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Catastrophizing misinterpretations predict somatoform-related symptoms and new onsets of somatoform disorders

Marcella L. Woud [a,*], Xiao Chi Zhang [a], Eni S. Becker [b], Armin Zlomuzica [a], Jürgen Margraf [a]

[a] Mental Health Research and Treatment Center, Department of Psychology, Ruhr-Universität Bochum, Bochum, Germany
[b] Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands

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ABSTRACT

Background: Somatoform disorders are characterized by multiple recurring symptoms that resemble physical illnesses but defy medical explanation. Psychological models suggest that catastrophizing misinterpretations of harmless physical symptoms play a key role. However, the question of whether such biases predict somatoform-related symptoms and the onset of somatoform disorders has not been adressed. Hence, the aim of the present study was to further advance our understanding of the role of catastrophizing misinterpretations in somatoform disorders.
Methods: In the present study, we used data from the Dresden Predictor Study ($N = 1538$), in which an epidemiologic sample of young German women was tested at two time points approximately 17 months apart. Each participant completed a diagnostic interview, an interpretation questionnaire for somatoform and hypochondriacal symptoms, and three measures of such symptomatology: somatization subscale of the Symptom Checklist-90-Revised (SCL-90-R), Whiteley Index (WI), Body Sensations Questionnaire (BSQ).
Results: At follow-up, 33 women were diagnosed with new onsets of lifetime somatoform disorder. Results showed that catastrophizing misinterpretations assessed at baseline were predictive of somatoform-related symptoms at follow-up, i.e., symptoms assessed with the WI and BSQ. Moreover, catastrophizing misinterpretations were predictive of new onsets of somatoform disorders, even after controlling for general threat-related misinterpretations and indices of somatoform symptoms (i.e., SCL-90-R and BSQ).
Conclusions: This is the first prospective, longitudinal study to demonstrate that catastrophizing misinterpretations have incremental validity as predictors of future somatoform-related symptomatology and somatoform disorders.

1. Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders [1], somatoform disorders are characterized by multiple recurring bodily symptoms that resemble physical illness but cannot be explained medically. Hence, the term 'medically unexplained symptoms' is used interchangeably with somatoform disorders [2]. Psychological models of somatoform disorders [3–6] suggest that the interpretation of ambiguous bodily symptoms plays a key role in somatoform disorders. The central assumption is that (harmless) physical symptoms are interpreted in a negative and/or catastrophizing manner, and that implausible and unhelpful explanations are used to account for the bodily sensations [2]. To illustrate, patients suffering from a somatoform disorder might interpret a harmless physical symptom such as dizziness on a hot day as a sign of a severe illness rather than a consequence of the heat. Once patients make such an interpretation, their attention becomes increasingly focused on bodily sensations. As a consequence, they experience and interpret these as more intense and disturbing, which in turn amplifies the perception and negative interpretation of bodily sensations. The repetitive and self-reinforcing nature of this process creates a vicious circle in which (harmless) bodily symptoms are interpreted in an ever-more catastrophizing manner. Following this, the interpretation of ambiguous bodily symptoms in the context of somatoform disorders can be summarized best as 'catastrophizing misinterpretations'.

Previous research has focused on elucidating the role of catastrophic misinterpretations of bodily symptoms in somatoform disorders. To illustrate, a study [7] investigated whether patients suffering from hypochondriasis differ from control patients in their perceived risk of developing physical illness and being susceptible to physical harm (measured by the Comparative Risk Questionnaire [8,9]). Indeed, results showed that hypochondriacal patients perceived a significantly higher total risk than control patients. Further support for the specific role of catastrophic misinterpretations in somatoform disorders comes from

* Corresponding author at: Mental Health Research and Treatment Center, Department of Psychology, Ruhr-Universität Bochum, Massenbergstrasse 9-13, 44787 Bochum, Germany.
E-mail address: marcella.woud@rub.de (M.L. Woud).

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findings that college students' levels of hypochondriasis were concurrently predicted by dysfunctional beliefs about physical illness [10].

