
Article:
Whitfield, A., Walsh, S., Levita, L. orcid.org/0000-0001-6002-6817 et al. (1 more author) (2020) Catastrophising and repetitive negative thinking tendencies in patients with psychogenic non-epileptic seizures or epilepsy. Seizure, 83. pp. 57-62. ISSN 1059-1311

https://doi.org/10.1016/j.seizure.2020.09.034

Keywords

Psychogenic non-epileptic seizures; Epilepsy; Repetitive negative thinking; Catastrophising, Dissociative seizures

Introduction

Psychogenic Non-Epileptic Seizures (PNES) are characterised by episodic disturbances of normal brain functions superficially resembling epileptic seizures. However, rather than being related to epileptic activity in the brain, PNES are considered to result from activation of an established 'seizure scaffold' and as a dissociative response to aversive internal or external stimuli [1]. The aetiology of PNES is heterogeneous and a combination of aetiological factors is likely to be relevant in most cases [2,3]. PNES have a complex association with affective disorders. At group level, patients with PNES (PWPNES) are characterised by higher levels of anxiety than those with epilepsy (PWE) [4] in whom, as a group, the prevalence of anxiety disorders is twice has high as in the general population [5]. Symptoms of depression also tend to be more prevalent in PWPNES than in the general population and, in most studies, in PWE [6].

Anxiety or depression may be largely independent "comorbidities" of PNES, develop as the result of having a seizure disorder or be more closely associated with seizures as a contributory predisposing, precipitating, perpetuating or triggering factor. In the 'Integrative Cognitive Model' of PNES, as proposed by Brown and Reuber [7], cognitions typically associated with anxiety, depression and chronic arousal such as catastrophising or perseverative negative thinking tendencies could facilitate the

progression of a sudden stress response to an aversive trigger to a PNES by reducing the effectiveness of inhibitory processes. However, despite their possible aetiological role, and their suitability as a specific psychological treatment target, these cognitive tendencies have received relatively little attention in PWPNES to date, although they have been studied in health problems sometimes associated with PNES such as chronic pain [8,9].

Catastrophisation has been defined as an exaggerated set of negative cognitions in response to an anticipated or perceived threat. It has been suggested to have three dimensions: magnification of a threat, helplessness in dealing with the threat and rumination on the threat [10]. Rumination has been defined as repeated perseveration on one's feelings rather than the content of one's thoughts and to be associated with a persistent focus on negative stimuli [11]. It has also been characterised as repetitive negative thinking (RNT).

The only previous study to have explored rumination or RNT in PWPNES reported that PWPNES are more likely to ruminate on past stressful events than PWE [12]. However, given that the focus of this study was on historical traumatic or stressful events it did not examine RNT more fully as a general cognitive bias.

The present study was designed further to explore the prevalence of catastrophisation and RNT among patients with seizures and to examine the relationship between these cognitive tendencies, anxiety, depression and seizure frequency in both PWPNES and PWE. We hypothesised that firstly, RNT and catastrophising cognitions would be more common among PWPNES than PWE; second, that RNT and catastrophisation

would be associated with anxiety and depression; and finally, that the association of RNT and catastrophisation with PNES would be independent of the levels of anxiety and depression.

Method

Participants

Participants (N = 55, PNES n = 26, PWE n = 29, for demographics see Table 2) were recruited from the neurology outpatient clinic or video telemetry ward at the Royal Hallamshire Hospital in Sheffield, United Kingdom, between October 2016 and April 2017. Participants were required to have a clinically secure diagnosis (i.e. the patient's neurologist was confident enough in the diagnosis only to offer treatment for one condition, epilepsy or PNES) based on all available clinical information about the patient (including video-EEG of typical seizure recordings when available). Participants were excluded from participation if their diagnosis could not be confirmed by their consultant neurologist, if they had any other identified neurological disorder, a learning disability, were aged under 18 or if there was any suspicion of a mixed seizure disorder (epilepsy and PNES). A ten-question demographic and seizure-related questionnaire was completed by each participant.

