Associations Between Maladaptive Schemas, Early Trauma, Depression, Anxiety, and Stress in Functional Neurological Disorders: An Initial Study

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Declaration and signature of candidate
I confirm that the thesis submitted is the outcome of work that I have undertaken during my programme of study, and except where explicitly stated, it is all my own work. I confirm that the decision to submit this thesis is my own. I confirm that except where explicitly stated, the work has not been submitted for another academic award. I confirm that the work has been conducted ethically and that I have maintained the anonymity of research participants at all times within the thesis. Signed: Date: 30/04/2025

Preface

Table illustrating the breakdown of total word counts:

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Acknowledgements	209
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Thesis Abstract

Paper 1 is a literature review, which aims to identify and evaluate literature on the association between Cluster B personality disorders and functional seizures (FS) or functional movement disorder (FMD). A total of 20 papers were identified and critically evaluated using a modified AXIS appraisal tool. Overall, the quality of the included studies was good. Results indicated a high prevalence of Cluster B personality disorders, particularly borderline presentations, in both FS and FMD, and suggest key shared psychological factors. The review highlighted that further research, particularly with more diverse samples, is needed to determine the directionality of this relationship and further examine differences between functional presentations. Clinical implications are discussed.

Paper 2 is a cross-sectional, empirical study investigating early maladaptive schemas (EMS) and associated psychological factors in 73 participants with a diagnosis of Functional Neurological Disorder (FND) who experience functional seizures (n = 38) or do not (n = 35). Participants completed online self-report measures of adverse childhood events (ACEs), mental health, EMS, and functional impairment, with additional questionnaires about demographic information and FND diagnosis and symptoms. Results found ACEs scores were significantly higher for people with FS, and scores across all other measures were higher for FS, but not statistically significant. A significant association was found between schema elevation and group, with people with FS showing more “elevated” schemas. Regression analyses investigated whether ACEs, depression, anxiety, stress, number of “elevated” schemas, and functional impairment predicted the number of FND symptoms. Regression models were not significant, but functional impairment and depression consistently predicted number of symptoms. The results found moderate-severe levels of depression, anxiety, and stress in both groups. Descriptive analysis identified self-sacrifice, unrelenting standards, and social isolation as clinically meaningful schemas across groups. Findings present evidence for the occurrence of EMS in FND, suggesting it could be beneficial for clinicians to assess schemas in clinical practice. Further research with larger and more diverse samples is needed.

Paper 3 is an executive summary of the empirical paper. It is written for people living with FND and those supporting them, including professionals working with this population.

Paper 1: Literature Review

What is known about the relationship between Cluster B personality disorders and functional seizures or functional movement disorder?

Word Count: 7894 (Excluding title page, references and appendices)

This review is intended for publication in The Clinical Neuropsychologist. Author guidelines can be found in Appendix A. As this review was initially submitted as part of a doctoral thesis, university requirements for formatting and word count have been applied. Modifications will later be made to meet journal guidelines before submitting.

Abstract

Background

Research suggests that Functional Neurological Disorder (FND) and personality disorders may share underlying psychological concepts and risk factors, including interpersonal difficulties, emotional dysregulation, and early trauma or stressful life events. Both conditions are also associated with a high prevalence of self-harm and suicidality, delayed diagnosis, and poor clinical outcomes. This review aimed to identify and critically appraise the existing literature to examine the relationship between Cluster B personality disorders and functional seizures or functional movement disorder as the most common presentations of these conditions.

Method

A systematic search of six databases was conducted in May 2024. A total of 20 studies meeting eligibility criteria were identified, critically appraised using a modified version of the AXIS tool, and synthesised narratively.

Results

Results indicate a high prevalence of co-morbid Cluster B personality disorders in both functional seizures and functional movement disorder, in particular borderline phenomena. Findings also suggest some key shared psychological constructs and associated factors between these presentations, including dissociative experiences, self-harm and suicidality, interpersonal difficulties, childhood trauma or stressful life events, and poor clinical outcomes.

Conclusion

This review suggests a relationship between these two functional disorders and Cluster B personality pathology. Overall, study quality was good, but limitations across the literature were highlighted, particularly concerning the representativeness of study samples. Further research is required to determine the direction of this relationship and further examine differences in personality pathology between different FND subtypes. This could help to establish a better understanding of these complex conditions and improve clinical care.

Introduction

Functional Neurological Disorder (FND), previously known as conversion disorder, is a complex condition wherein pseudo-neurological symptoms cannot be explained by any underlying medical or organic cause (Brown et al., 2007). In the UK, FND is estimated to occur in 12/100,000 people annually, with approximately 50,000-100,000 people affected in the community (Mavroudis et al., 2024). However, due to misdiagnosis and underdiagnosis of the condition, this is likely to be an underestimate of the true prevalence (Bennett et al., 2021).

FND significantly impacts well-being, daily functioning, and quality of life, and prognosis can be poor, particularly in the absence of appropriate treatment (Carson et al., 2011; Espay et al., 2018; Gelauff et al., 2013; Karakis et al., 2020). Nevertheless, sparse resources are allocated to the clinical management of these patients, whose needs often remain unmet. A recent investigation found that half of UK Health Boards have no specific agreement to treat FND, almost 10% do not accept referrals for FND treatment, and only 35% said they had plans to improve their services for FND (FND Hope UK, 2023).

FND has been linked to numerous psychological factors, including childhood trauma, stressful life events, interpersonal conflicts, and dysregulated emotional processing such as alexithymia and emotional reactivity (Demartini et al., 2016; Ekanayake et al., 2017; Pick et al., 2019). However, empirical testing of these associations is relatively limited (Mavroudis et al., 2024), and the etiological role of these psychological factors remains poorly understood (Stroink et al., 2022). Importantly, not all FND patients report such psychological factors, and some research indicates that prevalence may vary depending on the subtype of FND (Driver-Dunkley et al., 2011; Ekanayake et al., 2017; Stone et al., 2004), suggesting that psychological factors may be differentially implicated in the development of different types of FND.

Amongst these factors, comorbid psychiatric conditions such as personality pathology have been associated with FND in the clinical literature, in particular, borderline personality disorder (BPD) (Pastore et al., 2018). BPD falls under the category of Cluster B personality disorders in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.) (DSM-V: APA, 2013), which are characterised by difficulties with regulating emotions and behaviour and maintaining relationships. There are four Cluster B disorders: antisocial, borderline, histrionic, and narcissistic personality disorders. Behaviours associated with these conditions can lead to significant distress and present an increased risk of self-harm and suicide attempts (Krysinska et al., 2006). Research suggests that Cluster B personality

disorders are the most frequent personality pathology in FND populations, but the reported frequencies vary widely (Gargiulo et al., 2022), and studies have predominantly focused on BPD. Previous studies on personality traits in FND have shown mixed results, indicating no consistently found personality traits compared with controls (Deary, 1999; Jalilianhasanpour et al., 2018).

According to the National Institute of Neurological Disorders and Stroke (NINDS, 2024), the two most common forms of FND are functional seizures, previously known as psychogenic non-epileptic seizures (PNES) and functional movement disorder (FMD), and Ahmad & Ahmad (2016) report that 64% of all functional neurological symptoms fall into these two subtypes. In addition, the majority of research into psychological factors associated with FND has focused on PNES and FMD (Newson, 2019).

Research indicates that FND and personality disorders may share some core psychological constructs and risk factors, including emotional dysregulation, interpersonal dysfunction, and childhood trauma (Direk et al., 2012). PNES, FMD, and personality disorders can be difficult to diagnose, which can incur significant delays in diagnosis. For example, Hamed et al. (2020) found an average delay in PNES diagnosis of 7.12 years. Often, psychiatric comorbidities and psychological distress can be under-recognised, which puts patients at risk of falling through gaps in services and can affect the provision they receive (Harden et al., 2003). Clinical outcomes and treatment compliance can often be poor for patients with functional seizures (LaFrance et al., 2013) and patients with personality disorders (McMurran et al., 2010). Additionally, both have also been associated with a high prevalence of self-harm and suicide attempts (Faiman et al., 2024; Krysinska et al., 2006).

Rationale

Given the complexity, significant risks, and poor prognosis for these populations, there is a need to clarify the comorbidity of Cluster B personality disorders and FND and explore the shared underlying factors in relation to how they might predispose individuals towards or contribute to maintaining functional symptoms. Expanding knowledge of FND's relationship with Cluster B personality disorders and associated clinical features could lead to improvements in assessment and clinical care for these complex patients. The purpose of this review is to examine existing literature on the relationship between Cluster B personality disorders and functional seizures or functional movement disorder.

Review question

Are Cluster B personality disorders associated with functional seizures and functional movement disorder? Are there shared factors associated with Cluster B personality disorders and functional seizures or functional movement disorder?

Methodology

Scoping searches

To determine the feasibility of the review topic and its relevance to existing literature, preliminary scoping searches of Google Scholar, EBSCOhost, and the University of Staffordshire's Library Collection were carried out. The Cochrane Library and the International Prospective Register of Systematic Reviews (PROSPERO) were also consulted, and no published or prospective reviews were found on the topic.

Search Strategy

Following the preliminary scoping searches, systematic searches were conducted in May 2024, following PRISMA guidelines (Page et al., 2021). The search terms were determined based on the results of the scoping searches and reviewing relevant literature on different terminology used for the diagnoses included. This focused the topic to consider research specifically around Cluster B personality disorders and functional seizures or functional movement disorder: ("Cluster B personality disorder" OR "borderline personality disorder" OR "emotionally unstable personality disorder" OR "emotional intensity disorder" OR "borderline pattern personality disorder" OR "antisocial personality disorder" OR "histrionic personality disorder" OR "narcissistic personality disorder") AND ("functional seizure" OR "non-epileptic seizure" OR "dissociative seizure" OR "psychogenic seizure" OR "non-epileptic attack disorder" OR "non-epileptic event" OR pseudo-seizure OR "pseudo-epileptic seizure" OR "conversion seizure" OR "psychogenic non-epileptic seizure" OR pseudo-epilepsy OR "hysterical seizure" OR hysteroepilepsy OR "functional movement disorder" OR "functional motor disorder" OR "psychogenic movement disorder" OR "dissociative motor disorder" OR "dissociative movement disorder").

The following databases were searched individually: CINAHL, MEDLINE, PsycINFO, PsycARTICLES, Scopus, and WebofScience. Where possible, limiters were set for English-language and 'academic journals'.

Eligibility criteria

No restrictions on publication date were placed on the articles searched. Studies focused on children or adolescents (aged 5-17 years) were excluded.

Inclusion criteria:

- Published in a peer-reviewed journal.
- Quantitative, qualitative, or mixed design.
- Available in English due to lack of translation resources.

- Participants' mean age was 18+ years.
- Participants were diagnosed with functional seizures using video/EEG recordings, or functional movement disorder using the Fahn & Williams (FW: 1988) criteria, or DSM-IV criteria for conversion disorder, in line with the terminology used in the search strategy.

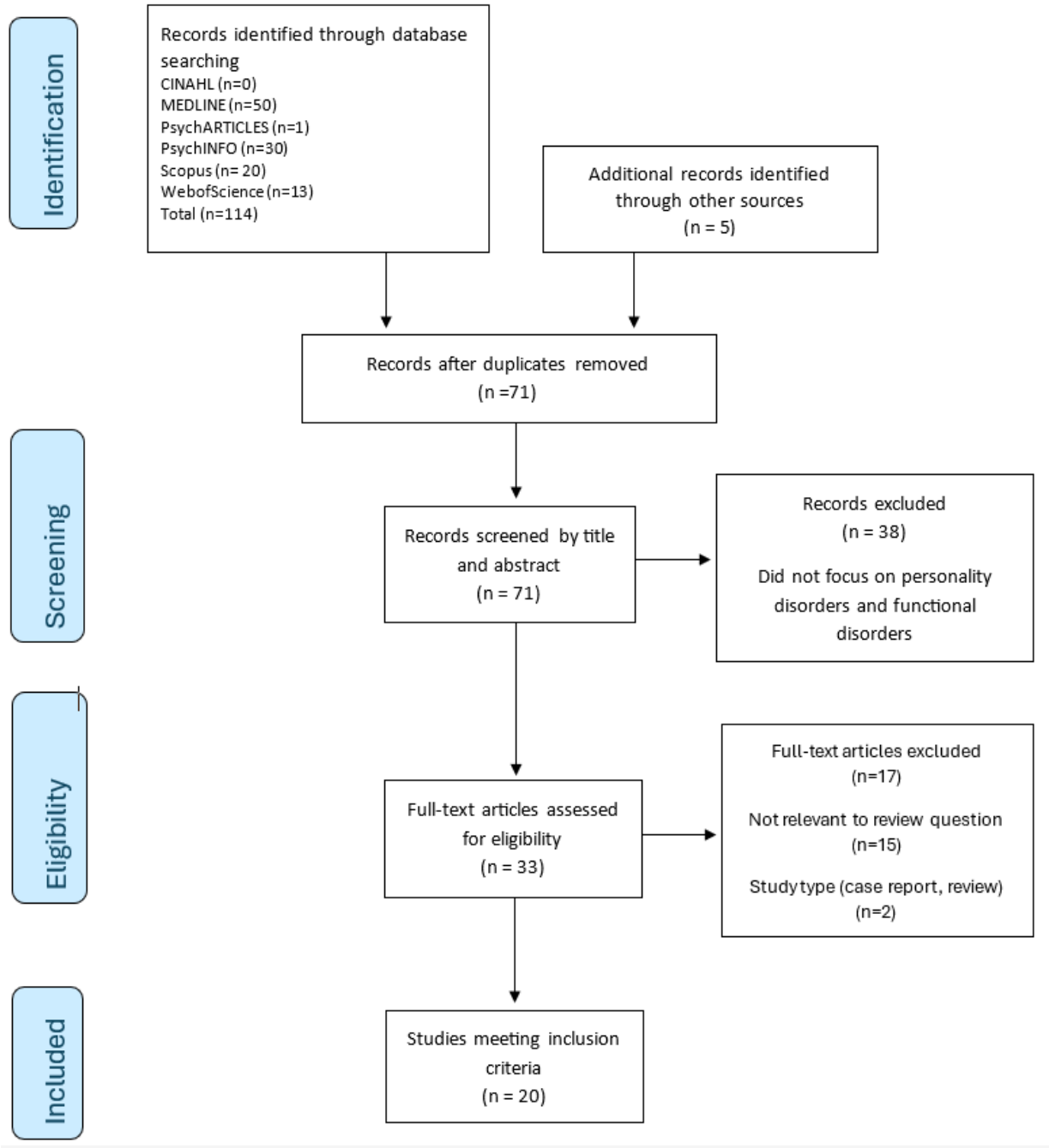
Exclusion criteria:

- Non-peer-reviewed articles, intervention studies, reviews, perspective/opinion pieces, and editorials.
- Participants' mean age was under 18 years.
- The sample was mixed, and it was not possible to separate data from different diagnoses.

Selection process

See Figure 1 for details of the search process. Duplicates were first removed, followed by screening of titles and abstracts. Full-text reviews of the remaining articles using the selection criteria were then completed, and overall, fifteen relevant articles were identified. Subsequently, a manual search of the references cited in the eligible studies was conducted, which resulted in five further articles being included.

Figure 1 – PRISMA flow chart of search and selection process



Quality Appraisal Method

As the majority of studies in the review were cross-sectional, the Appraisal Tool for Cross-Sectional Studies (AXIS: Downes et al., 2016) was chosen as the quality appraisal tool. Given there was some heterogeneity in study designs, it was decided to combine relevant questions for longitudinal and case-control studies from other quality appraisal tools, so that all studies could be appraised using the same tool. All 20 questions of the AXIS were included, one question from the CASP Case-Control Study Checklist to appraise the quality of control group selection, and two questions from the CASP Cohort Study Checklist to appraise the quality of follow-up data were also included (Critical Appraisal Skills Programme, 2018).

For this review, the AXIS response system of “Yes/No/Don’t know” was utilised, whereby “yes” answers were awarded 1 point, and “no/don’t know” answers were awarded 0 points. Questions not relevant to a study were scored as ‘not applicable’ and excluded from the overall total. Overall quality scores were calculated as a percentage of the potential total score to provide a numerical rating. See Appendix B for the modified appraisal tool and results for each study.

Results

Study Characteristics

Table 1 provides a summary of the included studies. All studies used a quantitative design. The majority were cross-sectional studies (12), four were cohort studies, and four were case-control studies.

Table 1

Summary of studies

Authors, Year, and Location	Sample	Measures (FND, personality disorders, and associated factors)	Main Findings
Bora et al., 2011 Turkey	61 – PNES mean age = 30 (16-65), 75% female 9% concurrent epilepsy	Semi-structured clinical interview based on DSM-IV-TR criteria	9.8% of patients had PDs (3 borderline, 3 histrionic) 70% reported traumatic life events as initiators of seizures, including sexual abuse. 3 borderline & 1 histrionic attempted suicide in the past.
Direk et al., 2012 Turkey	PNES – 35, mean age = 29.1, 82.9% female Epilepsy – 35 (age & gender matched controls), mean age = 28.2, 80% female Healthy controls – 35 (age & gender matched hospital	Structured Clinical Interview for DSM-IV-TR Axis I disorders (SCID-I) Structured Clinical Interview for DSM-III-R Axis II Disorders (SCID-II)	Prevalence of PDs significantly higher in PNES than ES/controls ($p=0.001$); Cluster B PDs more prevalent in PNES than ES ($p<0.001$) – no significant differences between PNES & ES for Cluster A ($p=0.326$) or Cluster B ($p=0.065$). Regression with PDs as predictor of PNES – presence of any PD produces significant improvement in estimates and having a PD was the only predictor of PNES.

	staff), mean age = 28.4, 78.4% female		74% of PNES had PDs – 60% Cluster B – BPD most common (40%) followed by histrionic (20%) and narcissistic (20%).
Drake et al., 1992 USA	20 - pseudoseizures Mean age = 27.9, 95% female	Minnesota Multiphasic Personality Inventory (MMPI)	30% of patients had PD – 3 borderline, 3 borderline/histrionic mixed 14/20 experienced recent acute situational stress. Patients with PD were more refractory, 4/6 continued to have seizures, all eventually lost to follow-up but continued to present to other centres.
Galimberti et al., 2003 Italy	ES/PNES – 38, mean age = 33.8, 89% female (epilepsy controls -38) PNES – 31, mean age = 32.6, 77% female (epilepsy controls-31)	Cognitive Behavioural Assessment (CBA) – self-report Structured Clinical Interview for DSM-III-R Patient Version (SCID P) and SCID-II (Italian versions)	PNES (28%) & PNES/ES (34%) showed higher incidence of Cluster B PDs than epilepsy controls – BPD (PNES/ES = 16%; PNES = 10%) & histrionic (PNES/ES = 12%; PNES = 13%) most common.
Harden et al., 2009 USA	16 – PNES, median age = 45 (30-65), 94% female	SCID-II	13/16 PNES & 12/16 ES met criteria for PDs; 69% PNES and 30% ES had Cluster B PDs (PNES – 8 B only & 3 A+B).

	16 - Epilepsy comparisons, median age = 37 (27-65), 63% female		Distribution of having a Cluster A or B PD compared to Cluster C was significantly different between PNES and ES (p=0.007).
Hovorka et al., 2007 Czech Republic	PNES – 56, mean age = 29.6, 69.6% female, neurological comorbidity 12.5%	Evaluation according to ICD-10 criteria	PDs most frequent psychiatric comorbidity (44.6%) with BPD prominent (72%). Risk factors: problems in family relations (28.6%), sexual/physical abuse in childhood or early adulthood (10.7%). PNES with PDs most problematic group to treat.
Krishnamoorthy et al., 2001 UK	NEAD – 10, 50% female, 5 with comorbid epilepsy Epilepsy – 35, 40% female	Standardised Assessment of Personality (SAP) ICD-10 diagnosis criteria	SAP personality trait accentuation common in ES (46.7%) and PNES (25%) – difference not significant PNES – PDs evenly distributed across 3 clusters (10%); Cluster B PDs significantly underrepresented in ES.
Kuloglu et al., 2003 Turkey	Conversion disorder – 198 PNES (82:41%), Motor (41: 20.7%), Sensory (66: 33.3%), Mixed (9: 4.5%).	Clinical Interview and case evaluation form – designed specifically for study SCID-I and SCID-II – Turkish version	PNES (82:41%), Motor (41: 20.7%), Sensory (66: 33.3%), Mixed (9: 4.5%). Cluster B PDs in 32.3% – BPD (11.1%) and Histrionic (17.7%) most common.

	Female – 153, mean age = 28.31; male – 45, mean age = 26.53.	DSM-III-R psychosocial stress sources severity index	Psychosocial stress factors: problems with primary support group (37.9%), problems with social environment (12.6%); traumatic experiences: intrafamilial conflict (27.3%), sexual abuse (6.6%), physical trauma (8.1%).
Marchetti et al., 2008 Brazil	PNESD = 14 PNESD/E = 13 E = 1 93% female, mean age = 37 (19-62)	Open clinical interviews	PNES = 1 (4%) with BPD & 1 with histrionic; PNES/ES = 1 (4%) with antisocial & 1 with histrionic.
Pastore et al., 2018 Italy	31 – conversion motor disorder (CMD – tremor 8, dystonia 8, gait disorder 15), mean age = 47.97; 58% female, symptom duration = 6.03 years 31 – organic dystonia (OD) matched controls, mean age = 58.29; 58% female, symptom duration = 11.65 years	State-Trait Anxiety Inventory (STAI) Form Y-1 & Y-2 – self-report SCID-I and SCID-II Beck Depression Inventory (BDI) – self-report Dissociative Disorders Interview Schedule (DDIS) – structured interview; 12/16 sections including BPD	FMD showed significantly higher rates of any PD (35%, vs 6%, p=0.011) and BPD (p=0.000) than controls. FMD show higher frequency of negative opinions about doctors' understanding of the disorder (p=0.004) and delivering proper care (p=0.030) & having a PD is statistically associated with discordance status (p=0.035) with neurologists about the etiological nature of the disorder.

