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INTEGRATED MASTER´S THESIS

Functional Movement Disorders: Literature Review

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2. LIST OF ABBREVIATIONS

General abbreviations	
BoNT	Botulinum Neurotoxin
CBT	Cognitive Behavioural Therapy
CG	Control Group
CI	Confidence Interval
CFT	Compassion-Focused Therapy
CNS	Central Nervous System
d./w./m./y.	Day/ week/ month/ year
DSM-4/5	Diagnostic and Statistical Manual of Mental Disorders, 4th/ 5th edition
EMG	Electromyography
EMG-EEG	Electromyography-Electroencephalogram
F/M	Female/ Male
fMRI	Functional Magnetic Resonance Imaging
FMD	Functional Movement Disorder
FND	Functional Neurological Disorder
IP	inpatient
MDT	Multidisciplinary Treatment
N	Number of Participants in a sample
NS	Not statistical significant
OP	outpatient
OT	Occupational therapy
PET	Positron Emission Tomography
PF	Physical Functioning
PT	Physiotherapy
PsychT.	Psychotherapy
QoL	Quality of Life
RCT	Randomized Controlled Trial
SS	Statistical significant
ST	Speechtherapy
T0	Baseline/ Pre-treatment
T1	Post-Treatment/ End of treatment
T2	First follow-up
T3	Second Follow-up
TAU	Treatment as Usual
TMS	Transcranial Magnetic Stimulation
Outcome measures	
6MWT	Six Minute Walk Test
10MWT	Ten Minute Walk Test
30sSTS	30-Second Sit-to-Stand
BAI	Beck Anxiety Inventory
BBS	Berg Balance Scale
BDI	Beck Depression Inventory
CGI-S	Clinical Global Impression Severity
CGI-I	Clinical Global Impression Improvement
COPM	Canadian Occupational Performance Measure

CORE-OM	Clinical Outcomes in Routine Evaluation
EQ-5D-5L	EuroQol 5 Dimensions - 5-Level Questionnaire
EQ-VAS	EuroQol Visual Analogue Scale
FIM	Functional Independence Measure
FMS	Functional Movement Screen
GAD-7	Generalized Anxiety Disorder-7 Scale
HADS-A/ HADS-D	Hospital Anxiety and Depression Scale
HoNOS-ABI	Health of the Nation Outcome Scales for Acquired Brain Injury
IPQ-R	Revised Illness Perception Questionnaire
PGI-I	Patient Global Impression of Change
PGI-S	Patient Global Impression of Severity
PHQ-9	Patient Health Questionnaire-9
PMDRS	Psychogenic Movement Disorder Rating Scale
PSFS	Patient Specific Functional Scale
PSYCHLOPS	Psychological Outcomes Profiles
SCS	Self-Compassion Scale
SF-36	36-Item Short Form Survey
SF-36 MCS	36-Item Short Form Mental Component Summary
sFMDRS	Simplified Functional Movement Disorders Rating Scale
SQ-48	Symptoms Questionnaire-48
TUG	Time Up and Go
WHOQOL-BREF	World Health Organization Quality of Life
WSAS	Work and Social Adjustment Scale
ZBI	Zarit Caregiver Burden Interview

3. ABSTRACT

Background: Functional movement disorders (FMDs) are one of the most common subtypes of functional neurological disorders (FNDs). They are associated with involuntary motor symptoms causing significant impairment in the quality of life of patients. Despite the common use of non-pharmacological treatments, such as physiotherapy, psychological interventions, and multidisciplinary approaches, as effective strategies for managing the disease, there is still insufficient evidence regarding their efficacy in improving patient outcomes due to the limited literature available on this topic.

Objectives: 1. To describe epidemiology, etiology, pathogenesis, diagnosis and treatment strategies of functional movement disorder. 2. To assess the effect of non-pharmacological treatments (physiotherapy, psychological interventions, and multidisciplinary treatment) in alleviating motor symptoms and improving functional status, psychological well-being, and quality of life of functional movement disorder patients.

Methods: A non-systematic literature review was performed to overview epidemiology, etiology, pathogenesis, diagnosis, and treatment of functional movement disorder. A systematic literature review was performed in PubMed and Scopus for studies published between 2020 and 2025. Inclusion criteria (based on the PICO framework) focused on adults (>16 years) with functional movement disorder or predominant motor form of functional neurological disorders receiving physiotherapy, psychological interventions (e.g., cognitive behavioural therapy, hypnosis, compassion-focused therapy), or multidisciplinary approaches. All study designs were included because of the limited randomized controlled studies (RCTs) available. Study selection, data extraction, and narrative synthesis were performed systematically.

Results: Thirteen studies (2 RCTs and 11 observational studies) involving a total number of 531 patients were included in this review. Both RCTs demonstrated the significant effect of specialized physiotherapy and multidisciplinary treatment (physiotherapy plus cognitive behavioural therapy) on motor symptom severity, physical functioning, and quality of life in patients with functional movement disorders. Observational studies (N = 244) demonstrated improvements across clinical and functional domains, with multidisciplinary therapies being particularly effective for motor symptom severity and mobility, while psychological monotherapies yielded more consistent benefits for mood and quality of life. Heterogeneity was high across the interventions, outcome measures, and overall study quality.

Conclusions: Non-pharmacological interventions, particularly individualized physiotherapy and multidisciplinary approaches, have a moderate positive effect on improving motor symptoms, functional capacity, and quality of life in functional movement disorder. Psychological therapies

provide additional benefits for emotional and psychological outcomes. However, due to methodological limitations, small sample sizes in observational studies, and high heterogeneity, it is necessary to have high-quality randomized controlled trials with standardized outcome measures and longer follow-up periods in the future to determine standardized therapeutic guidelines.

Keywords: functional movement disorder, functional neurological disorder, physiotherapy, psychological therapy, multidisciplinary treatment, quality of life, motor symptoms, systematic review

SANTRAUKA *(lithuanian translation)*

Įvadas: Funkciniai judėjimo sutrikimai (FJS) yra vienas iš dažniausių funkcinių neurologinių sutrikimų (FNS) potipių. Jie pasireiškia nevalingais motoriniais simptomais, kurie gerokai pablogina pacientų gyvenimo kokybę. Nepaisant plačiai taikomų nefarmakologinių gydymo metodų, tokių kaip kineziterapija, psichologinės intervencijos ir multidicipliniai metodai, kurie laikomi reikšmingomis ligos valdymo strategijomis, vis dar trūksta pakankamai įrodymų dėl jų veiksmingumo gerinant pacientų būklę.

Tikslai: 1. Aprašyti FJS epidemiologiją, etiologiją, patogenezę, diagnostiką ir gydymo strategijas. 2. Įvertinti nefarmakologinių FJS gydymo metodų (kineziterapijos, psichologinių intervencijų ir multidisciplininio gydymo) poveikį motorinių simptomų kontrolei bei bei pacientų funkcinei būklei, psichologinei savijautai ir gyvenimo kokybei.

Metodai: Buvo atlikta nesisteminė literatūros apžvalga, siekiant apžvelgti funkcinių judėjimo sutrikimų epidemiologiją, etiologiją, patogenezę, diagnostiką ir gydymą. Tuomet atlikta sisteminė literatūros apžvalga, kurios metu analizuoti 2020–2025 m. *PubMed* ir *Scopus* duomenų bazėse paskelbti nefarmakologinio FJS gydymo metodų tyrimai. Įtraukimo kriterijai (remiantis PICO sistema): 1) vyresnis nei 16 m. amžius, 2) diagnozuotas FJS arba FNS vyraujant motoriniams simptomams, 3) FJS gydymas taikant kineziterapiją, psichologines intervencijas (pvz., kognityvinę elgesio terapiją, hipnozę, užuojautos terapiją) arba multidisciplininius metodus. Dėl riboto atsitiktinių kontroliuojamų tyrimų (AKT) skaičiaus į sisteminę apžvalgą pateko įvairaus dizaino studijos. Tyrimų atranka, duomenų išgavimas ir naratyvinė sintezė buvo atliekami sistemiškai.

Rezultatai: Į apžvalgą buvo įtraukta trylika tyrimų (2 AKT ir 11 stebimųjų tyrimų), kuriuose dalyvavo iš viso 531 pacientas. Abu atsitiktiniai kontroliuojami tyrimai parodė reikšmingą specializuotos kineziterapijos ir multidisciplininio gydymo (kineziterapija + kognityvinė elgesio terapija) poveikį FJS motorinių simptomų sunkumui, pacientų fiziniam funkcionavimui ir gyvenimo kokybei. Stebimieji tyrimai (N = 244) pademonstravo reikšmingą pagerėjimą įvairiose klinikinėse ir

funkcinėse srityse: multidisciplininės terapijos buvo ypač veiksmingos motorinių simptomų kontrolei, o psichologinės monoterapijos davė nuoseklesnę naudą nuotaikai ir gyvenimo kokybei. Įtrauktiems tyrimams būdingas didelis intervencijų, rezultatų matavimo priemonių ir bendros tyrimų kokybės heterogeniškumas.
Išvados: Nefarmakologinės intervencijos, ypač individualizuota kineziterapija ir multidisciplininiai metodai, turi vidutiniškai teigiamą poveikį motoriniams simptomams, funkciniam pajėgumui ir gyvenimo kokybei sergant FJS. Psichoterapijos metodai suteikia papildomos naudos emocinei ir psichologinei būklei. Tačiau dėl metodologinių apribojimų, mažų imčių stebimuosiuose tyrimuose ir didelio heterogeniškumo, norint suformuluoti standartizuotas gydymo gaires, būtina atlikti tolesnius aukštos kokybės atsitiktinius kontroliuojamus tyrimus, taikant standartizuotus rezultatų vertinimo instrumentus ir ilgesnį stebėjimą.

Raktažodžiai: funkcinis judėjimo sutrikimas, funkcinis neurologinis sutrikimas, kineziterapija, psichologinė terapija, multidisciplininis gydymas, gyvenimo kokybė, motoriniai simptomai, sisteminė apžvalga.

4. INTRODUCTION

4.1 Definition

Functional movement disorder (FMD) represents a common subtype of functional neurological disorder (FND), which arises not due to structural brain damage but due to altered functioning in brain networks (1). Historically it was known as “hysteria”, later renamed to conversion disorder, and after that to psychogenic disorder or functional neurological disease. Just in the recent years, the term “functional movement disorder” is more commonly used. Research into FMD has expanded significantly over the last two decades, resulting in a more comprehensive understanding of the disorder and the patients, and is in turn leading to new and more specialized treatment approaches (2). FMD is characterized by a diverse array of involuntary or altered movement symptoms, such as tremor, jerks, tics, dystonia, fixed postures and gait abnormalities, which can occur alone or can overlap with each other (1,3–5). Despite these abnormal movements, FMD can also encompass weakness (4), such as limb weakness and functional paralysis (6). The leading phenotype is mixed FMD, with tremor-dominant type, followed by weakness-dominant and then dystonia-dominant type (3). These neurological manifestations often result in severe and/or chronic symptoms with significant impact on quality of life (7). Along with FMD, several comorbid symptoms can appear, which are often seen in FMD patients, like pain, fatigue or brain fog (4).

Patients with FMD usually seek for neurological consultation, since FMD is linked to significant disability and distress, carry a generally poor prognosis, and impose a substantial financial burden (8).

4.2 Epidemiology

Several factors complicate the establishment of FMD epidemiology, because it may be underdiagnosed or misdiagnosed. Clinic-based studies have estimated that FMD accounts for roughly 3-8% of visits to movement disorder clinics (2). Other studies indicate that FMD represents between 2-20% of patients in movement disorder clinics, with the exact proportion depending on the clinic setting and the diagnostic criteria used (9). These figures may underestimate its true prevalence, as FMD can occur alongside organic neurological conditions (2). Furthermore, numerous factors can trigger the development of FMD; e.g., there was a marked increase in FMD cases during COVID-19 pandemic, also “after war, mass vaccination or toxic exposure” (2). FMD typically emerges in middle adulthood, with a mean age of onset that is approximately 40 years (3,10). A study by Lidstone et al. (3) that pooled patient data from 4.905 cases, found that there is a strong female predominance, 72.6% women overall. Also other analyses show that the rate of FMD is higher in females than in males (2,9).

4.3 Etiology & Pathophysiology

Functional movement disorder (FMD), a subclass of functional neurological disorders (FND), is caused by a combination of biological, psychological and social factors, also known as the biopsychosocial model and does not involve structural lesions in the brain (7,11). FMD is understood as an involuntary yet learned habitual movement pattern, driven by abnormal self-focused attention (8). Traumatic experiences in life such as in childhood, dysfunctional family environments, acute stress or chronic psychological conditions, such as anxiety, depression, and alexithymia can all increase a person´s susceptibility to the condition. Genetic factors and underlying biological vulnerabilities in the nervous system may also act as predisposing factors. There are a wide variety of precipitating factors such as physical injury, acute stress, acute panic attack, emotional distress, fatigue and sensory overload, along with perpetuating factors such as maladaptive illness beliefs (e.g. chronicity, low perceived control, poor expectations regarding treatment, perception of symptoms as being irreversible, not feeling believed, perception that movement causes damage), avoidant behaviours towards symptom provocation and chronic psychosocial stressors. Also biological causes can perpetuate the disorder e.g. changes in

neuroendocrine and immune function, similar to those found in depression and anxiety, as well as abnormal plasticity in the central nervous system, can disrupt normal motor and seonsory pathways (including pain processing). The coexisting factors often lead to persistent abnormal movements, that may cause a poorer quality of life, difficulties in social and work life, and reduced hope of getting better (7,8,11).

Pathophysiologically, FMD is depicted as a dysfunctional relationship between various brain networks responsible for controlling movement, attention, emotions, and sense of self-agency versus damage to the brain due to organic disease. The core mechanisms of FMD include: impairment in attention, meaning that the symptoms often improve with distraction, and worsen with focus on it; disrupted sense of agency, where movements may appear to be voluntary but will feel involuntary due to a mismatch between what the individual expects to occur and what they feel will occur; disruption in predictive processing, that means that the person with FMD/FND has abnormal beliefs and expectations about his disorder which may lead to symptom persistence and exaggeration. A further key characteristic is the limbic-motor interaction observed in FMD patients. Heightened emotional arousal or negative mood states in these individuals may trigger or amplify motor symptoms by disrupting the connectivity between limbic and motor circuits in the brain (1). These mechanisms provide the justification for how non-pharmacological treatments such as physiotherapy (focusing on attention and motor retraining), cognitive behavioural therapy (focusing on beliefs and emotional regulation), and multidisciplinary approaches are biologically plausible and increasingly recommended (12).
This systematic review is therefore designed to examine the impact of these interventions on outcomes in FMD to provide evidence-based guidance for clinical practice.