Measures

Perseverative Thinking Questionnaire (PTQ)

The PTQ is a 15-item questionnaire of RNT. RNT is recognised as a transdiagnostic phenomenon observed in different disorders with common characteristics with only the content of the thoughts being disorder specific. Because of this, different aspects of RNT including worry, rumination and perseveration can be thought of as a unitary concept [13]. McEvoy et al. [14] and Segerstrom et al [15] have argued that the high degree of overlap between these different types of RNT mean it should ideally be assessed as a unitary construct, such as by using the PTQ. The PTQ has been shown to correlate with other measures of RNT and clinical associations of RNT including the Response Style Questionnaire (r = .72), Penn State Worry Questionnaire (r = .70), Beck depression Inventory (r = .54), State Trait Anxiety Inventory (r = .64) and the Inventory of Depressive Symptomology (r = .58) suggesting it is a valid measure of RNT. The measure also showed satisfactory retest reliability (r = .69) [13]. In view of the fact that this measure has not been used in PNES previously we checked the internal consistency in both patient groups and found outstanding Cronbach's alpha levels (α = .96) in both the PWPNES and PWE groups.

Modified Safety Behaviors and Catastrophizing Scale (mSBCS)

The SBCS [16] is a 12-item questionnaire assessing catastrophising and safety behaviours originally focusing on pain and poor sleep. For this study, the instructions were modified so that the measure could be used as a self-report measure of safety behaviours and fear in relation to seizures. While our modification to the questionnaire makes validity difficult to establish, we found excellent internal consistency within the measure using Cronbach alpha in both the PNES (α = .91) and epilepsy (α = .86) groups.

Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 [17] is a well-established measure of depressive symptoms which has been used extensively in clinical settings. Scores reflect the likely severity of clinical depression as follows: 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe. As well as the 9-item scale (PHQ-9-total), the PHQ-9 contains a question assessing the difficulty associated with the problems identified (PHQ-9-difficulty). It has been shown to have excellent test-retest reliability (r = .91) [18] and demonstrated excellent internal consistency in both PNES (α = 0.83) and epilepsy (α = 0.92) patient groups.

General Anxiety Disorder-7 (GAD-7)

The GAD-7 [19] is a well validated measure of generalised anxiety which has been used extensively in clinical settings with scores of 5, 10, and 15 suggested as the cut-off points for likely mild, moderate or severe anxiety. It has been shown to have excellent test-retest reliability (r = .83) [19], and we found it to have excellent internal consistency in the PNES (α = .89) and epilepsy (α = .93) groups.

Analysis

Group size Analysis

Power analysis based on a large expected effect size (d = .80) [20], α = .05 and β-1 = .80 determined that 52 participants (26 per group) would be required for this study.

Missing data

Across the dataset missing data rates were low (0.4%) except for the mSBCS where 10 participants (5 with PNES, 5 with epilepsy) missed >10% of items and were excluded from further analyses involving this questionnaire. Following these exclusions, missing data rates did not exceed 1%. Little's 'Missing Completely at Random' (MCAR) [21] test identified that data was MCAR except on the mSBCS where visual analysis suggested the data was 'missing at random' (MAR) rather than 'missing not at random'. Multiple imputation [22] was used to calculate missing data points in all questionnaires. A mean of the imputations was calculated and used as the imputed value for each missing data point.

For demographic and seizure-related questions, 17 participants were excluded from analyses of seizure frequency (4 PNES, 13 epilepsy) due to missing data. Additionally, several participants did not complete all demographic measures and were not included in comparisons of the questions with missing data. The number of eligible participants for analysis in each critical measure is shown in Table 1.

Table 1

The number of eligible participants per measure

Measure	**Total *N***	**PNES *n***	**Epilepsy *n***
PTQ/PHQ-9-total/GAD-7	55	26	29
mSBCS	45	21	24

Statistical analyses

Data were analyzed using SPSS, version 26 [23]. The alpha level was set at a p value of 0.05. The risk of false-positive findings was reduced by the Benjamini-

Hochberg False Discovery Rate (FDR) [24] to correct for multiple comparisons with Q value set at Q=0.05. FDR correction was used in order to maintain power but incurs an increased risk of type I error compared to more conservative techniques.

Demographic and seizure-related variables

All demographic and seizure group differences were compared using independent t-tests, Mann-Whitney U tests or chi-square as appropriate. Comparisons between demographic and seizure-related variables were uncorrected to highlight any significant differences in group composition that would need to be considered.

Self-report scales

Group differences on the mSBCS, PTQ, PHQ-9 and GAD-7 were also compared using independent t-tests and, Mann-Whitney U tests as appropriate. These were all two-tailed analyses, with the exception of the PTQ, which used a one-tailed analysis as we hypothesised a direction of the relationship between the groups.

