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Synopsis

Outcomes of specialist physiotherapy for functional motor disorder: the Physio4FMD RCT

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Abstract

Background: Functional motor disorder often causes persistent disabling symptoms that are associated with high healthcare costs. In recent years, specialist physiotherapy, informed by an understanding of functional motor disorder, has emerged as a promising treatment, but there is an absence of evidence of its effectiveness from large randomised controlled trials.

Methods: We conducted a pragmatic, multicentre, randomised controlled trial, comparing specialist physiotherapy for functional motor disorder to treatment as usual, which was defined as community neurological physiotherapy. The primary outcome was the Short Form questionnaire-36 items Physical Functioning domain at 12 months (scale range 0–100, with 100 indicating optimum health). The trial was powered to detect a 9-point difference in the primary outcome with 90% power at the 5% level of significance. Secondary domains of measurement included a patient perception of improvement, health-related quality of life, mobility, anxiety, depression and illness perception. We also completed a health economic analysis with the primary aim of calculating the mean incremental cost per quality-adjusted life-year over 12 months. In prespecified analysis plans, we excluded participants from the primary analysis if they were unable to receive their trial-allocated treatment due to COVID-19 lockdown restrictions. Sensitivity analysis explored the impact of this decision.

Results: Between 19 October 2018 and 31 January 2022, 355 adults with functional motor disorder were randomised (1 : 1) to specialist physiotherapy (n = 179) and treatment as usual (n = 176). Eighty-nine participants were excluded due to COVID-19 disruptions. Retention for the primary analysis was 90% for both groups, leaving 241 participants in the primary analysis. At 12 months, there was no between-group difference in the primary outcome (adjusted mean difference 3.5, 95% confidence interval −2.3 to 9.3). However, several secondary outcomes favoured specialist

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physiotherapy, including the participant perception of improvement, Short Form questionnaire-36 items Mental Health domain, confidence in the diagnosis and two subscales (Personal Control and Illness Coherence) of the Revised Illness Perception Questionnaire. There were no differences in the remaining outcomes. At 6 months, the following outcome measures were significantly different, in favour of specialist physiotherapy: participant perception of improvement, the Short Form questionnaire-36 items Physical Role Limitations, Short Form questionnaire-36 items Social Functioning, Short Form questionnaire-36 items Mental Health, EuroQol-5 Dimensions five-level version utility score, confidence in the diagnosis and three subscales (Timeline Cyclical, Personal Control and Treatment Control) of the Revised Illness Perception Questionnaire. No outcomes significantly favoured treatment as usual. In the health economic analysis, the incremental cost per quality-adjusted life-year gained from a health and social care cost perspective was £4133 with an 86% probability that specialist physiotherapy is cost-effective compared to treatment as usual at a cost-effectiveness threshold of £20,000 per quality-adjusted life-year gained. There were no adverse events related to physiotherapy.

Conclusion: Specialist physiotherapy was not superior to treatment as usual for the primary outcome, the Short Form questionnaire-36 items Physical Functioning domain at 12 months. However, a number of secondary outcome measures favoured specialist physiotherapy at 6 and 12 months. There is a high probability that specialist physiotherapy is cost-effective.

Limitations: Participants in treatment as usual waited longer to start physiotherapy, which resulted in a shorter time between concluding treatment and completing the primary outcome. Most outcome measures, including the primary outcome, were participant reported, which may have been biased by perceptions of the randomised treatment allocation.

Future work: Future work should identify or develop more suitable outcome measures for functional motor disorder research, explore who is most likely to benefit from specialist physiotherapy and identify alternative interventions for those unlikely to benefit from this treatment. Additional work is needed to adapt treatment to meet the needs of minority groups and young people.

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Introduction

Background and rationale for research

Functional neurological disorder (FND) is a common and debilitating condition accounting for between 5% and 16% of neurology outpatients and 8% of admission to acute stroke services.[1,2] It includes a range of neurological symptoms, with specific clinical features of FND, including weakness, movement disorders, seizures, dizziness, sensory impairment and cognitive disorder.[3] Alongside these core symptoms of FND, patients usually experience other physical and psychological symptoms, such as pain, fatigue and anxiety.[4,5] This research is concerned with the motor symptoms of FND, which we refer to as functional motor disorder (FMD). Follow-up studies of FMD find that 80% of patients remain symptomatic in the long term, and for 40% of patients, the severity of symptoms remain unchanged or worsen over time.[6] Persistent FMD symptoms are associated with high health and social care costs, unemployment and increased rates of lifestyle-associated illnesses.[7–9]

In recent years, the pathophysiology of FMD has been reconceptualised from simplistic psychological models to broad biopsychosocial frameworks. These recognise predisposing, precipitating and perpetuating factors, and seek to explain the mechanisms for how symptoms are produced and experienced as involuntary.[10–12] Two important concepts in contemporary models of FMD are attention and expectation. With regard to attention, functional symptoms are exacerbated when the patient is attending to the symptom, and symptoms are attenuated or resolve when attention is externalised. This clinical observation forms the basis of many 'rule-in' signs used for diagnosis. Expectations, in this context, refers to a Bayesian predictive processing model for functional symptoms, where symptom-related beliefs or *priors* (top-down predictions) distort motor output and sensory (bottom-up) processing. Belief and predictions are not necessarily consciously reportable thoughts.

Although there is a long history of interventions for FMD,[13,14] contemporary aetiological models for FMD have led to the development of novel approaches to treatment. For example, physiotherapy can aim to change maladaptive priors and retrain movement with redirected attention. A growing number of studies have explored the value of physical-based interventions for FMD,[15–17] but there has been an absence of evidence from sufficiently powered randomised controlled trials (RCTs).

Leading up to the specialist physiotherapy for functional motor disorder (Physio4FMD) RCT, we developed a psychologically informed, physiotherapy treatment protocol for FMD, based on consensus recommendations.[18] The intervention aims to address maladaptive beliefs about symptoms, retrain movement with redirected attention and address factors that may be working to maintain disability. The treatment approach was developed into a 5-day treatment protocol and tested in a cohort of 47 consecutive patients.[19] The results were encouraging, with improved physical outcomes in the majority of participants at 3 months. Next, we conducted a randomised feasibility study which randomised 60 people with FMD to the specialist physiotherapy protocol or usual physiotherapy (community neurological physiotherapy).[20] This study demonstrated the feasibility of conducting a powered RCT. At 6 months' follow-up, there was a moderate to large difference between groups in a range of physical and quality-of-life outcome measures. The Physical Functioning domain of the Short Form questionnaire-36 items (SF-36) emerged as a suitable primary outcome for a powered trial. The Physio4FMD RCT commenced in May 2018.

Aims and objectives

We set out to determine the clinical and cost-effectiveness of a specialist physiotherapy intervention for FMD compared to treatment as usual (TAU), defined as community physiotherapy suitable for people with neurological symptoms. The primary objective was to determine the effectiveness of specialist physiotherapy compared to TAU in reducing disability, as measured by the SF-36 Physical Functioning domain at 12 months post randomisation.

The secondary objectives were to evaluate the effectiveness of specialist physiotherapy compared to TAU with regards to:

- the participant's perception of change in their motor symptoms at 6 and 12 months
- mobility at 6 and 12 months
- health-related quality of life (HRQoL) at 6 and 12 months
- understanding of health condition and illness beliefs at 6 and 12 months
- anxiety and depression at 6 and 12 months
- health service utilisation at 12 months
- satisfaction with trial allocated treatment.

The primary aim of the health economic evaluation was to calculate the mean incremental cost per quality-adjusted life-year (QALY) gained with specialist physiotherapy compared to TAU over 12 months using the EuroQol-5 Dimensions, five-level version (EQ-5D-5L) questionnaire. The objectives were to evaluate specialist physiotherapy compared to TAU with regard to:

- cost-effectiveness from a health and social care perspective at 12 months
- cost-effectiveness from a societal perspective at 12 months
- continued employment or return to work at 12 months.

Methods

Reporting of the study is in compliance with the relevant guidelines.[21,22] The trial protocol and analysis plans were published prior to completion of data collection and locking of the database.[23,24]

The study design was a pragmatic, parallel arm, RCT. The trial was conducted at 11 sites in Scotland and England:

- Ninewells Hospital, NHS Tayside, Dundee
- Western General Hospital, NHS Lothian, Edinburgh
- Queen Victoria Infirmary, Newcastle upon Tyne Hospital NHS Foundation Trust, Newcastle
- The Walton Centre NHS Foundation Trust, Liverpool
- Royal Hallamshire Hospital, Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield
- Queen's Medical Centre, Nottingham University Hospitals NHS Trust, Nottingham
- Salford Royal, Salford Royal NHS Foundation Trust, Salford
- Southmead Hospital, North Bristol NHS Trust, Bristol
- Dorset County Hospital, Dorset County Hospital NHS Foundation Trust, Dorset
- King's College Hospital, King's College NHS Foundation Trust, London
- St George's University Hospital, St George's NHS Foundation Trust, London.

The participants, adults diagnosed with FMD by a neurologist, were randomised (1 : 1) to receive the trial intervention (specialist physiotherapy), or TAU (referral to community physiotherapy). The eligibility criteria and trial treatments are described in more detail in the protocol.[23]

Specialist physiotherapy was a protocolised intervention comprising nine sessions and a 3-month follow-up. The nine sessions were scheduled within a 3-week block to provide a minimum level of intensity. The intervention was guided by an interactive workbook. The physiotherapists delivering this treatment completed a 5-day comprehensive

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training programme. The workbook and physiotherapy training manual are available to download.[25,26]

Participants randomised to receive TAU were referred to the local community physiotherapy service suitable for people with neurological conditions. Given the pragmatic nature of the study, there was no attempt to control the treatment received in this group. We found that participants randomised to TAU received a median of four sessions [interquartile range (IQR) 2–7].

Follow-up of both groups was conducted remotely at 6 and 12 months. Participants could choose their preferred method of completing the study outcome measures from an online form, pen and paper via return mail, or by telephone with a blinded research assistant. We also received digital data from NHS England and NHS Scotland on the number of admissions and hospital appointments attended by each participant in the 12 months prior to and 12 months post randomisation. In addition, between 6 and 12 months post randomisation, participants completed a telephone interview which collected details of the content, frequency and duration of physiotherapy sessions, as well as satisfaction with treatment.

The original target sample size was 264, which was powered to detect a 9-point difference in the SF-36 Physical Functioning domain, at the 5% level of significance with 90% power. In February 2020, the target sample size was increased to an upper threshold of 300, allowing for a greater potential dropout rate. The sample size was increased again, as described below, to mitigate the impact of the COVID-19 pandemic.

In February 2023, towards the end of the data collection period, the physiotherapists delivering specialist physiotherapy attended an in-person debrief meeting, which included a Nominal Group Process that explored potential barriers and facilitators to implementing the intervention across the NHS.

