Psychological Inflexibility and Somatisation in Non-Epileptic Attack Disorder

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Non-epileptic attack disorder

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Abstract

Background: There is no clear understanding of what causes and maintains non-epileptic attack disorder (NEAD), or which psychological therapies may be helpful. The relationships between variables of psychological inflexibility: experiential avoidance (EA), cognitive fusion (CF), mindfulness, and key outcome variables in NEAD: somatisation, impact upon life and non-epileptic attack (NEA) frequency were investigated.

Method: 285 individuals with NEAD completed validated measures online. Linear regression was used to explore which variables predicted somatisation and impact upon life. Ordinal regression was used to explore variables of interest in regard to NEA frequency.

Results: EA, mindfulness, CF, somatisation and impact upon life were all significantly correlated. Mindfulness uniquely predicted somatisation when considered in a model with EA and CF. Higher levels of somatization increased the odds of experiencing more NEAs. Individuals who perceived NEAD as having a more significant impact upon their lives had more NEAs, more somatic complaints and more EA.

Conclusions: Higher levels of CF and EA appear to be related to lower levels of mindfulness. lower levels mindfulness predicted greater levels of somatisation and somatisation predicts NEA frequency. Interventions which tackle avoidance and increase mindfulness, such as acceptance and commitment therapy, may be beneficial for individuals with NEAD. Future directions for research are suggested as the results indicate more research is needed.

Psychological Inflexibility, Somatisation and the Impact of Non-Epileptic Attack Disorder

1.1 Non-Epileptic Attack Disorder

Non-epileptic attacks (NEAs) are medically unexplained paroxysmal attacks which resemble epileptic seizures but for which no epileptiform discharges can be found [1, 2]. Non-epileptic attack disorder (NEAD) is still a poorly understood phenomenon and there is debate as to how it can best be explained and understood. Although it is agreed that NEAs are most likely caused, or otherwise influenced, by psychological factors as opposed to unknown organic physiopathology [3], there is less known about what psychological factors and processes may contribute to NEAD.

Brown and Reuber [1] posit a theoretical integrative cognitive model of NEAD in which a cognitive representation of an NEA, the 'seizure scaffold,' is activated when individuals experience internal or external triggers, such as trauma memories, hypo/hyper arousal, and daily stressors which lead the individual to identify a seizure risk [1]. The seizure scaffold is a cognitive blueprint of the NEA which has been established through past experiences. Once a trigger has been identified, individuals then anticipate a seizure, which in turn activates the seizure scaffold. Following the activation of a seizure scaffold, it is a deficit in inhibitory processing which causes the NEA (the physical manifestation of the seizure scaffold).

One psychological concept of potential relevance in this model is *psychological inflexibility*. This occurs when individuals perceive that they are unable to change their internal or external behaviour to be in accordance with their own desires and values. It is comprised of six key components: experiential avoidance (EA), cognitive fusion (CF), attachment to the conceptualised self, dominance of the conceptualised past and future,

lack of values, clarity and unworkable action [4]. All components of psychological inflexibility are thought to be highly interconnected constructs but to still uniquely contribute to psychological distress [5].

Three aspects of psychological inflexibility, cognitive fusion (entanglement of thoughts) [6], experiential avoidance (the active experience of disengaging from unwanted thoughts of feelings) [6], and mindfulness (being in contact with the present moment), appear to be theoretically important within the Brown and Reuber model [1]. CF is when thoughts become entangled with behavioural responses, thoughts are not viewed as options or opinions but absolute truths, which must be acted upon. Thus, an individual will have a perceived lack of personal agency in their behaviours [7]. For example, an individual with NEAD may think "I cannot go out as I will have a NEA" and due to high levels of conviction will not be able to go out, because going out will inevitably lead to an NEA. CF may be important for the seizure scaffold as it appears likely that individuals who have higher levels of CF will be entangled with the mental representation of an NEA, feeling it to be a real and true event to which they must respond [6]. Individuals with NEAD then possibly engage in EA to try to avoid internal experiences (thoughts and physical sensations) associated with NEAs [8]. Engaging in EA can paradoxically intensify and strengthen unwanted internal experiences [6]. Consequently, attempting to suppress thoughts of seizures or unwanted feelings, may instead strengthen the association between the internal experiences and the 'seizure scaffold'. Thus, it seems possible that EA may perpetuate CF, and CF in turn perpetuates EA. It is at this point that mindfulness may become important.

