Characteristics of patients with motor functional neurological disorder in a large UK mental health service: a case control study

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Abstract

Background Functional neurological disorder (FND), previously known as conversion disorder, is common and often results in substantial distress and disability. Previous research lacks large sample sizes and clinical surveys are most commonly derived from neurological settings, limiting our understanding of the disorder and its associations in other contexts. We sought to address this by analysing a large anonymised electronic psychiatric health record dataset.

Methods Data were obtained from 322 patients in the South London and Maudsley NHS Foundation Trust (SLaM) who had an ICD-10 diagnosis of motor FND (mFND) (limb weakness or disorders of movement or gait) between 1st January 2006 and 31st December 2016. Data were collected on a range of socio-demographic and clinical factors and compared to 644 psychiatric control patients from the same register.

Results Weakness was the most commonly occurring functional symptom. mFND patients were more likely to be female, British, married, employed pre-morbidly, to have a carer, and a physical health condition, but less likely to have had an inpatient psychiatric admission or to receive benefits. No differences in self-reported sexual or physical abuse rates were observed between groups, although mFND patients were more likely to experience life events linked to inter-personal difficulties.

Conclusions mFND patients have distinct demographic characteristics compared to psychiatric controls. Experiences of abuse appear to be equally prevalent across psychiatric patient groups. This study establishes the socio-demographic and life experience profile of this under-studied patient group and may be used to guide future therapeutic interventions designed specifically for mFND.

Background

Functional Neurological Disorder (FND), also known as conversion disorder, refers to a spectrum of neurological symptoms which have no known conventional neurological cause and are assumed psychological in origin (American Psychiatric Association, 2013). A wide range of symptoms and signs are reported, the commonest are seizures, sensory symptoms (e.g. numbness or visual impairment) or motor symptoms (e.g. limb weakness, tremor, dystonia or gait disorders). FND may begin suddenly, progress quickly, increase with attention or excessive fatigue, and disappear with distraction (Espay, 2018).

Establishing a population prevalence of FND is difficult due to changes in its terminology, diagnostic criteria, and the need for neurological examination prior to diagnosis. Evidence suggests its incidence is 4 to 5 per 100,000 of the population per year (Binzer et al., 1997, Akagi et al., 2001). A large study of neurology outpatients in Scotland found functional symptoms were the second most common disorder after headache, affecting 16% of patients (Stone et al., 2010a), a finding recently replicated in an Australian neurology practice (Ahmad et al., 2016).

Previous studies have shown higher rates of females with FND, usually in the range of 60-80% (Villain, 2017, McCormack et al., 2014, Carson et al., 2016), lower socio-economic status (Binzer et al., 1997), lower educational attainment (Deka et al., 2007, Stone et al., 2004) as well as lower mood and higher anxiety (Stone et al., 2010b, Binzer et al., 1997), although the evidence on this is mixed (van der Hoeven et al., 2015). Views regarding the connection between ethnicity and FND have been expressed over the years, usually along the lines that somatic manifestations of distress occur more in those from non-Western backgrounds (Lambo, 1956, Kleinman, 1982, Kleinman, 1980), although comparing rates is difficult due to the disparity in sampling methods and measures used as well as the diagnostic criteria employed (Brown et al., 2011)

Childhood sexual and physical abuse rates are higher in FND compared to neurological disorders or healthy controls (Roelofs et al., 2005b, Ludwig et al., 2018, Sharpe et al., 2006). Studies in neurology settings report lower abuse rates compared to studies in psychiatry settings (Ludwig et al., 2018). Estimating the rates of abuse is challenging and depends on the type of measures used and the skill of the interviewer, among other factors.

Patients with functional symptoms had the same rate of paid employment as patients with symptoms that were ‘largely’ or ‘completely’ explained by organic conditions, however amongst unemployed patients, patients with functional symptoms were more often unemployed due to ill health and were more likely to receive incapacity benefit and disability living allowance (Carson et al., 2011). The

higher rate of benefits is likely explained by the increased physical and mental ill health experienced by functional cases in this study. Functional disorders occur in all areas of medicine and often result in chronic and severe symptoms with attendant high health and social care costs. Bermingham et al. (2010) reported that the incremental cost incurred by somatising patients is £3 billion per year, accounting for 10% of total NHS expenditure.

Most studies on motor FND (mFND) have originated in neurology clinics, and are characterised by low sample sizes and lack control groups (Factor et al., 1995, Garcin, 2018, van der Hoeven et al., 2015, Schrag et al., 2004, Ertan et al., 2009, Binzer et al., 1997, Crimlisk et al., 1998). This could lead to overestimates of abuse risk and co-morbid psychiatric disorders and underestimates of physical illness comorbidities.