		Interpersonal functioning – semi-structured interview (9-items) specifically designed	
Rady et al., 2021 Egypt	33 – Epilepsy, mean age = 31.3, 64% female 33 – PNES, mean age = 31.15, 58% female	Mini International Neuropsychiatric Interview – structured interview (Arabic version) SCID-II (Arabic version) Goldberg's International Personality Item Pool (IPIP) Big Five personality questionnaire (Arabic version) – self-report	PNES = 87.9% had PDs, ES = 69.7% had PDs Prevalence of only Cluster B PDs was higher in PNES (69.7%) than ES (33.3%) (p=0.003), no difference for Clusters A and C. BPD significantly more prevalent in PNES than ES (66.7% vs 27.3%) (p<0.001). Personality traits – only conscientiousness construct significantly lower in PNES (54.5%) vs ES (24.2%) p=0.012.
Rechlin et al., 1997 Germany	18 – pseudoseizures, mean age = 22 (17-29), 72% female, 17% possible comorbid epilepsy	Psychiatric examination according to DSM-III-R	15/18 had Axis II disorders (83.3% - all Cluster B): 10/18 = BPD, 2/18 = antisocial, 3/18 = histrionic. Sexual abuse reported in 5 female patients. 67% had attempted suicide at least once, concealed self-injuries observed in 50% and incisions on arms in 5.

Sar et al., 2004 Turkey	34 = pseudoseizures 4 = paralysis Mean age = 34.5 (16-56), 86.8% female	Structured Clinical Interview for DSM-IV Dissociative Disorders (SCID-D) Turkish version SCID + PTSD module SCID-II BPD section - Turkish version Dissociation Questionnaire – self-report Somatoform Dissociation Questionnaire (SDQ) – self-report, Turkish version Childhood Trauma Questionnaire (CTQ) – self-report	23.7% diagnosed as having BPD and all but 1 were among patients with dissociative disorder (p=0.007). Patients with dissociative disorder endorsed more BPD criteria - Mean no. of BPD criteria endorsed (out of 8) overall = 2.5, DD = 4.1, no DD = 1.2 (p=0.001). 47.4% had DSM-IV dissociative disorder. Neglect overall (57.9%), emotional neglect (36.8%), physical neglect (42.1%), physical abuse (44.7%), emotional abuse (34.2%), sexual abuse (26.3%), any abuse and/or neglect (68.4%). Childhood physical neglect and childhood emotional and sexual abuse more frequently reported by participants with dissociative disorder. Suicide attempts (34.2%) and self-mutilation (31.6%) reported more frequently for participants with dissociative disorder.
Sar et al., 2009 Turkey	Conversion disorder General population – women	Dissociative Disorders Interview Schedule (DDIS) – Turkish version	3.8% had pseudoseizures

	500 households- 628 women Mean age = 34.8	Structured Clinical Interview for DSM-III-R (SCID) PTSD module Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II) – semi-structured interview, Turkish version Sociodemographic info & list of Criterion-A traumatic life events	Conversion group showed significantly higher comorbidity for lifetime and current BPD vs non-conversion group. Regression (BPD as predictor of conversion symptoms) not significant. conversion group showed higher frequency of all types of childhood abuse than non-conversion group. 26.5% of conversion group had concurrent DSM-IV dissociative disorder. Conversion group reported more suicide attempts and self-mutilation than non-conversion group.
Sar, Islam & Ozturk, 2009 Turkey	32 – Conversion disorder 23 – pseudoseizures, 3 – gait disturbance, 2 – paresthesia, 4 – paralysis, inability to speak, blurred or double sight 18-65, mean age = 33.3, 84% female	DDIS – Turkish version Dissociative Experiences Scale (DES) – self-report, Turkish version SDQ - Turkish version	46.9% had DSM-IV dissociative disorder (DD). DD group endorsed higher number of BPD criteria and had a BPD diagnosis more frequently than non-DD group. Regression (no. of endorsed BPD criteria predicted by 5 types of childhood abuse/neglect) showed no significant results.

		Clinician-Administered Dissociative State Scale (CADSS) – subject and observer ratings. STAI – self-report CTQ - Turkish version	
Silva et al., 2001 Argentina	PNES - 17, 70% female, mean age = 33 (12-69), mean duration of NESs before diagnosis = 9 years (1-30)	Psychiatric diagnoses based on DSM-IV criteria	3/12 = BPD; 1/17= histrionic. 41.1% had coexisting epilepsy.
Stone, Sharpe & Binzer., 2004 Sweden	20 – pseudoseizures, mean age = 27 (18-54); 75% female 30 – motor conversion symptoms, (18-74) mean age = 39 (18-74); 60% female	SCID-I and SCID-II Global Assessment of Functioning (GAF) Scale – self-report My Memories of Upbringing inventory – self-report	PNES & FMD had high levels any PDs (65% vs 50%). No major difference in proportion of any PDs, but substantially higher proportion of BPD in PNES (35%) vs FMD (7%) ($p<0.05$). Higher parental divorce in PNES, 6/20 PNES vs 1/30 FMD reported incest; significantly lower perceived emotional warmth from both parents & higher perception of rejection from father in PNES.

			Life events – overall number of life events in 12 months before assessment significantly higher in PNES (p<0.001), but not if only 3 months prior to onset was considered. FMD experienced life events significantly more negatively (0<0.01); ACEs particularly common in PNES (+ incest + BPD).
Sullivan-Baca et al., 2022 USA	Veterans – age and diagnosis matched Female sample from previous study – 118 (90 with PNES, 28 with epilepsy Female: PNES – mean age = 41.9, 56.7% white; E – mean age = 47.8, 57.1% white Male sample – 115 (87 with PNES, 28 with epilepsy) Male: PNES – mean age = 42.1, 80.2% white; E –	Retrospective review of electronic medical records	PNES male vs female - significantly more females had BPD diagnoses (18.9% vs 4.7%, p=0.004). No significant differences in PDs in PNES vs ES in men. Significant difference for childhood physical abuse in PNES (27.9%) vs ES (3.6%), p=0.007.

	mean age = 46.1, 53.6% white		
Tezcan et al., 2003 Turkey	Conversion Disorder - 59: 26 = non-epileptic seizures (44.1%), 21 = sensorial symptoms (35.6%), 5 = motor symptoms (8.4%), 7 = mixed type (11.9%); 93.2% female, mean age = 28.58 (18-56) DD group = 18 (30.5%) 17 comparison patients (scored below 10 on DES) = non-DD	Clinical Interview and Case Evaluation Form – designed specifically for the study DES - Turkish version DDIS - Turkish version SCID-D - Turkish version	PNES (44.1%), Sensory (21: 35.6%), Motor (5:8.4%), Mixed (7: 11.9%). In DD group, 77.8% had comorbid BPD compared with 5.9% in comparison group. History of sexual abuse: 100% in DD group vs 5.9% (n=1) in comparison group ($p<0.001$).
Turner et al., 2011 Italy	21 – Epilepsy, mean age = 37.3, 57% female 22 – PNES, mean age = 40.2, 77% female	SCID-D & SCID-II (Italian version) Stressful & traumatic life events from childhood to present – non-standardised interview	PNES (18%), PNES/ES (40%), ES (10%) met criteria for PDs. Cluster B PDs more common in PNES (with or without ES): BPD (PNES = 2, ES/PNES = 1), histrionic (ES/PNES = 2), Narcissistic (ES/PNES = 1). 54% PNES reported trauma vs 70% ES/PNES vs 20% ES (included psychological trauma, physical abuse, severe physical illness).

	10 – Epilepsy + PNES, mean age = 39.2, 50% female		

Study samples

Seven studies were conducted in Turkey (Bora et al., 2011; Direk et al., 2012; Kuloglu et al., 2003; Sar et al., 2004; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003), three in Italy (Galimberti et al., 2003; Pastore et al., 2018; Turner et al., 2011), three in the USA (Drake et al., 1992; Harden et al., 2009; Sullivan-Baca et al., 2022), one in Sweden (Stone et al., 2004), one in Egypt (Rady et al., 2021), one in the Czech Republic (Hovorka et al., 2007), one in Germany (Rechlin et al., 1997), one in Argentina (Silva et al., 2001), one in Brazil (Marchetti et al., 2008) and one in the UK (Krishnamoorthy et al., 2001). Only one study recorded the ethnicity of participants (Sullivan-Baca et al., 2022), which included a majority white sample.

Sample size ranged from 17 (Silva et al., 2001) to 628 (Sar et al., 2009). Except for Sar et al. (2009), who specifically aimed to recruit only women, most studies aimed to recruit both men and women, but female participants significantly dominated the samples. The vast majority of studies recruited participants from clinical populations, with two exceptions, which drew from the general population (Sar et al., 2009) and a veteran population (Sullivan-Baca et al., 2022).

Procedure

Most studies involved the completion of clinician and self-report measures administered in the clinic. Sar et al. (2009) used clinician measures administered during home visits. Two studies used retrospective data collected from clinical notes (Bora et al., 2011; Sullivan-Baca et al., 2022). Sullivan-Baca et al. (2022) was the only study to use data collected from a previous study. The majority of measures used were previously published and had good psychometric properties.

Most studies that examined functional seizures used video-EEG data to establish a diagnosis (15). The vast majority of studies (18) were conducted in specialist units or departments specialising in neurology, psychiatry, epilepsy, movement disorders, or neurophysiology. Sullivan-Baca et al. (2022) used a sample from a veteran medical centre.

Measures

Nine of the studies used the Structured Clinical Interview for DSM Axis II Disorders (SCID-II) as a measure of personality disorders. The SCID-II is a semi-structured interview serving as a diagnostic tool for DSM personality disorders. The English, Arabic, Turkish, and Italian versions were used across the studies.

Alternative measures of personality pathology included the Minnesota Multiphasic Personality Inventory (MMPI) used by Drake et al. (1992). Galimberti et al. (2003) used the

Cognitive Behavioural Assessment (CBA), a self-administered battery that measures personality characteristics and emotional adjustment. One study (Krishnamoorthy et al., 2001) used the Standardised Assessment of Personality (SAP). Rady et al. (2021) used Goldberg's International Personality Item Pool (IPIP) Big Five personality questionnaire alongside the SCID-II to assess personality traits. Four studies used the Dissociative Disorders Interview Schedule (DDIS) section for assessing borderline personality disorder (Pastore et al., 2018; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003).

Six studies did not state what measures they had used to investigate personality pathology (Bora et al., 2011; Hovorka et al., 2007; Marchetti et al., 2008; Rechlin et al., 1997; Silva et al., 2001; Sullivan-Baca et al., 2022).

Associated mental health difficulties

Comorbid psychiatric disorders were assessed primarily through the Structured Clinical Interview for DSM Axis I Disorders (SCID-I). Rady et al. (2021) used the Arabic language version of the Mini International Neuropsychiatric Interview (MINI), a structured interview for assessing DSM-IV and ICD-10 psychiatric disorders. Five studies reported assessing psychiatric disorders through clinical interviews based on criteria for DSM-III-R, DSM-IV-TR, or ICD-10 but did not explicitly state the measures used (Bora et al., 2011; Hovorka et al., 2007; Krishnamoorthy et al., 2001; Rechlin et al., 1997; Silva et al., 2001). Two studies (Drake et al., 1992; Marchetti et al., 2008) did not state what measures or classifications were used to assess psychiatric diagnoses.

Studies used a range of measures to assess associated mental health difficulties. Key variables also measured were anxiety (Pastore et al., 2018; Sar, Islam & Ozturk, 2009) and depression (Pastore et al., 2018). A number of studies also assessed dissociative disorders and/or experiences (Pastore et al., 2018; Sar et al., 2004; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003) using various measures including the Dissociative Disorder Interview Schedule (DDIS), the Structured Clinical Interview for DSM-IV Dissociative Disorders (SCID-D), The Dissociation Questionnaire, The Somatoform Dissociation Questionnaire (SDQ), Dissociative Experience Scale (DES) and the Clinician-Administered Dissociative State Scale (CADSS).

Stressful life events, trauma, and risks

The majority of studies (14) also made use of additional measures to assess the prevalence of stressful life events and/or childhood trauma, which varied in specificity. For example, some studies collected information about personal history through unstructured interviews (Galimberti et al., 2003; Drake et al., 1992; Rechlin et al., 1997; Hovorka et al.,

2007; Turner et al., 2011), whereas others made use of standardised measures. Two studies used the Childhood Trauma Questionnaire (CTQ) (Sar et al., 2004; Sar, Islam & Ozturk, 2009). Four studies used the DDIS childhood trauma items (Pastore et al., 2018; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003). Kuloglu et al. (2003) assessed psychological stress factors and traumatic experiences through the DSM-III-R psychosocial stress sources severity index.

Stone et al. (2004) did not directly assess adverse childhood events but used the My Memories of Upbringing self-rating inventory to explore participants' perceived parental-rearing practices. Additionally, they measured stressful life events through a 56-item semi-structured interview inventory.

Three studies collected information about self-harm and suicide attempts through unstructured clinical interviews of non-standardised personal history forms (Rechlin et al., 1997; Sar et al., 2004; Sar et al., 2009).

Functioning

Two studies additionally examined aspects of participants' functioning. Stone et al. (2004) used the Global Assessment of Functioning (GAF) scale to measure psychological, social, and occupational functioning according to axis V of the DSM-IV over the past year. Pastore et al. (2018) specifically designed a semi-structured interview with 9 items to assess interpersonal functioning with participants' neurologists, relatives, and work colleagues.

Quality Appraisal

All included studies stated clear aims and used designs appropriate to the research question(s), with one exception (Silva et al., 2001), in which the study aims were not clearly stated, so it was, therefore, unclear whether the research design was appropriate. The majority of studies did not provide justification for their sample sizes, which appeared to primarily be determined by recruitment capacity and response rates. Two studies justified the sample size with formal power calculations (Direk et al., 2012; Rady et al., 2021), one with a stratified random sampling procedure (Sar et al., 2009), and Sullivan-Baca et al. (2022) created their sample to match a sample used in their prior study. Sample populations were somewhat defined, for example, most studies clarified mean age and gender, but only one study (Sullivan-Baca et al., 2022) reported the ethnicity of participants. Nonetheless, most studies provided comprehensive information about the sample's diagnoses of functional seizures or functional movement disorder and related clinical features. Five studies considered conversion disorder (Kuloglu et al., 2003; Sar et al., 2004; Sar et al., 2009; Sar,

Islam & Ozturk, 2009; Tezcan et al., 2003) but provided detailed information relating to the symptoms experienced.

The majority of studies struggled to recruit representative samples, with most samples being heavily female dominated. Fourteen mixed-gender studies recruited over 70% female participants: Stone et al. (2004: 75% PNES group), Turner et al. (2011: 77% PNES group), Harden et al. (2009: 94% PNES group), Bora et al. (2011: 75%, PNES), Rechlin et al. (1997: 72%, PNES), Silva et al. (2001: 70%, PNES), Sar et al. (2009: 84%), Sar et al. (2004: 86.8%), Tezcan et al. (2003: 93.2%), Kuloglu et al. (2003: 77%), Galimberti et al. (2003: 89% PNES/ES, 77% PNES), Marchetti et al. (2008: 93%), Direk et al. (2012: 82.9% PNES, 80% ES, 78.4% control), and Drake et al. (1992: 95%). The gender imbalance appears to be particularly apparent for samples with functional seizure patients. Although these populations are not equally gender distributed, this likely somewhat reflects the higher prevalence of functional seizures in women, estimated to be three times higher than in men (Dworetzky & Baslet, 2017). Furthermore, the reliance on clinical samples and recruitment in single-centre tertiary services decreases the representativeness of the samples and risks potential self-selection bias.

All four case-control studies selected control participants appropriately, and three studies matched controls for age and gender (Direk et al., 2012; Galimberti et al., 2003; Pastore et al., 2018). Non-responders were addressed in three studies, but with little detail given. The majority of studies included appropriate validated measures of Cluster B personality disorders. Most studies that included participants with functional seizures used video-EEG monitoring to confirm the diagnosis, which is considered the gold standard for diagnosis (LaFrance et al., 2013). Three studies (Galimberti et al., 2003; Krishnamoorthy et al., 2001; Stone et al., 2004) included information on the blinding of interviewers; in Stone et al. (2004), this was regarding being blinded to the study hypotheses, and in two cases, being blinded to participants' diagnoses. All standardised measures of personality disorders were reported to have good psychometric properties, including language-adapted versions. Of the four cohort studies, three provided adequate timeframes between primary and secondary data collection, but only Sar et al. (2004) provided enough information to evaluate whether follow-up was complete enough. Most studies (15) used p-values to determine statistical significance. Overall, the quality of methodology reporting was average, with only half of the included studies sufficiently describing the methods and statistical analysis methods to allow for replication.

Reporting of results was overall of good quality across all included studies. Basic data were adequately described in most studies (16) with appropriate use of tables. Results

were internally consistent for most studies (15), and all included studies provided results for all analyses presented in the methods section. Many studies failed to adequately describe response rates and non-responders, which could have introduced non-response bias. Two studies (Direk et al., 2012; Sar et al., 2004) reported no significant differences in age or sex between participants and non-responders. Most studies could not account for why patients chose not to participate.

All included studies, except for one, provided discussions and conclusions justified by their results. The majority (12) described their limitations in varying amounts of detail. Four studies declared no conflicts of interest that may influence their interpretation of results (Bora et al., 2011; Direk et al., 2012; Pastore et al., 2018; Rady et al., 2021). Five studies acknowledged funding sources (Galimberti et al., 2003; Hovorka et al., 2007; Krishnamoorthy et al., 2001; Sar et al., 2004; Sullivan-Baca et al., 2022) but did not state whether conflicts of interest may exist. Six studies did not explicitly describe consent being obtained from participants (Drake et al., 1992; Harden et al., 2009; Hovorka et al., 2007; Krishnamoorthy et al., 2001; Rechlin et al., 1997; Silva et al., 2001), and twelve studies did not mention gaining ethical approval for the research.

Overall, the quality of studies was rated as moderate to good. Three studies were rated as poor quality (Drake et al., 1992; Rechlin et al., 1997; Silva et al., 2001). The highest scoring study was 90% (Direk et al., 2012). The modal average was 70%, scored by three studies. Generally, marks were lost for lack of justified sample size, not addressing or describing non-responders, not sufficiently describing the methodology, including statistical analyses, lack of in-depth discussion of limitations, and lack of a representative sample due to female dominance and recruiting almost exclusively from single-centre specialist services.

Main Findings

See Table 1 for detailed results.

Prevalence of Cluster B personality disorders in functional seizures

Overall, results showed a high prevalence of co-morbid Cluster B personality disorders in participants with functional seizures, ranging from 9.8% (Bora et al., 2011) to 83.3% (Rechlin et al., 1997) of samples, with borderline most frequently observed, followed by histrionic. Sullivan-Baca et al. (2022) found that significantly more females than males with functional seizures had BPD diagnoses (18.9% vs 4.7%, $p = 0.004$).

When compared with epilepsy controls, participants with functional seizures show a significantly higher prevalence of Cluster B personality disorders (Harden et al., 2009; Rady et al., 2021). Krishnamoorthy et al. (2001) found no significant difference in personality trait

accentuation between participants with functional seizures and those with epilepsy, but Cluster B disorders were significantly underrepresented in the epilepsy group. Furthermore, participants with functional seizures, with or without comorbid epilepsy, show a higher prevalence of Cluster B personality disorders, with borderline and histrionic again being the most common (Galimberti et al., 2003; Marchetti et al., 2008; Turner et al., 2011). Direk et al. (2012) compared participants with functional seizures with a group of epilepsy controls and a group of healthy controls and found that the prevalence of any personality disorder was significantly higher in functional seizures than in epilepsy or healthy controls and that Cluster B disorders were more prevalent in functional seizures than epilepsy ($p < 0.001$). 74% of participants with functional seizures had a personality disorder; of these, 60% were Cluster B, with BPD the most common (40%), followed by histrionic (20%) and narcissistic (20%). Regression analysis with personality disorder as a predictor of functional seizures found that the presence of any personality disorder produces significant improvement in the estimates and that having a personality disorder was the only predictor of functional seizures.

Five studies sampled participants with conversion disorder (Kuloglu et al., 2003; Sar et al., 2004; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003), in which predominantly functional seizures were the most common symptom experienced. Kuloglu et al. (2003) found Cluster B disorders in 32.3% of participants, with BPD (11.1%) and histrionic (17.7%) most common. The remaining four studies only investigated the prevalence of BPD. Sar et al. (2004) found that 23.7% were diagnosed as having BPD, and Sar et al. (2009) found that compared with controls, participants with conversion symptoms showed significantly higher comorbidity for lifetime and current BPD, but BPD was not a significant predictor of conversion symptoms. Two studies found that participants with comorbid dissociative disorder endorsed a higher number of BPD criteria (Sar et al., 2004; Sar, Islam & Ozturk, 2009).

Prevalence of Cluster B personality disorders in functional movement disorders

When comparing functional movement disorder (FMD) to a control group with organic dystonia, Pastore et al. (2018) found that the FMD group showed significantly higher rates of any personality disorder (35% vs 6%, $p = 0.01$), and in particular BPD ($p = 0.00$) than controls. Stone, Sharpe, and Binzer (2004) was the only study to directly compare functional seizures and functional movement disorder and found little difference between the groups in terms of overall personality disorder levels (65% vs 50%), but a substantially higher proportion of BPD in functional seizures compared with FMD (35% vs 7%, $p < 0.05$).

Associated factors

Four studies reported a high prevalence of comorbid DSM-IV dissociative disorder in participants with conversion disorder, ranging from 26.5% to 61.1% (Sar et al., 2004; Sar et al., 2009; Sar, Islam & Ozturk, 2009; Tezcan et al., 2003).

