

The development and psychometric properties of a self-report Catastrophising Questionnaire

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Catastrophising is a cognitive process that can be defined as predicting the worst possible outcome. It has been shown to be related to psychiatric diagnoses such as depression and anxiety, yet there are no self-report questionnaires specifically measuring it outside the context of pain research. Here, we therefore develop a novel, comprehensive self-report measure of general catastrophising. We performed five online studies (total n=734), in which we created and refined a Catastrophising Questionnaire, and used a factor analytic approach to understand its underlying structure. We also assessed convergent and discriminant validity, and analysed test-retest reliability. Furthermore, we tested the ability of Catastrophising Questionnaire scores to predict relevant clinical variables over and above other questionnaires. Finally, we also developed a four-item short version of this questionnaire. We found that our questionnaire is best fit by a single underlying factor, and shows convergent and discriminant validity. Exploratory factor analyses indicated that catastrophising is independent from other related constructs, including anxiety and worry. Moreover, we demonstrate incremental validity for this questionnaire in predicting diagnostic and medication status. Finally, we demonstrate that our Catastrophising Questionnaire has good test-retest reliability (Intra-Class-Correlation Coefficient=0.77, $p<.001$). Critically, we can now, for the first time, obtain detailed self-report data on catastrophising.

Keywords: psychiatry, anxiety disorders, mood disorders, cognitive distortions, self-report questionnaire, catastrophising

Catastrophising, colloquially defined as imagining or predicting the worst possible outcome, was originally used to describe instances where individuals see any negative outcome as ‘catastrophic’ and intolerable, when in fact it is likely worse in anticipation than in reality (1). A catastrophe, in turn, is defined as ‘*a momentous tragic event ranging from extreme misfortune to utter overthrow or ruin*’ (2). Ellis’ description of catastrophising is closely related to Beck’s cognitive distortion of *magnification*, defined as ‘*inflation of the magnitude of [his] problems and tasks*’. Beck refined this definition in 1979, as when an individual ‘*always think[s] of the worst. It’s most likely to happen to [them]*’ (3). These early definitions highlight the fact that catastrophising has two facets: the prediction of an objective catastrophe, which a majority of others would agree to be disastrous (e.g. the death of a partner or oneself), or the (subjective) perception of a particular negative outcome as ‘catastrophic’, such as social rejection. One of these is a belief in the excessive likelihood of catastrophic events, and the other is attributing excessive gravity to a situation. Both of these facets often occur together, as is perhaps evident from the fact that they are referred to under the same name – an individual overestimates the likelihood of a negative event, and also believes that the negative event will be catastrophic. Catastrophising, for the purposes of this paper, is considered to be a cognitive process, which is more common in clinical populations (e.g. those suffering from anxiety or depression), but also exists in the general population. Catastrophising is also likely to cause distress to the individual experiencing it, and – if this is in the context of a psychiatric diagnosis – may be considered a symptom. We do not consider it to be a diagnosis, but rather a transdiagnostic factor which acts as a predisposing or maintaining factor for anxiety, depression, and perhaps other disorders.

Notably, Gellatly and Beck have suggested that the cognitive process of catastrophising is transdiagnostic, and present in disorders ranging from phobias, to obsessive-compulsive

disorder, to post-traumatic stress disorder, to traumatic brain injury (4). The role of catastrophising in psychiatric disorders may in fact be causal: catastrophic misinterpretations of (often somatic) signals have been considered as a key factor in the onset of panic disorder (5). Panic disorder patients are more likely to misinterpret sensations such as heart palpitations as the onset of a heart attack or ‘insanity’, which subsequently leads to escalating panic and panic attacks (6).

Catastrophising and other cognitive distortions are targeted for treatment in cognitive behavioural therapy (CBT). CBT is based on the theory that attitudes or assumptions developed from previous experience may become distorted, leading to dysfunctional cognitions and negatively biased information processing, resulting in a feedback loop (3,7). The therapeutic techniques of CBT are designed to identify, test and correct both the cognitions and the underlying beliefs, leading to symptom reduction (3). Catastrophising is targeted in CBT using an approach known as decatastrophising (8), and is used in the treatment (and prevention) of many varied disorders. Despite the importance of catastrophising, our ability to measure it in the context of mental health is surprisingly limited.

Catastrophising has been most thoroughly studied in the field of pain research, which may be partly due to the existence of self-report measures specific to pain catastrophising. Specific measures such as the Pain Catastrophising Scale (PCS) (9) and the Coping Strategies Questionnaire (CSQ-CAT) (10) have been developed. Research using these scales has shown that catastrophising is an important psychological predictor of pain experience (9), such that those who score highly on a measure of pain catastrophising report more intense pain and often fail to improve with treatment (8,9,11,12).

Importantly, pain catastrophising has also been shown to be related to psychiatric diagnoses such as depression and anxiety. Higher levels of pain catastrophising have been shown to be present in both worriers (13,14) and those with elevated levels of anxiety (15,16), and depression (14,16). CBT treatment studies indicate that changes in pain catastrophising (measured using the PCS) and negative affect have a positive relationship with changes in clinical pain (such that increases in catastrophising increase reported pain, and vice versa) and the effects of the treatment last for months or years (12,17).

Research into general catastrophising has generally relied either on the scales developed to measure catastrophising in pain, structured interviews, or self-report measures which do not focus on catastrophising or contain few items measuring it. The structured-interview procedure most commonly used (13,15) is the ‘Catastrophising Interview’ developed by Vasey and Borkovec (1992) or a variant of it, in which the participant generates a sequence of catastrophising steps and rates their likelihood (essentially the opposite of the decatastrophising method typically employed in CBT). In theory, and as shown in Vasey and Borkovec’s study, worriers generate more steps than non-worriers and the contents of those steps are more catastrophic (18). This interview is well validated, and the only existing measure specific to catastrophising outside of the context of pain research. However, there are a few limitations to this approach. The experimenter who administers the catastrophising interview is not blind to diagnosis, there are no objective criteria for rating the ‘catastrophic’ nature of steps generated by individuals, and requiring participants to generate steps may induce a demand characteristic (such that they generate more steps than they would otherwise). Finally, this interview requires in-person testing, which is not feasible when studying catastrophising in larger sample sizes, or remotely. Other studies (14,16) use self-