Inhibition relates to the ability to inhibit or prevent previously learnt rules or sets. Intact inhibitory processes allow an individual to choose how to respond, as opposed to responding in the way that has been learnt previously. Brown and Reuber [1] suggest that

individuals with NEAD have a deficit in inhibitory processing which gives the individual no option but to succumb to the seizure scaffold. Mindfulness has been demonstrated to improve inhibition [8], providing individuals with cognitive skills which allow them the freedom to decide how to respond to thoughts [6]. By increasing individuals' ability to select how they respond to cognitions, individuals may be able to employ strategies to prevent the NEA from occurring [7], eventually weakening the link between the 'seizure scaffold' and the physical manifestation of an NEA [1].

1.5 Research Aims and Questions

In summary, there is reason to believe that the three components of psychological inflexibility described above (EA, CF and mindfulness) might be particularly relevant to the genesis and maintenance of NEAD in accordance with Brown and Reuber's [1] model. The aim of the current study was to determine whether EA, CF, and mindfulness would predict key NEAD variables. There is no easily identifiable or reliable outcome measure for NEAD [9]. NEA remission is often used, and was therefore used here. However, Reuber et al. [9] suggest that this is too narrow and unlike individuals with epilepsy, 'seizure' frequency is not a clear indicator of quality of life and productivity for individuals with NEAD. Therefore impact upon life was measured. Owczarek [10], Wolf, Hentz, Ziemba, Kirlin, Noe, Hoerth, Crepeau, Sirven, Drazkowski and Locke [11] suggested somatisation reduction should be included as a focus of psychological support for individuals with NEAD. Therefore, somatisation was also measured. Three research questions were asked:

I) What are the relationships between CF, EA, mindfulness, and somatisation in NEAD? It was hypothesised that higher levels of CF, EA, and lower levels of mindfulness would all be correlated with somatisation and these variables would independently predict somatization.

II) Do the psychological inflexibility variables, NEA frequency and somatisation predict perceived impact on life within the NEAD population? It was hypothesised that all variables would be significantly correlated and that higher levels of EA, CF, and somatisation, higher NEA frequency and lower levels of mindfulness would relate to more impact upon life within the NEAD population. It was also hypothesised that all factors would independently predict impact upon life.

III) Does mindfulness, EA, CF, and somatisation predict NEA frequency? It was hypothesised that individuals with higher levels of somatisation, CF and EA, and lower levels of mindfulness would experience more frequent NEAs.

2. Methods

2.1 Design

An online single group cross-sectional observational design was used. An online recruitment strategy was selected so as to reach a wide variety of individuals at reduced cost and burden to both participant and researcher [12]. Service users, accessed through NEAD charities, were consulted throughout the design phase of this project. The host institution's Faculty of Health and Medicine Research Ethics Committee approved the project. All participants provided informed consent.

Participants

Participants were 285 individuals who identified as having a diagnosis of NEAD. The link to the survey was posted on Twitter, and NEAD Facebook information and support groups with international membership and highly active participation. Several individuals from the Facebook groups and Twitter reposted the link on their personal accounts. In addition, UK charities supporting individuals with NEAD (including NEAD UK, FND Action, and FND Hope) posted the link on their websites and social media platforms (Facebook and

Twitter). Of the 425 individuals who clicked on the link to participate, 331 people consented, 29 of these did not begin the study (completed less than one questionnaire) and a further 17 individuals were missing one or more entire questionnaires and were therefore excluded from the final analysis.

2.2 Analysis

All analyses were conducted using IBM SPSS version 23. Mean imputation was used for missing data as less than 0.5% of the data missing, with no consistent patterns and therefore multiple imputation was not necessary [13]. Descriptive characteristics of the data were explored. Normality of all variables of interest (mindfulness, EF, EA, somatisation, impact upon life) were explored using a Shapiro-Wilk test. All variables were found to be significantly different from a normal distribution ($p<.05$). Therefore, medians and inter-quartile ranges (IQR) were reported. Univariate correlations were conducted using Spearman's rank-order correlation. Regression analyses were conducted for each of the dependent variables: somatisation, impact upon life, and NEA frequency. The first two research questions were explored using backwards hierarchal multiple linear regressions. Assumptions of: linearity, multivariate normality, homoscedasticity, independence of errors, and no-multicollinearity [14] were all met. The third research question was explored using ordinal regression with NEA frequency as the dependent variable and CF, EA, mindfulness, and somatisation as independent variables. To correct for family-wise type one error rate, Holm-Bonferroni corrections were applied. All analyses were adequately powered.

