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Evidence-Based Mind-Body Interventions for Children and Adolescents with Functional Neurological Disorder

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Learning objectives:

- Develop and implement treatment plans for children and adolescents with functional neurological disorder (FND)
- Outline a plan to increase awareness and standardize the care for patients with FND using evidence-based interventions

Abstract: Functional neurological disorder (FND) in children and adolescents involves the biological embedding of lived experience in the body and brain. This embedding culminates in stress-system activation or dysregulation and in aberrant changes in neural network function. In pediatric neurology clinics, FND represents up to one-fifth of patients. Current research shows good outcomes with prompt diagnosis and treatment using a biopsychosocial, stepped-care approach. At present, however—and worldwide—FND services are scarce, the result of long-standing stigma and ingrained belief that patients with FND do not suffer from a real ("organic") disorder and that they therefore do not require, or even deserve, treatment. Since 1994, the Mind-Body Program for children and adolescents with FND at The Children's Hospital at Westmead in Sydney, Australia—run by a consultation-liaison team—has delivered *inpatient* care to hundreds of patients with FND and *outpatient* care to hundreds of others. For less-disabled patients, the program enables community-based clinicians to implement biopsychosocial interventions locally by providing a positive diagnosis (by a neurologist or pediatrician), a biopsychosocial assessment and formulation (by clinicians from the consultation-liaison team), a physical therapy assessment, and clinical support (from the consultation-liaison team and the physiotherapist). In this Perspective we describe the elements of a biopsychosocial mind-body program intervention capable of providing, as needed, effective treatment to children and adolescents with FND. Our aim is to communicate to clinicians and institutions around the world what is needed to establish effective community treatment programs, as well as hospital inpatient and outpatient interventions, in their own health care settings.

Keywords: adolescents, biopsychosocial, children, functional neurological disorder (FND), functional seizures, mind-body, rehabilitation, stress, treatment

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Functional neurological disorder (FND) in children (including adolescents) involves the biological embedding of lived experience in the body and brain,* culminating in stress-system activation or dysregulation and in aberrant changes in neural network function.[8–12] In pediatric neurology clinics, FND is common and represents up to 23% of new patients.[13,14] Current research shows good outcomes (see Supplemental Table 1, http://links.lww.com/HRP/A208).[15–24] Full resolution of FND symptoms occurs in 63%–95% of children if diagnosis

Biological embedding of early experiences refers to the process whereby stress, the social environment, or early experience effects the body's (including brain's) biological systems. In 1998, George Chrousos raised this issue in "A Healthy Body in a Healthy Mind—and Vice Versa—the Damaging Power of 'Uncontrollable' Stress."[1] In 2009, Stephen Hyman published "How Adversity Gets Under the Skin."[2] This theme was picked up by Bruce McEwen in "Brain on Stress: How the Social Environment Gets Under the Skin"[3] and by Charles Nelson in "Biological Embedding of Early Life Adversity."[4] More recent accounts review our current knowledge about the manner in which adverse life experiences are biologically embedded.[5,6] Recent studies in FND suggest that FND also involves the biological embedding of adverse life experiences.[7–9]

and treatment are promptly delivered using a multidisciplinary, biopsychosocial, stepped-care approach.[25] Despite this need, pediatric FND services are scarce worldwide.[25] Across countries and health care settings, there are marked differences in patient populations, designated funding, recognition of clinical need, clinician experience, clinician beliefs, and culture of care.[26] These factors, together with the structure and delivery of health care services, work against the effective implementation of evidence-based interventions in "real-world" clinical settings.

Since 1994, the Mind-Body Program for children with FND at The Children's Hospital at Westmead in Sydney, Australia, has delivered inpatient care to hundreds of patients with FND (see Supplemental Text Box 1, http://links.lww.com/HRP/A209, The Historical Origins of the Mind-Body Program and Family Systems Underpinnings[27–31]). In collaboration with community-based clinicians, the program has also put together hundreds of individualized treatment programs for implementation in children's local settings. The Mind-Body Program has been run by one of the hospital's two consultation-liaison teams, which—to emphasize its focus on problems at the intersection of "mind and body" and "psychiatry and neurology"—is commonly referred to as the *mind-body team*.

It has been a full decade since we published a description and analysis of our program's structure, goals, and methods.[18,32] That original analysis focused on the inpatient setting and included our first retrospective clinical cohort outcome study.[†] Given both the scientific and clinical advances of recent years, the time is ripe for an update. In this Perspective we share the clinical experience of our mind-body team—spanning almost 30 years—of treating children who have presented to our tertiary-care hospital with FND. We describe the therapeutic elements that a biopsychosocial, mind-body intervention brings together. This therapeutic process enables the clinician (or multidisciplinary team) to personalize the intervention for each child and family. Our hope is that the information provided in this article will enable clinicians from around the world, whether working in the community or in outpatient or inpatient hospital settings, to establish their own programs for children with FND.

In the sections that follow we outline the seven steps—the therapeutic process—needed to ensure successful treatment interventions:

1. Prompt diagnosis: the medical/neurological assessment and provision of a positive diagnosis of FND
2. Triaging the referral for a holistic (biopsychosocial) assessment
3. A holistic (biopsychosocial) assessment with the child and family
4. Co-constructing a mind-body formulation with the child and family (this collaborative process identifies the factors that contribute to and maintain the child's symptoms)
5. Using the formulation to guide the process of assembling a personalized treatment intervention (the treatment plan)
6. Implementing the intervention
7. Building resilience and preventing relapse

Throughout the article we highlight that the way in which clinicians communicate with the child and family has a powerful impact on the healing process.[35–37]

Text Box 1
Common Positive (Rule-In) Neurological Signs Found on Physical Examination in Children with Functional Motor and Sensory Symptoms[a]

Neurological symptom	Neurological sign that the neurologist may use to support a diagnosis of FND
Across symptoms	Symptoms are more marked when the child attends to them and less marked when the child's attention is directed elsewhere Symptoms are variable across contexts (e.g., a child presenting with visual loss can use her mobile phone but cannot see the text that she needs to read in the classroom; a child's gait difficulty is present when she walks forward but not when she turns around; tremor in a limb is less when the child is distracted by the neurologist)
Gait difficulty	A swaying gait or apparent loss of balance with a narrow-base gait Each foot is lifted off the ground as if requiring great effort and put back down as if requiring great effort The child walks with bent knees (which requires more strength than normal walking)
Weakness (generalized or partial)	Discordance between strength or functional ability of the child's affected body part on formal examination and during routine tasks (e.g., moving around on the hospital bed) Limb weakness not conforming to an anatomical distribution (e.g., arm and leg weakness on opposite sides of the body)
Tremor	Variable distribution or frequency of the child's tremor when examined at different times The child's tremor changes with contralateral body movements (entrainment)
Sensory symptoms (pain excluded)	Sensory symptoms not conforming to a dermatomal distribution Hemisensory loss with a sharp midline distribution
Visual loss	Tunnel vision Preserved response to a "menace reflex" (the rapid approach of an object)

[a] For a more comprehensive list of rule-in signs in children and adolescents, see Kozlowska and Mohammad (2022).[38]

[†]For the three subsequent prospective clinical cohort outcome studies, see Kozlowska and colleagues (2017, 2018, 2021).[17,33,34] For a review of all pediatric outcome studies—including those from our team—see Supplemental Table 1, http://links.lww.com/HRP/A208, reproduced from Vassilopoulos and colleagues (2022).[25]

Text Box 2
Examples of Explanations for FND[a]

Example 1 (suitable for FND generally)

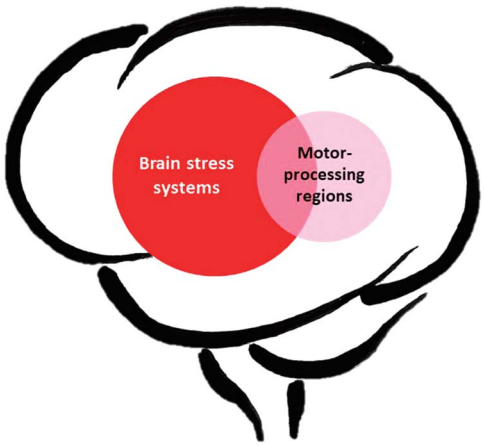
In FND the structure of the nervous system is intact, but the nervous system's function has been disrupted. Treatment involves a range of interventions—interventions that target the body and interventions that target the mind—that help the function of the nervous system return to normal.

Example 2 (pertaining to functional seizures)

Functional seizures are sudden, time-limited episodes of brain-network dysregulation that occur in the context of high arousal. Arousal—in the brain and body—refers to the level of activation. When the young person's brain and body are calm, the level of arousal is low. When the young person's brain and body activate in response to the challenges of daily living, arousal increases. In the normal course of events, arousal increases in response to a challenge—to enable the young person to meet that challenge—and then decreases (downregulates) back to baseline. But young people with functional seizures activate their systems—including brain networks—into a state of overdrive and temporary dysregulation (reproduced from the Fact Sheet in Savage et al. [2022]).[40]

Example 3 (talking over a visual metaphor for FND)

The red ball represents the *brain stress systems*. The pink ball represents *motor-processing regions*. When the brain stress systems are activated by infection, illness, injury, or emotional stress, they become overactive and over-dominant, and they disrupt motor function, causing functional motor symptoms. © Kasia Kozlowska 2017



[a] More visual metaphors are available in Kozlowska and colleagues (2020)[39] and Savage and colleagues (2022).[40]

STEP 1: THE MEDICAL/NEUROLOGICAL ASSESSMENT AND PROVISION OF A POSITIVE DIAGNOSIS

The first step in the assessment and treatment process is to conduct the medical/neurological assessment and for the pediatrician, neurologist, neuropsychiatrist, or family doctor to provide a positive diagnosis of FND. Major advances in the last decade have been to recognize that FND is a positive diagnosis (rather than a diagnosis of exclusion) and to understand that clinical interactions during the assessment process are, in themselves, a potentially valuable therapeutic intervention. In the case of children with motor or sensory symptoms, the clinical diagnosis is based on rule-in (positive) physical signs elicited during a neurological examination (see Text Box 1). When presenting a positive diagnosis to the child and family, the doctor also needs to explain the diagnosis (see Text Box 2), provide information about treatment, and, when working with children, include positive suggestions about the likelihood of a good outcome.[25,37] A number of recent publications describe the use of positive rule-in signs for diagnosis and for explaining the diagnosis in detail to both child and adult patients.[38,41–45]

In many Western settings, the medical assessment for FND includes a blood panel and may also include imaging. Because the diagnosis is typically based on clinical examination, however, the doctor needs to prepare the child and family that the outcome of these investigations is expected to be normal. The doctor should also facilitate any necessary referrals, whether to an inpatient or outpatient program, to a clinic, or to therapists (psychotherapist or physical therapist) working in the community setting.

