

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

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14 Word Count: 4,383

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31 **Abstract**

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

38

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

44

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

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

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63 **Background**

64 Functional Neurological Disorder (FND), also known as conversion disorder, refers to a spectrum of
65 neurological symptoms which have no known conventional neurological cause and are assumed
66 psychological in origin (American Psychiatric Association, 2013). A wide range of symptoms and signs
67 are reported, the commonest are seizures, sensory symptoms (e.g. numbness or visual impairment)
68 or motor symptoms (e.g. limb weakness, tremor, dystonia or gait disorders). FND may begin suddenly,
69 progress quickly, increase with attention or excessive fatigue, and disappear with distraction (Espay,
70 2018).

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

77 Previous studies have shown higher rates of females with FND, usually in the range of 60-80% (Villain,
78 2017, McCormack et al., 2014, Carson et al., 2016), lower socio-economic status (Binzer et al., 1997),
79 lower educational attainment (Deka et al., 2007, Stone et al., 2004) as well as lower mood and higher
80 anxiety (Stone et al., 2010b, Binzer et al., 1997), although the evidence on this is mixed (van der
81 Hoeven et al., 2015). Views regarding the connection between ethnicity and FND have been expressed
82 over the years, usually along the lines that somatic manifestations of distress occur more in those from
83 non-Western backgrounds (Lambo, 1956, Kleinman, 1982, Kleinman, 1980), although comparing rates
84 is difficult due to the disparity in sampling methods and measures used as well as the diagnostic
85 criteria employed (Brown et al., 2011)

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

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

95 higher rate of benefits is likely explained by the increased physical and mental ill health experienced
96 by functional cases in this study. Functional disorders occur in all areas of medicine and often result in
97 chronic and severe symptoms with attendant high health and social care costs. Bermingham et al.
98 (2010) reported that the incremental cost incurred by somatising patients is £3 billion per year,
99 accounting for 10% of total NHS expenditure.

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

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

110 **Methods**

111 ***Design and source of clinical data***

112 This was a case-control study of mFND patients in contact with secondary mental health services in
113 South London and Maudsley (SLaM) Foundation Trust between 1st January 2006 and 31st December
114 2016. Data were obtained from the SLaM Biomedical Research Centre's (BRC) 'Clinical Records
115 Interactive Search' (CRIS) database. The database contains anonymised electronic health records from
116 SLaM, the largest provider of secondary mental health care in Europe. CRIS holds records on over
117 250,000 anonymised individuals referred to SLaM services (Perera et al., 2016). This is a single online
118 system where daily activities, medication, diagnoses, correspondence, health scores and all patient
119 information is recorded. Relevant records can be retrieved using search terms of the database's
120 structured fields such as diagnoses or from searches of free text fields (for example clinical notes and
121 correspondence).

122 ***Study setting and participants***

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

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

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

136 ***Ethical approval***

137 CRIS has received ethical approval from the Oxfordshire Research Ethics Committee C
138 (08/H0606/71+5) as an anonymised dataset for mental health research. Ethical approval as an
139 anonymised database for secondary analysis was granted in 2008, and renewed for a further five years
140 in 2013. This study was approved by a patient-led NIHR BRC CRIS oversight committee (CRIS 14-101).

141 ***Outcome measures***

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

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

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

158 **Statistical analysis**

159 SPSS for Windows (SPSS v21.0, Chicago, Illinois, USA) and Microsoft Excel (Microsoft Office
160 Professional Plus 2010, Version 14.0.7015.1000) were used to analyse data. Socio-demographic and
161 clinical characteristics were analysed using descriptive statistics. Proportions were used to describe
162 categorical data, and means and standard deviations for continuous variables. Odds ratios (OR) with
163 95% confidence intervals compared unadjusted event rates. Two binary logistic regression analyses
164 were performed to compare socio-demographic characteristics of mFND patients with control
165 patients and precipitating events respectively.

166 **Results**

167 **Socio-demographic characteristics**

168 Our search returned 322 mFND and 644 control patients.

169 The control group comprised patients with mood disorders (22.7%), mental and behavioural disorders
170 due to psychoactive substances (17.4%), schizophrenia, schizotypal and delusional disorders (14%),
171 factors influencing health status and contact in health services (Z00 – Z99) (13.8%), unspecified mental
172 disorders (F99) (11.3%), neurotic, stress and somatoform disorders (10.9%), behavioural syndromes
173 associated with physiological disturbances (2.6%), behavioural and emotional disorders with onset in
174 childhood and adolescence (2.2%), disorders of personality and behaviour (1.9%) and other disorders
175 (3.2%).