2.3 Materials

2.3.1 Physical Health Questionnaire -15 [PHQ-15; 15]. The PHQ-15 is a 15-item measure of somatisation and physical symptoms. It has been administered to numerous populations [15] including the NEAD population [16]. It has an acceptable internal

consistency of α=.79 [17] and has been recommended as the best tool to measure somatic symptomology [18]. For regression and correlation analysis two questions were excluded from the PHQ-15 total score. The question which asks about fainting spells, as it was thought this related directly to experiencing NEAD and therefore may inflate the PHQ-15 scores. As well as the question about menstruation, which was excluded as this question only applies to women. It was therefore thought that the inclusion of this question may artificially inflate the impact of gender upon somatisation.

2.3.2 Acceptance and Action-two Questionnaire-II [AAQ-II; 19]. The AAQ-II is a seven-item scale which measures EA, it asks participants to rate how true each statement is on a seven-point Likert scale. Higher scores reflect higher levels of experiential avoidance. It has been used previously to measure experiential avoidance within the NEAD population [20]. It is a reliable measure, having a mean α coefficient of .84 and a 12-month test- retest reliability of .79.

2.3.3 Mindful Attention Awareness Scale [MAAS; 21]. The MAAS is a 15-items scale that asks participants to rate how frequently they have experienced each statement on a six-point Likert scale from almost always to almost never; it is a reliable, valid and useful measure of mindfulness [21, 22]. The MAAS has been used to measure mindfulness broadly, however it is considered to tap into the construct of dispositional mindfulness or mindful awareness [22]. Higher scores indicate higher levels of dispositional mindfulness. It has been used across a wide variety of populations and has good convergent and divergent validity [21]. The MAAS has good internal consistency with a reported Cronbach's α of .89 [22].

2.3.4 Cognitive Fusion Scale [CFS; 7]. The CFS has a similar structure to that of the AAQ-II. This scale has been shown to differentiate significantly between distressed and non-

distressed samples. It has also been found to have a good internal consistency with a reported Cronbach's α of .88 in a mixed mental health sample and .90 in a community sample. Test-retest reliability is .80 [7].

2.3.5 Demographic information and diagnosis information. A bespoke demographic and diagnosis information questionnaire was used. As part of the demographic questionnaire, individuals reported upon NEA frequency.

2.3.6 Work and Social Adjustment Scale [WSAS; 23]. The WSAS is a five-item scale which uses a zero to eight Likert scale to identify how much an individual finds their difficulties impact their life. The questions pertain to areas of leisure, work, social and home functioning. The scale is frequently used in mental health out-patient services and has been validated to be used with a wide variety of populations within the UK. The WSAS has an acceptable to good internal consistency with Cronbach's α ranging from .7-.9 [24].

3. Results

3.1 Demographic and Descriptive Information

Of the 285 participants included, 210 reported diagnostic confirmation via video telemetry, the gold standard for diagnosing NEAD [25]. Thirty individuals stated that their diagnosis had been made in hospital but it was unclear how this diagnosis had been made, 17 stated that their diagnosis was made using MRI, 18 stated that their diagnosis was given by a medical professional such as a neurologist or psychiatrist, and finally 10 participants did not disclose how they received a diagnosis of NEAD. Most participants were female (n=247, 86.7%), with an age range of 18-72 years (mean=38.16, SD=12.02). Most participants (n=275) were from English speaking western counties and identified as white (n=211, 74.0%), refer to Table 1 for further details.

Forty (14.0%) participants reported concurrent epilepsy. There were no significant differences between the group with concurrent epilepsy and those exclusively with NEAD on any of the variables of interest. Therefore, individuals with concurrent epilepsy were included within the analyses. Most of the sample (n=227, 79.6%) reported a mental health diagnosis such as anxiety, depression, bipolar disorder, or post-traumatic stress disorder (Table 1 for details).

Table 1

Demographic characteristics of the sample

Sample Characteristics	N (285)
Gender	
Female	247
Male	34
Non-binary gender identification	4
Age	
Minimum	18
Maximum	72
Mean (SD)	38.16 (12.03)
Ethnicity	
White	211
Black or visual minority	17
Not-disclose	57
Country of residence	
United States of America (USA)	146
United Kingdom (UK)	101
Australia	19
Canada	9
Other country	9
Not reported	1
Diagnosis procedure	
Video telemetry	210
MRI	17
In hospital not specified	30
Medical Professional	18
Not specified	10
Additional diagnosis	
Epilepsy	40
Physical health condition	32
Mental health diagnosis	227
Additional Medically Unexplained Diagnosis	26
Personality disorder	24

Employment Status	
Currently unable to work	170
Employed full time	(46 full time, 20 part time)
Student	26
Unemployed	8
Fulltime parent or carer	9
Retired	5
Not specified	1
Highest level of education	
*GCSEs or equivalent	35
**A-levels or equivalent	85
Vocational training	56
University education	92
Left prior to *GCSEs or equivalent	15

* GCSE - General Certificate of Secondary Education. GCSEs are standardised exams taken per subject in the UK at the age of 15/16. Approximately equivalent to Grade 11 in the USA

** A level – General Certificate of Education Advanced Level. A levels are formal subject specific qualifications taken following GCSEs. They the formal entry requirements to University in the UK. Considered comparable to an Advanced Placement Grade 12 course in the USA.