Indirect approaches to measuring catastrophizing misinterpretations that bypass self-report measures have yielded similar results in the area of pain disorders. For example, research has shown that participants who exhibited catastrophizing interpretations in relation to pain, compared to non-catastrophizers, showed increased attentional interference during a threatening but low-intensity electrocutaneous stimulation [11]. Finally, on a modified Stroop task, individuals scoring high on health anxiety displayed relatively more interference for (i.e., more attention towards) illness-related words than other emotional words compared to individuals scoring low on health anxiety [12]. Related results are reported in the context of catastrophic misinterpretations in somatoform disorders [13–19,6,2].

In conclusion, there is empirical consensus that somatoform disorders are characterized by catastrophic misinterpretations of bodily symptoms. However, it remains unclear whether catastrophic misinterpretations are a consequence or a predictor of somatoform disorders, or even a possible causal risk factor. [20] We know of no longitudinal, population-based study that tested whether catastrophic misinterpretations could predict future somatoform-disorder related problems and new onsets of somatoform disorders. Such an investigation is important from both a theoretical and clinical perspective. Identifying cognitive mechanisms underlying somatoform disorders advances the understanding of their etiology, which could aid the development and refinement of psychological models. Identifying individuals who exhibit catastrophic misinterpretations and therefore might belong to an elevated risk group could aid the prevention of somatoform disorders.

Accordingly, we employed a longitudinal prospective design to test whether catastrophic misinterpretations predict somatoform-related symptomatology and new onsets of somatoform disorders. An epidemiologic, population-based sample of young German women completed an assessment on two occasions. Each assessment included a DSM diagnostic interview, an interpretation questionnaire for somatoform disorders and hypochondriasis, and measures of somatoform-related symptomatology. We predicted first that catastrophic misinterpretations at baseline would predict somatoform-related symptomatology at follow-up, and second that catastrophic misinterpretations at baseline would predict new onsets of somatoform disorders at follow-up.

2. Methods

2.1. Study design and participants

Participants were 1538 female participants of the Dresden Predictor Study (DPS), i.e., residents who were drawn randomly from the population register of Dresden whose age at the time of the initial interview ranged from 18 to 25 years. Full details of the study design, data collection, procedures, etc., have been reported elsewhere [21]. The study involved two assessments approximately 17 months apart ($M = 16.9$ months, $SD = 6$, range = 7–30 months). During both assessments, participants completed a diagnostic interview and self-report questionnaires.

2.2. Diagnostic interview

At both assessments, a trained interviewer administered the "Diagnostisches Interview bei psychischen Störungen – Forschungsversion" (F-DIPS; translation: Diagnostic Interview for Mental Disorders – Research Version) [22] individually to each participant. The F-DIPS assesses DSM-IV Axis I disorders. Baseline interviews assessed participants' symptoms over the past 7 days, and the lifetime and point prevalence of selected DSM mental disorders. Follow-up interviews also assessed 7-day symptoms plus symptoms in the time interval since baseline assessment. The F-DIPS has good reliability (Kappa for anxiety disorders: 0.64, affective disorders: 0.71, somatoform disorders: 0.66; Yule for substance abuse: 0.85, and for eating disorders: 0.94) [23].

2.3. Somatization problems and hypochondria

Whiteley Index (WI). [24,25] The WI is a 14-item questionnaire assessing possible hypochondriacal concerns such as "Are you afraid of illness?". Items are rated on a five-point Likert scale (1 = "Not at all" to 5 = "A great deal"). The WI's internal consistency is generally adequate and reliability is good [26].

Symptom Checklist-90-Revised: *Somatization subscale* (SCL-90-R somatization). [27,28] The SCL-90-R assesses various symptoms of psychopathology, amongst them somatization. The somatization subscale includes 12 items, e.g., "Feeling weak in parts of your body", and participants use a five-point Likert scale (0 = "Not at all" to 4 = "Extremely") to rate them. The somatization subscale has sufficient to good internal consistency [29].

Body Sensations Questionnaire (BSQ). [30,31] The BSQ includes 17 items reflecting specific bodily sensations (e.g., heart palpations, dizziness). Participants are asked to indicate the degree to which they experience anxiety related to these sensations by means of a five-point Likert scale (1 = "Not at all" to 5 = "Extremely"). The BSQ has good to excellent internal consistency and reliability [32].