report questionnaires which cover a variety of different cognitive distortions, with limited numbers of items focusing specifically on catastrophising, reducing their sensitivity. In particular, shorter questionnaires will not allow a sufficient range of scores to enable improvement or deterioration to be tracked over time (as might be required if one wished to assess the effects of decatastrophising), and also prohibit more nuanced analyses of the structure of catastrophising (i.e. the underlying factor structure). More specifically, existing self-report questionnaires which contain catastrophising items include the Cognitive Emotion Regulation Questionnaire, or CERQ (19), which includes four items to assess catastrophising, all of which are focused on the magnification of past events, in contrast to our conceptualisation of catastrophising as being future-oriented. Another questionnaire, the Cognitive Distortions Scale(20), contains two items to measure catastrophising (one in a social, and one in an achievement setting), but relies on participants' abilities to generalise from a vignette to other situations in everyday life. Other questionnaires containing items that measure catastrophising include the Children's Negative Cognitive Error Questionnaire (21) and the Children's Cognitive Style Questionnaire(22), which are not validated for use in adults. Finally, research into catastrophising in psychiatry may simply use pain-catastrophising scales, which are not validated for use outside of the context of pain research; and are not necessarily designed to (or able to) differentiate between other cognitive distortions or psychiatric phenomena and catastrophising. For instance, Keefe et al. found that in patients with rheumatoid arthritis, there was a level of construct redundancy in the CSQ-CAT between catastrophising and depression, with one predicting the other (11). Furthermore, negative mood and pain catastrophising were found not to be independent in another study (23). Sullivan et al. examined scales measuring pain-related catastrophising, depression and anxiety and found that they were markedly similar in content, although intended to measure distinct constructs (9). Notably, however, the authors concluded that

catastrophizing is an independent construct, but that operational or measurement confounds may have resulted in this apparent redundancy (9).

As noted above, no specific self-report measure of catastrophising currently exists outside of pain research. Developing a questionnaire that a) measures catastrophising outside of the specific context of pain, and is b) designed to differentiate between catastrophising and other constructs such as anhedonia or worry would allow us to increase our understanding of catastrophising. Such a questionnaire would help researchers and clinicians to better understand the role of catastrophising in mediating emotional reactions and treatment outcomes (20), and would allow investigation into the role of catastrophising as a risk factor for anxiety and depression. A questionnaire measuring catastrophising would also allow CBT and decatastrophising research to measure changes in catastrophising more directly, and with greater sensitivity. Personalised medicine approaches could also be developed, where those who score highly on measures of catastrophising could receive more intensive decatastrophising interventions. Finally, a catastrophising questionnaire would allow the investigation of differences in patterns in catastrophising across individuals (frequency and intensity). The aim of the present study, therefore, is to create a new self-report questionnaire measuring catastrophising, which can be used in a psychiatric or mental health setting and in the general community.

Methods

Procedure

Five studies were performed, using iterative versions of the Catastrophising Questionnaire. In all studies participants were recruited online, and completed the latest version of the

Catastrophising Questionnaire. We also collected additional demographic information and information about psychiatric diagnosis and medication.

In Studies 1 and 2 we refined an initial 31-item version of the Catastrophising Questionnaire into a 24-item final version, whilst also performing exploratory factor analyses to understand the structure of the questionnaire. In Study 3, we assessed the factor structure of this novel instrument using a Confirmatory Factor Analysis, and also investigated convergent and discriminant validity. To start assessing clinical relevance we also tested whether scores on the Catastrophising Questionnaire were able to predict psychiatric diagnosis or psychiatric medication use over-and-above the PHQ-9 and GAD-7, two commonly used clinical instruments. We also introduced a short version of the Catastrophising Questionnaire. In Study 4, we examined its test-retest reliability. Finally, we report further evidence for discriminant validity in Study 5.

Participants

The questionnaire versions were hosted online using Gorilla (<https://gorilla.sc>) and participants were recruited via Prolific (<https://prolific.co>). Participants were required to be fluent in English, and age 18-60, without any self-reported history of mild cognitive impairment or dementia. We asked participants to report whether they had any psychiatric diagnosis, and if they were taking any psychiatric medication. These questions were used as additional metrics of convergent validity, not as exclusion criteria. Demographic information on participants from all studies is reported in the Supplementary Materials.

We did not perform a power analysis to determine the sample size for these studies, as the issue of how best to perform a power analysis for factor analysis research is still an open

question: it depends on the nature of the data being collected and the model it is fitted to, and even the best methods require the researcher to make a number of assumptions about the population values of estimated parameters and/or have initial data (24,25).

Throughout all studies, based on the estimated time to complete the full protocol, we set payment at the rate of £7.50 an hour.

Informed Consent

All participants were presented with an online information sheet and subsequently gave online informed consent. They could also leave the study at any time by closing their browser. This study was approved by the University College London Research Ethics Committee (approval number 5253/001).

General Analysis

The specific approach in each study is detailed under the study specific subheadings below.

However, there were some consistent approaches across studies: we tested for internal reliability and validity using Cronbach's alpha and omega, and examining inter-item and item-total correlations; we performed exploratory factor analyses in studies 1 and 2, then confirmatory factor analyses in subsequent studies 3, 4 and 5. These methods are further detailed in the supplementary materials, along with our policy for item reduction during scale development.

Study 1

Scale

An initial scale with 31 items was used. Further details on how the items were developed can be found in the Supplement.

Participants

We tested this first version of the questionnaire on a sample of 117 participants.

Study 2

In this second study, we reduced the number of items in the scale, and simplified items which were considered too long and too complex. Details of item removal can be found in the Supplement.

Scale

Based on item reduction in study 1, we tested a version of the scale with 25 items.

Participants

This iteration of the questionnaire was tested on 117 participants.

Study 3

All participants completed the final version of the Catastrophising Questionnaire along with convergent and discriminant validity questionnaires (all of which showed acceptable internal consistency in our sample, see Table 3).