Functional seizures (versus FND generally) are an exception to the above because they are not usually diagnosed on clinical examination alone and because they are best assessed by neurologists who have clinical expertise in functional seizures. The diagnosis of functional seizures is typically made by a pediatric neurologist based on clinical history, witnessed descriptions, home videos, and, in the best of circumstances, a video encephalogram (vEEG) (the gold standard for establishing the diagnosis).[38,46,47] When vEEG is not available, a standard EEG with review of home video material by a pediatric neurologist is usually sufficient to diagnose functional seizures.[47,48] Neurologists pay careful attention to the semiology of the

Table 1

Clinically Useful Neurological Signs for Diagnosis of Functional Seizures

Seizure likely functional	Sensitivity	Specificity
Long duration (>2 min)	65%	93%
Eyes closed	34%–88%	74%–100%
Eyes clenched/shut tightly	33%	100%
Eyelid flutter	50%	100%
Fluctuating course	69%	96%
Side-to-side movements	25%–63%	96%–100%
Ictal crying	13%–14%	100%
Memory of seizure	63%	96%

Reproduced with permission from Stoyan Popkirov and compiled from a range of resources.[49–54] For more detail see webinar entitled "Communicating Diagnosis of Functional/Dissociative Seizures."[55]

seizures—the way the seizures present clinically—to facilitate a diagnosis of functional seizures, especially when the gold standard VEEG is not available (see Table 1). For the subgroup of children whose functional seizures present as syncopal-like events, cardiac monitoring and assessment by a pediatric cardiologist may be required.

Functional dystonia can also be challenging to diagnose because variability of symptoms, task-related changes in dystonia, and sudden onset can demonstrate features of both "organic"[‡] and functional dystonia.[56] Dystonia may require assessment by a pediatric neurologist or neurology team.

During this first step of the therapeutic process, a good clinical encounter ensures that the child and family understand "what is going on" and that they have positive expectations regarding the healing process and a positive treatment outcome.

STEP 2: TRIAGING THE REFERRAL FOR A HOLISTIC (BIOPSYCHOSOCIAL) ASSESSMENT

In Western pediatric practice the holistic (biopsychosocial) assessment is usually completed by a clinician—or clinical team—working in a psychological service. It can also be completed by the pediatrician, neurologist, or the family doctor. The challenge for this latter group of clinicians is the need to create a therapeutic space in which the assessment process is allowed to unfold free of time pressures (see next section). For clinicians working in psychological services—whose scope of practice may not include medical training—it is important to triage the referral, to ensure that the first, "medical" step of the therapeutic process has been completed:

- The medical/neurological examination and any necessary investigations have been completed, and the outcome communicated to the child and family.
- The child and family have been given a positive diagnosis of FND.
- The diagnosis has been explained to the child and family, and a general description of the treatment required has been provided.
- The referring doctor has communicated whether the child and family appear to understand and accept the diagnosis.
- If the child and family do not accept the diagnosis, the referring doctor arranges for a second, neurology opinion to help them understand and accept it. The outcome of the second opinion will be communicated to the mental health clinician (or clinical team).[§]

The important point here is that the process of medical assessment and diagnosis is outside the scope of practice of most clinicians working in psychological services, who generally do not have appropriate skills** to distinguish a functional disorder from an "organic" one and to determine a reliable, authoritative diagnosis. Without the above elements being clearly established, it is also not safe for clinicians working in psychological services to pick up the referral until and unless a functional diagnosis has been established. In the case of mixed presentations, the functional and "organic" elements should be clearly differentiated.

The following vignettes of Hazel (an amalgam case) and Kaila (pseudonym) highlight why it is so important to obtain a good medical/neurological assessment that yields a clear differentiation between symptoms that are "organic" and functional.

Clinical Vignette: Hazel

Hazel, an adolescent girl with learning difficulties and longstanding, refractory epilepsy (diagnosed in preschool) developed a new type of seizure event.

Video EEG showed that the new type of seizure was not accompanied by the signature spike-and-wave pattern of epileptic seizures, and that it reflected the new onset of functional seizures. These had been triggered in the context of puberty and the increased academic and social stress experienced at the beginning high school.

Hazel's parents and the school staff were confident that they could reliably tell the functional seizures from the epileptic seizures. Hazel's epileptic seizures presented daily and were always the same. They were characterized by loss of awareness, rhythmic jerking in the upper or lower limbs, rhythmic contraction of facial muscles, and eye deviation. Hazel's functional seizures tended to occur in the afternoon (when Hazel

[‡]We have retained the term *organic* in this context because of its common usage by current physicians. We put the term in quotation marks, however, to communicate that the dualistic division of functional versus organic is an artificial one; all disorders, whether functional or organic, are underpinned by changes in the body (including the brain).

[§]In cases where the family's acceptance of the diagnosis following the second opinion is tentative or on the fence, our mind-body team would still offer a biopsychosocial assessment. We do this because the majority of children and families accept the diagnosis following the biopsychosocial assessment process (steps 3, 4, and 5) with our team.

**Depending on their training, psychiatrists will vary in their confidence with regard to performing the neurological examination that elicits the positive neurological signs needed for the diagnosis of FND.

was tired) or when something made her upset or angry. They began with a period of fast, shallow breathing (hyperventilation), followed by a change in Hazel' speech pattern (regressed or angry vocalizations), increased tension in Hazel's limbs, and gait disturbance (stiff walking). Hazel reported that she could feel the warning signs of an imminent functional seizure: a felt sensation of her body activating or, in Hazel's words, "feeling hyper."

The management of the epileptic seizures involved medications for epilepsy. The management of the functional seizures involved implementation of calming strategies from the moment that Hazel noticed the warning signs of a functional seizure. The strategies that worked for her were slow breathing, rhythmic squeezing of a stress ball, and visualization exercises.

Clinical Vignette: Kaila

Kaila, a 13-year-old adolescent girl with autism spectrum disorder (level 2) and long-standing anxiety presented to her local hospital with left knee pain and reduced mobility. After multiple investigations, including pelvic x-ray, pelvic ultrasound, and MRI of the hip and lumbar spine, she was incorrectly diagnosed with FND and complex pain, and referred to a physical therapist and psychologist in the community.

One month later Kaila presented to the tertiary care hospital with a one-week history of headache, weakness in the left arm and left leg, and altered sensation in the left arm. An MRI of the brain under the neurology team showed a Chiari I malformation, which precluded a lumber puncture. Nerve conduction studies showed asymmetrical proximal neuropathy of the upper limbs (left > right) and lower limbs (left tibial nerve being most affected). Kaila was treated with methylprednisolone and intravenous immune globulin (IVIG), with no improvement in the neuropathy. Gabapentin was commenced for neuropathic pain.

During the admission Kaila developed urinary retention requiring an indwelling catheter. She found manipulation of the catheter—including attempts to learn self-catheterization—extremely aversive. On each occasion she experienced panic attacks (indexed by high heart rate and high respiratory rate). With time, the panic attacks morphed into functional seizures (periods of unresponsiveness or limb jerking without associated epileptiform activity on the EEG). She also developed difficulty walking, with a bucking gait that was inconsistent with the neuropathy.

Kaila was referred to the mind-body team with a request for a rehabilitation (mind-body) admission. As part of the triage process, the team clarified with the neurology team which symptoms were "organic" (due to the neuropathy) and which symptoms were functional. When goals for the admission were being set with Kaila and her family, the mind-body team was explicit that the mind-body intervention could help Kaila with the functional symptoms (the abnormal gait and the functional seizures) but not with the symptoms that were caused by the neuropathy (weakness in her arms and legs and the urine retention).

After a two-week mind-body intervention, Kaila's gait had returned to normal. She had also begun a treatment intervention for the functional seizures.[40] In the months that followed, she worked on de-arousal strategies (see Text Box 3), which she implemented when she noticed the early warning signs of her functional seizures. She used olanzapine in advance of catheter changes and self-catheterization practice sessions. After 12 months, the functional seizures settled. By contrast, the "organic" symptoms related to the neuropathy continued over time. And in an unfortunate turn of events, Kaila also developed neuropathy-related bowel issues and required regular bowel washouts.

Text Box 3
Examples of Some Commonly Used Calming (De-arousal) Strategies[a]

Bottom-up (body) regulation strategies
- Slow-breathing interventions (with or without biofeedback guidance)
- Humming (e.g., humming a favorite tune) or use of the voo sound
- Grounding interventions (e.g., a focus on the felt sense of the ground)
- Bottom-up mindfulness (e.g., focusing on a calm part of the body, on the breath (if slow and calming), or on the felt sense relating to a repetitive calming movement (e.g., tensing and relaxing the thighs, passing a ball from hand to hand, gentle rocking)
- Progressive muscle relaxation
- Sensory strategies (e.g., weighted blankets or toys, slime, fidget toys)
- Repetitive activities (e.g., swinging on a swing, jumping on a trampoline, bouncing a ball)

Top-down (cognitive) regulation strategies
- Changing focus-of-attention away from the symptoms onto something else (also known as distraction)
- Visualization exercises (e.g., visualizing the self in a safe place that is calming)
- Guided imagery
- Positive self-talk (e.g., I can do this, this will pass)
- Hypnosis
- Top-down mindfulness (e.g., observing thoughts coming and going like leaves on a stream or clouds in the sky; practicing noticing thoughts without judgment; formal meditation)

[a] For more detail about bottom-up and top-down regulation strategies, see Kozlowska and colleagues (2020),[39] Savage and colleagues (2022),[40] and Ogden and Fisher (2015).[57]

STEP 3: CLINICAL (BIOPSYCHOSOCIAL) ASSESSMENT WITH THE CHILD AND FAMILY

The clinical assessment with the child and family, which is undertaken after diagnosis and triage (steps 1 and 2) have been completed, is a comprehensive biopsychosocial assessment. The key goals for the clinician(s) during the assessment are the following:

– To form a therapeutic relationship with the child and family
– To obtain a comprehensive developmental history (what our team calls the *family story*), enabling the symptoms to be conceptualized in context
– To co-construct a formulation (an explanation of what has occurred to trigger the illness process)
– To use the formulation to plan the treatment process.