Four studies reported rates of self-harm and suicide attempts. In participants with functional seizures, Bora et al. (2011) reported that four participants with comorbid Cluster B personality disorders had attempted suicide in the past, whilst Rechlin et al. (1997) reported 67% of participants had attempted suicide at least once, concealed self-harm was observed in 50% and 5 participants presented with incisions on the arms. In participants with conversion disorder, Sar et al. (2004) reported suicide attempts (34.2%) and self-harm (31.6%) as frequent, and Sar et al. (2009) found that participants reported more suicide attempts and self-harm than participants without conversion symptoms.

Three studies briefly mentioned aspects related to clinical outcomes. For patients with functional seizures, Drake et al. (1992) found those with a personality disorder were more refractory and were eventually all lost to follow-up but continued to present to other centres. Hovorka et al. (2007) found that patients with comorbid personality disorders were the most problematic group to treat. Pastore et al. (2018) found that patients with FMD show a higher frequency of negative opinions about their doctors' understanding of the disorder ($p = 0.004$) and delivering proper care ($p = 0.03$) and that having a personality disorder was statistically associated with discordance status ($p = 0.04$) with neurologists about the etiological nature of the disorder.

Several studies (11) included measures of childhood trauma and/or stressful life events. Reports of traumatic and stressful life events, including sexual, emotional and physical abuse and/or neglect, and interpersonal problems were high for functional seizures, conversion disorder and FMD (Bora et al., 2011; Drake et al., 1992; Hovorka et al., 2007; Kuloglu et al., 2003; Rechlin et al., 1997; Sar et al., 2004; Sar et al., 2009; Stone et al., 2004; Sullivan-Baca et al., 2022; Tezcan et al., 2003; Turner et al., 2011).

Discussion

This review aimed to examine the relationship between Cluster B personality disorders and functional seizures or functional movement disorder. Twenty relevant papers were identified and critically appraised. A synthesis of findings indicates that there is evidence across the studies of the relationship between personality pathology and these two functional disorders. The review highlights a high prevalence of co-morbid Cluster B

personality disorders in both participants with functional seizures and participants with functional movement disorder, with borderline personality disorder most frequently observed.

Studies considering dissociative experiences reported a high prevalence of comorbid DSM-IV dissociative disorder in participants with conversion disorder, including those with pseudoseizures and motor symptoms. This supports existing literature for an association between functional and dissociative disorders (Pick et al., 2017). Functional seizures are commonly considered to be dissociative phenomena, often being referred to as ‘dissociative seizures’ and interestingly, the International Statistical Classification of Diseases-10 (ICD-10: World Health Organisation, 2019) classification groups pseudoseizures and motor symptoms together under dissociative disorders because they are both considered to be associated with dissociative mechanisms (Pick et al., 2017). Research also indicates high levels of dissociation in individuals with BPD, and that these individuals seem to show higher levels of dissociation than those with other personality disorders, such as schizotypal (Cluster A) (Scalabrini et al., 2017). Given that dissociation is a prevalent feature of both, it is therefore reasonable to expect an association between functional disorders and BPD.

Some literature suggests that the relationship between dissociation and BPD is not a direct one, but that dissociation may act as a mediator between childhood trauma and borderline phenomena (Watson et al., 2006). Childhood trauma is highly prevalent in personality disorders (Lobbestael et al., 2010), and Ashiq et al. (2018) found that early trauma was significantly correlated with all four subtypes of Cluster B personality disorders. Prevalence of childhood trauma is also high in functional seizures (Yang et al., 2023) and functional movement disorder (Kranick et al., 2011). In line with the literature, studies in this review found a high prevalence of trauma, particularly in patients with functional seizures (Gargiulo et al., 2022). For FMD, the studies suggest more of an association with stressful life events; for example, Stone et al. (2004) found FMD patients experienced life events significantly more negatively than those with PNES.

The significant overlap between functional disorders, dissociation, childhood trauma, and personality pathology, particularly BPD, deserves further comprehensive exploration to better understand the directionality of these associations. It is worth noting that a broad range of stressful life events and traumatic experiences were considered across the included studies, but only one general population sample was included, and no community samples were included. It is possible that there could be differences in trauma exposure across different populations.

Cluster B personality disorders are often characterised in part by difficulties in interpersonal functioning (Harden et al., 2009), and these interpersonal problems can also

often be observed in the doctor-patient relationship (Direk et al., 2012). Studies in this review offer some evidence that for individuals with comorbid personality and functional disorders, interpersonal difficulties can occur within the clinical relationship. Drake et al. (1992) found that patients with comorbid PNES and personality disorder were eventually all lost to follow-up, and Pastore et al. (2018) found that FMD patients express negative opinions about the delivery of proper care from their doctors and that having a comorbid personality disorder was associated with higher patient-clinician discordance. Interpersonal dysfunction within clinical relationships may affect patients' ability to engage with services, including establishing trust with clinicians and attending appointments (Harden et al., 2009), which impacts their quality of care.

Research reports an established relationship between self-harm and suicidality in functional seizures (Faiman et al., 2024). Research has also shown that personality disorders, particularly Cluster B, are associated with a high risk of self-harm, suicidal ideation, and suicide attempts (Krysinska et al., 2006). This review supports these associations to some extent. Bora et al. (2011) found that 4/6 patients with a Cluster B personality disorder had attempted suicide in the past, while Rechlin et al. (1997) found 67% of participants had attempted suicide at least once, and 50% presented with self-harm behaviours. Dworetzky et al. (2015) suggest that other psychiatric factors, including a history of BPD, may compound the relationship between functional seizures and suicide attempts, which the results from this review may offer some support for.

Limitations of included studies

Most studies comprised cross-sectional observational designs and were therefore not able to establish causality or the directionality of the relationship between personality pathology and functional disorders.

The generalisability of the studies was generally quite poor due to the lack of representative samples. In the majority of studies, participants were recruited from specialist clinical settings using convenience sampling, which may have increased the risk of self-selection bias. The lack of community samples means that samples may not be representative of these populations. Furthermore, the vast majority of samples were female dominated, so were unable to assess gender-related difficulties.

Many of the studies had relatively small sample sizes, which limits their ability to draw solid conclusions and may have increased the risk of type II errors in the data. In addition, many made use of self-report measures, which risks potential self-reporting bias and recall bias, which could have impacted the reliability of results. Finally, two studies

analysed retrospective data. This limits the amount of information available and increases the risk of relevant data being missed, which may have impacted the validity of the results.

Clinical Implications

The review highlights some potential clinical implications. Firstly, because high levels of personality pathology may be associated with functional disorders, the review suggests that it may be helpful for clinicians to consider the complex clinical characteristics of personality disorders in their assessment of functional disorders, particularly as these patients tend to be assessed and managed within neurology services. Functional disorders and personality disorders can both be difficult to diagnose, meaning there are often significant delays to diagnosis, which impacts patients' well-being and quality of life. Furthermore, psychiatric comorbidities can often be overlooked, and a lack of recognition of psychological distress can affect care, with patients being at risk of falling through gaps in service provisions (Harden et al., 2003). Clinical outcomes can often be poor for patients with functional seizures as they demonstrate poor compliance with treatment, with adherence declining over time (LaFrance et al., 2013). Patients with personality disorders can also show poor compliance with treatment, resulting in adverse clinical outcomes (McMurran et al., 2010). This review, therefore, emphasises the importance of understanding and characterising personality pathology features that may contribute to the complex clinical presentation of patients with functional disorders and the challenges in managing these individuals appropriately. This also supports the importance of the integration of specialised multidisciplinary, including psychological, input for the assessment and treatment of these presentations to provide more efficient and appropriate clinical care.

Limitations of current review

This review employed a systematic search strategy, but due to limiters set around English-language and 'academic journals', relevant papers may have been missed. Additionally, only peer-reviewed published papers were included, so there is a risk of publication bias. The critical appraisal was conducted independently by the author, so the inter-rater reliability of the appraisal rating could not be tested, and as such was open to subjectivity and potential bias. Furthermore, due to the mixture of designs used across the included studies, the critical appraisal tool was adapted to include items related to control groups and follow-up designs to allow comparison. Nevertheless, the appraisal tool may not have been sufficiently comprehensive to capture the heterogeneity of studies. In addition, a numerical rating not featured in the original AXIS appraisal tool was utilised, which could have potentially compromised its validity. Therefore, the results of the critical appraisal should be interpreted with caution.

Future Research

Future research would benefit from more longitudinal studies to assess causation and the predictive value of diagnoses, or whether a bi-directional relationship exists between the two clinical presentations. Studies should aim to include larger sample sizes and more demographically diverse samples, particularly in relation to ethnicity, gender, and community-based samples, to improve generalisability.

Further consideration of variables associated with or mediated by personality pathology could be explored to contribute to understanding around how functional disorders develop and are maintained. Additionally, research could benefit from further direct comparison between participants with functional seizures and functional movement disorder in order to compare differences in personality pathology, clinical characteristics, and etiological factors.

Conclusion

This review aimed to establish whether research indicates a relationship between Cluster B personality disorders and two functional disorders. The 20 included studies were generally of moderate to high quality. Overall, the synthesis of results suggests a high prevalence of Cluster B personality disorders in functional seizures and functional movement disorder, with borderline phenomena most frequently observed. Findings also suggest some shared psychological constructs and risk factors between these presentations, including dissociative experiences, interpersonal difficulties, and childhood trauma. More research is needed to assess the directionality of this relationship and to further explore differences in personality pathology between different types of functional disorders. This would help to better understand these complex presentations and to improve the clinical care they receive.

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Appendices

Appendix A

Author Guidelines – The Clinical Neuropsychologist

To meet examination requirements, the final paper will be edited to meet the journal guidelines after submission. Full author guidelines can be accessed here:

https://www.tandfonline.com/action/authorSubmission?show=instructions&journalCode=ntcn20

Appendix B – Quality appraisal scoring

Modified AXIS Questions	Bora et al., 2011	Direk et al., 2012	Drake et al., 1992	Galimberti et al., 2003	Harden et al., 2009	Hovorka et al., 2007	Krishnamoorthy et al., 2001
Introduction							
1. Were the aims/objectives of the study clear?	1	1	1	1	1	1	1
Methods							
2. Was the study design appropriate for the stated aim(s)?	1	1	1	1	1	1	1
3. Was the sample size justified?	0	1	0	0	0	0	0
4. Was the target/reference population clearly defined? (is it clear who the research was about?)	1	1	1	1	1	1	1
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?	1	1	1	1	1	1	1
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?	0	1	0	1	0	1	1
7. Were the controls selected in an acceptable way?	N/A	1	N/A	1	1	N/A	N/A
8. Were measures undertaken to address and categorise non-responders?	0	1	0	0	0	0	0
9. Were the risk factor and outcome variables measured appropriate to the aims of the study?	1	1	1	1	1	1	1
10. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?	0	1	0	1	1	0	1

11. Was the follow up of subjects complete enough?	N/A	N/A	0	N/A	N/A	0	N/A
12. Was the follow up of subjects long enough?	N/A	N/A	0	N/A	N/A	1	N/A
13. Is it clear what was used to determine statistical significance and/or precision estimates (e.g. p-values, confidence intervals)?	0	1	0	1	1	0	1
14. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	0	1	0	1	0	0	1
Results							
15. Were the basic data adequately described?	1	1	1	1	0	1	1
16. Does the response rate raise concerns about non-response bias?	0	0	0	0	0	0	0
17. If appropriate, was information about non-responders described?	0	1	0	0	0	0	0
18. Were the results internally consistent?	1	1	0	1	1	1	0
19. Were the results presented for all the analyses described in the methods?	1	1	1	1	1	1	1
Discussion							
20. Were the author's discussions and conclusions justified by the results?	1	1	1	1	1	1	1
21. Were the limitations of the study discussed?	1	1	0	1	0	0	1
Other							
22. Were there any funding sources of conflicts of interest that may affect the author's interpretation of the results?	0	0	0	0	0	0	0
23. Was ethical approval or consent of participants attained?	1	1	1	1	0	0	0
Total	11	19	8	16	11	11	13
Total %	55%	90%	36%	76%	52%	50%	65%

Modified AXIS Questions	Kologlu et al., 2003	Marchetti et al., 2008	Pastore et al., 2018	Rady et al., 2021	Rechlin et al., 1997	Sar et al., 2004	Sar et al., 2009
Introduction							
1. Were the aims/objectives of the study clear?	1	1	1	1	1	1	1
Methods							
2. Was the study design appropriate for the stated aim(s)?	1	1	1	1	1	1	1
3. Was the sample size justified?	0	0	0	1	0	0	1
4. Was the target/reference population clearly defined? (is it clear who the research was about?)	1	1	1	1	1	1	1
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?	1	1	1	1	1	1	0
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?	0	1	1	1	1	0	1
7. Were the controls selected in an acceptable way?	N/A	N/A	1	N/A	N/A	N/A	N/A
8. Were measures undertaken to address and categorise non-responders?	0	0	0	0	0	1	1
9. Were the risk factor and outcome variables measured appropriate to the aims of the study?	1	1	1	1	1	1	1
10. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?	1	0	1	1	0	1	1

11. Was the follow up of subjects complete enough?	N/A	N/A	N/A	N/A	N/A	1	N/A
12. Was the follow up of subjects long enough?	N/A	N/A	N/A	N/A	N/A	1	N/A
13. Is it clear what was used to determine statistical significance and/or precision estimates (e.g. p-values, confidence intervals)?	1	0	1	1	0	1	1
14. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	1	0	1	1	0	0	0
Results							
15. Were the basic data adequately described?	0	1	1	1	0	1	1
16. Does the response rate raise concerns about non-response bias?	0	0	0	0	0	1	0
17. If appropriate, was information about non-responders described?	0	0	0	0	0	1	0
18. Were the results internally consistent?	1	1	1	1	0	1	1
19. Were the results presented for all the analyses described in the methods?	1	1	1	1	1	1	1
Discussion							
20. Were the author's discussions and conclusions justified by the results?	1	1	1	1	0	1	1
21. Were the limitations of the study discussed?	0	0	0	1	0	1	1
Other							
22. Were there any funding sources of conflicts of interest that may affect the author's interpretation of the results?	0	0	0	0	0	0	0
23. Was ethical approval or consent of participants attained?	1	1	1	1	0	1	1
Total	12	11	15	16	7	18	15
Total %	60%	55%	71%	80%	35%	82%	75%

Modified AXIS Questions	Sar et al., 2009	Silva et al., 2001	Stone et al., 2004	Sullivan-Baca et al., 2022	Tezcan et al., 2003	Turner et al., 2011	
Introduction							
1. Were the aims/objectives of the study clear?	1	0	1	1	1	1	
Methods							
2. Was the study design appropriate for the stated aim(s)?	1	0	1	1	1	1	
3. Was the sample size justified?	0	0	0	1	0	1	
4. Was the target/reference population clearly defined? (is it clear who the research was about?)	1	1	1	1	1	1	
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?	1	1	1	1	1	1	
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?	0	0	0	0	0	0	
7. Were the controls selected in an acceptable way?	N/A	N/A	N/A	N/A	N/A	N/A	
8. Were measures undertaken to address and categorise non-responders?	0	0	0	0	0	0	
9. Were the risk factor and outcome variables measured appropriate to the aims of the study?	1	1	1	1	1	1	
10. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?	1	0	1	0	1	1	
11. Was the follow up of subjects complete enough?	N/A	0	N/A	N/A	N/A	N/A	

12. Was the follow up of subjects long enough?	N/A	1	N/A	N/A	N/A	N/A	
13. Is it clear what was used to determine statistical significance and/or precision estimates (e.g. p-values, confidence intervals)?	1	1	1	1	1	1	
14. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	0	0	1	1	1	1	
Results							
15. Were the basic data adequately described?	1	1	1	1	1	0	
16. Does the response rate raise concerns about non-response bias?	0	0	0	0	0	0	
17. If appropriate, was information about non-responders described?	0	0	0	0	1	0	
18. Were the results internally consistent?	1	0	1	1	0	1	
19. Were the results presented for all the analyses described in the methods?	1	1	1	1	1	1	
Discussion							
20. Were the author's discussions and conclusions justified by the results?	1	1	1	1	1	1	
21. Were the limitations of the study discussed?	1	0	1	1	1	1	
Other							
22. Were there any funding sources of conflicts of interest that may affect the author's interpretation of the results?	0	0	0	0	0	0	
23. Was ethical approval or consent of participants attained?	1	0	1	0	1	1	
Total	13	8	14	13	14	14	
Total %	65%	36%	70%	65%	70%	70%	

Paper 2: Empirical Paper

Associations Between Maladaptive Schemas, Early Trauma, Depression, Anxiety, and Stress in Functional Neurological Disorders: An Initial Study

Word count: 7976 (Excluding title page, references, and appendices)

This paper has been written with the intention of submitting to Epilepsy & Behavior. Author guidelines can be found in Appendix A. The paper will first be submitted to the University of Staffordshire as part of a doctoral thesis. Formatting and word count have been modified to meet university requirements and will later be edited to meet journal guidelines before submitting.

Abstract

Aim: Early maladaptive schemas (EMS) have been found to occur in Functional Neurological Disorder (FND) patients (Newson, 2019; Stroink et al., 2022). This study was designed to explore differences in EMS and associated psychological experiences between individuals with functional seizures (FS) and FND without FS (No-FS).

Methods: 73 participants (38 FS, 35 No-FS) completed online measures of ACEs (Adverse Childhood Experiences Questionnaire for Adults), depression, anxiety and stress, (Depression Anxiety Stress Scales – Short Form), EMS (Young's Schema Questionnaire - Short form, version 3), and functional impairment (Work and Social Adjustment Scale) in addition to demographic and FND diagnosis and symptom questions. Outcomes on measures were compared to assess differences between FS and No-FS. Four regression analyses were conducted to assess predictors of the number of FND symptoms.

Results: Scores for ACEs were significantly higher for FS than No-FS, and scores across all other measures were non-significantly higher for FS than No-FS. A significant association was found between group and schema elevation, with FS showing a higher number of "elevated" schemas. Descriptive analysis identified self-sacrifice, unrelenting standards, and social isolation/alienation as clinically meaningful schemas for FS and No-FS. Across all regression models, overall fit remained non-significant, but functional impairment and depression consistently demonstrated significant effects. A key limitation was the reliance on self-report measures and the quality of the number of symptoms data.

Conclusion: This study adds to understanding of the occurrence of EMS in FND and provides novel evidence on differences between FND subtypes. The study highlighted challenges with the collection of accurate and reliable symptom data. It is recommended that future research recruit larger samples to improve representativeness and increase the statistical power of models.

Introduction

Functional Neurological Disorder (FND) is a condition characterised by the presence of what look like neurological symptoms (e.g., movement disorders, cognitive and sensory disturbances, seizures) arising from nervous system dysfunction rather than an identified structural cause (Bennett et al., 2021; Stone et al., 2020). Although the prevalence of FND is not well understood, research indicates a prevalence of 50,000 to 100,000 people with FND in the UK (Bennett et al., 2021), and it is the second most common reason for referral to neurology clinics (Stone et al., 2010). FND is associated with stigma, poor health outcomes and quality of life (QoL), and significant economic costs (O'Mahony et al., 2024; Foley et al., 2024; Carson et al., 2011), and prognosis can be poor in the absence of treatment (Espay et al., 2018; Gelauff et al., 2014).

The underlying mechanisms of FND are still poorly understood, and there is no unified, commonly accepted explanatory model (Pick et al., 2019). More recently, models have highlighted the role of biological and psychological factors. Neurobiological studies have found differences in connectivity and activation in specific brain areas (Espay et al., 2018), whilst psychological models focus on associations between functional symptoms, the attentional system, and illness beliefs (Edwards et al., 2012). The Integrated Cognitive Model (ICM) proposes that psychological factors contribute to the development and persistence of functional seizures (FS) through a feedback loop maintaining heightened arousal responses (Brown & Reuber, 2016a). Biopsychosocial frameworks seek to integrate these concepts, recognise the range and complexity of contributing factors, and facilitate understanding of the multifaceted and diverse FND presentations (Pick et al., 2020; Butler et al., 2021). However, the role of psychological factors in FND is still largely unclear. Therefore, it is important to explore which psychological factors are relevant to this population to tailor treatment pathways to target these factors and potentially improve outcomes.

Individuals with FND often present with multiple subtypes (Hallett et al., 2022). FS are involuntary events resembling epileptic seizures but are not due to abnormal electrical activity in the brain (Asadi-Pooya et al., 2021). Motor symptoms include tremors, weakness, and gait disturbances; sensory symptoms include altered sensation, numbness, and tingling, whilst cognitive symptoms include memory and attention difficulties, executive dysfunction, and language disturbances (Mavroudis et al., 2024). FND can also encompass 'non-physical' symptoms such as pain, fatigue, and sleep disturbance (Gilmour et al., 2020).

Co-morbid psychological conditions, including anxiety, depression, and PTSD, are common in FND, with rates reported as higher than in neurological conditions (Cabreira et

al., 2023; Walsh et al., 2018). Research indicates around half of FS patients experience depression, anxiety, or PTSD (Brown & Reuber, 2016b; Popikorov et al., 2019), and Feinstein et al. (2001) found anxiety (38.1%) and depression (19.1%) were common in patients with Functional Movement Disorder (FMD).

The relationship between FND and adverse experiences is complex, and a considerable proportion (14-77%) of people do not report a history of trauma or stressful life events (Brown & Reuber, 2016b; Ludwig et al., 2018). Nevertheless, trauma is widely recognised as a significant risk factor for FND and is clinically relevant for many individuals, with research indicating an increased prevalence of adverse childhood experiences (ACEs), particularly emotional neglect, and stressful life events in adulthood (Ludwig et al., 2018; Mavroudis et al., 2024). Importantly, studies suggest differences between FND subtypes, highlighting trauma and chronic stress as more prevalent in patients with FS compared with other functional symptoms (Driver-Dunkley et al., 2011; Ekanayake et al., 2017; Reuber et al., 2007; Stone et al., 2004). Research also indicates that ACEs impact the number of FND symptoms and symptom severity (Gray et al., 2020). Roelofs et al. (2002) found that childhood physical abuse was associated with a greater number of FND symptoms, and multiple traumatic experiences positively correlated with symptom severity.