Scale

One item from the second version of the questionnaire was removed, resulting in a final version of the Catastrophising Questionnaire with 24 items.

Short version of the Catastrophising Questionnaire

We developed a short version of the Catastrophising Questionnaire, as there are a number of circumstances in which researchers or clinicians might need a briefer scale which corresponds to the full version. This short version consisted of four items. Three of them were from the Catastrophising Questionnaire and were chosen based on their high factor loading and relevance to catastrophising. The fourth item, “I turn minor issues into really big problems in my head” which was derived from the first version of the questionnaire, reflected a more general definition of catastrophising. We analysed the relationship between this questionnaire and its full version using a Pearson’s correlation, and also analysed the relationship between this questionnaire without the fourth item and the full Catastrophising Questionnaire.

Participants

500 participants provided good quality data in Study 3 (for additional data quality assurance checks see supplementary material).

Convergent and discriminant measures

We collected data on a number of additional self-report questionnaires, in order to assess convergent and discriminant validity. We define construct validity here as positive (but not large enough to indicate redundancy) associations between two measures of the same construct (i.e. two different questionnaires measuring the same thing), and define convergent validity as positive associations between two measures of different constructs which are

theoretically hypothesised to be related. We define discriminant validity as a lack of significant positive association between measures of constructs that are not hypothesised to be related to catastrophising, but are related to mental health – such as anhedonia, schizotypy and alcohol use disorder. These measures are itemised below.

Construct validity measures

Cognitive Distortion Scale: Catastrophising Subscale

The Cognitive Distortion Scale (CDS) conceived by Covin et al. contains a 2-item Catastrophising subscale (Covin et al., 2011). This subscale was used for comparison with our Catastrophising Questionnaire to assess construct validity.

Convergent measures

Anxiety

Catastrophising is believed to relate to psychiatric diagnoses such as anxiety and depression, and as such should be related to scores on questionnaires measuring symptoms of these disorders. Therefore, we included the GAD-7 (Generalized Anxiety Disorder Assessment), which measures symptoms of generalized anxiety disorder over the previous two weeks (Spitzer et al., 2006). We also included the STAI-T (Trait Anxiety Subscale of the State Trait Anxiety Inventory) which measures anxiety level as an enduring personality trait, and focuses on anxiety in general rather than on a specific anxiety disorder (Spielberger et al., 1983).

Depression

For the same reasons as above, we included the PHQ-9 (Patient Health Questionnaire) which is a depression scale that asks about symptoms over the preceding two weeks (Spitzer et al., 1999). As we were testing participants online and could not assess risk of harm in person, we removed the question about suicidal ideation.

Worry

Worry is an important feature of anxiety disorders that may also be related to catastrophising. Thus, we included the PSWQ (Penn State Worry Questionnaire) which measures traits of worry independently from anxiety (Meyer et al., 1990). It examines the excessiveness, generality and uncontrollable dimensions of worry.

Rumination

Rumination is related to depression, and we thus hypothesised it would also correlate with catastrophizing. However, it is thought to be separable from depression, so in addition to the PHQ-9, we included the RRS (Rumination Response Scale) which measures two aspects: brooding and reflective pondering (Nolen-Hoeksma and Morrow, 1991).

Discriminant measures

Experience of Pleasure

We expected the experience of pleasure to be orthogonal to catastrophising as it implies a positive conception of the anticipation of pleasure and enjoying the present moment. Therefore, we included the TEPS-ANT and TEPS-CON (Temporal Experience of Pleasure Scale – Anticipatory and Consummatory subscales), which assess pleasure experienced during anticipation of reward and on attaining rewards, respectively (Gard et al., 2006).

Analysis of convergent and discriminant measures

We performed Pearson's correlations between scores on different questionnaires to assess the magnitudes of relationships between the putative latent constructs. To assess the extent to which the convergent measures examine separable constructs, we performed an EFA including all these items, and hypothesised that the items from the Catastrophising Questionnaire would load on to a separate factor to other items. We chose to use an EFA as a model-free way of attempting to characterise the relationships between individual items from

all questionnaires – rather than assuming that each questionnaire is separate, we wanted to test whether the catastrophising questionnaire items coupled together with other questionnaires, or whether they loaded separately onto a factor of their own. To assess discriminant validity, we also used the heterotrait-monotrait ratio of correlations (HTMT), which is a particularly robust measure of discriminant validity (26), for which statistic a value of $<.85$ can be considered discriminant.

We also present an exploratory CFA analysis, performed using lavaan, in the supplementary materials, in which each ‘convergent’ questionnaire was mapped to a latent factor, such that each individual item within that questionnaire became an indicator for that latent factor, and subsequently estimated the covariances between each latent variable. We anticipated that this would result in heightened correlations between questionnaires, due to the disattenuation for measurement error for each indicator. The aim of this analysis was to assess whether the anticipated heightened correlations between items were specifically increased for correlations with the catastrophising questionnaire, which might have indicated redundancy with the other questionnaire measures we used.

Self-reported medication, psychiatric diagnoses and catastrophising: incremental validity

We also examined participants’ responses to questions on their mental health and their medication history.

We performed binomial logistic regression analyses to establish the incremental validity gained in predicting self-reported diagnostic status by using the Catastrophising Questionnaire over two questionnaires which are commonly obtained in primary care settings in the UK – the GAD-7 and PHQ-9. A null model predicting the self-report diagnosis status of each participant using GAD-7 and PHQ-9 was compared to a model of interest which included the

GAD-7, PHQ-9 and Catastrophising Questionnaire Scores. Similarly, we also performed multinomial logistic regression analyses on the self-reported medication status of each participant. We hypothesised that the Catastrophising Questionnaire would show incremental validity over these questionnaires in predicting both self-report medication and diagnosis.

Study 4

A number of participants (100) who had completed Study 3 repeated the final 24-item version of the Catastrophising Questionnaire 2 months later. We did not systematically select these participants – the study was placed online and open to all participants who had completed Study 3, and recruitment proceeded in a ‘first-come, first-served’ manner.

Participants

This study was completed by an unselected, first-come, first-served group of 100 participants who had completed Study 3.