3.2 Somatising

The scores on the PHQ-15 ranged from 1-30, with a median of 15.00 (IQR=7). The majority of the sample (88.2%) fell within the severe range, and less than one percent (.7%) of the sample fell within the mild range [15]. Following the removal of the items mentioned above the median was 14.00 (IQR=6.5) with an acceptable internal consistency (Cronbach's α=.76).

3.3 Impact Upon Life

The WSAS was used to identify the individuals' perceived impact of their NEAD upon their life. The internal consistency for the scale was found to be good (Cronbach's α= .87). Total scores of the WSAS ranged from zero to forty with a median of 25.00 (IQR=16.50). Most of the sample (68.4%) reported scores which placed them in the severe categorisation of the WSAS.

3.4 Experiential Avoidance, Cognitive Fusion and Mindfulness

The AAQ-II has good internal consistency (Cronbach's α =.94). Within the sample scores ranged from 7-49. The median total score was 32.00 (IQR=18.00).

The CFQ had an excellent internal consistency (Cronbach's α =.94). As with the AAQ-II, the full range of scores was obtained (7-49). The median total score was 34.00 (IQR=15.00).

The MAAS was found to have a good internal consistency (Cronbach's α = .88). The total mean scores ranged from 1.13 - 5.87, with a medium 3.33 (IQR=1.33).

3.5 NEA Frequency

NEA frequency was defined by four categories: daily attacks, weekly but not daily, monthly but not weekly, yearly but not monthly, and not currently having attacks.

The highest medians for EA, somatisation, and impact upon life were seen in the daily category of NEA frequency. The lowest median for mindfulness (least mindful) was seen in the weekly category, and the highest median for CF was seen in the monthly category. See Table 2.

Table 2

Median and IQR of variables of interest across NEA frequency

Variable	Not having attacks (n=17)	Yearly attacks (n=28)	Monthly attacks (n=50)	Weekly attacks (n=81)	Daily attacks (n=109)	Group total (n=285)
Somatisation	12.00 (6.00)	12.00 (7.25)	13.00 (5.25)	15.00 (7.00)	15.00 (6.00)	14.00 (6.50)
Impact upon life	10 (18.00)	14.50 (17.00)	22 (16.75)	26.0 (12.50)	28.0 (12.00)	25.0 (16.50)
EA	30.0 (24.50)	31.5 (15.75)	31.00 (16.50)	33.0 (18.00)	34 (18.00)	32.0 (18.00)
CF	32.00 (19.50)	31.50 (14.00)	37.0 (16.25)	34.0 (16.50)	34.0 (15.00)	34.00 (15.00)
Mindfulness	3.60 (1.87)	3.47 (1.07)	3.47 (1.20)	3.20 (1.27)	3.27 (1.43)	3.33 (1.33)

3.6 Correlations

Significant correlations were found in the expected directions between mindfulness, CF, EA, somatising and impact of NEAD on the individual's life, with effect sizes ranging from medium to large. NEA frequency was significantly correlated with somatisation, mindfulness, and impact upon life, but not with EA or CF (see Table 3). Gender was only significantly correlated with somatisation, with females identifying more somatic symptoms and age was only found to significantly correlate with CF (greater age was linked with lower levels of CF).

Table 3

Correlations

Variables	1	2	3	4	5	6	7	8
1. EA	-							
2. CF	.837**	-						
3. Mindfulness	-.582**	-.570**	-					
4. Somatisation	.361**	.363**	-.509**	-				
5. Impact upon life	412**	.304**	-.305**	.400**	-			
6. Age	-.109	-.135*	.074	-.003	.064	-		
7. Sex	.059	.060	.082	-.128*	.019	.032	-	
8.NEA Frequency	.081	.011	-.104*	.191**	.353**	.-021	-.010	-

* p <.05, **p<.0005. Cohen's standard for effect size was used therefore, correlation coefficients between less than .2 were considered small, .3-.5 were identified as medium effect size, and correlation coefficients greater than .5 were identified as larger.