Correlation and regression analyses

Spearman rank correlations were performed between scores from PTQ, mSBCS, PHQ-9, GAD-7 and Seizure Frequency within the last 4 weeks. Data were not normally distributed hence non-parametric tests were used.

In order to determine whether the diagnosis of PNES made a contribution to RNT or catastrophisation levels that is independent of the levels of anxiety, depression or seizure frequency, we carried out two multiple regression analyses.

Assumptions were checked for each regression before analysis using Durbin-Watson test for independent variables; scatterplots and partial regressions for linearity and by checking homoscedasticity by plotting studentised residuals against unstandardized predicted values; tolerance and VIF for multicollinearity; Cook's distance for influential outliers and residuals for normality.

In the first multiple regression analysis PTQ was assessed as the dependent variable and mSBCS, PHQ-9, GAD-7, Seizure Frequency and Diagnosis were added in consecutive blocks using a forward model. In the second analysis, mSBCS was the dependent variable and PTQ, PHQ-9, GAD-7, Seizure Frequency and Diagnosis placed as independent variables in consecutive blocks using a forward model.

Ethics

Ethical approval was obtained through the NHS Scotland East of Scotland Research Ethics. Participants due to attend an outpatient or video-EEG appointment were sent a letter and information sheet, explaining the study and requesting their participation. Participants who agreed to participate completed a consent form and were provided with a debrief sheet at the end of the experiment. All participants' data was recorded under an anonymous code and could not be linked to their identity. If scores on the PHQ-9 and GAD-7 were ≥ 10, the participant's neurologist was notified.

Results

Participants

There were few significant demographic differences between the PWPNES and PWE groups (Table 2): More PWE took anti-epileptic or psychiatric medication, more PWPNES had previously had psychotherapy and had at least moderate levels of depression or anxiety compared to PWE. In addition, PWPNES reported more seizures in the four weeks preceding their study participation.

Table 2

Demographic analysis

	PNES (*n* = 26)	Epilepsy (*n* = 29)	X^2 value	*p* value
Demographic variables				
Age- mean (SD)	38.2 (12.5)	43.7 (15.4)	*t* = -1.43	.158
Gender (female)	15 (57.7)	17 (58.6)	0.005	.944
Ethnicity			3.87	.569
White British	25 (45.5)	24 (43.6)		
Other white	0	1 (1.8)		
Other mixed ethnicity	0	1 (1.8)		
Indian	0	1 (1.8)		
Pakistani	1 (1.8)	1 (1.8)		
Black African	0	1 (1.8)		
Employment			9.64	.140
Full-time paid work	6 (23.1)	8 (28.6)		

Part-time paid work	2 (7.7)	5 (17.9)		
Full-time education	1 (3.8)	3 (10.7)		
Part-time education	2 (7.7)	0		
Out of work due to illness/ disability	14 (53.8)	7 (25.0)		
Retired	1 (3.8)	4 (14.3)		
Self-employed	0	1 (3.8)		
Education			10.82	.147
No qualifications	5 (20.0)	1 (3.6)		
O levels/GCSEs	9 (36.0)	11 (39.3)		
Highers/A levels	1 (4.0)	4 (14.3)		
Vocational qualification	8 (32.0)	6 (21.4)		
HNC/HND	1 (4.0)	0		
Degree	0	3 (10.7)		
Postgraduate qualification	0	2 (7.1)		
Professional qualification	1 (4.0)	1 (3.6)		
Taking anti-epileptic or psychiatric medication***	15 (60.0)	26 (100)	†	<.001
Previous psychotherapy (yes)*	15 (57.7)	7 (26.9)	5.04	.048
Moderate depression or above***	23 (88.5)	10 (34.5)	16.64	<.001
Moderate anxiety or above**	19 (73.1)	8 (27.6)	11.35	.001

Seizure-related variables				
Duration- years- mean (SD)	8.7 (7.7)	17.2 (16.3)	$U = 249$	.152
Frequency in the last four weeks- median (IQR)**	12 (4.8–88.8)	2.5 (1.0–8.5)	$U = 79.5$	.003
Most recent seizure			6.125	.295
In the last week	17 (70.8)	12 (46.2)		
In the last month	5 (20.8)	5 (19.2)		
In the last three months	1 (4.2)	2 (7.7)		
In the last six months	1 (4.2)	3 (11.5)		
In the last year	0	1 (3.8)		
Over a year ago	0	3 (11.5)		

Note: All data show 'number (% of total)' value unless otherwise specified

† Fischer's exact test

* p < .05, ** p < .01, *** p < .001

Self-reported measures

PWPNES reported significantly higher scores (after FDR correction) on PTQ, mSBCS, PHQ-9 and GAD-7 (Table 3). See *q* value for required significance level to reject the null-hypothesis.

