Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Psychosomatic Research 152 (2022) 110687

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

journal homepage: www.elsevier.com/locate/jpsychores

Do patients with pathological health anxiety fear COVID-19? A time-course analysis of 12 single cases during the "first wave" of the COVID-19 pandemic in Germany

Karoline S. Sauer [a,*], Andrea Schmidt [b], Stefanie M. Jungmann [a], Josef Bailer [c], Michael Witthöft [a]

[a] Department of Clinical Psychology, Psychotherapy, and Experimental Psychopathology, Johannes Gutenberg-University of Mainz, Germany
[b] DIPF | Leibniz Institute for Research and Information in Education, Germany
[c] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim/University of Heidelberg, Germany

ARTICLE INFO

Keywords:
COVID-19
Health anxiety
Hypochondriasis
SARS-CoV-2
Virus anxiety

ABSTRACT

Objective: Pre-existing health anxiety is associated with an intensified affective response to the novel COVID-19 pandemic in the general population. Still, results on the reaction of people with a diagnosis of pathological health anxiety (i.e., hypochondriasis) are scarce.

Methods: In the present study, we investigated the course of (health) anxiety related to SARS-CoV-2/COVID-19 in comparison to (health) anxiety related to other severe diseases (e.g., cancer) in a sample of 12 patients with the diagnosis of pathological health anxiety during the "first wave" of the COVID-19 pandemic in Germany. Both SARS-CoV-2 related anxiety and anxiety related to other severe diseases were assessed weekly over 16 measurement points (30.03.-19.07.2020) and primarily analyzed with fixed effects regression analyses.

Results: Unexpectedly, SARS-CoV-2 related anxiety was on average significantly lower than anxiety related to other severe diseases ($d = -0.54$, $p < .001$) and not significantly associated with anxiety related to other severe diseases or pre-COVID-19 health anxiety.

Conclusion: It therefore appears premature to assume that SARS-CoV-2 related anxiety and other health worries are necessarily strongly interrelated and comparably high in people with pathological health anxiety.

1. Introduction

The COVID-19 (SARS-CoV-2) pandemic and related measures to reduce virus spreading (e.g., quarantine) are known to trigger and partly intensify mental distress (e.g., anxiety) in the general population [1,2]. Current research increasingly focuses on investigating risk factors for an elevated response to the COVID-19 pandemic [3] and on identifying vulnerable groups suffering from higher mental distress. Research in this area gained further importance and urgency, as recent large-scale studies found a bidirectional association between mental disorders and the risk and severity of COVID-19 [4,5]. So far, the research on risk factors for higher COVID-19 related mental distress has highlighted effects of e.g., sociodemographic (e.g., age [1]), psychological (e.g., intolerance of uncertainty [6]), personality (e.g., neuroticism [7]), and COVID-19-risk-related (e.g., pre-existing somatic conditions [8]) factors, and has promoted the development of theoretical frameworks on the response to the pandemic (e.g., [9]). Several large-scale studies in the general population have furthermore confirmed the association between increasing levels of health anxiety and intensified COVID-19 related mental distress (e.g., virus anxiety), and cognitive (e.g., attention to virus-related stimuli) and behavioral responses (e.g., reassurance-seeking) [10–16].

People with pre-existing mental disorders are thought to be prone to increased COVID-19 related stress as they are at risk of showing an elevated response to external stressors [17] due to psychopathological factors (e.g., anxiety sensitivity [18]), processes (e.g., cognitive evaluation of stressors), and coping strategies (e.g., avoidance). These mechanisms could promote an intensification of symptomatology or

* Corresponding author at: Department of Clinical Psychology, Psychotherapy, and Experimental Psychopathology, Johannes Gutenberg-University of Mainz, Wallstraße 3, 55122 Mainz, Germany.
E-mail addresses: karsauer@uni-mainz.de (K.S. Sauer), andrea.schmidt@dipf.de (A. Schmidt), jungmann@uni-mainz.de (S.M. Jungmann), josef.bailer@zi-mannheim.de (J. Bailer), witthoef@uni-mainz.de (M. Witthöft).

https://doi.org/10.1016/j.jpsychores.2021.110687
Received 25 February 2021; Received in revised form 25 November 2021; Accepted 27 November 2021
Available online 1 December 2021

even a recurrence of previously remitted symptoms [17]. Results so far indicate that current and pre-existing *unspecified* mental disorders and *specific* anxiety-related and mood disorders are associated with higher levels of COVID-19- or isolation-related distress [17,19–22]. An intensification of pre-existing symptomatology was partly reported as well (e.g., for OCD; [23]).

People with pre-existing pathological levels of health anxiety (e.g., a diagnosis of hypochondriasis) are also considered as a high-risk group for increased mental distress in the context of the COVID-19 pandemic [24,25]. In line with the cognitive-behavioral model of hypochondriasis [26] and current models of somatic symptom perception (e.g., [27]), illness−/health-related schemata or symptom expectations (priors) could be activated by the pandemic threat and lead to heightened awareness *for* and catastrophic (mis-)interpretation (somatosensory amplification; [28]) *of* benign body sensations (posterior). Thereby triggered hypochondriacal safety (e.g., reassurance-seeking) and virus-preventive (e.g., hoarding) behavior [10,11,24] may further contribute to the maintenance of COVID-19 related anxiety. The detrimental association between health anxiety and COVID-19 related mental distress, which was observed in the general population [10–15], should be especially pronounced in people with pathological health anxiety [24]. Quittkat et al. [29], indeed, found a trend towards an increase of health worries (partly retrospectively assessed) in people with a self-reported Illness Anxiety Disorder. Longitudinal data of people with a *diagnosed* Hypochondriasis (according to the International Classification of Mental and Behavioural Disorders (10th ed.; ICD-10; [30])) or Illness Anxiety Disorder/Somatic Symptom Disorder (with predominant health worries) (according to the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; [31])), which furthermore differentiates between SARS-CoV-2 related worries and worries in relation to other severe diseases (e.g., cancer), nevertheless, is still lacking.

The present study, therefore, aimed at investigating the emotional reaction of people with pathological health anxiety throughout the "first wave" of the COVID-19 pandemic in Germany. More specifically, we were interested in whether the intensity of SARS-CoV-2 related anxiety and anxiety related to other severe diseases (e.g., cancer) are comparable and whether they do reciprocally reinforce each other. We hypothesized that patients with pathological health anxiety report constantly high levels of SARS-CoV-2 related anxiety, which are comparable to levels of anxiety in relation to other severe diseases (e.g., cancer) and which are further intensified by pre-COVID-19 health anxiety. We further hypothesized that SARS-CoV-2 related anxiety and anxiety related to other severe diseases would be strongly positively correlated both (a) simultaneously and (b) time-lagged. In detail, we assumed that they mutually intensify (or weaken) each other both in the same week and across weeks (e.g., from week 3 to week 4).

2. Materials and methods

2.1. Participants

Participants were patients of two psychotherapy outpatient clinics (with specialized treatment units for pathological health anxiety) at the Johannes Gutenberg-University (JGU) of Mainz (cases 1–7, 9–12) and at the Central Institute of Mental Health (CIMH) in Mannheim (case 8).