This study addresses the imbalance in knowledge on mFND patients within psychiatric settings. We aimed to establish the socio-demographic, health and clinical characteristics, and possible symptom precipitants of mFND patients referred to a large psychiatric NHS Trust and compare outcomes to an otherwise random sample of psychiatric patients derived from the same database but matched for time of presentation.

Methods

Design and source of clinical data

This was a case-control study of mFND patients in contact with secondary mental health services in South London and Maudsley (SLaM) Foundation Trust between 1st January 2006 and 31st December 2016. Data were obtained from the SLaM Biomedical Research Centre's (BRC) 'Clinical Records Interactive Search' (CRIS) database. The database contains anonymised electronic health records from SLaM, the largest provider of secondary mental health care in Europe. CRIS holds records on over 250,000 anonymised individuals referred to SLaM services (Perera et al., 2016). This is a single online system where daily activities, medication, diagnoses, correspondence, health scores and all patient information is recorded. Relevant records can be retrieved using search terms of the database's structured fields such as diagnoses or from searches of free text fields (for example clinical notes and correspondence).

Study setting and participants

SLaM provides inpatient and community services for a catchment population of over 1.5 million people living in southeast London and also receives national referrals for FND. All participants were receiving mental healthcare in SLaM.

mFND cases included all patients aged over-18 with a primary or secondary diagnosis of 'Conversion disorder with motor symptom or deficit' (ICD-10 code: F44.4). Patients with any F44 diagnosis and evidence of functional motor symptoms in unstructured case notes or correspondence were also included as were patients with a confirmed mFND diagnosis in their case notes. See "Supplementary Materials" for a comprehensive list of the search strategies.

Our control group comprised contemporaneous SLaM patients who received any non-functional (i.e. non-F44) psychiatric diagnosis on the succeeding day the mFND patient received their diagnosis. Patients aged under-18 and those with a neurodegenerative disease of old age or an intellectual disability (F70 – F79) diagnosis were excluded. We used a random number generator from the website, random.org to select controls from the search list and adopted a case-control ratio of 1:2.

Ethical approval

CRIS has received ethical approval from the Oxfordshire Research Ethics Committee C (08/H0606/71+5) as an anonymised dataset for mental health research. Ethical approval as an anonymised database for secondary analysis was granted in 2008, and renewed for a further five years in 2013. This study was approved by a patient-led NIHR BRC CRIS oversight committee (CRIS 14-101).

Outcome measures

Data were extracted from structured fields in CRIS (e.g. dates and diagnoses) and unstructured clinical notes and correspondence. Socio-demographic characteristics included date of birth, gender, ethnicity, marital status, receipt of welfare benefits, housing status, employment and pre-morbid employment status and type. Clinical data included age at psychiatric symptom onset, the nature of cases' motor symptoms, smoking status, psychiatric inpatient history, and comorbid physical health conditions.

Information about experiences of physical or sexual childhood or adult abuse exposure was collected from free text notes. Where no mention of abuse was mentioned, this was coded as 'not known' and removed from frequency calculations. The rate of unknown information is reported.

Any available information on possible symptom precipitants was collected from CRIS's unstructured text. All references in patients' clinical records to possible precipitants were noted, which comprised any noted life event, at any stage of their life. This information was taken from referral letters, clinicians' notes and case reviews. No exclusion criteria were applied and categorisation of events occurred after data collection. Events were then classified as those occurring in early life and events occurring after the age of 18. Our method is similar to the qualitative classification method utilised with the same database by Bell et al. (2018).

Statistical analysis

SPSS for Windows (SPSS v21.0, Chicago, Illinois, USA) and Microsoft Excel (Microsoft Office Professional Plus 2010, Version 14.0.7015.1000) were used to analyse data. Socio-demographic and clinical characteristics were analysed using descriptive statistics. Proportions were used to describe categorical data, and means and standard deviations for continuous variables. Odds ratios (OR) with 95% confidence intervals compared unadjusted event rates. Two binary logistic regression analyses were performed to compare socio-demographic characteristics of mFND patients with control patients and precipitating events respectively.

Results

Socio-demographic characteristics

Our search returned 322 mFND and 644 control patients.

The control group comprised patients with mood disorders (22.7%), mental and behavioural disorders due to psychoactive substances (17.4%), schizophrenia, schizotypal and delusional disorders (14%), factors influencing health status and contact in health services (Z00 – Z99) (13.8%), unspecified mental disorders (F99) (11.3%), neurotic, stress and somatoform disorders (10.9%), behavioural syndromes associated with physiological disturbances (2.6%), behavioural and emotional disorders with onset in childhood and adolescence (2.2%), disorders of personality and behaviour (1.9%) and other disorders (3.2%).