3.7 Research Question One

To further explore the relationships between CF, EA, levels of mindfulness, and somatisation, regressions were conducted with somatisation (13-item PHQ) as the dependent variable, controlling for gender. Variables entered were, gender, EA, CF, and mindfulness. All models were found to be significant. Two variables were retained in the final iteration, being female and levels of mindfulness ($F(2,282) = 2.272$, $p<.0005$, adj

R^2= .263.). Only mindfulness was found to be a significant unique predictor of somatisation. See Table 4.

Table 4

First and Last models of Backwards Multiple regression with somatisation as dependent

Variable	*B*	Standard Error B	*ß*	F	adj R^2	f^2
Model 1				22.076	.271	.394
Constant	18.864***	2.076				
Mindfulness	-2.175***	.326	.057			
CF	.013	.044	.131			
EA	.030	.038	-.435			
Women	1.675**	.737	.028			
Non-binary	1.943	2.120	.063			
Model 6				2.272	.263	.379
Constant	21.668***	1.101				
Women	1.328	.696	.097			
Mindfulness	-2.504***	.251	-.508			

Note: * p<.05, **p<.05 and maintains significance at Holm-Bonferroni specified alpha level, ***p<.0005

3.8 Research Question Two

A backward linear regression was conducted to explore whether the psychological inflexibility variables, NEA frequency and somatisation predicted perceived impact on life. NEA frequency was entered as binary dummy variable, per each of the frequency categories. The final model retained five significant predictors of impact upon life: daily NEAs, weekly NEAs, monthly NEAs, somatisation, and EA, which explained 33.1% of the variance (F(8,276)=29.078, p<.0005, adj R^2=.331). See Table 5.

Table 5

First and Last models of Backwards Multiple regression with impact upon life as dependent variable

Variable	*B*	Standard Error B	*ß*	F	adj R^2	f^2
Model 1				18.350	.328***	.531
Constant	1.635	5.064				
EA	.329***	.082	.379			
CF	-.108	.094	-.108			
Mindfulness	.354	.742	.033			
Somatisation	.537***	.127	.244			
NEA daily	8.963***	2.222	.426			
NEA weekly	4.493***	2.379	.167			
NEA monthly	6.530	2.271	.288			
NEA yearly	-.692	2.586	-.020			
Model 4				29.078	.331***	.522
Constant	2.235**	2.002				
EA	.263***	.045	.302			
Somatisation	.492***	.116	.224			
NEA daily	9.507***	1.515	.452			
NEA weekly	7.061***	1.579	.312			
NEA monthly	4.645**	1.728	.173			

Note: * p<.05, **p<.05 and maintains significance at Holm-Bonferroni specified alpha level, ***p<.0005

3.9 Research Question Three

To explore whether mindfulness, EA, CF, and somatisation, predicted NEA frequency a cumulative odds ordinal logistic regression was conducted. The assumptions of proportional odds (full likelihood ratio test $\chi^2(12)=19.235$, P>.05) and no multicollinearity were met. Cells were sparse as 80% had zero frequencies, therefore goodness of fit was determined by comparing the final model's ability to predict the dependent variable compared to the intercept-only model, a statistically significant difference was found ($\chi^2(4)=17.380$, p=.002). An increase in somatisation was associated with an increase in the odds of having more NEAs, with an odds ratio of 1.093, 95% CI[1.035, 1.154], $\chi^2(1)=10.220$, p=.001. An increase in CF was associated with a decrease in the odds of having more NEAs

with an odds ratio of .956, 95% CI=[.917,996], $\chi^2(1)=1.653$, p=.031. Neither EA nor mindfulness were significantly associated with NEA frequency. See Table 6.

Table 6

Ordinal Logistic regression with NEA frequency as the dependent variable

Variable	*B*	Standard Error B	*Exp(B)*	95% CI		Wald χ^2
				lower	upper	
EA	.034	.0179	1.034	.999	1.071	3.563
CF	-.045**	.0209	.956	.917	.996	4.670
Mindfulness	.000	.1605	1.000	.730	1.369	3.560
Somatisation	.089***	.0277	1.093	1.035	1.154	10.220

Note: * p<.05, **p<.05 and maintains significance at Holm-Bonferroni specified alpha level, ***p<.005