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

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

182 British patients constituted 60.6% of the mFND group, compared to 50.9% in the control group (OR:
183 1.5, 95% CI: 1.1-1.9, $p = 0.001$). mFND patients were more likely to be married, in a civil partnership
184 or cohabiting (43.4%) compared to 17.7% in the control group (OR: 4, 95% CI: 2.9 – 5.4, $p = 0.001$).

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

188 patients (47.8%) (OR: 0.73, 95% CI: 0.55 – 0.96, $p = 0.03$). Of patients receiving benefits, mFND patients
189 were more likely to receive Disability Living Allowance compared to controls ($\chi^2 = 17.7$, $df = 1$, $p =$
190 0.001).

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

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

197 38.8% of mFND patients themselves had a carer compared to 23.5% of control group participants (OR:
198 2.06, 95% CI: 1.5 – 2.8, $p = 0.001$). The significant difference was maintained when data were stratified
199 by gender.

200 **Health**

201

202 The type of motor and sensory symptoms affecting mFND patients was categorised. Most participants
203 had more than one symptom, with the mean number of functional motor and sensory symptoms
204 equalling 2.42 (SD: 1.1). The most commonly reported symptom was ‘weakness’ of any type
205 accounting for 50.3% of all reported symptoms, followed by ‘other’ motor or sensory symptoms
206 (37.9%) such as visual disturbances, facial droop etc., and ‘tremor’ which includes ‘tremor, spasms,
207 jerks and tics’ (33.9%). Figure 1 outlines the rate of motor, sensory and other co-morbid functional
208 symptoms.

209

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

217 38.5% of mFND patients smoked cigarettes at the time of data collection, significantly fewer than
218 controls at 62.6%, see Table 1. A significantly higher proportion of mFND patients had a co-morbid
219 physical health condition compared to control patients (74.5% versus 59.6%, OR: 1.9, 95% CI: 1.4 –

220 2.7, $p = 0.001$), with 'diseases of the nervous system' the most common illness in mFND patients,
221 accounting for 22.2% of all reported illness.

222 More control than mFND patients had at least one psychiatric inpatient admission (43.5% versus
223 33.2%). Control patients spent more days in inpatient settings with a mean of 143.3 days (SD: 209,
224 median: 67, IQR: 155) compared to mFND patients' mean of 130.3 days (SD: 124) (median: 112 days,
225 IQR: 89, $U = 11944.5$, $p = 0.007$) We assessed whether there were reports of mental health problems
226 in patients' family members. There was a positive history in 52.1% of mFND patients and 60% of
227 control patients, with no statistical difference. Amongst mFND patients, the most common relative
228 reported to have a mental health problem were patients' mothers (accounting for 30.4% of all
229 relatives), followed by fathers (18.2%) and patients' sons (6.1%). Similar patterns were observed in
230 the control group and there were no statistical differences between groups.

231 **Abuse**

232 We examined clinical records for experience of childhood sexual abuse (CSA), childhood physical
233 abuse (CPA) and physical or sexual abuse in adulthood. No information was available on the presence
234 or absence of CSA in 22.4% of mFND patients and 39.9% of control group patients. The rate of CSA in
235 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
236 > 0.05). When stratified by gender, the CSA rate in female mFND patients was 22.8% and 30.3% in
237 female control patients. CSA rates in male mFND patients were 11.3% and 11.2% in male control
238 patients. Using odds ratios, comparing female abuse rates in both groups to females not experiencing
239 abuse, there was no statistical difference, with the same finding amongst males.

240 Information on the presence or absence of CPA was lacking in 22% of mFND patients and 40.2% of
241 control patients. There was no difference in the rate of CPA in the mFND group (22.7%) compared to
242 the control group at 21.8%. When stratified by gender, 24.3% of female mFND patients experienced
243 CPA compared to 27.1% of female control patients. The rate in male mFND patients was 17.7% and
244 15.8% in control patients.

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

249 **Predictors of mFND**

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

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

255 In the adjusted model, factors that predict an mFND diagnosis include being female (OR: 2.5, 95% CI:
256 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%
257 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,
258 95% CI: 1.4 – 5.7, $p = 0.005$), having a physical health condition (OR: 3.9, 95% CI: 1.9 – 8.1, $p = 0.001$)
259 and being less likely to have a psychiatric admission (OR: 0.4, 95% CI: 0.2 – 0.7, $p = 0.03$). Britishness,
260 being employed, a social or health care worker, carer to family member, smoking status and history
261 of CSA, CPA and experience of sexual or physical abuse in adulthood were not significant predictors of
262 mFND status in the adjusted model.

