

## **Title**

Organic vs. Functional Neurological Disorders:

The Role of Childhood Psychological Trauma

## **Brief Title**

Neurological Disorders and Childhood Trauma

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## **Abstract**

Although the relationship between psychological trauma and medically unexplained symptoms (MUS) is well established, this relationship is less well understood in people with medically unexplained neurological symptoms. In the present study, we set out to compare people with functional neurological disorders, and organic neurological disorders, in terms of childhood and adulthood traumatic events, traumatic stress, emotional dysregulation and symptoms of depression and anxiety. We have hypothesised that those with functional neurological disorders would be more likely to report childhood and adulthood traumatic life events, traumatic symptomatology, emotional dysregulation and symptoms of anxiety and depression, compared to those with organic neurological disorders. Sample consisted of a consecutive series of people with functional neurological disorders and with organic neurological disorders (n=82) recruited from a hospital in Scotland. Participants completed measures of life events, traumatic stress, emotional regulation, anxiety and depression. The two groups were found to significantly differ in relation to all measures, with the MUS group being more likely to report childhood and adulthood life events, more severe emotional dysregulation, traumatic stress and symptoms of anxiety and stress. Logistic regression analysis revealed that exposure to childhood traumatic life events, specifically childhood sexual abuse, and childhood physical neglect, were the only factors which were significantly associated with membership of the medically unexplained neurological symptoms group. Although further research is required to confirm our findings, our results suggest that identifying and addressing the impact of childhood trauma, may alleviate distress and aid recovery from functional neurological disorders.

**Keywords:** childhood trauma, neurological disorders, functional disorders, medically unexplained symptoms

## **Introduction**

It has been estimated that at least 33% of somatic symptoms in primary care are medically unexplained (Kroenke, 2003). Presence of Medically Unexplained Symptoms (MUS) has been associated with frequent consultations (Fiddler, Jackson, Kapur, Wells, & Creed, 2004), significant personal suffering and decreased quality of life (Kirmayer, Groleau, Looper & Dao, 2004). Three different types of MUS can be observed. These include somatisation that is best understood as the physiological components of anxiety and depression; normal daily sensations that are misinterpreted as serious illness; and functional somatisation, which describes subjective symptoms that cannot be attributed to either physical or psychiatric illness, or hypochondriasis (Roelofs & Spinhoven, 2007). The aetiological factors of functional somatisation remain unknown.

Recent population based studies on the relationship between traumatic life events and physical health confirm a strong association and a dose-response relationship between experience of traumatic life events and physical health problems (e.g. Karatzias, Yan & Jowett, 2015). Numerous studies have also demonstrated an association between psychological trauma and MUS. In particular, psychological trauma has been associated with chronic pelvic pain, Irritable Bowel Syndrome (IBS), Somatisation Disorders and Chronic Fatigue Syndrome (e.g. Taylor & Jason, 2002; Roelofs & Spinhoven, 2007). Limited evidence exists on the association between psychological trauma and neurological disorders. For example, in a study comparing people with psychogenic non-epileptic seizures vs. people with epilepsy, it was found that those with psychogenic epileptic seizures were more likely to have experienced childhood psychological trauma, as well as increased difficulty in identifying their feelings (Kaplan, Dwivedi, Privitera, Isaacs, Hughes & Bowman, 2013). This is supported by the finding that prevalence rates of both childhood and adulthood abuse were significantly higher in a non-epileptic attack disorder group, than an epileptic group

(Reilly, Baker, Rhodes, & Salmon, 1999). Furthermore, a study investigating the prevalence rates of potential predisposing factors in a sample of patients with functional neurological symptoms concluded that the most prominent factors were non-sexual trauma, family/relationship difficulties, and bereavement (Reuber, Howlett, Khan, & Grunewald, 2007). Finally, in a study exploring the extent to which severity of pain was related to coping strategies and post-traumatic symptomatology in people with Chronic Fatigue Syndrome (CFS), it was found that participants with CFS present with significantly more post-traumatic stress symptoms and report significantly less emotion focused strategies and problem focused coping strategies compared to healthy controls (Krzeczkowska, Karatzias & Dickson, 2015).