2.4. Assessment catastrophic misinterpretations and general threat-related misinterpretations

The Interpretation Questionnaire for Somatization and Hypochondriasis [33] was used to assess participants' misinterpretations. It targets two types of misinterpretations: catastrophic misinterpretations related to ambiguous bodily reactions, e.g., "You are in a shop and you feel dizzy" (*catastrophic misinterpretations*), and misinterpretations related to general ambiguous threat situations, e.g., "You smell smoke" (*general threat-related misinterpretations*). The questionnaire includes 18 scenarios, eight for catastrophic misinterpretations and ten for threat-related misinterpretations. Below each scenario, three explanations are provided that vary in their somatoform- or threat-relatedness, respectively. To illustrate, for the first example targeting catastrophic misinterpretations the following explanations are given: 1. My sense of balance is not very good, 2. The air is very bad inside; 3. These are the first signs for a brain tumor. Participants are told, "Please choose the explanation most likely to come to mind if you experienced this situation."

When a catastrophic misinterpretation was checked for a somatoform scenario or when a threat-related misinterpretation was checked for a threat scenario, the response was coded '1'; otherwise it was coded '0'. Each participant's score was thus the sum of these codes. The questionnaire's reliability assessed in the present sample is acceptable (Cronbach's $\alpha = .77$).

2.5. Statistical analysis

Statistical analyses were performed using SPSS version 22 (IBM Corp, USA) and were carried out two-tailed on a 5% level. Given our specific hypotheses, we also cautiously interpreted marginally significant results where appropriate. As the present study uses data collected via a large epidemiologic study, all analyses are secondary analyses of an existing data set.

To test our first prediction, that catastrophic misinterpretations assessed at baseline would predict somatoform-related symptomatology at follow-up, we correlated baseline and follow-up data of catastrophizing misinterpretations, threat-related misinterpretations, levels of hypochondriasis (WI), levels of somatization (SCL-90-R somatization subscale), and fear of bodily sensations (BSQ). To test the incremental validity of catastrophizing interpretations as predictors of future problematical outcomes, we conducted three linear hierarchical regressions, one per somatoform-related symptom assessed at follow-up. The first predicted

levels of hypochondriasis (WI), the second predicted levels of somatization (SCL-90-R somatization subscale), and the third predicted fear of bodily sensations (BSQ). Each regression included two steps. In step 1, the baseline data of the predictors relevant for the particular regression were entered (e.g., for the prediction of WI at follow-up: baseline data of the WI, SCL-90-R somatization subscale, BSQ, threat-related misinterpretations). In step 2, catastrophizing misinterpretations assessed at baseline were entered, which enabled us to test whether the level of catastrophizing misinterpretations at baseline predicted somatoform-related symptomatology at follow-up over and above the other predictors.

Our second prediction, that catastrophic misinterpretations assessed at baseline would predict new onsets of somatoform disorders at follow-up, was tested by five single and three multiple logistic regressions. The dependent variable in each regression was new onset of somatoform disorder at follow-up (1 = present, 0 = absent). By means of the five single logistic regressions, we tested the predictive validity of each predictor assessed at baseline separately (i.e., catastrophic misinterpretations, threat-related misinterpretations, WI, SCL-90-R somatization subscale, BSQ). Via the three multiple logistic regressions, we tested the predictive validity of catastrophic misinterpretations for new onsets of somatoform disorders while controlling for the other relevant predictors. The small sample size in the somatoform group at follow-up precluded a logistic regression including all five predictors [34]. Hence, in addition to our predictor of interest (catastrophizing misinterpretations) we added only the two most important control variables: anxiety-related misinterpretations that did not target health-related issues, i.e., general-threat related misinterpretations, and another measure of somatoform-related symptomatology (i.e., hypochondriasis somatization, fear of bodily sensations), one per regression (similarly done elsewhere [35]).

Table 1
Scores on measures of interpretation and somatization.