4.4 Diagnosis of FMD

Establishing a diagnosis of FMD can be quite challenging, because the symptoms can be overlapping or very similar to those of organic neurological disorders, e.g. Parkinson´s disease. Therefore, in contemporary clinical practice, the diagnosis of FMD is based on specific positive/inclusionary clinical features, rather than exclusion of other neurological and organic conditions. It is primarily made by experienced neurologists at the bedside via detailed history and neurological examination that focuses on two key principles: inconsistency and incongruity of motor symptoms, which are the key positive diagnostic signs. Inconsistency means that there are fluctuations in symptom presentation, meaning that the intensity, frequency or distribution across different moments varies; they diminish or disappear when the patient is distracted by cognitive

tasks; they intensify or change when attention is drawn to them, especially during conversation, or they may appear only in certain situations while being absent in others. Another key feature is incongruity which means the lack of typical characteristics seen in organic movement disorders. These include tremor entrainment, where the tremor changes its rhythm to match voluntary tapping of the opposite limb, and characteristic gait abnormalities such as marked slowness, astasia-abasia, sudden knee buckling, walking as if on a tightrope, or irregular movements of the trunk. Other signs that support incongruity are not necessarily present in all patients. These include Hoover´s sign (when a person lifts one leg, the opposite hip automatically extends; a positive sign shows involuntary strength is present in a "weak" leg, indicating a functional disorder); fixed dystonic toe postures; the appearance of abnormal movements in a different body part when the original movement is suppressed; the ability to normally move while sitting, despite having gait disturbances. These positive indicators provide the foundation for making a confident diagnosis (2,13,14). The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) criteria for FND are the most commonly used by clinicians. They emphasize positive clinical findings rather than exclusion and focus on identifying clinical signs that are incompatible with known neurological conditions (15). The DSM-5 criteria for Functional Neurological Symptom Disorder, require (A) "one or more symptoms of altered voluntary motor or sensory function; (B) clinical findings can provide evidence of incompatibility between the symptoms and recognized neurological or medical conditions" (15) (e.g., through positive signs of inconsistency or incongruence); (C) "another medical or mental disorder does not better explain the symptom or deficit; and (D) the symptom or deficit results in clinically significant distress or impairment in social, occupational, or other vital areas of functioning or warrants medical evaluation" (15). Previously, DSM-IV criteria additionally included an identifiable psychological stressor to make the diagnosis of FMD, but it was removed, because the presence of psychological factors are no longer regarded as etiological in the development of FND (10,16).

After making a diagnosis, it is necessary to deliver it in an understandable and empathic manner to the patient, with a clear explanation of what it is, highlighting that it is not due to damage in the brain, but rather a disconnection within the nervous system. Showing patients and family members positive signs, such as tremor distractibility can encourage their healing process, motivate the patient, and demonstrate that these symptoms are potentially reversible (16). Park states that "acceptance of the diagnosis by the patient, as well as the management of psychological stressors and concurrent psychiatric disorders, were the most important factors for predicting a favourable prognosis" (2).

In some cases, other diagnostics, such as electrophysiology (e.g. electromyography-electroencephalogram (EMG-EEG)), functional magnetic resonance imaging (fMRI), positron

emission tomography (PET) or transcranial magnetic stimulation (TMS) may be necessary, e.g. electrophysiological testing can be particularly useful in supporting the diagnosis in cases of functional tremor and myoclonus. In patients with functional tremor, EMG often reveals a highly variable frequency and amplitude, distractibility, and entrainment when the patient performs rhythmic tapping with the opposite limb. The tremor frequently pauses briefly during ballistic movements of another body part and may paradoxically increase in amplitude when a weight is added to the limb. In functional myoclonus, surface EMG typically shows longer and more variable muscle burst durations, inconsistent patterns of muscle recruitment, and longer, more variable delays before the jerk occurs after a stimulus. Additionally, jerk-locked EMG EEG back-averaging often shows a Bereitschaftspotential, which is a slow negative brain wave that normally appears just before a person makes a voluntary movement. This finding suggests that the brain uses the same voluntary motor pathways to generate the jerks, even though the patient experiences them as involuntary (2). Furthermore, these tests may be required to make a definite diagnosis, to differentiate between organic neurological disorder and functional motor disorder, because symptoms can be very similar to each other and it is not unusual for patients to present with an organic neurological disorder alongside superimposed functional symptoms. In these cases, clinicians may incorrectly attribute atypical presentations of organic neurological disease to FMD, therefore other testing techniques can be of utmost importance (2,17).

4.5 Overview of Treatment approaches

Historically, treatment for FND and FMD primarily involved inpatient psychiatric management, because previously it was believed that FND is a purely psychological disorder, healthcare professionals doubted, blamed or stigmatized individuals with this disorder. This explains why many patients with FND report negative experiences within the healthcare system. However, since the 1980s, the limited available literature on conversion disorders indicates a shift in therapeutic strategies. These gaps in knowledge also stem from relatively limited amounts of research conducted in the past. Nevertheless, this situation has changed markedly over the last 10 to 15 years, as growing awareness of FNDs has driven expansion of research efforts. Treatment has increasingly adopted a multidisciplinary model, incorporating inpatient physical rehabilitation alongside psychiatric care (18). Nevertheless, there are some other approaches to treat FMD population.

Management of FMD includes various pharmacological and non-pharmacological treatment approaches, with the major aim of alleviating motor and comorbid symptoms, e.g. anxiety, depression or chronic pain, of regaining voluntary control over the movements, and targets also

improvement of health-related quality of life. Given the biopsychosocial nature of FMD, treatments often comprise multidisciplinary components that address the neurological and psychological manifestations (17). There is no universal treatment approach for FMD, therefore careful patient selection and individualized therapy are essential (5).

4.5.1 Pharmacological approaches

In FMD, the pharmacological therapy mainly focuses on treating comorbid symptoms like depression, anxiety or chronic pain, and therefore needs to be individualized (17). Approximately two-thirds of individuals with FMD had an anxiety disorder, while nearly one-third had depression, and a similar proportion had trauma-related disorders. Failure to address these comorbidities may negatively impact outcomes of treatments such as physical rehabilitation (19). For these secondary symptoms, antidepressants (e.g. citalopram, paroxetine) have been used. After treatment patients may show improvement or even complete remission of motor and generalized symptoms (20), but it remains unclear whether functional gains are directly related to pharmacological treatment, such as antidepressants, or are instead mediated by improvement of an underlying mood disorder (19). Most probably, and also what most articles suggest, is that antidepressants alone do not lead to improvement in motor function (17,21,22). Another type of pharmacological approach, is sedation (e.g. propofol) that may help to reverse symptoms, especially in fixed functional dystonia, a severe type of FMD (23). Current evidence indicates that pharmacological interventions for Functional Movement Disorder (FMD) have limited efficacy, with botulinum toxin (BoNT) showing no significant benefit over placebo in improving motor symptoms or reducing symptom severity among patients with FMD. However, open-label extensions have occasionally reported apparent benefits in the BoNT-treated group, suggesting that observed improvements may be influenced by expectation effects rather than the pharmacological action of the toxin itself (17,19,23,24). Pharmacological treatment on its own rarely improves the core motor symptoms, and long-term use can result in dependence and only partial benefit, or may even worsen the functional symptoms (24). This highlights the importance of combining medication with non-pharmacological therapies, as these treatments more effectively address both motor symptoms and secondary symptoms.

4.5.2 Non-pharmacological treatment approaches

There are several non-pharmacological treatment methods, that can be applied for the motor type of FND, including physiotherapy, psychotherapy, occupational therapy, multidisciplinary treatment

approach (MDT), hypnosis and newer approaches e.g. transcranial magnetic stimulation to enhance physiotherapy (24).

4.5.2.1 Physiotherapy

The golden standard for FMD is physiotherapy. Nielsen et al. highlights the importance to adapt physiotherapy to the biopsychosocial aetiological framework of FMD, stating that the "treatment should address illness beliefs, self-directed attention and abnormal habitual movement patterns through a process of education, movement retraining and self-management strategies within a positive and non-judgmental context"(8). The aim of physiotherapy is to improve and restore motor function, by retraining movements, which the patients cannot properly exert anymore, due to their movement disorder. One of the key stones that form a good treatment basis is that the patient understands his diagnosis and changes his negative beliefs into hopeful thoughts. **Patient education** forms a crucial foundation in physiotherapy for FMD, helping the patient accept the diagnosis, reduce anxiety and engage actively in recovery. It is important that the patient gains trust in his physician, that the patient feels believed about his symptoms and accepts that he has a genuine problem that is not imagined. It is important that the patient is convinced that the core problem lies in how the nervous system processes and controls movements, and that it is a reversible software-like glitch in brain signalling, and not a permanent hardware damage or structural injury. This means that significant improvement or full recovery is often possible and that these issues are common, and encountered often by physiotherapists (8,10,24). After the patient is well educated about FMD, **movement retraining with diverted attention** can be applied. In this context, the goal of the physiotherapist is to demonstrate to the patient that normal movement of the affected body part is possible e.g. in activities like walking. The core strategy involves reducing excessive self-monitoring of the affected body part (by the patient), by shifting the patient's attention away from conscious control of the movement and instead to promote more natural, automatic movements. This is done by redirecting patients´ focus during the tasks, for example by encouraging quicker, new or variable movements that make overthinking difficult or to make the patient concentrate on different parts of the movement. Other distraction techniques include engaging the patient in a conversation or giving them mental tasks or by playing music (8,10,24). This approach has demonstrated substantially greater effectiveness than standard physiotherapy. In a study by Nielsen et al., 72% of patients participating in a one-week specialized FND physical rehabilitation program showed symptom improvement after six months, compared with 28% improvement rate among those receiving standard physiotherapy (18). Other physiotherapy treatment strategies include the empathetic use of language, meaning the use of motivated wording when communicating with

patients; non-specific graded exercise to help improve low exercise tolerance and to reduce long-term pain and fatigue and graded exercise which starts with low-level exercises and builds then gradually, to avoid worsening of symptoms and to encourage ongoing participation. It may be also beneficial to implement visualization techniques. For example, this may involve the patient performing movements while visualizing smooth, flowing motion or imagining a positive and enjoyable scenario during the execution of the task. Mirror and video feedback may be administered and can be useful tools to give patients real-time, objective feedback about their actual movements, posture or gait patterns, and is showing a clear difference from what the person believes or perceives, furthermore it can help to shift attention which reduces self-focused awareness. It is also recommended that the patients use a rehabilitation diary where they can track their goals and achievements. Pain education can be necessary, if the motor symptoms come along with chronic pain. If additional equipment e.g. aids, splints are not necessary, it is recommended to omit them (8). Adjunctive interventions such as electrical muscle stimulation, electromyography (EMG) biofeedback, and transcranial magnetic stimulation have been proposed as potential biological treatment options that could become part of the therapeutic repertoire for FND and FMD. These approaches may enhance physiotherapy by providing objective evidence of motor function, thereby challenging maladaptive beliefs about movement and facilitating motor relearning. However, current evidence for their effectiveness is still limited, as it largely derives from small-scale studies with heterogeneous designs, varying stimulation parameters, and diverse outcome measures (8,18,24). Regarding the clinical setting and the treatment duration, physiotherapy can be conducted in outpatient, inpatient or telehealth settings (17,18). Inpatient care provides frequent and coordinated treatment, which can be especially beneficial for patients requiring intensive support. Outpatient care is more appropriate for patients with milder symptoms and lower intensity needs and the benefit is that they can immediately include strategies learned in physiotherapy sessions into their daily life activities. Telehealth rehabilitation has recently become more widespread, with studies reporting positive outcomes supported by statistically significant measures. Typically, this approach begins with an initial series of face-to-face assessments and therapy sessions (often three), followed by subsequent sessions conducted virtually. Benefits include greater accessibility and convenience for patients (17). However, majority of treatment programs are delivered on an outpatient basis over a defined time period, typically involving one to three sessions per week and when feasible and clinically appropriate, more intensive multidisciplinary short-term programs , either outpatient or inpatient, may be offered to patients with greater symptom severity or disability who are unlikely to benefit from standard outpatient care (24). There are no universal guidelines on the treatment duration of FMD, because it has to be individualized to the needs of the patients (18).

4.5.2.2 Psychological treatment

At present, psychological therapies are the most extensively researched treatment alternatives for FND (24). There are various psychological treatment modalities that can be used for FMD population. These include Cognitive behavioural therapy (CBT), psychodynamic therapy, mindfulness-based psychotherapy, prolonged exposure or multi-modality neurobehavior therapy (24).

CBT is centred on helping patients recognize and break the patterns of behaviour, physiology and cognition that are triggered by stress and often lie behind the symptoms of psychogenesis. By assisting the patients to identify the automatic and negative thoughts and linking them to the corresponding emotions and behaviours, CBT allows the patients to trace these thoughts back to the underlying beliefs or thinking patterns that are not true and are preventing the patients from recovering from their symptoms (24–26). By changing these core patterns, CBT decreases the cycle that sustains the symptoms. CBT works best when the underlying key issues are related to low self-esteem, depression, or anxiety, as these issues often play a major role in perpetuating the symptoms of movement problems (26).

Psychodynamic therapy is a form of psychoanalytic therapy that aims to change the internal psychological structure through exploration of linkages between past and early experiences, family or parenting patterns, stable personality traits, and current problems, emotions and difficulties. Under this therapy, the psychiatrist can also prescribe antidepressants or anxiolytics if necessary to properly treat the co-exiting anxiety or depression (26).

Mindfulness-based psychotherapy can aim to reduce stress (mindfulness-based stress reduction) or can focus more on CBT (mindfulness-based cognitive therapy). Its central purpose is not the reduction of symptoms but the alleviation of suffering. This is accomplished by assisting individuals in being more able to cope with their internal experiences, developing stronger coping mechanisms, and implementing healthier ways of dealing with unpleasant sensations in the body and emotions. Rather than concentrating on symptom reduction, this approach shifts the focus away from the notion that well-being can be improved only after the symptoms have been reduced. In the context of functional neurological disorder (FND), this approach may assist in breaking cycles of symptom exacerbation maintained by hypervigilance, avoidance, and threat-related interpretations. Thus, it could potentially provide the conditions for the symptoms to decrease and for the functioning to improve. These effects are considered to be indirect and secondary to the primary goal of intervention. This approach is not intended to replace established treatments such as specialized physiotherapy or individual psychological therapy. Rather, it can be employed in conjunction with these, depending on what the individual requires (27).

Hypnosis is another method that has been incorporated in the treatment of FND population with motor symptoms, and has already been used historically in psychiatry and neurology to treat "hysteria" (28). It is the use of communicated suggestions from one person to another to influence imaginative experiences, feelings, thinking and behaviours that can change perception, memory, or actions (28,29). FND and FMD patients are sensitive to verbal input from their therapist and thus their expression of symptoms can be shaped by explanations and instructions from the physician. Therefore the goal of hypnosis therapy is to induce subjectively meaningful changes in the patients´ experience and behaviour (30). The protocol outlined by Hoogduin et al. is based solely on symptom-focused instructions, which are specifically aimed at the relief of presenting symptoms rather than the therapeutic process (30). The symptom-focused verbal suggestions create an incompatible bodily sensation that directly blocks the unwanted movement in the FMD patient. For example, the physician suggests to imagine profound heaviness or relaxation in a trembling arm so the tremor can´t continue, altering the motor control. Hereby the patients are learning to trigger this helpful incompatible feeling themselves, making control more automatic outside hypnosis (30). Treating specific symptoms is one of the strategies of hypnosis. The second strategy is that the suggestions formulated during hypnosis therapy aim at exploring the underlying psychological factors, such as trauma and interpersonal or intrapsychic conflicts, that might be involved in the genesis of symptoms (31). Hypnosis can be applied together with Catalepsy induction, which is teaching the patient to create a state of rigid, heavy immobility (like a limb becoming stiff in a position). With this technique someone with arm tremors learns to induce catalepsy in the arms to produce stiffness which in turn will stop the tremor. This gives a direct, voluntary way to interrupt symptom patterns (30).