Table 3

PWE and PWPNES mean self-report scores

Questionnaire	**PNES**	**PWE**	***t* value**	***q* value**	***p* value**	**Effect size**

PTQ*	34.7 (15.5)	27.6 (13.5)	1.80	0.05	.039	.48
mSBCS**	28.5 (12.4)	17.6 (9.7)	3.32	0.04	.002	-.98
PHQ-9 †***	17.5 (12.0-20.3)	5.0 (2.0-14.0)	$U = 163$	0.02	< .001	-.49
GAD-7†***	13.0 (8.8-18.0)	5.0 (1.5-10.5)	$U = 173$	0.01	<. 001	-.46

Note: Results indicate means (SDs) unless otherwise indicated

† median (IQR)

t value given unless otherwise stated

* $p < .05$, ** $p < .01$, *** $p < .001$ after Benjamini-Hochberg False Discovery Rate test

Correlations and effects of individual factors

High levels of positive correlation were observed between all self-reported psychological measures (Table 4). However, none of these measures showed greater than moderate correlations with seizure frequency in PWPNES or PWE.

Table 4

Spearman rank correlations

	PTQ			mSBCS			PHQ-9			GAD-7		
	Total	PWE	PNES	Total	PWE	PNES	Total	PWE	PNES	Total	PWE	PNES
PTQ		n/a										
mSBCS	.625**	.561**	.663**		n/a							
PHQ-9	.731**	.787**	.781**	.715**	.568**	.804**		n/a				

GAD-7	.762**	.823**	.665**	.698**	.681**	.463*	.827**	.852**	.604**		n/a	
Seizure freq.	.157	.113	-.119	.382*	.168	.002	.326*	.176	-.056	.257	.054	-.001

Results indicate correlation coefficients

* $p < .05$, ** $p < .01$ after Benjamini-Hochberg False Discovery Rate test

Using a stepwise hierarchical multiple linear regression PTQ score was predicted by mSBCS, PHQ-9, GAD-7 and Diagnosis. Seizure frequency did not predict PTQ score and so was removed by the stepwise process. Linearity was confirmed using partial regression plots and a plot of studentized residuals against the predicted values showed homoscedasticity. Residuals showed independence, as assessed by a Durbin-Watson statistic of 2.063. There was no evidence of multicollinearity, as tolerance values were greater than 0.1. There were no studentized deleted residuals greater than ±3 standard deviations, no leverage values greater than 0.2, or Cook's distance values above 1. The assumption of normality was met, as assessed by Q-Q Plot. The addition of consecutive factors significantly improved the fit of the model. Notably, the addition of Diagnosis to the regression significantly explained an additional 6.9% of the variance in PTQ score. Results of this regression are shown in Table 5a.

Another stepwise multiple linear regression was then used to determine the effects of PTQ, PHQ-9, GAD-7, Seizure Frequency and Diagnosis on mSBCS score. PTQ and PHQ-9 contributed to the final regression model as shown in Table 5b. GAD-7, Seizure Frequency and Diagnosis did not contribute to the final model and so were removed by the stepwise process. All assumptions were also met for this model.

Table 5

Hierarchical multiple regression predicting measures of RNT (5a) and catastrophisation (5b)

Table 5a

Predicting RNT from mSBCS, PHQ-9, GAD-7, Seizure Frequency, Diagnosis

Variable	Model 1	Model 2	Model 3	Model 4
mSBCS	.639***	.269	.188	.247
PHQ-9		.526**	.217	.371
GAD-7			.447*	.410*
Diagnosis				.312**
R^2	.408	.548	.611	.679
R^2 change	.408	.139	.063	.069
Change statistic	F (1,41) = 28.30	F (1,40) = 12.31	F (1,39) = 6.32	F (1,38) = 8.13
Change significance	<.001	.001	.016	.007
Model ANOVA	F (1,41) = 28.30***	F (2,40) = 24.21***	F (3,39) = 20.39***	F (4,38) = 20.12***