In our own clinical practice we conduct the biopsychosocial assessment (step 3) and co-construct the formulation (step 4) in a single, long (1–2 hour) meeting with the child and family.[39,40] This meeting is followed as soon as feasible by an individual assessment with the child. Further information is obtained from the school. All of this information is integrated into an ever-evolving formulation. The advantage of this initial, intensive family assessment is that treatment planning and the implementation of the treatment intervention are undertaken in an expeditious manner.

Other clinicians undertake the biopsychosocial assessment over a number of sessions.[58,59] In this scenario, the length of the assessment with the child and family can be varied to meet both clinical need (what the family can manage) and the available clinical resources (e.g., hospital or community) in which the assessment takes place. Variations include one long session over a day (3–6 hours); 3–4 shorter sessions over 3–4 days (3–6 hours); and multiple sessions with the family, parents, and child over a week (including assessments of psychological, cognitive, and physical function (8–10 hours) (Helene Helgeland, personal communication). The advantage of the long initial assessment is that the resulting formulation is more detailed and complete, and requires less updating over time. The disadvantage is that the implementation of treatment is delayed.

Because clinical examples of the biopsychosocial assessment are available in case studies published by our team[60–64] and have been described in detail elsewhere,[39,40,58,59,65] here we summarize the key pieces of information to be generated by the initial assessment:

– *A three-generation genogram*, or *family tree*, that helps the clinician obtain a gestalt view of the pattern of family relationships (e.g., marriages, separations, relational breakdowns). This genogram should also include information about medical conditions (always asked about before any questions about mental health issues, to communicate that the clinician is interested in the body) and mental health histories and concerns.
– *The child's developmental history, starting at conception*. This aspect of the family story helps the clinician, child, and family to understand both the *temporal order* of the key events, positive and negative, that shaped the child's development and the *context* in which the symptoms emerged.
– *The child's response to key events in the family story*. The clinician uses the information from the genogram to probe how the child managed key events in the family story. The clinician also inquires how the child's body responded to any challenging events. Did sleep become disturbed? Did the child show any other physical symptoms of stress, such as disrupted eating, headaches, tummy pains? Did the child show any behavioral symptoms of stress, such as tearfulness, emotional withdrawal, not wanting to go to school?
– *Levels of stress and anxiety, and changes in mood, over time*. The clinician may use simple Likert scales to get a sense of the levels of family stress or any changes in the child's anxiety or mood over time (see Figures 1 and 2). The clinician also tracks the emergence of functional symptoms over time and the context in which the symptoms emerged.

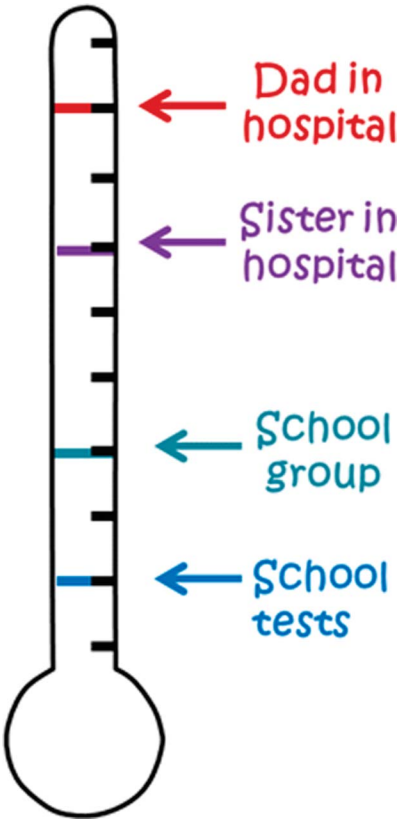


Figure 1. Family thermometer tool used to gauge the level of stress (the family temperature) in the family system. © Kasia Kozlowska 2019

The following vignette of Freya (an amalgam case) provides an example of a family story told by the child and family.

Clinical Vignette: Freya

Freya was a 13-year-old girl presenting with functional leg weakness, difficulties with balance, and dizziness. Freya lived with her mother, father, and 6-year-old brother. Freya was a high-achieving student who was placed in a gifted class.

The family genogram revealed a harmonious family with a history of thyroid problems and anxiety in women on the maternal side (grandmother and great-grandmother) and of hypertension and related cardiac issues (grandfather) and depression on the paternal side (paternal uncle and grandmother).

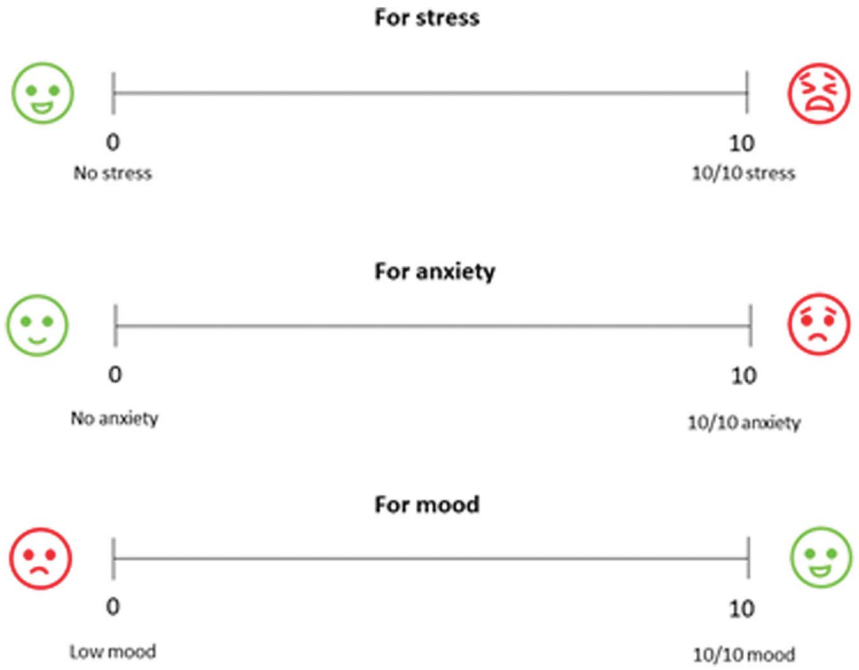


Figure 2. Likert scales used to gauge changes in the child's anxiety, mood, and felt sense of stress over time (e.g., in different years of school). © Kasia Kozlowska 2022

Freya's early developmental history—in utero, delivery, developmental milestones in the first five years—were all unremarkable. She had experienced quite significant separation anxiety on starting preschool, but this had eventually settled.

In third grade, Freya began to experience conflict within her peer group, which resulted in anxiety expressed as daily worries and in somatic symptoms, a mark of stress-system activation. Her pet rabbit also died during this year. Freya recalled that during this difficult time, she would wake up with nausea, sometimes accompanied by a sensation that she might vomit, that persisted throughout the day. She was taken to a gastroenterologist, who found no cause for the nausea.

In fifth grade, Freya completed exams for selection to an elite academic high school. Her parents reported that they noticed that Freya became more withdrawn at home. In sixth grade, Freya was elected as school captain. She reported feeling a burden of responsibility in this role to take care of others. Also in sixth grade, her family doctor made a formal diagnosis of anxiety and recommended starting medication. Freya's parents declined this intervention. During this period, Freya was reporting difficulties falling asleep (due to worrying about the upcoming day at school), concentration difficulties, and nausea. Nevertheless, she remained active and participated in many hours of dance per week.

At the start of seventh grade (in Australia, the beginning of high school), Freya became unwell with a viral illness. She reported experiencing ongoing nausea, dizziness, and vertigo following the illness. She was terrified that she had contracted COVID-19, and she experienced strong and persistent catastrophic thoughts that failed to settle even when her COVID-19 test came back negative. Freya was taken to see an ear, nose, and throat specialist, who did not find any cause for Freya's symptoms. On a daily basis Freya worried that she might be suffering from some unknown and potentially lethal illness. The COVID-19 lockdown further interrupted Freya's schooling, as she was required to do her learning online. During this time, Freya began having panic attacks, and she asked her mother to sleep in her room overnight. Freya went to bed later and later, woke up frequently throughout the night, and slept until late morning. She began to nap frequently during the day. She recalled struggling with her motivation to do her online learning and then worrying excessively about keeping up with her schoolwork and staying in her advanced class.

During this period of COVID-19, Freya's father was unable to work. Her mother had to increase her hours to support the family income, and the family structure changed because the father was home more often. Freya's parents struggled with these changes. Her mother became chronically stressed and irritable, and her father became depressed.

At the end of seventh grade, Freya presented to hospital after she collapsed to the ground one morning when getting out of bed. Freya reported having "weak and wobbly legs" and also dizziness and problems with her balance. Her parents brought her to hospital, where she was reviewed by the neurology team, who—based on rule-in (positive) neurological signs of FND—made a clinical diagnosis of her functional neurological disorder. A blood panel and MRI were normal. A standing test was positive for postural orthostatic tachycardia syndrome (POTS); it showed a heart rate increase of >40 beats per minute on standing.[66] During the

biopsychosocial assessment with the mind-body team, Freya's breathing rate was counted at 35 breaths a minute (normal respiratory rate ≤19 breaths per minute).[67]

STEP 4: CO-CONSTRUCTING THE MIND-BODY FORMULATION WITH THE CHILD AND FAMILY

The next step of the therapeutic process is to co-construct the formulation with the child and family. The formulation is a synthesis of the factors that contribute to the child's presentation.[68–70] In this step the clinician integrates what he or she knows (knowledge about the neurobiology of FND) and what the family knows as revealed in the story that they have provided. The formulation should also include hypotheses about predisposing, triggering, maintaining, and protective factors.