The COVID-19 pandemic

The full impact of the COVID-19 pandemic on the trial and the mitigating strategies are described in a separate publication.[24] To summarise, the UK national lockdown was instigated on 23 March 2020. Trial recruitment and the physiotherapy treatment were suspended. However, follow-up of participants was remote and therefore continued as described in the protocol. At the point of suspension, the recruitment total was 267. Among the recruits, there were 89 participants who had completed baseline assessment but were waiting to receive their randomised treatment. These participants either did not receive treatment during the follow-up period, or their treatment was substantially delayed so that it was received close to the time of the primary outcome. The TAU group were more highly represented within these 89 participants due to the longer wait experienced by this group to start treatment (*n* = 27 specialist physiotherapy and *n* = 62 TAU).

To mitigate the impact of the pandemic on the study results, the trial was extended, and an additional 88 participants were recruited. We continued to collect follow-up data from the 89 participants who had not received their trial-allocated treatment prior to lockdown. However, as per our prespecified analysis plans,[24] these data were treated as missing in the primary analysis. A series of sensitivity analyses explored the impact of excluding these participants, and the wider impact of the pandemic on the trial.

Summary of results

Recruitment occurred between 19 October 2018 and 31 January 2022, with a 17-month break during the COVID-19 pandemic. In total, 355 participants were recruited into the trial from 11 sites; 179 were assigned to specialist physiotherapy and 176 to TAU. After excluding the 89 participants who did not receive treatment prior to COVID-19 lockdown, there were *n* = 152 participants in specialist physiotherapy and *n* = 114 in TAU. The baseline characteristics of the participants are presented in *Tables 1* and *2*. Retention at 12 months was *n* = 138 (91%) and *n* = 103 (90%), respectively. The trial profile is presented in *Figure 1*.

The primary outcome, SF-36 Physical Functioning, was not significantly different between the groups at 12 months. The adjusted difference was 3.5 [95% confidence interval (CI) −2.3 to 9.3].

In secondary outcomes, between group differences were significant in favour of specialist physiotherapy at 12 months for the Clinical Global Impression Improvement (CGI-I) – participant perception of improvement in their motor symptoms [odds ratio (OR) 2.3, 95% CI 1.4 to 3.9); the SF-36 Mental Health domain (adjusted mean difference 5.4, 95% CI 0.9 to 9.8); confidence in the diagnosis; two out of nine scales of the Revised Illness Perception Questionnaire (Personal Control and Illness Coherence). There were no significant differences for the remaining outcomes [the remaining domains of the SF-36, Functional Mobility Scale, Hospital Anxiety and Depression Scale (HADS), a fatigue 5-point scale and digital data on health service use]. The primary and secondary outcomes at 12 months are presented in *Tables 3–6*.

TABLE 1 Baseline demographic characteristics of the participants included in the primary analysis

	Specialist physiotherapy (*n* = 141)	TAU (*n* = 106)	Total (*n* = 247)
Age, years			
Mean (SD)	45.0 (14.3)	44.4 (14.9)	44.7 (14.6)
Median (IQR)	48 (33–55)	45 (31–55)	46 (33–55)
Gender			
Male	37 (26.2%)	27 (25.5%)	64 (25.9%)
Female	104 (73.8%)	79 (74.5%)	183 (74.1%)
Ethnicity			
White	126 (89.4%)	97 (91.5%)	223 (90.3%)
Black	6 (4.3%)	1 (0.9%)	7 (2.8%)
Asian	6 (4.3%)	2 (1.9%)	8 (3.2%)
Mixed	2 (1.4%)	5 (4.7%)	7 (2.8%)
Other	1 (0.7%)	1 (0.9%)	2 (0.8%)
Relationship status and dependants			
Married or cohabitating with partner	77 (54.6%)	63 (59.4%)	140 (56.7%)
Single, separated or widowed	64 (45.4%)	43 (40.6%)	107 (43.3%)
Has dependants	52 (36.9%)	41 (38.7%)	93 (37.7%)
Highest qualification, years of education			
No qualification	11 (7.8%)	4 (3.8%)	15 (6.1%)
General Certificate of Secondary Education	35 (24.8%)	25 (23.6%)	60 (24.3%)
A Level	25 (17.7%)	16 (15.1%)	41 (16.6%)
National Vocational Qualification	26 (18.4%)	17 (16.0%)	23 (9.3%)
Higher National Certificate/Diploma	16 (11.4%)	7 (6.6%)	45 (18.2%)
Degree	18 (12.8%)	27 (25.5%)	45 (18.2%)
Higher degree	9 (6.4%)	9 (8.5%)	18 (7.3%)
Other	1 (0.7%)	1 (0.9%)	2 (0.8%)
Years of education (SD)	14.2 (3.8)	14.4 (2.8)	14.3 (3.4)
Employment status			
Working or studying	49 (34.8%)	37 (34.9%)	86 (34.8%)
Not working/studying because of sickness	40 (28.4%)	31 (29.3%)	71 (28.7%)
Not working because of unemployment	42 (29.8%)	29 (27.4%)	71 (28.7%)
Other	10 (7.1%)	9 (8.5%)	19 (7.7%)

SD, standard deviation.

Source

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TABLE 2 Baseline clinical characteristics of the participants included in the primary analysis

	Specialist physiotherapy (*n* = 141)	TAU (*n* = 106)	Total (*n* = 247)
Care needs			
Has a carer	56 (39.7%)	27 (25.5%)	83 (33.6%)
Has a paid carer	17 (12.1%)	7 (6.6%)	24 (9.7%)
Previous treatment			
Physiotherapy	69 (49.6%)[a]	42 (40.4%)[a]	111 (45.7%)[a]
Psychology	25 (18.0%)[a]	17 (16.4%)[a]	42 (17.3%)[a]
Occupational Therapy	22 (15.8%)[a]	8 (7.7%)[a]	30 (12.3%)[a]
Specialist inpatient rehabilitation	5 (3.7%)[a]	4 (3.9%)[a]	9 (3.7%)[a]
Symptom duration, years			
Mean (SD)	5.2 (7.2)	4.4 (4.9)	4.8 (6.3)
Median (IQR)	2.6 (1.3–6.0)	2.6 (1.1–5.4)	2.6 (1.2–5.6)
Dominant motor symptom			
Weakness	47 (33.3%)	31 (29.2%)	78 (31.6%)
Gait disturbance	45 (31.9%)	35 (33.0%)	80 (32.4%)
Tremor	21 (14.9%)	13 (12.3%)	34 (13.8%)
Mixed movement disorder	19 (13.5%)	16 (15.1%)	35 (14.2%)
Jerks	7 (5.0%)	6 (5.7%)	13 (5.3%)
Dystonia/fixed dystonia	2 (1.4%)	5 (4.7%)	7 (2.8%)
Body part affected, dominant hand[b]			
Left upper limb	68 (48.3%)	43 (40.6%)	111 (44.9%)
Right upper limb	68 (48.3%)	45 (42.5%)	113 (45.7%)
Left lower limb	99 (70.2%)	74 (69.8%)	173 (70.0%)
Right lower limb	92 (65.3%)	75 (70.8%)	167 (67.6%)
Head/neck	36 (25.5%)	20 (18.8%)	56 (22.7%)
Trunk	31 (22.0%)	13 (12.3%)	44 (17.8%)
Dominant hand, right	128 (90.8%)	97 (91.5%)	225 (91.1%)

a Indicates variables with missing data, so the denominator is < 141 for specialist physiotherapy or 106 for TAU.
b Multiple sites/body parts could be affected.
SD, standard deviation.

Source

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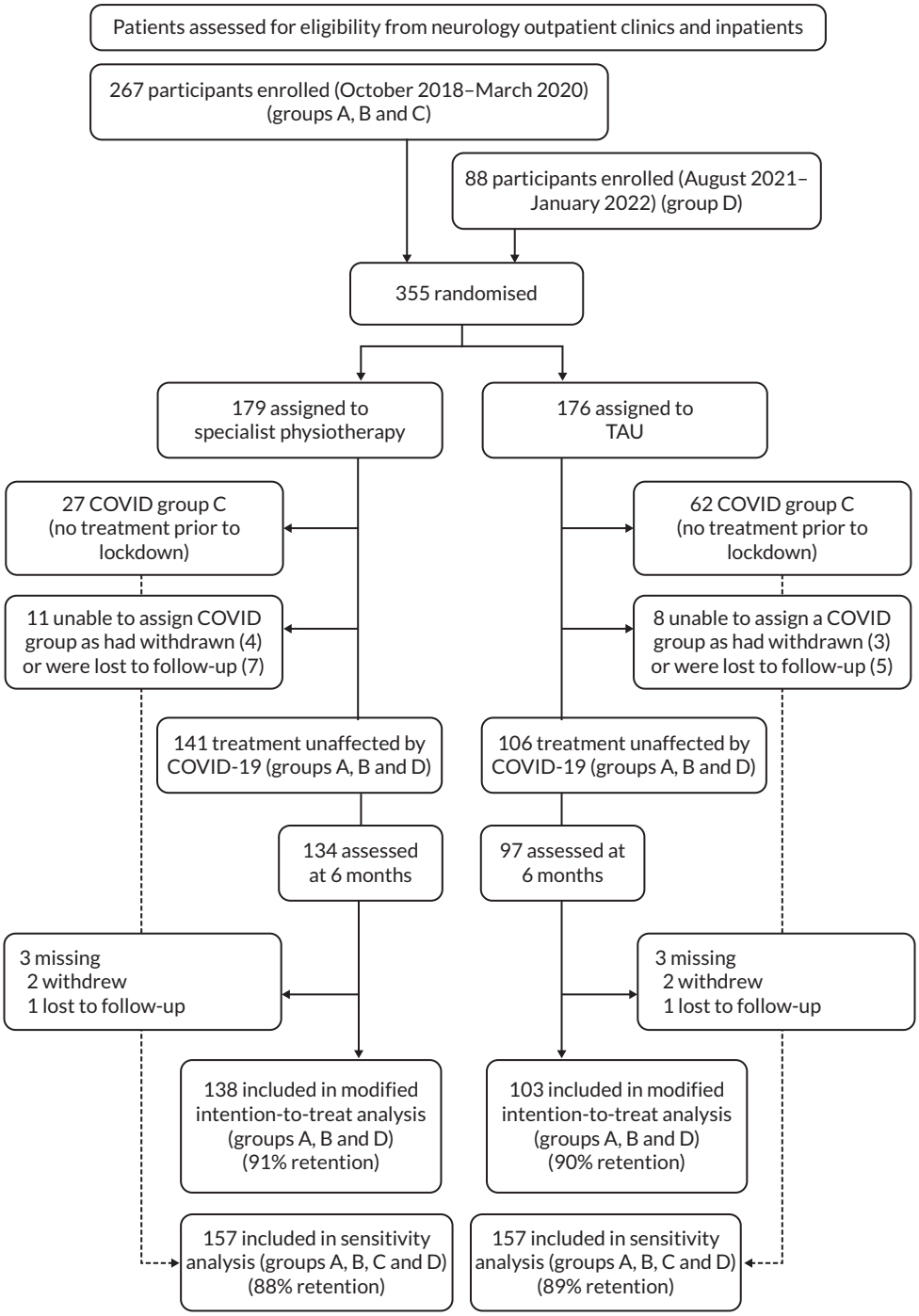

FIGURE 1 Trial profile. Adapted from Nielsen *et al.*[27] This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: https://creativecommons.org/licenses/by/4.0/. The figure includes minor additions and formatting changes to the original text.