Cases 1–5, and 8 were treated as part of a study in which a new cognitive-behavioral treatment approach to pathological health anxiety [32] was piloted. These participants were recruited via press releases and social media (e.g., Twitter) and were screened for eligibility in a personal psychological consultation. Minimum age of 18 years, a diagnosis of a DSM-5 Illness Anxiety Disorder/Somatic Symptom Disorder with predominant health worries (diagnosed with the structured Diagnostic Interview for Mental Disorders (DIPS; [33,34])), and no current severe major depression, no substance use while having a substance use disorder, no acute suicidality, no acute psychotic symptoms, no indications for organic brain disorders and/or intellectual disabilities and no somatic disorders which exclude exposure-based approaches were required as eligibility criteria. All six patients provided informed consent to participate in the study.

Besides, patients, who were already treated in the outpatient clinic specialized in the treatment of pathological health anxiety of the JGU, were also asked to participate in the weekly assessment. All of these patients did have a current ICD-10 Hypochondriacal Disorder (diagnosed with the Structured Clinical Interview for DSM-IV (SCID; [35])), and were neutrally informed about the purpose of the study by their therapist without indicating any benefits of participating and any disadvantages of non-participation. Of the $N = 35$ patients being treated on behalf of a diagnosis of an ICD-10 Hypochondriacal Disorder in the outpatient clinic of the JGU in calendar week 14, $N = 7$ provided informed consent to participate in the weekly assessment prior to participation. One participant was excluded, as he participated only in one measurement point.

Of the total $N = 12$ included patients, $N = 8$ had missing data on the weekly anxiety ratings (missing data rate: about 19% [case 6], 25% [case 7], about 38% [case 8], 50% [cases 9, 10], about 56% [case 12], about 69% [case 11]), which leads to a total sample missing data rate of 25.52% each for anxiety related to SARS-CoV-2 and to other severe diseases. Case 5, furthermore, lacked a value for pre-COVID-19 health anxiety (total sample missing data rate of 8.33% for pre-COVID-19 health anxiety). As this study was conducted in a naturalistic setting, all patients were in different treatment phases and treated by different therapists (for information on sample characteristics see Table 1). All included participants sought for help because of health worries typical for people with pathological health anxiety (e.g., cancer and cardiovascular diseases; [36,37]).

Data collection was carried out from the 30th of March (calendar week 14) to the 19th of July 2020 (calendar week 29) in the "first wave" of the COVID-19 pandemic in Germany with $N = 57{,}298$ (30th of March) and $N = 201{,}574$ (19th of July) registered cumulated SARS-CoV-2 infections, and $N = 4751$ (30th of March) and $N = 202$ (19th of July) newly-registered SARS-CoV-2 infections [38,39]. Germany was mainly considered as passing well through the "first wave" of the COVID-19 pandemic, especially due to a sufficient, well-resourced health care system, early set containment measures (e.g., restriction of contact from 22nd of March 2020), and a broad testing strategy [40]. Although therefore being able to contain COVID-19 related deaths during the "first wave" of the COVID-19 pandemic, especially in comparison with highly affected countries, such as Italy, Germany still ranked in the upper half of European countries, in terms of daily reported new infections and new deaths per million inhabitants [41].

All procedures were performed in accordance with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all participants. An approval by the local ethics committee of the Johannes Gutenberg-University of Mainz was obtained in relation to the study in which a new cognitive-behavioral treatment approach to pathological health anxiety [32] was piloted (2019-JGU-psychEK-011).

2.2. Measures

2.2.1. Pre-COVID-19 health anxiety

Pre-COVID-19 health anxiety was assessed with the German version of the Whiteley-Index (WI) [42,43]. The WI comprises 14 dichotomous items, which can be aggregated to a sum score (proposed cut-off for ICD-10 Hypochondriacal Disorder: 8 affirmative ratings; [42]). The reliability and validity of the WI can be considered as good in both non-clinical and clinical samples [42,44,45].

2.2.2. Weekly anxiety ratings

Participants weekly rated the intensity of anxiety related to SARS-CoV-2 (incl. COVID-19) and to other severe diseases (not COVID-19; e.g., cancer). Two previously used items [10,11] were adapted and

Table 1
Participant information.

Case	Sex	Age	Education	Profession	Session	Therapist	Pre-COVID-19 HA	*M* Anxiety SARS-CoV-2	*M* Anxiety Other Diseases	Comorbid diagnoses	Initial manifestation
1	Male	28	4	2	0–11	A	10	0.07	2.53	–	2010
2	Male	24	3	1	1–14	A	10	0.13	1.25	–	2011
3	Male	37	3	2	1–15	A	7	1.19	1.84	Social Anxiety Disorder; Major depressive disorder, recurrent, in partial remission	1990
4	Male	47	3	2	0–15	A	9	2.5	2.94	–	1985
5	Female	38	3	2	1–15	A	–	5.5	5.19	Panic disorder with agoraphobia; Major depressive disorder, recurrent, moderate	1996
6	Male	36	1	2	8–22	B	14	0.69	3.23	–	2004
7	Female	39	4	5	13–20	C	12	1	4	–	1995
8	Female	43	4	3	7–16	D	8	1.2	1.6	–	2019
9	Male	25	2	2	32–41	C	10	2	2.25	Specific phobia	2012
10	Female	24	3	4	45–56	E	7	1.63	1.75	Specific phobia	2014
11	Female	67	2	6	0–6	A/F	6	1	1.2	Alcohol use disorder	2013
12	Male	56	2	2	34–41	E	9	3.57	2.57	–	2016

Note. Education refers to the highest achieved educational level; coded 1 = primary school or basic school leaving qualification, 2 = secondary school certificate, 3 = higher education entrance qualification, 4 = university degree. Profession is coded 1 = college student, 2 = employee, 3 = civil servant, 4 = self-employee, 5 = parental leave, 6 = pensioner. Session refers to the number of the individual treatment session (defined as a planned therapeutic contact between therapist and patient of normally 50 min) of the respective patient during the studied period. Pre-COVID-19 HA (health anxiety) was assessed with the WI. *M* Anxiety SARS-CoV-2 / Other Diseases refers to the mean of anxiety related to SARS-CoV-2 and to other severe diseases over the studied period for each case.

administered with a seven-point scale from *not afraid at all* (0) to *very much afraid* (6): "Last week, I was not afraid at all (0) / very much afraid (6) to be infected with the novel SARS-CoV-2 virus (including possible secondary diseases, e.g., COVID-19) / to have another severe disease (not COVID-19; e.g., cancer).".

2.3. Statistical analyses

A dependent (paired) samples *t*-test with bias-corrected and accelerated (BCa) bootstrap intervals was performed to test for a difference between SARS-CoV-2 related anxiety and anxiety related to other severe diseases.