In children with FND, the biopsychosocial approach pays particular attention to adverse childhood experiences (ACEs), the manner in which these experiences are biologically embedded, and the cumulative effect of these experiences on body systems and on health and well-being.[39,40,58,59] In children with FND, ACEs include a broad range of physical stressors (illness, injury, or medical procedures), emotional stressors (friendship problems, bullying, problems in the family), and academic stressors (expectations that exceed the child's capacity, grueling academic schedules, learning difficulties). While maltreatment—physical, emotional, and sexual abuse, and exposure to domestic violence—is reported by a percentage of children and families (5%–29% in our team's clinical cohorts),[8,71–73] commonplace cumulative stressors are much more typical, as noted above. It is important to listen carefully to the family story to understand the child's actual story and experience and to ensure that the co-constructed formulation reflects the content of the family story.

The biopsychosocial approach also pays attention to predisposing factors intrinsic to the child. These factors include hypersensitivity to sensory and tactile stimulation in infancy[59,74] and emotional vulnerability in social contexts (distress if other people are hurt or distressed).[59] In addition, it is important to identify children with comorbid neurodevelopmental conditions such as learning difficulties,[58,75–78] attention-deficit/hyperactivity disorder, autism spectrum disorder, and intellectual disability, because these children typically need additional interventions (e.g., an individualized learning plan), scaffolding (e.g., adult supervision to implement regulation strategies), and an adapted time frame (e.g., a slower pace) when the mind-body intervention is implemented.

An important point pertains to the quality of the biopsychosocial assessment (step 3)—what we call the *family story*. When the clinician is able to elicit a family story that is sufficiently detailed and textured, the story tracks the child's developmental history in a such a way that the process of co-constructing the formulation is straightforward. With a view to bringing attention to the most salient elements of that story, the clinician uses the family's own language, if possible, to bring that story into focus and bring out its clinical significance. The clinician may say, for example, that the child's stress system was activated over and over in the context of illness, bullying, academic stress, and so on, listing events recounted by the family. The child and family resonate with the formulation because it incorporates their lived experience. By contrast, if the biopsychosocial assessment is poorly done—lacking in data and in texture—co-constructing the formulation is much more difficult. For this very reason, child and adolescent clinicians prioritize the biopsychosocial assessment. They work hard to build rapport with the child and family and to create a therapeutic space where the child and family feel comfortable and safe to share the details of the family story. For other case examples of this process, see the stories of M,[63] BJ,[62] Jai,[61] and Paula or Samantha.[39]

When working with children and families, many clinicians use visual metaphors[39,40] or a visual representation of the formulation on a white board (see Figures 3, 4, and 5).[58,59]

STEP 5: USING THE FORMULATION TO DEVELOP THE TREATMENT PLAN

The co-constructed formulation is used to develop the individualized treatment plan for the child and family. When a formulation has been done well, the interventions needed to help settle the child's stress system (what we often call the *brain stress systems* when talking to children)[††] and neural network dysregulation are usually readily apparent. Figure 6 depicts the manner in which the formulation guided the treatment intervention for Freya.

Important elements of the treatment intervention typically include one or more of the following components:

Managing Attention

Attention to functional symptoms amplifies them.[39,40,79] Excessive attention to symptoms is a core aspect of FND.[15,26,80] Drawing focus-of-attention away from the symptoms and toward functional goals is implemented across all interventions: the work with the child (including physical therapy), the work with the family, and attendance at school.

On the family system level, for example, this intervention necessitates that the child's parent's stop asking the child about his or her symptoms and that they focus, instead, on the child's success in learning regulation strategies and in attaining functional goals.

Developing a Safety Plan for Functional Seizures

For children with functional seizures, development of a safety plan comes early in the treatment process. This intervention prevents injuries from falls. The child is asked to get him- or herself on the floor in a sitting or lying position when experiencing the warning signs of a functional seizure—that is, sensations indicating a seizure is about to occur. Once the child has learned some regulation strategies (see Text Box 3 and subsection "Learning and Practicing Mind-Body Regulation Strategies," below), the child is ready to begin learning how to implement those strategies—to avert the functional seizure—after he or she

[††]In talking with children and families, we use the terms *stress system* and *stress systems* interchangeably, depending upon whether we are trying to draw attention to the stress system as a whole or to the various interlinking subsystems within the broader stress system.

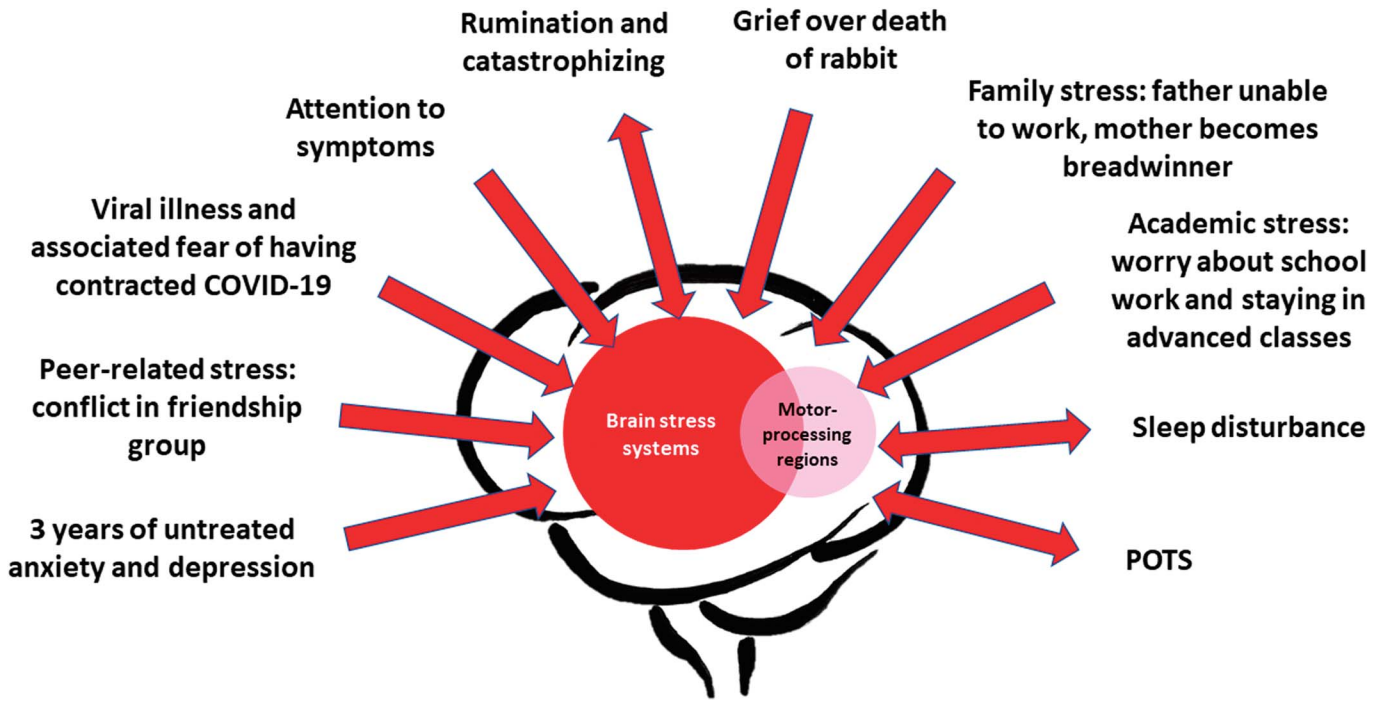


Figure 3. Visual representation of the formulation co-constructed with Freya and her family. At the end of the biopsychosocial assessment with Freya and her family, a visual metaphor was used to explain—for a second time—the neurobiology of FND. The red ball represents the brain stress systems, and the pink ball represents the motor-processing regions. The formulation—the key factors that had contributed to Freya's presentation—were then added into the visual representation used to explain FND. The completed figure summarized how the events in Freya's life (physical, emotional, relational, academic, or other) had functioned to activate her stress systems (in the body and in the brain), thereby making Freya's body (including brain) vulnerable to functional neurological symptoms (and other comorbid functional somatic symptoms). POTS, postural orthostatic tachycardia syndrome. © Kasia Kozlowska 2017

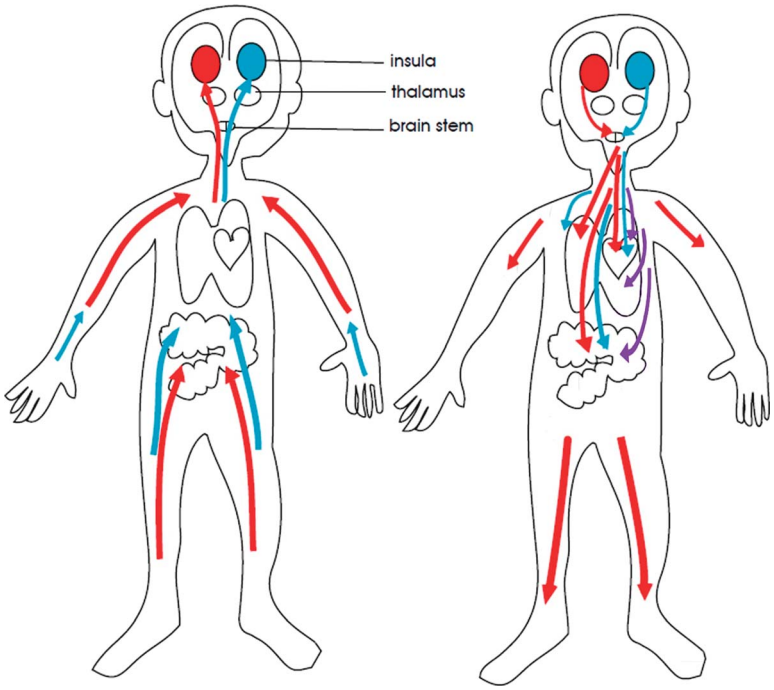


Figure 4. Visual representation of the autonomic nervous system. The figure is a functional representation of the autonomic nervous system. The red lines depict the sympathetic component that activates the body. The blue lines depict the restorative parasympathetic component that calms the body. The purple lines depict the defensive parasympathetic component that activates defensive programs in the gut (nausea, vomiting, and diarrhea) and heart (fear-induced bradycardia and fainting). The red and purple systems activate together. The figure was used to explain to Freya and her family how autonomic system activation caused her panic attacks (red-system activation), symptoms of nausea and the vomiting sensation (purple-system activation) and her postural orthostatic tachycardia syndrome (on standing up, too much red-system activation, and too little blue-system activation). Treatment would include mind-body strategies that help switch on the blue system and that help switch off the red and purple systems. © Kasia Kozlowska 2013