Compassion-focused therapy (CFT) aims to reduce shame and self-criticism in patients and therefore can be a helpful tool in FND/FMD patients, because these patients may feel neglected with their diagnosis, and criticize themselves for their disorder, which boosts negative thoughts and with that functional motor symptoms (32). CFT has been created to help patients to feel safe again, and experience an inner warmth, build compassion and exchange it against rejection towards themselves (33).

4.5.2.3 Multidisciplinary treatment

Multidisciplinary treatment approach (MDT) is most frequently recommended these days in FMD treatment, because it addresses the entire spectrum of FMD symptoms and complaints. Furthermore, it can be tailored to the individual symptoms of the patient, the severity and duration of symptoms. Within an MDT framework primary motor symptoms in FMD are primarily

addressed through physiotherapy-based rehabilitation e.g. attention-distraction exercise (34) (described in more detail in physiotherapy section) whereas secondary symptoms, including fatigue, pain, cognitive symptoms, sleep disturbances, maladaptive illness beliefs, psychological and social factors, and medication side effects, are managed through a combination of psychological therapies, medical management, and supportive care (5) . The diagnosis of FMD is done by a neurologist or neuropsychiatrist, while the treatment is delivered by a multidisciplinary team. Usually the multidisciplinary team involves neurologist, psychiatrist, family doctor, rehabilitation professionals like physiotherapists, occupational therapists, speech and language therapists, therapists specialized in cognitive rehabilitation and sometimes even orthopaedic surgeons or pain managing specialists. Not only it is important to have a wide range of different specialists involved in the treatment process, but also it is recommended that the family of the patient, close friends, and workmates will be involved in the diagnosis to enhance treatment participation and understanding of the disorder (24).

4.5.2.4 Neurostimulation augmented therapy

Transcranial-magnetic stimulation (TMS) primed physiotherapy is a novel therapy strategy for functional movement disorder patients. A single-pulse TMS can be used before physiotherapy, to trigger involuntary or evoked movements in people with functional weakness. This stimulation often produces a rapid, visible response in the affected limb e.g. a twitch, which demonstrates to the patient that the brain-muscle pathway is intact and may produce reflective activity, recorded by a surface electromyography (EMG). This may help to modify maladaptive beliefs and improve patients´ confidence and their expectations regarding symptom reversibility. It may reduce their functional weakness by breaking the cycle of symptom maintenance and reducing the fear of movement. Afterwards demonstration that normal movement of the muscles is possible, TMS is combined with pressure feedback. As the patient tries to voluntarily contract the muscle or imagines an attempt to move the weaker limb against resistance, the therapist applies firm pressure at the end of the limb to provide sensory feedback that helps the brain relate the attempt to movement. Single pulses of TMS are given to the motor cortex area of the brain. The patient’s attention remains focused on the attempt to voluntarily move the weaker limb against resistance while each pulse is given. After this TMS primer, the patients attend to a specialist physiotherapy session in which they can relearn normal movement patterns and independent walking (35).

4.6 Gaps and uncertainties in the literature

In the recent years, FMD gained more understanding among physicians and attention in the research, but still there are large gaps found in the literature, and no concrete guidelines in how to treat FMD, making it difficult for physicians and therapists to decide on the best intervention. For instance, although physiotherapy and psychological treatments such as CBT appear to be effective, there are not enough high-quality studies, such as randomized controlled trials, to provide strong evidence and clear guidelines on how to treat patients (8,36). Many studies that have been conducted are small and have different ways of administering treatments and measuring the outcome, such as using different scales for measuring movement and quality of life, making it difficult to compare the findings of different studies (37,38). There is also a lack of understanding about the long-term effects, as most studies only follow patients for a short period of time, such as a few months, and do not compare physiotherapy, multidisciplinary treatment and psychological treatments with each other (38,39). In addition, the impact of variables such as the patient´s age, early stressful life events or the type of symptoms (for example, tremors or gait disturbances), has not been adequately investigated in relation to treatment outcomes, and as such, there is a question of who would benefit the most (38). This proves that further research is needed to develop more structured and concrete treatment plans, that can be adapted to personal needs of the patient.

4.7 Rationale, aims and objectives of this systematic literature review

During the last 5 years there are several meta analyses on phenotype of FMD (e.g. Functional movement disorder gender, age and phenotype study: a systematic review and individual patient meta-analysis of 4905 cases) (3), but there is a lack of systemic reviews on treatment of functional movement disorders. There are recent data on treatment outcomes of functional neurological disorders that may include movement disorders but are not specified to FMD (e.g. Treatment outcomes in functional neurological disorder: a systematic review and meta-analysis exploring the influence of symptom chronicity) (38). Considering these gaps, this systematic literature review focused on the question: how effective are non-pharmacological interventions (physiotherapy, psychotherapy and combined therapies) for FMD patients in terms of treatment outcomes? Despite growing acceptance of the biopsychosocial model in FMD treatment, gaps remain in the literature, including inconsistencies in interventions and outcome measures, as well as a lack of strong evidence comparing physiotherapy and psychological approaches (8,37). This highlights the importance of this systematic literature review in addressing gaps in the literature, including issues of misdiagnosis and poorly defined treatment strategies. We formulated the hypothesis that the multidisciplinary strategies combining physiotherapy and psychological components will show

better outcomes in terms of symptom control, functional recovery, and quality of life (2,40), compared to stand-alone physiotherapy, or solo psychotherapy.

5. METHODS

5.1 Eligibility criteria

Eligibility was based on the following predefined inclusion and exclusion criteria, aligned with the PICO framework (Population: adults and children >16 years with functional movement disorder or FND with motor symptoms; Intervention: non-pharmacological treatments; Comparison: any or none; Outcomes: patient-rated or clinician-rated measures of symptom severity, quality of life, function, etc.). The full inclusion and exclusion criteria are summarized in **Table 1** and **Table 2**. These criteria were applied independently during title/abstract and full-text screening to minimize selection bias.

Table 1*:* Inclusion criteria. *(table continues until p. 21)*

Criteria	Inclusion Criteria
1. **Population, or participants and conditions of interest**	Patients with Functional Neurological Disorder (FND) as a primary diagnosis, including hyperkinetic and hypokinetic subtypes (e.g. functional tremor, dystonia, jerks/myoclonus, gait disorder, parkinsonism, limb weakness, facial symptoms). Or Functional Movement disorder (FMD) as a primary diagnosis. Participants must be >16 years.
2. **Interventions or exposures**	Physiological (e.g. physiotherapy, automatic movement retraining, distraction techniques, video feedback, education, biofeedback) or Psychological interventions (e.g. Cognitive Behavioural therapy, trauma-focused therapy, psychodynamic therapy, mindfulness, psychoeducation, hypnotherapy, motivational interviewing,

Criteria	Inclusion Criteria
	compassion-focused therapy).
3. **Comparisons or control groups**	No restriction; comparator/control groups optional/not required
4. Outcomes of interest	Emotional, psychological, or functional outcomes as described by the patient; patient experiences; clinician perspectives on outcomes; symptom change descriptions; treatment acceptance; perceived effectiveness; patient experience in general with FND; any patient-reported outcome (capturing experience, perceived change, Qol, symptoms) or clinician-rated outcomes (e.g. symptom severity, functional measures)
5. Setting	Any setting where patients with FMD received psychological or physiological treatment (e.g. outpatient, inpatient, rehabilitation)
6. Study design	Qualitative studies: interviews, focus groups, case studies/series, observational studies with qualitative analysis, mixed-methods with extractable qualitative data, descriptive research, clinical trials with qualitative data, literature reviews, peer-reviewed articles; randomized controlled trials (RCT), retrospective studies, retrospective case series, pilot studies; All study designs were eligible due to limited RCT evidence in FMD
7. Language	English
8. Publication Date	2020-2025

Table 2: Exclusion criteria.

Criteria	Exclusion criteria
1. **Population, or participants and conditions of interest**	Studies involving patients with comorbid organic movement disorders (e.g.Parkinson's disease) or studies with other functional neurological disorders that include only e.g.functional seizures, sensory symptoms Participants <16 years.
2. **Interventions or exposures**	Studies focusing solely on pharmacological or surgical interventions, or those not involving physiotherapy or psychological treatment components.
3. **Comparisons or control groups**	None
4. **Outcomes of interest**	Studies not focusing on treatment (e.g. but only on diagnostics or epidemiology). Studies not focusing on patient or clinician-rated outcomes.
5. **Setting**	Animal studies (non-human participants).
6. **Study design**	Systematic reviews, Systematic scoping review

5.2 Search strategy

For each database, two search strings were created to investigate physiotherapy and psychotherapy separately and to obtain more articles.

The initial search strategy was developed for PubMed, which uses Medical Subject Headings (MeSH) as a controlled vocabulary to index articles. MeSH terms ensure that all relevant articles related to a specific concept are captured, regardless of the exact wording used by authors. Using MeSH terms precises the search in PubMed.

The search strategy for the database Scopus was adapted, because it doesn't use MeSH but instead primarily keywords and text searches. It was adjusted to focus on searching within Title, Abstract, and Keywords fields (often referred to as TITLE-ABS-KEY in Scopus). Controlled vocabulary

terms like MeSH were replaced with equivalent keywords and synonyms to maintain the sensitivity and specificity of the search.
Boolean operators (AND, OR) was applied in both databases to combine concepts and ensure a systematic approach. A detailed description of the search strategy, including all search strings for each database, is provided in the appendices.
After exporting search results from all databases into Zotero, duplicates were identified and removed automatically by the software, and manually to check for any uncertain matches. 93 records were retrieved. The full search string, including tables, are presented in **Annex 9.1**.

5.3 Study selection

Following duplicate removal, all 93 retrieved records were screened in two stages against the predefined inclusion and exclusion criteria.
Titles and abstracts were screened to identify potentially relevant studies. Records that were clearly irrelevant (e.g. based on title/abstract content not matching population, intervention, or topic) or not accessible were excluded at this stage.
Full-text articles of the records that were possibly eligible for inclusion were then retrieved and evaluated for final inclusion eligibility.
No automation tools or software were used for screening, but all decisions were made manually based on eligibility criteria. To promote consistency and avoid selection bias, the criteria were strictly and uniformly applied to all records for evaluation.
The entire process of selection, including the numbers of records identified, duplicates removed, records screened at title/abstract level, full texts evaluated, studies excluded (with categorized reasons), and final inclusions, is presented in the PRISMA flow diagram in **Figure 1**.

5.4 Data collection process

Data were extracted from the full texts of the included studies using a standardized data collection form developed in advance. All data extraction was conducted independently by the author, consistent with the single-reviewer approach used for screening and study selection in this thesis.
Assessment timepoints were labelled inconsistently across included studies (e.g. baseline as “T0” in some studies and “T1” in others). To enable consistent comparison across studies, assessment of timepoints was standardized and redefined: all pre-treatment/baseline assessments were redefined as T0; post-treatment (end of treatment) as T1; first reported follow-up as T2; second reported follow-up as T3. The data extraction form was pretested on 2-3 studies that were included in the review to

ensure that it was free from ambiguities and inconsistencies before they were fully applied. Any issues that were encountered during extraction (e.g. unclear reporting of outcome time points or intervention components), were resolved by re-viewing the original reports and adjusting the form notes as needed.

Data extraction was performed manually by using Microsoft Excel, with one row per included study. From the data extracted, two summary tables were constructed to present study characteristics and treatment outcomes in the Results section.

As all necessary information was available in the published reports, authors were not contacted for additional data.

5.5 Data Items

The extraction form was designed to capture the following information relevant to the review question:

- Study characteristics: (e.g. author(s), year of publication, study design, sample size)
- Participant details (e.g. age range, gender, primary diagnosis of functional movement disorder (FMD)/ functional neurological disorder (FND) subtype, e.g. tremor, gait disorder, dystonia), comorbidities
- Intervention details: (physiological e.g. physiotherapy, motor rehabilitation, distraction, biofeedback, video feedback, mirror therapy, graded exercise training, repetitive transcranial magnetic stimulation (rTMS); psychological e.g. cognitive behavioral therapy (CBT)/ mindfulness, hypnosis, imagery reprocessing, psychodynamic psychotherapy; occupational therapy e.g. coping strategies, sensory modulation training or multidisciplinary treatment (MDT), duration, delivery mode, follow-up period, comparator (if present)
- Outcomes: patient-reported outcomes (PROMS), clinician-rated outcomes (CROMS), caregiver outcomes

A detailed list of all specific outcome measures extracted is provided in **Annex 9.2**.

5.6 Outcome measures

In an attempt to address the heterogeneity of the outcome reporting among the included studies, the primary and secondary outcomes were independently defined based on their relevance and alignment with the research question and core outcomes in functional movement disorders. This

approach was necessary because some studies did not clearly indicate whether the outcomes were primary or secondary, while in other studies, the same outcome was defined as primary and secondary in another. Therefore, two tables were designed to facilitate the clarity and comparison of the outcomes. **Table 3** provides the predefined/review-defined primary and secondary outcomes based on the research question. The primary outcomes we selected reflect the core motor symptoms, functional abilities, and patient-perceived improvements that are most clinically relevant in FMD. The secondary outcomes we included allow for the evaluation of the broader effects of non-pharmacological interventions on quality of life, psychological well-being, and patient performance, for example in occupational settings. In the results section, findings are presented in accordance with these predetermined outcomes, in order to allow synthesis and interpretation. Where studies reported compatible data for the predefined outcomes (even if labelled differently or not designated as primary outcomes in the original paper), these data were extracted and included. All included studies reported data relevant to at least one predefined outcome. A brief overview of the outcome measures, including their scoring range, used in this study is provided in **Table 4.** The original study-defined outcomes (primary and secondary) of the included studies are presented in **Table 9.3** ***(Annex 9.3),*** while detailed descriptions of all outcome measures, including scoring ranges and direction of interpretation and subscales, are provided in Table **9.4** ***(Annex 9.4).***

Table 3: Review-defined primary and secondary outcomes. *(table continues until p. 26)*

Outcome Category	Specific measures	Rationale as primary/secondary
Primary outcomes		
Motor symptom severity (Clinician-rated)	sFMDRS, PMDRS, CGI-S	Core to FMD; often the primary in RCTs and reviews for symptom change; directly assesses motor disorder severity
Functional mobility (Clinician-rated)	Oxford Muscle Test, BBS, TUG, 30sSTS, 6MWT, 30 Second Arm Curl Test, Box and Block Test, 10 MWT	Key functional improvements in physiotherapy
Functional status (patient- or clinician- rated)	PSFS, WSAS, FIM	Direct measure of daily function
Perceived change (patient-reported)	PGI-I, PGI-S	Captures patient-perceived improvement

Outcome Category	Specific measures	Rationale as primary/secondary
Perceived/observed effectiveness (quantitative/qualitative)	Any findings on perceived/observed effectiveness	
Secondary outcomes		
Quality of life (patient-reported)	SF-36, EQ-5D-5L, EQ-VAS, WHOQOL-BREF	Life impact domain (physical/mental components)
Psychological status/ mental health (patient-reported)	SF-36 MCS, GAD-7, BAI, BDI, PHQ-9, SQ-48, PSYCHLOPS, HADS, CORE-OM, SCS, Confidence in the diagnosis, IPQ-R	Common comorbidities in FMD
Occupational performance (patient-reported)	COPM	Supportive for daily participation
Functional performance (clinician-rated)	FMS	Ability to move in real-world settings over different distances
Comorbidity	HoNOS-ABI	Measures comorbid symptoms (e.g. mental health)