In post hoc analysis, we calculated the number of participants who made a 10-point improvement in the primary outcome, which we determined to be a clinically significant change. We found 67 of 138 (49%) in specialist physiotherapy made a clinically significant improvement at 12 months, compared to 39 of 103 (38%) in TAU.

At the 6-month assessment, the outcome measures that were significantly better for specialist physiotherapy compared to TAU were:

- CGI-I (OR of improvement 4.7, 95% CI 2.6 to 8.6)
- SF-36 Physical Role Limitations (adjusted difference 10.1, 95% CI 3.7 to 16.5)

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TABLE 3 Short Form questionnaire-36 items Physical Functioning (primary outcome) and the remaining domains of the SF-36 questionnaire (secondary outcomes) at 12 months

	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
SF-36 Physical Functioning, mean (SD), scale range 0–100			
Baseline	26.3 (23.1)	30.9 (23.2)	
Participants with available data	141 (93%)	106 (93%)	
12 months	37.1 (28.4)	37.2 (28.5)	3.534 (−2.258 to 9.325)[a]
Participants with available data	138 (91%)	103 (90%)	
SF-36 Physical Role Limitations, mean (SD), scale range 0–100			
Baseline	20.9 (21.3)	21.9 (22.2)	
Participants with available data	141 (93%)	106 (93%)	
12 months	33.0 (26.9)	31.8 (27.0)	2.267 (−3.687 to 8.221)
Participants with available data	138 (91%)	103 (90%)	
SF-36 Bodily Pain, mean (SD), scale range 0–100			
Baseline	28.4 (22.7)	32.6 (23.3)	
Participants with available data	141 (93%)	106 (93%)	
12 months	35.4 (26.4)	37.1 (25.6)	1.144 (−4.615 to 6.902)
Participants with available data	138 (91%)	103 (90%)	
SF-36 General Health Perceptions, mean (SD), scale range 0–100			
Baseline	34.2 (19.4)	37.1 (21.7)	
Participants with available data	141 (93%)	106 (93%)	
12 months	34.9 (18.9)	35.5 (20.9)	1.796 (−1.977 to 5.570)
Participants with available data	136 (89%)	103 (90%)	
SF-36 Energy/Vitality, mean (SD), scale range 0–100			
Baseline	22.2 (16.7)	22.3 (18.0)	
Participants with available data	141 (93%)	106 (93%)	
12 months	29.8 (20.3)	26.1 (18.7)	3.752 (−0.874 to 8.377)
Participants with available data	137 (90%)	103 (90%)	
SF-36 Social Functioning, mean (SD), scale range 0–100			
Baseline	29.5 (22.6)	30.8 (26.5)	

TABLE 3 Short Form questionnaire-36 items Physical Functioning (primary outcome) and the remaining domains of the SF-36 questionnaire (secondary outcomes) at 12 months (*continued*)

	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
Participants with available data	141 (93%)	106 (93%)	
12 months	38.8 (27.7)	38.1 (27.5)	1.068 (−5.356 to 7.492)
Participants with available data	137 (90%)	103 (90%)	
SF-36 Emotional Role Limitations, mean (SD), scale range 0–100			
Baseline	48.7 (34.3)	50.8 (36.8)	
Participants with available data	141 (93%)	106 (93%)	
12 months	51.1 (32.0)	48.9 (33.5)	3.638 (−2.850 to 10.126)
Participants with available data	138 (91%)	103 (90%)	
SF-36 Mental Health, mean (SD), scale range 0–100			
Baseline	52.3 (21.5)	54.0 (21.7)	
Participants with available data	141 (93%)	106 (93%)	
12 months	55.1 (23.3)	51.4 (23.9)	5.360 (0.940 to 9.779)[b]

a Intraclass correlation coefficient = 0.017.
b Denotes a statistically significant difference.

Source

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TABLE 4 Participant-rated CGI-I

CGI-I (frequency)	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114) (%)	Difference adjusting for baseline (95% CI)
6-month			
Participants with available data	134 (88%)	96 (84)	
Much improved	29 (21.6%)	5 (5.2)	
Improved	55 (41.0%)	22 (22.9)	
No change	40 (29.9)	59 (61.5)	
Worse	7 (5.2%)	8 (8.3)	
Much worse	3 (2.2%)	2 (2.1)	
OR of improving (95% CI)[a]			4.745 (2.630 to 8.564)[b]
12-month			
Participants with available data	138 (91%)	102 (89)	
Much improved	36 (26.1%)	14 (13.7)	
Improved	45 (32.6%)	25 (24.5)	
No change	41 (29.7%)	47 (46.1)	
Worse	12 (8.7%)	10 (9.8)	
Much worse	4 (2.9%)	6 (5.9)	
OR of improving (95% CI)[a]			2.315 (1.361 to 3.938)[b]

a OR of improving if assigned to specialist physiotherapy (much improved or improved vs. no change, worse or much worse).
b Denotes a statistically significant difference.

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TABLE 5 Secondary outcomes at 12 months

	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
Functional Mobility Scale, mean (SD)[a], scale range 3–18			
Baseline	11.4 (4.5)	11.5 (4.4)	
Participants with available data	140 (92%)	104 (91%)	
12 months	12.2 (4.5)	11.9 (4.6)	0.598 (−0.198 to 1.395)
Participants with available data	136 (89%)	97 (85%)	
HADS: anxiety, mean (SD), scale range 0–21			
Baseline	10.3 (5.0)	9.5 (5.2)	
Participants with available data	140 (92%)	105 (92%)	
12 months	10.0 (5.2)	9.4 (4.9)	−0.531 (−1.412 to 0.350)
Participants with available data	135 (89%)	97 (85%)	
HADS: depression, mean (SD), scale range 0–21			
Baseline	8.8 (4.1)	8.3 (4.4)	
Participants with available data	140 (92%)	105 (92%)	
12 months	8.5 (4.7)	8.2 (4.8)	−0.203 (−1.200 to 0.795)
Participants with available data	135 (89%)	97 (85%)	
Fatigue 5-point scale (frequency)			
Baseline			
Participants with available data	141 (93%)	106 (93%)	
No, slight or moderate fatigue	83 (58.9)	53 (50.0%)	
Severe or extreme fatigue	58 (41.1)	53 (50.0%)	
12-month			
Participants with available data	136 (89%)	97 (85%)	
No, slight or moderate fatigue	67 (49.3%)	48 (49.5%)	
Severe or extreme fatigue	69 (50.7%)	49 (50.5%)	
OR of milder fatigue (95% CI)[b]			1.102 (0.621 to 1.955)

continued

This synopsis should be referenced as follows: Nielsen G, Marston L, Hunter RM, Carson A, Goldstein LH, Holt K, *et al.* Outcomes of specialist physiotherapy for functional motor disorder: the Physio4FMD RCT. *Health Technol Assess* 2025;**29**(34). https://doi.org/10.3310/MKAC9495

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TABLE 5 Secondary outcomes at 12 months (*continued*)

	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
Confidence in the diagnosis, mean (SD), scale range 0–10			
Baseline	8.1 (2.0)	8.0 (2.2)	
Participants with available data	141 (93%)	106 (93%)	
12 months	8.1 (2.3)	7.4 (2.8)	**0.781 (0.193 to 1.369)**[c]
Participants with available data	134 (88%)	94 (82%)	

a Functional Mobility Scale rates the assistance needed over three distances: 5, 50, and 500 m. Each distance is rated from 1 to 6 : 1 = uses wheelchair; 2 = uses walker/frame; 3 = uses crutches; 4 = uses walking stick(s); 5 = independent but needs to hold rail on stairs; 6 =independent on all surfaces.
b OR of milder fatigue if assigned to specialist physiotherapy (no or slight fatigue vs. moderate, severe or extreme).
c Denotes a statistically significant difference.

Source

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TABLE 6 Revised Illness Perception Questionnaire (secondary outcome) at 12 months

Revised Illness Perception Questionnaire, mean (SD)	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
Identity baseline (item range 0–14)	9.0 (2.7)	8.6 (2.9)	
Participants with available data	139 (91%)	105 (92%)	
Identity 12 months	9.3 (2.7)	9.1 (3.0)	−0.247 (−0.839 to 0.345)
Participants with available data	132 (87%)	94 (82%)	
Causes baseline (range 18–90)	40.8 (10.4)	40.9 (12.0)	
Participants with available data	139 (91%)	105 (92%)	
Causes 12 months	42.0 (10.2)	41.7 (10.6)	−0.183 (−2.404 to 2.038)
Participants with available data	132 (87%)	94 (82%)	
Timeline baseline (range 6–30)	20.6 (4.4)	20.3 (4.5)	
Participants with available data	140 (92%)	106 (93%)	
Timeline 12 months	22.8 (4.5)	22.2 (4.0)	−0.194 (−1.175 to 0.787)
Participants with available data	132 (87%)	94 (82%)	
Timeline cyclical baseline (range 4–20)	14.2 (3.7)	14.0 (3.95)	

TABLE 6 Revised Illness Perception Questionnaire (secondary outcome) at 12 months (*continued*)

Revised Illness Perception Questionnaire, mean (SD)	Specialist physiotherapy (*n* = 152)	TAU (*n* = 114)	Difference adjusting for baseline (95% CI)
Participants with available data	141 (93%)	106 (93%)	
Timeline cyclical 12 months	13.7 (3.7)	13.7 (3.7)	−0.188 (−1.021 to 0.644)
Participants with available data	133 (87%)	94 (82%)	
Consequences baseline (range 6–30)	24.0 (4.0)	23.9 (3.6)	
Participants with available data	140 (92%)	105 (92%)	
Consequences 12 months	22.6 (4.5)	22.8 (4.0)	−0.573 (−1.508 to 0.362)
Participants with available data	132 (87%)	94 (82%)	
Personal control baseline (range 6–30)	18.6 (4.0)	19.7 (3.8)	
Participants with available data	140 (92%)	105 (92%)	
Personal control 12 months	19.4 (4.4)	19.0 (4.2)	**1.108 (0.138 to 2.079)**
Participants with available data	133 (87%)	94 (82%)	
Treatment control baseline (range 5–25)	16.3 (2.6)	16.9 (2.6)	
Participants with available data	140 (92%)	105 (92%)	
Treatment control 12 months	15.7 (3.7)	15.9 (3.5)	0.339 (−0.512 to 1.190)
Participants with available data	133 (87%)	94 (82%)	
Illness coherence baseline (range 5–25)	13.3 (4.7)	13.7 (4.7)	
Participants with available data	141 (93%)	106 (93%)	
Illness coherence 12 months	17.2 (4.9)	15.6 (5.0)	**1.669 (0.592 to 2.745)**[a]
Participants with available data	133 (87%)	94 (82%)	
Emotional representation baseline (range 6–30)	21.4 (5.3)	20.4 (5.3)	
Participants with available data	141 (93%)	106 (93%)	
Emotional representation 12 months	19.5 (5.5)	19.6 (4.7)	−0.911 (−1.999 to 0.176)
Participants with available data	133 (87%)	94 (82%)	

a Denotes a statistically significant difference.