Although the relationship between psychological trauma and MUS is well established, this relationship is less well understood in people with medically unexplained neurological symptoms. In the present study we set out to compare for the very first time people with functional neurological disorders, and organic neurological disorders, in terms of childhood and adulthood traumatic events, traumatic stress, emotional dysregulation and symptoms of depression and anxiety. We have hypothesised that those with functional neurological disorders would be more likely to report childhood and adulthood traumatic life events, traumatic symptomatology, emotional dysregulation and symptoms of anxiety and depression, compared to those with organic neurological disorders. Identifying potential differences between those with functional neurological disorders compared to those with organic neurological disorders is important because such information can inform development of interventions to alleviate distress in people with MUS (i.e. functional somatisation).

## **Method**

### *Design*

The present study employed a cross-sectional survey design of hospital – based neurology patients using standardised questionnaires in Scotland.

### *Participants*

A consecutive series of patients with neurological MUS (n = 41) were invited to participate. Diagnoses in this group included Fibromyalgia, Non-epileptic seizures and Functional Movement Disorder. A control sample of 41 patients with organic neurological disorders, matched on age and gender, were randomly selected from a sample of 107 patients recruited as part of this study, using the SPSS Select Cases function. Diagnoses in this group included Multiple Sclerosis, Epilepsy, Myasthenia Gravis and Guillian Barre Syndrome. Diagnoses of MUS and organic disorders were made by consultant neurologists following appropriate tests and investigations.

### *Procedure*

Ethical approval was granted from the appropriate NHS Ethics Committee. Informed consent was obtained by a senior member of the medical team, and patients who agreed to take part in the study were then introduced to the researcher who conducted the assessment. Interviews lasted approximately 30-45 minutes. All participants were presented with an Information Sheet outlining the purpose of the study and the associated risks. Participants were then asked to first complete the demographics form, followed by the five questionnaires. Participation in the study was voluntary and anonymous.

### *Measures*

*Childhood Trauma Questionnaire* (CTQ; Bernstein & Fink, 1998) is a 28-item self-report questionnaire used to assess five types of childhood traumatic events: emotional,

physical and sexual abuse, and emotional and physical neglect. Each item is rated on a 5-point Likert scale (1 = *never true*, 5 = *very often true*) aimed at encapsulating frequency of occurrence for each traumatic event. Severity of each type of trauma can be categorized as low to moderate, moderate to severe, and severe to extreme (Bernstein & Fink, 1998). The measure was found to have good internal consistency, test-retest reliability, and good convergent validity (Bernstein & Fink, 1998).

*Life Events Checklist* (LEC; Weathers, Blake, Schnurr, Kaloupek, Marx, & Keane, 2013) comprises of 17 items purposefully created to screen for the presence of potentially traumatic events (PTEs) across the lifespan. Out of the 17 items, 16 items assess the exposure to traumatic events, whilst 1 item asks respondents to list any other PTEs not captured by the previous items. Respondents are asked to rate each item by indicating if the PTE: (1) happened to them; (2) if they witnessed it; (3) if they learned about it. The measure demonstrated good test-retest reliability and good convergent validity with other measures which assess exposure to potentially traumatic events (Gray *et al.*, 2004).

*Difficulties in Emotion Regulation Scale* (DERS; Gratz & Roemer, 2004) is a 36 item self-report measure for the assessment of difficulties in emotion regulation. The measure is organised in 6 sub-scales: Non-acceptance; Goals; Impulse; Awareness; Strategies; Clarity. Each item is rated using a 5-point Likert scale (1 = *Almost never*, 5 being = *Almost always*). A high score is indicative of difficulties to engage in adaptive emotion-regulation strategies. The DERS has high internal consistency, good test–retest reliability, and adequate construct and predictive validity (Gratz & Roemer, 2004).