Abbreviations: SF-36 (36-Item Short Form Survey; **EQ-5D-5L** (EuroQol 5 Dimensions - 5-Level Questionnaire); **EQ-VAS** (EuroQol Visual Analogue Scale); **WHOQOL-BREF** (World Health Organization Quality of Life); **SF-36 MCS** (36-Item Short Form Mental Component Summary); **GAD-7** (Generalized Anxiety Disorder-7 Scale); **BAI** (Beck Anxiety Inventory); **PHQ-9** *(*Patient Health Questionnaire-9); **SQ-48** (Symptoms Questionnaire-48); **PSYHLOPS** (Psychological Outcomes Profiles); **HADS** (Hospital Anxiety and Depression Scale); **CORE-OM** (Clinical Outcomes in Routine Evaluation); **SCS** (Self-Compassion Scale); **IPQ-R** (Revised Illness Perception Questionnaire); **COPM** (Clinical Outcomes in Routine Evaluation); **FMS** (Functional Mobility Scale); **HoNOS-ABI** *(*Health of the Nation Outcome Scales for Acquired Brain Injury)

Table 4: Overview of outcome measures. *(table continues until p. 29)*

Outcome domain	Measure/Tool	What it assesses	Direction (higher=…)
Motor symptom severity	sFMDRS (41)	Severity of functional motor symptoms	Higher = worse
Motor symptom severity	PMDRS (42)	Severity across 10 movement phenomena	Higher = worse
Perceived severity	CGI-S (43)	Clinician-rated illness severity	Higher = worse
Perceived change	CGI-I (44)	Clinician-rated improvement from baseline	Higher = worse
Perceived severity	PGI-S (44)	Patient-rated severity	Higher = worse
Perceived change	PGI-I (44)/ participant-rated CGI-I	Patient-rated improvement	Higher = worse
Psychological status	PSYCHLOPS (45)	Individual psychological problems & functioning	Higher = worse
Psychological status	SQ-48 (46)	Multidimensional symptoms (depression, anxiety, somatization…)	Higher = worse
Quality of life	SF-36 (47)	Health-related quality of life	Higher = better
Quality of life	EQ-5D-5L (incl. EQ Index & EQ VAS) (48,49)	Health utility & perceived health	Higher = better
Quality of life	WHOQOL-BREF	Subjective	Higher = better

Outcome domain	Measure/Tool	What it assesses	Direction (higher=…)
	(50)	quality of life	
Functional status	WSAS (51)	Impairment in daily activities	Higher = worse
Functional status	PSFS (52)	Patient-specific functional difficulties	Higher = better
Functional status	FIM (53)	Independence in self-care & mobility	Higher = better
Occupational performance	COPM (54)	Self-rated performance & satisfaction	Higher = better
Comorbidity/Psychiatric symptoms	HoNOS-ABI (55)	Behaviour, impairment, symptoms, social functioning in acquired brain injury	Higher = worse
Psychological status	GAD-7 (56)	Anxiety severity	Higher = worse
Psychological status	BAI (57)	Anxiety severity	Higher = worse
Psychological status	BDI (58)	Depression severity	Higher = worse
Psychological status	PHQ-9 (59)	Depression severity	Higher = worse
Psychological status	HADS (60)	Anxiety and depression severity	Higher = worse
Psychological status	CORE-OM (61)	Global psychological distress	Higher = worse
Functional mobility & motor performance	FMS (62)	Functional walking ability in	Higher = better

Outcome domain	Measure/Tool	What it assesses	Direction (higher=…)
		everyday environments	
Psychological status	SCS(63)	Self-compassion	Higher = better
Perception of illness	IPQ-R (64)	Patient beliefs and understanding of illness	Higher = better

Abbreviations: **sFMDRS** (Simplified Functional Movement Disorders Rating Scale); **PMDRS** (Psychogenic Movement Disorder Rating Scale); **CGI-S** (Clinical Global Impression Severity); **CGI-I** (Clinical Global Impression Improvement); **PGI-S** (Patient Global Impression of Change), **PGI-S** (Patient Global Impression of Severity); **PSYCHLOPS** (Psychological Outcomes Profiles); **SQ-48** (Symptoms Questionnaire-48); **SF-36** (36-Item Short Form Survey); **EQ-5D-5L** (EuroQol 5 Dimensions - 5-Level Questionnaire); **EQ-VAS** (EuroQol Visual Analogue Scale); **WHOQOL-BREF** (World Health Organization Quality of Life); **WSAS** (Work and Social Adjustment Scale); **PSFS** (Patient Specific Functional Scale); **FIM** (Functional Independence Measure); **COPM** (Canadian Occupational Performance Measure); **HoNOS-ABI** (Health of the Nation Outcome Scales for Acquired Brain Injury); **GAD-7** (Generalized Anxiety Disorder-7 Scale), **BAI** (Beck Anxiety Inventory); **BDI** (Beck Depression Inventory); **PHQ-9** (Patient Health Questionnaire-9), **HADS** (Hospital Anxiety and Depression Scale); **CORE-OM** (Clinical Outcomes in Routine Evaluation); **FMS** (Functional Movement Screen); **SCS** (Self-Compassion Scale); **IPQ-R** (Revised Illness Perception Questionnaire)

5.7 Effect measures

No meta-analysis was conducted due to heterogeneity across studies. Instead, intervention effects were described narratively for each predefined primary and secondary outcome. From the included studies, statistical results were extracted and reported in **Table 6** including point estimates of change from the baseline with 95% confidence intervals (CI) or p-values for between-group comparisons to see the difference between one and another treatment, as well as p-values for within-group changes in studies without a comparison group to see the change from the baseline within one group after a specific treatment. Statistically significant p-values and confidence intervals that were reported in the included studies were extracted and presented. Non-significant results were recorded as “non-

significant" without reporting the exact p-values or confidence intervals. Studies that did not provide p-values and confidence intervals were described narratively (improvement or no improvement or worsening were extracted). Point estimates (i.e., the exact magnitude of change on outcome measures) were not included in the summary table but are available in the original publications. Data were extracted for all reported timepoints, including pre-treatment (baseline), immediate post-treatment, and any follow-up assessments.

5.8 Methods for data synthesis

A narrative synthesis was performed. The studies were grouped as follows:

- Randomized controlled trials (RCTs) were presented separately
- Observational studies were grouped by type of treatment: multidisciplinary treatment, psychological therapy, and neurostimulation-augmented therapy

For each group and for each primary and secondary outcome, the following was described:

- Whether symptoms or function improved, didn't change or got worse
- Whether the change was reported as statistically significant
- How consistent the findings were across studies

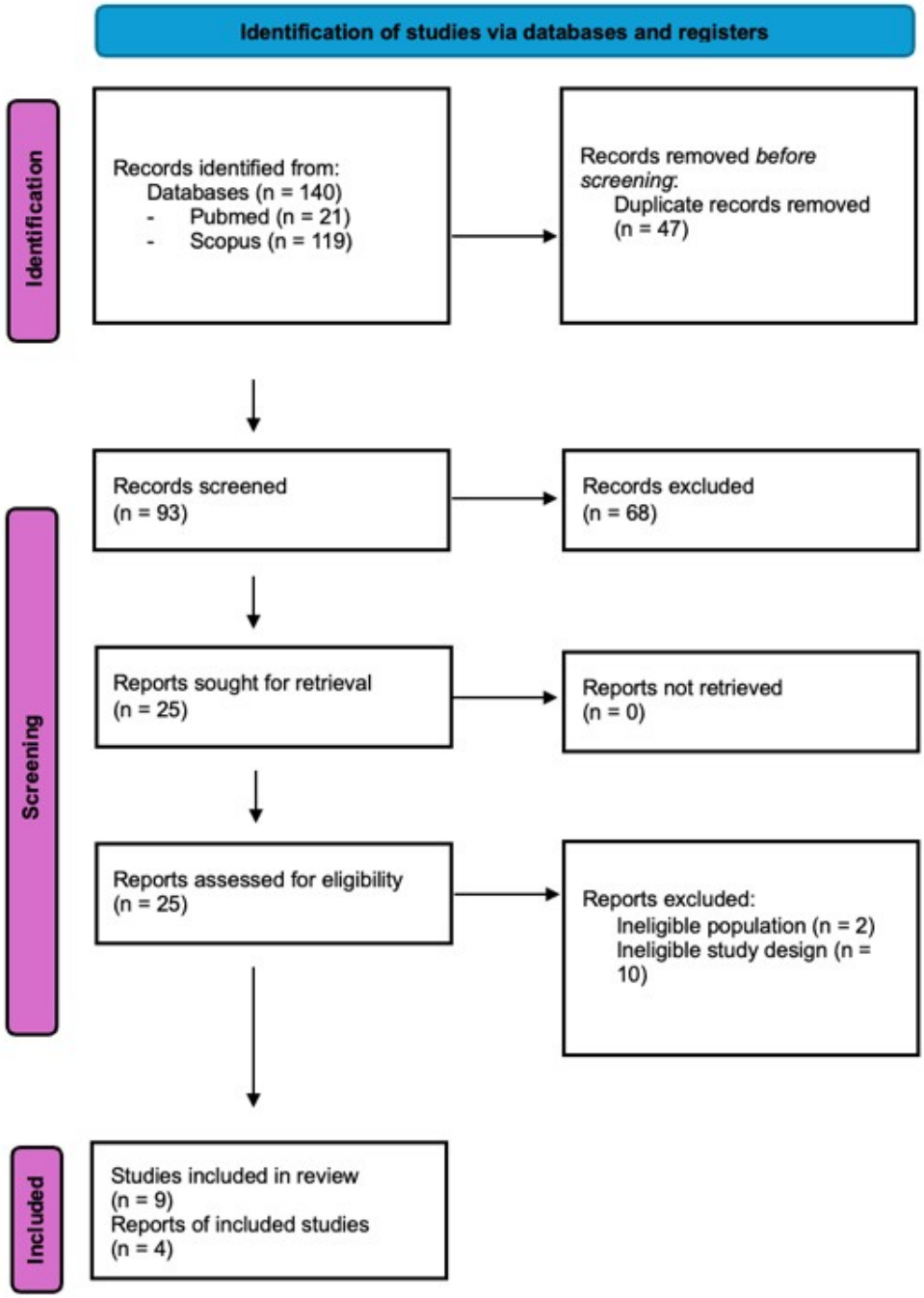
Results were shown for those time points which demonstrated a treatment effect. Findings are presented in the text in the results section and in more detail in the summary tables, **Table 5 and Table 6.**

6. RESULTS

6.1 Study selection

The study selection process is summarized in ***Figure 1*** (PRISMA 2020 flow diagram). Of the 140 records identified, 93 were screened after duplicates were removed and 25 full-text articles were assessed for eligibility. 13 studies met inclusion criteria and were included in the review synthesis.

Figure 1: PRISMA Flow diagram.



6.2 Study characteristics.

Table 5. *(table continues until p. 34)*

Study & Author	Study type	Samle size (n)	Population (age, % female)	Motor symptoms	Intervention type	Duration/ Setting	Timepoints & Follow-up (standardized)
Macias-Garcia et al., 2024 (65)	RCT	40	mean age 42.3-44.7; 80% F	tremor, gait disorder, dystonia, myoclonus/jerks, tics, mixed FMD	MDT (PT + CBT) vs. nondirected psychological support therapy (CG)	4-6 w.; OP	T0, T2 (3 m.), T3 (5 m.)
Nielsen et al., 2025 (66)	RCT	247	mean age 44.7; 74% F	gait disturbances, weakness, mixed FMD, tremor, jerks, dystonia/fixed dystonia	Specialist PT vs. TAU (CG)	3 w.; OP	T0, T2 (6 m.), T3(12 m.)
Tibben et al., 2023 (30)	Pilot study	46	mean age 43.87; 76.1% F	resting tremor, action tremors, dystonia, chorea, bradykinesia, myoclonus, tics, athetosis, ballism, cerebellar incoordination	Behavioral therapy w. hypnosis and catalepsy induction	8 w.; OP	T0, T1 (after 5 w.), T2 (after 8 w.), T3 (8 w. after post-treatment)
Palmer et al., 2023 (34)	Pilot observational study	11	mean age 42; 64% F	dystonia, dissociative attacks, tremor/jerks, weakness, gait disorder w. diff. FND symptoms: pain, fatigue, cognitive difficulties, sensory overload, dysfluent speech, imbalance	MDT (PT, PsychT, CBT)	12 w.; OP	T0, T1
Reid et al., 2022 (67)	Retrospective study	18	mean age 47; 94.4% F	gait disturbances, tremor	MDT (PT, OT, ST, meditation, minfulness practice)	5 d.; OP	T0, T1
Schmidt et al., 2021 (68)4/27/2026	Retrospective (observational) study	31 (23 in follow-	median age 47; 54.84% F	gait and balance disturbance, tremor, myoclonus, chorea,	MDT (PT, CBT, trauma therapeutic interventions	21 d.; IP	T0, T1, T2 (5 m.)

		up)		dystonia, paresis, speech disturbance, tics, mixed			
Schneider et al., 2024 (69)	Single-center retrospective study	30	mean 43.6; 70% F	hemiparesis, paraparesis, tetraparesis	MDT (PT, OT, PsychT.)	4 w.; IP	T0, T1, T2 (36 m.)
O'Connell et al., 2020 (70)	Retrospective observational case-control study	98	mean age 44.5; 72.4% F	weakness, tremor, shakes, jerking, dystonia, pain	CBT	3-4 m.; OP	T0, T1 (up to max.3 m. after end of treatment)
Scrivener et al., 2025 (35)	Retrospective case series	3	mean age 43.3; 66.7% F	severe functional limb weakness and immobility	TMS-primed specialist PT	1 d.; OP	T0, T1
Hsieh & Deshpande et al., 2020 (71)	Case report	1	age 40; F	functional fixed dystonia	MDT (specialized PT, CBT, mirror therapy, physical actitivities, relaxation techniques)	8 w.; OP	T0, T1, T2 (2m.), T3 (6 m.)
Joos & Halmer et al., 2020 (72)	Case report	1	age 64; M	chronic functional tremor	MDT (PT, PsychT., OT, mirror therapy, art therapy)	8 w.; IP	T0, T1, T2 (2 m.)
Gros et al., 2024 (39)	Case report and Review	4	mean age 27.8; 75% F	functional dystonia	Specialist PT, CBT, MDT (individualized to patient)	3 m. - 1 y.; OP	T0, T1, T2 (3 m. to 2 y.)
Zarotti & Poz et al., 2022 (32)	Case study	1	age 81; M	functional gait disorder	CBT, voluntarily psychology, neurobiology and Buddhist philosophy (compassion-focused therapy)	12 w.; OP	T0, T1.