Time line		BIOLOGICAL Medical history – body symptoms	PSYCHOLOGICAL Personality – thoughts – feelings	SOCIAL Home – school – friends – ecosystem[a]
What factors contribute to vulnerability?	**Birth** **Preschool** **Primary school** **Year 3**	Heredity: anxiety and depression, thyroid problems, cardiac issues	Separation anxiety → settled Anxiety	Conflict in peer group Freya`s Pet dies The gastroenterologist: Finds no cause
	Year 5	Nausea – sensation of needing to vomit	Parents notice: Freya becomes withdrawn	Exams for elite academic high school
	Year 6	Difficulties falling asleep Feeling exhausted & tired during daytime Concentration problems	A burden of responsibility Revenue of anxiety symptoms Worrying at bedtime Pushing her limits?	Elected school captain The family doctor: Diagnosis of anxiety Continues school and leisure activities
What triggered the symptoms?	**Year 7**	Virus infection → nausea, dizziness, vertigo	Terrified – Covid-19? Continuing catastrophic thoughts	Home from school, no dancing, no friends
What factors contribute to maintenance?		Symptoms continue ↑ activity in body stress system Difficult falling asleep at night, many awakenings, sleeps into late mornings, daytime napping → disturbed sleep rhythm	Worrying for lethal illness Feeling isolated & lonely Increasing anxious → panic attacks Afraid sleeping alone Struggling with motivation for school work, worrying for lagging behind	Sees the ENT specialist: Finds no cause Covid-19 lockdown → home schooling No contact friends or training mates Difficult changes in the family: Dad unable to work, stays home → depressed Mum works more to support family income → irritable
	End of Year 7	Freya collapses in the morning		Admitted to the hospital The neurological team: diagnosis of FND
Freya's strengths & resources		Intelligent, insightful, conscientious, motivated to get better, goals for future, supportive family and friends		

[a] In studies of children with FND, stress related to climate change and associated natural disaster events is becoming apparent through recent studies.[9]

Figure 5. Visual representation of the biopsychosocial formulation for Freya on a whiteboard. © Helene Helgeland and Kasia Kozlowska 2022

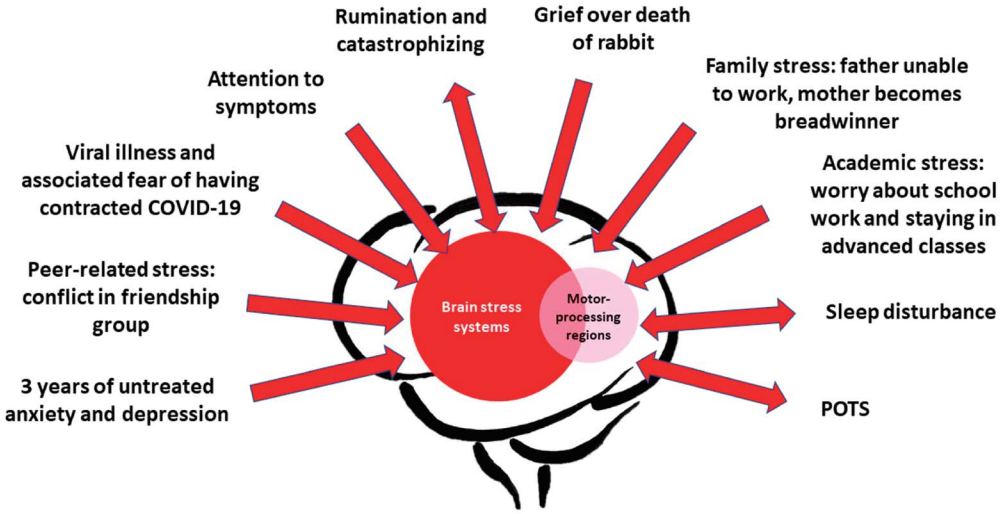
has detected the warning signs of a seizure and moved to a safe position on the floor. The strategies are also integrated into the daily timetable to help downregulate background arousal in an ongoing way. For a more detailed account of the treatment plan for functional seizures, see Savage and colleagues (2022).[40] For other resources from other teams, see Sawchuk and colleagues (2020)[81] and publications by Fobian and colleagues.[15,80]

Downregulating (Calming Down) or Re-Regulating the Child's Stress System

In visual terms that are both child and family friendly, we often talk about this group of interventions for downregulation and re-regulation in terms of reducing the size of the red ball we used in communicating the formulation (see brain stress systems metaphor embedded in Figure 6). Once the child has become adept at utilizing the calming strategies, they are integrated into the daily timetable for regular practice, thereby helping to downregulate background arousal. They are also used "as needed"—when the child feels his or her level of arousal to be increasing.

Common interventions in this category include the following:

- *Implementing a sleep intervention* to help regulate the circadian clock and to switch off the stress system at night (see Chapter 5 in Kozlowska et al. [2020][39]).
- *Working with the felt sense of the body.* Learning to read the felt sense of the body—its level of activation or calm—is a form of body mindfulness or bottom-up mindfulness.[82] In our own clinical work, we support this learning process—the child's awareness of changes in his or her body state—and make it more concrete by asking the child to draw his or her felt sense of the body on a body map. This task typically begins with an open question such as, "Can you draw some of the things that have been going on in your body?" Or if this is too difficult, a more focused question can be used, such as "Can you draw what happened in your body when you felt weak and wobbly [or dizzy, angry, or distressed] yesterday?" Figure 7 depicts two adolescent girls' visual representations of the felt sense of the body: the felt sense of the body when it is activated and the felt sense of the body when it has been calmed by implementing regulation strategies.



Identified issues	Treatment intervention
Sleep disturbance	Sleep intervention to regulate the circadian clock
Attention to symptoms	Focus-of-attention intervention with Freya, family members, school staff, etc.
Activated stress systems	Implement regulation strategies to calm the stress system (see Text Box 3)
Disrupted motor function	Psychologically informed physical therapy
POTS (and dizziness)	Good fluid and salt intake, tight leggings, and regulation strategies (see Text Box 3)
Rumination, catastrophizing	CBT intervention
Unresolved grief	Grief intervention if does not resolve spontaneously
Academic stress	School intervention (work to delineate expectations that are achievable)
Family stress	Family intervention to strengthen the parenting dyad; treat father's depression
Untreated anxiety/depression	Safety plan for suicidal ideation; start Freya on an SSRI; and CBT intervention

CBT, cognitive-behavioral therapy; POTS, postural orthostatic tachycardia syndrome; SSRI, selective serotonin reuptake inhibitor.

Figure 6. Using the formulation to develop a treatment plan. CBT, cognitive-behavioral therapy; POTS, postural orthostatic tachycardia syndrome; SSRI, selective serotonin reuptake inhibitor. © Kasia Kozlowska 2022

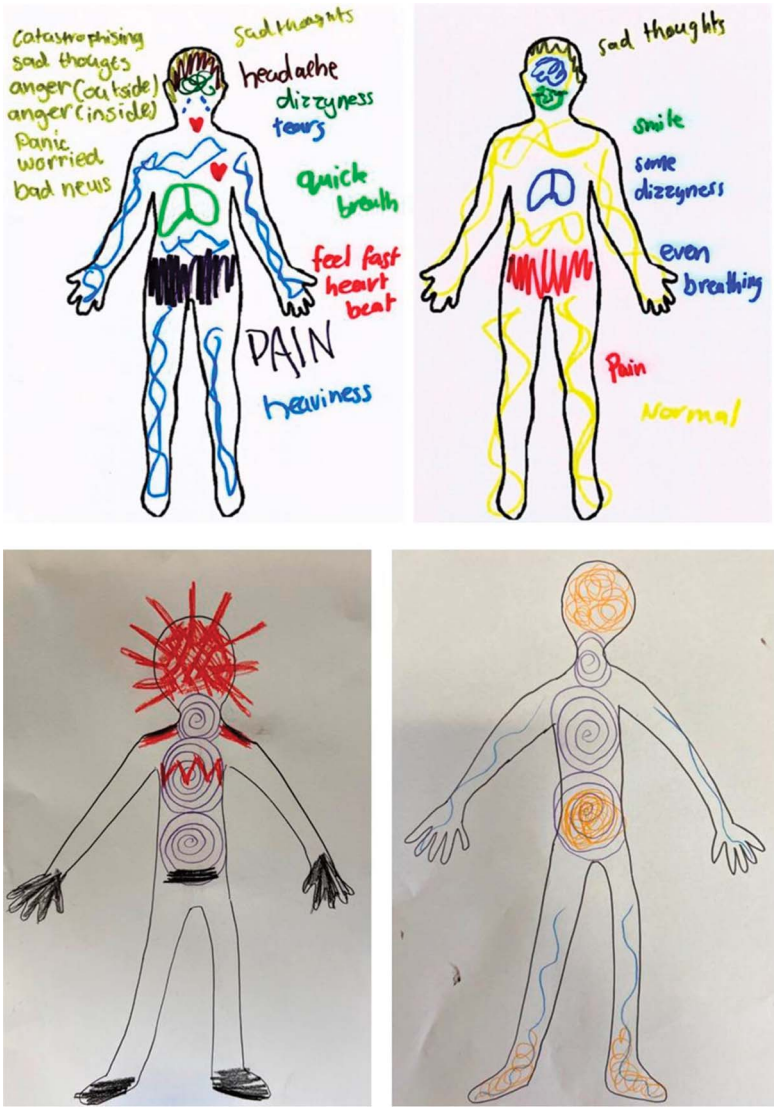


Figure 7. Visual representation of felt sense of body. These two-part images depict two adolescent girls' body maps of the felt sense of the body (a, on the left) when the body is activated and (b, on the right) when it has been calmed by implementation of regulation strategies. © Kasia Kozlowska 2018 (first row of images, reproduced from Kozlowska and colleagues [2018][34]), © Kasia Kozlowska 2022 (second row of images)