The socio-demographic and clinical characteristics of the mFND patients are described in Table 1. There were 238 females (73.9%) and 84 males (26%) in the mFND group, a significantly higher proportion of females compared to control patients (OR: 2.52, 95% CI: 1.9 – 3.4, $p = 0.001$).

The mean age of mFND patients' was 46.1 years (SD = 13.4) versus 47.6 years (SD = 16.2) for controls (not significantly different). The mean age at which mFND patients first began experiencing psychiatric symptoms was 33.2 years (SD: 14.6), similar to that of control patients (32.5 years, SD: 17.8).

British patients constituted 60.6% of the mFND group, compared to 50.9% in the control group (OR: 1.5, 95% CI: 1.1-1.9, $p = 0.001$). mFND patients were more likely to be married, in a civil partnership or cohabiting (43.4%) compared to 17.7% in the control group (OR: 4, 95% CI: 2.9 – 5.4, $p = 0.001$).

mFND patients were more likely to employed than control patients (24.5% versus 17.4%, OR: 1.5, 95% CI: 1.1 – 2.2, $p = 0.02$). Employment was stratified by gender, but no differences between groups emerged. Control patients were more likely to receive welfare benefits (55.7%) compared to mFND

patients (47.8%) (OR: 0.73, 95% CI: 0.55 – 0.96, $p = 0.03$). Of patients receiving benefits, mFND patients were more likely to receive Disability Living Allowance compared to controls ($\chi 2 = 17.7$, $df = 1$, $p = 0.001$).

In total, 19% of mFND and 8% of control patients were employed or had been employed in care-giving roles in health, social care, child care, or mental health sectors (OR: 2.63, 95% CI: 1.73 – 4, $p = 0.001$).

Patients were grouped according to whether they were carers to a family member or friend, either formally or informally. mFND patients were significantly more likely to act as carers (9.8%) than control patients (2.8%) (OR: 3.77, 95% CI: 2 – 7.1, $p = 0.001$). The significant difference was maintained in both males and females after stratification by gender.

38.8% of mFND patients themselves had a carer compared to 23.5% of control group participants (OR: 2.06, 95% CI: 1.5 – 2.8, $p = 0.001$). The significant difference was maintained when data were stratified by gender.

Health

The type of motor and sensory symptoms affecting mFND patients was categorised. Most participants had more than one symptom, with the mean number of functional motor and sensory symptoms equalling 2.42 (SD: 1.1). The most commonly reported symptom was 'weakness' of any type accounting for 50.3% of all reported symptoms, followed by 'other' motor or sensory symptoms (37.9%) such as visual disturbances, facial droop etc., and 'tremor' which includes 'tremor, spasms, jerks and tics' (33.9%). Figure 1 outlines the rate of motor, sensory and other co-morbid functional symptoms.

A third (33.8%) of all mFND patients had a comorbid functional diagnosis. The most common syndromes were non-epileptic seizures (16.2% of all mFND patients), irritable bowel syndrome (7.5%) and somatoform pain disorder (4.3%). Four per cent of patients had co-morbid functional diagnoses classified as 'other'. These include depersonalisation disorder, psychogenic polydipsia, dissociative amnesia, foreign accent syndrome, somatoform disorder and dissociative identity disorder. Figure 1 outlines co-morbid functional diagnoses. There were significantly more co-morbid functional diagnoses in the mFND group than the 1.9% in the control group (OR: 26, 95% CI: 14 – 48.2, $p = 0.001$).

38.5% of mFND patients smoked cigarettes at the time of data collection, significantly fewer than controls at 62.6%, see Table 1. A significantly higher proportion of mFND patients had a co-morbid physical health condition compared to control patients (74.5% versus 59.6%, OR: 1.9, 95% CI: 1.4 –

2.7, p =0.001), with 'diseases of the nervous system' the most common illness in mFND patients, accounting for 22.2% of all reported illness.

More control than mFND patients had at least one psychiatric inpatient admission (43.5% versus 33.2%). Control patients spent more days in inpatient settings with a mean of 143.3 days (SD: 209, median: 67, IQR: 155) compared to mFND patients' mean of 130.3 days (SD: 124) (median: 112 days, IQR: 89, U = 11944.5, p = 0.007)We assessed whether there were reports of mental health problems in patients' family members. There was a positive history in 52.1% of mFND patients and 60% of control patients, with no statistical difference. Amongst mFND patients, the most common relative reported to have a mental health problem were patients' mothers (accounting for 30.4% of all relatives), followed by fathers (18.2%) and patients' sons (6.1%). Similar patterns were observed in the control group and there were no statistical differences between groups.