The association between (t-1 lagged) SARS-CoV-2 related anxiety and (t-1 lagged) anxiety related to other severe diseases, and a further intensification of SARS-CoV-2 related anxiety by pre-COVID-19 health anxiety were analyzed with panel data analysis methods, i.e., fixed effects regression and hybrid models (based on Allison [46]). Fixed effects regression models divide the unobserved, individual heterogeneity in two error terms, one for the intra-individual varying unobserved variables (ε_{it}), and one for the unobserved variables, which are time-invariant and allowed to correlate with the observed variables (= fixed; μ_i) [46]. By including a fixed error term, the fixed effects regression model can adjust for differences between cases and thus quite accurately and statistically robustly model the within-person effects, i.e., the association between (t-1 lagged) anxiety related to SARS-CoV-2 and other severe diseases within one person. The effect of time-invariant variables (e.g., age) cannot be separately analyzed. The equations for the fixed effects regression models on SARS-CoV-2 related anxiety with (t-1 lagged) anxiety related to other severe diseases (Eqs. (1) and (2)) as main predictors, and on anxiety related to other severe diseases with (t-1 lagged) SARS-CoV-2 related anxiety (Eqs. (3) and (4)) as main predictors are provided in the following (measurement t, person i). As shown in Eqs. (2) and (4), the t-1 lagged dependent variables were included in the fixed effects regression models with the t-1 lagged main predictors.

$$\text{Anxiety\_SARS}_{it} = \beta_1 \text{Anxiety\_Diseases}_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

$$\text{Anxiety\_SARS}_{it} = \beta_1 \text{Anxiety\_SARS}_{it-1} + \beta_2 \text{Anxiety\_Diseases}_{it-1} + \mu_i + \varepsilon_{it} \quad (2)$$

$$\text{Anxiety\_Diseases}_{it} = \beta_1 \text{Anxiety\_Diseases}_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

$$\text{Anxiety\_Diseases}_{it} = \beta_1 \text{Anxiety\_Diseases}_{it-1} + \beta_2 \text{Anxiety\_SARS}_{it-1} + \mu_i + \varepsilon_{it} \quad (4)$$

A further intensification of SARS-CoV-2 related anxiety by pre-COVID-19 levels of health anxiety was examined with a hybrid model, again based on the recommendations by Allison [46]. In this hybrid model, both time-invariant (i.e., pre-COVID-19 health anxiety) and time-varying predictors (i.e., anxiety related to other severe diseases), the latter both as person-specific means and as deviations from person-specific means, are included.

All models were examined for heteroscedasticity (via a Stata module by Baum [47]), and serial correlation (based on Drukker [48], which uses the test for serial correlation by Wooldridge [49]). If indications for heteroscedasticity or serial correlation were found, robust standard errors according to Hoechle [50] (based on specifications by White [51]) were calculated. All analyses were performed with Stata. Both the data and the script of the fixed effects and hybrid regression models are provided on OSF (osf.io/cmkb5).

3. Results

3.1. Level and variability of SARS-CoV-2 related anxiety

Fig. 1 depicts the course of anxiety related to SARS-CoV-2 and other severe diseases during the studied period both on individual and sample level. Participants reported significantly less anxiety (difference BCa 95% CI [−1.23, −0.53]; $t = |4.83|$, $p < .001$, $d = -0.54$, d BCa 95% CI [−0.77, −0.30]) related to SARS-CoV-2 ($M = 1.75$, $SD = 1.85$) than related to other severe diseases ($M = 2.67$, $SD = 1.61$). As shown in the visual analysis, both SARS-CoV-2 related anxiety ($iSD = 0.83$) and anxiety related to other severe diseases ($iSD = 1.01$) showed some intraindividual variability over the study period, which was descriptively higher for anxiety related to other severe diseases.

3.2. Mutual associations of anxiety related to SARS-CoV-2 and other severe diseases

No significant effect of anxiety related to other severe diseases (non-lagged: $b = 0.05$, $SE = 0.08$, b 95% CI [−0.11, 0.22], $p = .50$; t-1 lagged: $b = 0.06$, $SE = 0.06$, b 95% CI [−0.07, 0.19], $p = .33$) on SARS-CoV-2 related anxiety and vice versa of SARS-CoV-2 related anxiety (non-

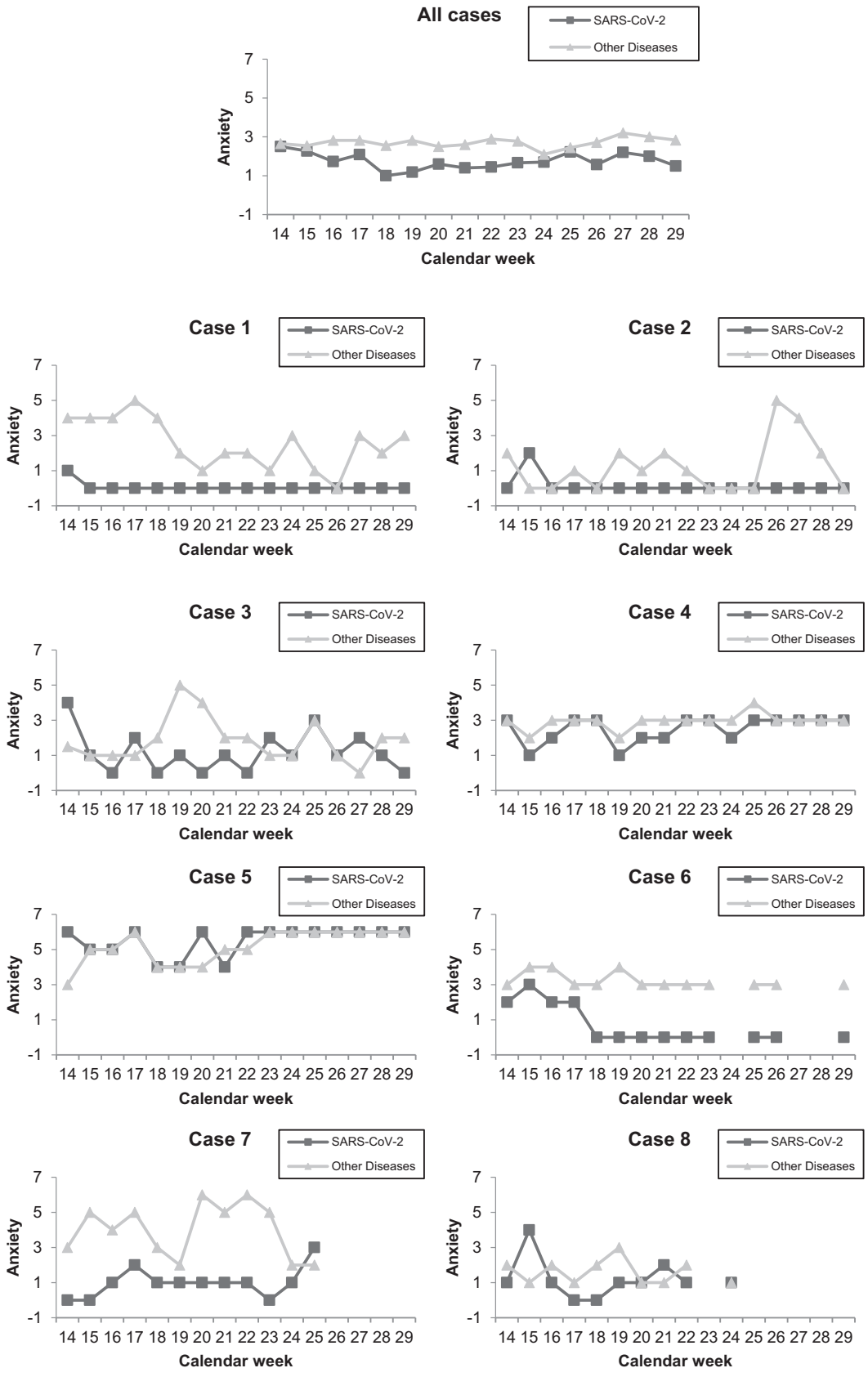

Fig. 1. The course of anxiety related to SARS-CoV-2 (incl. COVID-19) and other severe diseases (all cases and cases 1–12).