Assessment	Measure	No diagnosis at T1 and T2 *M* (*SD*)*N*	No diagnosis at T1 but at T2 *M* (*SD*)*N*
T1			
	Catastrophic misinterpretations	2.38 (1.55)	3.1 (1.74)
		1393	29
	Threat-related misinterpretations	4.55 (3.36)	4.37 (3.19)
		1367	27
	Somatization	.32 (.3)	.55 (.37)
		1401	29
	WI	1.97 (2.01)	3.55 (2.67)
		1397	29
	BSQ	1.81 (.62)	1.95 (.7)
		1369	29
T2			
	Catastrophic misinterpretations	2.18 (1.52)	3.12 (1.56)
		1317	26
	Threat-related misinterpretations	4.14 (3.29)	4.08 (3.51)
		1295	26
	Somatization	.29 (.3)	.44 (.39)
		1329	26
	WI	1.44 (1.8)	3.85 (4.11)
		1328	26
	BSQ	1.67 (.61)	2 (.66)
		1328	26

Note: T1: baseline; T2: follow-up; Catastrophic misinterpretations: scores somatoform-related scenarios on Interpretation Questionnaire for somatization and hypochondria; Threat-related misinterpretations: scores general threat-related scenarios on Interpretation Questionnaire for somatization and hypochondria; Somatization: somatization subscale Symptom Checklist-90-Revised; WI: Whiteley Index; BSQ: Body Sensations Questionnaire.

3. Results

3.1. Participant characteristics

Out of the 1538 women, 33 women were diagnosed with new onsets of lifetime somatoform disorders at follow-up (for other studies examining incidence/prevalence rates of somatoform disorders [36–38]). Within this group, $n = 1$ suffered from a somatization disorder, $n = 4$ had hypochondriasis, $n = 24$ had a pain disorder, $n = 2$ suffered from a conversion disorder, and $n = 2$ had a pain and a conversion disorder. There were $n = 1461$ who had no diagnosis at baseline and no diagnosis at follow-up (for means and standard deviations of the interpretation questionnaire and somatization data, see Table 1).[1]

3.2. Predicting somatoform-related symptoms at follow-up by catastrophic misinterpretations at baseline

First, we examined the relevant correlations (Table 2). The top line 1, columns 8–10, show that the higher the catastrophizing misinterpretations at baseline, the higher the levels of hypochondriasis (column 8, WI T2), levels of somatization (column 9, somatization T2), and anxiety related to bodily sensations (column 10, BSQ T2) at follow-up.

Second, three linear hierarchical regressions investigated whether catastrophizing misinterpretations at baseline (T1) would predict somatoform-related symptoms at follow-up (T2) over and above the other predictors assessed at T1 (Table 3). There was no multicollinearity in any of the three regressions. Post-hoc power analyses revealed a power of 1 for all regressions. The first regression used levels of hypochondriasis as outcome (WI T2), and showed that catastrophizing misinterpretations assessed at T1 were a significant predictor (Beta coefficient = .11, $p < .001$), over and above the other predictors assessed at T1. Hence, the higher the levels of catastrophizing misinterpretations at baseline, the higher the levels of hypochondriasis at follow-up. The second regression used levels of somatization assessed at T2 as outcome (Somatization T2). However, catastrophizing misinterpretations assessed at T1 were not a significant predictor here (Beta coefficient = .03, $p > .05$). The third regression used fear of bodily sensations assessed at T2 as outcome (BSQ T2). Results showed that catastrophizing misinterpretations assessed at T1 were a significant predictor (Beta coefficient = .06, $p < .01$), over and above the other predictors assessed at T1. That is, the higher the level of catastrophizing misinterpretations at baseline, the higher the fear of bodily sensations at follow-up.

3.3. Predicting new somatoform disorders by catastrophic misinterpretations at baseline

Several logistic regressions predicted new onsets of somatoform disorders at follow-up (Table 4). Post-hoc power analyses revealed a power between .99 and 1 for these regressions. Single logistic regression revealed that catastrophizing misinterpretations assessed at baseline (T1) significantly predicted new onsets of somatoform disorder at follow-up (T2). Notably, this prediction was significant over and above the other predictors when including either the SCL-90-R somatization subscale or the body sensations questionnaire (BSQ), although only marginally significant when including the Whitely Index (WI).