Source

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- SF-36 Social Functioning (adjusted difference 8.9, 95% CI 2.6 to 15.2)
- SF-36 Mental Health (adjusted difference 5.0, 95% CI 0.5 to 9.6)
- Confidence in the diagnosis (adjusted difference 1.1, 95% CI 0.5 to 1.6)
- HADS, Anxiety (adjusted difference −1.0, 95% CI −2.0 to −0.1)
- Three domains of the Revised Illness Perception Scale (Timeline Cyclical, Personal Control and Illness Coherence).

Outcomes that showed no difference at 6 months were the remaining domains of the SF-36, the Functional Mobility Scale, HADS Depression, a fatigue 5-point scale, six out of nine scales of the Revised Illness Perception Questionnaire. No outcomes were significantly different in favour of TAU. The complete 6-month data are published in the supplementary appendix of the main trial report.[27]

More participants randomised to specialist physiotherapy were satisfied with their treatment (96.7% vs. 65.3%). Specialist physiotherapy participants rated the knowledge of their physiotherapist more highly (median 10/10 vs. 8/10), and more were likely to recommend their treatment to others who needed similar treatment (99.2% vs. 68.0%).

In the economic evaluation, at 12 months, the mean total adjusted health and social care costs in the specialist physiotherapy group was £3814 (95% CI £3194 to £4433), while the total for TAU was £3670 (95% CI £2931 to £4410); adjusting for baseline, specialist physiotherapy cost £143 (95% CI −£825 to £1112) more than TAU.

Participants in the specialist physiotherapy group had significantly higher EQ-5D-5L utility scores at 6 months (difference 0.054 95% CI 0.002 to 0.107), but not 12 months. There was no significant difference in QALYs over the 12-month follow-up period (0.030 95% CI −0.007 to 0.067). From a health and social care perspective, the mean incremental cost per QALY gained for specialist physiotherapy compared to TAU was £4133. The probability of cost-effectiveness at the £20,000 threshold was 86%. The complete health economic data are published in a separate report.[28]

Publications

Papers:

1. The study protocol[23]
2. The statistical analysis plan and the impact of COVID-19[24]
3. Trial outcomes: Specialist physiotherapy for functional motor disorder in England and Scotland (Physio4FMD): a pragmatic, multicentre, phase 3 randomised controlled trial[27]
4. Economic analysis: Cost Utility of Specialist Physiotherapy for Functional Motor Disorder (Physio4FMD)[28]
5. Secondary statistical analysis: [29]Which factors predict outcome from specialist physiotherapy for functional motor disorder?
6. The physiotherapist's perspective: Considerations for Implementation of the Physio4FMD Trial Intervention: Recommendations based on the experiences of the trial physiotherapists (under review)

Other trial outputs:

7. Physio4FMD Workbook[25]
8. Physio4FMD Intervention Manual for physiotherapists[26]
9. Animation of lay summary of trial outcomes.[30]

Discussion/interpretation

Primary and secondary outcomes

The primary outcome was not significantly different between the randomised groups. The CGI-I (patient-rated perception of improvement of motor symptoms) was significantly different in favour of specialist physiotherapy. Based on this measure, participants randomised to specialist physiotherapy were 4.7 times more likely to rate their motor symptoms as improved at 6 months compared to TAU, and 2.3 times more likely to rate their motor symptoms as improved at 12 months. This finding is of clinical importance, as the patient-rated CGI-I was the main recommended outcome measure for FND research in a recent systematic review and expert consensus recommendation of outcome measurement in FND.[31]

In contrast to the feasibility study, the current study found that both randomised groups improved in the primary outcome (SF-36 Physical Functioning) from baseline to 12 months. In the feasibility study, only the intervention group improved on this measure.[20] The improved performance of physical function in the TAU group may point to a national improvement in physiotherapists' knowledge and skills over the past few years and, in part, account for the lack of significant difference between groups at 12 months.

In post hoc analysis, we found that 38% of participants in the TAU group made a 10-point improvement on the primary outcome (SF-36 Physical Functioning), which

matched the proportion of participants who rated their symptoms as improved on the CGI-I, also 38%. For specialist physiotherapy, there was a discrepancy between these values, 49% made a 10-point improvement on the primary outcome, yet 59% rated their symptoms as improved. We hypothesised that the greater perception of improvement in specialist physiotherapy may be related to the parallel findings in this group, of higher confidence that their diagnosis was correct, perceived better understanding of their symptoms, perceived better control over their symptoms, and better scores of mental health (less anxiety at 6 months, higher SF-36 Mental Health at 12 months). These parallel findings may be associated with developing self-efficacy.

In terms of the serious adverse events (SAEs), we found that physiotherapy was safe, with no SAEs related to treatment. However, an important finding was a high rate of hospitalisation among trial participants in both arms over the 12-month follow-up period. Seventeen per cent of participants from both treatment arms who had timely treatment had at least one hospital admission. There were 77 events leading to hospitalisation. The most common reason for hospital admission related to gastroenterological symptoms (21% of events), followed by neurological symptoms (19%), respiratory symptoms/illness (12%), cardiological (9%), urological (8%), oncological (7%), gynaecological (6%), psychiatric (6%), orthopaedic (4%) and other reasons (8%). Hospitalisations were reported as SAEs in the trial outcomes, and all were judged to be unrelated to physiotherapy treatment. The high rate of hospitalisation relates to the health complexity of people with FMD, and the highlights the need for multidisciplinary care.

Health economic analysis

At 6 months, specialist physiotherapy had significantly higher EQ-5D-5L utility scores compared to TAU. The difference was not significant at 12 months (adjusted difference, 0.040, 95% CI −0.014 to 0.095). This corresponded to a difference in QALYs at 12 months of 0.030 (95% CI −0.007 to 0.067). After accounting for the cost of training and delivering the respective interventions, the mean incremental cost per QALY was £4133. The research was not specifically powered for the health economic analysis, and greater subject numbers would be needed to be assured of the significance of this finding. Sensitivity analysis revealed that those recruited and treated in the trial extension after COVID-19 lockdowns saw the greatest savings, influencing the cost-effectiveness of specialist physiotherapy. The full health economic analysis, including data on employment and costs from a societal perspective, is published separately.[28]

The impact of the COVID-19 pandemic

As described above, recruitment and physiotherapy treatment were suspended during the peak of the COVID-19 pandemic. Return to clinical and research activity occurred after 6–9 months and varied by trial site, depending on local policies. The immediate impact of the pandemic on the trial was the interruption to the delivery of the physiotherapy treatment. We categorised the trial participants into four groups, according to how their trial journey interacted with the pandemic as follows:

Group A (*n* = 25): received treatment and completed their 12-month follow-up before 23 March 2020 (the date when national lockdown restrictions were imposed in the UK).
Group B (*n* = 134): received treatment before 23 March 2020 but were followed up after 23 March 2020.
Group C (*n* = 89): recruited prior to but did not receive treatment before 23 March 2020, followed up as per protocol.
Group D (*n* = 88): participants recruited after July 2021 as part of the trial extension.

In prespecified analysis plans,[24] we excluded participants in group C from the primary analysis. In the specialist physiotherapy group, 27 participants met the criteria for group C; among them, only 8 (26.6%) received physiotherapy within the trial follow-up period. This treatment was delayed by a median of 253 days (compared to a median treatment start delay of 36 days for COVID groups A, B and D). In the TAU group, 62 participants met the criteria for group C, 22 (out of 60 with available data, 36.7%) received physiotherapy within the trial follow-up period. This was delayed by a median of 174 days (compared to a median treatment start delay of 97 days for COVID groups A, B and D). These findings support the decision to exclude group C from the primary analysis.

Sensitivity analyses found that excluding group C from the primary analysis had no impact on the significance of the result for the primary outcome. Adding a supplementary fixed effect of group indicator and its interaction with the assigned treatment to the primary analysis model did not find that the intervention differed by COVID group indicator (COVID group C vs. groups A, B and D) (p = 0.825).

How the randomised treatments differed

We explored the composition of physiotherapy received in both randomised groups by participant report in a telephone interview conducted at approximately 6 months after randomisation. The results of this interview are

reported in the supplementary appendix of the main trial outcome paper.[27]

Treatment as usual comprised fewer sessions (median 4, IQR 2–7, compared to specialist physiotherapy median number of sessions 9, IQR 8–9), which were scheduled less frequently (75% had sessions that were scheduled fortnightly or less frequently, while specialist physiotherapy scheduled more than one session per week).

Specialist physiotherapy was centred around a printed, interactive workbook, whereas there was little evidence of a similar device used in TAU. One of the primary objectives of specialist physiotherapy was to help participants understand their movement problem and the role of attention in driving symptoms. Ninety-nine per cent of participants in specialist physiotherapy agreed that their physiotherapist tried to help them understand their movement problem, and 98% agreed that their physiotherapist talked to them about how attending to movement can make movement worse. In participants allocated to TAU, these figures were 66% and 61%, respectively.

The specialist physiotherapy intervention protocol included education and development of management plans for persistent pain and fatigue when present. Among participants who experienced persistent pain (82%), 91% in specialist physiotherapy agreed their physiotherapist tried to help them with this, compared to 48% in TAU. Among participants who experienced fatigue (93%), 98% in specialist physiotherapy agreed their physiotherapist tried to help with this, compared to 59% of TAU.

The specialist physiotherapy intervention protocol included education about the potential negative side effects of medications, such as opiates and muscle relaxants. Fifty-six per cent of participants reported taking medication for their movement problem. Among this group, 84% of participants in specialist physiotherapy reported discussing medication side effects with their physiotherapist, compared to 33% in TAU.

The specialist physiotherapy intervention included information about the symptoms of memory and concentration problems. Of those with memory and concentration problems (88% specialist physiotherapy, 71% TAU), 91% in specialist physiotherapy reported discussing this with their physiotherapist, compared to 40% of TAU.

Finally, 98% in specialist physiotherapy reported that they made a self-management plan to help continue to improve following treatment, compared to 66% of TAU.

We used the data from the telephone interview to look for evidence of contamination between randomised groups, that is, if participants randomised to TAU received elements of specialist physiotherapy. We found one case of clear contamination, where a participant allocated to TAU received the specialist physiotherapy workbook and the core treatment components. This was recorded as a deviation from the protocol.