The cumulative effect of multiple symptoms may significantly impact daily functioning, distress, and QoL, and the more symptoms experienced, the more complex the condition may be to manage, which may impact chronicity and clinical outcomes (Mavroudis et al., 2024; Butler et al., 2021). This suggests that the number of symptoms may be associated with increased severity. Researchers have used the number and diversity of symptoms as a proxy indicator of symptom severity (Roelofs et al., 2005; Nicholson et al., 2020) and have demonstrated correlations between self-reported and objective symptom severity measures and the number of different symptoms (Forejtova et al., 2023). Forejtova et al. (2023) found the number of different symptoms negatively correlated with health-related QoL; Jankovic et al. (2006) found symptom comorbidity was associated with poor outcomes, and Gelauff et al. (2019) found a high symptom count predicted poorer outcomes. Complexity, as indicated by the number of symptoms, is therefore a meaningful construct for understanding symptom severity.

Evidence suggests that difficulties with emotional and interpersonal coping are important factors in the development and maintenance of FND. Research has found a higher prevalence of fearful attachment in FND (Holman et al., 2008; Williams et al., 2019) and higher rates of alexithymia (Demartini et al., 2016; Cole et al., 2023). Research also demonstrates associations between FND and elevated rates of personality disorders (PDs).

For FS, Howorka et al. (2007) found 45% of their sample met PD criteria, predominantly Borderline Personality Disorder (BPD; 32%), and Reuber et al. (2004) found 51% of their sample had a personality pathology profile resembling BPD. Similarly, for FMD, Feinstein et al. (2001) found 45% of their sample met PD criteria, while Demartini et al. (2014) found 25% of patients met criteria for PD. Stone et al. (2004) found rates of PD were elevated both in FMD and FS (50 vs. 65%), but patients with FS had significantly higher rates of BPD (35% vs. 5%) than those with FMD.

Taken together, this research indicates that FND is associated with adverse experiences and difficulties with emotional coping, but that the exact nature of these varies across presentations, suggesting psychological factors may be differentially implicated in different functional symptoms. It is also the experience of the researcher that clinicians working with FND patients have observed differences in the psychological profiles of different FND presentations, particularly those with FS, compared with other FND subtypes. This may influence clinical decision-making and suggests that clinical practice would benefit from further examination of the differences in presentations.

Cognitive Behavioural Therapy (CBT) is a recommended intervention for FND, with other modalities including psychodynamic and Acceptance and Commitment Therapy (ACT) also demonstrating promising therapeutic benefits (Graham et al., 2018; Gutkin et al., 2020). Recently, research has started to explore the utility of theories associated with schema therapy as a model for understanding the role of psychological factors in FND (Newson, 2019; Stroink et al., 2022). Young (1999) developed schema therapy to treat individuals with complex difficulties who struggled with identifying, accessing, and changing their cognitions and emotions. The model focuses on the developmental origins of psychological distress and maladaptive coping mechanisms. Early Maladaptive Schemas (EMS) are defined as pervasive problematic cognitive and emotional patterns regarding oneself and one's relationships with others that develop if a child's emotional and relational needs are seriously and consistently unmet (Young et al., 2003).

The schema model offers an explanation for the link between early adverse experiences and emotional and interpersonal coping in later life, and how this may influence psychopathology. Maladaptive coping strategies to manage schema activation, e.g., surrender, avoidance, and compensation, can lead to social isolation, emotional avoidance, and energy depletion (Young, 1999), which may contribute to maintaining FND symptoms through chronic accumulative stress. Research indicates that EMS and their associated coping behaviours play an important role in many psychological disorders (Wright et al.,

2009; Pinto-Gouveia et al.,2006), particularly in personality pathology, with studies suggesting that most EMS play a mediating role between ACEs and PDs (Bach et al., 2018).

In applying the schema model to FND, it could be hypothesised that the elevated rates of ACEs, emotional neglect, presence of PD, and fearful attachment in FND are associated with an increased risk of developing EMS, manifesting as problems with well-being and functioning. The schema model may also help to explain some of the variability in findings relating to psychological presentations in different FND subtypes, as it could be hypothesised that different patterns of EMS are implicated in different types of FND.

Wider relevance of this research

Evidence for the presence and potential role of EMS in FND subtypes could support the promotion of targeted psychological treatment to reduce their influence. Schema therapy interventions aimed at addressing maladaptive schemas thought to maintain symptoms have demonstrated clinically significant improvements for complex conditions, including PDs, anxiety, and PTSD (Jacob & Arntz, 2013; Peeters et al., 2022). Alternatively, resources could be focused on targeting other psychological factors such as stress, anxiety, or depression, if these prove more influential.

Improvements in psychological treatments for FND are crucial as access to intervention is currently limited. A recent investigation found that half of UK Health Boards have no specific agreement to treat FND, 16-43% do not accept psychology referrals or provide psychological therapy for FND, and only 35% reported plans to improve their services for FND (FND Hope UK, 2023).

It is important to understand the role of psychological factors in FND and differences between subtypes, as this may have implications for clinical decision-making and treatment. Identifying factors contributing to complexity could support understanding around prognosis and outcomes and help in identifying patients who may be vulnerable to developing multiple symptoms. Multiple symptoms are likely to require interdisciplinary care. Limited treatment provision may lead to patients' access to services varying depending on specific symptoms, which may impact clinical outcomes (Mavroudis et al., 2024). Therefore, understanding the diversity of clinical manifestations and the contributing factors is vital to tailoring interventions and supporting service design and resource allocation.

Hypotheses

1. Participants with functional seizures will endorse a significantly higher number of adverse childhood events than participants without functional seizures.

2. Participants with functional seizures will score in the elevated range on more schema subscales compared with participants without functional seizures.

3. Participants with functional seizures will have significantly higher depression, anxiety, and stress scores compared with participants without functional seizures.

4. A higher number of elevated maladaptive schemas, greater number of adverse childhood events, and higher anxiety, depression, stress, and functional impairment scores will predict an increased number of FND symptoms.

Methods

Design

The study used a cross-sectional, observational design to compare the results of online self-report measures between FS and FND without FS (No-FS). Ethical approval was obtained from the University of Staffordshire (Appendix B), and informed consent was obtained for all participants.

Recruitment and procedure

The study used a volunteer sampling approach to recruit participants self-reporting a diagnosis of FND with or without functional seizures. To be eligible, participants needed to be aged 18 or older and capable of completing online measures in English. Recruitment took place between November 2024 and February 2025. A research advertisement including study information, inclusion criteria, and a link to access the online survey (Appendix C) was shared by the researcher in Facebook groups for people with FND/FS.

Participation involved accessing Qualtrics survey software, with the link leading to a digital participant information sheet, consent form, measures, and a debrief sheet providing information regarding some sources of support (Appendices D-H). All data was anonymised, with Qualtrics generating a randomised ID number. Participants were informed that they could withdraw from the study within two weeks of participation. No participants withdrew their data. In addition to the standardised measures (Appendix G), participants completed a demographic questionnaire, an FND questionnaire, and a symptom checklist (Appendix F).

Participants

The participant total was 73 (No-FS = 35, FS = 38). The researcher manually grouped participants based on whether they reported experiencing FS in the symptom checklist. Those who reported FS were placed in the FS group, and those who did not were placed in the No-FS group. Combined group demographic information is presented in Table 1. The majority of the sample identified as female (90.4%), and age ranged from 18-66 (M = 42.74, SD = 11.68). Most of the sample identified as White (84.9%) and resided in the UK (63%). Further demographic information used for assessing group comparability is presented in Table 4.

Table 1

Combined group demographic information (n = 73)

	(M)	(SD)	(Range)
	Category	**Frequency**	**Percentage**
Age	(42.74)	(11.68)	(18-66)
Gender	Female	66	90.4%
	Male	5	6.8%
	Other (transgender)	1	1.4%
	Missing data	1	1.4%
Ethnicity	Ashkenazi	1	1.4%
	Australian	2	2.7%
	British	4	5.5%
	English	1	1.4%
	European	1	1.4%
	Mennonite	1	1.4%
	Scottish	1	1.4%
	White	62	84.9%
Country of Residence	Australia	8	11%
	Canada	3	4.1%
	Israel	1	1.4%
	New Zealand	1	1.4%
	UK	46	63%
	USA	13	17.8%
	Missing data	1	1.4%

Measures

The *Adverse Childhood Experiences Questionnaire for Adults* (ACE-Q; Felitti et al., 1998) is a 10-item measure assessing instances of adverse experiences before the age of

18. It examines exposure to childhood psychological, physical, and sexual abuse as well as household dysfunction, including domestic violence, substance use, and incarceration. Items are scored as either absent (0) or present (1), and scores are summed to provide an overall ACE-Q score out of 10. The higher the score, the more adverse childhood experiences. Test-retest reliability is good, with kappa coefficients ranging from .55 to .77, and convergent validity has been established through high correlations between ACE scores and scores of previous sexual abuse assessment tools (Edwards et al., 2001).

Young's Schema Questionnaire - Short form, version 3 (YSQ-S3; Young, 2005) is a measure of EMS comprising 90 items, measuring 18 subscales with five items each. Participants are asked to rate items based on their experience over the past year. Items are rated on a scale from 1 (completely untrue of me) to 6 (describes me perfectly). Subscale scores are calculated as the mean of their five items, with an average score of four or higher indicating that EMS subscale is within the "elevated" range and clinically meaningful (Young et al., 2003). The YSQ-S3 has equivalent reliability and factor structures to the long form (Waller et al., 2001) and is advocated for use in research due to the administration speed compared with the 205-item form.

The *Depression Anxiety Stress Scales – Short Form* (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report questionnaire measuring levels of depression, anxiety, and stress. Each scale consists of 7 items, with four response options ranging from 0 (did not apply to me at all) to 3 (applied to me much, or most of the time). The maximum score for each scale is 42; each scale is multiplied by 2 to make scores comparable with the DASS-42 questionnaire. The DASS-21 total scale score has excellent internal consistency (.93; Henry & Crawford, 2005), and its score interpretations have sound construct validity (Henry & Crawford, 2005; Page et al., 2007).

The *Work and Social Adjustment Scale* (WSAS; Mundt et al., 2002) is a 5-item self-report measure assessing patients' perceived functional impairment resulting from a health problem. The five items cover the domains of work, home management, social leisure activities, private leisure activities, and relationships with others. Patients are asked to rate their response on each item, ranging from 0 (not at all) to 8 (very severely). Responses are summed to produce an overall score ranging from 0 to 40, with lower scores indicating better functioning. Scores above 20 indicate moderately severe psychopathology, scores between 10 and 20 are associated with significant functional impairment but less severe clinical symptomology, and scores below 10 are associated with subclinical populations (Mundt et al., 2002). The WSAS has sound psychometric properties, with Cronbach's alpha measure

of internal scale consistency ranging from 0.70 to 0.94, and test-retest correlation of 0.73 (Mundt et al., 2002).

Relevant demographic information was collected to characterise the sample and to check for differences in group composition. Data relating to age, gender, ethnicity, and country of residence were collected and analysed for descriptive statistics. Data relating to diagnosis and symptoms were collected to group participants. Participants were asked to indicate the functional symptoms they currently experience to provide a measure of the number, nature, and complexity of FND symptoms (Appendix F).

Power analysis

To determine the required number of participants, a power calculation was conducted based on a similar study that reported medium to large effect sizes (Demartini et al., 2016). Demartini et al. (2016) examined differences in psychological factors including psychoform dissociation (d=.94, d=.76), somatoform dissociation (d=2.36, d=2.68), alexithymia (d=.85, d=.82), and depression and anxiety (d=1.34, d=1.26, d=.85, d=.97) between patients with FS, patients with FMD and healthy controls (N = 60). Cohen's d scores were converted to correlation coefficients, and the average correlation coefficient for all variables calculated. This was used to calculate Cohen's f-squared, $f^2 = 0.33$, indicating an overall medium effect size.

Based on the G*Power calculation for a multiple regression with six predictors (number of elevated EMS, number of ACEs, depression, anxiety, stress, and functional impairment) for a medium effect size (0.33), power set at 0.8 and alpha at 0.05, a minimum of 48 participants were needed (Faul et al., 2009).

Data Analysis

All data were downloaded from Qualtrics survey software, and statistical analysis was completed using IBM SPSS Statistics (Version 29).

Data Screening

Data integrity was checked using ReCAPTCHA scores, with a cutoff of <0.5. No data reached the cutoff. Out of a total of 145 people who started the survey, 23 did not complete the consent form, 20 did not complete any standardised measures, and 29 withdrew from the study before finishing. In line with guidance in the participant information sheet and consent form (Appendices D and E), their data were not included. Data for 73 participants remained for analysis.

The means, standard deviations, and ranges for ACEs, depression, anxiety, stress, functional impairment, and schema scores are provided in Tables 2 and 3.

Table 2

Combined outcomes for analysis measures (n = 73)

	Mean	Standard Deviation	Range
ACEs (ACE-Q)	4.12	2.96	0-10
Depression (DASS-21)	17.18	11.46	0-42
Anxiety (DASS-21)	16.47	9.70	0-42
Stress (DASS-21)	20.99	10.43	4-42
Functional Impairment (WSAS)	27.30	8.69	2-40
Total YSQ score (YSQ-S3)	272.38	90.30	107-512

Table 3

Combined outcomes for schema subscales (n = 73)

	Mean	Standard Deviation	Range
Emotional Deprivation	12.82	7.64	5-30
Abandonment	14.56	7.72	5-30
Mistrust	16.04	7.13	5-30
Social Isolation/Alienation	18.62	7.22	5-30
Defectiveness/Unlovability	14.08	7.50	5-29
Failure to Achieve	15.21	7.31	5-29
Practical Incompetence/Dependence	14.29	5.10	5-29
Vulnerability to Harm or Illness	15.45	6.72	5-30
Enmeshment	10.67	5.93	5-29
Subjugation	15.03	6.62	4-29

Self-Sacrifice	20.12	6.47	6-30
Emotional Inhibition	15.19	6.91	5-30
Unrelenting Standards	18.18	6.81	5-30
Entitlement/Superiority	12.27	4.89	5-27
Insufficient Self-Control/Self-Discipline	16.74	6.67	5-30
Admiration/Recognition-Seeking	12.67	6.01	5-27
Pessimism/Worry	16.68	7.34	5-30
Self-Punitiveness	13.75	6.81	5-30

Statistical Assumptions

Data checks for parametric and regression assumptions were conducted.

For parametric between-groups tests, assumptions of normality and homogeneity of variance need to be met. Histogram inspection and Kolmogorov-Smirnov tests showed that the measure of depression was normally distributed, and a non-significant Levene's test demonstrated equal variance (Appendix I). Depression was, therefore, compared using an independent t-test. ACEs, anxiety, and stress were not normally distributed, so comparisons were conducted using non-parametric Mann-Whitney U tests. All between-group tests were two-tailed.

Demographic data were compared between FS and No-FS to assess group differences. Chi-square and Fisher-Freeman-Halton exact tests were used for categorical data, and Mann-Whitney U to compare non-normally distributed ordinal data.

Data checks for the Poisson regression indicated overdispersion, so the model was re-fit using Negative Binomial regression. The Akaike Information Criterion (AIC) showed the Poisson model to have a better fit (425.8 vs. 526.7), indicating the overdispersion to be tolerable. Histogram inspection indicated an approximately normal distribution of the count outcome; therefore, a multiple linear regression was run as a sensitivity analysis. Additionally, to provide a fairer assessment of severity, the number of symptoms was weighted according to symptoms' frequency within the dataset, and a multiple linear regression was conducted on the weighted counts of symptoms.

Linear regression assumptions, including checking for outliers, normality, homoscedasticity, linearity, multicollinearity, and independence of errors, were assessed for each dependent variable (number of symptoms and weighted counts of symptoms). High

levels of correlation were found between depression, stress, and anxiety (DASS-21 subscales); however, all Variance Inflation Factor (VIF) results were below 10, and tolerance statistics were greater than 0.1, therefore did not indicate problematic multicollinearity (Tabachnick & Fidell, 2013). For the model predicting the number of symptoms, inspection of the scatterplot suggested an outlier with a problematic standardised residual result (-3.26, Appendix M). Bootstrapping was used to control for the potential influence on normality; however, the lack of difference in the confidence intervals between the bootstrapped and original models suggested that the outlier did not influence the model (Field, 2018).

Results

Descriptive Statistics to Assess Comparability of FS and No-FS

Groups were compared to assess similarity across demographic categories (Table 4). No significant differences were found between FS and No-FS; therefore, samples were considered to be similar enough to allow comparison, and no potential confounding variables were identified for the regression analysis.

Table 4

Demographic characteristics for considering comparability between groups (n = 73)

	No-FS (n = 35)	**FS (n = 38)**	**Between-group differences**
Age	M = 43.54, SD = 11.528	M = 42, SD = 11.919	U = 615, *p* = .581
Gender	Female = 33 Male = 1 Other = 1 Missing = 1	Female = 33 Male = 4	X^2 = 3.68, *p* = .30
Ethnicity	Ashkenazi = 1 Australian = 1 British = 3 English = 1 Mennonite = 1 Scottish = 1 White = 27	Australian = 1 British = 1 European = 1 White = 35	*p* = .418
Country of Residence	Australia = 3 Canada = 1	Australia = 5 Canada = 2	*p* = .882

UK = 24	Israel = 1
USA = 6	New Zealand = 1
Missing = 1	UK = 22
	USA = 7

Between-groups differences in ACEs, depression, anxiety, and stress

Mean scores across all measures were higher for FS than No-FS (Table 5). Means scores across all schema subscales were higher for FS than No-FS except for 'Failure to Achieve', 'Entitlement/Superiority', and 'Admiration/Recognition-Seeking' (Table 6).

An Independent t-test was conducted to compare depression between groups, as this variable met parametric assumptions.

Depression scores for the 38 FS (M = 17.84, SD = 12.59) were not significantly higher than for the 35 No-FS (M = 16.46, SD = 10.27), $t(71) = -.513$, $p = .609$.

Mann-Whitney U tests were conducted for comparisons of ACEs, anxiety, and stress, as these variables violated parametric assumptions of normality. Medians are reported (Field, 2018).

ACEs scores for FS (Md = 5, n = 38) were significantly higher than No-FS (Md = 2, n = 35), $U = 481.00$, $p = .041$.

Anxiety scores for FS (Md = 15, n = 38) were not significantly higher than No-FS (Md = 15, n = 35), $U = 599.50$, $p = .468$.

Stress scores for FS (Md = 19, n = 38) were not significantly higher than No-FS (Md = 20, n = 35), $U = 664.00$, $p = .991$.

Table 5

Comparison of group means (SD) for ACEs, depression, anxiety, stress, functional impairment, and total schema score (n = 73)

	No-FS (n = 35)	**FS (n = 38)**
ACEs (ACE-Q)	3.43 (3.17)	4.76 (2.64)
Depression (DASS-21)	16.46 (10.27)	17.84 (12.56)
Anxiety (DASS-21)	14.97 (8.14)	17.84 (10.87)

Stress (DASS-21)	20.63 (9.78)	21.32 (11.10)
Functional Impairment (WSAS)	26.29 (10.63)	28.24 (6.40)
Total YSQ score (YSQ-S3)	262.09 (73.03)	281.87 (103.80)

Table 6

Comparison of means (SD), and number of elevated scores for schema subscales (n = 73)

	No-FS (n = 35)		**FS (n = 38)**	
	Mean (SD)	**Elevated scores**	**Mean (SD)**	**Elevated scores**
Emotional Deprivation	12.29 (6.85)	7	13.32 (8.36)	10
Abandonment	13.80 (6.91)	7	15.26 (8.44)	12
Mistrust	15.60 (7.13)	12	16.45 (7.21)	14
Social Isolation/Alienation	18.03 (6.99)	14	19.16 (7.49)	21
Defectiveness/Unlovability	13.63 (6.83)	9	14.50 (8.14)	12
Failure to Achieve	15.37 (6.46)	10	15.05 (8.09)	13
Practical Incompetence/Dependence	13.69 (4.08)	2	14.84 (5.88)	10
Vulnerability to Harm or Illness	14.91 (6.53)	9	15.95 (6.93)	10
Enmeshment	9.71 (4.84)	2	11.55 (6.72)	8
Subjugation	13.80 (5.36)	5	16.16 (7.49)	13
Self-Sacrifice	19.06 (6.78)	16	21.11 (6.09)	22
Emotional Inhibition	15.11 (6.00)	7	15.26 (7.72)	10
Unrelenting Standards	17.40 (6.38)	12	18.89 (7.19)	17
Entitlement/Superiority	12.31 (3.99)	2	12.24 (5.64)	4
Insufficient Self-Control/Self-Discipline	16.46 (4.79)	10	17.00 (8.08)	16
Admiration/Recognition-Seeking	12.89 (6.36)	6	12.47 (5.74)	6
Pessimism/Worry	15.63 (6.42)	11	17.66 (8.05)	18
Self-Punitiveness	12.40 (5.48)	3	15.00 (7.70)	9

Between-group differences in number of elevated and non-elevated schemas

A chi-square test of independence was performed to examine the relationship between group and the presence of schemas within the clinically elevated range. Results indicated a difference between the groups in the number of schemas in the elevated range. This association was significant, $X^2(1, N = 73) = 16.36$, $p < .001$. The phi coefficient, $\phi = -.11$ suggests a small negative effect. Observed counts are shown in Table 7.

Table 7

Observed counts for elevated schemas for No-FS (n = 35) and FS (n = 38).

Group	Elevated schemas	Non-elevated schemas
No functional seizures (No-FS)	144	486
Functional seizures (FS)	225	459

Correlations

Correlations were considered for the variables in the regression analysis predicting the number of functional symptoms. The analysis included ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as predictor variables. Correlations between these variables are presented in Table 8.