*PTSS Checklist for DSM-5* (PCL-5; Weathers, Litz, Keane, Palmieri, Marx, & Schnurr, 2013) is a 20-item self-report questionnaire assessing the severity of re-experiencing, avoidance, altered cognition and mood, and hyperarousal symptoms in response to very stressful traumatic events. Using a 5-point Likert scale (0 = *not at all*, 4 = *extremely*)

respondents are asked to indicate how bothered they have been by each symptom in the past month. A cut-off score of 38 paired with DSM-5 criteria for diagnosis which requires items to have a score of  $\geq 2$  = “moderately” on the following scales: 1 item on Re-experiencing scale, 1 item on Avoidance scale, 2 items on Altered cognition and mood scale and 2 items on Hyperarousal scale, is indicative of probable Posttraumatic Stress Disorder. The PCL-5 has been found to have good internal consistency, test-retest reliability, and convergent and discriminant validity (Bovin et al, 2015).

*Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)* is comprised of 14 items assessing the presence and frequency of anxiety and depression symptoms, each on a four-point scale. It provides two subscale scores, one measuring anxiety (A-scale) and one measuring depression (D-scale), which are scored separately. Participants underline the reply which ‘comes closest’ to how they have felt in the past week. Scores for items in each subscale of the HADS are summed to produce an anxiety score (HADS-A) or a depression score (HADS-D). Each item is rated on a 4-point scale (ranging from 0 to 3), for a total score ranging from 0-21 for each subscale for anxiety and for depression. A higher score indicates higher distress. A review of the psychometric properties of the HADS reported good internal consistency and concurrent validity in a variety of patient populations (Bjellanda, Dahl, Tangen Haug, & Neckelmann, 2002).

### *Statistical Analysis*

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 21. Means (SDs) were calculated for continuous variables and frequencies (%) for categorical variables. To explore group differences on measures of interest, a series of t-tests were undertaken. Measures which displayed significantly different scores were then entered as predictors into a series of logistic regressions, to determine the factors which predict the presence of MUS symptoms.

## Results

The demographic characteristics of the MUS and non-MUS groups are shown in Table 1. Groups did not differ with respect to age ( $t(80) = 1.31, p = .194$ ), gender ( $\chi^2(1) = 0.00, p = 1.00$ ), ethnicity ( $\chi^2(3) = 2.86, p = .414$ ), or level of deprivation according to the Scottish Index of Multiple Deprivation ( $\chi^2(6) = 4.50, p = .609$ ).

### Table 1 about here

T-tests were undertaken to compare the groups on measures of childhood and adulthood psychological trauma, PTSD symptoms, emotion regulation, anxiety and depression. The means and standard deviations of each group are displayed in Table 2, along with the comparison between groups. As shown, the MUS group scored significantly higher on all measures except Childhood Physical Neglect, DERS Goals, and DERS Awareness.

### Table 2 about here

Significant measures were then entered as predictors in a series of logistic regression analyses, where group (MUS or non-MUS) was the outcome variable. In separate univariate analyses, the following variables were found to significantly predict presence of MUS symptoms: total childhood trauma ( $OR = 1.06, 95\% CI = 1.02-1.10, p = .001$ ); total life events ( $OR = 1.37, 95\% CI = 1.10-1.71, p = .005$ ); PTSD ( $OR = 1.03, 95\% CI = 1.01-1.06, p = .011$ ); emotion dysregulation ( $OR = 1.03, 95\% CI = 1.01-1.05, p = .004$ ); anxiety ( $OR = 1.22, 95\% CI = 1.08-1.36, p = .001$ ); and depression ( $OR = 1.17, 95\% CI = 1.04-1.30, p = .007$ ).

### Table 3 about here

A multivariate analysis including all significant predictors was undertaken (see Table 3). Data were checked for independence of errors and collinearity. This set of predictors was statistically significant, and correctly classified 68.3% of cases ( $\chi^2 = 24.05, df = 6, p = .001$ ,



Nagelkerke  $R^2=.339$ ), therefore distinguishing between the MUS and non-MUS groups.

Childhood trauma, as measured by the CTQ, was found to be the only individual significant factor associated MUS or non-MUS group membership. However, as the 95% confidence interval contained 1, this result is inconclusive (OR=1.04, 95% CI= 1.00-1.08,  $p=.037$ ).