Test-retest reliability

We firstly calculated the Pearson’s correlation coefficient between participants’ scores in Study 3 and Study 4. We also calculated the intraclass correlation coefficient (ICC). More details on the ICC can be found in the Supplement.

Study 5

A number of participants (264) who had completed Study 3 repeated the final 24-item version of the Catastrophising Questionnaire 10 months later. They also completed two additional questionnaires to measure discriminant validity, and repeated the PHQ-9, GAD-7, PSWQ, and RRS.

Participants

This study was completed by a subset of participants who had completed Study 3. As in Study 4, we did not systematically select these participants.

Discriminant measures

We collected data on two additional questionnaires: the Alcohol Use Disorder Identification Test (AUDIT), and the Short Scales for Measuring Schizotypy. More details on these can be found in the Supplement.

Results

All data and analyses are available online as a fully reproducible workbook here:

doi.org/10.17605/OSF.IO/CRFUW.

Study 1

Reliability and validity

Cronbach's alpha, omega, and the inter-item and inter-total correlations are presented in Table 1, and all distributions of inter-item correlations are presented in the Supplementary Materials. All fit indices show initial evidence that the questionnaire is reliable and valid (27).

Table 1. Reliability and Validity fit indices for the Catastrophising Questionnaire. Internal consistency is measured by Cronbach's alpha, Omega, and inter-item correlations. Item-total correlations are used to assess discriminability of items – i.e. the extent to which they distinguish between high and low scorers on a task. Whilst adequate values for these measures depends on the application, the nature of the construct, and other factors, some suggested values for acceptability are given to aid interpretation. 0.8 (for basic or applied research) is considered to be an acceptable value for Cronbach's alpha, with .9 or

above recommended for applied work that is guiding decision-making (27,28). Similar values are recommended for Omega. Mean inter-item correlations should be between .15 and .5 (27). Item-total correlations should be over 0.3 or 0.4 (29).

Study	Questionnaire version	Cronbach's alpha	Omega	Average Inter-item Correlation	Average Item-total correlation
Study 1	31 item version	.95	.96	.40	.65
Study 2	25 item version	.93	.94	.36	.62
Study 3	24 item version	.94	.95	.41	.66
Study 4	24 item version	.94	.95	.42	.66
Study 5	24 item version	.95	.95	.43	.67

Exploratory Factor Analysis

The KMO value was .92, and Bartlett's test of sphericity was significant, so our requirements for conducting an exploratory factor analysis were met. Parallel analysis indicated a three-factor structure. EFA fit indices are reported for all studies in the supplement.

Study 2

Reliability and validity

This version of the Catastrophising Questionnaire also showed good internal consistency. Cronbach's alpha, omega, and the inter-item and inter-total correlations are presented in Table 1.

Exploratory Factor Analysis

The KMO value was .9, and Bartlett's test of sphericity was significant, so our requirements for conducting an exploratory factor analysis were met. We performed an EFA in the same way as in the first study. Parallel analysis did not indicate conclusively how many factors should be considered, and solutions indicating one or two factor structures were both produced (parallel analysis, by generating 'random' datasets, is by definition stochastic: in the open code for this paper we use two different seeds to demonstrate these different solutions, which the interested reader can inspect further – <https://doi.org/10.17605/OSF.IO/CRFUW>). However, the eigenvalue for the second factor was less than 1, indicating that the putative second factor is not stable, so we assumed a single-factor structure was the best fit to the data. The fit indices for the EFA are displayed in the supplement.

Study 3

Reliability and validity

This final version of the Catastrophising Questionnaire showed internal consistency. Cronbach's alpha, omega, and the inter-item and inter-total correlations are presented in Table 1.

Confirmatory Factor Analysis (CFA)

We ran a CFA specifying a one-factor model. This model had a $\chi^2(252) = 1034$, SRMR of .05, a CFI of .87, a TLI of .86, and a RMSEA of .08 [CI: .074-.084]. These fit indices are reported in Table 2.

Table 2. Fit Indices for Confirmatory Factor Analysis solutions for the Catastrophising Questionnaire.

Study	Description	χ^2 (df)¹	CFI²	TLI³	RMSEA⁴	SRMR⁵
Study 3	CFA one-factor model	1033 (252)	.87	.86	.08	.05
Study 4	CFA one-factor model	433 (252)	.85	.84	.09	.07
Study 5	CFA one-factor model	677 (252)	.87	.86	.08	.05

Short version of the Catastrophising Questionnaire

The Catastrophising Questionnaire had a strong correlation with its short version ($r_{498} = .81$, $p < .001$, Figure 1b), which indicates that this could be used as a brief measure when necessary (although the correlation is not equal to 1, indicating that the full version contains more information). We include one item in the short version that did not overlap with the final version of the Catastrophising Questionnaire. When this is omitted, the correlation between full and short version scores decreases ($r_{498} = .77$, $p < .001$). Notably, the short version is four times faster to complete than the full version: with participants in Study 3 taking a mean of 1

¹ χ^2 likelihood test

² Comparative Fit Index

³ Tucker-Lewis Index (good fit indicated by close to .95)

⁴ Root Mean Square Error of Approximation (good fit indicated by $< .08$)

⁵ Standardised Root Mean Square Residual (good fit indicated by $< .08$)

minute and 59 seconds to respond to the full version, and a mean of 26 seconds to respond to the short version.

Convergent and discriminant validity

Internal consistency indices for all questionnaires used to test convergence are presented in Table 3.

Table 3. Internal Consistency indices for all measures used.

Measure	Cronbach's alpha	Omega
GAD-7 ¹	.90	.93
PHQ-9 ²	.89	.91
PSWQ ³	.94	.95
RRS ⁴	.94	.95
STAI-T ⁵	.94	.95
TEPS-ANT ⁶	.77	.82
TEPS-CON ⁷	.68	.77
CDS – Catastrophising ⁸	.70	<i>N/A</i> ⁹
Short version (4 items) ¹⁰	.81	.83
AUDIT ¹¹	.88	.92
SS-UE ¹²	.75	.79
SS-CD ¹³	.83	.86
SS-IA ¹⁴	.63	.72
SS-IN ¹⁵	.55	.62

¹ Generalized Anxiety Disorder Assessment

² Personal Health Questionnaire

³ Penn-State Worry Questionnaire

⁴ Ruminative Responses Scale

⁵ Spielberger State-Trait Anxiety Inventory – Trait Subscale

⁶ Temporal Experience of Pleasure Scale, Anticipatory Subscale

⁷ Temporal Experience of Pleasure Scale, Consummatory Subscale

⁸ Cognitive Distortion Scale: Catastrophising Subscale

⁹ There were too few items (n=2) to calculate Omega in the CDS – Catastrophising scale.

