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Research Article

Evaluation of ReAttach in FND with the Symptom Amplification Module (SAM) of Neurolog Study Protocol

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Abstract

NeuroLog [1,2] provides a continuous, patient-led data infrastructure to measure the impact of ReAttach objectively [3], facilitated by specifically trained Affect Coach Online Professionals [4]. Neurolog transforms subjective progress into quantifiable change through Real-world symptom tracking, Emotional and behavioral analytics, Automated longitudinal comparisons, Integration of qualitative patient voice. Together, these data create a scientifically robust yet human-centered evidence base for the therapeutic value of interventions in Functional Neurological Disorder. This study protocol is the first of several intervention studies using Neurolog to assess changes in symptomatology, beginning with the evaluation of the effectiveness of ReAttach self-regulation techniques [3,4] in FND patients with stress-related disorders.

Keywords: Neurolog, Symptom Amplification Model, ReAttach, Functional Neurological Disorder, W.A.R.A., Forgive and Forget Hood

Introduction

Anxiety, a transdiagnostic symptom prevalent across numerous neurological and psychiatric disorders, represents a major concern in the field of mental health due to its pervasive impact on emotional, cognitive, and physiological functioning [5,6] . As a transdiagnostic construct, anxiety is not confined to specific diagnostic categories. However, it occurs across a spectrum of conditions, including depression, post-traumatic stress disorder, obsessive-compulsive disorder, and even neurodevelopmental and neurodegenerative disorders [7]. The central phenomena of fear and loss of control define the anxious experience. Fear reflects the immediate emotional and physiological response to perceived threat, while loss of control refers to the subjective sense of helplessness or inability to predict and manage one's environment. These mechanisms underlie many maladaptive behaviors such as avoidance, hypervigilance, and excessive worry, which contribute to functional impairment and distress [8]. Because of its cross-cutting nature and profound influence on multiple aspects of mental health [9], anxiety remains a crucial area of study for understanding both the etiology of mental disorders and the development of effective, integrative therapeutic interventions [10, 11, 12, 13, 14]. By overall overview of psychological disorders, the prominence of hyper-arousal in anxiety disorders is evident in their relationship with sleep disorders, physical complaints, and depression [11]. The comorbidity of anxiety disorders with depression, as highlighted by Gaspersz et al. [12], predicts poorer treatment outcomes. With a lifetime prevalence of approximately 30% [13, 14], anxiety disorders are a global health issue, causing significant suffering to patients, their loved ones, and society.

Specific elements of ReAttach, a transdiagnostic intervention for adults and children [3], could be used to offer relief via remote training as a self-regulation tool for patients with stress-related complaints. We hypothesize that patients with complex stress-related symptoms may benefit from this package of self-regulation tools that are part of the ReAttach Affect Coach Professional Training [4], as described in previously published pilot studies [15,16,17,18], case studies [19, 20, 21, 22, 23, 24, 25, 26], and ReAttach protocols [27, 28, 29, 30, 31].

Objective

To evaluate changes in emotional regulation, symptom severity, and functional stability in FND patients undergoing ReAttach

remote therapy, using continuous, real-world data collected via the NeuroLog platform.

The primary aim of this study is to evaluate changes in emotional regulation, symptom severity, and functional stability among patients diagnosed with FND who are undergoing ReAttach remote therapy, using continuous, real-world data collected via the NeuroLog platform. This objective represents an integrative approach that combines therapeutic innovation with digital health monitoring. FND, characterized by neurological symptoms such as motor dysfunction, sensory disturbances, or non-epileptic seizures in the absence of a structural neurological cause, is increasingly recognized as a disorder of impaired self-regulation and emotional processing. Accordingly, assessing emotional regulation —the ability to identify, modulate, and respond adaptively to emotional experiences — is central to understanding treatment response. Evaluating symptom severity provides insight into the direct clinical effects of ReAttach on core FND manifestations, while examining functional stability—the consistency of cognitive, emotional, and behavioral functioning over time—captures broader improvements in patients' daily performance and psychological resilience.

The implementation of ReAttach remote therapy in this context introduces a novel therapeutic pathway. ReAttach is a transdiagnostic, neurocognitive intervention designed to enhance self-regulation, sensory integration, and affective processing through structured tasks and therapist-guided feedback. Delivered remotely, it allows patients to participate in exercises that strengthen emotional control and cognitive flexibility beyond the clinical setting, offering particular value for individuals with limited access to in-person care or elevated stress-related symptoms.