There are some clear differences between the randomised treatments. Specialist physiotherapy included more treatment sessions that were scheduled with higher frequency. The workbook is unique to the trial intervention, but 69% of TAU received some form of printed material, most commonly a list of exercises. The components of specialist physiotherapy are based on published consensus recommendations, and it appears that many of these were included in TAU (e.g. 61% learnt about the role of attention in symptoms, 49% received pain management, 59% received fatigue management and 66% developed a self-management plan). Overall, one might conclude that TAU for most participants was delivered to a high standard. This supports our suggestion that the quality of TAU improved from the feasibility study to the current trial.

Recommendations for implementation: the physiotherapist's perspective

Following completion of the intervention phase of the study, the physiotherapists delivering specialist physiotherapy attended a meeting to debrief and consider factors relating to implementation (paper under review). Nominal Group Technique[32] was used to identify and rank in order of importance, facilitators and potential barriers to implementing the Physio4FMD treatment protocol. Twenty-three facilitators and 26 potential barriers were identified. The top two facilitators were the intervention workbook and physiotherapist training to deliver specialist treatment for FMD. These factors reflect the novelty of the intervention. The top potential barrier was inappropriate referral/selection of patients. In line with the eligibility criteria for the study, we acknowledge that the trial intervention is not suitable for all people with FMD, and in previous work found that 32% of patients with functional motor symptoms met the eligibility criteria for specialist physiotherapy.[20] The availability of alternative treatment pathways for those not meeting eligibility for specialist physiotherapy was considered to be important. Alternative treatments include specialist FND multidisciplinary programmes and psychological therapy. We reported a list of recommendations for implementation of specialist physiotherapy based on content analysis of the final facilitators and potential barriers.

In light of the perceived importance of training, we explored how the training could be adapted to aid implementation, using an online questionnaire completed by study physiotherapists. All reported that the training programme introduced them to concepts or ways of treating FMD that they were not previously using, and that the training had changed their ongoing practice. The training was delivered over 5 full days, which has implications for cost. In the training questionnaire, we explored the opinions of the physiotherapists about whether the training could be reduced by condensing the content over fewer days. Most agreed that training could be reduced from 5 to 4 days, and that further cuts could be made, but this would impact the effectiveness of training. The findings indicate the specialist physiotherapy for FMD is a complex intervention that requires experience, training and some support from a multidisciplinary team.

Contributions to existing knowledge

The Physio4FMD is the first published, powered, multicentre RCT of a physical-based intervention for FMD. There was no difference in SF-36 Physical Functioning scores between specialist physiotherapy and TAU; both groups improved over 12 months for this outcome measure. SF-36 Physical Functioning is a self-report measure that takes into account ability to complete vigorous activities, moderate activities, stair climbing, walking various distances, carrying groceries, and washing and dressing. In secondary outcomes, participants receiving specialist physiotherapy were more likely to report their motor symptoms as improved at 6 months (OR 4.7, 95% CI 2.6 to 8.6) and 12 months (OR 2.3, 95% CI 1.4 to 3.9). Additionally, specialist physiotherapy was associated greater scores for mental health, and other outcomes relating to understanding and self-efficacy. Improvements occurred despite high levels of complexity at baseline, as indicated by long symptom durations (mean 4.8 years) and high rates of coexisting health problems, such as anxiety, pain and fatigue.

The Physio4FMD trial demonstrated that rehabilitation for FMD can occur outside specialist centres. We set up 11 trial sites, of which most did not previously have a dedicated service for FMD/FND. The neurologists who diagnosed and screened potential participants and the physiotherapists delivering treatment completed training for their respective roles, and all had some previous experience with FMD.

We found a high cost of illness, with hospital admissions and hospital appointments accounting for the greatest proportion of costs. Specialist physiotherapy showed a high probability of cost-effectiveness, resulting in more QALYs and lower costs than TAU, although the difference did not reach statistical significance. The probability of cost-effectiveness at the £20,000 cost per QALY threshold was 86%.

Strengths and weakness of the Physio4FMD trial: reflections on the project

Strengths of this research include the protocolised study intervention, which proved capable of being delivered with fidelity. Specialist physiotherapy was highly rated by the trial participants in the satisfaction survey, which was backed up by high levels of attendance and low attrition. The trial physiotherapists also rated the intervention highly during the debrief meeting.

Strengths in the research design include the powered sample size, 12-month follow-up and blinding of those who collected and analysed the trial outcomes. A strength of the conduct of the trial was the high retention and low levels of missing data for the primary outcome.

There are important weaknesses to acknowledge. With the pragmatic design, waiting times to start treatment were different between randomised groups, with specialist physiotherapy starting at a median of 36 (IQR 25–58) days after randomisation and TAU 97 (IQR 60–176) days. Added to this, the duration of treatment was longer for TAU, with the result that specialist physiotherapy had completed treatment a median of 310 days (IQR 282–323) prior to completing the primary outcome and TAU 179 (IQR 123–238) days. However, the treatment effect did not appear to reduce over time. To address this issue in future research, the timing and nature of the comparator intervention could be more strictly defined. However, this would come with additional costs and the loss of the pragmatic 'real-world' effects. Alternatively, if the trial were to be repeated, the primary outcome could be defined as 12 months post-intervention commencement.

We found that both randomised treatments improved on scores of physical function from baseline to 12 months. Without a 'no treatment' or 'waiting list control' arm in the trial design, it is unclear how much these changes relate to the efficacy of both interventions or natural recovery.

The study relied on subjective, patient-reported outcomes. There are currently few FND-specific, validated, objective outcome measures.[31] Developing and choosing an appropriate assessment tool for FMD is complicated by factors such as the potential for variability of FMD symptoms over short periods of time. Additionally, patients typically experience

multiple symptoms, and each may contribute to the illness burden, so measuring only one domain may miss clinically important changes.[33] A recent consensus statement for a core outcome measurement set for FND highlighted the value of patient-reported outcomes over objective or single time-point measurements and recommended the patient-reported CGI-I as the most useful measure of symptom severity.[31] With this measure, we found a statistically significant difference in favour of specialist physiotherapy.

We were unable to record the number of patients screened for eligibility. This limits our ability to comment on generalisability. This was related to the method of recruitment from multiple sources and sites, and limitation of resources. We did record this data in the feasibility study from a single site and found that 32% met selection criteria. While this may be viewed as a limitation in generalisability, we argue that given the heterogeneity of people with FMD, different treatment approaches are necessary, and a one-size-fits-all approach to treatment is a dated view. Additionally, there are alternative existing treatments for those whom specialist physiotherapy is deemed unsuitable, including multidisciplinary rehabilitation, and psychotherapy.[34–36]

Another limitation was that determining participant eligibility required interpretation by the recruiting neurologist rather than being operationalised, for example, with a cut-off score from a validated assessment tool. We felt that there were no suitable assessment tools for this purpose, and this may be a focus for future research.

The COVID-19 pandemic and associated 'stay at home' orders (lockdown) occurred during the trial data collection. We took a number of steps to minimise the impact of these events on the trial results, which included excluding participants whose treatment was interrupted by the pandemic from the primary analysis. We explored the impact of this decision with a series of sensitivity analyses. Although the sensitivity analyses did not show differences in the primary outcome depending on whether participants were recruited before or after the pandemic, it is impossible to rule out that confounding factors may have influenced the primary and secondary outcomes. In the economic evaluation, we found a higher probability that specialist physiotherapy was cost-effective compared to TAU in participants recruited after the pandemic compared to those recruited before. We hypothesised that this may be related to improved skill within the specialist physiotherapy group with practice; however, other confounding factors related to the pandemic may have influenced this finding.

Take-home messages

People with FMD often have complex health problems that can be associated with persistent pain, fatigue, anxiety and other coexisting diagnoses. This complexity is associated with high rates of healthcare utilisation, including hospitalisation, and a high cost of illness. It follows that access to multidisciplinary care is needed.

Despite this complexity, physiotherapy within neurology/neurorehabilitation services is a valuable treatment for people with FMD. Specialist FMD physiotherapy appeared to be more cost-effective than TAU (non-specialist physiotherapy). The additional value of specialist physiotherapy over TAU was greater participant perception of improvement, improved mental health, greater confidence in the correctness of the diagnosis, greater understanding of symptoms and greater perception of control over symptoms.

Patient and public involvement

Aim of patient and public involvement

The overall aim of our patient and public involvement (PPI) strategy was to include people with FMD in all phases of the research, from design to dissemination, in order to optimise benefits of the intervention, relevance of the study findings and to ensure that the research was conducted with the well-being and interests of service users (SUs) in mind.

The specific aims of PPI in the development phase were:

- to ensure the research questions were meaningful
- to ensure the study intervention matched patients' priorities and expectations for treatment
- to ensure the study procedures were acceptable
- to ensure the study outcomes were meaningful and relevant.

The specific aims of PPI during the trial were:

- to support and advise on the conduct and management of the trial
- to input into the interpretation of the results
- to support and oversee dissemination of the results to relevant stakeholders.

Methods of involving patients and the public

Knowledge from previous PPI during the intervention development phase and feasibility testing was carried forward to the current study. To further inform the

research design, we carried out a large patient and public engagement project via social media, with support from patient charities, FND Hope UK and FND Action. In the first stage, 139 people who identified themselves as having the diagnosis of FMD took part by listing their priorities for treatment. In order of importance, the top five priorities were: (1) improve walking; (2) improve ability to work/study; (3) improve pain; (4) improve fatigue; and (5) understanding what is wrong. In a second stage, we invited people to join a dialogue hosted on a Facebook discussion group. Fifty-five people joined this discussion, where comments were invited on various themes related to the research. An additional workshop was held with two SUs and a family member to review the protocol, participant requirements, outcome measures and patient-facing documentation. The findings from this work informed the design of the intervention and the trial protocol.

Once funding for the trial was awarded, the primary method of PPI was through representation on the Trial Management Group (which met approximately 6-weekly) and the independent Trial Steering Committee (which met approximately 6-monthly). Two PPI representatives were appointed to each committee. Latterly, an additional PPI member, representing patient charity, FND Hope UK, was invited to join the Trial Management Group to support the existing members and assist with interpretation and dissemination of the trial results. Each PPI member attended a training day to help them prepare for their role in the research. PPI members were encouraged and supported to be active members of their respective committee ensuring their point-of-view informed decisions, analysis and the write-up.

Results of patient and public involvement

Patient and public involvement shaped the research design in a number of ways. Firstly, PPI provided reassurance that the randomised design was acceptable, ethical and started from a position of equipoise. Other examples include the social media project finding that improved mobility was the highest-ranked priority outcome for treatment influenced the choice of the primary outcome (SF-36 Physical Functioning domain); the number of assessments were reduced to lessen the participant burden; and three choices for the method of completing trial outcomes were added to improve ease and accommodate for various potential difficulties.