¹⁰ Short version of the full novel Catastrophising Questionnaire reported in this paper

¹¹ Alcohol Use Disorders Identification Test

¹² Short Scales for Measuring Schizotypy – Unusual Experiences subscale

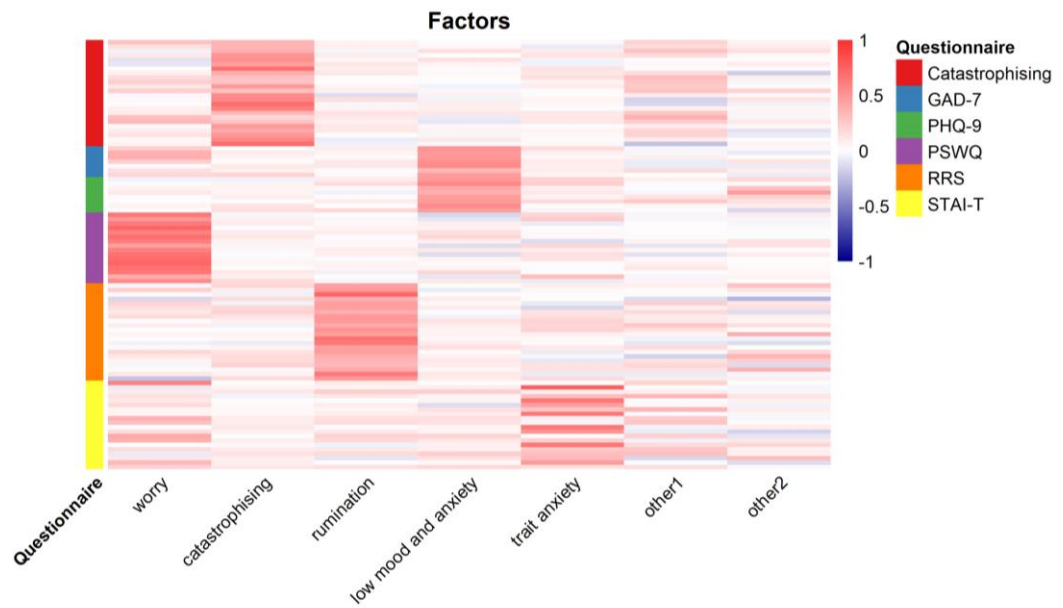
¹³ Short Scales for Measuring Schizotypy – Cognitive Disorganisation subscale

¹⁴ Short Scales for Measuring Schizotypy – Introverted Anhedonia subscale

¹⁵ Short Scales for Measuring Schizotypy – Impulsive Nonconformity subscale

We ran an EFA with the Catastrophising Questionnaire and the questionnaires used for convergent validity in order to determine the underlying factor structure that best represents the individual items (97 in total). The results, analysed using parallel analysis, suggested a seven-factor model. All fit indices are presented in the supplement. Factor loadings are presented in a heatmap (Figure 1a) which highlights that the items from the Catastrophising Questionnaire heavily load onto one factor that is specific to catastrophising. Therefore, these results suggest that catastrophising may be a construct that is independent from worry, rumination, and low mood and anxiety, at least in our data.

A



B

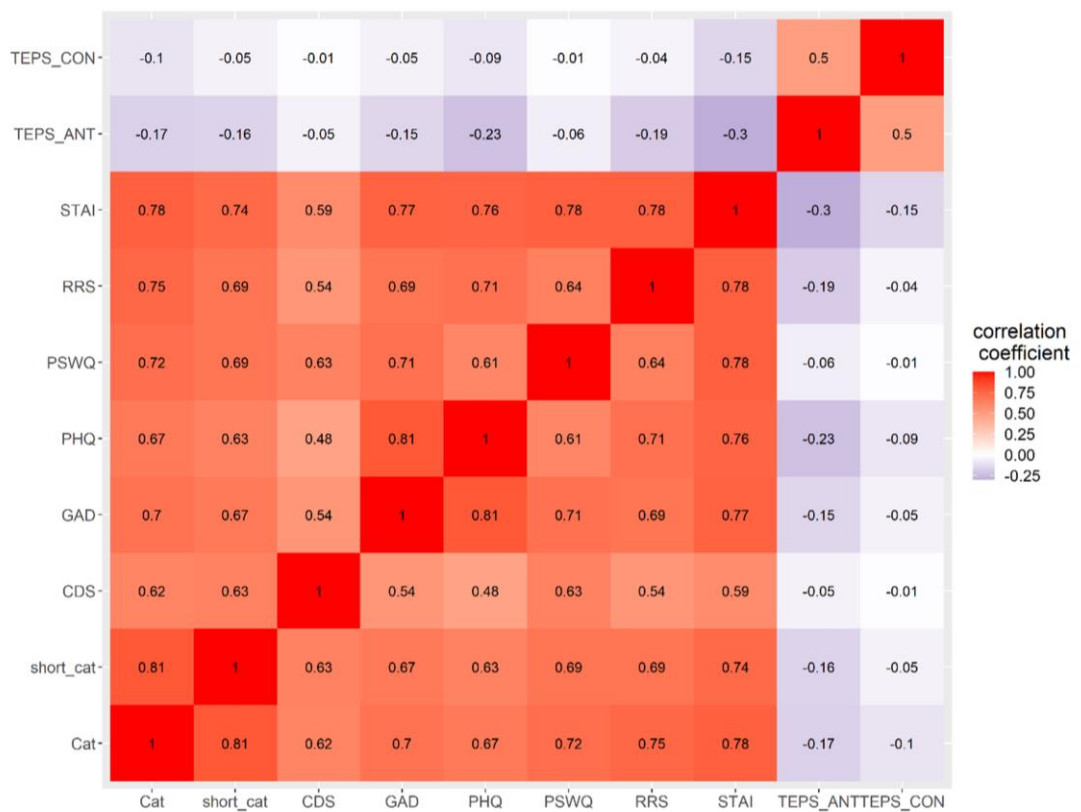


Figure 1. a. Heatmap displaying factor loadings from the Exploratory Factor Analysis of the Catastrophising Questionnaire and all the scales used for convergent validity. **b.** Correlation plot displaying the correlations between the Catastrophising Questionnaire and all scales used for discriminant and convergent measures in Study 3.