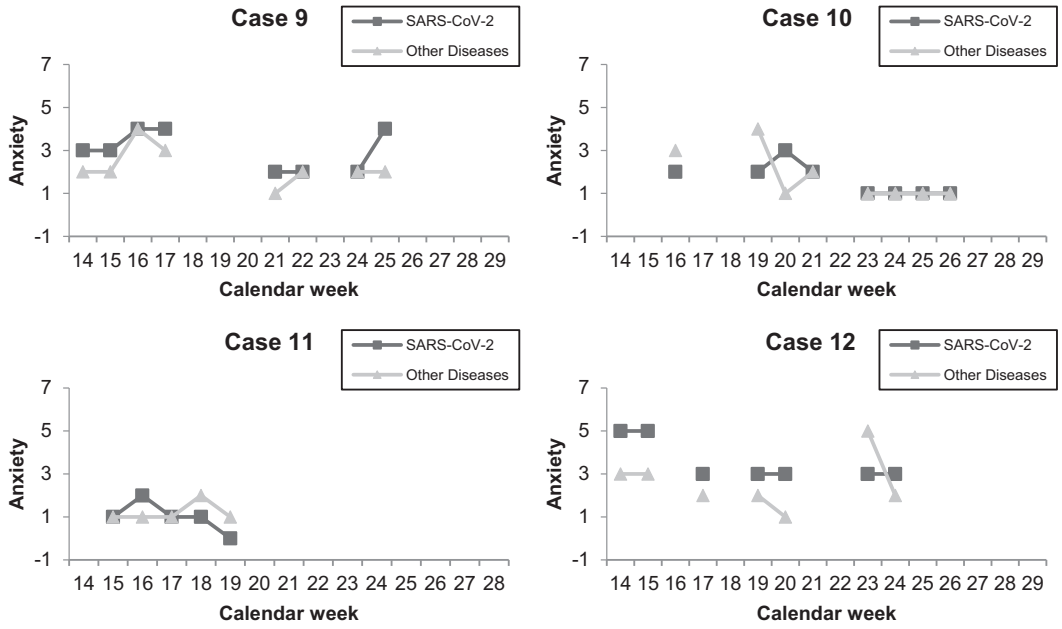

Fig. 1. (*continued*).

lagged: $b = 0.09$, $SE = 0.12$, b 95% CI [−0.18, 0.36], $p = .48$; t-1 lagged: $b = 0.03$, $SE = 0.12$, b 95% CI [−0.23, 0.28], $p = .81$) on anxiety related to other severe diseases was observed. Only the t-1 lagged value of anxiety related to other severe diseases significantly predicted the later (t) value of anxiety related to other severe diseases ($b = 0.26$, $SE = 0.07$, b 95% CI [0.11, 0.41], $p = .003$); regarding SARS-CoV-2 related anxiety, conversely, no significant associations between current and t-1 lagged values were found ($b = 0.19$, $SE = 0.14$, b 95% CI [−0.11, 0.49], $p = .19$).

Accordingly, SARS-CoV-2 related anxiety and anxiety related to other severe diseases were not significantly associated in the same week. Furthermore, SARS-CoV-2 related anxiety in the previous week did not significantly predict changes from the previous to the current week in anxiety related to other severe diseases. Likewise, anxiety related to other severe diseases in the previous week did not significantly predict changes from the previous to the current week in SARS-CoV-2 related anxiety. Current week's anxiety related to other severe diseases was significantly predicted by last week's anxiety related to other severe diseases. By contrast, there was no significant association between current and previous week's SARS-CoV-2 related anxiety.

3.3. Robustness and sensitivity of results

As sensitivity analyses, we repeated the fixed effects regression analyses as shown in Eqs. (2) and (4), but this time excluded the t-1 lagged dependent variables from analyses. Furthermore, all fixed effects regression models were calculated again with a reduced sample of participants without any missing data or with 50% of missing data on the weekly assessed predictors (anxiety related to SARS-CoV-2/other severe diseases). All previously reported results were confirmed: there were no significant associations between (t-1 lagged) SARS-CoV-2 related anxiety and (t-1 lagged) anxiety related to other severe diseases in these additional sensitivity and robustness analyses. The results of the sensitivity analyses are reported and compared with the results of the previous analyses on the original data set in Supplementary Fig. 1.

3.4. Associations of anxiety related to SARS-CoV-2 with pre-COVID-19 health anxiety

The hybrid model on SARS-CoV-2 related anxiety confirmed the previously reported non-significance regarding the effect of anxiety related to other severe diseases on SARS-CoV-2 related anxiety, now both on between ($b = 0.77$, $SE = 0.59$, b 95% CI [−0.38, 1.93], $p = .19$) and within level ($b = 0.02$, $SE = 0.07$, b 95% CI [−0.12, 0.16], $p = .77$). There was no significant association between pre-COVID-19 health anxiety and SARS-CoV-2 related anxiety ($b = -0.30$, $SE = 0.22$, b 95% CI [−0.73, 0.13], $p = .18$).

We also calculated a hybrid model on anxiety related to other severe diseases, which again showed no significant association between SARS-CoV-2 related anxiety and anxiety related to other severe diseases (between: $b = 0.24$, $SE = 0.18$, b 95% CI [−0.12, 0.59], $p = .19$; within: $b = 0.04$, SE = 0.12, b 95% CI [−0.21, 0.28], $p = .77$). In contrast to SARS-CoV-2 related anxiety, a significant positive effect of pre-COVID-19 health anxiety on anxiety related to other severe diseases was found ($b = 0.29$, $SE = 0.09$, b 95% CI [0.12, 0.47], $p = .001$).

In conclusion, while for anxiety related to other severe diseases a significant effect of pre-COVID-19 health anxiety was detected, no significant association with pre-COVID-19 health anxiety was found for SARS-CoV-2 related anxiety.

4. Discussion

The present study investigated the course of anxiety related to SARS-CoV-2 and to other severe diseases (e.g., cancer) among 12 patients, currently being treated for pathological health anxiety, during the "first wave" of the COVID-19 pandemic in Germany (end of March – mid-July 2020). Against our assumptions, SARS-CoV-2 related anxiety was on average lower than anxiety regarding other severe diseases and fluctuated in the lower section of the given scale ($M = 1.75$ on a scale ranging from 0 to 6). Descriptively, there was some indication of between-person heterogeneity regarding SARS-CoV-2 related anxiety, with some people reporting (almost) no SARS-CoV-2 related anxiety (e.g., cases 1, 2, and 6), while others (e.g., cases 5 and 9) were affected by higher levels of virus anxiety. At the same time, intraindividual variability over the studied period was at the same time lower than for anxiety related to other severe diseases.