The PPI perspective influenced the decisions and advice provided by the trial committees, and this was particularly important when developing a COVID-19 mitigation strategy and plans to restart the trial after pausing during the initial pandemic. PPI members helped to consider the risks of restarting face-to-face treatment and balance the risks against the potential benefits from access to treatment. There was a perception among PPI members that people with FMD had suffered from the lack of access to treatment during COVID-19 lockdowns, and that continuing the trial with risk limitation strategies was of high importance.

Patient and public involvement was important to increase the reach of our dissemination strategy. Together with our PPI collaborators, we co-designed an animation, summarising the main trial findings.[30] The PPI group also assisted with social media dissemination, which is highly used by the patient community. A post of the trial animation on X Corp. (X Corp., San Francisco, CA, USA) (formally Twitter) had received 204.7 thousand views between 24 July 2024 and 18 November 2024.[37]

Discussion, conclusions and reflections

We underestimated the burden of the role when inviting our PPI members to collaborate. Their commitment turned out to be over 5 years in duration, longer than initially planned due to COVID-19 delays. An additional PPI representative was appointed when the trial restarted after COVID-19 to share the burden of the work. Our PPI members were essential to the delivery of the trial and, without exception, were a positive influence during all stages.

People with FND commonly report negative interactions with healthcare professionals and often feel abandoned by the healthcare system.[38,39] Collaboration with SUs was, therefore, crucial to ensure the research addressed the priorities of patients and for ensuring the trial intervention and research procedures were acceptable and relevant. The high levels of satisfaction in participants receiving the trial intervention and high retention over 12 months reflect the value of our ongoing SU collaboration.

Equality, diversity and inclusion

It has been consistently reported in the literature that women are more frequently affected by FMD, representing 60–75% of patients.[40] Our cohort was consistent with these data. From all 355 participants, 258 (72.7%) were female. More research is needed to understand this gender disparity. In addition to physiological differences, some have suggested that greater exposure to social and environmental risk, such as physical and sexual abuse in women, may account for at least some of the difference.[41] Another potential explanatory factor is the finding that women are more likely than men to present to health services by a factor of 1.5–1.[40]

TABLE 7 Ethnicity breakdown of all participants vs. those recruited in England and Scotland, compared to census data

Ethnicity	Physio4FMD, total cohort (%)	Physio4FMD English cohort (%)	Physio4FMD Scottish cohort (%)	England and Wales census 2021[42] (%)	Scotland census 2011[43] (%)
White	318 (89.6)	242 (89.0)	76 (91.6)	81.7	96.0
Black	10 (2.8)	9 (3.3)	1 (1.2)	4.0	> 1.0
Asian	12 (3.4)	11 (4)	1 (1.2)	9.3	2.7
Mixed	12 (3.4)	9 (3.3)	3 (3.6)	2.9	< 1.0
Other	3 (0.8)	1 (0.4)	2 (2.4)	2.1	

With regards to ethnic representation, we collected data following the Office for National Statistics ethnic group classifications; see *Table 7* for the ethnicity breakdown. Compared to the census data, the Physio4FMD cohort is skewed towards ethnically white people, with under-representation from those identifying as ethnically Asian in particular.

The under-representation of ethnic minorities is an important finding to consider. A likely contributing factor is the exclusion of people who could not understand English sufficiently to complete the study questionnaires independently, which will disproportionally affect people from minority ethnic backgrounds. However, under-representation may have occurred due to any number of reasons and at any stage in the chain of events leading to recruitment, including referral to neurology from primary care.

An unresolved question to consider is, does the incidence of FMD differ across cultures and ethnicities? While we lack good data on this topic, we know that FMD is reported in studies from geographically diverse locations, including Sudan, Pakistan, Turkey, Iran and China, showing similar symptom phenomenology to European and North American cohorts.[44,45] There may be cultural differences in the prevalence of certain symptom phenotypes, but, overall, the demographic profile is thought to be consistent across cultures.[46] A study by Wilkins *et al.* 2018 looked at 1961 consecutive admissions to a stroke service at a large general hospital in Qatar and reported the proportion of functional stroke mimic (patients presenting with stroke-like symptoms before being diagnosed with FND) by ethnicity.[47] People of South Asian nationality (India, Bangladesh, Nepal, Pakistan and Sri Lanka) had the lowest proportion of functional stroke mimic (5.2% of admissions), compared to people from Western nations (6%), the Far East (6.3%), people from Qatar (7.9%), people from Arab nations (15.6%) and people from Africa (16.8%). The ethnic differences were thought to be related to a complex mixture of economic, social and cultural factors. In particular, the South Asian population in Qatar are composed of expatriates, and the majority are economically disadvantaged, have precarious employment, no family support and inadequate health insurance. Cultural influences may include heightened stigma around mental illness and preferences for traditional therapies. Barriers to recruiting ethnic minorities to mental health research have been explored and include the explanatory model of illness, language barriers, religious beliefs, trust, stigma and gender-related issues.[48]

Regardless of the cause, the low numbers of people from ethnic minority backgrounds is a limitation of the generalisability of the trial outcomes. Further research is recommended to explore how ethnic and cultural identity may impact the lived experience of FMD and how treatment should be adjusted to accommodate. Future work should include culture-specific co-design of interventions with SUs. Future trials should consider evidence-based strategies to improve recruitment of people from minority ethnic backgrounds.[48]

When designing this research, a number of choices were made to minimise barriers to inclusion. These were supported options for completing outcome measures for people with difficulty reading and filling in forms, flexibility in scheduling physiotherapy sessions to accommodate employment and child care, and reimbursement of travel costs to minimise the financial burden. A key motivating factor for this research was the inequality of care received by people with FND compared to other physical and mental health conditions. The findings of this research show that physiotherapy was safe and that both randomised groups improved, which makes exclusion of FND from rehabilitation services difficult to justify.

Impact and learning

The future impact of the Physio4FMD trial is to be determined. An important potential impact will be

supporting people with FMD to access rehabilitation on the NHS. Patient-led charity, FND Hope UK, submitted a freedom of information request to Clinical Commissioning Groups and Health Boards in England, Wales and Scotland, that asked for information regarding commissioning agreements for FND.[49] The exercise found that 14% (England), 21% (Scotland) and 43% (Wales) of services did not accept physiotherapy referrals for people with FND. We argue that FND has been unfairly excluded from rehabilitation services on unfounded grounds. The findings of the Physio4FMD trial show that physiotherapy was safe and that both randomised groups improved; this makes exclusion of FND difficult to justify. Support for the argument that people with FND should have access to rehabilitation therapies comes from the National Institute for Health and Care Excellence, who are in the development phase of a guidance document on 'Rehabilitation for chronic neurological disorders including acquired brain injury'.[50] Following stakeholder consultation, the document scope was updated to include FND. As one of very few randomised studies of FND, the findings from the Physio4FMD trial will be important to inform recommendations of this guideline.

Since participating in the trial, the physiotherapists from each site continue to provide treatment for people with FMD informed by the intervention protocol. Some sites have since secured additional funding for specialist FMD physiotherapy posts. There was consensus among the physiotherapists delivering specialist physiotherapy in the trial (manuscript in preparation) that several important ingredients are needed to set up a specialist physiotherapy for FMD service. These included (1) training for the specialist physiotherapist; (2) experienced clinicians to select patients for whom specialist physiotherapy is most suited and direct patients who are unlikely to benefit to more suitable treatment; and (3) a supportive multidisciplinary team to help with cases of high complexity. However, the trial interventions can be applied to settings outside of specialist services, and the trial materials are available to inform interventions of physiotherapists and other health professionals.

We found high health and social care costs at baseline, that were similar to people with advanced Parkinson's disease and moderate-severity multiple sclerosis.[51,52] Hospital inpatient and outpatient services accounted for a substantial proportion of total costs. We suggest that this is a reflection of the complexity and multicomorbidity of the patient population. Although many of these hospital contacts may have been necessary and appropriate, the data suggest that there is further potential for cost savings with early diagnosis and treatment.

We have shown that it is possible to conduct a large, randomised trial in people with FMD. Future trials will need to consider what is the most meaningful outcome measure for rehabilitation in FMD. Our chosen primary outcome, SF-36 Physical Functioning, improved over 12 months in both groups, but it is unclear from the current study whether or not this change can be attributed to physiotherapy (from both randomised treatments) or natural recovery. Alternative assessment tools should be considered in research involving people with FMD. A recent expert consensus statement on core outcomes for FND research suggested that the CGI-I is currently the most suitable assessment of FND symptom severity. An alternative assessment tool is the Simplified Functional Movement Disorders Rating Scale,[53] which would require in-person assessments and therefore has cost implications.

Other metrics to assess the future impact of the Physio4FMD trial will include uptake of future training and downloads for the physiotherapy training resource manual and intervention workbook.

Implications for decision-makers

We have demonstrated that it is possible to train physiotherapists to deliver specialist interventions, that are highly regarded by both the patient and clinician.

We found that specialist physiotherapy for FMD, compared to standard physiotherapy, has a high probability of being cost-effective at the £20,000 cost per QALY threshold. Specialist physiotherapy has additional benefits, including a higher OR of patient-reported improvement, better scores of mental health and other benefits related to self-efficacy. Additionally, physiotherapy was found to be safe, with no SAEs related to treatment. Our findings suggest that specialist physiotherapy has value for some people with FMD and that usual-care physiotherapy may be augmented with strategies described in the specialist physiotherapy approach.

There are currently regions in the UK where there is no provision for NHS-funded physiotherapy or other rehabilitation for FMD.[49] Despite the lack of allocated resources, we found a high cost of illness, mostly accounted for by hospital outpatient appointments and admissions. There is a strong argument that the costs

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could be reduced if healthcare resources were directed towards early diagnosis and treatment. Different treatment pathways are needed to meet the needs of this large heterogenous population, including psychology and specialist multidisciplinary interventions involving occupational therapy and speech and language therapy.[54]

Research recommendations

Measurement of symptom severity, disability and distress associated with functional motor disorder

Currently there are few outcome measures that have been validated for FMD, and there is insufficient data to determine which assessment tools are most useful for research.[55] The discrepancy found in the current study between the SF-36 Physical Functioning, and patient perception of change, suggests that the SF-36 Physical Functioning score may miss important changes associated with specialist physiotherapy. We did not include an in-person assessment of motor symptom severity (e.g. the Simplified Functional Movement Disorders Rating Scale) due to cost limitations, and this may have been a better primary outcome or provided additional information as a secondary outcome.[53] Future research should explore the use of modern technology to develop more objective outcome measures for FMD, such as wearable mobility trackers, that can account for symptom variability over time.

Patient selection and refining the intervention

Future research is needed to identify who benefits most from specialist physiotherapy for FMD and what alternative or additional treatments are needed. This work may include identifying which components of specialist physiotherapy are most important and optimal dose.

What is the cost of illness and what are the cost benefits of interventions for functional motor disorder?