Note. CDS= CDS-Catastrophising Subscale.

Correlations between the Catastrophising Questionnaire and convergent and discriminant measures were performed using the Pearson Correlation test (Figure 1b). When the same analysis was performed in a structural equation modelling framework, in order to disattenuate for measurement error, all the correlations increased, but this was not specific to correlations with the Catastrophising Questionnaire alone (Supplementary Figure 7). This provides further evidence for convergent validity without redundancy. The Catastrophising Questionnaire had a moderate correlation with the CDS-Catastrophising subscale ($r_{498}=.62, p<.001$), confirming its construct validity.

The Catastrophising Questionnaire was more strongly associated with scores on the GAD-7 ($r_{498}=.70, p<.001$), STAI-T ($r_{498}=.78, p<.001$), PHQ-9 ($r_{498}=.67, p<.001$), PSWQ ($r_{498}=.72, p<.001$), and RRS ($r_{498}=.75, p<.001$) than with TEPS-ANT ($r_{498}=-.17, p<.001$) and TEPS-CON ($r_{498}=-.1, p=.02$), indicating that catastrophising is more associated with measures of anxiety, depression, worry and rumination than with measures of the experience of pleasure. Furthermore, all HTMT_{.85} values for a model including the TEPS-ANT, TEPS-CON and Catastrophising Questionnaire indicated discriminant validity (TEPS-ANT = .326, TEPS-CON = .182).

Self-reported medication, psychiatric diagnoses and catastrophising: incremental validity

We tested incremental validity by seeing whether the Catastrophising Questionnaire could predict a) self-reported diagnostic status and b) self-reported medication status significantly better than using the PHQ-9 and GAD-7, which are in common clinical use within mental health services in the UK. A comparison of two logistic regression models, one including the

PHQ-9 and GAD-7, and a nested model also including scores on the Catastrophising Questionnaire, indicated that the Catastrophising Questionnaire is able to predict self-reported psychiatric diagnosis significantly better than using the PHQ-9 and GAD-7 alone ($\chi^2(1, N = 500) = 14.53, p = 0.00014$). This was also true when the dependent variable was self-reported (current or former) diagnosis of anxiety or depression specifically ($\chi^2(1, N = 500) = 9.74, p = 0.0018$). Analysis of self-reported psychiatric medication in a multinomial logistic regression also indicated incremental validity ($\chi^2(2, N = 500) = 12.99, p = 0.0015$). Finally, incremental validity was also shown in when the dependent variable was self-reported medication for anxiety and/or depression more specifically ($\chi^2(2, N = 500) = 18.43, p = 0.0001$). The means and standard deviations on the Catastrophising Questionnaire by self-reported diagnosis and psychiatric medication status are shown in Supplementary Table 3 and in Figure 2.

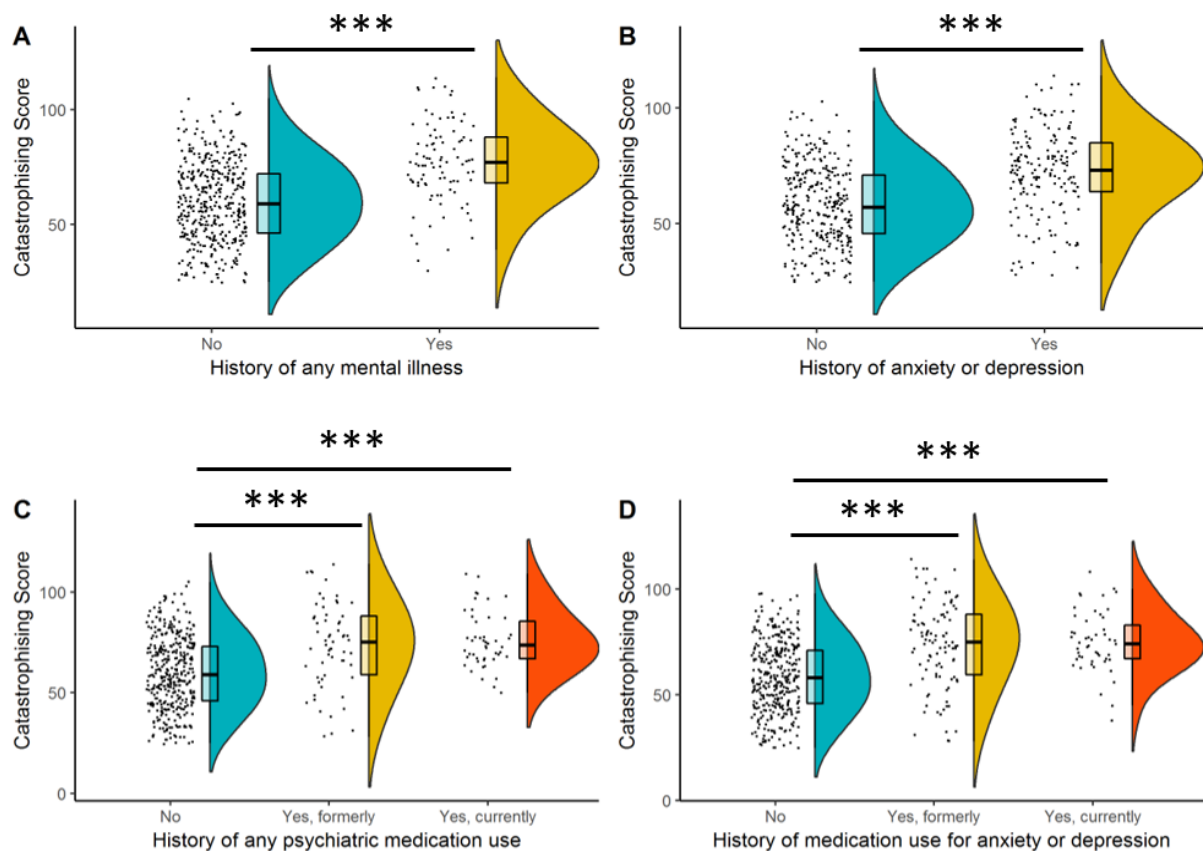


Figure 2. Raincloud Plots displaying the means and standard deviations on the Catastrophising Questionnaire from Study 3 separated by response to self-reported psychiatric diagnosis/medication questions. a) Participants with and without a self-reported psychiatric diagnosis. b) Participants with and without a self-reported diagnosis of anxiety or depression. c)