To provide further clarity on the association between childhood trauma and MUS, a multivariate logistic regression was undertaken, entering each of the facets of childhood trauma, according to the CTQ, simultaneously (see Table 4). Data were checked for independence of errors and collinearity. The total model was statistically significant, and correctly classified 68.3% of cases ( $\chi^2= 25.76$ ,  $df= 5$ ,  $p<.001$ , Nagelkerke  $R^2=.359$ ). It was found that Childhood Sexual Abuse (OR= 1.22, 95% CI= 1.00-1.49,  $p=.046$ ) and Childhood Physical Neglect (OR= 0.74, 95% CI= 0.55-1.00,  $p=.048$ ) significantly predicted membership of the MUS group, while Childhood Emotional Neglect was approaching significance (OR= 1.17, 95% CI= 1.00-1.38,  $p=.055$ ). There is a consistent trend in all 3 variables supporting an association between childhood trauma and MUS.

#### **Table 4 about here**

### **Discussion**

We set out to compare functional versus organic neurological symptom groups in terms of traumatic life events, traumatic symptomatology, emotional dysregulation, anxiety and depression. Our results indicate that those with functional symptoms are significantly more likely to report childhood and adulthood psychological traumas, posttraumatic stress symptomatology, emotional dysregulation, anxiety, and depressive symptomatology. This supports previous findings on the increased prevalence of traumatic experiences in this population, and, importantly, extends these findings by demonstrating the increased prevalence of other mental health symptoms (Kaplan et al 2013; Reilly et al, 2009). Logistic

regression analysis revealed that exposure to childhood traumatic life events, specifically childhood sexual abuse, and childhood physical neglect, are the only factors which were significantly associated with the MUS group membership. However, as the 95% confidence intervals of the odds ratios included 1, these results cannot be interpreted conclusively, and require replication with a larger sample to confirm.

Our study suffers a number of limitations including a cross sectional design, small sample, and the fact that we have not controlled for the timing of adverse life events, meaning we cannot conclude whether functional and organic symptoms have preceded or followed life events. We have also used a hospital based sample that is more likely to present with severe illness and therefore not necessarily representative of the population as a whole.

Nevertheless, people with a range of functional neurological disorders were included in our sample. We also assessed both childhood as well as adulthood psychological traumatic life events, and our results suggest that presence of childhood psychological trauma, in particular, increases the likelihood of presenting with functional neurological disorders. This is of interest in determining the relative impact of childhood versus recent traumatic events on the presence of medically unexplained symptoms.

To date, a number of theoretical conceptualisations have been proposed to explain the relationship between psychological trauma and somatoform symptoms. One possibility is heightened arousal in the form of posttraumatic stress, as well as changes in the monitoring of self-regulatory strategies (Brown, 2004). Our results partially support this conceptualisation, as higher levels of PTSD symptoms and emotional dysregulation were found to predict MUS group membership, in univariate analyses. This was not supported in multivariate analysis. The reason for this is not clear from this study but it may have been the result of the small sample size or due to correlations among the predictor variables.

Future research should consider the role of alternative psychological factors in MUS presentations, beyond psychopathology and emotional dysregulation. One area of enquiry is the role of cognitive factors, including attentional processes, in the form of increased awareness of bodily sensations, following exposure to traumatic life events (Brown, 2004). Indeed, it has been suggested that a history of psychological trauma is associated with somatosensory amplification, which includes a tendency to experience somatic sensations as intense and threatening. The effects of psychological trauma on cognition have also been described in DSM-V PTSD criteria (i.e. Criterion D) (American Psychiatric Association, 2013). It was confirmed in our data that the MUS group scored significantly higher in the relevant PCL subscale that assesses alterations in cognition and mood, but this effect was not maintained in multivariate analysis. Future research on the association between traumatic life events and physical health should also be culturally sensitive considering that across different cultures, patients have certain explanations for their symptoms linking interpersonal or intrapersonal problems in family or community with bodily distress (e.g. Kirmayer et al., 2004).

Identifying the pathways to MUS following psychological trauma is essential, as this knowledge can inform psychological interventions to aid recovery from MUS. There is a need for further larger scale, longitudinal research to determine the role of traumatic events on functional and organic neurological conditions as well as the role of mediating psychological and neuropsychological factors in the relationship between psychological trauma, particularly in childhood, and MUS.