– *Developing the capacity to read the felt sense of the body* enables the child with FND to feel the difference between a body that is activated (state of high arousal) and a body that is calm (arousal that is not too high and not too low). This skill forms the foundation for the next step of the therapeutic process: the child learning regulation skills to calm the body (see subsection "Learning and Practicing Mind-Body Regulation Strategies," below). As noted above, this skill allows children with functional seizures to notice the warning signs of an imminent functional seizure (increasing arousal that precedes the functional seizure) and, in turn, to implement regulation skills for calming the body *in the moment*, thereby averting the functional seizure.[40]
– *Teaching the child bottom-up (body) regulation strategies* to help calm the brain, body, and mind (see Text Box 3). Bottom-up regulation approaches target the body system level and are referred to using various expressions: body or bottom-up mindfulness, or body-oriented, somatic, or biofeedback interventions.[82] Many of these approaches involve working with the felt sense of the body, with the child's attention focused on body sensations. They do not engage the executive control system.[83] Because the child is presenting with symptoms that affect the body, bottom-up (body) regulation strategies have an inherent acceptability to children with FND and their families.
– *Teaching the child top-down (cognitive) regulation strategies* to help calm the brain, body, and mind (see Text Box 3). Top-down (cognitive) regulation approaches activate the executive control system[83]—the child's cognitions, thought processes, attention, and awareness—in an effortful way to improve regulation and control of

thoughts and emotions. Cognitive strategies are less likely to be beneficial early in the treatment process, when levels of brain arousal are high and when prefrontal networks are weakened.[84]

- *Addressing activation factors* that function to activate the stress system—on the family, school (regarding peers, academics, or sports), and other system levels. For detailed discussion see Chapter 16 in Kozlowska and colleagues (2020) (working with the family)[39] and Chapter 13 in Savage and colleagues (2022) (working with the school).[40]
- *Adjunctive use of medication to help decrease arousal.* If arousal levels are so high that the child is unable to successfully implement regulation strategies, adjunctive medication that helps dampen arousal may be used for a limited period of time (see Table 2).

Normalizing Motor and Sensory Function

All mind-body regulation interventions listed in the previous section are essential for normalizing motor and sensory function; increased arousal modulates aberrant neural network function and is both a precipitating and maintaining factor in pediatric FND.[8] The child's FND symptoms are less likely to resolve if arousal stays high. For this reason, physical therapy implemented alongside psychotherapy—with physiological regulation as a focus—is more likely to be helpful than physical therapy alone. Likewise, physical therapy interventions need to be psychologically informed.[85]

Physical therapy interventions help normalize motor function.[16,85,86] *Psychologically informed physical therapy*—what we have called the *wellness approach*—prioritizes interpersonal processes and physical therapy techniques beyond the scope of standard physical therapy.[85] In addition to stressing the need to establish a therapeutic relationship and create a safe space for physical therapy, psychologically informed physical therapy uses indirect physical therapy approaches that redirect the focus-of-attention away from symptoms and emphasize the completion of tasks and activities targeting the sick body part indirectly. The intervention is always tailored to address the needs and presentation of each particular child.[85]

Attendance at school, participation in group activities (social, art, music, or other), and occupational therapy promote normal function across multiple domains (motor, sensory, social, academic).

For clinicians working in adult settings, resources pertaining to FND-informed physical therapy and occupational therapy are also available.[44,87]

Attendance at School

In the usual course of events, children do not go to school when they are sick; they stay home, recover from the illness, and then return to school. But when treating FND, school staff are part of the multidisciplinary team, and going to school is part of the treatment intervention. How the school manages the child's illness and how school staff respond to the child's symptoms can make or break the treatment intervention. In this context, working with the school to maintain school attendance, even if attendance is partial and is slowly built up over time, is an essential component of the intervention that helps the child return to normal function and to well-being.

Addressing Comorbid Health Concerns

Comorbid mental health concerns are present in a proportion of children (22%–84%), with comorbid anxiety and depression being the most common.[25] These comorbid disorders need to be treated in their own right because children with FND whose comorbid mental health concerns do not resolve have poorer outcomes.[17,25]

Illness-promoting psychological processes[15,26]—for example, overly high expectations, rumination, catastrophizing, negative thoughts about the self—are also common and may need to be addressed. These processes can be present even when the child does not meet diagnostic criteria for anxiety or depression.

Comorbid functional symptoms such as postural orthostatic tachycardia syndrome,[‡‡,39,66,88,89] functional gut problems (e.g., functional constipation),[90] or comorbid fatigue may need to be treated alongside other symptoms. Complex pain is, like FND (see Figure 1), driven by overactivation of brain regions representing arousal and emotion processing.[91] Interventions that manage focus-of-attention and interventions that aim to calm the brain, body, and mind are therefore also effective for comorbid complex pain.

Pharmacotherapy

Medications can be used as an adjunct to behavioral interventions (e.g., sleep hygiene), regulation strategies (bottom-up and top-down), and psychotherapy for anxiety and depression (e.g., cognitive-behavioral therapy [CBT]). Medications are typically initiated in very small doses to avoid somatic side effects and are increased very slowly. Positive suggestions are made to emphasize that when medication is started slowly and in tiny doses, side effects are rare. When using antidepressant and antianxiety medications, those that have an activating profile are avoided (see Table 2). Medications to help initiate and maintain sleep and to manage arousal are typically used for a time-limited period, while the child is learning strategies that help calm his or her body systems (see Table 2).

Building Mastery, Coping, and Resilience

A key goal of all of the above interventions—and any interventions that continue into the future—is to increase the child's (and family's) sense of control, sense of mastery, positive coping, and resilience.[37,92] The long-term aim is to enable the child and family to better manage future stress and the challenges of daily living.

[‡‡] *Postural orthostatic tachycardia syndrome* (POTS) is an overarching term that includes stress-related dysregulation of the autonomic nervous system, dysregulation secondary to being bedbound in the context of illness (and lack of exercise that would function to regulate the autonomic nervous system on a daily basis), and dysregulation secondary to "organic" factors such as an autonomic neuropathy.[39,66,88,89] The comorbid POTS seen in pediatric patients with FND typically reflects the first and second conditions, sometimes in combination.

Table 2

Adjunct Pharmacotherapy Used in Children with FND[a]

Target symptom	Medication	Typical doses
Sleep initiation	Melatonin (immediate onset)	Start with 3 mg at bedtime (can titrate up to 9 mg)
	Clonidine	Start with 25 µg at bedtime (can titrate up to 100 µg)
	Quetiapine	Start with 6.25 mg or 12.5 mg at bedtime (can titrate up to 37.5 mg)
Sleep maintenance	Melatonin (delayed onset)	Start with 2 mg at bedtime (can titrate up to 8 mg)
Management of arousal	Clonidine	Start with 25 µg morning, lunchtime, and afternoon
	Guanfacine	Start with 1 mg morning or at bedtime (can titrate up by 1 mg increments to 7 mg if tolerated)
	Propranolol (for children with significant HR rises)	Start with 2.5 mg morning, midday, and afternoon (can titrate up if needed if tolerated), do not give at night as disrupts sleep
Anxiety and depression	An SSRI that is not too activating (build up very slowly to avoid side effects)	For example: Fluvoxamine starting with 12.5 mg BID to lowest therapeutic dose Escitalopram starting with 2.5 mg mane to lowest therapeutic dose Sertraline starting with 12.5 mg mane to lowest therapeutic dose

[a] Medications are used as an adjunct only. Those for sleep and arousal are used for a limited period of time and withdrawn when no longer needed. For a more in-depth discussion, see Online Supplement 5.1 (Pharmacological Interventions to Improve Sleep in Children with Functional Somatic Symptoms), Chapter 14 (Treatment Interventions I: Working with the Body) in Kozlowska and colleagues (2020),[39] and Chapter 15 (Medication as an Adjunct to Treatment) in Savage and colleagues (2022).[40]

The next section—Step 6: Implementing the Mind-Body Intervention—provides an example of a typical treatment intervention.

STEP 6: IMPLEMENTING THE MIND-BODY INTERVENTION (FREYA'S PERSONALIZED MIND-BODY PROGRAM)

The personalized treatment intervention for Freya, the 13-year-old girl introduced in an earlier vignette, was made up of the components listed below. Although the various components of treatment were implemented very early on (more or less in parallel), they are discussed here in a rough order of priority. Given that the required resources were available, Freya's treatment was begun in hospital, continued in an outpatient hospital setting, and then transitioned to the community. Treatment could likewise have been implemented in an outpatient or community setting. In the latter case the pace of implementation and improvement, as well as recovery, would likely have been slower. Had Freya's presentation included functional seizures, an intervention targeting functional seizures, along with a safety plan, would have been integrated into her treatment program.[40]

Sleep Intervention

The goal was to support the return of Freya's circadian clock to a normal diurnal rhythm. Freya was required to stop napping during the day, which was reducing her sleep debt at night. Freya was given melatonin 3 mg and quetiapine 12.5 mg to support her in falling asleep. She was also provided with some guided-imagery recordings and encouraged to listen to them at night to help her mind focus on downregulating and falling asleep, in lieu of ruminating on her worries. The quetiapine was withdrawn two months later after Freya was established on an antianxiety medication (see below).

Mind-Body Formulation

Freya and her therapist took time to make sure that Freya was clear about the mind-body formulation (first discussed at the end of the biopsychosocial assessment with Freya and her family). Working together, Freya and her therapist were able to identify (again) all the factors that were contributing to the activation of Freya's stress system. From Freya's point of view, the most important factors included her grief over her rabbit's death, the pressure that she placed on herself to function well academically, her long-standing anxiety and low mood, her viral illnesses, the COVID-19 lockdowns, and loss of physical activity during the COVID-19 lockdowns (which had been a coping resource). It was in discussing the mind-body formulation that Freya disclosed that she had struggled, for months, with intermittent suicidal ideation.