We found a high cost of illness and high probability that specialist physiotherapy was cost-effective in those meeting the eligibility criteria. Research specifically designed and powered for economic evaluation involving broader eligibility criteria is needed. Considering that people with FMD often experience delays in diagnosis and exclusion from treatment (e.g. the mean symptom duration in participants of the current study was 4.8 years), it is likely that there are opportunities to reduce costs, and early intervention may prove to be even more cost effective.

What is the most effective treatment for children and young people with functional motor disorder?

The incidence rate of FMD in children is similar to that of adults, and a recent study found that prognosis is often poor.[56] Yet research and evidence for treatment of FMD in children is scarce and therefore should be a priority for research. Similarly, there are little data on how treatment may need to be adapted to meet the needs of people from different cultural backgrounds, and this should be explored in future research.

Conclusions

Specialist physiotherapy was not superior to TAU as measured by SF-36 Physical Functioning at 12 months. However, specialist physiotherapy had better scores for several secondary outcomes, related to participant perception of change, HRQoL, mental health and self-efficacy. Additionally, we found a high probability that specialist physiotherapy was cost-effective when compared to usual physiotherapy. Participants in both randomised treatments improved, and there were no adverse events related to physiotherapy treatment.

Additional information

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Patient data statement

This work uses data provided by patients and collected by the NHS as part of their care and support. Using patient data is vital to improve health and care for everyone. There is huge potential to make better use of information from people's patient records, to understand more about disease, develop new treatments, monitor safety, and plan NHS services. Patient data should be kept safe and secure, to protect everyone's privacy, and it's important that there are safeguards to make sure that it is stored and used responsibly. Everyone should be able to find out about how patient data is used. #datasaveslives You can find out more about the background to this citation here: https://understandingpatientdata.org.uk/data-citation

Data-sharing statement

Deidentified participant data can be made available by request to the corresponding author. Requests will be considered after planned analyses and reporting have been completed by the investigators. Access will require submission of a protocol that is approved by a review committee and a signed data access agreement. Due to our data-sharing agreement and for patient confidentiality reasons, we are not able to provide access to hospital episode statistics data from NHS England and NHS Scotland.

Ethics statement

Ethics approval was granted by the London-Surrey Borders Research Ethics Committee, reference number 18/LO/0486, 28 March 2018. All participants gave written informed consent to participate.

Information governance statement

St George's, University of London is committed to handling all personal information in line with the UK Data Protection Act (2018) and the General Data Protection Regulation (EU GDPR) 2016/679. Under the Data Protection legislation, St George's, University of London is the Data Controller, and you can find out more about how we handle personal data, including how to exercise your individual rights and the contact details for our Data Protection Officer here: www.sgul.ac.uk/about/our-professional-services/information-services/information-governance/data-protection

Disclosure of interests

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range of neuropsychiatric topics, including pain disorders. He is President of the FND Society and Associate Editor of JNNP. Jonathan Marsden has undertaken commercial research for Roche-Hoffmann Pharmaceuticals. Jonathan Marsden has received research grant funding from the NIHR. Jonathan Marsden has received honorary from Bern University and MS Trust. Jonathan Marsden is the chair for NIHR PCAF panel up until 2023. Irwin Nazareth participated in a monitoring board for the APRIL Trial and for the QMUL Clinical Trials Unit. Markus Reuber has received research funding from the NIHR and Epilepsy Research UL. Markus Reuber receives a salary as Editor in Chief for Seizure-European Journal of Epilepsy. Markus Reuber has received honoraria from Angelini Pharam, UCB Pharma and Precisis. Markus Reuber has received royalties from Oxford University Press and Jessica Kingsley Publishers. IN has received research funding from the NIHR, MRC and Wellcome Trust. Jon Stone reports honoraria from UptoDate, personal fees from Expert Witness Work and grants from National Research Scotland. He runs a free self-help website, www.neurosymptoms.org, for patients with FND. He is secretary of the FND Society and on the medical advisory boards of the charities FND Hope UK and FND Action. Mark J Edwards does medical expert reporting in personal injury and clinical negligence cases, including in cases of FND. Mark J Edwards has shares in Brain & Mind, which provides neuropsychiatric and neurological rehabilitation in the independent medical sector, including in people with FND. Mark J Edwards has received financial support for lectures from the International Parkinson's and Movement Disorders Society, European Academy of Neurology, and the FND Society (FNDS). Mark J Edwards receives royalties from Oxford University Press for his book The Oxford Specialist Handbook of Parkinson's Disease and Other Movement Disorder. Mark J Edwards has received honoraria for medical advice to Teva Pharmaceuticals. Mark J Edwards receives grant funding, including for studies related to FND, from the National Institute for Health and Care Research (NIHR) and the Medical Research Council (MRC). Mark J Edwards is an associate editor of the European Journal of Neurology. Mark J Edwards is a member of the international executive committee of the International Parkinson's and Movement Disorders Society and a board member of the FNDS. Mark J Edwards is on the medical advisory boards of the charities FND Hope UK and Dystonia UK. All other authors declare no competing interests.

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Award publications

This synopsis provided an overview of the research award *A randomised controlled trial of specialist physiotherapy for Functional Motor Disorder (Physio4FMD).*

Other articles published as part of this thread are:

Nielsen G, Stone J, Lee TC, Goldstein LH, Marston L, Hunter RM, *et al*. Specialist physiotherapy for functional motor disorder in England and Scotland (Physio4FMD): a pragmatic, multicentre, phase 3 randomised controlled trial. *Lancet Neurol* 2024;**23**:675–86. https://doi.org/10.1016/S1474-4422(24)00135-2

Hunter RM, Nielsen G, Le Novere M, Marston L, Lee TC, Stone J, *et al*. Cost Utility of Specialist Physiotherapy for Functional Motor Disorder (Physio4FMD). *Neurol Clin Pract* 2025;**15**:e200465. https://doi.org/10.1212/CPJ.0000000000200465

For more information about this research, please view the award page (www.fundingawards.nihr.ac.uk/award/16/31/63).

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List of abbreviations

CGI-I	Clinical Global Impression Improvement
EQ-5D-5L	EuroQol-5 Dimensions, five-level version
FND	functional neurological disorder
FMD	functional motor disorder
HADS	Hospital Anxiety and Depression Scale
HRQOL	health-related quality of life
PHYSIO4FMD	specialist physiotherapy for functional motor disorder
PPI	patient and public involvement
QALY	quality-adjusted life-year
RCT	randomised controlled trial
SAE	serious adverse event
SF-36	Short Form questionnaire-36 items
SU	service user
TAU	treatment as usual

References

1. Stone J, Carson A, Duncan R, Roberts R, Warlow C, Hibberd C, *et al*. Who is referred to neurology clinics?: the diagnoses made in 3781 new patients. *Clin Neurol Neurosurg* 2010;**112**:747–51. https://doi.org/10.1016/j.clineuro.2010.05.011
2. Gargalas S, Weeks R, Khan-Bourne N, Shotbolt P, Simblett S, Ashraf L, *et al*. Incidence and outcome of functional stroke mimics admitted to a hyperacute stroke unit. *J Neurol Neurosurg Psychiatry* 2015;**88**:2–6. https://doi.org/10.1136/jnnp-2015-311114
3. Hallett M, Aybek S, Dworetzky BA, McWhirter L, Staab JP, Stone J. Functional neurological disorder: new subtypes and shared mechanisms. *Lancet Neurol* 2022;**21**:537–50. https://doi.org/10.1016/s1474-4422(21)00422-1
4. Tinazzi M, Morgante F, Marcuzzo E, Erro R, Barone P, Ceravolo R, *et al*. Clinical correlates of functional motor disorders: an Italian multicenter study. *Mov Disord Clin Pract* 2020;**7**:920–9. https://doi.org/10.1002/mdc3.13077
5. Butler M, Shipston-Sharman O, Seynaeve M, Bao J, Pick S, Bradley-Westguard A, *et al*. International online survey of 1048 individuals with functional neurological disorder. *Eur J Neurol* 2021;**28**:3591–602. https://doi.org/10.1111/ene.15018
6. Gelauff J, Stone J, Edwards MJ, Carson A. The prognosis of functional (psychogenic) motor symptoms: a systematic review. *J Neurol Neurosurg Psychiatry* 2014;**85**:220–6. https://doi.org/10.1136/jnnp-2013-305321
7. Gelauff JM, Carson A, Ludwig L, Tijssen MAJ, Stone J. The prognosis of functional limb weakness: a 14-year case-control study. *Brain* 2019;**142**:2137–48. https://doi.org/10.1093/brain/awz138
8. Carson A, Stone J, Hibberd C, Murray G, Duncan R, Coleman R, *et al*. Disability, distress and unemployment in neurology outpatients with symptoms 'unexplained by organic disease'. *J Neurol Neurosurg Psychiatry* 2011; **82**:810–3. https://doi.org/10.1136/jnnp.2010.220640.
9. O'Mahony B, Nielsen G, Baxendale S, Edwards MJ, Yogarajah M. Economic cost of functional neurologic disorders: a systematic review. *Neurology* 2023;**101**:e202–14. https://doi.org/10.1212/wnl.0000000000207388
10. Perez DL, Edwards MJ, Nielsen G, Kozlowska K, Hallett M, Curt Lafrance W. Decade of progress in motor functional neurological disorder: continuing the momentum. *J Neurol Neurosurg Psychiatry* 2021;**92**:668–77. https://doi.org/10.1136/jnnp-2020-323953
11. Edwards MJ, Adams RA, Brown H, Parees I, Friston KJ. A Bayesian account of 'hysteria'. *Brain* 2012;**135**:3495–512. https://doi.org/10.1093/brain/aws129
12. Jungilligens J, Paredes-Echeverri S, Popkirov S, Barrett LF, Perez DL. A new science of emotion: implications

for functional neurological disorder. *Brain* 2022;**145**:2648–63. https://doi.org/10.1093/brain/awac204