Participants who report currently taking psychiatric medication, who report taking these medications in the past, and participants who report that they have never taken these medications. d) Participants who report that they are currently taking medication for anxiety or depression, who report that they have taken medication for anxiety or depression in the past, and participants who report that they have never taken any psychiatric medication for anxiety or depression (***: $p < .001$).

Study 4

An unselected subset of participants who completed Study 3 (100 participants) repeated the Catastrophising Questionnaire 2 months later.

Reliability and validity

Replicating results from the previous three studies, the Catastrophising Scale was internally consistent in the fourth study. Cronbach's alpha, omega, and the inter-item and inter-total correlations are presented in Table 1.

Test-retest reliability

The retest coefficient was high ($r_{98} = .78, p < .001$) confirming the reliability of the scale. The ICC(A,1) was .774 [CI: .682, .842], which was significantly different from 0 ($F_{99,99.7} = 7.91, p < .001$) and the ICC(C,1) was .776 [CI: .684, .843], which was also significantly different from 0 ($F_{99,99} = 7.91, p < .001$).

Confirmatory factor analysis

A one-factor model was an acceptable fit to the data. See Table 2 for fit indices.

Study 5

Reliability and validity

Replicating results from the previous four studies, the Catastrophising Scale was internally consistent in the fifth study. Cronbach's alpha, omega, and the inter-item and inter-total

correlations are presented in Table 1. It is notable that Cronbach's alpha and Omega were both relatively low for some of the subscales of the Short Scales for measuring Schizotypy.

Confirmatory factor analysis

A one-factor model was an acceptable fit to the data. See Table 2 for fit indices.

Convergent and discriminant validity

Internal Consistency indices for all items are presented in Table 3. Scores on the Catastrophising Questionnaire showed a small but significant correlation with scores on the AUDIT ($r_{262} = .27, p < .001$). The HTMT_{.85} was 0.315, below the .85 cutoff to indicate discriminant validity. Catastrophising Questionnaire scores showed a range of different correlations with the four facets on the Short Scales for Measuring Schizotypy (Unusual Experiences: $r_{262} = .47, p < .001$; Cognitive Disorganisation: $r_{262} = .63, p < .001$; Introverted Anhedonia: $r_{262} = .34, p < .001$; Impulsive Nonconformity: $r_{262} = .46, p < .001$). All HTMT_{.85} values indicated discriminant validity (UE = .555, CD = .705, IA = .508, IN = .650).

In summary, whilst these discriminant measures all showed positive correlations with catastrophising, many of the correlations are small to moderate, and all of the HTMT values indicated discriminant validity.

Discussion

We have developed the Catastrophising Questionnaire to provide a comprehensive self-report measure of a cognitive process that is related to diagnoses such as anxiety and depression but which, until recently, could only be measured in the context of pain. The questionnaire

demonstrates high reliability and internal consistency and measures a unitary construct that is separable from anxiety, depression and worry.

In Studies 1 and 2, we refined an initial version of a novel Catastrophising Questionnaire and examined the construct properties using Exploratory Factor Analysis. In Studies 3-5, we were able to show acceptable fit for a single factor-structure using an out-of-sample CFA, and demonstrated that all 24 items from the novel questionnaire loaded highly onto this factor, indicating that catastrophising can be considered a unitary construct. This finding is a little surprising given the definition of catastrophising that we propose above, which includes two components – the overestimation of the probability of rare negative events, and the overestimation of the magnitude or severity of negative events. We did not specifically test this hypothesis using a CFA in our data, and it would not be wise to do so after performing an EFA (30), but this may be a fruitful avenue for future work. It is possible that a wider item pool, with more items specifically referring to each separate component, would have shown such a two-item factor. Study 4 showed that test-retest reliability for this construct was high ($ICC(A,1) = .77$) over a 2-month period.

We demonstrated that the Catastrophising Questionnaire showed convergent and discriminant validity in Studies 3 and 5. Catastrophising was positively related to depression, anxiety, rumination and worry, but discriminant validity was demonstrated using measures of the experience of pleasure/anhedonia, alcohol use disorders, and schizotypy.

Critically, however, despite some convergence, this construct is also *dissociable* from other psychiatric constructs. The multi-questionnaire EFA in Study 3 (including the Catastrophising Questionnaire, PHQ-9, GAD-7, RRS, PSWQ and the STAI-T) indicated that Catastrophising

is independent from convergent constructs such as anxiety and low mood, worry, and rumination. Specifically, the items from the Catastrophising Questionnaire loaded onto a single factor, separate from the items of the other questionnaires. This work could be further extended, by also testing whether catastrophising is independent from other cognitive distortions such as black-and-white thinking or overgeneralisation. However, the findings reported thus far allow us to begin to address one of the important questions in the study of catastrophising: whether catastrophising should be considered as a construct independent from psychiatric diagnoses such as anxiety and depression. Our results indicate that catastrophising is a unitary construct, independent of anxiety, depression, rumination or worry. Therefore, we suggest that catastrophising is not just an epiphenomenon or a straightforward consequence of anxiety and depression, but may be a separable construct with at least partially independent aetiology (although, notably, factor analytic methods may not always accurately capture the underlying factor structure of a construct (31)). A personalised medicine approach could thus be brought to bear: those with high levels of catastrophising could receive therapy (such as decatastrophising) targeted at this cognitive process. Future work should therefore investigate whether decatastrophising therapy in CBT is able to specifically reduce catastrophising (as measured using our Catastrophising Questionnaire), as no study has yet assessed the mechanisms by which decatastrophising promotes improvement of psychiatric or mood symptoms.