To make the mind-body formulation more concrete, the therapist and Freya used a body map as a visual aid on which Freya could represent all the different ways that her body (and stress system) had been activated (see Figure 8). The therapist and Freya used the color red and the term *red system* to represent life events that had activated Freya's stress system. They used the color blue and the term *blue system* to represent

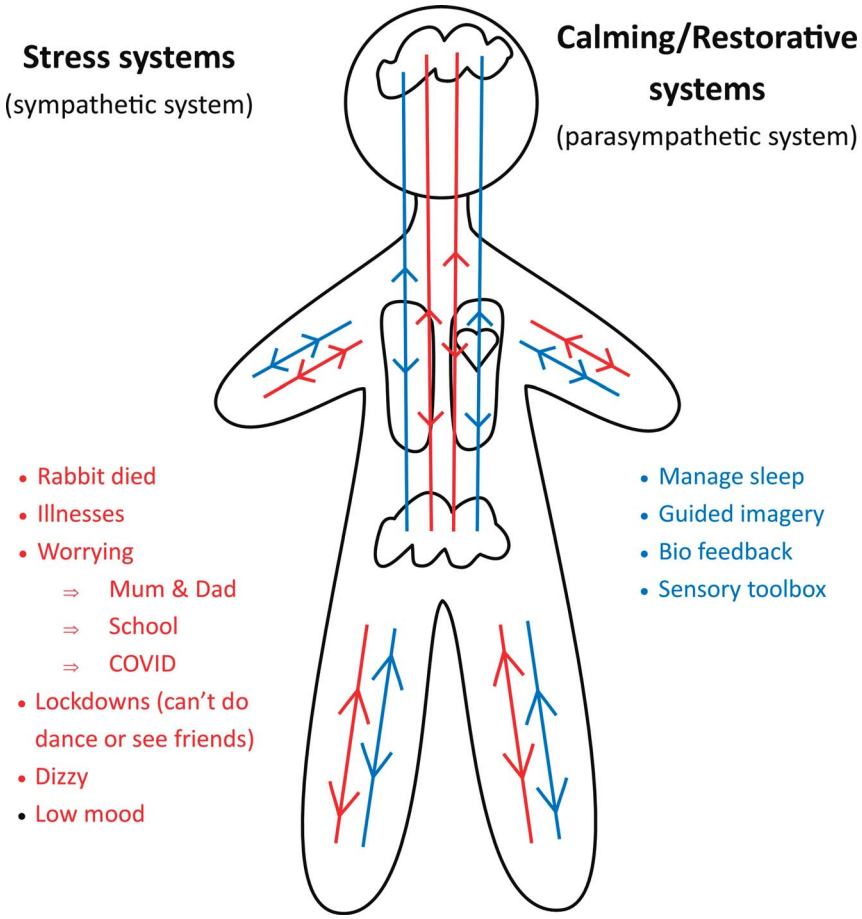


Figure 8. Freya's body map. Body map that Freya developed to depict all the different ways that her body (and stress systems) had been activated and all the strategies that she could engage in to calm her stress systems (and her brain and body). © Kasia Kozlowska and Catherine Chudleigh 2022

activities that helped to activate her restorative (calming) systems. They revisited the body map throughout the course of the treatment as a way of building Freya's insight into her body's responses to stress and also into the many different ways in which she could manage these responses.

At an early point in the therapeutic process, the therapist reminded Freya that, she, her family, the school, and everyone involved in her care would all be practicing the art of drawing focus-of-attention away from her symptoms. They would therefore not be asking Freya about the symptoms all the time—which would simply make the symptoms worse.

Physical Therapy

Physical therapy using the wellness approach[85] was begun while Freya was still in hospital (see "Normalizing Motor and Sensory Function," above). After a week, even though her gait had not yet returned to normal, Freya could mobilize independently. She was discharged home to continue physical therapy in the outpatient setting. The physiotherapist—and other members of the team—gave Freya the positive suggestion that everyone expected Freya's strength and gait to keep improving until it had returned to normal. She was not to use any aids. Outpatient physical therapy was offered on a weekly basis. Freya, who enjoyed swimming, also went to her local pool twice a week.

Learning and Practicing Mind-Body Regulation Strategies

As noted previously, during the assessment with Freya and the family, Freya had been breathing at 35 breaths per minute (activation of the respiratory motor system alongside autonomic system activation).[§§] During her first individual therapy appointment (as an inpatient), she was still breathing very fast at 28 breaths per minute. Freya's breaths were both fast and shallow. She was taught how to engage her diaphragm and slow her breathing (a bottom-up regulation strategy). After two weeks of practice (now as an outpatient), Freya could reduce her breathing rate to 20 breaths per minute. At this point she was taught to breathe with biofeedback that tracked heart rate variability. She was encouraged to practice her biofeedback five times a day for three minutes. It took her many months to decrease her breathing rate further. Increased heart rate variability reflects increased vagal tone (decreased arousal).

[§§]In children with FND—and especially those with functional seizures—an increased respiratory rate alongside autonomic activation is a common finding.[11,72]

Slow-paced breathing facilitates an increase of vagal tone because the nucleus ambiguous (vagal nucleus) sits next to, and is connected with, inspiratory and expiratory neurons of the central pattern generator for respiration.[93] The systems are coupled.

Other mind-body interventions used alongside the breathing intervention included visualization exercises to support Freya in settling her stress system—exercises that Freya was able to use quite effectively (a top-down regulation strategy). Freya's favorite was going to her imagined safe place (a rainforest), where she felt calm, safe, and relaxed. She also used sensory strategies such as a weighted blanket and fidget toys to manage her arousal and distress (bottom-up regulation strategies). She found the fidget toys particularly helpful in the classroom.

Freya's individual therapy was then handed over to a community-based therapist. Key areas of difficulty that had yet to be addressed included long-standing anxiety and depression, plus illness-promoting psychological processes such as rumination and catastrophizing. All were treated using CBT.

Attendance at School

During the admission, Freya attended the hospital school each day, which provided her with an opportunity to return to functioning within a typical routine. She was encouraged to seek support from the hospital school's teachers concerning some of the classwork she had missed. In therapy, she was provided the opportunity to challenge some unhelpful patterns around procrastination and avoidance of schoolwork.

The mind-body team liaised with Freya's own school to ensure that a graded return-to-school plan was in place. It was agreed that the initial focus was on returning to school and that expectations around schoolwork would be adjusted while Freya was making her adjustment to being back at school. Freya's teachers, in turn, liaised with peers in her class to ensure that, when she returned to school, she had a "reliable buddy" in place.

Following discharge, Freya continued to find the expectations in her elite academic high school very stressful. Six months later, she and her parents, with the support of her community-based therapist, decided that the selective school program was not suited to Freya's needs and that she would do better in a more mainstream school with less academic pressure and competition. Once the incessant academic pressure was put behind her, Freya was able to flourish. She performed well within a small group of academically oriented students in her new school.

Family Intervention

During Freya's hospitalization, she and her family were encouraged to focus on her functional goals and her success at meeting those goals, rather than focusing on her symptoms or distress. The parents and other family were asked not to visit while Freya was busy with the day's work under the Mind-Body Program, which was typically completed by about 4 p.m. At night, the parents were expected to sleep at home, not at the hospital. During parent visits, they were to practice using a mood-related safety plan that encouraged (and made more routine) their talking about Freya's low mood and intermittent suicidal ideation—topics that Freya had previously been unable to discuss with her parents.

On return home, her parents were encouraged to maintain the goals Freya had made, including that everyone sleep in their own beds. In response to the questions occasioned by Freya's return home, her parents received further psychoeducation around FND, anxiety, and depression. In addition, the parents were referred for a brief intervention with a therapist in their community to work on their skills as a parenting team in the face of managing a young person with complex needs.

Managing Comorbid Health Concerns

Freya's long-standing, untreated anxiety and depression (with intermittent suicidal ideation) were addressed by developing a safety plan with Freya (for her intermittent suicidal ideation), prescribing a selective serotonin reuptake inhibitor, and referring her, as mentioned above, for longer-term therapy with a community-based therapist.

Freya's comorbid POTS (and accompanying dizziness) settled with increased fluid and salt intake, temporary use of tight-fitting sports leggings, slow-paced breathing across the day, and reintroduction of exercise (which helps re-regulate the autonomic system).

Outcome

Freya's FND symptoms resolved over a three-week period. Her POTS—and associated dizziness—resolved after two months. Her anxiety and depression took many months to resolve. She stayed on the SSRI for two years. Subsequently, during periods of stress, she remained prone to symptoms of anxiety. Her body continued to signal stress-system activation via transient symptoms of nausea and an urge to vomit. When she experienced these sensations—her warning signs that she was getting stressed—she took special care to implement her mind-body regulation strategies and to assess whether she could do anything to decrease the stress in her life at that time. After finishing high school, Freya went on to college.

Table 3 provides the reader with a timeline of Freya's treatment intervention, including the steps that made up the intervention, the time frame of each step, and the health care professional(s) involved at each point.

STEP 7: TAKING THE PROGRAM HOME TO MAINTAIN RESILIENCE AND PREVENT RELAPSE

In our hospital-based clinical practice, we introduce the idea that the therapeutic intervention will continue; in particular, we expect the child and family to "take the mind-body program home." What this means in practice is that the family must think about the functional or structural changes that they need to make at home in order for the healing process to continue, and in order for the child (and family) to continue to build mastery, good coping skills, and resilience.[37,94,95] All these factors will help prevent relapse.

Taking the program home may involve one or more of the following:

Table 3

Timeline of Freya's Assessment and Treatment Process

	Time frame	Health care providers involved	Interventions provided
Step 1: Medical/neurological assessment and provision of a positive diagnosis	Day 1	ED doctor Neurology fellow Neurology consultant	Medical/neurological exam Blood panel Clinical diagnosis of FND based on rule-in signs Simple FND explanation by the neurologist
	Days 2–4	Neurology team	Admission to Neurology ward Repeat of diagnosis and simple explanation by neurologist Family informed about the Mind-Body Program and referral to the mind-body team Neurology team initiates physical therapy and sends Freya to Hospital School while she is waiting for biopsychosocial assessment by the mind-body team MRI Standing test for POTS
Step 2: Triaging the referral for a holistic (biopsychosocial) assessment	Days 2	Mind-body team	Referral accepted Assessment scheduled for Day 4 Mind-body team requests Neurology team (as noted above) to perform a standing POTS test and to initiate physical therapy and attendance at Hospital School
Steps 3–5 Step 3: Clinical (biopsychosocial) assessment with Freya and family Step 4: Co-constructing the mind-body formulation with the child and family Step 5: Using the formulation to develop the treatment plan	Day 4 (2 hours)	Mind-body team: Child psychiatrist Clinical psychologist Resident Any visiting student	Biopsychosocial assessment (obtaining the family story) Co-construction of the formulation Discussion of treatment plan (including focus of attention and parents stepping back) Freya expresses her willingness to be admitted into the Mind-Body Program Parents provide their consent
Step 6: Implementing the mind-body intervention (on Adolescent Medicine ward)	Days 5–13 (no program activities scheduled on weekends) Discharge home on day 14 after completion of program	Mind-body team: Nursing staff on adolescent ward Child psychiatrist Clinical psychologist Resident Physiotherapist Hospital School Occupational Therapist	Formal implementation of Mind-Body Program – Sleep intervention – Daily physical therapy – Daily attendance at school – Daily psychology sessions (e.g., repeat mind-body formulation, implement regulation strategies) – Weekly family meetings – Adolescent recreational group (optional) – Pharmacotherapy (melatonin, quetiapine, fluvoxamine) – Parents are allowed to visit beginning in late afternoon; they go home to sleep – Work with child's own school to set up return to school on discharge