Table 5b

Predicting mSBCS, from PTQ, PHQ-9, GAD-7, Seizure Frequency, Diagnosis

Variable	Model 1	Model 2
PTQ	.639***	.277
PHQ-9		.507**

R^2	.408	.534
R^2 change	.408	.125
Change statistic	F (1,41) = 28.30	F (1,40) = 10.76
Change significance	<.001	.002
Model ANOVA	F (1,41) = 28.30***	F (2,40) = 22.90***

Standardised beta coefficient shown unless otherwise stated

* $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

This study explored RNT and catastrophisation in PWPNES and PWE as well as the relationship between these factors with anxiety, depression and seizure frequency. As predicted, PWPNES were found to report higher levels of RNT and catastrophisation compared to PWE. These findings are consistent with other studies which also found evidence of greater catastrophising tendencies among PWPNES than PWE. A comparative study using a self-report tool measuring emotion processing found that PWPNES are more likely to experience overwhelming emotions, more severe somatic symptoms and to interpret these symptoms as threatening than PWE [25]. These cognitive tendencies may also explain the higher levels of helplessness, more external locus of control and avoidance reported in previous studies comparing PWPNES with PWE [26–28]. A qualitative study examining the verbal interactions between patients with seizures and doctors demonstrated that PWE tended to normalise the impact of

their seizures when talking to doctors, whereas those with PNES were likely magnify or catastrophise the impact of their condition on their daily life [29].

In addition, and consistent with others studies [15,30–32] we also found that PWPNES reported significantly higher levels of depression and anxiety than PWE, both in terms of median scores and the proportion of patients with at least moderate levels of severity of these disorders. As hypothesised, we were able to replicate the previously reported finding that depression and anxiety are strongly associated with RNT [30–32] by demonstrating high degrees of positive correlation between the measures of perseveration and catastrophisation and those of anxiety and depression. However, this does not allow us to infer whether higher levels of RNT in PWPNES could be explained by the higher levels of anxiety and depression in this patient group or vice versa.

Through the inclusion of all factors correlated with PTQ and mSBCS in two hierarchical multiple regression models, we were able to partially support our third hypothesis: that seizure diagnosis would be independently associated with RNT and catastrophisation. A factor's contribution to the variance of a regression model is proportional to its effect size and measures this effect separate to the influence of other factors. Our model exploring the variance in PTQ score demonstrated a significant independent effect of PNES as a diagnosis. Despite showing only a small to medium effect size with a greater proportion of the PTQ variance being explained by catastrophic thinking, anxiety and depression scores, this finding provides further support for the idea that RNT could facilitate PNES as hypothesised in the Integrative Cognitive Model [7]. It also highlights the importance of RNT in PWPNES as a

possible target for psychological interventions [30–33]. Psychological therapies targeting RNT in the form of rumination focused cognitive behavioural therapy have been found to be beneficial in the treatment of depression and anxiety [30,33]. Brosschot and van der Doef [34] found that limiting RNT time reduced functional somatic symptoms such as lower back pain, coughing and breathing difficulties suggesting possible translatability for RNT focused therapy in functional disorders such as PNES.

While seizure diagnosis did not independently contribute to the variance in catastrophic thinking as per the second regression model, mSBCS scores were higher among PWPNES. Nevertheless, the degree of correlation between PTQ and mSBCS scores and the large influence they have on each other's variation provide further support for the close association between RNT and catastrophic thinking as hypothesised by Sullivan et al. [10] and Flink et al. [35], and the close relationship between RNT and catastrophisation suggests that this cognitive tendency should also be considered a relevant therapeutic psychological treatment target in PWPNES, although catastrophic thinking was not independently associated with this seizure disorder in our study.

Importantly, although our data demonstrate a greater seizure frequency in the participants with PNES and a moderate positive correlation between seizure frequency and the cognitive tendencies of RNT and catastrophisation, seizure frequency did not make an independent contribution in either of the two regression models. There is therefore no evidence in our data that the differences in seizure frequency between groups have biased our analyses. This finding resonates with

previous reports demonstrating that psychological factors are a greater predictor of health-related quality of life than seizure related factors in patients with epilepsy or PNES [36]. However, we cannot exclude that there may be systematic differences in the accuracy of seizure frequency reports between those with PNES and epilepsy which could have affected our results.

