions to promote preventive measures in the population (Vaughan & Tinker, 2009; Wang et al., 2020; World Health Organization, 2020). At the same time, however, in March 2020 about

20 % stated that they were not or were only moderately informed on these topics, which also shows the need to further inform the population via responsible and authoritative sources.

Approval rates for behavior in response to the current pandemic indicate that more than 90 % of participants follow international recommendations (e.g., increased hand washing, avoidance of crowds; World Health Organization, 2020). Safety-seeking behaviors (Internet research, panic buying) are also widespread, while ambiguous and fear-inducing media reports can also contribute significantly to panic buying (Garfin et al., 2020). Since increased consumption of particularly hygiene products and masks can lead to shortages for medical staff and price increases, clear information and effective communication in the media on appropriate preventive measures are immensely important (Garfin et al., 2020).

Concerning the links among trait health anxiety, cyberchondria_{pandemic}, and virus anxiety, we found consistently significant positive correlations. The positive correlation between health anxiety and cyberchondria is consistent with cognitive-behavioral models of health anxiety and previous findings (Brown et al., 2019; McMullan, Berle, Arnáez, & Starcevic, 2019). In addition, this study showed that excessive Internet use in relation to the COVID-19 pandemic and, in particular, the resulting stress are also positively related to health anxiety. Furthermore, we found for the first time that the stronger the cyberchondria, the higher the current virus anxiety. This could also confirm the widely held assumption that excessive media consumption during the COVID-19 pandemic is associated with increased anxiety (Garfin et al., 2020). Even though we have examined state anxiety ("today"), and cyberchondria refers to a longer period of time, we cannot draw any causal conclusions with our study design. The relationship with the subscale "seeking reassurance" was very weak ($r = .09/.12, p < .001$) in contrast to the other subscales of cyberchondria_{pandemic} ($r = .19-.48, p < .001$). The items of this subscale refer to the fact that the Internet search leads to a doctor's visit or that the results of the Internet search are discussed with the doctor, which is likely to be less relevant in the context of the COVID-19 pandemic (e.g., a tendency to avoid visits to the doctor by recommending to visit a doctor only in urgent cases or with clear symptoms, or fears of being infected related to the visit to the doctor). The perception of being informed about the pandemic was consistently negatively correlated (albeit rather weakly correlated) with current virus anxiety, health anxiety, and cyberchondria. Feeling well informed thus seems to have a buffering and beneficial effect on the emotional state; on the other hand, people who feel well-informed seem to conduct less excessive and burdensome Internet research. This finding is also in line with current models of cyberchondria (Brown et al., 2019; Starcevic & Berle, 2013). Excessive Internet searches may have started in the hope of gaining information and relief (e.g., positive meta-beliefs such as "I need the Internet research during the pandemic to be better prepared"), but more often, on the contrary, result in a wealth of (often ambiguous) information and increased anxiety.

Anxiety about SARS-CoV-2 increased significantly between December 2019 and March 2020, with a particularly strong effect ($d = 1.16$) between the end of January and mid-March. As expected, this increase was significantly stronger for individuals with increased health anxiety. This also corresponds to cognitive-behavioral models (Williams, 2004; Witthöft & Hiller, 2010) that trait characteristics (such as trait anxiety) represent a vulnerability to health concerns. Specifically for the context of pandemics, it seems to confirm assumptions that pre-existing health anxiety can be a risk factor for increased anxiety during pandemics (Asmundson & Taylor, 2020). Cyberchondria might also play a relevant role in this relationship. We also found that when health anxiety and high cyberchondria are combined, virus anxiety is strongest (health anxiety as a moderator)—i.e., when these two factors come together, people suffer from severe anxiety about SARS-CoV-2. In accordance with our hypotheses, the higher the maladaptive emotional regulation, the higher the virus anxiety, and the higher the adaptive

emotional regulation, the lower the virus anxiety (although the last correlation was very weak). Additionally, it was found that a combination of a low level of adaptive emotion regulation and a low level of pandemic information is associated with particularly high virus anxiety (adaptive emotion regulation as moderator, Fig. 2). Conversely, a higher level of adaptive emotion regulation and especially a high level of information seem to have a positive effect (i.e. less virus anxiety). In particular, acceptance (to accept what has been experienced and what has happened) and putting into perspective (to put into perspective and compare with worse events, e.g. that there are worse things in life) proved to be significant moderators. This is consistent with previous studies, which also found negative correlations between acceptance and putting into perspective, and anxiety (Garnefski, Legerstee, Kraaij, van den Kommer, & Teerds, 2002; Martin & Dahlen, 2005). Concerning interventions, it was also shown that acceptance-based strategies are effective in reducing anxiety and somatoform complaints (Kelson, Rollin, Ridout, & Campbell, 2019; Kleinstäuber, Gottschalk, Berking, Rau, & Rief, 2016; Twhig & Levin, 2017).