4. Discussion

4.1 Research Question One: What are the relationships between CF, EA, levels of mindfulness, and somatisation?

The findings of this study were somewhat consistent with the hypothesis that EA, CF, and mindfulness would be correlated with somatisation and would independently predict somatisation when entered into a regression model together. Consistent with previous research higher levels of EA and lower levels of mindfulness were associated with higher levels of somatisation [26]. A novel finding was that lower levels of CF was associated with higher somatisation. In contrast to both the hypothesis and previous literature, only mindfulness was found to be a unique and independent predictor of somatisation when CF, EA and mindfulness when explored together. Mindfulness and EA have both been found to be unique independent significant predictors of somatisation within the general population [27]. This is possibly due to the inclusion of CF in this model which, although the assumption of non-multicollinearity was not violated, was highly correlated with EA and

possibly mitigated the unique contribution of EA. It is therefore possible that CF did not contribute to the model above and beyond the variance accounted for by EA. This may indicate that EA and CF possibly have a complex relationship not represented in linear terms.

There is limited research exploring NEAD and mindfulness [28, 29]. Considering the wider literature surrounding medically unexplained symptomology mindfulness appears to play an important role in somatisation. There are meta-analytic data demonstrating that mindfulness-based therapies can increase quality of life and reduce symptom severity with a variety of somatising conditions [30]. It is possible that If people are more able to choose how they respond to internal experiences they may not be fearful of them and avoid them, in turn minimizing somatisation [8]. In NEAD, individuals may fear physical sensations [8] and then avoid intrusive perceptions/sensations, inadvertently intensifying the sensations. However, if individuals are able to observe their thoughts around physical sensations instead of avoiding these thoughts they will reduce the intrusive nature of these sensations and thus paradoxically reduce the intensity of the physical experiences of somatisation Further exploration of mindfulness within NEAD may help to illuminate this relationship.

4.2 Research Question Two: Do the psychological inflexibility variables, NEA frequency and somatisation predict perceived impact of life?

It was hypothesised that EA, CF, mindfulness and NEA frequency would correlate with impact upon life and that all factors would uniquely contribute to the perceived impact of NEAD on an individual's life. Again, this hypothesis was not fully supported. Unsurprisingly, having more NEAs was associated with having a greater impact upon an individual's life. Although, higher levels of EA and CF and lower levels of mindfulness were associated with impact upon life, when entered into a regression model only EA,

somatisation and higher NEA frequency remained independent predictors of impact upon life. Neither CF nor mindfulness were found to be significant unique predictors when considered alongside the other variables of interest. The high correlation of CF with EA found within this sample, could again explain why CF was not retained. Interestingly, mindfulness was not found to be an independent predictor of impact upon life. However, mindfulness was found to be a highly significant independent predictor of somatisation, which in turn was highly significant within the impact upon an individual's life. This may imply that mindfulness does not directly contribute to impact upon life, but does contribute to experiencing more somatic symptoms. Experiencing more somatic symptoms results, in turn, in a greater perceived impact of NEAD on an individual's life.

4.3 Research Question Three: Do mindfulness, EA, CF, and somatisation predict NEA frequency?

The third question explored which variables predicted NEA frequency. It was hypothesised that higher levels of somatisation, EA, and CF, and lower levels of mindfulness would predict higher frequency of NEAs. The results were, again, partially consistent with the hypothesis. Lower levels of mindfulness, higher levels of somatisation and NEAD having a more negative impact upon life were all correlated with experiencing more NEAs. However, EA and CF were not significantly correlated with NEA frequency. Congruent with the hypothesis, having higher levels of somatisation in areas beyond what could be directly attributable to NEAD, significantly increased the odds of experiencing more NEAs.

The roles of EA, CF and mindfulness in relationship to NEA frequency were contrary to the hypothesis. EA was not associated with the frequency of NEAs. Although mindfulness was found to correlate with NEA frequency this correlation was relatively small and decreased levels of mindfulness was not found to significantly increase the odds of

experiencing more NEAs. CF was significantly associated with NEA frequency when considered alongside other variables, but the amount of variance accounted for in the correlational analysis was trivial and non-significant. The association was contrary to what was predicted, as CF was found to significantly reduce the odds of experiencing more NEAs in the regression analysis. Based on these observations, it seems highly likely that this is due to a suppressor effect. Suppressor effects occur when multiple variables which are highly related are entered as independent variables, changing the relationship the two variables have with the dependent variable. This suggests that when these variables were entered together the error term was reduced and a relationship between CF and NEA frequency was teased out [31]. However, suppressor effects are complex and this relationship warrants further investigation, as this may be a spurious finding. This further indicates that more complex modelling would be beneficial to consider in future research studying the constructs of EA, CF, mindfulness, somatisation and NEA frequency.