Abbreviations: **RCT** = randomized controlled trial; **FMD** = functional movement disorder; **FND** = functional neurological disorder; **n** = sample size, **F** = female; **M** = male; **d**. = days; **w**. = weeks; **m**. = months; **y**. = years; **MDT** = multidisciplinary treatment; **PT** = physiotherapy; **CBT** = cognitive behavioural therapy; **PsychT**. = psychotherapy; **OT** = occupational therapy; **ST** = speech therapy; **TMS** = trans magnetic stimulation; **CG** = control group; **TAU** = treatment as usual; **IP** = inpatient; **OP** = outpatient; **T0**: pre-treatment; **T1**: post-treatment; **T2**: first reported follow-up; **T3**: second reported follow-up

6.3 Treatment outcomes

Table 6. *(table continues until p. 45)*

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
MACIAS-GARCIA ET AL., 2024 (65)	RCT [a,c]					
		SF-36	T0-T2	95% CI: 17.31 (3.2 to 31.5), p=0.02* (PF)	SS in SF-36 (PF); NS in remaining SF-36 subdomains	MDT showed meaningful gains in daily activities, with fewer limitations from physical health
		SF-36	T0-T3	95%CI: 17.9 (6.0 to 30.0), p=0.004**(BP); 22.94 (6.3 to 39.6), p=0.007** (change in health)	SS in SF-36 BP and change in health; NS in remaining SF-36 subdomains	MDT reported less pain, meaningful shifts in their overall health
		EQ VAS	T0-T2 / T0-T3	–	NS	–
		EQ Index	T0-T2 / T0-T3	–	NS	–
		EQ-5D-5L	T0-T2	NR	NR	42% reported improved health (MDT) vs 26% (CG); 37% worsening (MDT) vs 42% (CG)
		EQ-5D-5L	T0-T3	NR	NR	47% reported improved health (MDT) vs 16% (CG); 42% improved in mobility (MDT) vs

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
						21% (CG); 26% improved in pain (MDT) vs 5% (CG); anxiety & depression improved in both groups
		sFMDRS	T0-T2	95%CI: -7.15 (−9.7 to −4.6), p<0.001***	SS	MDT: Consistent decrease of motor symptoms
		sFMDRS	T0-T3	95%CI: -9.41 (−12.6 to −6.2), p<0.001***	SS	MDT: scores (measuring motor symptoms) decreased >50%
		CGI-S	T0-T2	95%CI: -1.53 (-2.0 to -1.1), p< 0.001***	SS	Significant advantage for MDT in reduction of symptom severity
		CGI-S	T0-T3	95%CI: -1.70(-2.2 to -1.2), p<0.001***	SS	Significant advantage in MDT sustained
		CGI-I	T0-T3	p<0.001***	SS	MDT: 83% improved vs CG: 12%
		PGI-I	T0-T3	p=0.001***	SS	Significantly greater improvement in patients condition in MDT compared to CG
		ZBI	T0-T2 / T0-T3	–	NS	–
NIELSEN ET AL., 2025 (66)	RCT [a,d]					
		SF-36	T0-T2	95%CI: 10.1 (3.7 to 16.5) (RP); 8.9(2.6 to	SS in SF-36 (PR), (SF), (MH); NS in	Specialist PT: significant better

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
				15.2) (SF); 5(0.5 to 9.6) (MH)	remaining SF-36 subdomains	physical, social, mental performance
		SF-36	T0-T3	95% CI: ≈5.4(0.9 to 9.8) (MH)	SS in SF-36 MH; NS in remaining SF-36 subdomains	Specialist PT: significantly better mental performance
		PGI-I	T0-T2	95% CI: 4.7 (2.6 to 8.6)	SS	Specialist PT: 62.6% (of 134 patients) improved vs. 28.1% (of 96) in CG
		PGI-I	T0-T3	95% CI: 2.3 (1.4 to 3.9)	SS	Specialist PT: 58.7% (of 134 patients) improved vs. 38.2% (of 96) in CG
		HADS-A	T0-T2	95% CI: −1(−2 to −0.1)	SS	Specialist PT: anxiety levels decreased significantly vs. CG
		HADS-A / HADS-D	T0-T3/ T0-T2, T0-T3	–	NS	–
		EQ-5D-5L	T0-T2	95% CI ≈0.05 (0.002 to 0.107)	SS	Specialist PT: Significantly higher increase in HRQoL vs. CG
		EQ-5D-5L	T0-T3	–	NS	–
		FMS	T0-T2 / T0-T3	–	NS	–
		Confidence in the diagnosis	T0-T2	95% CI: 1.1(0.5 to 1.6)	SS	Specialist PT: patients became reliably more confident i. diagnosis
		Confidence in the diagnosis	T0-T3	95% CI: ≈ 0.8 (0.2 to 1.4)	SS	Specialist PT: patients became reliably more

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
						confident i. diagnosis
		IPQ-R	T0-T2	NR	SS for "Timeline Cyclical", "Personal Control", "Illness Coherence"; NS in the remaining domains	Specialist PT: patients felt more in control, understood illness better, perceived it as more predictable
		IPQ-R	T0-T3	95%CI: ≈1.1(0.14 to 2.08) (personal control); ≈1.7(0.59 to 2.74) (illness coherence)	SS for "personal control" and "illness coherence"; NS in the remaining domains	Specialist P: patients felt more in control, understood their illness better
TIBBEN ET AL., 2023 (30)	Pilot study [b]					
		PMDRS	T0-T3	p<0.001***	SS	Decreased; substantial improvement in FMD symptoms
		SQ-48	T0-T3	NR	NR	Decreased; improvement in mental health symptoms
		WHOQoL-BREF	T0-T3	NR	NR	Improved modestly, biggest gains in physical & psychological health; smaller improvements in social & environmental well-being
PALMER ET AL., 2023 (34)	Pilot observational study [b]					

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
		SF-36	T0-T1	NR	SS in SF-36 (PF), (RE), (VT), (MH), (SF), (BP), (GH); NS in SF-36 (RP)	Improved physical functioning, mental health, less pain, increased energy, greater social participation, fewer role limitations and more positive overall health perception
		PGI-C	T0-T1	NR	NR	Meaningful self-rated alleviation of symptom severity
		WSAS	T0-T1	NR	NR	Shift from severe to mild functional impairment
		Self-rated understanding of FND	T0-T1	NR	NR	Improvement in understanding of diagnosis
		Agreement with diagnosis of FND	T0-T1	NR	NR	Improvement in acceptance of diagnosis
REID ET AL., 2022 (67)	Retrospective study [b]					
		BBS, 30sSTS, 30s Arm Curl Test, Box & Block Test, 6MWT, PSFS, COPM	T0-T1	p=0.006** / 0.001*** / 0.005**&0.000*** / 0.001***&0.000*** / 0.001*** / 0.000*** / 0.000***	SS	Significant improvements in motor, gait, balance, mobility, strength, limb function, patient-reported function; perceived real-life

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
						benefits in every day activities
		TUG	T0-T1	–	NS	–
SCHMIDT ET AL., 2021 (68)	Retrospective (observational) study [b]					
		PMDRS	T0-T1/ T0-T2	p=0.0006***/ p=0.000032***	SS	Motor symptoms significantly decreased/ sustained
		S-FMDRS	T0-T1 / T0-T2	p=0.008** / 0.000888***	SS	Severity of FMD symptoms decreased / sustained
		CGI-S	T0-T1 / T0-T2	p=0.000136*** / 0.000032***	SS	Meaningful reduction in ssymptom everity / sustained
		PGI-S	T0-T1 / T0-T2	p=0.004** / 0.016*	SS	Perceived severity of symptoms decreased / sustained
SCHNEIDER ET AL., 2024 (69)	Single-center retrospective study [b]					
		FIM (motor)	T0-T1	p<0.001***	SS	Gains in independence in daily activities (22 patients), 10% relapsed
		FIM (motor)	T1-T2	p=0.54	NS	Gains sustained by 70% of patients
		Professional activity	T0-T2	NR	NR	Declined in 5 patients
O'CONNELL ET AL., 2020	Retrospective observational					

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
(70)	case-control study [b]					
		CORE-OM	T0-T1	95% CI=2.6-8.3, p=0.001***	SS	Mental health and well-being improved from clinically moderate to clinically low score
		PHQ-9	T0-T1	95% CI=0.6–6.5, p=0.02*	SS	Significant decrease of depressive symptoms
		HoNOS-ABI	T0-T1	Z=–3.1, p=0.002**	SS	Reduction in overall symptom severity & functional difficulties
		3 point scale measuring improvement	T0-T1	NR	NR	49.4% symptom improvement, 8.2% got worse
SCRIVENER ET AL., 2025 (35)	Retrospective case series [b]					
		Observations	T0-T1	NR	NR	Significant improvement in mobility & reduction in lower limb weakness. Pre-treatment: dependence on wheelchair; post-treatment: independence in mobility
		Observations	T1-T2	NR	NR	Improvements sustained on follow-up

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
HSIEH & DESHPANDE ET AL., 2020 (71)	Case report [b]					
		CGI-S	T1	NR	NR	Very strong overall improvement
		BAI	T0-T1-T2	NR	NR	Anxiety symptoms decreased during treatment; remained lower than baseline at follow-up
		BDI-2	T0-T1-T2	NR	NR	Depressive symptoms strongly decreased at discharge, slightly returned at follow-up
		WASAS	T0-T1-T2	NR	NR	Daily functioning was improved at discharge, slightly increased at follow-up
		10MWT	T0-T1-T2-T3	NR	NR	Walking speed steadily increased, mobility sustained
		Oxford muscle test	T1	NR	NR	Lower limb strength improved
		Observations	T1	NR	NR	Pain resolved, foot function restored, unaided walking achieved
JOOS & HALMER ET	Case report [b]					

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
AL., 2020 (72)						
		Observations	T1	NR	NR	Marked reduction in tremor severity, better fine motor control; patient became more emotional open
		Observations	T2	NR	NR	Improvements maintained at 2 months
GROS ET AL., 2024 (39)	Case report and Review [b]					
		Observations	T1-T2	NR	NR	Motor symptoms & dystonia improved in all 4 cases; one case had periodic flares during long-term follow-up
ZAROTTI & POZ ET AL., 2022 (32)	Case study [b]					
		PSYCHLOPS	T0-T1	NR	NR	30% reduction in perceived psychological impact of mFND
		SCS	T0-T1	–	NS	Slight increase in self-compassion
		HADS-A	T0-T1	–	NS	Anxiety decreased to clinically significant level
		HADS-D	T0-T1	RCI = 2.34	SS	Depression decreased to clinically significant

STUDY (AUTHOR, YEAR)	DESIGN	MEASURE(S)	TIME INTERVAL	STATISTICAL RESULTS	SIGNIFICANCE	NARRATIVE SUMMARY
						level
		Observations	T0-T1	NR	NR	No clear improvement of motor symptoms

Statistical significance: *p<0.05, **p<0.01, ***p<0.001.

- **General Abbreviations*:* 95%CI** = 95% confidence interval; **SS** = statistically significant; **NS** = not statistically significant; **NR** = not reported; **–** = not statistically significant; **p-value/95% confidence interval** (non-significant outcomes are not shown in values in the table and only marked with **–**); **CG** = control group; FMD = functional movement disorder; FND = functional neurological disorder
- **Abbreviations for measurements: SF-36** (36-Item Short Form Survey); **EQ VAS** (EuroQol Visual Analogue Scale); **EQ-5D-5L** (EuroQol 5 Dimensions - 5-Level Questionnaire); **sFMDRS** (Simplified Functional Movement Disorders Rating Scale); **CGI-S** (Clinical Global Impression Severity); **CGI-I** (Clinical Global Impression of Improvement); **CGI-S** (Clinical Global Impression Severity); **PGI-I/PGI-C** (Patient Global Impression of Change); **ZBI** (Zarit Caregiver Burden Interview); **HADS-A & HADS-D** (Hospital Anxiety and Depression Scale); **FMS** (Functional Movement Screen); **IPQ-R** (Revised Illness Perception Questionnaire); **PMDRS** (Psychogenic Movement Disorder Rating Scale); **SQ-48** (Symptoms Questionnaire-48); **WHOQoL-BREF** (World Health Organization Quality of Life); **PGI** (Patient Global Impression of Improvement); **WSAS** (Work and Social Adjustment Scale); **BBS** (Berg Balance Scale); **30sSTS** (30-Second Sit-to-Stand); **30s Arm Curl Test** (30 second Arm Curl Test); **6MWT** (Six Minute Walk Test); **PSFS** (Patient Specific Functional Scale); **COPM** (Canadian Occupational Performance Measure); **TUG** (Time Up and Go Test); FIM (Functional Independence Measure); **CORE-OM** (Clinical Outcomes in Routine Evaluation); **PHQ-9** (Patient Health Questionnaire-9); **HoNOS-ABI** (Health of the Nation Outcome Scales for Acquired Brain Injury); **BAI** (Beck Anxiety Inventory); **BDI-2** (Beck Depression Inventory 2); **10MWT** (10 metre walk test); SCS (Self-Compassion Scale); **PSYCHLOPS** (Psychological Outcomes ProfileS
- [a]All values in the randomized controlled trials (RCTs) reflect between-group changes. [b]All values in the non-randomized controlled trials reflect within-group changes. [c] MDT compared to nondirected psychological support therapy. [d]Specialist PT compared to treatment as usual (TAU).
- **Additional notes: T0**: pre-treatment; **T1**: post-treatment; **T2**: first reported follow-up; **T3**: second reported follow-up (exact timing varies across studies – see individual study characteristics in **Table 5** for details); **SS**: statistically significant improvement (or change) in the intervention group compared with

control or baseline.

The direction of change (improvement vs. worsening) is interpreted according to the scoring of each specific scale (e.g., lower scores on the sFMDRS indicate decrease in motor symptoms). Exact point estimates (i.e., magnitude of change) on the scales are not listed here and can be found in the original articles for full numerical details. The interpretation of scoring of the measurements is listed in **Table 4** and **Table 9.4, *Annex 9.4.***

6.4 Experimental studies

Two randomized control studies (RCTs), are included in this systematic literature review.

6.4.1 Overview of included RCTs

Two RCTs (65,66) evaluated physiotherapy-based interventions for FMD. RCT 1 (Macías-García et al., 2024(65)); N= 40 analyzed) was a single-center trial comparing multidisciplinary treatment (specialized physiotherapy plus cognitive behavioural therapy; N = 20) to a control group receiving nondirected psychological support therapy (N = 20) over 3 months and 5 months. The mean age of participants ranged from 42.3 to 44.7 with 80% female, and 20% male. Phenotypes included multiple FMD types per patient, with tremor and gait disorder being the most frequent. This suggests a high prevalence of mixed presentations. Treatment was delivered in an outpatient setting. Patients were assessed at baseline/pre-treatment (T0) and the latest follow-up was at 5 months post-treatment. RCT2 (Nielsen, G. et al.(66)); N=247 analyzed) was a multicenter trial comparing specialist physiotherapy (N = 141) to treatment as usual (TAU) (N = 106) over 6 months and 12 months. Participants had a mean age of 44.7 with 74% female, and 26% male. Dominant motor symptoms were reported per participant, with gait disturbances and weakness being the most frequent. The study design suggests an outpatient delivery. Patients were assessed at baseline/start of treatment (T0) and the latest follow-up was at 12 months post-treatment.