Abuse

We examined clinical records for experience of childhood sexual abuse (CSA), childhood physical abuse (CPA) and physical or sexual abuse in adulthood. No information was available on the presence or absence of CSA in 22.4% of mFND patients and 39.9% of control group patients. The rate of CSA in the mFND group was 20%, similar to the 21.9% rate in the control group (OR: 0.9, 95% CI: 0.6 – 1.3, p > 0.05). When stratified by gender, the CSA rate in female mFND patients was 22.8% and 30.3% in female control patients. CSA rates in male mFND patients were 11.3% and 11.2% in male control patients. Using odds ratios, comparing female abuse rates in both groups to females not experiencing abuse, there was no statistical difference, with the same finding amongst males.

Information on the presence or absence of CPA was lacking in 22% of mFND patients and 40.2% of control patients. There was no difference in the rate of CPA in the mFND group (22.7%) compared to the control group at 21.8%. When stratified by gender, 24.3% of female mFND patients experienced CPA compared to 27.1% of female control patients. The rate in male mFND patients was 17.7% and 15.8% in control patients.

No information was available on adult physical or sexual abuse in 20.2% of mFND patients and 37.9% of control group patients. The rate of adult physical or sexual abuse in mFND patients was 27.2% which did not significantly differ from the rate in the control group of 21%. All comparisons are outlined in Table 1).

Predictors of mFND

To assess the socio-demographic variables that might predict an mFND diagnosis, we conducted a binary logistic regression analysis performed amongst all patients with a diagnosis of mFND. mFND

was the dependent variable and our independent variables are outlined in Table 1. The overall prediction was 57.1% in this model. The Cox and Snell pseudo *R*-square was 0.45, indicating that the fit of the model to the data was moderate.

In the adjusted model, factors that predict an mFND diagnosis include being female (OR: 2.5, 95% CI: 1.2 – 5.1, $p = 0.01$), married (OR: 7.6, 95% CI: 3.4 -17, $p = 0.001$), pre-morbidly employed (OR: 4.9, 95% CI: 1.7 – 14, $p = 0.003$), receiving benefits (OR: 2.4, 95% CI: 1.1 – 5.2, $p = 0.03$), having a carer (OR: 2.8, 95% CI: 1.4 – 5.7, $p = 0.005$), having a physical health condition (OR: 3.9, 95% CI: 1.9 – 8.1, $p = 0.001$) and being less likely to have a psychiatric admission (OR: 0.4, 95% CI: 0.2 – 0.7, $p = 0.03$). Britishness, being employed, a social or health care worker, carer to family member, smoking status and history of CSA, CPA and experience of sexual or physical abuse in adulthood were not significant predictors of mFND status in the adjusted model.

Life experiences

While sexual and physical abuse rates did not differ between groups, we conducted an examination of other potential precipitants.

The classification of events in childhood and adulthood are outlined in Table 2. In the unadjusted analysis, a significantly lower proportion of mFND patients reported taking drugs under the age of 18 (1% v. 6.6%, $p = 0.002$), and a higher proportion of mFND patients experienced bullying before the age of 18 compared to the control group (17.8% v. 9.1% $p = 0.001$). Following stratification by gender, this significant difference remained for both men and women.

For events in adulthood, the unadjusted analysis found mFND patients experienced significantly higher rates of workplace, school or university problems compared to the control group (22.6% v 6.9%, $p = 0.001$), were more likely to be involved in a legal dispute (7% v 0.8%, $p = 0.001$), to report problems within a sexual relationship (32.1% v 23.2%, $p = 0.006$), to have experienced an accident or assault (15.3% v 2.3%, $p = 0.001$), to be affected by war or political upheaval (6.9% v 3.3%, $p = 0.02$), to have an unwell family member (22% v 6.4%, $p = 0.001$), and to have had an organic illness or injury precipitating their symptom onset (23.3% v 7.3%, $p = 0.001$). mFND patients were significantly less likely to report abusing drugs or alcohol compared to the control group (8% v. 29%, $p = 0.001$).

A binary logistic regression analysis accounting for gender, age and all other life events produced similar odds ratios however the adjusted model found no difference in proportions of those taking drugs aged under-18, or those involved in legal disputes.

Discussion

Main findings

Research on mFND patients is limited. To our knowledge, the current study is the largest of its kind in this patient group. We identified 322 mFND patients from a mental health service case register of 250,000 patient records. The associations between mFND and life events, demographic, social, occupational, and health characteristics were investigated and compared to a large unselected contemporaneous sample of patients with other mental health disorders.