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Table 1: Demographic Characteristics of MUS and non-MUS groups

	MUS Group			Non-MUS group		
	N	%	M (SD)	N	%	M (SD)
Age	41		47.34 (12.22)	41		50.98 (12.89)
Gender (female)	41	80.5%		41	80.5%	
Ethnicity (White British)	33	97.0%		41	95.1%	
Level of Deprivation	33			41		
Most Affluent		6.1%			7.9%	
2		18.2%			21.1%	
3		15.2%			28.9%	
4		6.1%			7.9%	
5		18.2%			13.2%	
6		33.3%			15.8%	
Most deprived		3.0%			5.3%	

Table 2: Group comparison of mean scores on psychometric measures

		<b>MUS Group (n=41)</b>		<b>Non-MUS group (n=41)</b>		<b>T (df)</b>	<b>P</b>
		<b>M</b>	<b>SD</b>	<b>M</b>	<b>SD</b>		
<b>CTQ</b>							
	Total	51.90	24.03	33.85	12.19	4.29 (59.31)	<.001
	Emotional Abuse	12.12	6.35	7.68	3.55	3.91 (62.79)	<.001
	Sexual Abuse	9.44	6.72	5.49	1.61	3.33 (44.60)	.001
	Physical Abuse	9.85	6.16	6.20	3.64	3.28 (64.88)	.002
	Emotional Neglect	12.51	6.42	7.98	4.08	3.82 (67.84)	<.001
	Physical Neglect	7.98	3.68	6.51	3.15	1.93 (78.09)	.057
<b>LEC</b>		4.17	2.66	2.66	1.64	3.10 (66.45)	.003
<b>PCL-5</b>							
	Total	33.27	20.40	22.02	17.28	2.69 (80)	.009
	Re-experiencing	7.80	6.32	5.10	5.43	2.08 (80)	.041
	Avoidance	3.56	2.62	2.07	2.30	2.74 (80)	.008
	Mood /Cognition	12.24	8.00	7.71	6.45	2.83 (80)	.006
	Arousal/Reactivity	9.66	5.81	7.15	5.23	2.06 (80)	.043
<b>DERS</b>							
	Total	97.56	28.53	79.39	24.03	3.12 (80)	.003
	Non-acceptance	17.51	7.20	14.10	6.55	2.25 (80)	.027
	Goals	14.80	5.17	13.80	5.02	0.89 (80)	.377
	Impulse Control	14.02	6.23	10.24	5.69	2.87 (80)	.005
	Awareness	17.71	6.02	16.00	4.44	1.46 (73.63)	.148
	Strategies	20.05	8.16	15.90	7.17	2.44 (80)	.017
	Clarity	13.46	4.91	9.34	3.64	4.32 (80)	<.001
<b>HADS</b>							
	Anxiety	10.90	3.97	7.22	4.66	3.85 (80)	<.001
	Depression	9.02	4.34	6.34	4.05	2.90 (80)	.005



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Note: Levene's test was significant for some variables, test statistics not assuming homogeneity of variance are reported in these cases.

Table 3: Logistic Regression predicting MUS symptom presence from measures of trauma and mental health.

Predicting Variable	OR	95% CI	p
CTQ	1.04	1.00-1.08	.037
LEC	1.11	0.85-1.46	.439
PCL-5	0.99	0.94-1.03	.561
DERS	1.01	0.98-1.05	.432
Anxiety	1.10	0.92-1.32	.292
Depression	1.02	0.86-1.21	.831

*Note.* OR= Odds Ratio; CI= Confidence Interval.  $R^2=0.251$  (Cox & Snell); 0.335 (Nagelkerke).

Table 4: Logistic Regression predicting MUS symptom presence from types of childhood trauma

<b>Predicting Variable</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>
Childhood Emotional Abuse	1.05	0.89-1.23	.572
Childhood Physical abuse	1.11	0.91-1.35	.315
Childhood Sexual Abuse	1.22	1.00-1.49	.046
Childhood Emotional Neglect	1.17	1.00-1.38	.055
Childhood Physical Neglect	0.74	0.55-1.00	.048
<i>Note.</i> OR= Odds Ratio; CI= Confidence Interval. $R^2=0.270$ (Cox & Snell); 0.359 (Nagelkerke).			