It is worth considering the function RNT may serve individuals with PNES. Nolen-Hoeksema et al. [11] propose that the conscious purpose of RNT is to understand meanings, anticipate and prepare for possible negative events. However, they suggest the unconscious purpose is actually to avoid aversive emotions or situations. Supporting this, Segerstrom et al. [15] found that repetitive thought inhibits emotional and cognitive information processing. It has been suggested that RNT reduces negative affect by occupying mental capacity [35]. This idea is consistent with the existing observation of greater avoidance tendencies among PWPNES than PWE [37]. While serving a partially useful role, RNT may, however, have a number of negative consequences for patients with PNES. For instance, RNT may contribute to the levels of depression, anxiety and stigma experienced by PWPNES and have a negative impact on patient's quality of life [38,39].

In the context of the integrative cognitive model of PNES [7], we propose that catastrophic and ruminative thinking contribute to the launch of a PNES response by priming the brain to experience unmanageable arousal and by reducing the potential of inhibitory processes to block a dissociative response to an adverse internal or external trigger. Within the model, RNT and catastrophisation are cognitive aspects of the persistently elevated level of arousal in PNES, demonstrated by physiological

measures such as reduced heart rate variability and elevated cortisol levels in patients with PNES [40,41]. Consistent with this idea, one previous study has revealed a positive correlation between an abnormal cognitive threat response and elevated basal cortisol levels in patients with PNES [41].

Limitations

The findings presented need to be viewed in light of this study's limitations. Firstly, the gold standard diagnostic method for epilepsy and PNES, the simultaneous video-EEG recording of typical seizures had not been performed in all participants, although patients were only included when fully trained neurologists had formulated a clear diagnosis. Patients in whom the neurologists had diagnostic doubt or cases in whom mixed (epileptic/nonepileptic) seizure disorders were suspected were not included. While this means that it is possible that some patients were misclassified, our case selection was more reflective of usual UK diagnostic practice, and means that our findings are more readily generalisable as only 40% of PNES diagnoses, and fewer epilepsy diagnoses are usually confirmed by video-EEG [42].

Second, neither the PTQ nor the mSCBS measures have been previously validated in patients with PNES, and changes were made to the wording of the SCBS to make it suitable for patients with seizure disorders as it was originally designed for use patients with co-morbid pain and sleep disorders. However, we felt that the focus on catastrophising and associated behaviours fitted well with the focus of this study. The questionnaire was also designed to provide three subscales rather than a unitary measure. Despite these limitations, the PTQ and modified SBCS used in this study

were found to have excellent internal consistency, and no participants reported any difficulties whilst completing it.

Finally, this study was not designed to explore the content of repetitive thoughts experienced by patients. The correlation between PTQ scores and mSBCS, and the moderate correlation between PTQ and seizure frequency may suggest some repetitive thoughts relate to seizure activity, though this is only an inference. Previous qualitative studies comparing reported experiences of PWPNES and PWE provide some initial insights, but no studies have focussed on the content of repetitive thoughts specifically [43,44]. The identification of themes for RNT would be an interesting focus for future research and could help better to specify targets for psychological therapies.

Conclusion

This study provides evidence for a possible role of repetitive negative and catastrophic thinking in the cognitive processes underlying PNES. PWPNES reported higher levels of repetitive negative thinking and catastrophisng of seizures than controls of PWE. Given that the diagnosis of PNES made an independent contribution to the prevalence of RNT and the high correlation of RNT and catastrophic thinking, both cognitive tendencies may well make a relevant aetiological contribution to the development and maintenance of PNES disorders. Consequently, they should be considered as clinically important targets in psychological therapies for PNES.

References

[1] Roberts NA, Reuber M. Alterations of consciousness in psychogenic nonepileptic seizures: Emotion, emotion regulation and dissociation. Epilepsy Behav 2014. https://doi.org/10.1016/j.yebeh.2013.09.035.

[2] Reuber M. The Etiology of Psychogenic Non-Epileptic Seizures: Toward a Biopsychosocial Model. Neurol Clin 2009. https://doi.org/10.1016/j.ncl.2009.06.004.

[3] Brown RJ, Reuber M. Psychological and psychiatric aspects of psychogenic non-epileptic seizures (PNES): A systematic review. Clin Psychol Rev 2016;45:157–82. https://doi.org/10.1016/j.cpr.2016.01.003.

[4] Diprose W, Sundram F, Menkes DB. Psychiatric comorbidity in psychogenic nonepileptic seizures compared with epilepsy. Epilepsy Behav 2016. https://doi.org/10.1016/j.yebeh.2015.12.037.

[5] Tellez-Zenteno JF, Patten SB, Jetté N, Williams J, Wiebe S. Psychiatric comorbidity in epilepsy: A population-based analysis. Epilepsia 2007. https://doi.org/10.1111/j.1528-1167.2007.01222.x.