Mindfulness did not uniquely contribute to NEA frequency but NEA frequency was predicted by somatisation and somatisation was predicted by mindfulness. Mindfulness appears to be an important element within somatisation in NEAD. When both NEAD and somatisation are entered into a model it appears that mindfulness contributes to somatisation, but not to the experience of NEA's above and beyond its contribution to somatisation. This explains why mindfulness was associated with NEA frequency at univariate level but not when considered alongside somatisation. This has implications for the possible mechanisms underlying NEAD. It appears possible that mindfulness contributes at an early stage of the process in somatisation, and perhaps not at the point of preventing the translation of the seizure scaffold into an NEA.

Brown and Reuber [1] suggest that inhibitory control is important in the translation of the thought of an NEA into its physical manifestation. However, this study did not directly explore inhibitory control but instead explored mindfulness, relying on the assumption that mindfulness is related to inhibitory control. Although we know that increasing mindfulness increases inhibitory control [32], we do not know as much about how these two variables are related prior to intervention. Therefore, the lack of association of mindfulness with NEA frequency may not necessarily correspond to a lack of relationship with inhibitory control and indeed it may be an area for future research to explore inhibitory control within NEAD and the relationship that it has with mindfulness and NEA frequency.

EA was not found to correlate with or predict NEA frequency. Although this was contradictory to the hypothesis, this may well reflect previous research as the findings on EA and NEA frequency have been inconsistent [16, 33]. This is possibly due to the way in which the NEA frequency data were obtained. Data were provided via self-report and in the categories of daily, weekly, monthly, yearly or not currently occurring. By having broad categories, the study data may have been unsuitable for the detection of subtle effects as those who experienced one daily NEA would be grouped with those who experienced many NEA's per day. Furthermore, this finding may relate to the use of self-report as individuals with NEA are not always aware when they have experienced an NEA and NEA may be categorised differently by different individuals which may result in unreliability.

Further consideration is required as to how best to evaluate severity of NEAD and frequency of NEAs. Clearly, no one approach is entirely satisfactory and in the present study the crude categorisation for the purposes of linear modelling may have been inadequate.

4.4 Overall Findings

In summary, this study provides evidence that EA, mindfulness, and somatisation are probably important factors in NEAD. It also raises questions about CF and the interrelated nature of variables of psychological inflexibility with NEAD. Although CF was correlated with impact upon life and somatisation, it was not found to be a unique predictor of either when explored in multivariate models. It is likely that more complex statistical modelling would reveal how these variables may work together in the generation of NEAs. However it will be important to consider the operationalisation of these variables, especially as the relationships between variables considered part of psychological inflexibility such as EA, CF and mindfulness have been questioned more broadly within the literature [34] and have not previously been explored within this population. It may well be that CF is important at an earlier stage of the process explored and therefore was not found to be directly related to any of the explored variables.

Somatisation may be a key route to experiencing NEAs and NEAD having a greater impact upon life. Somatisation in turn may be driven by factors associated with psychological inflexibility. This suggests that larger scale, more sophisticated analyses (path analysis/structural equation modelling) might be required in the future, so as to tease out potential explanatory models.

4.5 Limitations

Alongside the limitations due to measurement of “seizure” frequency and psychological inflexibility mentioned above, there are additional limitations with which the results of this study must be considered. This study utilised an observational design and therefore causality cannot be inferred. Furthermore, the lack of a control group also makes it impossible to tell if these findings are unique to the NEAD population. The study used an

online recruitment strategy which can increase external validity by reaching a wide variety of participants but poses limitations as well. Indeed, there is no way to identify if individuals participating truly had a diagnosis of NEAD. NEAD is a highly stigmatised condition (Rawlings, Brown, Stone, & Reuber, 2017) and most individuals self-reported that they had had multiple investigations into the aetiology of their seizures. Thus, even though it is impossible to assess if individuals did have a diagnosis of NEAD, it seems likely that most individuals did. Due to the nature of recruitment, the sample was self-selecting and only included those connected to an online community. This is likely to have resulted in an unrepresentative sample which may have excluded much of the community. Individuals who demonstrate higher levels of avoidance and disengagement are theoretically less likely to volunteer to participate in research. Although it seems likely, it is not known if there are psychological differences between individuals with NEAD who access on-line support, compared to those who access clinics and professional support, and those who do not access or have access to support. Therefore, it is impossible to fully understand the implications of on-line participation on the overall results. However, future research should rely on multiple recruitment strategies to manage this challenge.