By leveraging continuous, real-world data through the NeuroLog platform, this study moves beyond traditional pre- and post-assessment models. The NeuroLog system facilitates ecological momentary assessment (EMA)—the real-time collection of behavioral and physiological data within patients' natural environments—providing a more accurate and dynamic representation of therapeutic progress. Such continuous monitoring enables the detection of subtle fluctuations, supports the tracking of treatment adherence, and allows for the early identification of improvement or relapse, thereby enhancing both clinical understanding and therapeutic precision.

Study Framework

Design

Prospective observational cohort study (with potential for N-of-1 sub-analysis).

Population

We aim to select fifty adult participants (18-65) with a confirmed or suspected diagnosis of Functional Neurological Disorder (FND) receiving ReAttach remote therapy provided by trained Affect Coach Online Professionals. Participants will be invited and selected by Neurolog and need to consent to attend the 45 minutes self-regulation training of the ReAttach Affect Coaches twice a week for a period of eight weeks. All participants will receive patient video instructions of the self-regulation tools via Neurolog during the therapy period. The Affect Coach Online professionals have insights in these information videos to help them relate to the patient's understanding. We aim to select a group of ten professionals who should at least have a background as a psychologist or body-oriented psychotherapist experienced with patients with complex biopsychosocial conditions such as chronic pain, fibromyalgia, PTSD and FND. All attending professionals are blind for the scoring and there is an independent data gathering and analysis.

Duration

12–16 weeks (to capture pre-therapy baseline, therapy engagement, and short-term follow-up).

Data Capture via NeuroLog

NeuroLog will function as the digital measurement instrument, automatically capturing multi-dimensional metrics: (Table 1)

Quantitative Outcome Metrics

NeuroLog enables direct quantification of therapeutic change using aggregated and comparative statistics:

- **Mean Symptom Severity Reduction (ΔS):**
  Compare average symptom severity during baseline vs final two weeks post-therapy.
- **Emotional Intensity Change (ΔE):**
  Reduction in emotional amplitude (frustration, anxiety) over time.
- **Flare Frequency and Duration:**
  Percentage reduction in high-severity days (≥8/10) or recorded flare episodes.
- **Cascade Disruption Index:**
  Derived from emotion–symptom temporal correlations to measure how effectively ReAttach breaks the "frustration → anxiety → fatigue" loop.

Functional Stability Ratio (FSR):

Ratio of stable to unstable days — a proxy for self-regulation and resilience.

Each metric can be visualised longitudinally to demonstrate both group trends and individual response curves.

Qualitative Outcome Layer

Over 50% of NeuroLog entries include written notes. A mixed-methods approach can therefore be adopted:

Domain	Measure	Source in NeuroLog	Frequency
Symptom Severity	1–10 numeric severity score per symptom	Daily symptom log	Continuous
Emotional State	Emotion selection (frustrated, anxious, hopeful, etc.) + intensity	Emotional Thermostat module	Continuous
Trigger Exposure	Stress, fatigue, sensory load, etc.	Trigger fields	Continuous
Flare Events	Marked episodes of symptom escalation	Flare log	Event-based
Narrative Context	Patient-written notes	Free-text field (qualitative)	Continuous
Treatment Adherence	Therapy sessions, self-care interventions	Treatment tracker	Weekly

Table 1: Data capture via NeuroLog

- Thematic Analysis: Identify recurring reflections such as "feeling calmer," "less overwhelmed," or "able to control tremors."
- Sentiment Scoring: Convert qualitative reflections into emotional valence data to correlate with severity trends.

This combination provides both numerical and narrative evidence of therapeutic impact.

Analysis & Reporting

- Baseline Phase: 2 weeks prior to therapy
- Active Phase: Weeks 3–10 of ReAttach remote therapy sessions twice a week
- Post-Therapy Phase: 2–4 weeks of follow-up
- Data Export: CSV or JSON format for statistical analysis (R, SPSS, or Python)
- Report Outputs: Automated NeuroLog clinical report, aggregated dashboards, and anonymised data visualisations for publication.

The study is organized into several key phases to ensure a structured and data-driven approach to ReAttach remote therapy. The Baseline Phase, lasting two weeks prior to the start of therapy, focuses on collecting initial data to establish each participant's psychological, cognitive, and emotional starting point. This Baseline Phase provides a reference for measuring subsequent changes. The Active Phase spans Weeks 3 to 10, during which participants engage in ReAttach remote therapy sessions and personal counseling twice a week. This period represents the core intervention stage, where therapeutic outcomes and participant progress are closely monitored. Following the active treatment, the Post-Therapy Phase extends for 2 to 4 weeks, allowing for follow-up assessments to evaluate the persistence and stability of treatment effects over time. All collected data are then exported in CSV or JSON formats, enabling seamless integration with statistical software such as R, SPSS, or Python for in-depth quantitative analysis. Finally, the study produces automated NeuroLog clinical reports, aggregated dashboards, and anonymized data visualizations, ensuring both individual-level feedback for clinicians and high-quality, publication-ready insights for research dissemination.