6.4.1.1 RCT 1 (65)

Primary outcomes:

There were consistent improvements seen in the multidisciplinary group measured by sFMDRS with a significant reduction of >50% FMD motor symptom severity at month 5. The measurement of sFMDRS showed a statistically significant between-group difference in favour of MDT group for month 3 and 5. The overall clinical severity decreased, measured by the CGI-S that shows statistically significant improvements at months 3 and 5 in favour for the MDT group. The MDT group showed statistically significant advantages on the CGI-I over the control group at 5 months. A greater proportion of participants receiving multidisciplinary treatment were rated as improved (very much improved, improved or better) compared with the control group (83% vs 12%). No change was three times more

prevalent in the control intervention. None of the patients in the MDT group rated with the CGI-I worsened, compared with control intervention.

Secondary outcomes:

At 3 months follow-up there was a significant improvement, in favour of the MDT group, seen in the subdomain SF-36 physical functioning, which was not sustained in month 5. On the other hand, the subdomain SF-36 bodily pain and SF-36 Change in health, showed a significant improvement at month 5. No significant between-group differences were observed at 3 months in all subdomains of SF-36 except SF-36 physical functioning. No significant improvements at 5 months were in following subdomains of SF-36: general health perceptions, physical functioning, social functioning, role limitations due to physical problems, role limitations due to emotional problems, emotional well-being and energy and fatigue, and Zarit Caregiver Burden Interview.
Furthermore, at month 3, 42% of the MDT group indicated an improvement in their health state and 47% of MDT patients reported improved health in month 5, in contrast to 26% and 16% in the control group, demonstrated by the EQ-5D-5L. EQ-5D-5L also showed that 37% treated with multidisciplinary approach experienced worsening at 3 months, which decreased to 16% at 5 months. Additionally, improvements were observed in mobility by 42% of patients and in pain/discomfort by 26%, according to the EQ-5D-5L outcomes. In the control group, less percentage of patients demonstrated these improvements, but both groups reported decreased anxiety and depression by month 5. Self-perception of the patient's state of health measured by EQ VAS and EQ Index, improved in the active-treatment group with 39% improvement, and 11% respectively, but the difference to the control group was not significant at 5 months.

6.4.1.2 RCT 2 (66)

Primary outcomes:

At 6 months, specialist physiotherapy demonstrated statistically significant advantages over TAU on the participant-rated CGI-I (PGI-I), meaning that participants in the active control group demonstrated significantly greater clinical improvement. A greater proportion of participants receiving specialist physiotherapy were rated as improved (much improved or improved) compared with TAU (62.6% of 134 patients vs. 28.1% of 96 patients). In

contrast, no change was more common in the TAU group, while worsening was uncommon and similar across groups. At 12 months, specialist physiotherapy continued to show significant advantages over TAU on participant-rated CGI-I (PGI-I). A greater proportion of participants receiving specialist physiotherapy were rated as improved (much improved or improved) compared with TAU (58.7% vs. 38.2%). No change was more frequent in the TAU group, while worsening remained uncommon and similar across both groups.

Secondary outcomes:

At 6 months follow-up, specialist physiotherapy demonstrated statistically significant improvements compared with TAU on multiple secondary outcomes, including SF-36 domains of Physical Role Limitations, Social Functioning, and Mental Health; the EQ-5D-5L utility scores; Confidence in Diagnosis; HADS Anxiety, and in three domains of the Revised Illness Perception Questionnaire (Timeline Cyclical, Personal Control, Illness Coherence). No differences were observed in remaining outcome domains at 6 months: FMS, HADS Depression, Fatigue 5-point scale, six out of nine scales of the Revised Illness Perception Questionnaire.

At 12 months, specialist physiotherapy showed statistically significant improvements compared with TAU on following outcomes: Revised Illness Perception Questionnaire (Personal control, Illness coherence), Fatigue 5-point scale and Confidence in the diagnosis. HADS anxiety and EQ-5D-5L utility scores were no longer showing a statistically significant difference in favour of specialist physiotherapy group at 12 months, and there were also no between-group differences observed in these outcomes: HADS depression and in seven out of nine scales of the Revised Illness Perception Questionnaire.

6.4.2 Synthesis of experimental studies

The combined analyzed population across these two RCTs (65,66) consists of total 287 patients with mean ages ranging from 42.3 to 45 years and a clear female predominance (overall 74.9%). Both RCTs showed statistically and clinically relevant benefits for physiotherapy-based interventions (multidisciplinary with cognitive behavioural therapy or specialist physiotherapy) over control groups (nondirected psychological support therapy and TAU) on perceived effectiveness as measured by CGI-I/PGI-I (participant-rated improvement in motor symptoms), with greater numbers rated as improved and fewer as no change. The physical aspects of quality of life (SF-36 physical subdomains/PCS) showed significant improvement in the active groups, often

more noticeably at earlier time points (3—5 months in RCT1(65); 6 months in RCT2 (66)). Mental health/psychological benefits were apparent but small and non-persistent (e.g.SF-36 Mental Health or HADS Anxiety benefits at shorter-term follow-up, with less persistence at longer-term). Interventions were generally well-tolerated, with no significant safety issues raised. In general, both treatments “Multidisciplinary treatment combined with CBT” (65) and “Specialist physiotherapy” (66), support moderate effectiveness of non-pharmacological, physiotherapy-based approaches in terms of improving patient-reported outcomes, especially perceived motor improvement (as measured by CGI-I and PGI-I) and physical functioning (measured by SF-36 physical functioning) (65,66). Objective motor scales (sFMDRS) significantly improved in the multidisciplinary RCT (65) and were not measured in RCT 2 (66).

6.5 Observational studies

Eleven studies (30,32,34,35,39,67–72) with heterogeneous study designs were included, which provided lower-level evidence on physiotherapy and/or psychological interventions for FMD: three retrospective studies (67–69), one pilot observational study (34), one pilot study (30), one retrospective observational case-control study (70), one retrospective case series (35), two case reports (71,72), one case report and review (39) and one case study (32). Because of the heterogeneity of study designs, small sample sizes, lack of controls, and high risk of bias, meta-analysis was not feasible. Narrative synthesis is provided below, categorized by intervention type.

Overall, the combined analyzed population across these 11 observational studies consists of total 244 patients with FMD, with a mean age from 22 to 81 years across studies. There is a clear female predominance, which is consistent with other papers about FMD (2,3,9) .

6.5.1 Multidisciplinary treatment

Seven studies (34,39,67–69,71,72) examined the multidisciplinary treatment approach for patients with functional movement disorder or functional neurological disorder with motor symptoms. These comprise three retrospective studies (67–69), one pilot observational study (34), two case reports (71,72), and one case report and review, including four different cases (39). Multidisciplinary treatment consisted of specialized physiotherapy including mirror box therapy, psychological therapies, psychoeducation, CBT, occupational therapy, and trauma therapeutic interventions. The combined analyzed FMD population totalled N = 96, with a mean age range from 22-64 years in six studies (34,39,67,69,71,72) and median age of 47 (68). Across these studies we have a pooled female predominance with 68.75% and 31.25% male. Treatment settings varied: in four of these

studies the treatment was delivered in an outpatient setting (34,39,67,71), and the remaining three studies reported about inpatient clinical settingsd (68,69,72). Patients were all assessed at baseline/start of the treatment (T0), with follow-up ranging from five days (67) to 36 months (69). The prominent functional motor symptoms included dystonia, tremor, and gait disturbances, but the studies also included patients with myoclonus, chorea, paresis, speech disturbance, tics, and FND with motor symptoms along with comorbid symptoms such as fatigue, cognitive difficulties, sensory overload, dysfluent speech, pain, and dissociative attacks.

Primary outcomes

The functional motor symptom severity measured by clinician-rated CGI-S (71) and patient-rated PGI-C (34) substantially improved (34,71). Statistically significant reduction of functional movement disorder symptoms, measured by CGI-S and PGI-S was seen in one study, with sustained effects at five months (68). Additionally, statistically significant reductions in objective motor severity were demonstrated post-intervention with the clinician-rated PMDRS and sFMDRS, that were maintained after 5 months of follow-up. (68). MDT resulted in substantial improvements evidenced by reduced disability on the WSAS (34,71), although in one patient the WSAS score increased during two months follow-up (71). Statistical significant improvement in patient-identified activity performance on the PSFS at 5 days after treatment (67) and a statistically significant greater motor independence on the FIM motor subscale post-treatment, that was sustained by 70% of patients (21 patients) at long-term follow-up of 36 months, though 13.6% (3 participants) relapsed, requiring secondary hospitalization (69). Illustrative case-level improvements, in a patient with functional fixed dystonia in the foot, included increased lower-limb strength (Oxford muscle test 4/5 and 5/5), restored foot positioning, unaided walking, and increased gait speed after 8 weeks treatment, sustained at 2 months and constantly increased walking speed (10MWT), measured again at 6 months (71). Short-term gains in functional mobility, with statistical significance were observed in BBS, 30 Second Arm Curl Test, 30sSTS, Box and Block Test (assessed by the clinician) and the 6MWT, except TUG (67). Marked tremor reduction and improved fine motor control were noted in one chronic tremor case after eight weeks, sustained at two months (72). Across the four clinical cases, the use of specialized physiotherapy as part of an MDT approach led to marked improvements in motor symptoms (e.g. normalization of gait, reduction in dystonia severity, and reduction in attack frequency, and duration, discontinuation of ankle-foot orthoses (AFOs)) usually seen within 3-6 months and maintained or gradually improving in most cases, although, with some variability and

incomplete resolution in one case. In one case, periodic flares persisted over two years due to intermittent exacerbations linked to psychosocial factors (39).

Secondary outcomes

Quality of life, assessed by SF-36 improved statistically significantly in following subdomains: physical functioning (PF), role limitations emotional (RE), energy/fatigue (VT), emotional wellbeing (MH), social functioning (SF), pain (BP) and general health (GH), but non-significantly in SF-36 role limitation physical (RP) (34). Clinically significant pain reduction following multidisciplinary approach was observed (71). Anxiety decreased, measured by BAI, though the level of depression increased at follow-up at two months, demonstrated by BDI-2 in one case (71). Occupational performance, measured by COMP improved statistically significant (67), and there was an increased ability to participate in employment and social activities, with improvements in understanding and acceptance the FMD diagnosis (34) though professional activity status declined in five patients in another study (69). Increased emotional openness regarding the diagnosis was reported in one case following psychotherapy treatment within the FMD framework (72).

6.5.2 Psychological therapy

Three studies (30,32,70) investigated psychological therapy interventions for patients with FMD. These included one pilot study (30), one retrospective observational case-control study (70) and one case study (32). Therapy strategies comprised CBT (70), hypnosis combined with catalepsy induction (30) and compassion-focused therapy (32). The combined FMD sample size totalled N = 145, with mean ages ranging from 44 to 81 years across studies. Females predominated with 73.1% females and 26.9% males, and all treatments were delivered in outpatient settings. Patients were all assessed at baseline/pre-treatment (T0) and follow-up ranged from a minimum of 8 weeks (30) to a maximum of 12 weeks after treatment (32,70). Motor symptoms encompassed a broad range, including functional weakness, gait disturbances, tremor, dystonia, chorea, bradykinesia, myoclonus, tics, athetosis, ballism, cerebellar incoordination, shakes, jerking and pain.

Primary outcomes

Evidence for improvement in motor symptom severity was mixed but showed positive effects in two of the three studies (30,70). In the pilot study employing hypnosis and catalepsy induction (30), there was a statistically significant reduction in motor symptom severity, as measured by the PMDRS, with a large treatment effect observed during

treatment. These gains remained stable at eight-week follow-up. In the retrospective case-control study of CBT (70), 49.9% of patients self-reported improvement in motor symptoms on a 3-point Likert scale (improved, unchanged, worsened), while 8.2% reported worsening. By contrast, the single case study of compassion-focused therapy (32) reported no clear improvement in motor symptoms.

Secondary outcomes

Secondary psychological and functional outcomes showed more consistent benefits, especially for distress and mood domains, although findings varied by intervention and outcome measure.

Psychological distress and overall functioning: following CBT (70), there were statistically significant improvements in psychological distress (CORE-OM) and in clinician-rated domains including social functioning, general health, and symptom severity (HoNOS-ABI). In the hypnosis study (30), psychological distress showed a slight decrease, but did not reach statistical significance. In the compassion-focused therapy case (32), the perceived psychological impact of motor symptoms decreased by 30% at 12 weeks post-treatment (PSYCHLOPS), though changes on the Self-Compassion Scale (SCS) were slight and not reliable.

Anxiety and depression: clinically significant improvements were observed in anxiety (HADS-A) and depression (HADS-D) after compassion-focused therapy (32), with scores falling below clinical thresholds; the change in depression was deemed reliable. Depression also showed a statistically significant reduction following CBT, as measured by the PHQ-9 (70).

Quality of life and daily functioning: quality of life (WHOQoL-BREF) improved modestly across all domains, with biggest gains in physical and psychological health and smaller improvements in social and environmental well-being after hypnosis (30). Also, the compassion-focused therapy case (32) reported qualitative gains in practical daily life, including enhanced social engagement, greater acceptance of the FMD condition, and a more positive attitude toward it.

6.5.3 Neurostimulation augmented therapy

One newer treatment approach, specifically called transcranial magnet stimulation-primed (TMS) physiotherapy, is investigated in one retrospective case series (35). The study population is n = 3, with mean ages ranging from 30 to 55 years, and 66.67% of females and 33.33% of males. The

treatment was delivered in a stroke and neurology unit and included behavioural treatment elements and TMS which was used as a primer for specialist physiotherapy, that was delivered immediately after TMS primer was performed. The treatment was one session long; the follow-up differed between the patients and ranged from three months to one year. The predominant functional motor symptom was severe functional limb weakness and immobility, two patients were dependent on a wheelchair before treatment, and one on a power chair for mobility.

Outcome

Shortly after the first treatment session (35), mobility was clinically significant improved and functional motor symptoms reduced. Furthermore, all the three patients were independently mobile and achieved unassisted walking (without wheelchair) within hours following a single TMS-primed physiotherapy session. These improvements were maintained at follow-up. Another notable point is that the severity of symptoms varied among the patients, yet they all improved.

6.5.4 Synthesis of observational studies

Overall, non-pharmacological interventions had generally positive effects on clinical and functional outcomes in patients with FMD, although these are limited by methodological variability across the included observational studies, and sample sizes were generally small. Multidisciplinary treatments, consisting of specialized physiotherapy combined with psychological treatments and psychoeducation, had the most consistent beneficial outcomes, particularly for motor symptom severity, functional mobility, and disability. Several studies found long-term benefits for functional independence, gain, and participation in activities, and it may be that these types of treatment are particularly beneficial for patients with the complex range of motor and psychosocial symptoms of FMD. In contrast, psychological treatments delivered as monotherapy had variable outcomes for motor symptoms but were found to have consistent benefits for psychological distress, mood, and quality of life, which highlights their potential role in addressing the emotional and cognitive components of the disorder. Newer methods, such as transcranial magnetic stimulation-primed physiotherapy, have been found to produce rapid improvement in severe cases in motor function in a small case series, which may suggest that neuromodulation could support motor retraining processes. Overall, the observational studies suggest a potential for improvement in patient outcomes with non-pharmacological therapies in FMD, particularly with a multidisciplinary approach, but more well-controlled studies are needed to confirm these results and to identify optimal treatment strategies.