Unexpectedly, we did not detect any significant associations between SARS-CoV-2 related anxiety and anxiety related to other severe diseases regarding both directions (from "SARS-CoV-2" on "other diseases" and vice versa), and both temporal relations (simultaneous and t-1 lagged).

Interesting to notice, pre COVID-19 health anxiety neither did show off as significant risk factor for SARS-CoV-2 related anxiety in the present sample, whereas corresponding associations of pre-COVID-19 health anxiety with anxiety related to other severe diseases were indeed found. The latter result again undermines the stability of health worries in individuals with pathological health anxiety [52].

The results on SARS-CoV-2 related anxiety seem to contradict assumptions on risk groups for heightened mental distress during COVID-19 (e.g., [24,25]) and predictions based on previously found strong associations between health anxiety and SARS-CoV-2 related anxiety in large-scale world-wide samples (e.g., [10–15]). Considering the small and naturalistic sample with many missing data, which was not balanced for any variables (e.g., age), all conclusions must be drawn carefully. Nevertheless, our findings challenge the assumption that results from the general population can be easily transferred to the "high-risk" group of people with pathological health anxiety, or, at least, to the majority of this group.

Hypotheses on the observed divergences could be derived from a theoretical and an empirical perspective. People with pathological health anxiety, pre-pandemic, reported less fear of infections than of other diseases (esp. cancer and cardiovascular diseases) and assessed their risk of succumbing to infections as comparably high as people without a diagnosis of hypochondriasis [36,37]. Likewise, the studied sample was, pre-pandemic, mostly concerned with other diseases (e.g., cancer) and not with (virus) infections. Speaking in terms of the predictive processing framework [27,53], it is reasonable to assume that – pre COVID-19 – precise prior expectations regarding sensations existed, which drove active inference (e.g., body checking), and determined posterior perception (sensation = disease), especially when sensory input (bottom-up) was unprecise. The present study proposed that the COVID-19 pandemic due to its existential threat would trigger the building of new or the adaptation of old priors (e.g., breathing difficulties = COVID-19) and provoke a fearful reaction in people with pathological health anxiety. However, the opposite assumption would be likewise worth considering and would better fit the results of the present study. Thus, one could also argue that old priors remain dominant and dampen COVID-19 related affective responses.

First, especially highly precise priors (as seen in people with pathological health anxiety) would need many prediction errors to change. People with pathological health anxiety are known to have difficulties to disengage from a previous health threat [54,55], which is a core characteristic of the diagnosis and pathogenesis of pathological health anxiety and led to several attention bias modification approaches (e.g., [56,57]). Possibly COVID-19 related sensations could, therefore, still be attributed to other diseases (e.g., breathing difficulties = lung cancer, headache = brain tumor), be realistically assessed as notable, but not "that severe" (in relation to one's own risk), or even be neglected, which would dampen affective responses. Although only few studies have used ideographical stimuli so far, there is still some support of a stronger affective and cognitive response to personally relevant health threat in pathological health anxiety [58]. Supporting the hypotheses of a realistic assessment or neglect, people with pathological health anxiety do not differ regarding the assessment of "minor" diseases from people with anxiety disorders or "healthy" controls [59–61] and seem to partly neglect current medical disease burden in favor of other diseases [62]. Pathological health anxiety is, furthermore, mainly driven by catastrophic disease-related and little by non-catastrophic disease-related interpretations [63].

Second, a limited cognitive and emotional capacity could hinder the building/adaptation of priors or the mutual triggering of health worries. The majority of people with pathological health anxiety only fear *one* major disease and not many diseases simultaneously [36]. Neuroimaging studies also highlight the symptom-related activation of brain regions relevant for cognitive control in people with pathological health anxiety [64,65].

Third, the response to the COVID-19 pandemic could be affected by a self-focusing bias in pathological health anxiety. Individuals with pathological health anxiety are known to have a more restrictive health concept only regarding *themselves* and not regarding *other people* [66]. Although (pathological) health anxiety is linked to key mechanisms of contamination fears, such as disgust sensitivity and proneness (e.g., [70,71]), these results seemed to be less specific for hypochondriasis [68,69] and could be again attributed to concerns about one's own health rather than about the health of others [70]. The severity of COVID-19 related mental distress, however, is also significantly affected by the risk assessment regarding other, e.g., loved people [13,21,71,72].

Fourth, the crucial importance of (external) triggers in the activation / exacerbation of pathological health anxiety could be partly questioned [36,59] in favor of top-down processes [73]. Marcus [59], e.g., found that health-related triggers did not intensify anxiety in people with pathological health anxiety, but led to an approximation of the anxiety levels of less health anxious people to the levels of pathologically health anxious people. The COVID-19 pandemic as a global health crisis could, therefore, lead to a "global health anxiety pandemic" that is not that specific to people with pathological health anxiety.

4.1. Limitations

Some limitations of the present study should be mentioned. A non-validated, but previously used [10,11] instrument for the weekly assessment of anxiety was administered, which could have reduced convergent validity with related instruments (e.g., WI). The study was a single case study (with only 12 included participants and therefore limited power) and was carried out in a naturalistic setting and mainly during psychotherapeutic treatment. The fixed effects regression model adjusts for time-invariant unobserved variables but does not control for time-varying (unobserved) variables, which are not included in the statistical model. Regarding the COVID-19 pandemic, both external (e.g., development of the COVID-19 pandemic [e.g., increase/decrease of infection rates]) and internal (e.g., increase of reported somatic sensations) time-varying factors could have affected weekly anxiety ratings, but were not assessed or included in the analyses. Influences of a potentially more successful management (regarding death rates and in comparison with highly affected countries such as Italy) of the "first wave" of the COVID-19 in Germany on SARS-CoV-2 related anxiety should be likewise taken into consideration and could also reduce the representativeness and transferability of results. Additionally, we lacked a control group of people with no diagnosis of pathological health anxiety to compare the given results. Furthermore, we had a rather high missing data rate for certain participants, why we decided to repeat all analyses with a reduced sample comprising only patients with a maximum missing data rate of 50% (cases 1–10) or with no missing data (cases 1–5) on the weekly anxiety ratings. Previously drawn conclusions were confirmed in these analyses.

5. Conclusion

People with pathological health anxiety have been assumed to form a high-risk group for heightened mental distress during the COVID-19 pandemic [24]. The present study, therefore, investigated the intensity and time course of SARS-CoV-2 related anxiety (compared to other health anxieties) in a naturalistic sample of 12 patients with pathological health anxiety throughout the "first wave" of the COVID-19 pandemic in Germany. The studied sample on average did not suffer from high levels of SARS-CoV-2 related anxiety. No significant associations between SARS-CoV-2 related anxiety and concurrent and (t-1) lagged anxiety related to other severe diseases, and pre-COVID-19 health anxiety were found. It appears therefore premature to assume that the significant association between health anxiety and SARS-CoV-2 related anxiety, which was observed in the general population (e.g., [10,11]), can easily be transferred to people with pathological levels of health anxiety. The present study rather provided some indication of a

still persistent focus on pre-pandemically feared diseases. Considering the small and naturalistic sample of the present study, further research in bigger samples is needed to confirm the presented findings.