4. Discussion

The present longitudinal study found that catastrophizing misinterpretations predict somatoform-related symptomatology and new onsets of somatoform disorders. Women who interpreted ambiguous somatoform-related scenarios in a catastrophizing manner at baseline reported higher levels of hypochondriasis (WI) and fear of bodily sensations (BSQ) at follow-up. Crucially, these catastrophic misinterpretations were significant predictors over and above general threat-related

[1] The total sample's characteristics concerning somatoform disorders are as follows: diagnoses at baseline but no diagnosis at follow-up: $n = 41$; diagnosis at baseline and follow-up: $n = 3$. Due to missing data, *n*'s reported in the Table 1-4 might deviate from the description of the group's composition.

Table 2
Correlations between measures of interpretation and somatization at T1 and T2.

	1	2	3	4	5	6	7	8	9	10
1. Catastrophic misinterpretations T1	-									
2. Threat-related misinterpretations T1	.27** (1428)	-								
3. WI T1	.33** (1457)	.28** (1431)	-							
4. Somatization T1	.25** (1461)	.1** (1433)	.38** (1466)							
5. BSQ T1	.28** (1456)	.23** (1429)	.36** (1464)	.27** (1465)	-					
6. Catastrophic misinterpretations T2	.54** (1369)	.26** (1341)	.31** (1372)	.2** (1376)	.19** (1372)					
7. Threat-related misinterpretations T2	.22** (1347)	.61** (1320)	.24** (1350)	.12** (1354)	.19** (1349)	.32** (1852)	-			
8. WI T2	.3** (1383)	.22** (1354)	.53** (1387)	.28** (1391)	.22** (1386)	.38** (1882)	.27** (1861)			
9. Somatization T2	.17** (1384)	.8** (1355)	.25** (1388)	.45** (1392)	.19** (1387)	.27** (1882)	.15** (1860)	.43** (1909)	-	
10. BSQ T2	.23** (1383)	.19** (1355)	.28** (1387)	.2** (1391)	.52** (1386)	.28** (1881)	.26** (1860)	.4** (1910)	.37** (1909)	-

Note: Numbers presented are *r* (*N*). T1: baseline; T2: follow-up; Catastrophic misinterpretations: scores somatoform-related scenarios on Interpretation Questionnaire for somatization and hypochondria; Threat-related misinterpretations: scores general threat-related scenarios on Interpretation Questionnaire for somatization and hypochondria; Somatization: somatization subscale Symptom Checklist-90-Revised; WI: Whiteley Index; BSQ: Body Sensations Questionnaire. T1: assessment at T1; T2: assessment at T2. Significances are indicated with an asterisks: ** p < .001, * p < .05.

misinterpretations and other relevant predictors. However, when levels of somatization were used as outcome (SCL-90-R somatization scale), catastrophic misinterpretations were not a significant predictor. Similarly, women who interpreted ambiguous somatoform-related scenarios in a catastrophizing manner at baseline were more likely to develop a somatoform disorder at follow-up than were women who

Table 3
Prediction of somatoform-related symptoms at follow-up (T2) by means of catastrophic misinterpretations and somatoform-related symptoms assessed at baseline (T1).

Dependent variable assessed at T2	Steps	Predictors assessed at T1	Significance model	R^2/Adjusted R^2	R^2 change	Beta
WI T2 (N = 1345)	Step 1		$F(4,1341) = 140.39$ $p < .001$	.3/.29		
		WI				.48**
		Somatization				.08*
		BSQ				.02
		Threat-related misinterpretations				.08*
	Step 2		$F(5,1340) = 177.78$ $p < .001$	.31/.3	.01**	
		WI				.46**
		Somatization				.06*
		BSQ				−.00
		Threat-related misinterpretations				.06*
		Catastrophic misinterpretations				.11**
Somatization T2 (N = 1346)	Step 1		$F(4,1342) = 88.12$ $p < .001$	.21/.21		
		Somatization				.41**
		WI				.06*
		BSQ				.05#
		Threat-related misinterpretations				.00
	Step 2		$F(5,1341) = 70.84$ $p < .001$	.21/.21	.001	
		Somatization				.41**
		WI				.05#
		BSQ				.04
		Threat-related misinterpretations				−.00
		Catastrophic misinterpretations				.03
BSQ T2 (N = 1346)	Step 1		$F(4,1342) = 130.72$ $p < .001$	.28/.28		
		BSQ				.47**
		WI				.08*
		Somatization				.03
		Threat-related misinterpretations				.06*
	Step 2		$F(5,1341) = 105.88$ $p < .001$	.28/.28	.003*	
		BSQ				.46**
		WI				.07**
		Somatization				.02
		Threat-related misinterpretations				.05#
		Catastrophic misinterpretations				.06*