7. DISCUSSION

7.1 Interpretation of results

This systematic review of 13 studies, including two high-quality RCTs (total N = 287) and 11 observational reports (N = 244), indicates that nonpharmacological interventions are moderately effective in the treatment of FMD, primarily physiotherapy-based approaches, often combined with psychological elements, especially in improving patient-reported motor symptoms and physical function. Specialist physiotherapy, specifically designed to address the full clinical presentation of functional movement disorder, leads to greater perceived improvement in motor symptoms and better physical functioning compared to control conditions, either delivered alone or integrated within multidisciplinary treatment (e.g. with CBT), as the two included RCTs are demonstrating (65,66).

The two included RCTs provide the strongest evidence in this review. Macías-García et al. (2024) (65) demonstrated that a multidisciplinary approach, combining specialized physiotherapy with Cognitive Behavioural Therapy (CBT), led to a clinically meaningful reduction in motor severity. Specifically, over 50% of participants showed improvement on the sFMDRS at five months. Additionally, significant improvements were noted in Clinical Global Impression scores (CGI-S and CGI-I) and physical quality-of-life domains, such as reduced bodily pain (SF-36). Over half of participants are rated as improved versus a minimal change that was seen in the control group, that received nondirected psychological support. These gains lead to the assumption that the combination of motor retraining with targeted psychological therapy addresses both the habitual abnormal movements and maladaptive beliefs that perpetuate symptoms, aligning with the biopsychosocial model mentioned earlier (8,17). The early gains in physical functioning, which partially reversed by 5 months, including the SF-36 physical subdomain at 3 months, may represent the initial rapid motor skill gains with physiotherapy, while the continued improvements in pain and perceived health show that patients adapted on a longer term their illness beliefs towards their disorder and learned how to perform self-management (65).

The larger RCT study by Nielsen et al. (2024) (66) also supports the effectiveness of specialist physiotherapy, whereby participant-rated global improvement (PGI-I/CGI-I) was significantly higher at 6 and 12 months (≈59% improved compared to ≈38% in TAU) as well as improvements in physical role limitations, social functioning, illness coherence/personal control, reduction of fatigue, and short-term reduction of anxiety have been found. The maintenance of motor-perceived benefits up to 12 months is a promising finding (66) and supports the idea that, once patients experience

normal movement through distraction and retraining strategies, confidence and motor skills can be improved (10), even though some secondary psychological improvement effects, such as anxiety, may not be as sustained, possibly because the motor mechanisms are more directly addressed with physiotherapy than by usual care, and the management of psychological comorbidities possibly requires longer-term treatments.

The observational studies, although providing valuable insights, are also limited, especially due to their heterogenous nature, small sample sizes and risk of bias. Multidisciplinary approaches (34,39,67–69,71,72) N= 96 across seven studies) frequently achieved reductions in motor severity (e.g. PMDRS/sFMDRS, CGI), disability (WSAS, FIM) and functional mobility, with one study demonstrating long-term maintenance (69) (up to 36 months, though relapse was seen in around ≈14%). This supports the importance of an integrated, multidisciplinary care model that manages the whole range of motor symptoms, but also the comorbid factors that play into FMDs clinical picture, such as pain, fatigue and psychological factors (7). Purely psychological interventions (30,32,70) (such as CBT, hypnosis/catalepsy, compassion-focused therapy; N = 145) had varying effects on motor outcomes but significant benefits on mood (anxiety/depression), distress, social functioning and acceptance of diagnosis, which suggests they have an important adjunctive role, particularly if emotional regulation or self-compassion is an issue preventing regaining normal movement patterns (7,25). The remarkable and rapid improvements in mobility seen in the TMS-primed physiotherapy case series (35) show promising new treatment modalities for FMD, but larger studies are needed to draw a conclusion.

The population pooled in this systematic literature review (≈ 75% female, mean age ≈ 43-45 years, mixed phenotypes) mirrors the epidemiology of FMD (3,9) and the treatments applied (mostly outpatient with different durations and intensities) were well-tolerated. A recent umbrella review of systematic reviews and meta-analyses for FND treatment found that CBT showed consistent benefit, especially if it was integrated into a multidisciplinary framework, while physiotherapy-based interventions showed the strongest evidence with respect to primary motor outcomes (36). It seems to be so effective as it directly addresses critical underlying processes such as increased self-attention, diminished sense of agency, and limbic-motor dysregulation (7,36). Physiotherapy tends to show more rapid and clinically significant outcomes than psychological interventions alone by employing strategies such as education, redirection of self-attention, graded motor retraining, and feedback (8,24). Also, Kola and LaFaver (2022) noted that the available treatments comprise physiotherapy, CBT, and multidisciplinary rehabilitation, and highlighted that it is important to focus on the benefits of specialized physiotherapy (12). The inclusion of psychological interventions may help to reinforce recovery by targeting ongoing contributing factors such as

diminished sense of control and anxiety, or depression (17), which might explain the overall benefits reported for outcome domains with combined interventions versus physiotherapy alone.

The review was based on the hypothesis that multidisciplinary treatment may be particularly beneficial in FMD, but the results of the review can only partially confirm this assumption. It seems that, apart from the positive outcomes of a multidisciplinary treatment (2,65), which affects all domains of FMD, a specialized physiotherapy treatment alone can have a significant and long-lasting effect on motor domains, which may indicate that it is the core of a multidisciplinary treatment (66).

7.2 Limitations and future research

However, the evidence base and strength of conclusions is restricted by several factors: the small number of RCTs and the variability and predominance of observational study approaches(74–76). Observational designs often lack control groups (77) and are heterogenous in treatment intensity and outcome measurement.

Outcome measures varied across studies (75), limiting direct comparability across the studies. The sFMDRS, a disorder-specific motor severity scale (41) was used in only one (65) of the included RCTs. Follow-up durations differed across the paper and data on long-term maintenance of outcomes after 12 months are poor (66).

Additionally, there is limited direct comparison between physiotherapy alone, psychological interventions alone and combined interventions (65), making it difficult to estimate the main treatment effects and the additive ones.

The impact of various factors on treatment response, related to patients, such as the nature of their symptoms, duration of their illness, exposure to traumas, presence of psychiatric disorders, and beliefs about their illnesses (19), is an area that needs to be further explored in literature (78).

7.3 Limitations of the review process

This review only included studies published in English. It is possible that relevant studies published in other languages may have been missed, which may cause language bias, and the results may not be representative globally. Furthermore, the search was limited to studies that were published in the last five years to ensure that it reflects that latest evidence base. The focus of the extracted data was mainly on the motor outcomes and functional measures. While some of the studies have documented psychological comorbidities, trauma history, and other underlying vulnerability factors, these have not been analyzed and synthesized in this review. This may limit the interpretability of

the different treatment responses, since the psychiatric comorbidity, trauma, and illness beliefs have an impact on treatment outcomes.

7.4 Implications for practice, policy, and future research

From a clinical perspective, these findings highlight the significance of implementation of specialist physiotherapy. Applied should be a biopsychosocial approach to FMD treatment that is delivered by a trained physiotherapist who uses education, attentional redirection, graded retraining, and self-management techniques and should be considered as the first line treatment in FMD. Those with more severe presentations of FMD, especially those with psychological comorbidity e.g. anxiety or depression or trauma history, physiotherapy should be combined with psychological treatment, rather than physiotherapy alone, because if these underlying factors are left unaddressed, they might contribute to the maintenance of motor symptoms. Neurostimulation-augmented rehabilitation should be further explored, because it may deliver promising and very beneficial outcomes. Scrivener et al., 2025 (35) reported substantial and rapid improvements in motor function when physiotherapy was combined with TMS-priming. The study is limited to a small sample size, but due to the great improvements in independent walking (vs. being dependent on a wheelchair), further controlled trials should be conducted to evaluate the efficacy and safety of these interventions in more diverse patient populations.
The treatment setting should be individualized to the patient's needs. For example, for patients with milder presentations of FMD, outpatient treatment may be appropriate and sufficient, whereas patients with a greater disability may benefit more from an intensive-inpatient treatment. From a policy perspective, these findings support the development of specialized FMD services that integrate neurology, physiotherapy, and psychological care. Further research should focus on designing larger RCTs that apply standardized outcome measures, longer follow-up periods (>12 months) and incorporate direct comparisons between interventions like physiotherapy, psychological therapy (e.g. cognitive behavioural therapy), and combined interventions. Furthermore, a consensus-based core outcome measure should be adopted to improve comparability across studies.

7.5 Conclusion

In conclusion, this systematic literature review shows that non-pharmacological treatments can be helpful for people with Functional Movement Disorder, especially physiotherapy-based approaches. Across the included studies, patients generally showed improvements in motor symptoms, physical functioning, and overall quality of life (34,65,66,75). This supports the idea, that physiotherapy

should play a central role in treatment, as it directly targets the abnormal movement patterns and attention processes that are thought to drive the disorder (8,24).

Multidisciplinary approaches, which combine physiotherapy with psychological therapies such as cognitive behavioural therapy, appear to offer additional benefits. These approaches not only address motor symptoms but also help with emotional and psychological difficulties that are often present in functional movement disorder (34,65). While the results of this review only partly confirm the hypothesis that multidisciplinary treatment is superior to single therapies, they suggest that combining different treatment components may be particularly useful for patients with more complex symptoms or additional psychological challenges (2,40).

Psychological therapies on their own showed less consistent effects on motor symptoms, but they were clearly beneficial for improving mood, reducing distress, and helping patients better understand and cope with their condition (30,32,70). This highlights their important role as part of a broader treatment plan, even if they are not always sufficient alone to improve movement symptoms (25,26).

However, the overall strength of the evidence is still limited. There are only a small number of high-quality randomized controlled trials (65,66), and many studies included in this review were small and used different treatment approaches and outcome measures (67,68). This makes it difficult to directly compare results and to draw strong conclusions about the best treatment strategy. In addition, most studies only followed patients for a short period of time, so the long-term effects of these treatments are still unclear (32,34,72).

From a clinical perspective, these findings suggest that specialist physiotherapy should be considered a first-line treatment for functional movement disorder (8,12,24), with therapy tailored to each patient´s specific symptoms and needs. For patients with more severe or complex presentations, combining physiotherapy with psychological treatment may lead to better overall outcomes (65).

Future research should focus on larger and better-designed studies, especially randomized controlled trials with longer follow-up periods. It will be also important to use more consistent outcome measures and to better understand which patients benefit most from which specific type of treatment. This would help to develop clearer and more standardized treatment guidelines for functional movement disorder in the future.

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9. ANNEXES

Annex 9.1: Search String

Objective
The search aimed to identify studies on functional movement disorder and related interventions, involving physiotherapy and psychotherapy and their characteristics, therapy outcome and patient outcomes..
Both Medical Subject Headings (MeSH) and free-text keywords were used to capture all relevant studies.

Key concepts and search terms:

- **Functional movement disorder**
  MeSH: "conversion disorder"[MeSH Terms]
  ***Keywords*:**"functional movement disorder", "functional neurological disorder", "functional neurological symptom disorder", "psychogenic movement disorder", "conversion disorder", "conversion disorder with motor symptoms"
- **Interventions:**
  Physiotherapy
  MeSH: "physical therapy modalities" [MeSH Terms], "rehabilitation"[MeSH terms], "exercise therapy"[MeSH terms]
  Keywords: "physiotherapy", "physical therapy", "physical therapy modalities", "rehabilitation", "exercise therapy", "movement retraining", "motor retraining", "postural training", "gait training", "therapeutic exercise"
  Psychotherapy
  MeSH: "psychotherapy" [MeSH terms]
  Keywords: "psychotherapy", "cognitive behavioral therapy", "CBT", "behavioral therapy", "psychological treatment", "mindfulness", "CBT", "behavior therapy", "psychological treatment", "mindfulness-based therapy", "acceptance and commitment therapy", "ACT", "talk therapy", "manualised treatment", "manualized treatment",
- **Outcomes**:
  MeSH: "treatment outcome"[MeSH terms], "qualitative research"[MeSH terms]
  Keywords: "patient experience", "treatment characteristics", "intervention components", "therapy components", "therapy structure", "treatment protocol", "intervention design", "treatment approach", treatment outcome", "clinical outcome", "therapeutic outcome", "qualitative research", patient-reported outcomes", "effectiveness", "efficacy", symptom improvement, "functional improvement", "rehabilitation protocol"

Boolean Operators AND and OR were used to combine search terms within and across concepts.

Search Strategy

MeSH & Keywords for Search in PubMed

Table 9.1.1. Search String 1

Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**
("functional movement disorder"[All Fields] **OR** “conversion disorder”[MeSH Terms] **OR** "functional neurological disorder"[All Fields] **OR** "psychogenic movement disorder"[All Fields])		("motor"[Title/Abstract] **OR** "motor symptoms"[Title/Abstract] **OR** "motor dysfunction"[Title/Abstract] **OR** "movement disorder"[Title/Abstract] **OR** "gait disorder"[Title/Abstract] **OR** "abnormal movement"[Title/Abstract] **OR** "tremor"[Title/Abstract] **OR** "dystonia"[Title/Abstract] **OR** "weakness"[Title/Abstract] **OR** "paresis"[Title/Abstract])		"physical therapy modalities"[MeSH Terms] **OR** "rehabilitation"[MeSH Terms] **OR** "exercise therapy"[MeSH Terms] **OR** "movement retraining"[All Fields] **OR** "physical therapy"[All Fields])		("treatment outcome"[MeSH Terms] **OR** "effectiveness"[All Fields] **OR** "qualitative research"[MeSH Terms] **OR** "patient experience"[All Fields] **OR** "intervention components"[All Fields] **OR** "treatment characteristics"[All Fields])

Search string 1: Search conducted in PubMed: 8th of august 2025

- Aims to: investigate the characteristics of **physiotherapy** and **outcome/patient experience** in functional movement disorder
- Results retrieved: **12** (2020-2025)
- Filters applied: 2020-2025
- All Results: 27 (no filter) – 12 (2020-2025)
- Search string 1 uses broader vocabulary, like “All Fields” and broad MeSH. This is so the review won’t miss studies where physio is a secondary or implicit component. It maximises sensitivity for physiotherapy/rehab interventions in Functional movement disorder.

Table 9.1.2. Search string 2

Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**
"functional movement disorder"[Title/Abstract] **OR** "functional neurological disorder"[Title/Abstract] **OR** "psychogenic movement disorder"[Title/Abstract] **OR** "conversion disorder"[MeSH Terms] **OR** "conversion disorder"[Title/Abstract])		("motor"[Title/Abstract] **OR** "motor symptoms"[Title/Abstract] **OR** "motor dysfunction"[Title/Abstract] **OR** "movement disorder"[Title/Abstract] **OR** "gait disorder"[Title/Abstract] **OR** "abnormal movement"[Title/Abstract] **OR** "tremor"[Title/Abstract] **OR** "dystonia"[Title/Abstract] **OR** "weakness"[Title/Abstract] **OR** "paresis"[Title/Abstract])		("psychotherapy"[MeSH Terms] **OR** "psychotherapy"[Title/Abstract] **OR** "cognitive behavioral therapy"[Title/Abstract] **OR** "CBT"[Title/Abstract] **OR** "behavior therapy"[Title/Abstract] **OR** "psychological treatment"[Title/Abstract] **OR** "mindfulness"[Title/Abstract])		("treatment outcome"[MeSH Terms] **OR** "patient experience"[Title/Abstract] **OR** "treatment characteristics"[Title/Abstract] **OR** "intervention components"[Title/Abstract] **OR** "therapy components"[Title/Abstract] **OR** "manualised treatment"[Title/Abstract] **OR** "therapy structure"[Title/Abstract] **OR** "treatment protocol"[Title/Abstract] **OR** "intervention design"[Title/Abstract] **OR** "treatment approach"[Title/Abstract] **OR** "qualitative research"[MeSH Terms])

Search string 2: Search conducted in PubMed: 8th of august 2025

- Aims to: investigate the characteristics of **psychotherapy** and **outcome/patient experience** in functional movement disorder
- Filters applied: 2020-2025
- Results retrieved: **9** (2020-2025)
- All Results: 28 (no filter)– 9 (2020-2025)
- Search string 2 is focused on psychological therapy terms and is mostly restricted to Title/Abstract to focus specifically on psychological therapies.