It is well-established that mFND has a female preponderance (Stone et al., 2009, Stone et al., 2010a, McCormack et al., 2014, Binzer et al., 1997), again confirmed in our study. Women may be more likely to perceive and label noxious bodily sensations as a result of heightened body vigilance (Warner, 1995), societal gender differences may persuade more women to communicate bodily distress (Mechanic, 1972) or seek help for somatic symptoms from medical experts (Nathanson, 1977). There may be underlying genetic vulnerabilities, personality predispositions (McCrae et al., 2000), and hormonal differences could mediate responses to stressful life events leaving women more vulnerable to symptom development (Li et al., 2017). Alternatively, clinicians may be more likely to diagnose FND in women or specifically ask about experiences of trauma or abuse due to cultural and historical stereotypes of 'hysteria' as a specifically female malady.

Evidence on level of education and socio-economic status (SES) in mFND is mixed. Some studies report no difference in SES or education between cases and neurological or healthy controls (van der Hoeven et al., 2015, Roelofs et al., 2005a, Stone et al., 2010b), with others reporting lower education in mFND patients (Binzer et al., 1997, Stefansson et al., 1976). We do not have a measure of SES but proxy measures show increased SES in mFND patients compared to controls. Contrary to some stereotypes, mFND patients were less likely to receive benefits, were more likely to be employed pre-morbidly and were more likely to be married, even when gender was controlled. The argument that less educated patients might use functional symptoms as a coping mechanism is not borne out in this study. These findings (and others) emerged because of what we contend to be a fair comparison with other psychiatric service users where employment is expected to be lower, and receipt of benefits, higher than the national average.

Employment in care-giving positions within health and social care industries amongst mFND patients is worth noting. Studies in movement disorders clinics have found no difference between mFND patients and controls (Perry et al., 2017, Kenney et al., 2007), although McCormack et al. (2014) report

high rates of this employment. One theory is that working in healthcare roles or observing unwell family members allows the modelling of neurological symptoms (Shill et al., 2006, Hotopf et al., 2018).

Our adjusted regression analysis did not find any difference in paid care work between mFND and control patients. Gender is likely to partly account for the relationship between employment in the health and social care industry and mFND status. Employment data supports this as healthcare workers account for 6% of the UK's economy; and four-fifths are women (Yar et al., 2006). Similar trends in gender are seen in the status of non-paid carers. Census data from the Office for National Statistics (2011) found 58% of all carers are female. A combination of age and gender likely predicts carer status as in the general population, the peak age of caring is between 50 – 64 years of age, but one in four women aged 50-64 have caring responsibilities compared to one in six men of the same age.

In our study, weakness, or the loss of motor function, was the most common functional motor symptom. Studies from movement clinics report tremor as the most prevalent functional symptom (Hinson et al., 2006, van der Hoeven et al., 2015, Kranick et al., 2011, Park, 2018), reflecting a possible referral bias to those clinics. Weakness has been described as the most common functional symptom in an acute stroke centre (Gargalas et al., 2015), a tertiary psychiatric inpatient setting (McCormack et al., 2014) and a neurological clinic (Crimlisk et al., 1998). While weakness was common, in our study most patients had more than one functional symptom, a finding reported elsewhere (Stone et al., 2010b). Our cross-sectional design restricted us from establishing the evolution or prognosis of symptoms but it is likely symptoms do not remain static and can worsen or improve with time.

*We found mFND patients were less likely to have a hospital admission compared to controls. While we do not know why patients were admitted or if admissions were voluntary or involuntary, it is likely that the majority of mFND admissions were to the Lishman Unit, a specialist rehabilitation centre. Amongst control patients, those with an admission history were most commonly schizophrenia, schizotypal and delusion disorder and affective disorder patients, meaning they likely had qualitatively different kinds of admissions.*In our unadjusted analysis, mFND patients were less likely to smoke than controls. We hypothesised that this might be due to the high proportion of schizophrenia patients in our control group. In a sensitivity analysis, we removed patients with a schizophrenia diagnosis from the control group but the significant difference in smoking remained. In our adjusted model however, the difference disappeared, a finding similar to a general practice survey comparing patients with persistent medically unexplained symptoms to those with medical diagnoses (Dirkzwager et al., 2007). Nonetheless, while smoking rates are certainly no higher than other psychiatric groups, the rate of smoking of 38.5% in mFND patients is substantially higher than the population prevalence in English

adults of 19% (Health and Social Care Information Centre, 2015). This may be surprising in a group which one could argue may be more health-anxious or body-focused. Smoking might help reduce patients' anxiety or emerge due to distorted health behaviour beliefs. Future studies examining patients' knowledge of general health advice might help explain this and other health behaviours.