Note: T1: baseline; T2: follow-up; Catastrophic misinterpretations: scores somatoform-related scenarios on Interpretation Questionnaire for somatization and hypochondria; Threat-related misinterpretations: scores general threat-related scenarios on Interpretation Questionnaire for somatization and hypochondria; WI: Whiteley Index; Somatization: Symptom Checklist-90-Revised somatization subscale; BSQ: Body Sensations Questionnaire. ** $p < .001$, * $p < .05$, # $p < .10$.

Table 4
Prediction new onsets somatoform disorder at follow-up by means of catastrophic misinterpretations assessed at baseline (T1).

Predictor(s) in regression assessed at T1	N (1:0)	Nagelkerke R^2	p	OR	95% CI
Single logistic regression					
Catastrophic misinterpretations	29:1393	.019	.014	1.319	1.058–1.645
Threat-related misinterpretations	27:1367	.00	.783	.984	.876–1.105
WI	29:1397	.056	< .001	1.291	1.137–1.466
Somatization	29:1401	.050	< .001	4.432	2.103–9.337
BSQ	29:1396	.005	.231	1.406	.805–2.455
Multiple logistic regression					
Catastrophic misinterpretations	27:1361	.071	*.064*	1.265	.938–1.585
Threat-related misinterpretations			.119	.905	.786–1.027
WI			< .001	1.278	1.128–1.517
Catastrophic misinterpretations	27:1363	.059	.035	1.302	.977–1.643
Threat-related misinterpretations			.313	.938	.816–1.063
Somatization			.004	3.316	1.593–8.187
Catastrophic misinterpretations	27:1359	.035	.011	1.372	1.076–1.749
Threat-related misinterpretations			.259	.931	.822–1.054
BSQ			.391	1.313	.708–2.447

Note: Significant p-values are underlined, marginal significant p-values are printed in italics. Catastrophic misinterpretations: scores somatoform-related scenario on Interpretation Questionnaire for somatization and hypochondria; Threat-related misinterpretations: scores general threat-related scenarios on Interpretation Questionnaire for somatization and hypochondria; WI: Whiteley Index; Somatization: Symptom Checklist-90-Revised somatization subscale; BSQ: Body Sensations Questionnaire.

had benign interpretations of these scenarios. Generally, catastrophic misinterpretations were also predictive when combined with general-threat-related misinterpretations, fear of bodily sensations (BSQ), and levels of somatization (SCL-90-R somatization scale), respectively. However, in the regression analysis that included general-threat-related misinterpretations and levels of hypochondriasis (WI) as predictors, catastrophic misinterpretations were only a marginally significant predictor. These findings further our understanding of the key role of catastrophic misinterpretations in somatoform disorders. Previous research has been dominated by correlational designs; our findings provide initial evidence that catastrophic misinterpretations predict somatoform-related symptoms and new onsets of somatoform disorders.

Our findings are also relevant for other areas of emotional psychopathology. A great body of empirical evidence shows that e.g., various anxiety disorders are characterized by misinterpretations [39]. Given the transdiagnostic character of misinterpretations, they could thus be considered as a general cognitive psychopathological phenomenon. However, research in anxiety disorders is also dominated by correlational approaches. To the best of our knowledge, only one study in the area of panic disorder has addressed this issue, showing that panic-related misinterpretations predicted new onsets of panic disorder over and above other relevant predictors. [35].