[6] Walsh S, Levita L, Reuber M. Comorbid depression and associated factors in PNES versus epilepsy: Systematic review and meta-analysis. Seizure 2018. https://doi.org/10.1016/j.seizure.2018.05.014.

[7] Brown RJ, Reuber M. Towards an integrative theory of psychogenic non-epileptic seizures (PNES). Clin Psychol Rev 2016;47:55–70. https://doi.org/10.1016/j.cpr.2016.06.003.

[8] Ettinger AB, Devinsky O, Weisbrot DM, Goyal A, Shashikumar S. Headaches and other pain symptoms among patients with psychogenic non-epileptic seizures. Seizure

1999. https://doi.org/10.1053/seiz.1999.0334.

[9] Benbadis SR. A spell in the epilepsy clinic and a history of “chronic pain” or “fibromyalgia” independently predict a diagnosis of psychogenic seizures. Epilepsy Behav 2005. https://doi.org/10.1016/j.yebeh.2004.12.007.

[10] Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: Development and Validation. Psychol Assess 1995. https://doi.org/10.1037/1040-3590.7.4.524.

[11] Nolen-Hoeksema S, Wisco BE, Lyubomirsky S. Rethinking Rumination. Perspect Psychol Sci 2008. https://doi.org/10.1111/j.1745-6924.2008.00088.x.

[12] Lumley M, Tojek TM, Barkley G, Mahr G, Thomas A. Stress and other psychosocial characteristics of patients with psychogenic nonepileptic seizures. Psychosomatics 2000. https://doi.org/10.1176/appi.psy.41.3.221.

[13] T. E, U. Z, K. W, K. W, S. S, A. E. The Perseverative Thinking Questionnaire (PTQ): Validation of a content-independent measure of repetitive negative thinking. J Behav Ther Exp Psychiatry 2011.

[14] McEvoy PM, Watson H, Watkins ER, Nathan P. The relationship between worry, rumination, and comorbidity: Evidence for repetitive negative thinking as a transdiagnostic construct. J Affect Disord 2013. https://doi.org/10.1016/j.jad.2013.06.014.

[15] Segerstrom SC, Tsao JCI, Alden LE, Craske MG. Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. Cognit Ther Res 2000. https://doi.org/10.1023/A:1005587311498.

[16] MacDonald S, Linton SJ, Jansson-Fröjmark M. Avoidant safety behaviors and catastrophizing: Shared cognitive-behavioral processes and consequences in co-morbid pain and sleep disorders. Int J Behav Med 2008. https://doi.org/10.1080/10705500802222675.

[17] Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med 2001. https://doi.org/10.1046/j.1525-1497.2001.016009606.x.

[18] Lamers F, Jonkers CCM, Bosma H, Penninx BWJH, Knottnerus JA, van Eijk JTM. Summed score of the Patient Health Questionnaire-9 was a reliable and valid method for depression screening in chronically ill elderly patients. J Clin Epidemiol 2008. https://doi.org/10.1016/j.jclinepi.2007.07.018.

[19] Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. Arch Intern Med 2006. https://doi.org/10.1001/archinte.166.10.1092.

[20] Cohen J. Statistical Power Analysis for the Behavioural Science (2nd Edition). 1988.

[21] Little RJA. A Test of Missing Completely at Random for Multivariate Data with Missing Values. J Am Stat Assoc 1988. https://doi.org/10.2307/2290157.

[22] Rubin DB. Multiple Imputation for nonresponse in surveys. New York, NY: John Wiley & Sons.; 1987.

[23] IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk NIC. No Title, n.d.

[24] Benjamini Y, Hochberg Y. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. J R Stat Soc Ser B 1995. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x.

[25] Novakova B, Howlett S, Baker R, Reuber M. Emotion processing and psychogenic non-epileptic seizures: A cross-sectional comparison of patients and healthy controls. Seizure 2015;29:4–10. https://doi.org/10.1016/j.seizure.2015.03.007.

[26] Stone J, Binzer M, Sharpe M. Illness beliefs and locus of control. J Psychosom Res 2004. https://doi.org/10.1016/j.jpsychores.2004.03.013.

[27] Dimaro L V., Dawson DL, Roberts NA, Brown I, Moghaddam NG, Reuber M. Anxiety and avoidance in psychogenic nonepileptic seizures: The role of implicit and explicit anxiety. Epilepsy Behav 2014;33:77–86. https://doi.org/10.1016/j.yebeh.2014.02.016.