Life events

We found no significant differences in rates of childhood sexual or physical abuse or adulthood sexual or physical abuse between groups.

The 20% rate of CSA is slightly lower than previously reported in functional disorders in psychiatric settings, which range from 24% - 26.3% (Roelofs et al., 2002, Akyuz et al., 2017, Sar et al., 2004) (this excludes studies which select only non-epileptic seizure patients). Similarly, our CPA rate of 22.7% is moderately lower than previously reported rates in psychiatric settings, which varies between 23-28% (Nicholson et al., 2016, Farooq et al., 2016, McCormack et al., 2014, Roelofs et al., 2002). Our rates are also lower than those reported in a recent meta-analysis which reported CSA and CPA rates of 24% and 30% respectively, although this includes heterogeneous functional symptoms and service settings (Ludwig et al., 2018).

The somewhat lower childhood abuse rates reported in our study may be an underestimation due to the observational, retrospective method and lack of structured interviewing, as studies utilising interview techniques report higher CSA rates in FND (Ludwig et al., 2018). In our study, no mention of abuse in clinical records was classified as missing data but this may mask 5-10% of the true event rate. There were higher levels of missing data on abuse in control group patients compared to mFND patients, suggesting clinicians may be more likely to ask about trauma and childhood history in mFND patients.

This potential lack of methodological sensitivity would be expected to affect both groups equally. When stratified by gender, rates of childhood sexual and physical abuse are higher amongst females in both groups compared to their male counterparts, suggesting risk of childhood abuse is higher amongst females, but not a specific risk amongst female mFND patients. That abuse rates did not differ between mFND and control patients is an important finding which contradicts some theories of FND aetiology. There is evidence that in case-control studies, rate differences are attenuated when psychiatric controls rather than neurological or healthy controls are used (Ludwig et al., 2018). Perhaps more pertinent is that abuse is prevalent in the general public with retrospective surveys estimating CSA rates in English women of 11 – 17% (Bebbington et al., 2011, Gorey et al., 1997, Molnar et al., 2001, Office for National Statistics, 2016). Abuse experiences are likely to increase risk for

psychiatric morbidity generally and form a component of some patients' mFND development, but our findings suggest they should not be regarded as specific to the disorder or be used as a diagnostic indicator.

Perhaps more promising in the identification of specific risks in mFND aetiology are the findings on life events prior to symptom onset. Premorbid life experiences appear to be linked to disrupted or problematic inter-personal relationships; a finding echoed elsewhere where mFND patients had higher rates of family conflict (Akyuz et al., 2017, Stone et al., 2004). In some cases, functional symptoms may be a means, to help shape, negotiate or re-define problematic social interactions (see Nicholson et al., 2016). Evidence exists for reduced or impaired emotional processing in FND (Waller et al., 2006, Demartini et al., 2014) and this might disrupt the development of early inter-personal skills. The causal pathway is unlikely to be linear as the existence of functional symptoms may themselves exacerbate or undermine personal interactions and relationships. Where such a processes play a role in symptom development, patients might benefit if the management of inter-personal conflicts and the bolstering of inter-personal skills were incorporated into psychotherapeutic approaches for the condition.

Strengths and limitations

The strength of this study is its large sample size. The study uses an innovative source to access a larger sample of patients than would be possible to recruit in clinical research. Full electronic health records retrieved through the CRIS database enabled access to detailed information about mFND patients and their contact with psychiatric services. The use of a psychiatric control group allowed for the empirical test of differences in patient profiles and characteristics. Our sample is more representative of the population of patients seen in routine clinical care than would be the case in a typical clinical trial.

Part of our search strategy involved a search of free-text clinical notes. Given the ubiquity of synonyms associated with a functional diagnosis, it is possible our search terms were not exhaustive and more mFND patients were present in the database than were detected in our study. Secondly, while our sample can be taken as encompassing a representative greater London NHS psychiatric catchment-area population, it also included referrals to a tertiary neuropsychiatry service placing limitations on our ability to generalise findings to services without specialist neuropsychiatry input and to other NHS Trusts outside London. It is likely our mFND patients include more severely affected patients and of course our study only represents mFND patients who have had at least some contact with psychiatric clinical services. Thirdly, clinicians' own biases or preferences in clinical formulations and note writing will have shaped the free-text clinical records, although this bias is unlikely to be systematic or to affect our between-group comparisons. Furthermore, we have emphasised factual information, albeit

uncorroborated over clinical interpretation. Finally, it was not possible to blind the researcher to case-control status so we cannot discount the possibility of observer bias in data extraction.