Results also showed that other factors in addition to catastrophic misinterpretations were significant predictors. To illustrate, the first linear regression showed that general threat-related misinterpretations, levels of hypochondriasis (WI) and somatization (SCL-90-R somatization scale) assessed at baseline predicted levels of hypochondriasis at follow-up. Moreover, results of the logistic regression showed that levels of hypochondriasis and somatization were also predictive of new onsets of somatoform disorder. In fact, this is not surprising. First, it is possible that these concepts have some predictive validity on their own as they are all important predictors in the context of somatoform disorder. Second, it is very likely that there is some conceptual overlap among these concepts, which could explain their predictive qualities. However, other studies did find more unique relationships. For example, college students' levels of hypochondriasis were specifically predicted by catastrophic beliefs about physical illness, but not by any other predictor [10]. Various reasons could account for such different results. From a theoretical perspective, this finding indicates the need for a nuanced understanding of the contributions of predictors in somatoform disorders. The work of Barlow and colleagues [40,41] might provide a new theoretical starting point to describe the functional relationship between mood and anxiety disorders (similarly elaborated elsewhere [10]). Within their model, negative affect is the higher order factor shared by mood and anxiety disorders. In contrast, various lower order factors are unique to mood and anxiety disorders. For somatoform disorders, such a model does not yet exist. However, the present study could provide some first input, particularly for the lower order factors. Our data showed that somatoform-related symptomatology was predicted by a variety of relevant concepts, and the same was true for the prediction of new onsets of somatoform disorders. Hence, future research is needed to clarify and disentangle the role of such potential lower order factors in the context of somatoform-related symptomatology.

There are several limitations that need to be addressed. First, the sample included only well-educated young women, limiting the results' generalizability. Second, not many women developed a somatoform disorder at follow-up. Hence, logistic regressions including all five predictors as well as exploratory analyses including participants' pre-existing psychopathologies were impossible. Third, maintaining a constant time interval between baseline and follow-up was not possible. Therefore, the 17-month period was not an a-priori planned interval, and we do not know whether this affected our results.

To summarize, the present findings provide new and valuable insights in the context of somatoform disorders, i.e., findings that are relevant for both clinical practice and theory. Regarding the former, our results could provide important additional information when thinking of treating patients with somatoform disorders (e.g., identification and modification of the most prominent catastrophic misinterpretations). This is supported by findings showing that a reduction in catastrophic misinterpretations was predictive of the patients' functional improvement at discharge [42]. Moreover, results of a systematic review put forward that it could be useful to integrate such psychological criteria to current classification systems in order to refine and improve them [43]. Regarding the latter, our data showed that catastrophic misinterpretations are not only a correlate but also a risk factor for somatoform disorders [20]. These results support and extend prominent cognitive vulnerability models of somatoform disorders. However, as of yet we do not know whether such misinterpretations should be also considered as a *causal* risk factor [20]. Hence, studies are needed focusing on the manipulation of catastrophic misinterpretations. These studies can test whether the extent of catastrophic misinterpretations can be changed (e.g., increased or decreased), and whether such change predicts change in levels of somatoform symptomatology. Cognitive Bias Modification (CBM) techniques offer a number of computerized training procedures that could prove useful in this context [44,45]. CBM has provided exciting findings, e.g., in the context of social anxiety [46–48], analog posttraumatic stress [49,50] and depression [51–55]. For example, investigating

whether experimentally induced catastrophic misinterpretations affect the appraisal of bodily sensations could be a next intriguing step.

The present data also provide valuable insights for clinical practice. Catastrophic misinterpretations are risk factors for developing somatoform disorders, which means that practitioners can identify individuals at risk at an early stage. One CBM study provides a promising reinterpretation training procedure as a 'cognitive vaccine' in the context of depression [56]. Similar results were obtained in the field of analog trauma, showing that participants who received positive instead of negative CBM appraisal training before an analog stressful event (i.e., trauma film) reported less distress arising from their intrusive memories of the trauma film during the subsequent week [50]. The present findings suggest that such a preventative approach could be also a relevant tool in the context of somatoform disorders.

In conclusion, our findings provide some first support that catastrophic misinterpretations are predictive of somatoform-related problems and new onset of somatoform disorders. Hence, these data provide promising avenues for future research.

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