Keywords for Search in Scopus

Table 9.1.3 Search string 3

Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**
TITLE-ABS-KEY(("functional movement disorder" **OR** "functional neurological disorder" **OR** "psychogenic movement disorder" **OR** "conversion disorder with motor symptoms" **OR** "functional neurological symptom disorder")		"motor" **OR** "motor symptoms" **OR** "motor dysfunction" **OR** "movement disorder" **OR** "gait disorder" **OR** "abnormal movement" **OR** "tremor" **OR** "dystonia" **OR** "weakness" **OR** "paresis")		("physiotherapy" **OR** "physical therapy" **OR** "physical therapy modalities" **OR** "rehabilitation" **OR** "exercise therapy" **OR** "movement retraining" **OR** "motor retraining" **OR** "postural training" **OR** "gait training" **OR** "therapeutic exercise")		("treatment outcome" **OR** "clinical outcome" **OR** "therapeutic outcome" **OR** "effectiveness" **OR** "efficacy" **OR** "symptom improvement" **OR** "functional improvement" **OR** "qualitative research" **OR** "patient experience" **OR** "patient-reported outcomes" **OR** "intervention components" **OR** "treatment characteristics”**OR** "therapy protocol" **OR** "rehabilitation protocol"))

Search string 3: Search conducted in Scopus on: 8th of August 2025

- Aims to: investigate the characteristics of **physiotherapy** and **outcome/patient experience** in functional movement disorder
- Filters applied: 2020-2025
- Results retrieved: **61** (2020-2025)
- All results: 87 (no filter)– 61 (2020-2025)

Table 9.1.4:Search string 4

Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**	**AND**	Terms connected by **OR**
TITLE-ABS-KEY(("functional movement disorder" **OR** "functional neurological disorder" **OR** "psychogenic movement disorder" **OR** "conversion disorder with motor symptoms" **OR** "functional neurological symptom disorder" **OR** "conversion disorder")		("motor" OR "motor symptoms" OR "motor dysfunction" **OR** "movement disorder" **OR** "gait disorder" **OR** "abnormal movement" **OR** "tremor" **OR** "dystonia" **OR** "weakness" **OR** "paresis")		("psychotherapy" **OR** "cognitive behavioral therapy" **OR** "CBT" OR "behavior therapy" **OR** "psychological treatment" **OR** "mindfulness" **OR** "mindfulness-based therapy" **OR** "acceptance and commitment therapy" **OR** "ACT" **OR** "talk therapy")		("treatment outcome" **OR** "clinical outcome" **OR** "therapeutic outcome" **OR** "patient experience" **OR** "treatment characteristics" **OR** "intervention components" **OR** "therapy components" **OR** "manualised treatment" **OR** "manualized treatment" **OR** "therapy structure" **OR** "treatment protocol" **OR** "intervention design" **OR** "treatment approach" **OR** "qualitative research" **OR** "patient-reported outcomes" **OR** "effectiveness" **OR** "efficacy"))

Search string 4: Search conducted in Scopus on: 8th of August 2025

- Aims to: investigate the characteristics of **psychotherapy** and **outcome/patient experience** in functional movement disorder

- Filters applied: 2020-2025
- Results retrieved: **58** (2020-2025)
- All results: 113 (no Filter) – 58 (2020-2025)

Explanation about Search Strategy:

For each database were two search strings created, to investigate physiotherapy and psychotherapy separately from each other and to obtain more articles/papers.
The initial search strategy was developed for PubMed, which uses Medical Subject Headings (MeSH) as a controlled vocabulary to index articles. MeSH terms ensure to capture all relevant articles related to a specific concept, regardless of the exact wording used by authors. Using MeSH terms precises the search in PubMed.
The search strategy for the database Scopus was adapted, because it doesn't use MeSH but instead primarily keywords and text searches. It was adjusted to focus on searching within Title, Abstract, and Keywords fields (often referred to as TITLE-ABS-KEY in Scopus). Controlled vocabulary terms like MeSH were replaced with equivalent keywords and synonyms to maintain the sensitivity and specifity of the search.
Boolean operator (AND, OR) were applied in both databases to combine concepts and ensure a systematic approach.

ANNEX 9.2: List of all outcome measures that have been extracted from the included studies

Patient-reported outcomes (PROMS):

- Quality of life (QoL): e.g. 36-Item Short Form Survey (SF-36), EuroQol 5-Dimension 5-Level questionnaire (EQ-5D-5L), EuroQol Visual Analogue Scale (EQ-VAS), World Health Organization Quality of Life (WHOQOL-BREF);
- Perceived change*:* e.g. Patient Global Impression of Change (PGI-I), Patient Global Impression of Severity (PGI-S);
- Functional status: e.g. Patient Specific Functional Scale (PSFS), Work and Social Adjustment Scale (WSAS), Functional Independence Measure (FIM);
- Occupational performance: Canadian Occupational Performance Measure (COPM);
- Psychological status/Mental health: e.g. SF-36 Mental Component Summary (SF-36 MCS), Generalized Anxiety disorder-7 scale (GAD-7), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Patient Health Questionnaire-9 (PHQ-9), Symptom Questionnaire-48 (SQ-48), Self-Compassion Scale (SCS), Psychological Outcome Profiles (PSYCHLOPS), Hospital Anxiety and Depression Scale (HADS), Clinical Outcomes in Routine Evaluation (CORE-OM); Confidence in the diagnosis; Revised Illness Perception Questionnaire (IPQ-R)

Clinician-rated outcomes (CROMs):

- Motor symptom severity: e.g. Simplified Functional Movement Disorders Rating Scale (sFMDRS), Psychogenic Movement Disorder Rating Scale (PMDRS), Clinical Global Impression-Severity (CGI-S);
- Functional mobility: e.g. Oxford Muscle Test, Berg Balance Scale (BBS), Time Up and Go (TUG), 30-Second Sit-to-Stand (30sSTS), Six Minute Walk Test (6MWT), 30 Second Arm Curl Test, Box and Block test, Functional Movement Screen (FMS), 10 Metre Walk Test (10MWT);
- Functional status: Functional Independence Measure (FIM);
- Comorbidity: Health of the Nation Outcome Scales for Acquired Brain Injury (HoNOS-ABI) measure comorbid symptoms such as mental health;
- any quantitative or qualitative findings on perceived effectiveness, acceptance, or change)

Caregiver outcomes: Zarit Caregiver Burden Interview (ZBI)

ANNEX 9.3

Table 9.3: originally reported primary & secondary outcomes (as in original papers)

(table continues until p.72)

Author/year	Outcome measure	Primary outcome	Secondary outcome
Hsieh & Deshpande (2020) (71)	10-MWT, Oxford muscle test, CGI, PGI, BAI, BDI, WSAS	10-MWT, Oxford muscle test, CGI	PGI, BAI, BDI, WSAS
Joos & Halmer (2020) (72)	None, but observational		
Macias-Garcia et al. (2024) (65)	SF-36 PCS, SF-36 MCS, EQ VAS, EQ Index, EQ-5D-5L system, sFMDRS, CGI-S	SF-36 PCS, SF-36 MCS, EQ VAS, EQ Index, EQ-5D-5L system	sFMDRS, CGI-S, Zarit Caregiver Burden Interview(ZBI)
Zarotti & Poz (2022) (32)	PSYCHLOPS, SCS, HADS-A, HADS-D	Not specified	Not specified
Reid et al. (2022) (67)	Six minute walk test, PSFS, COMP, BBS, TUG, 30-Second-Sit-To-Stand, 30 Second Arm Curl Test, Box and Block Test	Not specified	Not specified
Tibben et al. (2023) (30)	PMDRS, SQ-48, WHOQol-BREF	PMDRS	SQ-48, WHOQol, WHOQoL-BREF
Schmidt et al. (2021)(68)	PMDRS, S-FMDRS, CGI-S, PGI-S	PMDRS, S-FMDRS, CGI-S	PGI-S
Schneider et al. (2024) (69)	FIM scale for motor part, Professional activity status	FIM scale	Professional activity status
Nielsen et al. (2025) (74)	SF-36, CGI-I, HADS-A, HADS-D, EQ-5D-5L, FMS	SF-36 physical functioning (PF)	SF-36 (mental health, role-physical, bodily pain, general health, vitality, social functioning, role emotional),CGI-I, FMS, HADS-A, HADS-D, EQ-5D-5L, IPQ-R, Confidence in the diagosis
O´Connel et al. (2020) (70)	CORE-OM, PHQ-9, HoNOS-ABI, 3-point scale (for measuring patient improvement)	Not specified	Not specified

Author/year	Outcome measure	Primary outcome	Secondary outcome
Gros et al. (2024) (39)	Only observational	Only observational	
Scrivener et al. (2025) (35)	Only observational	Only observational	
Palmer et al. (2023) (34)	SF-36, WSAS, Likert scale (agreement with the diagnosis of FND; self-rated understanding of FND), ability to participate in full-time or part-time employment, PGI-C	SF-36	WSAS, PGI-C, Likert scale, participation in employment

ANNEX 9.4

Table 9.4: Full description and scoring/range of measures (*continued until p. 77)*

Outcome domain	Measure/ Tool	Brief description	Scoring/range (direction)	Notes (e.g. subscales)
Motor symptom severity	sFMDRS(41)	Scale for FMD symptoms (severity, duration, incapacitation)	0-54 (higher scores = higher motor severity of FMD)	
Motor symptom severity	PMDRS(42)	Scale assessing 10 phenomena (e.g. tremor, dystonia, chorea) in psychogenic movement disorders, 2 functions (gait and speech) across 14 body regions (severity of FMD)	Varies by item; 0-144 (clinical range, higher score = maximum overall severity, duration, and incapacitation seen across all phenomena and functions/sum of all subscores)	Original scale; sFMDRS is a simplified version
Perceived severity	CGI-S (43)	Assesses patients current illness severity relative to clinicians experience with similar patients	1-7 (higher=worse severity)	Often used for baseline severity in FND/FMD studies
Perceived change	CGI-I (44)	Clinician-rated global impression of change/improvement from baseline	1 (very much improved) to 7 (very much worse)	Often paired with CGI-S; lower=better
Perceived severity	PGI-S(44)	Patient-rated current severity of condition	1-4/7 (higher = worse severity)	
Perceived change	PGI-I(44)/ participant-rated CGI-I	Patient-rated global impression of improvement from baseline	1 (very much better) to 7 (very much worse)	
Psychological status	PSYCHLOPS (45)	Captures individualized main psychological problem, functioning,	Problem-, Functioning-, and Well-being score 0-5 (higher = worse)	

Outcome domain	Measure/ Tool	Brief description	Scoring/range (direction)	Notes (e.g. subscales)
		well-being		
Psychological status	SQ-48(46)	48-item multidimensional questionnaire covering depression, anxiety, somatization, etc., plus vitality and work	Subscale totals vary (higher = greater symptoms/distress; total score 0-148 (higher=greater symptoms/distress)	9 subscales
Quality of life	SF-36(47)	36-item self-report assessing 8 health domains + physical/mental summary scores	0-100 per domain/summary (higher = better)	subdomains: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), mental health (MH)
Quality of life	EQ-5D-5L (incl. EQ Index & EQ VAS) (48,49)	5-dimension health utility questionnaire + visual analogue scale (VAS) for overall self-rated health	EQ Index: summarizes overall severity of EQ-5D health states by generating a score. EQ Index score ≈ -0.594-1(1 = full health); EQ VAS: 0-100 (higher = better perceived health)	Dimensions: mobility, self-care, usual activities, pain/discomfort, anxiety/depression EQ VAS is subjective self-rating
Quality of life	WHOQOL-BREF (50)	26-item self-report questionnaire assessing physical, psychological, social,	0-100 per domain (higher = better QoL)	Brief version of WHOQOL-100

Outcome domain	Measure/ Tool	Brief description	Scoring/range (direction)	Notes (e.g. subscales)
		environmental subjective quality of life domains		
Functional status	WSAS(51)	5-item self-report assessing impairment in work, home management, social/private leisure, relationships	Total 0-40 (higher = greater impairment)	
Functional status	PSFS (52)	Patient-specific scale where individuals identify and rate up to 5 important activities they are unable to do or have difficulty with	Each activity 0-10 (higher = unrestricted performance)	
Functional status	FIM(53)	18-item scale of independence in self-care, sphincter control, transfers, locomotion, communication, social cognition	Total 18 (complete dependence) to 126 (complete independence)	Subscales: Motor (13 items), cognitive (5 items)
Occupational performance	COPM(54)	Interview to identify and score client-perceived performance and satisfaction in self-care, productivity and leisure	Performance: 1-10, Satisfaction: 1-10 (higher = better)	
Comorbidity/ Psychiatric symptoms	HoNOS-ABI(55)	Scale for acquired brain injury, assessing behavior, impairment, symptoms, social functioning, service needs	Total: 0-48 (higher = greater severity/need), each item: 0-4	
Psychological	GAD-7(56)	Measures	Total: 0-21	

Outcome domain	Measure/ Tool	Brief description	Scoring/range (direction)	Notes (e.g. subscales)
status		severity of generalized anxiety symptoms; assesses core symptoms of general anxiety disorder	(higher = more severe anxiety)	
Psychological status	BAI(57)	Measures severity of anxiety symptoms (somatic/physical symptoms)	Total: 0-63 (higher = more severe anxiety)	
Psychological status	BDI(58)	Measures severity of depressive symptoms	Total: 0-63 (higher = more severe depression)	
Psychological status	PHQ-19(59)	Measures severity of depressive symptoms based no DMS criteria for major depressive disorder	Total: 0-27 (higher = more severe depression)	
Psychological status	HADS(60)	Measures anxiety and depression	Anxiety/ Depression subscales: 0-21 each; Total: 0-42 (higher = more severe)	
Psychological status	CORE-OM(61)	Measures global psychological distress	Total clinical score: 0-40 (higher = greater distress)	
Functional mobility & motor performance	FMS (62)	Measures functional walking ability in everyday environments	Total: 0-21 (higher = better movement quality/function)	
Psychological status	SCS(63)	Assesses self-compassion	Total: 1-5 (higher=greater self-compassion)	
Perception of illness	IPQ-R (64)	Measures how patients perceive and understand their	Higher scores=stronger beliefs in that dimension	Dimensions: identity, timeline, consequences,

Outcome domain	Measure/ Tool	Brief description	Scoring/range (direction)	Notes (e.g. subscales)
		illness		personal control, treatment control, illness coherence, emotional representation, casual beliefs