Implications of our study may be to reduce the identified risk factors (trait health anxiety, cyberchondria), to promote favorable factors (being informed, adaptive emotion regulation) and to consider interactions (combination of unfavorable/favorable factors) to reduce anxiety in times of virus outbreaks (cf. also e.g., Schimmenti, Billieux, & Starcevic, 2020; Xiao et al., 2020b). In terms of risk factors, it should be easier to reduce them with regard to cyberchondria, such as by educating and recommending behavior for the population (e.g., that excessive use of the Internet can increase anxiety; recommending reputable sources; basic help to reduce cyberchondria) and that recommendations should also be followed in media reporting (e.g., concrete/accurate, reputable information, avoiding fear-inducing language). This is also linked to the finding that feeling informed can have a buffering effect on anxiety and shows the importance of accurate and confident information and effective communication (Garfin et al., 2020). In the age of digitalization and online intervention, it is also conceivable that interventions to reduce health anxiety and/or promote adaptive emotion regulation strategies in the form of evaluated online tools could be a promising way to reduce anxiety during virus pandemics.

Some limitations should be mentioned. Although the study covers a large sample, it is not representative of the German general population in terms of socio-demographic variables (79.8 % female, $M_{age} = 33.36$ years, 39.4 % students). In addition, the type of recruitment (including social media) as well as the online nature of the study probably appealed more to people with an Internet affinity. It is possible that persons with a higher affinity for the Internet and online activities also show higher overall values in cyberchondria. Compared to the study by Barke et al. (2016), however, the sample of this study showed lower values in two subscales (and a higher and a comparable value in another subscale each). Concerning the information on the pandemic, the subjective evaluation of being informed was assessed, as it was assumed that the subjective experience is more associated with anxiety than with objectively assessed knowledge (e.g., through a quiz). However, it would have been interesting to examine whether the subjective evaluation is related to the objectively assessed knowledge and how the latter is related to anxiety. The virus anxiety in December 2019 and end of January 2020 was retrospectively recorded. This data could be influenced by memory bias, by interpretations depending on the current context (e.g., "Currently the pandemic is much stronger, I was hardly worried at all at an earlier time"), or by assumptions about a possible course. Overall, it would be promising for future studies to conduct longitudinal studies (e.g., ecological momentary assessments) to assess anxiety during virus outbreaks in order to be able to draw causal conclusions. Since the implementation of this study, three standardized self-report measures have been published that were specifically designed to assess anxiety and distress during the coronavirus pandemic, the "COVID Stress Scales" (CSS; Taylor et al., 2020; e.g., "I am worried

about catching the virus."), the "Fear of COVID Scale" (FC-19S; Ahorsu et al., 2020; e.g., "I am most afraid of coronavirus-19."), and the "Coronavirus Anxiety Scale" (CAS; Lee, 2020; e.g., "I had trouble falling or staying asleep because I was thinking about the coronavirus."). Due to the heterogeneity of measurement methods and individual, non-validated, questions in previous studies, it would be essential for the comparability and validity of studies on anxiety and distress in the context of the COVID-19 pandemic that these instruments continue to be tested and are increasingly used in future COVID-19 studies.

5. Conclusions

The study was the first to find, during the current COVID-19 pandemic, that health anxiety, cyberchondria, and especially the combination of the two was associated with increased virus anxiety. Regarding potential buffering effects on anxiety, the study found negative correlations between the perception of being informed and the virus anxiety. Current virus anxiety was lowest when individuals use adaptive emotion regulation strategies (acceptance and putting into perspective) and especially when they feel well informed. These findings may indicate starting points for interventions in times of a virus outbreak, such as the reduction of cyberchondria, providing and disseminating accurate information about the pandemic and effective communication through the media, as well as the promotion of adaptive emotion regulation strategies.

Role of funding sources

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

Declaration of Competing Interest

None.

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