Declarations of Competing Interest

None.

Funding

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2021.110687.

References

[1] J. Xiong, O. Lipsitz, F. Nasri, L.M.W. Lui, H. Gill, L. Phan, D. Chen-Li, M. Iacobucci, R. Ho, A. Majeed, R.S. McIntyre, Impact of COVID-19 pandemic on mental health in the general population: a systematic review, J. Affect. Disord. 277 (2020) 55–64, https://doi.org/10.1016/j.jad.2020.08.001.

[2] T. Wu, D. Ph, X. Jia, D. Ph, H. Shi, D. Ph, J. Niu, X. Yin, Prevalence of mental health problems during the COVID-19 pandemic : a systematic review and meta-analysis, J. Affect. Disord. 281 (2020) 91–98, https://doi.org/10.1016/j.jad.2020.11.117.

[3] C.M. Coelho, P. Suttiwan, N. Arato, A.N. Zsido, On the nature of fear and anxiety triggered by COVID-19, Front. Psychol. 11 (2020), 581314, https://doi.org/10.3389/fpsyg.2020.581314.

[4] M. Taquet, S. Luciano, J.R. Geddes, P.J. Harrison, Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA, Lancet Psychiatry 8 (2021) 130–140, https://doi.org/10.1016/S2215-0366(20)30462-4.

[5] Q. Wang, R. Xu, N.D. Volkow, Increased risk of COVID-19 infection and mortality in people with mental disorders: analysis from electronic health records in the United States, World Psychiatry 20 (2021) 124–130, https://doi.org/10.1002/wps.20806.

[6] M.T. Tull, A.C. Barbano, K.M. Scamaldo, J.R. Richmond, K.A. Edmonds, J.P. Rose, K.L. Gratz, The prospective influence of COVID-19 affective risk assessments and intolerance of uncertainty on later dimensions of health anxiety, J. Anxiety Disord. 75 (2020), 102290, https://doi.org/10.1016/j.janxdis.2020.102290.

[7] A.V. Nikčević, C. Marino, D.C. Kolubinski, D. Leach, M.M. Spada, Modelling the contribution of the big five personality traits, health anxiety, and COVID-19 psychological distress to generalised anxiety and depressive symptoms during the COVID-19 pandemic, J. Affect. Disord. 279 (2021) 578–584, https://doi.org/10.1016/j.jad.2020.10.053.

[8] Y. Wang, M.P. Kala, T.H. Jafar, Factors associated with psychological distress during the coronavirus disease 2019 (COVID-19) pandemic on the predominantly general population: a systematic review and meta-analysis, PLoS One 15 (2020), e0244630, https://doi.org/10.1371/journal.pone.0244630.

[9] M.J. Zvolensky, L. Garey, A.H. Rogers, N.B. Schmidt, A.A. Vujanovic, E.A. Storch, J.D. Buckner, D.J. Paulus, C. Alfano, J.A.J. Smits, C. O'Cleirigh, Psychological, addictive, and health behavior implications of the COVID-19 pandemic, Behav. Res. Ther. 134 (2020), 103715, https://doi.org/10.1016/j.brat.2020.103715.

[10] S.M. Jungmann, M. Witthöft, Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: which factors are related to coronavirus anxiety? J. Anxiety Disord. 73 (2020), 102239 https://doi.org/10.1016/j.janxdis.2020.102239.

[11] K.S. Sauer, S.M. Jungmann, M. Witthöft, Emotional and behavioral consequences of the COVID-19 pandemic: the role of health anxiety, intolerance of uncertainty, and distress (in)tolerance, Int. J. Environ. Res. Public Health 17 (2020) 7241, https://doi.org/10.3390/ijerph17197241.

[12] S.A. Lee, M.C. Jobe, A.A. Mathis, J.A. Gibbons, Incremental validity of coronaphobia: coronavirus anxiety explains depression, generalized anxiety, and death anxiety, J. Anxiety Disord. 74 (2020), 102268, https://doi.org/10.1016/j.janxdis.2020.102268.

[13] G. Mertens, L. Gerritsen, S. Duijndam, E. Salemink, I.M. Engelhard, Fear of the coronavirus (COVID-19): predictors in an online study conducted in march 2020, J. Anxiety Disord. 74 (2020), 102258, https://doi.org/10.1016/j.janxdis.2020.102258.

[14] S. Taylor, C.A. Landry, M.M. Paluszek, T.A. Fergus, D. McKay, G.J.G. Asmundson, COVID stress syndrome: concept, structure, and correlates, Depress. Anxiety 37 (2020) 706–714, https://doi.org/10.1002/da.23071.

[15] S. Taylor, C.A. Landry, M.M. Paluszek, T.A. Fergus, D. McKay, G.J.G. Asmundson, Development and initial validation of the COVID stress scales, J. Anxiety Disord. 72 (2020), 102232, https://doi.org/10.1016/j.janxdis.2020.102232.

[16] L. Cannito, A. Di Crosta, R. Palumbo, I. Ceccato, S. Anzani, P. La Malva, R. Palumbo, A. Di Domenico, Health anxiety and attentional bias toward virus-related stimuli during the COVID-19 pandemic, Sci. Rep. 10 (2020) 16476, https://doi.org/10.1038/s41598-020-73599-8.

[17] G.J.G. Asmundson, M.M. Paluszek, C.A. Landry, G.S. Rachor, D. McKay, S. Taylor, Do pre-existing anxiety-related and mood disorders differentially impact COVID-19 stress responses and coping? J. Anxiety Disord. 74 (2020), 102271 https://doi.org/10.1016/j.janxdis.2020.102271.

[18] D. McKay, H. Yang, J. Elhai, G.J.G. Asmundson, Anxiety regarding contracting COVID-19 related to interoceptive anxiety sensations: the moderating role of disgust propensity and sensitivity, J. Anxiety Disord. 73 (2020), 102233, https://doi.org/10.1016/j.janxdis.2020.102233.

[19] L. García-Álvarez, L. de la Fuente-Tomás, M.P. García-Portilla, P.A. Sáiz, C. M. Lacasa, F. Dal Santo, L. González-Blanco, M.T. Bobes-Bascarán, M.V. García, C.Á. Vázquez, Á.V. Iglesias, C.M. Cao, A.G. Fernández, M.T. Bascarán Fernández, A. P. Fernández, J.R. Revuelta, E.S. Zazo, P.Z. Madera, M.S. Álvarez, Á.P. Sánchez, C. F. Delgado, S.C. Suárez, I.M. Miranda, L.J. Treviño, G.P. Calzón, I. Abad, C. P. Duque, L. Riera, P.M. González, E.F. Pedrero, J. Bobes, Early psychological impact of the 2019 coronavirus disease (COVID-19) pandemic and lockdown in a large Spanish sample, J. Glob. Health 10 (2020), 020505, https://doi.org/10.7189/jogh.10.020505.

[20] F. Iasevoli, M. Fornaro, G. D'Urso, D. Galletta, C. Casella, M. Paternoster, C. Buccelli, A. de Bartolomeis, Psychological distress in patients with serious mental illness during the COVID-19 outbreak and one-month mass quarantine in Italy, Psychol. Med. 51 (2021) 1054–1056, https://doi.org/10.1017/S0033291720001841.