– Adopting elements of the program, with their regulating function, into the structure of family life and its daily timetable. These elements include healthy sleep patterns, healthy eating patterns, regular pleasurable exercise, and daily implementation of previously learned regulation strategies
– Setting times to facilitate communication and conversation about challenges that are experienced as stressful, thereby enabling family members or close others to help one another understand and address problems
– Continuing longer-term psychological work to finish addressing issues identified in the mind-body formulation (e.g., addressing illness-promoting psychological processes with a CBT intervention, or addressing unresolved loss or trauma with a trauma-focused intervention such as eye-movement

Table 3

Continued

	Time frame	Health care providers involved	Interventions provided
Step 7: Taking the program home to continue the healing process, maintain resilience, and prevent relapse	Week 3 onward	[Freya and her family]	Daily timetable including exercise regimen, implementation of regulation strategies, and Freya's return to own school
	Week 3 onward	School staff	Ongoing monitoring and support of Freya's return to school
	Weeks 3–5	Physical therapist for FND-informed physical therapy	Weekly Prescription of exercise program for home (daily) Discharged from physical therapy at end of Week 5 (FND symptoms had resolved)
	Weeks 3–9	Psychologist from mind-body team (with backup from team psychiatrist)	Individual sessions (every other week) to "hold" the therapy until community psychologist can take over Support of Freya's return to her own school Ironing out any glitches or answering any questions that occur on return home
	Week 3 onward	Family doctor	Quetiapine ceased at two months (as directed) Melatonin used intermittently during periods of stress Fluvoxamine (an SSRI) continued for a 2-year period
	Weeks 6–10	Family therapist (community-based)	Parent intervention aimed at building the parents' skills as a parenting team in the face of managing a distressed young person with FND, anxiety, depression, and intermittent suicidal ideation
	Week 9 to 2 years	Community psychologist	Weekly individual sessions (with intermittent family involvement), subsequently decreased to every other week and then to monthly – Ongoing follow-through for regulation strategies – CBT (though potentially different for other patients) Support of family as needed

desensitization, trauma-focused CBT, radical exposure tapping, or accelerated resolution therapy)[96–99]
- Engaging in longer-term family work to finish addressing issues identified in the mind-body formulation (e.g., family conflict)
- Maintaining longer-term interventions in the school context to address problem areas in an ongoing way—for example, via an individualized learning plan (see chapter "Working with the School" in Savage and colleagues [2022][40])

THE TREATMENT INTERVENTION IN A NUTSHELL

The biopsychosocial intervention for children with FND is a complex intervention in which multiple components of treatment are delivered in parallel. Because it is difficult to keep the entire process in mind, we have developed a flowchart that summarizes the therapeutic processes on one page (see Figure 9). The flowchart is designed to function as a road map that the multidisciplinary treatment team can consult to help guide the treatment process. The Five-Step Plan that is mentioned in the flowchart—for implementation with children with functional seizures—is available in Savage and colleagues (2022).[40] New methodologies for evaluating complex interventions—such as the one described in the current Perspective—are likely to be a focus of future research.[25,100,101]

BUILDING UP AN FND-INFORMED WORKFORCE

As noted in the introduction, at present—and worldwide—FND services are scarce. This scarcity of resources is the result of long-standing stigma coupled with a lack of knowledge and understanding about the neurobiology of FND and its treatment. Research efforts using newly developed technologies are rapidly building a knowledge base of FND as a mind-body (neuropsychiatric) disorder that sits at the interface of neurology and psychiatry.[38,102,103] The issue of stigma is also being addressed but will likely take decades to reverse.[26,104–106] An important challenge is to disseminate information into professional curricula so that teaching about FND and other functional disorders is integrated into contemporary medicine from the outset.[107] FND-informed practices can subsequently be integrated into existing services. For an in-depth discussion, see, "The Treatment Process: Educational and Structural Interventions to Overcome Mind-Body Dualism" in Kozlowska and colleagues (2021).[26]

Referral triage by the mental health clinician (step 2: check that the following have been completed)

- A comprehensive medical/neurology assessment has been completed by a medical practitioner: physical examination, blood panel, EEG (video EEG or EEG with review of video material by a pediatric neurologist in children with functional seizures), and imaging (if the medical practitioner has ordered imaging).
- The medical practitioner has provided a positive diagnosis.
- The medical practitioner has provided an explanation.

Biopsychosocial assessment with the young person and the family (steps 3, 4, and 5)

- The biopsychosocial assessment aims to bring to light the young person's developmental history in the context of the family story, including a timeline of physical, psychological, and relational stressors (the story of the family and the story of the symptoms).
- The biopsychosocial assessment allows the clinician, the young person, and family to co-construct a formulation—a summary of predisposing, precipitating, and perpetuating factors.
- The formulation is used, in turn, to develop a treatment plan and to guide the treatment process.
- The young person and family need to understand the rationale for the treatment plan and to agree to (contract to) the treatment intervention (including the offered time frame).

Psychoeducation (embedded in steps 4, 5, and 6)

- The initial psychoeducation intervention is delivered at the end of the biopsychosocial assessment. The clinician explains FND (including functional seizures) again. The clinician also provides information about the treatment components and their rationale.
- Psychoeducation is usually repeated during, and integrated into, some of the early treatment sessions.

The mind-body treatment intervention with the mental health clinician and multidisciplinary team (step 6)

Daily timetable	Five-Step Plan for Managing Functional Seizures	Daily pleasurable exercise or physical therapy	Working with the family	Working with the school	Medications	Longer-term individual or family therapy
• Stabilize rhythms of daily living • Document daily practice of treatment elements	For children with functional seizures: • Identify warning signs • Make yourself safe • Implement mind-body regulation strategy • Ride it out • Implement mind-body regulation strategy	• As a physical regulation strategy • To address decon-ditioning • To build resilience • For neuro-protection • To manage pain • To help sleep	• To address focus-of-attention • To hold positive expectations • To address family issues that contribute to the presentation	• Develop a school-based health care plan for managing the FND symptoms (including functional seizures) in the school setting • Implement integration of young person back to school	• To help decrease arousal • To help with sleep • For comorbid anxiety or depression • For comorbid functional gut disorders	• Complete bottom-up and top-down regulation work • To treat comorbid mental health disorders • To engage in a trauma-processing intervention • Ongoing family, parenting, or marital work (with parents)

Taking the mind-body intervention home (step 7)

The family continues to implement all components of the mind-body intervention (as relevant to their particular context).

Figure 9. Flowchart of assessment and treatment process for treatment team. © Kasia Kozlowska and Blanche Savage 2022

An important point here is that most health care professionals working in pediatrics can easily add an FND-informed skill set to their current clinical practice. Pediatricians and pediatric neurologists already have the required skill set to diagnose FND: they just need to reconceptualize some of the signs that are elicited as positive rule-in signs for FND[38,41–45] and to practice the skill of communicating the diagnosis to children and families in a clear and straightforward way devoid of stigma.[38,55] Physical therapists already have the broad range of skills needed to treatment FND: they just need to shift from a musculoskeletal framework that focuses attention on the problem area to an FND-informed framework that involves a careful management of attention away from the symptoms, with a particular focus on building the therapeutic relationship, use of play in physical therapy and application of physical therapy interventions in ways that address the problem indirectly.[85,86] Mental health clinicians already have the necessary skills to undertake a biopsychosocial assessment and to provide an individual and family-based intervention: they just need to add an understanding of the somatic narrative—the language of the body—and to add management of focus-of-attention and bottom-up regulation strategies to their skill set. For an in-depth discussion of the somatic narrative, see "Understanding the Somatic Narrative: The Language of the Body" in Kozlowska and colleagues (2021).[26]

Educational staff are likewise well positioned to manage FND—including functional seizures—in the school setting because they are already adept at managing epileptic seizures. And the management of FND—including functional seizures—entails a far lower risk than that associated with epilepsy, or with other medical conditions such as severe allergies. For an in-depth discussion of working with the school, see Online Supplement 16.3 (Working with the School) in Kozlowska and colleagues (2020)[39] and Chapter 13 (Working with the School) in Savage and colleagues (2022).[40]

CONCLUDING REMARKS

The last decade has seen significant advances in many areas related to pediatric FND: its neurobiology; the medical/neurological assessment of the disorder, which yields a positive diagnosis; the biopsychosocial assessment, which yields a formulation that is co-constructed with the child and the family; the use of the formulation as a guide to treatment planning; and the development of evidence-based interventions that make up the treatment components within the treatment intervention. These advances have been brought about through the dedicated work of clinicians and clinical teams from around the world, including Elena Garralda and her colleagues in the United Kingdom;[74,108–110] Jan Baker and her speech therapy colleagues in Australia;[43,111,112] Per Fink,[113,114] Charlotte Rask,[74,115,116] Karen Hansen Kallesøe[117–119] and their colleagues in Denmark; Trond Diseth,[120] Helene Helgeland,[37,58] Stein Førde,[59] and their colleagues in Norway; Tyson Sawchuk and his colleagues in Canada;[11,20,81] Aaron Fobian (Alabama),[15,80,92,121] Jeffrey Waugh (Texas),[122–124] and Areti Vassilopoulos (Connecticut),[25] and their colleagues, all in the United States; and, finally, the work of our own mind-body team in Australia (cited throughout this article). All these clinicians and their teams have contributed to recent advances in theory, best-practice guidelines, and evaluation of treatment outcomes, thereby providing direction for clinicians around the world (see Supplemental Text Box 2, http://links.lww.com/HRP/A210).[10,11,15,20,25,37,40,43,58,59,74,80,81,92,108–128] Through collaborative efforts, these teams have also worked hard to highlight that the pressing need to develop an FND-informed culture of care that takes into account recent advances in our understanding and clinical care of children and adolescents with FND.[26]

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