[28] Bakvis P, Spinhoven P, Zitman FG, Roelofs K. Automatic avoidance tendencies in patients with Psychogenic Non Epileptic Seizures. Seizure 2011. https://doi.org/10.1016/j.seizure.2011.06.006.

[29] Robson C, Drew P, Walker T, Reuber M. Catastrophising and normalising in patient's accounts of their seizure experiences. Seizure 2012;21:795–801. https://doi.org/10.1016/j.seizure.2012.09.007.

[30] Hirsch CR, Krahé C, Whyte J, Loizou S, Bridge L, Norton S, et al. Interpretation Training to Target Repetitive Negative Thinking in Generalized Anxiety Disorder and Depression. J Consult Clin Psychol 2018. https://doi.org/10.1037/ccp0000310.

[31] Breitholtz E, Johansson B, Öst LG. Cognitions in generalized anxiety disorder and panic disorder patients. A prospective approach. Behav Res Ther 1999. https://doi.org/10.1016/S0005-7967(98)00147-8.

[32] Sullivan MJL, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA, et al. Theoretical perspectives on the relation between catastrophizing and pain. Clin J Pain 2001. https://doi.org/10.1097/00002508-200103000-00008.

[33] Watkins ER, Mullan E, Wingrove J, Rimes K, Steiner H, Bathurst N, et al. Rumination-focused cognitive-behavioural therapy for residual depression: Phase II randomised controlled trial. Br J Psychiatry 2011. https://doi.org/10.1192/bjp.bp.110.090282.

[34] Brosschot JF, Van Der Doef M. Daily worrying and somatic health complaints: Testing the effectiveness of a simple worry reduction intervention. Psychol Heal 2006.

https://doi.org/10.1080/14768320500105346.

[35] Flink IL, Boersma K, Linton SJ. Pain Catastrophizing as Repetitive Negative Thinking: A Development of the Conceptualization. Cogn Behav Ther 2013. https://doi.org/10.1080/16506073.2013.769621.

[36] Rawlings GH, Brown I, Reuber M. Predictors of health-related quality of life in patients with epilepsy and psychogenic nonepileptic seizures. Epilepsy Behav 2017. https://doi.org/10.1016/j.yebeh.2016.10.035.

[37] Dimaro L V., Dawson DL, Roberts NA, Brown I, Moghaddam NG, Reuber M. Anxiety and avoidance in psychogenic nonepileptic seizures: The role of implicit and explicit anxiety. Epilepsy Behav 2014. https://doi.org/10.1016/j.yebeh.2014.02.016.

[38] Rawlings GH, Brown I, Reuber M. Deconstructing stigma in psychogenic nonepileptic seizures: An exploratory study. Epilepsy Behav 2017. https://doi.org/10.1016/j.yebeh.2017.06.014.

[39] Robson C, Myers L, Pretorius C, Lian OS, Reuber M. Health related quality of life of people with non-epileptic seizures: The role of socio-demographic characteristics and stigma. Seizure 2018. https://doi.org/10.1016/j.seizure.2018.01.001.

[40] Ponnusamy A, Marques JLB, Reuber M. Heart rate variability measures as biomarkers in patients with psychogenic nonepileptic seizures: Potential and limitations. Epilepsy Behav 2011. https://doi.org/10.1016/j.yebeh.2011.08.020.

[41] Bakvis P, Spinhoven P, Roelofs K. Basal cortisol is positively correlated to threat vigilance in patients with psychogenic nonepileptic seizures. Epilepsy Behav 2009. https://doi.org/10.1016/j.yebeh.2009.09.006.

[42] Mayor R, Smith PE, Reuber M. Management of patients with nonepileptic attack disorder in the United Kingdom: A survey of health care professionals. Epilepsy Behav 2011. https://doi.org/10.1016/j.yebeh.2011.05.019.

[43] Rawlings GH, Brown I, Reuber M. Narrative analysis of written accounts about living with epileptic or psychogenic nonepileptic seizures. Seizure 2018. https://doi.org/10.1016/j.seizure.2018.09.022.

[44] Rawlings GH, Brown I, Stone B, Reuber M. Written Accounts of Living With Epilepsy or Psychogenic Nonepileptic Seizures: A Thematic Comparison. Qual Health Res 2018. https://doi.org/10.1177/1049732317748897.