[21] J.M. Newby, K. O'Moore, S. Tang, H. Christensen, K. Faasse, Acute mental health responses during the COVID-19 pandemic in Australia, PLoS One 15 (2020), e0236562, https://doi.org/10.1371/journal.pone.0236562.

[22] T.E. Van Rheenen, D. Meyer, E. Neill, A. Phillipou, E.J. Tan, W.L. Toh, S.L. Rossell, Mental health status of individuals with a mood-disorder during the COVID-19 pandemic in Australia: initial results from the COLLATE project, J. Affect. Disord. 275 (2020) 69–77, https://doi.org/10.1016/j.jad.2020.06.037.

[23] L. Jelinek, S. Moritz, F. Miegel, U. Voderholzer, Obsessive-compulsive disorder during COVID-19: turning a problem into an opportunity? J. Anxiety Disord. 77 (2021), 102329 https://doi.org/10.1016/j.janxdis.2020.102329.

[24] G.J.G. Asmundson, S. Taylor, How health anxiety influences responses to viral outbreaks like COVID-19: what all decision-makers, health authorities, and health care professionals need to know, J. Anxiety Disord. 71 (2020), 102211, https://doi.org/10.1016/j.janxdis.2020.102211.

[25] R.M. Rivera, D. Carballea, Coronavirus: a trigger for OCD and illness anxiety disorder? Psychol. Trauma Theory Res. Pract. Policy 12 (2020) 66, https://doi.org/10.1037/tra0000725.

[26] H.M.C. Warwick, P.M. Salkovskis, Hypochondriasis, Behav. Res. Ther. 28 (1990) 105–117, https://doi.org/10.1016/0005-7967(90)90023-C.

[27] O. Van den Bergh, M. Witthöft, S. Petersen, R.J. Brown, Symptoms and the body: taking the inferential leap, Neurosci. Biobehav. Rev. 74 (2017) 185–203, https://doi.org/10.1016/j.neubiorev.2017.01.015.

[28] A.J. Barsky, G. Wyshak, Hypochondriasis and somatosensory amplification, Br. J. Psychiatry 157 (1990) 404–409, https://doi.org/10.1192/bjp.157.3.404.

[29] H.L. Quittkat, R. Düsing, F.-J. Holtmann, U. Buhlmann, J. Svaldi, S. Vocks, Perceived impact of Covid-19 across different mental disorders: a study on disorder-specific symptoms, psychosocial stress and behavior, Front. Psychol. 11 (2020) 1–17, https://doi.org/10.3389/fpsyg.2020.586246.

[30] World Health Organization, The ICD-10 Classification of Mental and Behavioural Disorders, World Health Organization, 1993.

[31] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 5th ed., Publisher, Washington, DC, 2013.

[32] M. Gropalis, M. Witthöft, J. Bailer, F. Weck, Optimizing exposure therapy for pathological health anxiety: considerations from the inhibitory learning approach, Cogn. Behav. Pract. 25 (2018) 250–260, https://doi.org/10.1016/j.cbpra.2017.09.001.

[33] J. Margraf, J.C. Cwik, V. Pflug, S. Schneider, Structured clinical interviews for mental disorders across the life span: psychometric quality and further developments of the DIPS open access interviews [Strukturierte klinische Interviews zur Erfassung psychischer Störungen über die Lebensspanne: Gütekriterien und Weiterentwicklungen der DIPS-Verfahren], Z. Klin. Psychol. Psychother. 46 (2017) 176–186, https://doi.org/10.1026/1616-3443/a000430.

[34] J. Margraf, J. Cwik, A. Suppiger, S. Schneider, DIPS open access: diagnostic interview for mental disorders [DIPS open access: Diagnostisches Interview bei psychischen Störungen], Bochum Ment. Heal. Res. Treament Center, Ruhr-Universität Bochum. (2017), https://doi.org/10.13154/rub.100.89.

[35] H.-U. Wittchen, M. Zaudig, T. Fydrich, SCID. Structured Clinical Interview for DSM-IV [SKID. Strukturiertes Klinisches Interview für DSM-IV], Hogrefe, Göttingen, 1997.

[36] M.-A. Haenen, P.J. de Jong, A.J. Schmidt, S. Stevens, L. Visser, Hypochondriacs' estimation of negative outcomes: domain-specificity and responsiveness to reassuring and alarming information, Behav. Res. Ther. 38 (2000) 819–833, https://doi.org/10.1016/S0005-7967(99)00128-X.

[37] A.J. Barsky, D.K. Ahern, E.D. Bailey, R. Saintfort, E.B. Liu, H.M. Peekna, Hypochondriacal patients' appraisal of health and physical risks, Am. J. Psychiatry 158 (2001) 783–787.

[38] Robert Koch-Institut, Daily Situation Report by the Robert Koch Institute on the Coronavirus-Disease (COVID-19) - 19.07.2020 - Current Status for Germany [Täglicher Lagebericht des RKI zur Coronavirus-Krankheit (COVID-19) - 19.07.2020 - Aktualisierter Stand für Deutschland]. https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Situationsberichte/2020-07-19-de.pdf?_blob=publicationFile, 2020 (accessed November 27, 2020).