In conclusion, mFND patients have distinct demographic characteristics when compared to psychiatry controls attending the same NHS Trust. While some of our findings are unsurprising, such as the female preponderance and chronicity, reliance on carers, and associations with life stress, others are not necessarily in line with the clinical stereotypes of the mFND patient. For example there was no increase of CSA; ethnic background and nationality were less diverse, there were fewer hospital admissions and there were higher levels of employment. By establishing the socio-demographic and life experience profile of this under-studied patient group we hope to stimulate novel psychosocial interventions.

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Conflict of interest

None.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guides on the care and use of laboratory animals.

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Table 1 *Binary logistic regression analysis of socio-demographic factors associated with a motor FND (F44.4) diagnosis compared to a psychiatry control group*

		mFND n (%)	Control group n (%)	Unadjusted OR	95% CI	*p* value	Adjusted OR[1]	95% CI	*p* value
Gender	Female	238 (73.9)	341 (53)	2.52	1.9 – 3.4	**0.001**	2.5	1.2 – 5.1	**0.01**
	Male	84 (26.1)	303 (47)	Reference			Reference		
Ethnicity	British	195 (60.6)	328 (50.9)	1.5	1.1 – 1.9	**0.005**	1.7	0.9 – 3.2	> 0.05
	Any other ethnic group	127 (39.4)	316 (49.1)	Reference			Reference		
Marital status	Married, civil partner or cohabiting	141 (43.4)	111 (17.7)	4	2.9 – 5.4	**0.001**	7.6	3.4 - 17	**0.001**
	Single, divorced, separated, widowed	163 (53.6)	515 (82.3)	Reference			Reference		
Work	Employed	73 (24.5)	104 (17.4)	1.5	1.1 – 2.2	**0.01**	1	0.4 – 2.5	> 0.05
	Unemployed	225 (75.5)	492 (82.6)	Reference			Reference		
	Employed pre-morbidly	246 (87.5)	385 (75)	2.34	1.6 – 3.5	**0.001**	4.9	1.7 – 14	**0.003**
	Not employed pre-morbidly	35 (12.5)	128 (25)	Reference			Reference		
	Receives benefits	143 (47.8)	337 (55.7)	0.73	0.6 – 0.9	**0.03**	2.4	1.1 – 5.2	**0.03**
	Does not receive benefits	156 (52.2)	268 (44.3)	Reference			Reference		
Carers	Social or health care worker	54 (19)	46 (8.2)	2.63	1.7 – 4	**0.001**	1.6	0.6 – 4.0	> 0.05
	Non-social or health care worker	230 (81)	515 (91.8)	Reference			Reference		
	Carer to family or friends	28 (9.8)	16 (2.8)	3.77	2 – 7.1	**0.001**	1.1	0.3 – 5.0	> 0.05
	Not a care to family or friends	257 (90.2)	553 (97.2)	Reference			Reference		
	Patients has a carer	107 (38.8)	128 (23.5)	2.06	1.5 – 2.8	**0.001**	2.8	1.4 – 5.7	**0.005**
	Patients without a carer	169 (61.2)	416 (76.5)	Reference			Reference		
Health	Smoker	70 (38.5)	206 (62.2)	0.38	0.3 - 0.6	**0.001**	0.8	0.4 – 1.5	> 0.05
	Non-smoker	112 (61.5)	125 (37.8)	Reference			Reference		
	Physical health condition	219 (74.5)	326 (59.6)	1.9	1.4 – 2.7	**0.001**	3.9	1.9 - 8.1	**0.001**
	No physical health condition	75 (25.5)	221 (40.4)	Reference			Reference		
	Psychiatric inpatient stay	107 (33.2)	280 (43.5)	0.65	0.5 – 0.9	**0.002**	0.40	0.2 – 0.7	**0.03**
	No psychiatric inpatient stay	215 (66.8)	364 (56.5)	Reference			Reference		
Abuse	History of child sexual abuse	50 (20)	85 (21.9)	0.89	0.6 – 1.3	> 0.05	1.1	0.5 – 2.6	> 0.05
	No history of child sexual abuse	200 (80)	302 (78.1)	Reference			Reference		
	History of child physical abuse	57 (22.7)	85 (22.1)	1.03	0.71 – 1.5	> 0.05	0.8	0.3 – 2.0	> 0.05
	No history of child physical abuse	194 (77.3)	300 (77.9)	Reference			Reference		
	History of adult SA or PA	70 (27.2)	84 (21)	1.4	0.98 – 2	> 0.05	1.9	0.8 – 4.6	> 0.05
	No history of adult SA or PA	187 (72.8)	316 (79)	Reference			Reference		