A significant weak positive correlation was found between the number of FND symptoms, anxiety (r = .23, $p < .05$), and functional impairment (r = .27, $p < .05$), indicating that a greater number of symptoms is associated with higher levels of anxiety and functional impairment. A significant weak positive correlation was found between ACEs, anxiety (r = .29, $p < .05$), and the number of elevated schemas (r = .30, $p < .01$), suggesting that a higher number of ACEs is associated with higher levels of anxiety and a greater number of elevated schemas. A significant moderate positive correlation was found between depression, anxiety (r = .59, $p < .01$), and functional impairment (r = .42, $p < .01$). A significant strong positive correlation was found between depression, stress (r =.72, $p < .01$), and number of elevated schemas (r = .60, $p < .01$). These correlations suggest that higher levels of depression are associated with higher levels of anxiety, functional impairment, stress, and number of elevated schemas. A significant strong positive correlation was found

between anxiety and stress (r = .73, $p < .01$). A significant weak positive correlation was found between anxiety and functional impairment (r = .27, $p < .05$). A significant moderate positive correlation was found between anxiety and number of elevated schemas (r = .59, $p < .01$). These correlations indicate that greater anxiety is associated with greater stress, functional impairment, and number of elevated schemas. A significant strong positive correlation was found between stress and number of elevated schemas (r = .61, $p < .01$), suggesting a higher level of stress is associated with a greater number of elevated schemas. A significant weak positive correlation was found between functional impairment and number of elevated schemas (r = .25, $p < .05$), indicating that a higher level of functional impairment is associated with a higher number of elevated schemas.

Table 8

Pearson's r correlations for the study variables (n = 73)

Variable	1	2	3	4	5	6	7
1. Number of symptoms	-						
2. ACEs (ACE-Q)	.13	-					
3. Depression (DASS-21)	.03	.15	-				
4. Anxiety (DASS-21)	.23*	.29*	.59**	-			
5. Stress (DASS-21)	.12	.17	.72**	.73**	-		
6. Functional Impairment (WSAS)	.27*	.10	.42**	.27*	.16	-	
7. Number of elevated schemas (YSQ-S3)	.14	.30**	.60**	.59**	.61**	.25*	-

Note. *$p < .05$ (two-tailed); **$p < .01$ (two-tailed).

Poisson regression predicting number of functional symptoms

The Poisson regression analysis assessed whether the number of functional symptoms would be predicted by ACEs, depression, anxiety, stress, functional impairment, and the number of elevated schemas. Predictor variables were entered into the model simultaneously using the enter method.

Regression output is summarised in Table 9. The overall regression model was not statistically significant, $\chi^2(6) = 11.33$, $p = .08$, suggesting that the model does not explain a significant proportion of the variance in the number of symptoms.

Despite the lack of overall significance, functional impairment significantly predicted the number of symptoms, β = .01, SE = .01, $p = .02$. The incidence rate ratio (IRR: 1.014) indicated that for each one-point increase in functional impairment, the number of symptoms increased by 1.4%. Depression was marginally significant, β = -.01, SE = .01, $p = .05$. The IRR (.998) indicated that for every one-point increase in depression, there was a 1% decrease in the number of symptoms. However, ACEs (β = .01, SE = .02, $p = .70$), anxiety β = .01, SE = .01, $p = .24$), stress (β = .01, SE = .01, $p = .52$), and number of elevated schemas (β = .003, SE = .01, $p = .78$) did not significantly contribute to the model.

Table 9

Poisson regression analysis of ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as predictors of number of FND symptoms (n = 73)

	B	SE	Wald χ^2	Sig	95% CI	
					Lower	Upper
Intercept	2.01	.18	121.31	<.001	5.25	10.72
ACEs (ACE-Q)	.01	.02	.15	.70	.98	1.04
Depression (DASS-21)	-.01	.01	3.79	.05	.98	1.00
Anxiety (DASS-21)	.01	.01	1.40	.24	1.00	1.02
Stress (DASS-21)	.01	.01	.42	.52	.99	1.02
Functional Impairment (WSAS)	.01	.01	5.85	.02	1.00	1.03
Number of elevated schemas (YSQ-S3)	.003	.01	.08	.78	.98	1.03

Note. Unstandardised coefficient, standard error, Wald chi-square coefficient, significance values, and confidence intervals are presented.

Post-hoc sensitivity analyses predicting number of functional symptoms

Post-hoc sensitivity analyses were conducted to assess the robustness of the findings. Due to concerns about overdispersion, a Negative Binomial regression analysis was run (Appendix L). The overall model remained non-statistically significant, $\chi^2(6) = 10.18$, $p = .12$. Functional impairment remained a significant predictor of the number of symptoms, β = .02, SE = .01, $p = .02$, with an IRR of 1.016, and depression remained marginally significant, β = -.01, SE = .01, $p = .07$, with an IRR of .987.

Histogram inspection indicated the number of symptoms to be approximately normally distributed; therefore, a multiple linear regression analysis was conducted. Due to concerns about normality of the residuals, bootstrapping was used. Similar confidence intervals between the original and bootstrapped models suggested that the original model was robust to violations (Appendix M). The significance of the model was consistent with the count models, $F(6,66) = 2.15$, $p = .06$. The R-squared value indicated that only 16% of the variance was explained by the predictors, with an adjusted R-squared of 9%, further suggesting that the model's explanatory power is limited. Depression (β = -.14, p = .04) and functional impairment (β = .16, p = .01) were significant predictors of the number of symptoms.

Finally, the number of symptoms was weighted according to the symptoms' frequency within the dataset, and a multiple linear regression was performed on the weighted values (Appendix N). The significance of the model was consistent with the other analyses, $F(6,66) = 2.04$, $p = .07$. The R-squared value indicated that only 16% of the variance was explained by the predictors, with an adjusted R-squared of 8%. Functional impairment remained a significant predictor (β = 3.31, p = .03), and depression remained marginally significant (β = -2.84, p = .09).

These sensitivity analyses support the stability of the original Poisson regression results.

Discussion

This study explored the occurrence of EMS and the relationship between psychological factors in different types of FND. It examined differences in measures of ACEs, depression, anxiety, stress, and EMS between FS and No-FS. Further analysis assessed whether ACEs, depression, anxiety, stress, functional impairment, or the number of elevated schemas predicted the number of FND symptoms.

The first hypothesis was met as individuals with FS endorsed a significantly greater number of ACEs. This aligns with previous research findings showing elevated rates of

adverse experiences in FS (Ludwig et al., 2018), compared with FMD (Driver-Dunkley et al., 2011; Stone et al., 2004), and further supports that the prevalence of trauma may vary depending on FND subtype.

The second hypothesis was also met. A chi-squared analysis revealed a significant association between group and the presence of schemas in the elevated range, with observed counts indicating that the number of elevated schemas was higher for FS (225) than for No-FS (144). EMS purportedly develop from traumatic experiences during childhood (Young et al., 2003), and research shows that individuals who have experienced interpersonal trauma demonstrate elevated EMS scores across all schema subscales compared with non-clinical controls (Karatzias et al., 2016). This study showed a significant correlation between ACEs and the number of elevated schemas. Therefore, the higher number of elevated schemas in FS may be related to a higher prevalence of trauma in FS compared to other FND subtypes (Stone et al., 2004). However, as the small effect size indicated that this association was weak, the results should be interpreted in the context of a more limited clinical significance.

Descriptive analysis showed that the mean total score on the YSQ-S3 was higher for FS, and mean scores were higher for FS on 15/18 schema subscales, which may again reflect differences in ACEs. Correlations between the number of elevated schemas and ACEs, depression, anxiety, and stress indicate an association between EMS and mental health difficulties. This may suggest that EMS are associated with the development of mental health difficulties rather than FND, and future predictive models may demonstrate that mental health difficulties mediate the role of schemas in FND. There may also be other relevant factors influencing the relationship between schemas and FND, such as personality pathology, that have not been investigated in this study.

When examining the mean scores for each schema, social isolation/alienation (SI/A: 18.03) and self-sacrifice (SS: 19.06) had the highest mean scores for No-FS, whilst mean scores were highest for SI/A (19.16), unrelenting standards (US: 18.89), and SS (21.11) for FS. These findings are consistent with the available literature. Stroink et al. (2022) found that FND patients only scored within the clinically meaningful range for SS, with US scoring second highest. Similarly, Newson (2019) found that for FS, SS and US scored within the elevated range, and for FMD, SS scored within the elevated range, with US scoring close to the clinical cut-off. Taken together, these findings suggest that SS and US schemas may play a specific role in FND and that this may be differentially implicated in different FND subtypes. The association between FND and SS, and US may be explained by several possible factors. Research indicates higher levels of fearful attachment, characterised by

high attachment anxiety and avoidance, in people with FND (Holman et al., 2008; Williams et al., 2019). Fearful attachment is often associated with experiences of affectionless and critical caregivers, and research indicates that high attachment anxiety often results in self-sacrifice by prioritising the needs of others over the self, and high attachment avoidance may result in an emphasis on achievements in non-interpersonal domains (Karantzas et al., 2023). US typically present as perfectionism (Young, 1999). Research suggests a high prevalence of perfectionism in FND (Mehanna et al., 2021), with higher levels of neuroticism and conscientiousness found in FND patients (Ekanayake et al., 2017). Conscientiousness is associated with self-oriented perfectionism, whilst neuroticism is associated with socially-oriented perfectionism (Stoeber et al., 2009), and both are associated with self-sacrificing individuals (Flett et al, 2007). Over time, SS and US lead to energy depletion from overdoing and over-giving, leading to chronic stress and fatigue, and potentially contributing to the maintenance of FND (Menne, 2024). The current study makes a novel contribution to the research field, suggesting that the SI/A schema may also play a role in FND. However, the directionality of this relationship is unclear. Many people with FND experience isolation (Foley et al., 2024), which may result in them scoring highly on this schema, although they may not have early experience of alienation.

The third hypothesis was partially met, with mean scores for depression, anxiety, and stress all non-significantly higher for individuals with FS. Whilst it was hypothesised that scores would be significantly higher for FS, they were representative of moderate to severe values on all subscales for both groups. For depression and stress, mean scores for both groups were in the moderate range. For anxiety, mean scores were at the top of the moderate range for No-FS and the severe range for FS. Moderate range scores for anxiety and depression have been reported in studies of FND (de Vroege et al., 2021; Apazoglau et al., 2017), and Huepe-Artigas et al. (2021) found non-significantly higher rates of anxiety and depression in FS compared with FMD, similar to findings in this study. It is possible that underlying biological and psychosocial mechanisms that predispose individuals to high levels of psychological distress, such as the accumulation of stressors and insecure attachment, may also contribute to the development of FND (Keynejad et al., 2019; Patron et al., 2022). The relationship between FND and mental health difficulties is likely bidirectional; for some individuals, premorbid mental health difficulties may contribute to FND development, for others, the impact of living with FND may lead to psychological distress (Rezaei & Stanley, 2025), or both.

Overall, these findings provide some supporting evidence that FND subtypes may exhibit variability in the precise nature of their psychological characteristics.

The fourth hypothesis was that a higher number of elevated EMS, a greater number of ACEs, and higher anxiety, depression, stress, and functional impairment scores would predict an increased number of FND symptoms. Across all regression analyses, the overall model was not statistically significant. However, functional impairment and depression consistently emerged as significant or marginally significant predictors, suggesting that these associations are likely robust. The lack of model significance may reflect several factors. It is possible that there is no meaningful relationship between the predictors and the outcome variable, or that these associations are weak, therefore reducing the models' overall predictive power. There could be multicollinearity between the predictors, which would weaken the power of the model (Kim, 2019). Although multicollinearity checks appear to indicate no concerns, these may not have fully captured multicollinearity involving non-linear relationships or complex relationships between multiple variables (Vatcheva et al., 2016). Consistency across models suggests that important predictor variables may be missing from the model, rather than indicating an issue with functional form misspecification.

Limitations

A key limitation of this study was the quality of the number of symptoms data. While complexity, indicated by the number of distinct symptoms, is a useful proxy, it is not a perfect indicator of symptom severity, and the use of this data may have limited the models' effectiveness in detecting significant effects. Additionally, participants may have found it difficult to differentiate between different symptoms, which may have impacted reliability. Some research has found discrepancies between FND patients' self-reported perception of symptoms and objective measures, with patients significantly overestimating symptom frequency and catastrophising their experiences (Parees et al., 2012; Robson et al., 2012). Considering these challenges, some studies have adopted standardised measures of symptom severity, including the Somatoform Dissociation Questionnaire (SDQ-20: Nijenhuis et al., 1996) and the Patient Health Questionnaire-15 (PHQ-15: Kroenke et al., 2002). However, FND-specific outcome measures able to capture the full spectrum of symptoms are missing, and it is unclear whether a single measure could appropriately assess all relevant domains given the heterogeneity (Pick et al., 2020). Therefore, the difficulties associated with collecting data on symptom complexity in this study reflect wider challenges in the measurement of FND outcomes.

A further limitation is that it was not possible to objectively validate the diagnosis of each participant beyond self-report. Participants were asked to report the profession of the person who provided their diagnosis in an attempt to improve reliability. Self-reporting also affected the interpretation of questions around diagnosis and FND symptoms, resulting in

the researcher manually grouping participants to avoid invalidating the results of group comparisons. Furthermore, this study is reliant on self-report measures to assess psychological constructs. Research suggests that some people with FND may have poor interoceptive awareness (Ricciardi et al., 2016) and may under-report psychological symptoms (Dimaro et al., 2014). This may have impacted the accuracy of the constructs being assessed.

As the study used convenience sampling, the results should be interpreted with caution. The study sample predominantly identified as female, which is consistent with FND prevalence rates reported in the literature as a female-to-male ratio of approximately 3:1 (Finkelstein et al., 2024). However, this study's sample had a much higher proportion of participants identifying as female than reported rates (90.4%). Moreover, the majority of the sample identified as White. This impacts the representativeness of the sample and how well results can be generalised to wider FND populations. Additionally, using an open ethnicity question led to some confusion and variability in response quality, which somewhat limits the usefulness of this data.

Clinical Implications

Two of the four study hypotheses were not supported; therefore, considerations of clinical implications are somewhat limited. Nevertheless, findings of high levels of depression, anxiety, and stress add to the evidence that individuals with FND commonly experience psychological difficulties. The presence of co-occurring psychological conditions has been shown to predict poorer outcomes in FND patients (Gelauff & Stone, 2016), suggesting an increased need for psychological intervention in this population. Additionally, results support evidence that psychological factors, particularly early trauma, may be differentially implicated in different types of FND.

To the author's best knowledge, no previous studies have directly analysed differences in the occurrence of EMS in different FND subtypes; therefore, this study makes a significant contribution to this research area. Results indicate there may be differences in the occurrence of EMS between FS and No-FS, and add to emerging evidence that particular schemas, such as SS, may play a specific role in FND. Cautiously, this suggests that clinicians working therapeutically with individuals with FND may benefit from assessing EMS and considering targeted intervention if scoring highly. Schema activation may result in chronic stress and fatigue that could contribute to maintaining FND. Therefore, understanding the EMS that are likely to feature in presentations of FND, and providing targeted intervention, could be beneficial in reducing functional symptoms. Correlations showed significant relationships between elevated schemas, ACEs, and psychological

factors, which may suggest that EMS could be more associated with trauma or mental health difficulties as opposed to FND, wherein EMS influence the development of psychological distress, which in turn influences the development of FND. This also tentatively suggests that FND patients may benefit from psychological interventions targeting trauma or mental health difficulties. Rutten et al. (2025) report that people with FND most frequently hope that treatment will result in improvements in mental health, illustrating the importance of evolving understanding of the role of psychological factors in the development and maintenance of FND, which could help with optimising individualised treatment.

There is a conception that although the underlying mechanisms of FND are not fully understood, different FND subtypes may have distinct yet overlapping pathophysiological processes (Hallett et al., 2022). In the current study, scores were higher across psychological measures for FS; however, the lack of a significant difference for most suggests that FS and FND without FS cannot easily be distinguished by the psychological factors assessed. This adds to evidence that there is a large overlap in FND phenotypes and their possible underlying mechanisms (Hallett et al., 2022) and therefore supports thinking proactively about interventions for all FND populations and tailoring treatment to individual needs, given current limited provisions.

Future research

As the current study was cross-sectional, causal relationships could not be identified. Therefore, longitudinal research of study variables for different functional symptoms would be valuable.

This study adds to the emerging evidence around EMS in FND; however, further research is needed to explore the role of EMS in FND and differences between symptom presentations. The SS, US, and SI/A schemas should be examined more specifically, as these have been reported more frequently in FND populations. It would also be beneficial to explore potentially mediating factors in the relationship between EMS and FND, such as mental health difficulties, and further explore factors influencing the development of EMS in FND subtypes, for example, perceived parenting and attachment.

This study's regression models were not significant. Future models examining a more targeted subset of predictors, such as depression and functional impairment, which appeared as key variables, may improve model specification and overall significance. Additionally, examination of other potentially relevant predictors not captured in this study would be valuable. Previous research into predictors of distinct FND symptoms suggests that PTSD symptoms may be worth further investigation. It would also be valuable to investigate factors predicting FND subtype. Improved methods for measuring FND

complexity and severity may improve the accuracy and reliability of reporting and analysis in future models. Furthermore, ACEs, depression, anxiety, stress, and the number of elevated schemas were not found to be significant predictors of the number of FND symptoms. It may be useful for future studies to consider the potential predictive role of these study variables for other outcomes in FND populations. Outcomes suggested as important by people with FND include interpersonal difficulties in adulthood, independence, and QoL (Newson, 2019; Rutten et al., 2025).

Overall, it is recommended that future research recruit larger samples to improve representativeness and increase the statistical power of models to find significant effects.

Conclusion

This study adds evidence to research into the occurrence and role of EMS in FND and provides novel findings on differences between functional symptoms. Associations were found between ACEs, depression, anxiety, stress, and the number of clinically elevated schemas, for both FS and No-FS. Mean differences on measures of depression, anxiety, and stress were not statistically significant between groups, suggesting they are potentially important in both populations. Regression models predicting the number of FND symptoms were consistently not significant, although functional impairment and depression appear to be potentially meaningful predictors, suggesting that future models focusing on these key factors, as well as considerations of additional relevant predictors, would be beneficial.

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Appendices

Appendix A

Author guidelines for Epilepsy & Behavior

To meet university requirements, the final paper will be edited to meet the journal guidelines after submission. Full author guidelines can be accessed here:

https://www.sciencedirect.com/journal/epilepsy-and-behavior/publish/guide-for-authors

Appendix B

Ethical approval from the University of Staffordshire

School of Health, Education, Policing and Sciences

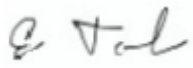
ETHICAL APPROVAL FEEDBACK

Researcher name:	Grace Sunerton
Title of Study:	Associations Between Maladaptive Schemas, Early Trauma, Depression, Anxiety, and Stress in Functional Neurological Disorders: An Initial Study
Status of approval:	Approved

Thank you for addressing the committee's comments. Your research proposal has now been approved by the Ethics Panel and you may commence the implementation phase of your study. You should note that any divergence from the approved procedures and research method will invalidate any insurance and liability cover from the University. You should, therefore, notify the Panel of any significant divergence from this approved proposal. This approval is only valid for as long as you are registered as a student at the University.

When your study is complete, please send the ethics committee an end of study report. A template can be found on the ethics BlackBoard site.

Signed: **Date: 13.05.2024**



Dr. Edward Tolhurst

Ethics Co-ordinator - HEPS

Appendix C

Research Advertisement

Appendix D

Participant Information Sheet

Experiences of Childhood, Thinking Patterns and Emotional Distress in Functional Neurological Disorders

Participant Information Sheet

(Version 3: 09/05/2024)

Invitation

I would like to invite you to participate in this research project, which forms part of my doctoral research. Before you decide if you want to take part, it is important that to understand why this research is being done and what taking part will involve. Please take time to read this information and discuss it with others if you would like. Please contact me if anything is not clear or if you would like more information about the study.

What is the purpose of the study?

We want to explore the experiences of people with Functional Neurological Disorder (FND) and/or functional seizures (otherwise known as Non-epileptic Attack Disorder, NEAD). We want to gain a better understanding of the role of psychological factors in symptom presentation, which could lead to improvements in psychological care for people affected in the future. As an individual with one of these diagnoses, we would greatly value your participation.

Why have I been invited to take part?

We aim to recruit adults with a diagnosis of Functional Neurological Disorder and/or functional seizures (NEAD). We are recruiting through FND charities and Facebook support groups, and hope to recruit people from a range of different backgrounds. This survey is only intended to be completed by people aged over 18 years; therefore, if you are younger, please do not continue.

What will happen if I take part?

The study involves completing an online survey, which includes 4 questionnaires and some background questions about age, gender, ethnicity, country of residency, and symptoms related to FND. The questionnaires will also ask about mental health, childhood experiences, and daily functioning.

It should take a total time of between 20 minutes and one hour to complete all the questionnaires. They will cover topics including experiences of depression, anxiety, and stress, emotional and thinking patterns, stressful early life experiences, and quality of life.

Do I have to take part?

No. Participation is completely voluntary, and you should only take part if you want to. Choosing not to take part will not disadvantage you in any way. Once you have read the information sheet, please contact me if you have any questions that will help you make a decision about taking part. If you decide to take part, you will be asked to sign an online consent form.

What are the possible risks of taking part?

There are no direct risks to taking part in the study. We recommend sitting comfortably whilst completing the questionnaires and completing them somewhere private where you can be alone, as they contain personal and sensitive information.

We are aware that answering questions about mental and physical health can be distressing. If you become distressed at any point, it is recommended that you take a break and consider not continuing with the questions. You will be able to pause and reopen the survey for up to one week, but it is preferable if you could try to complete the questions within a day.