[39] Robert Koch-Institut, Daily Situation Report by the Robert Koch Institute on the Coronavirus-Disease (COVID-19) - 30.03.2020 - Current Status for Germany [Täglicher Lagebericht des RKI zur Coronavirus-Krankheit (COVID-19) - 30.03.2020 - Aktualisierter Stand für Deutschland]. https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Situationsberichte/2020-03-30-de.pdf;jsessionid=A0F246ACEE208779A4CB697E885C2D5A.internet071?_blob=publicationFile, 2020 (accessed November 27, 2020).
[40] Emerging COVID-19 success story: Germany''s push to maintain progress, Our World in Data. https://ourworldindata.org/covid-exemplar-germany, 2021 (accessed May 8, 2021).
[41] Coronavirus Pandemic (COVID-19) - Statistics and Research, Our World in Data. https://ourworldindata.org/coronavirus, 2021 (accessed May 9, 2021).
[42] W. Hiller, W. Rief, International Scales for Hypochondriasis. German Adaptation of the Whiteley-Index (WI) and the Illness Attitudes Scales (IAS) [Internationale Skalen für Hypochondrie. Deutschsprachige Adaptation des Whiteley-Index (WI) und der Illness Attitudes Scales (IAS)], Huber, Bern, 2004.
[43] I. Pilowsky, Dimensions of hypochondriasis, Br. J. Psychiatry 113 (1967) 89–93, https://doi.org/10.1192/bjp.113.494.89.
[44] A. Hinz, W. Rief, E. Brähler, Hypchondriasis in the general population: psychometric properties and population based norms of the Whiteley-Index [Hypochondrie in der Allgemeinbevölkerung: Teststatistische Prüfung und Normierung des Whiteley-Index], Diagnostica. 49 (2003) 34–42, https://doi.org/10.1026//0012-1924.49.1.34.
[45] A.E.M. Speckens, P. Spinhoven, P.P.A. Sloekers, J.H. Bolk, A.M. van Hemert, A validation study of the Whitely Index, the Illness Attitude Scales, and the Somatosensory Amplification Scale in general medical and general practice patients, J. Psychosom. Res. 40 (1996) 95–104, https://doi.org/10.1016/0022-3999(95)00561-7.
[46] P.D. Allison, Quantitative Applications in the Social Sciences: Fixed Effects Regression Models, SAGE Publications, Thousand Oaks, 2009.
[47] C. Baum, XTTEST3: Stata Module to Compute Modified Wald Statistic for Groupwise Heteroskedasticity. https://econpapers.repec.org/RePEc:boc:bocode:s414801, 2001.
[48] D.M. Drukker, Testing for serial correlation in linear panel-data models, Stata J. Promot. Commun. Stat. Stata. 3 (2003) 168–177, https://doi.org/10.1177/1536867X0300300206.
[49] J.M. Wooldridge, Econometric Analysis of Cross Section and Panel Data, The MIT Press, Cambridge, Massachusetts, 2002.
[50] D. Hoechle, Robust standard errors for panel regressions with cross-sectional dependence, Stata J. Promot. Commun. Stat. Stata. 7 (2007) 281–312, https://doi.org/10.1177/1536867X0700700301.
[51] H. White, A Heteroskedasticity-consistent covariance matrix estimator and a direct test for Heteroskedasticity, Econometrica. 48 (1980) 817, https://doi.org/10.2307/1912934.
[52] F. Creed, A. Barsky, A systematic review of the epidemiology of somatisation disorder and hypochondriasis, J. Psychosom. Res. 56 (2004) 391–408, https://doi.org/10.1016/S0022-3999(03)00622-6.
[53] G. Pezzulo, D. Maisto, L. Barca, O. Van den Bergh, Symptom perception from a predictive processing perspective, Clin. Psychol. Eur. 1 (2019) 1–14, https://doi.org/10.32872/cpe.v1i4.35952.
[54] F. Jasper, M. Witthöft, Health anxiety and attentional bias: the time course of vigilance and avoidance in light of pictorial illness information, J. Anxiety Disord. 25 (2011) 1131–1138, https://doi.org/10.1016/j.janxdis.2011.08.004.
[55] H. Lee, J.E. Turkel, S.P. Cotter, J.M. Milliken, J. Cougle, A.R. Goetz, A.M. Lesnick, Attentional bias toward personally relevant health-threat words, Anxiety Stress Coping 26 (2013) 493–507, https://doi.org/10.1080/10615806.2012.713474.
[56] H.A. Wadlinger, D.M. Isaacowitz, Fixing our focus: training attention to regulate emotion, Personal. Soc. Psychol. Rev. 15 (2011) 75–102, https://doi.org/10.1177/1088868310365565.
[57] C. Papageorgiou, A. Wells, Effects of attention training on hypochondriasis: a brief case series, Psychol. Med. 28 (1998) 193–200, https://doi.org/10.1017/S0033291797005825.
[58] K. Schütte, S. Vocks, M. Waldorf, Fears, coping styles, and health behaviors, J. Nerv. Ment. Dis. 204 (2016) 778–786, https://doi.org/10.1097/NMD.0000000000000566.
[59] D.K. Marcus, The cognitive-behavioral model of hypochondriasis: misinformation and triggers, J. Psychosom. Res. 47 (1999) 79–91, https://doi.org/10.1016/S0022-3999(99)00008-2.
[60] F. Weck, J.M.B. Neng, S. Richtberg, U. Stangier, Dysfunctional beliefs about symptoms and illness in patients with hypochondriasis, Psychosomatics. 53 (2012) 148–154, https://doi.org/10.1016/j.psym.2011.11.007.
[61] J.M.B. Neng, F. Weck, Attribution of somatic symptoms in hypochondriasis, Clin. Psychol. Psychother. 22 (2015) 116–124, https://doi.org/10.1002/cpp.1871.
[62] A.J. Barsky, R.R. Coeytaux, M.K. Sarnie, P.D. Cleary, Hypochondriacal patients' beliefs about good health, Am. J. Psychiatry 150 (1993) 1085–1089, https://doi.org/10.1176/ajp.150.7.1085.
[63] P.B. Hitchcock, A. Mathews, Interpretation of bodily symptoms in hypochondriasis, Behav. Res. Ther. 30 (1992) 223–234, https://doi.org/10.1016/0005-7967(92)90068-R.
[64] Z. Yan, M. Witthöft, J. Bailer, C. Diener, D. Mier, Scary symptoms? Functional magnetic resonance imaging evidence for symptom interpretation bias in pathological health anxiety, Eur. Arch. Psychiatry Clin. Neurosci. 269 (2019) 195–207, https://doi.org/10.1007/s00406-017-0832-8.
[65] D. Mier, M. Witthöft, J. Bailer, J. Ofer, T. Kerstner, F. Rist, C. Diener, Cough is dangerous: neural correlates of implicit body symptoms associations, Front. Psychol. 7 (2016) 1–13, https://doi.org/10.3389/fpsyg.2016.00247.
[66] F. Weck, J.M.B. Neng, S. Richtberg, U. Stangier, The restrictive concept of good health in patients with hypochondriasis, J. Anxiety Disord. 26 (2012) 792–798, https://doi.org/10.1016/j.janxdis.2012.07.001.
[68] G.C.L. Davey, N. Bond, Using controlled comparisons in disgust psychopathology research: the case of disgust, hypochondriasis and health anxiety, J. Behav. Ther. Exp. Psychiatry 37 (2006) 4–15, https://doi.org/10.1016/j.jbtep.2005.09.001.
[69] F. Weck, S. Esch, S. Rohrmann, The role of disgust in patients with hypochondriasis, Anxiety Stress Coping 27 (2014) 576–586, https://doi.org/10.1080/10615806.2013.873793.
[70] E. Hedman, M. Lekander, B. Karshikoff, B. Ljótsson, E. Axelsson, J. Axelsson, Health anxiety in a disease-avoidance framework: investigation of anxiety, disgust and disease perception in response to sickness cues, J. Abnorm. Psychol. 125 (2016) 868–878, https://doi.org/10.1037/abn0000195.
[71] C. Benke, L.K. Autenrieth, E. Asselmann, C.A. Pané-Farré, Lockdown, quarantine measures, and social distancing: associations with depression, anxiety and distress at the beginning of the COVID-19 pandemic among adults from Germany, Psychiatry Res. 293 (2020), 113462, https://doi.org/10.1016/j.psychres.2020.113462.
[72] E. McElroy, P. Patalay, B. Moltrecht, M. Shevlin, A. Shum, C. Creswell, P. Waite, Demographic and health factors associated with pandemic anxiety in the context of COVID-19, Br. J. Health Psychol. 25 (2020) 934–944, https://doi.org/10.1111/bjhp.12470.
[73] E.C. Karademas, S. Christopoulou, A. Dimostheni, F. Pavlu, Health anxiety and cognitive interference: evidence from the application of a modified Stroop task in two studies, Personal. Individ. Differ. 44 (2008) 1138–1150, https://doi.org/10.1016/j.paid.2007.11.007.