13. Reynolds JR. Remarks on paralysis and other disorders of motion and sensation dependent on idea. *BMJ* 1869;**2**:483–5.
14. Trieschmann RB, Stolov WC, Montgomery ED. An approach to the treatment of abnormal ambulation resulting from conversion reaction. *Arch Phys Med Rehabil* 1970;**51**:198–206.
15. Nielsen G, Stone J, Edwards MJ. Physiotherapy for functional (psychogenic) motor symptoms: a systematic review. *J Psychosom Res* 2013;**75**:93–102. https://doi.org/10.1016/j.jpsychores.2013.05.006
16. Jordbru AA, Smedstad LM, Klungsøyr O, Martinsen EW. Psychogenic gait disorder: a randomized controlled trial of physical rehabilitation with one-year follow-up. *J Rehabil Med* 2014;**46**:181–7.
17. Czarnecki K, Thompson JM, Seime R, Geda YE, Duffy JR, Ahlskog JE. Functional movement disorders: successful treatment with a physical therapy rehabilitation protocol. *Parkinsonism Relat Disord* 2012;**18**:247–51. https://doi.org/10.1016/j.parkreldis.2011.10.011
18. Nielsen G, Stone J, Matthews A, Brown M, Sparkes C, Farmer R, *et al*. Physiotherapy for functional motor disorders: a consensus recommendation. *J Neurol Neurosurg Psychiatry* 2015;**86**:1113–9. https://doi.org/10.1136/jnnp-2014-309255
19. Nielsen G, Ricciardi L, Demartini B, Hunter R, Joyce E, Edwards MJ. Outcomes of a 5-day physiotherapy programme for functional (psychogenic) motor disorders. *J Neurol* 2015;**262**:674–81. https://doi.org/10.1007/s00415-014-7631-1
20. Nielsen G, Buszewicz M, Stevenson F, Hunter R, Holt K, Dudziec M, *et al*. Randomised feasibility study of physiotherapy for patients with functional motor symptoms. *J Neurol Neurosurg Psychiatry* 2017;**88**:484–90. https://doi.org/10.1136/jnnp-2016-314408
21. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC Med* 2010;**8**:18. https://doi.org/10.1186/1741-7015-8-18
22. Husereau D, Drummond M, Augustovski F, de Bekker-Grob E, Briggs AH, Carswell C, *et al*. Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) statement: updated reporting guidance for health economic evaluations. *MDM Policy Pract* 2022;**3**:100063–11. https://doi.org/10.1177/23814683211061097
23. Nielsen G, Stone J, Buszewicz M, Carson A, Goldstein LH, Holt K, *et al*.; Physio4FMD Collaborative Group. Physio4FMD: protocol for a multicentre randomised controlled trial of specialist physiotherapy for functional motor disorder. *BMC Neurol* 2019;**19**:242. https://doi.org/10.1186/s12883-019-1461-9
24. Marston L, Le M, Ricciardi F, Nazareth I, Carson A, Edwards M, *et al*. COVID-19 and the Physio4FMD trial: impact, mitigating strategies and analysis plans. *Contemp Clin Trials Commun* 2023;**33**:101124. https://doi.org/10.1016/j.conctc.2023.101124
25. Nielsen G, Holt K. *Physio4FMD Programme Workbook 2.0*. London: St George's, University of London Online Resource; 2023. https://doi.org/10.24376/rd.sgul.23967024.v1
26. Nielsen G, Holt K. *Physio4FMD Intervention Manual*. London: St George's, University of London; 2023.
27. Nielsen G, Stone J, Lee TC, Goldstein LH, Marston L, Hunter RM, *et al*. Specialist physiotherapy for functional motor disorder in England and Scotland (Physio4FMD): a pragmatic, multicentre, phase 3 randomised controlled trial. *Lancet Neurol* 2024;**23**:675–86. https://doi.org/10.1016/s1474-4422(24)00135-2
28. Hunter RM, Nielsen G, Le Novere M, Marston L, Lee TC, Stone J, *et al*. Cost-utility of specialist physiotherapy for functional motor disorder (Physio4FMD): economic analysis of a pragmatic randomised control trial. Neurol Clin Pract 2025;15:e200465. httpd://doi.org/10.1212/CPJ.0000000000200465.
29. Nielsen G, Lee TC, Marston L, Carson A, Edwards MJ, Goldstein LH, *et al*. Which factors predict outcome from specialist physiotherapy for functional motor disorder? Prognostic modelling of the Physio4FMD intervention. *Journal of Psychosomatic Research* 2025;**190**:112056. doi:10.1016/j.jpsychores.2025.112056.
30. Science Animated with the Physio4FMD Collaborative Group. *Animation Plain English Summary of the Physio4FMD RCT: A Randomised Trial of Specialist Physiotherapy for Functional Motor Disorder*. 2024. URL: https://youtu.be/pRgVoL9nFgo?feature=shared (accessed 10 November 2024).
31. Pick S, Anderson DG, Asadi-Pooya AA, Aybek S, Baslet G, Bloem BR, *et al*. Outcome measurement in functional neurological disorder: a systematic review and recommendations. *J Neurol Neurosurg Psychiatry* 2020;**91**:638–49. https://doi.org/10.1136/jnnp-2019-322180
32. Gallagher M, Hares T, Spencer J, Bradshaw C, Webb I. The nominal group technique: a research tool for general practice? *Fam Pract* 1993;**10**:76–81.
33. Nicholson TR, Carson A, Edwards MJ, Goldstein LH, Hallett M, Mildon B, *et al*. Outcome measures for functional neurological disorder: a review of the theoretical complexities. *J Neuropsychiatry Clin Neurosci*

2020;**32**:33–42. https://doi.org/10.1176/appi.neuropsych.19060128

34. Demartini B, Batla A, Petrochilos P, Fisher L, Edwards MJ, Joyce E. Multidisciplinary treatment for functional neurological symptoms: a prospective study. *J Neurol* 2014;**261**:2370–7. https://doi.org/10.1007/s00415-014-7495-4

35. McCormack R, Moriarty J, Mellers JD, Shotbolt P, Pastena R, Landes N, *et al*. Specialist inpatient treatment for severe motor conversion disorder: a retrospective comparative study. *J Neurol Neurosurg Psychiatry* 2013;**85**:895–900.

36. Gutkin M, McLean L, Brown R, Kanaan RA. Systematic review of psychotherapy for adults with functional neurological disorder. *J Neurol Neurosurg Psychiatry* 2020;**92**:36–44. https://doi.org/10.1136/jnnp-2019-321926

37. Nielsen G. *Twitter Dissemination of Animation of Plain Language Summary of the Physio4FMD RCT*. X (Formally Twitter). 2024. URL: https://x.com/Sci_Ani/status/1816080898032615805 (accessed 18 November 2024).

38. Nielsen G, Buszewicz M, Edwards, Stevenson MJ A qualitative study of the experiences and perceptions of patients with functional motor disorder *Disabil Rehabil* 2019; **42**(14)::2043–2048. doi:10.1080/09638288.2018.1550685.*Manuscipt in preparation*.

39. Nettleton S, Watt I, O'Malley L, Duffey P. Understanding the narratives of people who live with medically unexplained illness. *Patient Educ Couns* 2005; **56**:205–10. https://doi.org/10.1016/j.pec.2004.02.010.

40. Carson A, Lehn A. Epidemiology. In: Hallett M, Stone J, Carson A, editors. *Functional Neurologic Disorders, Vol 139 of the Handbook of Clinical Neurology Series*. Amsterdam: Elsevier; 2016. pp. 47–60.

41. Mcloughlin C, Hoeritzauer I, Cabreira V, Aybek S, Adams C, Alty J, *et al*. Functional neurological disorder is a feminist issue. *J Neurol Neurosurg Psychiatry* 2023;**1**:7. https://doi.org/10.1136/jnnp-2022-330192

42. Office for National Statistics (ONS). *Ethnic Group, England and Wales: Census 2021*. ONS Website, Statistical Bulletin. n.d. URL: www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/bulletins/ethnicgroupenglandandwales/census2021 (accessed 31 August 2023).

43. *Ethnicity | Scotland's Census*. n.d. URL: www.scotlandscensus.gov.uk/census-results/at-a-glance/ethnicity/ (accessed 13 October 2023).

44. Edwards MJ, Yogarajah M, Stone J. Why functional neurological disorder is not feigning or malingering. *Nat Rev Neurol* 2023;**19**:246–56. https://doi.org/10.1038/s41582-022-00765-z

45. Ng BY. Hysteria: a cross-cultural comparison of its origins and history. *Hist Psychiatry* 1999;**10**:287–301. https://doi.org/10.1177/0957154X9901003901

46. Brown RJ, Lewis-Fernández R. Culture and conversion disorder: implications for DSM-5. *Psychiatry* 2011;**74**:187–206. https://doi.org/10.1521/psyc.2011.74.3.187

47. Wilkins SS, Bourke P, Salam A, Akhtar N, D'Souza A, Kamran S, *et al*. Functional stroke mimics: Incidence and characteristics at a primary stroke center in the middle east. *Psychosom Med* 2018;**80**:416–21. https://doi.org/10.1097/PSY.0000000000000563

48. Waheed W, Hughes-Morley A, Woodham A, Allen G, Bower P. Overcoming barriers to recruiting ethnic minorities to mental health research: a typology of recruitment strategies. *BMC Psychiatry* 2015;**15**:1–11. https://doi.org/10.1186/s12888-015-0484-z

49. FND Hope UK. *Freedom of Information Project Aimed to Explore Issues Reported by NHS Clinicians and the FND Community Regarding Accesses to Treatment for People with FND*. 2019. URL: www.fndhope.org.uk/freedom-of-information-project-aimed-to-explore-issues-reported-by-nhs-clinicians-and-the-fnd-community-regarding-accesses-to-treatment-for-people-with-fnd/ (accessed 6 December 2023).

50. National Institute for Health and Care Excellence (NICE). *Project Information | Rehabilitation for Chronic Neurological Disorders Including Acquired Brain Injury | Guidance [GID-NG10181]*. NICE; n.d. URL: www.nice.org.uk/guidance/indevelopment/gid-ng10181 (accessed 29 November 2023).

51. Weir S, Samnaliev M, Kuo TC, Tierney TS, Walleser Autiero S, Taylor RS, Schrag A. Short- and long-term cost and utilization of health care resources in Parkinson's disease in the UK. *Mov Disord* 2018;**33**:974–81. https://doi.org/10.1002/mds.27302

52. Thompson A, Kobelt G, Berg J, Capsa D, Eriksson J, Miller D; European Multiple Sclerosis Platform. New insights into the burden and costs of multiple sclerosis in Europe: results for the United Kingdom. *Mult Scler* 2017;**23**:204–16. https://doi.org/10.1177/1352458517708687

53. Nielsen G, Ricciardi L, Meppelink A, Holt K, Teodoro T, Edwards MJ. A simplified version of the Psychogenic Movement Disorders Rating Scale: the Simplified Functional Movement Disorders Rating Scale (S-FMDRS). *Mov Disord Clin Pract* 2017;**4**:710–6. https://doi.org/10.1002/mdc3.12475

54. National Neurosciences Advisory Group (NNAG). *Optimum Clinical Pathway for Adults: Functional Neurological Disorder National Neurosciences Advisory Group (NNAG)*. Hertfordshire: NNAG; 2023.

55. Nicholson T, Carson A, Edwards MJ, Goldstein L, Hallett M, Mildon B, *et al*. Outcome measures for functional neurological (conversion) disorder: a review of the theoretical complexities. *J Neurol Clin Neurosci* 2020;**32**:33–42.

56. Yong K, Chin RFM, Shetty J, Hogg K, Burgess K, Lindsay M, *et al*.; the Edinburgh Paediatric FND Study Group. Functional neurological disorder in children and young people: incidence, clinical features, and prognosis. *Dev Med Child Neurol* 2023;**65**:1238–46. https://doi.org/10.1111/dmcn.15538