If reading this information or taking part in the survey leads to distressing feelings, please consider speaking to someone close to you. If further support is needed, please think about contacting the below supportive services:

Samaritans – the emotional support charity. They offer a number of ways to contact them, including via telephone on 116 123, email, online chat, letter, face-to-face, and a self-help app https://www.samaritans.org/how-we-can-help/contact-samaritan/. Their website also includes a contact list of organisations offering specialist advice and support: https://www.samaritans.org/how-we-can-help/if-youre-having-difficult-time/other-sources-help/

Mind – the mental health charity. Their website includes a range of mental health resources, including the “Get help now” section, which includes some helpful videos teaching calming techniques such as breathing skills: https://www.mind.org.uk/need-urgent-help/. They also have supportive helplines: www.mind.org.uk.

The ACT Mindfully website includes a range of resources, including videos, for helping when distressed: www.actmindfully.com.au

In the event of a medical emergency, please contact NHS 111, or 999.

What are the possible benefits of taking part?

There are not expected to be any direct individual benefits to taking part beyond contributing to a better understanding of FND, which could help lead to improvements in the future clinical care of service users.

Data handling and confidentiality

We will need to use information from you for this research project, including the answers you provide to the questions, if you choose to take part, although they will not be linked to any identifiable information. If you contact the researcher via telephone or email, they will have access to these contact details, which will be saved securely until the end of the study. People who do not need to know who you are will not have access to your name or contact details.

To keep your information anonymous, your data will have a code number. When you complete the survey, a randomised number will be generated and given to you. You will not be asked to provide your name or contact details.

We will keep all information about you safe and secure.

Once the study is finished, we will keep some of the data so we can check the results. The reports will be written so that no-one can work out that you took part in the study.

For the research to be reliable, your records need to be managed in specific ways. This means that we won't be able to let you see or change the data we hold about you.

The analysed data will be written up into an academic paper, which is intended to be submitted for publication. Anonymised data and results of the study may be used for other purposes such as teaching or training. In accordance with the University of Staffordshire's research policy, data will be archived for potential future review for up to 10 years. All data will be stored exclusively on the University of Staffordshire's secure OneDrive system. If you have any questions or concerns about confidentiality, please contact me using the contact details below.

Data Protection Statement

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

The data controller for this project will be the University of Staffordshire. The University will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under GDPR is a 'task in the public interest' You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the University of Staffordshire's Data Protection Officer. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk

What if I change my mind about taking part?

We would encourage you to monitor your levels of distress when completing the questionnaires and to take a break or to stop the survey if you feel that distress is increasing

too much. A ‘withdraw from study’ button will be provided on each page of the questionnaires which you can use if you wish to stop the survey. You are also free to withdraw from the study without giving a reason, by contacting the main researcher by email or telephone up until two weeks after completing the survey. You will be asked to provide the unique ID number given to you when you completed the survey.

Withdrawing from the study will not affect you in any way. If you choose to withdraw from the study, we will not retain any information that you have provided as a part of this study.

What will happen to the results of the study?

Anonymised study results may be shared in relevant forums such as conferences. The intention is to submit the results for publication in a peer-reviewed journal with potential use for teaching or training purposes. A summary of the research will be provided to the recruiting charities and can be requested by anyone participating. If you are happy to share your email address with me, you can contact me directly to request a copy of this summary after completing the survey.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact the main researcher using the following contact details:

Main Researcher: Grace Sunerton (Trainee Clinical Psychologist)

Work email: g042176m@student.staffs.ac.uk

Work telephone: 07442076589

What if I have further questions, or if something goes wrong?

You are free to withdraw from this study if you are experiencing undue distress and we would encourage you to do so if this is the case. However, if you feel that this study has contributed significantly to distress or if you wish to make a complaint about the conduct of the study you can contact the study supervisor or the Chair of the University of Staffordshire Ethics Committee for further advice and information:

Study supervisor: Dr Craig Shealy

Email: craig.shealy@staffs.ac.uk

Chair of the University of Staffordshire Ethics Committee: Professor Nachiappan Chockalingam

Email: N.Chockalingam@staffs.ac.uk

Thank you for reading this information sheet and for considering taking part in this research.

If you would like to be involved, please click “next” and complete the consent form provided. The survey will begin on the page after this.

Appendix E

Consent Form

Experiences of Childhood, Thinking Patterns and Emotional Distress in Functional Neurological Disorders

Consent Form

(Version 2: 09/05/2023)

Please tick box

1. I confirm that I have read the information sheet dated 09/05/2024 (version 3) for the above study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw up until two weeks after completing the questionnaires without giving any reason, without my legal rights being affected. ☐

3. I understand that my answers will be anonymously grouped with those of other participants. The data will be shared with research supervisors and potentially other parties (e.g. external examiners, university audit). ☐

I agree to the above and to take part in the above study. ☐

Thank you for providing your consent.

Please now click next to proceed to the questions.

Appendix F

Demographic Information Questionnaire and FND Questionnaire/symptom checklist

Demographic Information Questionnaire

1. What is your age?
2. What is your gender?
3. What is your ethnicity?
4. What is your current country of residence?

Functional Neurological Disorder Questionnaire/Symptom Checklist

1. What is your diagnosis? If you have a diagnosis of FND, do you have any functional seizures? If you do, tick the 'functional seizures' box. If you don't, but have a diagnosis of FND, tick the 'functional neurological disorder' box.

Functional seizures (NEAD) ☐ Functional Neurological Disorder ☐

2. What is the profession of the person who provided your diagnosis?

3. Please tick which of these symptoms you currently experience. Please only tick the symptoms if they have been diagnosed as functional:

   Limb weakness or paralysis ☐
   Functional seizures ☐
   Tremors ☐
   Muscle spasm (dystonia) ☐
   Tics ☐
   Gait disorder (problems walking) or balance problems ☐
   Facial spasm ☐
   Jerks and twitches ☐
   Functional drop attacks (falling to the ground suddenly without losing consciousness) ☐
   Sensory changes (sight, sound e.g. deafness, touch, taste, smell) ☐
   Cognitive changes (e.g. memory, concentration, brain fog) ☐
   Bladder and bowel changes (e.g. overactive bladder, IBS) ☐
   Headaches or migraines ☐
   Chronic pain (e.g. fibromyalgia, complex regional pain syndrome) ☐
   Sleep disturbances (e.g. insomnia, hypersomnia) ☐

Persistent fatigue ☐

Dissociative symptoms (e.g. feeling spaced out, feeling disconnected from your body or the world around you, feeling like you are floating) ☐

Visual symptoms (e.g. blurred vision, double vision, sensitivity to light, blindness) ☐

Persistent Postural Perceptual Dizziness (constant dizziness) ☐

Speech or swallowing difficulties ☐

Appendix G

Measures

Adverse Childhood Experiences Questionnaire (ACE-Q)

Response options: Yes (1), No (0)

1. Did a parent or other adult in the household often: Swear at you, insult you, put you down, or humiliate you? Or Act in a way that made you afraid that you might be physically hurt?
2. Did a parent or other adult in the household often: Push, grab, slap, or throw something at you? Or Ever hit you so hard that you had marks or were injured?
3. Did an adult or person at least 5 years older than you ever: Touch or fondle you or have you touch their body in a sexual way? Or Attempt or actually have oral, anal, or vaginal intercourse with you?
4. Did you often feet that: No one in your family loved you or thought you were important or special? Or Your family didn't look out for each other, feel close to each other, or support each other?
5. Did you often feel that: You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? Or Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?
6. Were your parents ever separated or divorced?
7. Were any of your parents or other adult caregivers: Often pushed, grabbed, slapped, or had something thrown at them? Or Sometimes or often kicked, bitten, hit with a fist, or hit with something hard? Or Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?
8. Did you live with anyone who was a problem drinker or alcoholic, or who used street drugs?
9. Was a household member depressed or mentally ill, or did a household member attempt suicide?
10. Did a household member go to prison?

Young's Schema Questionnaire - Short form, version 3 (YSQ-S3)

Response options: 1 (Completely untrue of me), 2 (Mostly untrue of me), 3 (Slightly more true than untrue), 4 (Moderately true of me), 5 (Mostly true of me), 6 (Described me perfectly)

1. I haven't had someone to nurture me, share him/herself with me, or care deeply about everything that happens to me.
2. I find myself clinging to people I'm close to because I'm afraid they'll leave me.
3. I feel that people will take advantage of me.
4. I don't fit it.
5. No man/woman I desire could love me once he or she saw my defects or flaws.
6. Almost nothing I do at work (or school) is as good as other people can do.
7. I do not feel capable of getting by on my own in everyday life.
8. I can't seem to escape the feeling that something bad is about to happen.
9. I have not been able to separate myself from my parent(s) the way other people my age seem to.
10. I think that if I do what I want, I'm only asking for trouble.

11. I'm the one who usually ends up taking care of the people I'm close to.
12. I am too self-conscious to show positive feelings to others (e.g., affection, showing I care).
13. I must be the best at most of what I do; I can't accept second best.
14. I have a lot of trouble accepting "no" for an answer when I want something from other people.
15. I can't seem to discipline myself to complete most routine or boring tasks.
16. Having money and knowing important people make me feel worthwhile.
17. Even when things seem to be going well, I feel that it is only temporary.
18. If I make a mistake, I deserve to be punished.
19. I don't have people to give me warmth, holding, and affection.
20. I need other people so much that I worry about losing them.
21. I feel that I cannot let my guard down in the presence of other people, or else they will intentionally hurt me.
22. I'm fundamentally different from other people.
23. No one I desire would want to stay close to me if he or she knew the real me.
24. I'm incompetent when it comes to achievement.
25. I think of myself as a dependent person when it comes to everyday functioning.
26. I feel that a disaster (natural, criminal, financial, or medical) could strike at any moment.
27. My parent(s) and I tend to be over-involved in each other's lives and problems.
28. I feel as if I have no choice but to give in to other people's wishes, or else they will retaliate, get angry, or reject me in some way.
29. I am a good person because I think of others more than myself.
30. I find it embarrassing to express my feelings to others.
31. I try to do my best; I can't settle for "good enough."
32. I'm special and shouldn't have to accept many of the restrictions or limitations placed on other people.
33. If I can't reach a goal, I become easily frustrated and give up.
34. Accomplishments are most valuable to me if other people notice them.
35. If something good happens, I worry that something bad is likely to follow.
36. If I don't try my hardest, I should expect to lose out.
37. I haven't felt that I am special to someone.
38. I worry that people I feel close to will leave me or abandon me.
39. It is only a matter of time before someone betrays me.
40. I don't belong; I'm a loner.
41. I'm unworthy of the love, attention, and respect of others.
42. Most other people are more capable than I am in areas of work and achievement.
43. I lack common sense.
44. I worry about being physically attacked by people.
45. It is very difficult for my parent(s) and me to keep intimate details from each other without feeling betrayed or guilty.
46. In relationships, I usually let the other person have the upper hand.
47. I'm so busy doing things for the people that I care about that I have little time for myself.
48. I find it hard to be free-spirited and spontaneous around other people.
49. I must meet all my responsibilities.
50. I hate to be constrained or kept from doing what I want.
51. I have a very difficult time sacrificing immediate gratification or pleasure to achieve a long-range goal.
52. Unless I get a lot of attention from others, I feel less important.

53. You can’t be too careful; something will almost always go wrong.
54. If I don’t do the job right, I should suffer the consequences.
55. I have not had someone who really listens to me, understands me, or is tuned into my true needs and feelings.
56. When someone I care for seems to be pulling away or withdrawing from me, I feel desperate.
57. I am quite suspicious of other people’s motives.
58. I feel alienated or cut off from other people.
59. I feel that I’m not lovable.
60. I’m not as talented as most people are at their work.
61. My judgment cannot be counted on in everyday situations.
62. I worry that I’ll lose all my money and become destitute or very poor.
63. I often feel as if my parent(s) are living through me – that I don’t have a life of my own.
64. I’ve always let others make choices for me, so I really don’t know what I want for myself.
65. I’ve always been the one who listens to everyone else’s problems.
66. I control myself so much that many people think I am unemotional or unfeeling.
67. I feel that there is constant pressure for me to achieve and get things done.
68. I feel that I shouldn’t have to follow the normal rules or conventions that other people do.
69. I can’t force myself to do things I don’t enjoy, even when I know it’s for my own good.
70. If I make remarks at a meeting, or am introduced in a social situation, it’s important for me to get recognition and admiration.
71. No matter how hard I work, I worry that I could be wiped out financially and lose almost everything.
72. It doesn’t matter why I make a mistake. When I do something wrong, I should pay the consequences.
73. I haven’t had a strong or wise person to give me sound advice or direction when I’m not sure what to do.
74. Sometimes I am so worried about people leaving me that I drive them away.
75. I’m usually on the lookout for people’s ulterior or hidden motives.
76. I always feel on the outside of groups.
77. I am too unacceptable in very basic ways to reveal myself to other people or to let them get to know me well.
78. I’m not as intelligent as most people when it comes to work (or school).
79. I don’t feel confident about my ability to solve everyday problems that come up.
80. I worry that I’m developing a serious illness, even though nothing serious has been diagnosed by a doctor.
81. I often feel I do not have a separate identity from my parent(s) or partner.
82. I have a lot of trouble demanding that my rights be respected and that my feelings be taken into account.
83. Other people see me as doing too much for others and not enough for myself.
84. People see me as uptight emotionally.
85. I can’t let myself off the hook easily or make excuses for my mistakes.
86. I feel that what I have to offer is of greater value than the contributions of others.
87. I have rarely been able to stick to my resolutions.
88. Lots of praise and compliments make me feel like a worthwhile person.
89. I worry that a wrong decision could lead to disaster.
90. I’m a bad person who deserves to be punished.

Depression Anxiety Stress Scales – Short Form (DASS-21)

Response options: 0 (Did not apply to me at all), 1 (Applied to me to some degree, some of the time), 2 (Applied to me to a considerable degree or a good part of time), 3 (Applied to me very much or most of the time)

1. I found it hard to wind down.
2. I was aware of dryness of my mouth.
3. I couldn't seem to experience any positive feeling at all.
4. I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion).
5. I found it difficult to work up the initiative to do things.
6. I tended to over-react to situations.
7. I experienced trembling (e.g. in the hands).
8. I felt that I was using a lot of nervous energy.
9. I was worried about situations in which I might panic and make a fool of myself.
10. I felt that I had nothing to look forward to.
11. I found myself getting agitated.
12. I found it difficult to relax.
13. I felt down-hearted and blue.
14. I was intolerant of anything that kept me from getting on with what I was doing.
15. I felt I was close to panic.
16. I was unable to become enthusiastic about anything.
17. I felt I wasn't worth much as a person.
18. I felt that I was rather touchy.
19. I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat).
20. I felt scared without any good reason.
21. I felt that life was meaningless.

Work and Social Adjustment Scale (WSAS)

Response scale: 0 (Not at all) to 8 (Very severely)

1. Because of my [FND], my ability to work is impaired. '0' means 'not at all impaired' and '8' means very severely impaired to the point I can't work.
2. Because of my [FND], my home management (cleaning, tidying, shopping, cooking, looking after home or children, paying bills) is impaired.
3. Because of my [FND], my social leisure activities (with other people e.g. parties, bars, clubs, outings, visits, dating, home entertainment) are impaired.
4. Because of my [FND], my private leisure activities (done alone, such as reading, gardening, collecting, sewing, walking alone) are impaired.
5. Because of my [FND], my ability to form and maintain close relationships with others, including those I live with, is impaired.

Appendix H

Participant Debrief Sheet

Experiences of Childhood, Thinking Patterns and Emotional Distress in Functional Neurological Disorders

Debriefing Form

(Version 2: 09/05/2024)

Thank you for taking part in this research. This study aims to explore the experiences of people with Functional Neurological Disorder (FND) and/or functional seizures (NEAD) to gain a better understanding of the role of psychological factors in symptom presentation. The intention is to publish the results in a peer-reviewed journal, with potential use for teaching or training purposes. It is hoped that this information could help to improve clinical care for people affected in the future.

Please read the information below to complete your participation.

- How can I contact the researcher if I have any further questions, or if I wish to withdraw my data once I have completed the online questionnaires?

Data can be withdrawn up to two weeks after completing the questionnaires. Please contact the researcher and provide them with your unique ID number.

Email: g042176m@student.staffs.ac.uk

Telephone: 07442076589

- Can I obtain a summary of the results of the research?

To obtain a summary of the results, please contact the researcher via email: g042176m@student.staffs.ac.uk

- What can I do if this research has raised personal issues or caused distress that I want to address?

Please consider talking to someone close to you. In addition, useful online resources for managing distress can be found at the following links:

Samaritans – the emotional support charity. They offer several ways to contact them, including via telephone on 116 123, email, online chat, letter, face-to-face, and a self-help

app https://www.samaritans.org/how-we-can-help/contact-samaritan/. Their website also includes a contact list of organisations offering specialist advice and support: https://www.samaritans.org/how-we-can-help/if-youre-having-difficult-time/other-sources-help/

Mind – the mental health charity. Their website includes a range of mental health resources, including the “Get help now” section, which includes some helpful videos teaching calming techniques such as breathing skills: https://www.mind.org.uk/need-urgent-help/. They also have supportive helplines: www.mind.org.uk.

The ACT Mindfully website includes a range of resources, including videos, for helping when distressed: www.actmindfully.com.au

For medical concerns, contact NHS 111, or 999 in the case of an emergency.

- Who should I contact if I have concerns about this research or the way in which it was conducted?

Professor Nachiappan Chockalingam

Chair of the University of Staffordshire Ethics Committee

University of Staffordshire

Email: N.Chockalingam@staffs.ac.uk

Appendix I

SPSS Output – Test of normality for study variables

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total ACE-Q Score	73	10	0	10	4.12	2.958	.164	.281	-1.178	.555
Total D Score	73	42	0	42	17.18	11.459	.447	.281	-.518	.555
Total A Score	73	42	0	42	16.47	9.698	.657	.281	-.388	.555
Total S Score	73	38	4	42	20.99	10.425	.366	.281	-.689	.555
Total WSAS Score	73	38	2	40	27.30	8.681	-.712	.281	.634	.555
Total Overall YSQ Score	73	405	107	512	272.38	90.304	.249	.281	-.130	.555
Valid N (listwise)	73									

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total ACE-Q Score	.121	73	.010	.934	73	<.001
Total D Score	.090	73	.200*	.955	73	.011
Total A Score	.122	73	.009	.939	73	.002
Total S Score	.113	73	.022	.959	73	.018
Total WSAS Score	.094	73	.179	.946	73	.004
Total Overall YSQ Score	.055	73	.200*	.980	73	.292

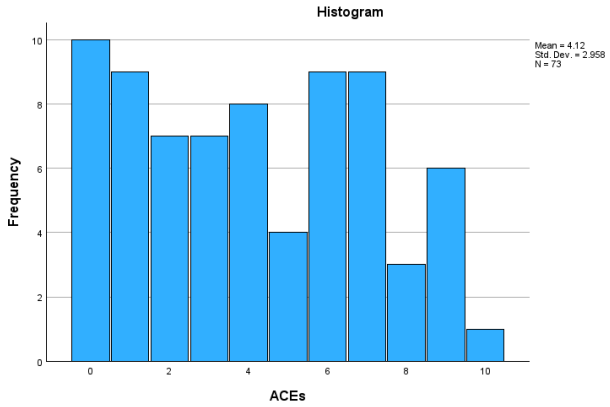
*. This is a lower bound of the true significance.