SA: sexual abuse, PA: physical abuse

[1] Adjusted for gender, age, ethnicity, marital status, employment status, pre-morbid employment status, benefit receipt, social or health care worker status, caring for family or friends, having a carer, smoking status, the presence of a physical health condition, stay in a psychiatry inpatient setting, history of child sexual abuse, history of child physical abuse, history of adult sexual or physical abuse

Table 2 *Binary logistic regression of possible precipitant events occurring in childhood or adulthood associated with motor FND (F44.4) diagnosis compared to a psychiatry control group*

		mFND n (%)	Control group n (%)	Un-adjusted OR	95% CI	*p* value	Adjusted OR[2]	95% CI	*p* value
Events in childhood	Left or abandoned by a parent as a child[1]	30 (10.5)	37 (7.1)	1.5	0.9 – 2.5	> 0.05	1.1	0.5 – 2.4	> 0.05
	Violence between parents[1]	15 (5.3)	31 (6)	0.87	0.46 – 1.6	> 0.05	0.5	0.2 - 1.2	> 0.05
	Parents divorced or separated[1]	38 (13.2)	63 (12.2)	1.1	0.7 – 1.7	> 0.05	1.2	0.6 - 2.2	> 0.05
	In care, fostered or adopted as a child[1]	14 (4.9)	35 (6.8)	0.7	0.4 – 1.3	> 0.05	0.9	0.4 – 2.5	> 0.05
	Bullied in primary or secondary school[1]	51 (17.8)	47 (9.1)	2.16	1.4 – 3.3	**0.001**	2.0	1.1 – 3.7	**0.03**
	Took drugs under-18[1]	3 (1)	34 (6.6)	0.15	0.05 – 0.5	**0.002**	0.3	0.6 – 1.5	> 0.05
Events in adulthood	Financial difficulties (e.g. debt, homelessness)[1]	35 (12.2)	59 (11.4)	1.08	0.7 – 1.7	> 0.05	1.5	0.7 – 3.1	> 0.05
	Bereavement but unlikely a precipitant[1]	49 (17.1)	64 (12.4)	1.5	0.97 -2.2	> 0.05	1.5	0.9 – 2.7	> 0.05
	Bereavement as likely precipitant[1]	54 (18.8)	75 (14.5)	1.4	0.9 – 2	> 0.05	1.6	0.9 – 2.9	> 0.05
	Interpersonal problems in the workplace, school or university[1]	65 (22.6)	36 (6.9)	3.9	2.5 – 6.1	**0.001**	4.6	2.4 – 8.9	**0.001**
	Involved in a legal dispute[1]	20 (7)	4 (0.8)	9.6	3.3 – 28	**0.001**	7.0	0.7 – 70	> 0.05
	Problems within a sexual relationship (e.g. divorce)[1]	92 (32.1)	120 (23.2)	1.6	1.1 – 2.2	**0.006**	1.7	1 – 2.9	**0.04**
	Accident or assault but unlikely a precipitant[1]	19 (6.6)	9 (1.7)	4	1.8 – 8.9	**0.001**	10.3	2.6 – 40.6	**0.001**
	Accident or assault a likely precipitant[1]	44 (15.3)	12 (2.3)	7.6	3.9 – 14.7	**0.001**	5.8	2.2 – 15.3	**0.001**
	Affected by war or political turmoil[1]	20 (6.9)	17 (3.3)	2.2	1.13 – 4.3	**0.02**	5.5	1.9 – 15.9	**0.002**
	Socially isolated[1]	5 (1.7)	9 (1.7)	1	0.3 – 3	> 0.05	1.1	0.1 – 8.0	> 0.05
	Abusing drugs or alcohol[1]	23 (8)	150 (29)	0.2	0.13 – 0.3	**0.001**	0.3	0.6 – 1.4	**0.001**
	Family member unwell[1]	63 (22)	33 (6.4)	4.1	2.6 – 6.5	**0.001**	5.2	2.7 – 9.9	**0.001**
	Organic illness or injury[1]	67 (23.3)	38 (7.3)	3.8	2.5 – 5.9	**0.001**	5.7	3 – 10.9	**0.001**
	Complication in pregnancy (e.g. postnatal depression, miscarriage or still birth)[1]	22 (10.4)	33 (11.7)	0.88	0.5 – 1.6	> 0.05	0.5	0.2 – 1.1	> 0.05

[1] Reference: Patients not experiencing the event

[2] Adjusted for gender, age, & life events