Using self-report exclusively is considered a limitation. This is particularly salient considering the nature of the population. Some Individuals with NEAD are likely to experience alexithymia [35]. This poses limitations on exclusively relying upon self-report given that alexithymic individuals struggle to identify their internal state and therefore may struggle to complete self-report measures accurately.

The sample had a large variety in terms of geographical location and education, however, the sample was overwhelmingly made up of white females, therefore there is a lack of cross-cultural factors considered. There is evidence to indicate that the

psychological profiles of individuals with a diagnosis of NEAD are different between men and women [36]. Therefore, the results of this study may not generalise beyond women, and due to the limited NEAD research within black and populations which are a visible minority within western counties it is impossible to ascertain if this phenomenon generalises.

4.6 Clinical Implications

The current recommended treatment for NEAD is CBT with psychoeducation [37]. CBT's primary outcome measures is typically symptom reduction. Although CBT is effective for some, if leaves many without a successful remission in symptomology [38]. However, it remains unclear if symptomology reduction is the best outcome to focus upon. Perhaps it is time to consider outcomes in NEAD in terms of recovery and quality of life and therapies which focus on moderating psychological mechanisms that are maintaining NEAD. This study provides evidence that therapies which work to increase psychological flexibility by minimising the use of EA, CF and increase mindfulness are likely to be useful in the treatment of NEAD.

The findings of this study suggest that higher levels of EA were predictive of a greater negative impact of NEAD on a person's life suggesting that therapies which target EA will provide benefits for a person above and beyond NEA remission. Although EA was not directly found to predict NEA frequency in this study, there is limited evidence that therapies which specifically target avoidance such as prolonged exposure can reduce NEA frequency [39]. This provides further evidence that EA is a highly important mechanism within NEAD and reducing avoidance and increasing acceptance can contribute to a positive outcome in NEAD treatment.

The findings suggest that to support people who are experiencing NEAD, decreasing levels of somatisation and somatic symptoms above and beyond NEA frequency may help to improve their lives. Furthermore, focusing therapeutic goals around reducing somatisation may reduce NEA frequency. This is consistent with that the wider literature showing that somatisation is an associated in outcomes [40]. This is a hopeful perspective as certain psychological factors associated with NEAD, such as attachment history and trauma histories, cannot be changed. However, identifying how somatisation translates into the expression of NEAs may help to establish better treatment options for individuals.

This study also provided evidence for which psychological mechanisms may be best targeted to reduce somatisation. For example, levels of mindfulness may be important. Therapies which consider mindfulness, such as many third wave cognitive behavioural therapies (CBTs), may be helpful at reducing the level of somatisation that people with NEAD experience. This is consistent with literature from somatising conditions more generally [30]. The evidence base on mindfulness-based interventions in the effective treatment and support of individuals with NEAD is only just beginning to developed. Baslet et al [41] has recently published promising evidence that a manualised mindfulness-based treatment can reduce NEA frequency in women. Further research is needed to investigate the effectiveness and efficacy of mindfulness-based interventions at reducing levels of somatisation, and as a result, the impact on the frequency of NEAs.

The findings of this study suggest that it would be beneficial to consider therapies which target CF, EA and mindfulness to support individuals with NEAD such as Acceptance and Commitment Therapy (ACT). ACT has been found to be more beneficial than traditional CBT for individuals who exhibit high levels of avoidance [42] a psychological strategy highly utilised by those affected by NEAD [43]. This study suggests that psychological mechanisms

that ACT specifically targets may be important in the pathogenesis of NEAD. To date, empirical evidence of ACT being used to support people with NEAD is highly limited [8]. Baslet and Hill [29] published a case study in which ACT was successfully used to support a 31-year-old woman experiencing NEAD to reach her goals and reduce her somatic symptoms. When considering the medically unexplained symptoms literature more broadly, ACT appears a promising avenue for exploration. For example, ACT has successfully been used to support individuals with other medically unexplained presentations such as chronic pain [44] and irritable bowel syndrome [45].

4.7 Future Research

This study provided evidence of psychological factors which may be important within NEAD. Due to the high correlations between EA, and CF it is possible that these variables, would be best examined in a combined fashion. Furthermore, due to the interlaced nature of these constructs as well as the cyclical nature of psychological distress, it is likely that variables explored interact in a bi-directional manner. However, due to the nature of this study, directionality could not be ascertained. Future research should consider more complex statistical modelling which would provide further understanding into such relationships.

Clinical trials which explore the effectiveness of therapies which specifically target acceptance and include mindfulness, for individuals with NEAD are also required to advance the evidence base.

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