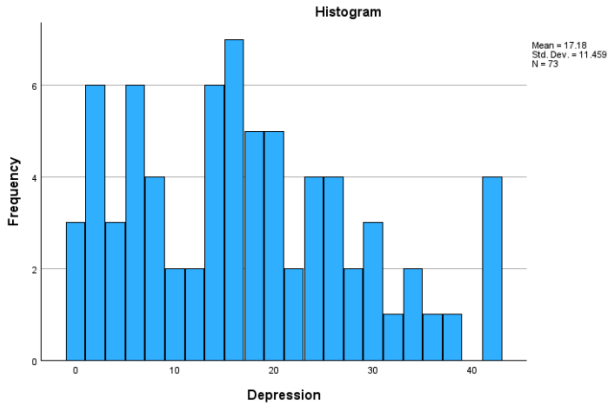
a. Lilliefors Significance Correction

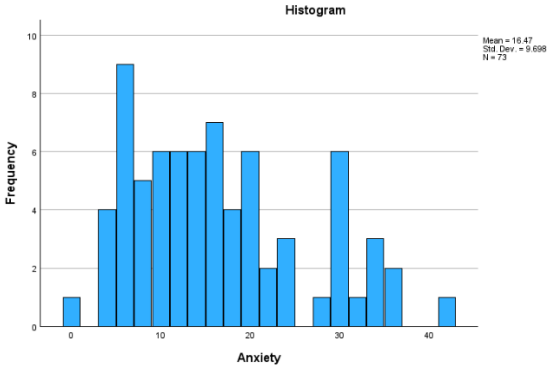
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
No. of symptoms	.092	73	.200*	.958	73	.016
No. of Elevated Schemas (<20)	.148	73	<.001	.892	73	<.001
No. of Non-Elevated Schemas	.148	73	<.001	.892	73	<.001

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction


Histogram
Mean = 4.12
Std. Dev. = 2.958
N = 73
Frequency
ACEs


Histogram
Mean = 17.18
Std. Dev. = 11.459
N = 73
Frequency
Depression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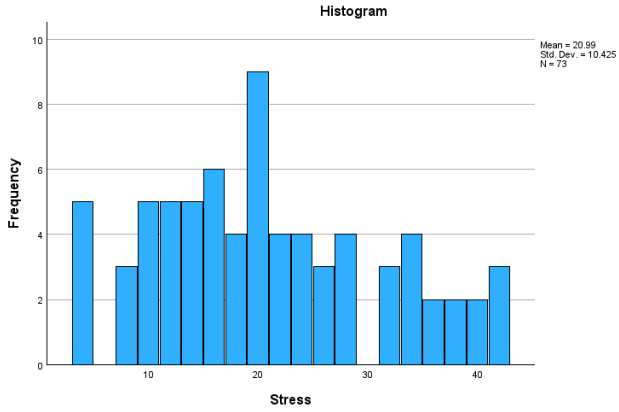
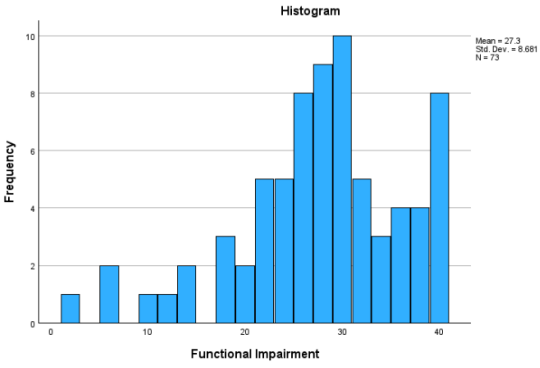
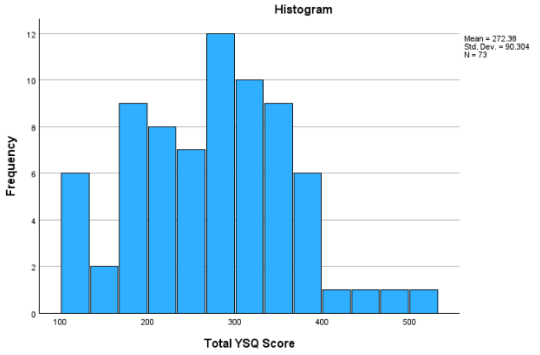
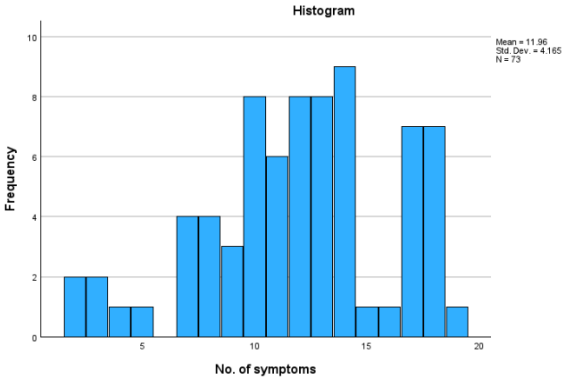
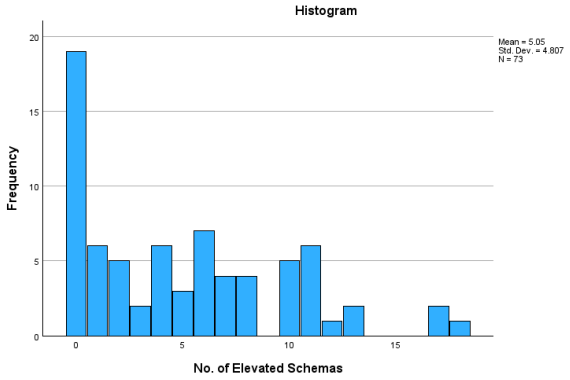
Mean = 16.47
Std. Dev. = 9.698
N = 73
Frequency
Anxiety

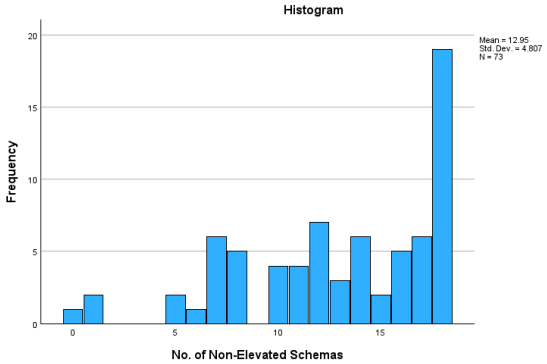

Histogram
Mean = 20.99
Std. Dev. = 10.425
N = 73
Frequency
Stress


Histogram
Mean = 27.3
Std. Dev. = 8.681
N = 73
Frequency
Functional Impairment


Histogram
Mean = 272.38
Std. Dev. = 90.304
N = 73
Frequency
Total YSQ Score


Histogram
Mean = 11.96
Std. Dev. = 4.165
N = 73
Frequency
No. of symptoms


Histogram
Mean = 5.05
Std. Dev. = 4.807
N = 73
Frequency
No. of Elevated Schemas


Histogram
Mean = 12.95
Std. Dev. = 4.807
N = 73
Frequency
No. of Non-Elevated Schemas

Appendix J

SPSS Output for between-group comparisons

T-test comparison of depression between No-FS and FS

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
Depression	Equal variances assumed	1.472	.229	-.513	71	.305	.609	-1.385	2.699	-6.766	3.996
	Equal variances not assumed			-.517	70.046	.303	.606	-1.385	2.676	-6.723	3.953

Mann-Whitney U comparison of ACEs, anxiety, and stress between No-FS and FS

Test Statistics[a]

	ACEs	Anxiety	Stress
Mann-Whitney U	481.000	599.500	664.000
Wilcoxon W	1111.000	1229.500	1294.000
Z	-2.044	-.726	-.011
Asymp. Sig. (2-tailed)	.041	.468	.991

a. Grouping Variable: Group

Chi-square test of independence between group and elevated schemas

Group * Elevated (Y/N) Crosstabulation

			Elevated (Y/N)		
			Yes	No	Total
Group	No functional seizures (No-FS)	Count	144	486	630
		Expected Count	176.9	453.1	630.0
	Functional seizures (FS)	Count	225	459	684
		Expected Count	192.1	491.9	684.0
Total		Count	369	945	1314
		Expected Count	369.0	945.0	1314.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	16.360[a]	1	<.001		
Continuity Correction[b]	15.867	1	<.001		
Likelihood Ratio	16.478	1	<.001		
Fisher's Exact Test				<.001	<.001
Linear-by-Linear Association	16.348	1	<.001		
N of Valid Cases	1314				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 176.92.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	-.112	<.001
	Cramer's V	.112	<.001
N of Valid Cases		1314	

Appendix K

SPSS Outputs Poisson regression model with number of FND symptoms as the dependent variable and ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as the predictors

Goodness of Fit[a]

	Value	df	Value/df
Deviance	101.638	66	1.540
Scaled Deviance	66.000	66	
Pearson Chi-Square	87.079	66	1.319
Scaled Pearson Chi-Square	56.546	66	
Log Likelihood[b,c]	-205.909		
Adjusted Log Likelihood[d]	-133.710		
Akaike's Information Criterion (AIC)	425.817		
Finite Sample Corrected AIC (AICC)	427.541		
Bayesian Information Criterion (BIC)	441.851		
Consistent AIC (CAIC)	448.851		

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Information criteria are in smaller-is-better form.

b. The full log likelihood function is displayed and used in computing information criteria.

c. The log likelihood is based on a scale parameter fixed at 1.

d. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
11.328	6	.079

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III Wald Chi-Square	df	Sig.
(Intercept)	121.314	1	<.001
ACEs	.148	1	.701
Depression	3.791	1	.052
Anxiety	1.400	1	.237
Stress	.417	1	.519
Functional Impairment	5.845	1	.016
No. of Elevated Schemas	.080	1	.777

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	df	Sig.	Exp(B)	95% Wald Confidence Interval for Exp(B) Lower	95% Wald Confidence Interval for Exp(B) Upper
(Intercept)	2.014	.1829	1.656	2.372	121.314	1	<.001	7.493	5.236	10.723
ACEs	.006	.0152	-.024	.036	.148	1	.701	1.006	.976	1.036
Depression	-.012	.0062	-.024	7.936E-5	3.791	1	.052	.988	.976	1.000
Anxiety	.008	.0068	-.005	.021	1.400	1	.237	1.008	.995	1.022
Stress	.005	.0075	-.010	.019	.417	1	.519	1.005	.990	1.020
Functional Impairment	.014	.0059	.003	.026	5.845	1	.016	1.014	1.003	1.026
No. of Elevated Schemas	.003	.0121	-.020	.027	.080	1	.777	1.003	.980	1.027
(Scale)	1.540[a]									

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Computed based on the deviance.

Appendix L

SPSS Outputs – Sensitivity analysis – Negative Binomial regression with number of FND symptoms as the dependent variable and ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as the predictors

Goodness of Fit[a]

	Value	df	Value/df
Deviance	9.888	66	.150
Scaled Deviance	66.000	66	
Pearson Chi-Square	6.759	66	.102
Scaled Pearson Chi-Square	45.110	66	
Log Likelihood[b,c]	-256.356		
Adjusted Log Likelihood[d]	-1711.046		
Akaike's Information Criterion (AIC)	526.711		
Finite Sample Corrected AIC (AICC)	528.434		
Bayesian Information Criterion (BIC)	542.745		
Consistent AIC (CAIC)	549.745		

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Information criteria are in smaller-is-better form.

b. The full log likelihood function is displayed and used in computing information criteria.

c. The log likelihood is based on a scale parameter fixed at 1.

d. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
10.178	6	.117

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III Wald Chi-Square	df	Sig.
(Intercept)	89.644	1	<.001
ACEs	.161	1	.688
Depression	3.351	1	.067
Anxiety	1.143	1	.285
Stress	.534	1	.465
Functional Impairment	5.941	1	.015
No. of Elevated Schemas	.055	1	.814

Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.940	.2049	1.538	2.341	89.644	1	<.001	6.956	4.656	10.393
ACEs	.007	.0169	-.026	.040	.161	1	.688	1.007	.974	1.041
Depression	-.013	.0069	-.026	.001	3.351	1	.067	.987	.974	1.001
Anxiety	.008	.0076	-.007	.023	1.143	1	.285	1.008	.993	1.023
Stress	.006	.0082	-.010	.022	.534	1	.465	1.006	.990	1.022
Functional Impairment	.016	.0067	.003	.029	5.941	1	.015	1.016	1.003	1.030
No. of Elevated Schemas	.003	.0136	-.023	.030	.055	1	.814	1.003	.977	1.030
(Scale)	.150[a]									
(Negative binomial)	1[b]									

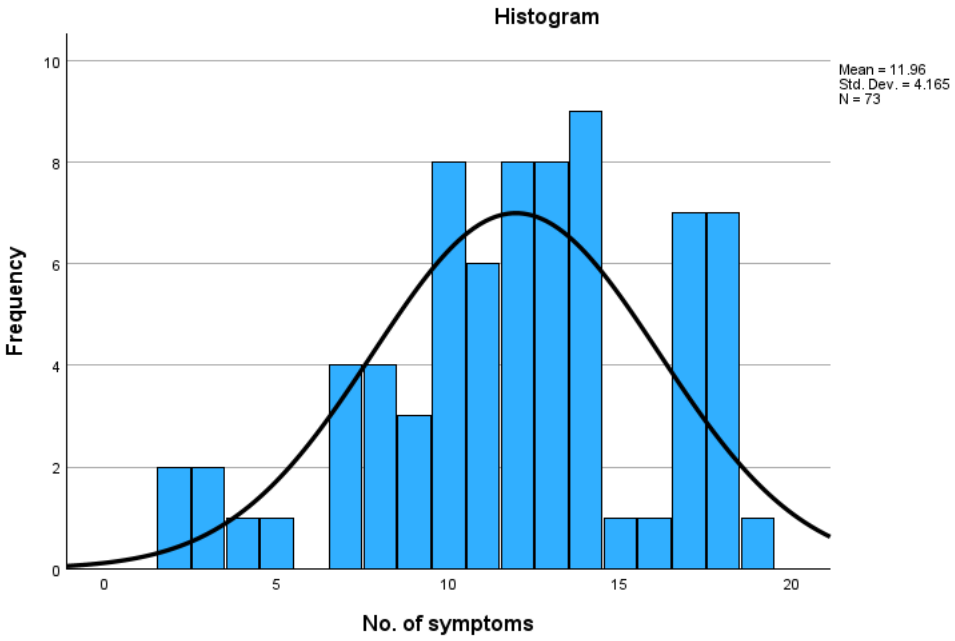
Dependent Variable: No. of symptoms
Model: (Intercept), ACEs, Depression, Anxiety, Stress, Functional Impairment, No. of Elevated Schemas

a. Computed based on the deviance.

b. Fixed at the displayed value.

Appendix M

SPSS Output – Descriptive analysis of distribution of number of symptoms as outcome variable



Sensitivity analysis - Linear regression model with number of FND symptoms as the dependent variable and ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as the predictors

Multiple regression analysis of ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as predictors of number of FND symptoms (n=73)

	Multiple Regression						Bootstrapping				
	B	SE B	β	Sig.	95% CI		Bias	SE B	Sig.	95% BCa CI	
					Lower	Upper				Lower	Upper
Constant	6.75	1.90		<.001	2.96	10.54	-.02	2.04	.002	2.94	11.10
ACEs (ACE-Q)	.07	.17	.05	.68	-.27	.41	.02	.15	.65	-.23	.45
Depression (DASS-21)	-.14	.07	-.39	.04	-.28	-.01	.002	.06	.02	-.26	-.02
Anxiety (DASS-21)	.10	.08	.22	.22	-.06	.25	-.01	.08	.25	-.09	.23
Stress (DASS-21)	.05	.08	.13	.52	-.11	.22	.01	.07	.41	-.09	.21
Functional Impairment (WSAS)	.16	.06	.33	.01	.04	.28	-.003	.06	.02	.04	.27
Number of elevated schemas (YSQ-S3)	.06	.14	.06	.69	-.22	.33	.003	.15	.69	-.28	.33

Note. R^2 = 16.4%; Adjusted R^2 = 8.8%. Unstandardised coefficient, standard error, standardised coefficient, significance values and confidence intervals are presented, along with the bootstrapped comparison including bias-corrected accelerated confidence intervals. Bootstrap results are based on 1000 bootstrapped samples.

SPSS Output

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.405[a]	.164	.088	3.978	2.374

a. Predictors: (Constant), No. of Elevated Schemas, Functional Impairment, ACEs, Stress, Anxiety, Depression

b. Dependent Variable: No. of symptoms

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	204.366	6	34.061	2.152	.059[b]
	Residual	1044.511	66	15.826		
	Total	1248.877	72			

a. Dependent Variable: No. of symptoms

b. Predictors: (Constant), No. of Elevated Schemas, Functional Impairment, ACEs, Stress, Anxiety, Depression

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	6.749	1.899		3.554	<.001	2.957	10.542		
	ACEs	.070	.170	.050	.411	.683	-.269	.409	.870	1.149
	Depression	-.140	.068	-.386	-2.072	.042	-.275	-.005	.366	2.733
	Anxiety	.095	.076	.221	1.251	.215	-.057	.247	.405	2.470
	Stress	.053	.082	.134	.654	.515	-.110	.217	.303	3.298
	Functional Impairment	.160	.062	.333	2.567	.013	.035	.284	.753	1.329
	No. of Elevated Schemas	.055	.136	.064	.407	.685	-.216	.326	.516	1.939

a. Dependent Variable: No. of symptoms

Casewise Diagnostics[a]

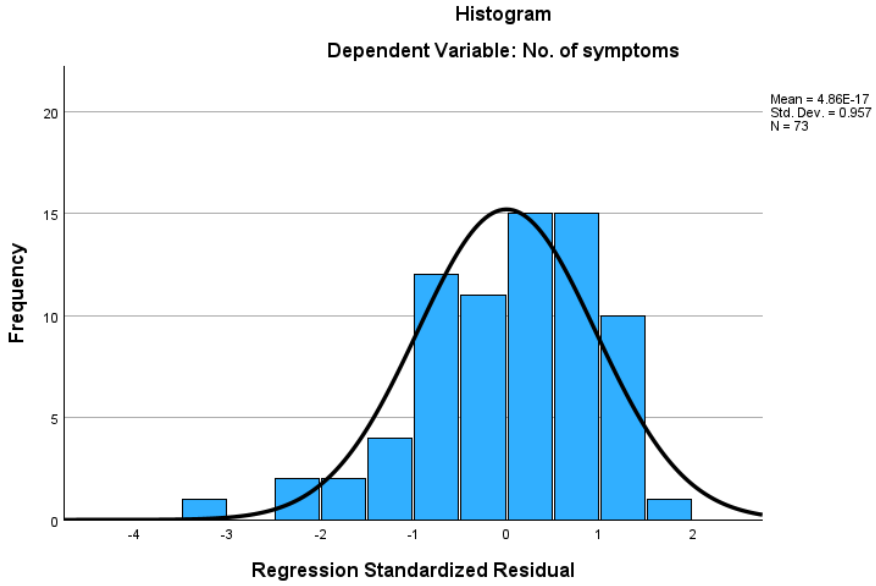
Case Number	Std. Residual	No. of symptoms	Predicted Value	Residual
66	-3.262	2	14.98	-12.976

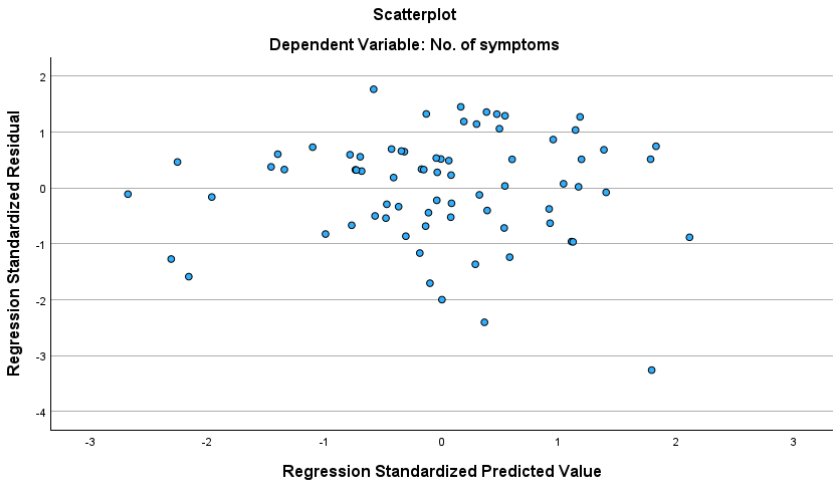
a. Dependent Variable: No. of symptoms

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	7.45	15.52	11.96	1.685	73
Std. Predicted Value	-2.678	2.114	.000	1.000	73
Standard Error of Predicted Value	.688	1.946	1.199	.286	73
Adjusted Predicted Value	7.59	17.17	11.97	1.722	73
Residual	-12.976	7.021	.000	3.809	73
Std. Residual	-3.262	1.765	.000	.957	73
Stud. Residual	-3.527	1.857	-.001	1.009	73
Deleted Residual	-15.173	7.770	-.007	4.239	73
Stud. Deleted Residual	-3.886	1.893	-.008	1.036	73
Mahal. Distance	1.165	16.245	5.918	3.330	73
Cook's Distance	.000	.301	.016	.039	73
Centered Leverage Value	.016	.226	.082	.046	73

a. Dependent Variable: No. of symptoms




Scatterplot
Dependent Variable: No. of symptoms
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Regression Standardized Predicted Value
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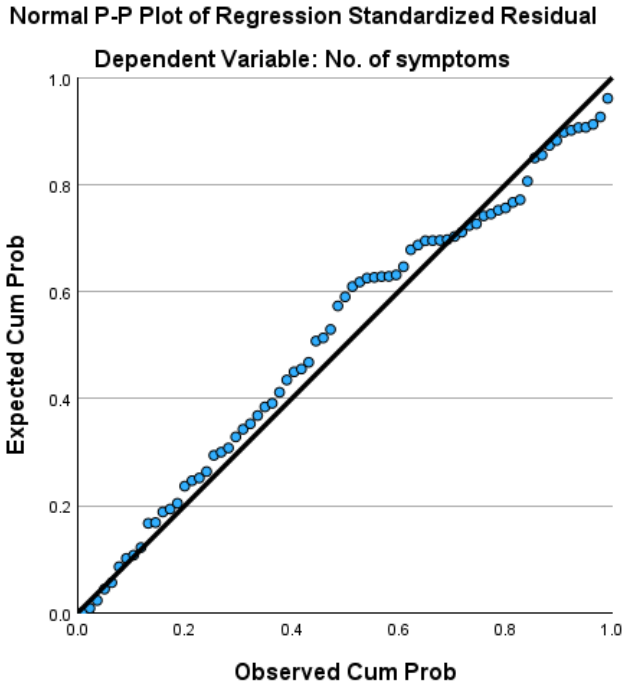
-3
-2
-1
0
1
2
3


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: No. of symptoms
Expected Cum Prob
Observed Cum Prob
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0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0

Appendix N

SPSS Output – Sensitivity analysis - Linear regression model with weighted FND symptoms as the dependent variable and ACEs, depression, anxiety, stress, functional impairment, and number of elevated schemas as the predictors

Weighting of outcome variable – count frequency of each symptom within the dataset, then calculate the percentage of each symptom amongst all symptoms and weight them with the inverse of the percentage (100/%) so that symptoms that are less common have a higher weighting. Apply the weights to each observation so each participant's weighted symptoms are summed to give a total indicating symptom severity.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.395[a]	.156	.080	96.20775	2.392

a. Predictors: (Constant), No. of Elevated Schemas (<20), Functional Impairment, ACEs, Stress, Anxiety, Depression

b. Dependent Variable: Weighted symptom severity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	113122.388	6	18853.731	2.037	.073[b]
	Residual	610891.511	66	9255.932		
	Total	724013.899	72			

a. Dependent Variable: Weighted symptom severity

b. Predictors: (Constant), No. of Elevated Schemas (<20), Functional Impairment, ACEs, Stress, Anxiety, Depression

Coefficients[a]