263 ***Life experiences***

264

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

267 The classification of events in childhood and adulthood are outlined in Table 2. In the unadjusted
268 analysis, a significantly lower proportion of mFND patients reported taking drugs under the age of 18
269 (1% v. 6.6%, $p = 0.002$), and a higher proportion of mFND patients experienced bullying before the age
270 of 18 compared to the control group (17.8% v. 9.1% $p = 0.001$). Following stratification by gender, this
271 significant difference remained for both men and women.

272 For events in adulthood, the unadjusted analysis found mFND patients experienced significantly
273 higher rates of workplace, school or university problems compared to the control group (22.6% v 6.9%,
274 $p = 0.001$), were more likely to be involved in a legal dispute (7% v 0.8%, $p = 0.001$), to report problems
275 within a sexual relationship (32.1% v 23.2%, $p = 0.006$), to have experienced an accident or assault
276 (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
277 an unwell family member (22% v 6.4%, $p = 0.001$), and to have had an organic illness or injury
278 precipitating their symptom onset (23.3% v 7.3%, $p = 0.001$). mFND patients were significantly less
279 likely to report abusing drugs or alcohol compared to the control group (8% v. 29%, $p = 0.001$).

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

283 **Discussion**

284 ***Main findings***

285 Research on mFND patients is limited. To our knowledge, the current study is the largest of its kind in
286 this patient group. We identified 322 mFND patients from a mental health service case register of
287 250,000 patient records. The associations between mFND and life events, demographic, social,
288 occupational, and health characteristics were investigated and compared to a large unselected
289 contemporaneous sample of patients with other mental health disorders.

290 It is well-established that mFND has a female preponderance (Stone et al., 2009, Stone et al., 2010a,
291 McCormack et al., 2014, Binzer et al., 1997), again confirmed in our study. Women may be more likely
292 to perceive and label noxious bodily sensations as a result of heightened body vigilance (Warner,
293 1995), societal gender differences may persuade more women to communicate bodily distress
294 (Mechanic, 1972) or seek help for somatic symptoms from medical experts (Nathanson, 1977). There
295 may be underlying genetic vulnerabilities, personality predispositions (McCrae et al., 2000), and
296 hormonal differences could mediate responses to stressful life events leaving women more vulnerable
297 to symptom development (Li et al., 2017). Alternatively, clinicians may be more likely to diagnose FND
298 in women or specifically ask about experiences of trauma or abuse due to cultural and historical
299 stereotypes of ‘hysteria’ as a specifically female malady.

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

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

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

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

325 In our study, weakness, or the loss of motor function, was the most common functional motor
326 symptom. Studies from movement clinics report tremor as the most prevalent functional symptom
327 (Hinson et al., 2006, van der Hoeven et al., 2015, Kranick et al., 2011, Park, 2018), reflecting a possible
328 referral bias to those clinics. Weakness has been described as the most common functional symptom
329 in an acute stroke centre (Gargalas et al., 2015), a tertiary psychiatric inpatient setting (McCormack et
330 al., 2014) and a neurological clinic (Crimlisk et al., 1998). While weakness was common, in our study
331 most patients had more than one functional symptom, a finding reported elsewhere (Stone et al.,
332 2010b). Our cross-sectional design restricted us from establishing the evolution or prognosis of
333 symptoms but it is likely symptoms do not remain static and can worsen or improve with time.

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

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

351 ***Life events***

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

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

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

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

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

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

394 ***Strengths and limitations***

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

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

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

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

422 **Financial support**

423 This paper represents independent research funded by the National Institute for Health Research
424 (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's
425 College London. The views expressed are those of the authors and not necessarily those of the NHS,
426 the NIHR or the Department of Health and Social Care.

427 **Conflict of interest**

428 None.

429 **Ethical standards**

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

435 **Acknowledgements**

436 We thank the NIHR BRC for their support in this project, particularly Megan Pritchard, Amelia Jewel
437 and Debbie Cummings at the BRC Nucleus for their advice and expertise.

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600

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
Health	Patients without a carer	169 (61.2)	416 (76.5)	Reference			Reference		
	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
Abuse	No psychiatric inpatient stay	215 (66.8)	364 (56.5)	Reference			Reference		
	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