Interpretation Framework

We will map the results against NeuroLog's dual-pathway model:

- Arousal-Mediated Type: Improvement marked by decreased anxiety and emotional volatility, which includes a reduction in the overall volume of negative emotional symptoms as logged and categorised in Neurolog, including but not limited to Anxious, Nervous, Panic, Scared, Overwhelmed and Uneasy.
- Depletion-Mediated Type: Improvement marked by reduced fatigue and better recovery between flares. This can be gauged by the reduction of the severity of logged symptoms under the cognitive and memory and autonomic categories of symptoms including but not limited to Difficulty Concentrating, Memory Problems, Brain Fog and Extreme Fatigue.

This allows ReAttach remote therapy outcomes to be interpreted by phenotype, aligning with Paula's existing theoretical model of ReAttach as a transdiagnostic intervention for adults and children with mental health problems [3].

Deliverables

Therapy Effectiveness Report

Statistical Summary

What NeuroLog Will Provide (for new participants):

- Pre/Post Symptom Severity: Track specific symptom severity changes across baseline, therapy, and post-therapy phases (1–10 scale).
- Flare Frequency Changes: Compare total flare counts before, during, and after ReAttach therapy.
- Emotional State Trends: Measure shifts in emotional patterns such as anxiety reduction and mood stabilization.
- Recovery Metrics: Assess post-flare recovery duration and quality as an indicator of growing resilience.

Technical Output:

- Aggregate statistics (means, standard deviations, and p-values for significance).
- Effect sizes (Cohen's d) for each outcome measure.
- Response rates (% of participants achieving clinically meaningful improvement).

Phenotype-Specific Insights:

Visual Comparisons

What NeuroLog Will Support in the new cohort:

- **Arousal-Mediated Cohort:** Participants with high baseline anxiety or emotional volatility; track improvement in regulation and stress recovery.
- **Depletion-Mediated Cohort:** Participants whose primary challenge is fatigue and reduced energy; monitor gains in stamina and recovery intervals.
- **Comparative Charts:** Display side-by-side response curves illustrating differential treatment effects between phenotypes.

Technical Capability:

- Built-in emotion classification (positive, neutral, negative).
- Symptom frequency tracking at the individual and group level.
- Time-series trend visualization for longitudinal comparison.

Publication-Ready Dataset De-identified (New Data Only)

NeuroLog Infrastructure Includes:

- Fully anonymized data pipeline with separately stored demographic variables.
- CSV export function for new study datasets.
- Aggregate views for summary statistics.
- Consent tracking and withdrawal management compliant with GDPR.

What Will Be Exported:

- De-identified symptom logs, emotions, triggers, and flare episodes collected prospectively.
- Anonymized demographic fields (age band, gender, diagnosis duration, region).
- Derived treatment response metrics without personal identifiers.

Standardised Digital Protocol – Replicable Framework for Future Trials

NeuroLog Provides a Template For:

- **Daily tracking protocols:** Defined symptom categories with 1–10 severity scales.
- **Flare documentation:** Standardized fields for triggers, duration, severity, and recovery.
- **Emotion measurement:** Consistent emotion categories with sentiment classification.
- **Adaptive questioning:** Dynamic follow-up items driven by symptom patterns.

Summary

NeuroLog provides a continuous, patient-led data infrastructure to objectively measure the impact of ReAttach remote therapy

It transforms subjective progress into quantifiable change through:

- Real-world symptom tracking
- Emotional and behavioral analytics
- Automated longitudinal comparisons
- Integration of qualitative patient voice

Together, these create a scientifically robust yet human-centred evidence base for the therapeutic value of ReAttach in Functional Neurological Disorder.

NeuroLog serves as an advanced, patient-driven data infrastructure designed to assess the effectiveness of ReAttach remote therapy objectively. It converts subjective experiences of progress into measurable, data-backed insights by continuously tracking real-world symptoms and analyzing emotional and behavioral patterns over time. Through automated longitudinal comparisons, NeuroLog identifies meaningful trends and changes across therapy sessions, providing a dynamic view of each patient's therapeutic journey. Additionally, by integrating the qualitative "patient voice," the evaluation process ensures that personal experiences and perceptions remain central. Altogether, this approach establishes a scientifically rigorous yet compassionate evidence framework that captures both the measurable and human aspects of ReAttach therapy's impact on individuals with FND.

Declaration of interest

Dr. Paula Zeestraten-Bartholomeus is the developer of ReAttach.

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