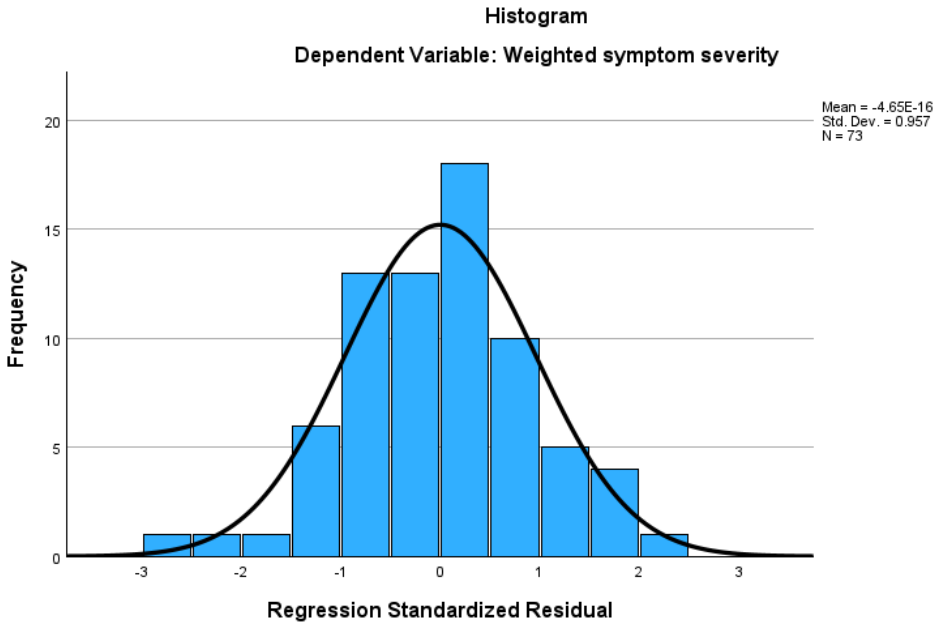
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	127.448	45.933		2.775	.007	35.741	219.156		
	ACEs	2.567	4.109	.076	.625	.534	-5.637	10.771	.870	1.149
	Depression	-2.837	1.636	-.324	-1.734	.088	-6.103	.429	.366	2.733
	Anxiety	2.736	1.837	.265	1.489	.141	-.932	6.405	.405	2.470
	Stress	.202	1.975	.021	.102	.919	-3.742	4.145	.303	3.298
	Functional Impairment	3.314	1.506	.287	2.201	.031	.308	6.320	.753	1.329
	No. of Elevated Schemas (<20)	1.974	3.284	.095	.601	.550	-4.582	8.531	.516	1.939

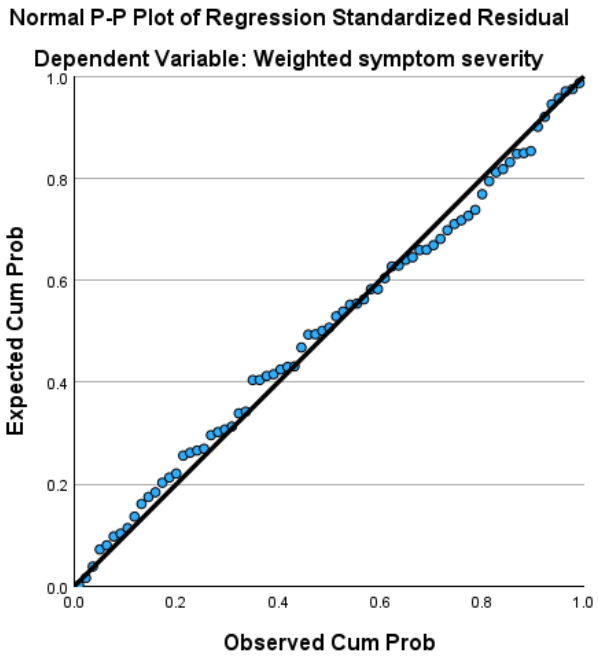
a. Dependent Variable: Weighted symptom severity

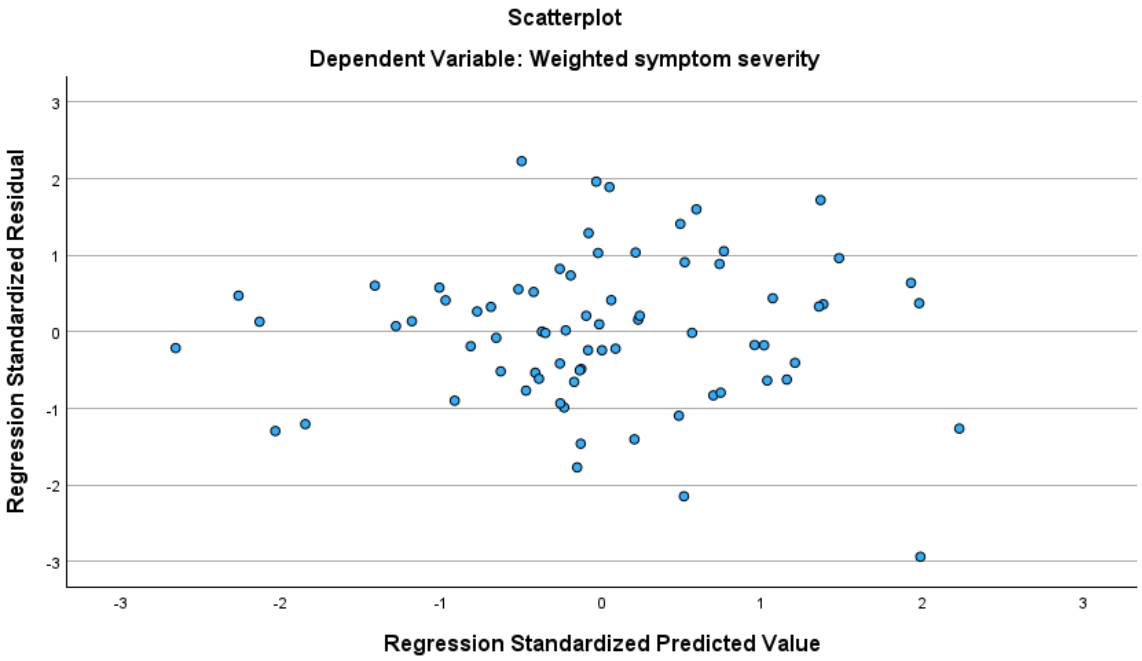
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	133.7168	327.3663	239.0407	39.63766	73
Std. Predicted Value	-2.657	2.228	.000	1.000	73
Standard Error of Predicted Value	16.628	47.066	28.987	6.927	73
Adjusted Predicted Value	140.1812	365.6434	239.0459	40.62024	73
Residual	-282.85397	214.29553	.00000	92.11191	73
Std. Residual	-2.940	2.227	.000	.957	73
Stud. Residual	-3.179	2.343	.000	1.008	73
Deleted Residual	-330.74338	237.17094	-.00519	102.31161	73
Stud. Deleted Residual	-3.428	2.429	-.002	1.031	73
Mahal. Distance	1.165	16.245	5.918	3.330	73
Cook's Distance	.000	.244	.016	.033	73
Centered Leverage Value	.016	.226	.082	.046	73

a. Dependent Variable: Weighted symptom severity




Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Weighted symptom severity
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Scatterplot
Dependent Variable: Weighted symptom severity
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
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-3
-2
-1
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3

Paper 3: Executive Summary

Experiences of Childhood, Thinking Patterns, and Emotional Distress in Functional Neurological Disorders

Word Count: 2090 (Excluding title page and references)

Overview

This report summarises a research project into schemas and their related psychological experiences in people diagnosed with Functional Neurological Disorder (FND) who experience different symptoms. It is written for people with FND and people supporting them, alongside professionals working with people with FND. People who took part generously gave feedback on the content and structure to advise on improvements.

Background

What is a schema?

Schemas are negative patterns of thinking and feeling that develop in childhood, often after difficult or traumatic experiences. These create a blueprint for how a person views themselves and others and can lead to difficulties with relationships and mental health in adulthood, as they influence how someone reacts to things. There are lots of different schemas, including mistrust and negativity, that influence someone's behaviour. Schema therapy helps people recognise and change these negative patterns.

Previous studies have shown that people with FND have schemas, and that the psychological experiences linked to schema development can be common in FND. Schema behaviours may help to explain why functional symptoms start and continue, and why there are differences in the psychological experiences of people with different types of FND. It is important to understand psychological factors that might contribute to the development and maintenance of FND, and to understand differences between different types of FND. This may lead to improvements in psychological therapies and tailoring these to support managing different symptoms. It could also help with understanding how services can best use limited resources to meet the needs of people with FND.

The study focused on adverse childhood experiences, depression, anxiety, stress, functional impairment (see key terms), the number of schemas, and their impact on the number of FND symptoms a person experiences.

Key terms

Adverse Childhood Experiences (ACEs)

- Difficult or traumatic events experienced in childhood, such as abuse or neglect.
- These experiences can impact someone's behaviour and mental and physical health in adulthood.

Functional Impairment

- Difficulties completing daily tasks such as working, self-care, and socialising due to mental or physical health difficulties.

Depression, Anxiety, and Stress

- Depression is characterised by low energy, a lack of interest or pleasure in doing things, changes in appetite and sleep, and low mood.
- Anxiety is characterised by intense worry or fear, and physical symptoms including sweating, rapid heartbeat and breathing, or difficulty sleeping.
- Stress is the body's natural reaction to challenges in life and produces mental and physical responses. It is characterised by feeling irritable or restless, and physical symptoms including headaches or muscle tension.

Why are these factors important for people with FND?

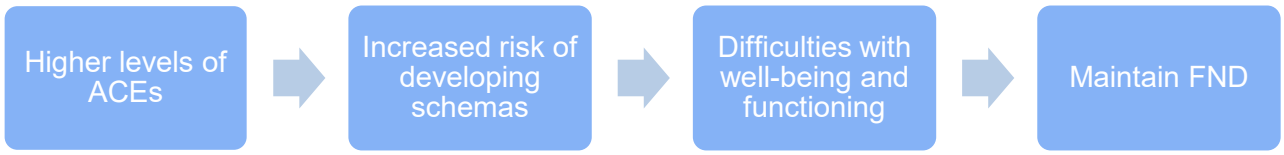
The causes of FND are still not well understood. Research has shown that psychological factors are important in the development of FND, but more research is needed to better understand what role they play and which psychological therapies could be beneficial.

Research has found high levels of factors relating to schema development in people with FND, including ACEs (Ludwig et al., 2018), and that this can influence the number of different functional symptoms a person experiences (Roelofs et al., 2002; Gray et al., 2020). This suggests that people with FND may be at a higher risk of developing schemas, and that these schemas may show as difficulties with well-being and functioning. Research shows that high levels of mental health difficulties (Cabreira et al., 2023; Walsh et al., 2018) and difficulties with daily living tasks (Mavroudis et al., 2024; Butler et al., 2021) are common in people with FND. These can lead to stress, exhaustion, and loneliness, which can maintain FND symptoms (Keynejad et al., 2019). Research is needed to look at schemas in FND and how they impact symptoms to explore if schema therapy could be beneficial for people living with FND.

However, research also shows that the nature of these psychological factors is different across different types of FND (Driver-Dunkley et al., 2011; Ekanayake et al., 2017). This

suggests that these psychological factors may play different roles in different types of FND. More research is needed to understand the differences between FND subtypes and how these factors influence symptoms.

In summary:



Aims

This study was designed to explore schemas in different types of FND and their underpinning psychological factors, including ACEs and mental health difficulties, and to consider the potential influence of psychological factors on the number of different functional symptoms people experience.

If research were to find that people with FND report high levels of schemas and score highly on specific schemas, then this might suggest that it would be helpful for clinicians working with people with FND to assess schemas and consider using schema therapy to target these and reduce their influence. Alternatively, focus may be better spent on targeting other psychological factors if they prove to influence symptoms more.

Previous research has highlighted differences in the psychological experiences between people with different types of FND, with certain factors being more common in people who experience functional seizures (Ludwig et al., 2018; Stone et al., 2004). Therefore, this study aimed to highlight whether there would be differences in psychological factors related to schemas between people with or without functional seizures. These comparisons would add evidence for whether services need to tailor psychological support specifically for different types of FND.

Aims

1. Do people with functional seizures score higher on measures of ACEs, depression, anxiety, and stress than people without functional seizures?
2. Do people with functional seizures score in the ‘elevated’ range on more schemas than people without functional seizures?
3. Do higher numbers of ACEs and elevated schemas, and higher scores on measures of depression, anxiety, stress, and functional impairment, predict a higher number of functional symptoms?

Method

Ethical approval for the research was provided by the University of Staffordshire.

Who was invited to take part?
✓ People diagnosed with FND
✓ 18 years or older
✓ Able to independently complete online questionnaires in English

What did taking part involve?

Recruitment took place between November 2024 and February 2025. A research advertisement with information about the study and a link to access the online questionnaires was shared in social media groups for people living with FND. All participants signed a digital consent form to take part, and all their information was anonymised. Participants completed four questionnaires (see below), and additional questions about themselves and their FND, such as their age, what country they live in, and what functional symptoms they experience.

Questionnaires completed:

Adverse Childhood Experiences Questionnaire for Adults (ACE-Q: Felitti et al., 1998)

10 statements rated as either absent (0) or present (1).

Example statement: "Were your parents ever separated or divorced?"

Depression Anxiety Stress Scales – Short Form (DASS-21; Lovibond & Lovibond, 1995)

21 statements rated on a scale of 0 (did not apply to me at all) to 3 (applied to me much, or most of the time).

Example statement: "I felt I was close to panic".

***Young's* Schema Questionnaire - Short form, version 3** (YSQ-S3: Young, 2005)

90 statements rated on a scale of 1 (completely untrue of me) to 6 (describes me perfectly).

Example statement: "I don't fit in".

Work and Social Adjustment Scale (WSAS; Mundt et al., 2002)

5 statements rated on a scale of 0 (not at all) to 8 (very severely).

Example statement: "Because of my [FND], my ability to form and maintain close relationships with others, including those I live with, is impaired.

Who took part?

Overall, 73 people took part in the research, 38 people who experienced functional seizures, and 35 who did not. The majority of people identified as female (90.4%) and age ranged from 18-66. Most participants identified as White (84.9%) and lived in the UK (63%).

How were data analysed?

Three main types of statistical analysis were used. The first and second analyses were used to compare differences between people who experience functional seizures and those who do not, on scores from questionnaires about psychological experiences. The first test involved taking the average scores from each group and comparing them to see if there is a significant difference between the two. The second test involved counting the total number of schemas scored in the "elevated" range and the total number below the clinical cutoff for each group and comparing these total counts to see if there was a significant relationship between the number of schemas and the groups.

The final analysis used regression analysis, which looks at whether changes in one factor can predict changes in another factor. The diagram below shows the factors used to predict

changes in the number of FND symptoms. Different types of regression analysis were used to check how reliable the findings were.

Predictors:
ACEs
Depression
Anxiety
Stress
Functional Impairment
Number of “elevated” schemas

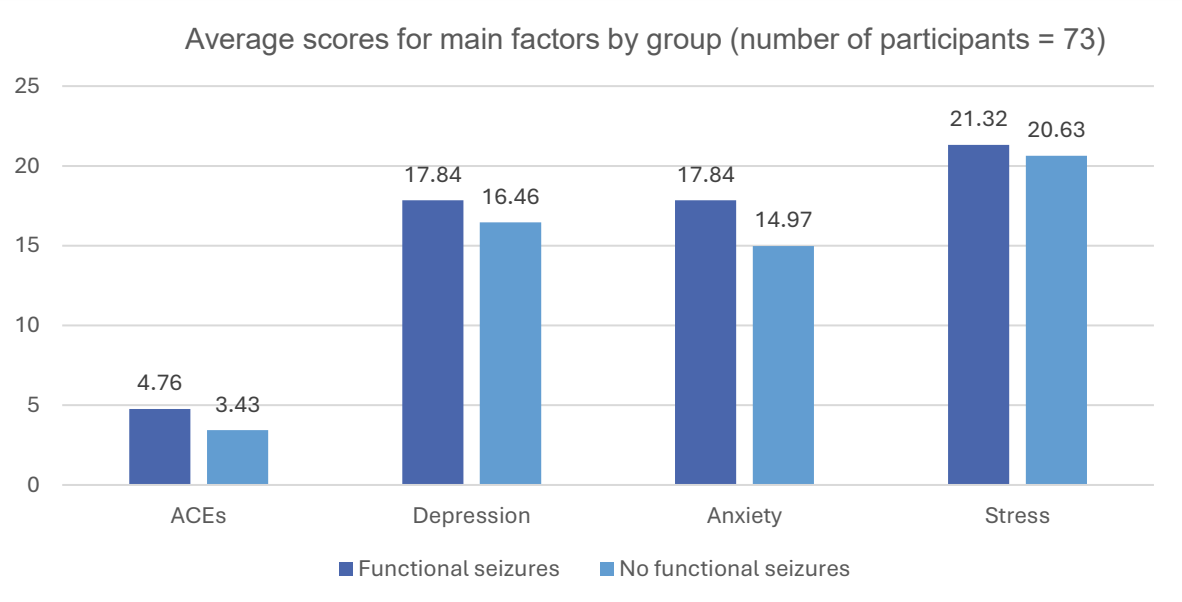
→

Outcome:
Number of functional symptoms

Key findings

Aim 1

- Average scores on measures of ACEs were statistically significantly higher for people with functional seizures than for people without functional seizures.
- Average scores on measures for depression, anxiety, and stress were higher for people with functional seizures than for people without functional seizures, but these differences were not statistically significant.
- Scores indicated moderate to severe levels of depression, anxiety, and stress for both groups.



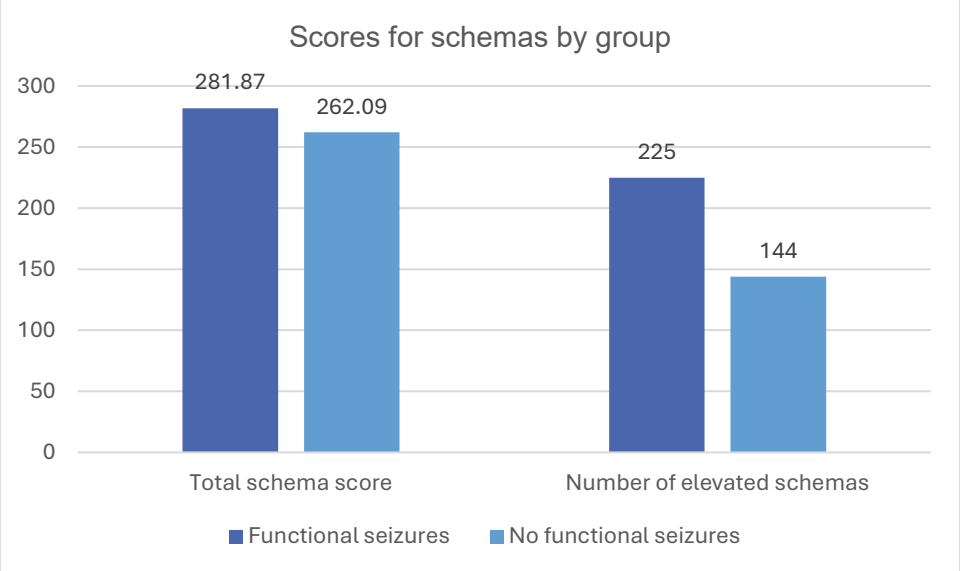
Aim 2

A significant association was found between group and schemas in the “elevated” range. The number of ‘elevated’ schemas was higher for people with functional seizures (225) than for those without functional seizures (144).

- Significant positive relationships were found between all psychological factors and the number of “elevated” schemas. This means that people who had higher scores for ACEs, depression, anxiety, stress, and functional impairment also had a higher number of schemas in the “elevated” range.
- People with functional seizures had a higher total schema score and scored higher on 15/18 of the different schemas than people without functional seizures.
- The schemas of self-sacrifice, unrelenting standards, and social isolation/alienation were scored highest across both groups.

Aim 3

None of the regression analyses showed a significant overall effect of the predicting factors on the number of symptoms, although functional impairment and depression significantly predicted the number of symptoms. This suggests that depression and functional impairment are related to the number of symptoms people report, but other factors that also relate to this were missing from this study.



Conclusions and clinical implications

High levels of depression, anxiety, and stress suggest that it is important for people with FND to have access to appropriate psychological interventions.

Differences in experiences of early trauma and schemas between people with and without functional seizures suggest that interventions may need to be tailored to support different types of functional symptoms. Higher scores for ACEs may relate to higher scores for schemas and suggest that psychological services should offer targeted trauma interventions for people with functional seizures, where this is appropriate.

Finding higher scores for particular schemas across both groups suggests that people with FND may benefit from schema therapy to target the influence of high-scoring schemas on maintaining functional symptoms.

Limitations

- The study asked participants to self-report the number of functional symptoms they experience by ticking symptoms from a list provided. It can be difficult to differentiate between different symptoms and to differentiate between functional symptoms and symptoms that are caused by other mental or physical health conditions. This resulted in data that may not accurately represent the complexity or severity of having multiple symptoms.
- The study relied on participants' self-reporting their diagnosis of FND, which could increase the chance of bias from the wrong diagnosis being reported.
- The majority of participants identified as female, of white ethnicity, and reported living in the UK. This limits how well the findings can be generalised to wider FND populations.

Future research recommendations:

- Improved measures of the complexity and severity associated with having multiple functional symptoms are needed to improve the accuracy and reliability of analyses.
- Psychological factors in this study were not found to predict the number of functional symptoms. This raises questions about other relevant psychological factors that may predict the number of functional symptoms and whether the psychological factors included in this study may predict other outcomes in people with FND. Outcomes suggested as important by people living with FND include

social and relationship difficulties, independence, and quality of life (Newson, 2019; Rutten et al., 2025).

- Future research should also aim to recruit larger, more diverse samples.

What will happen to the results of this study?

The study has been written up, and the report will be submitted to an appropriate academic journal for potential publication. This executive summary will be shared with participants who have requested a copy.

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