Importantly, results on the Catastrophising Questionnaire were also predictive of self-reported psychiatric diagnosis and medication history, over-and-above commonly used clinical scales (the PHQ-9 and GAD-7). Thus, we have shown that this construct is relevant to the field of psychiatry, and shows incremental validity over other measures. We believe, therefore, that our measure of catastrophising captures an important additional risk factor for diagnosis that

is not present in existing scales. From a clinical perspective, we believe that having an ability to measure general catastrophising will facilitate the assessment of the efficacy and mechanism-of-action of de-catastrophising approaches, and, furthermore, items on the scale may potentially provide patient-specific directions for de-catastrophising during therapy.

The items on the Catastrophising Questionnaire are related to items used in pain catastrophising measures – indeed, we used pain catastrophising scales as inspiration for our bank of items. However, many of the items included in pain catastrophising scales either assume a current experience of pain - for example ‘there’s nothing I can do to reduce the intensity of the pain’ – or at least assume a current difficult experience – for example ‘I worry all the time about whether it will end’. Our questionnaire should be applicable to the general population, as well as psychiatric populations, by not presupposing these points.

Limitations

Despite its strengths, the Catastrophising Questionnaire has several limitations to consider. First, we based the definition of catastrophising on our understanding of it, seeking additional guidance from the research literature in the context of pain and from experts in the field. However, there is not yet consensus on a precise definition of catastrophising outside of the context of pain, meaning that subjective judgement was required when developing the items.

Relatedly, we did not include pain catastrophising measures in our study of convergent validity, which may have given us valuable additional information. Our justification for this was that many of the questions in pain catastrophizing scales explicitly discuss a current pain experience, making them inappropriate to administer to a general sample of the population.

Second, catastrophising may be rooted in one or more specific contexts for each individual. We aimed at including this factor in the Catastrophising Questionnaire by having examples of catastrophising for each context. We provided specific situations which may not apply to all individuals. Nevertheless, the examples provided were kept as general as possible in all contexts.

Third, our use of rules of thumb for determining sample size is sub-optimal. Notably, however, Monte-Carlo simulation studies in general suggest that whilst our first two studies are likely underpowered for obtaining a factor structure, our third study, on which we base the majority of our conclusions, is likely sufficiently powered even if there are many weakly determined factors (32). Relatedly, future research should provide further validation of the Catastrophising Questionnaire in a larger population in order to confirm the factor model.

Fourth, we did not have an inbuilt method such as an attention check to detect careless responding: though, notably, in experiment 3 (on which we base the majority of our conclusions) we manually check data from individuals who repeatedly give the same responses or give different responses to repeated questions.

Fifth, it should be noted that for studies 3, 4 and 5, testing the final scale, fit indices did not universally indicate good fit of a single-factor model. However, fit values were still close to the requirements; thus, our fit indices indicate a reliable analysis.

Sixth, as with any questionnaire it takes some time to complete (around 2 minutes). To this end we also created a short version of the Catastrophising Questionnaire. The challenge in developing a short form of an existing questionnaire is to maintain the level of information

while significantly reducing the length of the scale. A further limitation to this study is that we could have based the development of the short form questionnaire on Item Response Theory analysis which enables the identification of items yielding maximum information (27). Indeed, the development of the short form questionnaire was mostly based on theory. Additionally, one of the four items constituting the short form questionnaire was not in the Catastrophising Questionnaire from study 3 and was derived from the Catastrophising Questionnaire of study 1. This procedure may seem unusual for a short form questionnaire which is meant to contain information from the original version. The item that we included was originally part of the initial item bank, but was removed from later versions of the questionnaire as other items were more specific. However, when developing a short form, we theorised that more general items would be more valuable, given the limited data collected using a short form of any questionnaire. Nevertheless, this short version demonstrated good internal consistency and correlated highly with the full version, indicating that it could be used as a brief measure (around 30 seconds for completion) where necessary. Researchers could choose to use the 3-item short form, which includes only items present in the final version of the Catastrophising Questionnaire, though removing the non-overlapping item reduces the correlation between scores on the short and full version, but this version is less closely correlated with the full version.

Finally, although we concluded from the EFA in study 3 that catastrophising may be considered independent from other closely related constructs, it may be argued that the EFA was detecting patterns of responding to similarly-phrased items rather than the true structure underlying these latent variables. However, many of the items in our questionnaire share phrasing with those from other questionnaires, in particular the RRS, but do not load onto the same factor, arguing against this interpretation.

Conclusions

Overall, our new Catastrophising Questionnaire is the first self-report measure of the general cognitive process of catastrophising, with strong evidence of reliability and validity across multiple studies. It offers a powerful tool for probing the nature and the progression over time of catastrophising (and the effects of interventions), with the potential to advance understanding of its contribution to the development or maintenance of mental ill-health and distress. Given the rising interest in catastrophising in CBT and as a potential risk factor for a range of psychiatric symptoms, the Catastrophising Questionnaire may be useful to many clinicians and researchers.

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Declaration of interest

OJR's MRC senior fellowship is partially in collaboration with Cambridge Cognition (who plan to provide in-kind contribution) and he is running an investigator-initiated trial with medication donated by Lundbeck (escitalopram and placebo, no financial contribution). He also holds an MRC-Proximity to discovery award with Roche (who provide in-kind

contributions and have sponsored travel for ACP) regarding work on heart-rate variability and anxiety. He has also completed consultancy work on affective bias modification for Peak and online CBT for IESO digital health. JS and ACP declare no other conflicts of interest. Neither the MRC or Wellcome Trust (who provided funding) had any role in the study design, collection, analysis, or interpretation of data.

Author contributions

ACP and OJR conceived the project. ACP and JS collected and analysed the data, with supervision by OJR. All authors drafted the manuscript and revised it. All authors have approved the final article.

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