

nitive symptoms, thereby maintaining or improving HRQoL. Qualitative analyses will be performed to allow successful implementation into clinical practice.

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### Neural cortical activation during upright posture in people with Multiple Sclerosis: a cross-sectional fNIRS study

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**Background and purpose:** Balance impairments are common in people with Multiple Sclerosis (PwMS). However, no studies have examined brain activation while performing balance tasks in PwMS.

The present study aims to investigate hemodynamic response function (HRF) between Healthy Subjects (HS) and PwMS during the execution of balance tasks on a stabilometric platform using functional near-infrared spectroscopy (fNIRS).

**Methods:** We recruited 18 PwMS with mean±standard deviation age of 42.1±10.6 years and Expanded Disability Status Scale (EDSS) of 2.0±1 points, and 18 age- and gender-matched HS aged 37.3±9.7 years. Participants underwent fNIRS recordings while maintaining upright standing on a foam with eyes open (EO) and closed (EC) for 30 seconds. We investigated frontal, occipital, and temporal cortices using the NIRScoutX system to measure oxy- and deoxyhemoglobin levels for 44 measurement channels. We concurrently measured the Area of the centre of pressure. We used a t-test to compare between-group differences on Area (Platform variable), while we ran a linear mixed model (Area, channel, and group) to fit HRF changes between EO and EC conditions.

**Results:** We observed statistically significant between-group differences in Area in EO (p=0.04) and EC condition (p=0.02). Group means (standard error) adjusted for Area and multiple comparisons denotes statistically significant differences in 3 active channels (Broadman Area 21): right temporal (Channel 1, HS:1.41(0.23) uM; PwMS:0.41(0.26) uM) and left temporal (Channel 2, HS:1.47(0.23) uM; PwMS:0.30(0.25) uM; Channel 3, HS:1.76(0.23) uM; PwMS:0.98(0.26) uM). We did not observe differences in the other cortical areas.

**Discussion:** As expected, balance control is impaired in PwMS on foam with EC. The current study adds to the literature that the increase in HRF observed in EC condition in HS is reduced in PwMS. This reduction occurs explicitly symmetrically in the right and left temporal cortices.

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### Low Referral Rates for Pelvic Floor Physical Therapy in MS Patients with Bladder Dysfunction: An Opportunity to Close the Gap

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**Background and Purpose:** Approximately 80% of people with multiple sclerosis (MS) experience bladder dysfunction (BD). BD decreases quality of life, reduces mobility, and increases disease burden. Pelvic floor

physical therapy (PFPT) is an evidence-based, non-invasive, and effective treatment for MS-related BD. Here, we provide a descriptive study, leveraging longitudinally collected patient-reported (PRO) BD severity scores against coinciding electronic health record (EHR) reports, to understand barriers to timely evaluation and treatment of BD.

**Methods:** The FITriMS study is a prospective cohort of ambulatory participants with progressive or relapsing MS, which included PROs of BD at baseline, 6-months, and 1-year. This analysis compared BD PRO (with Bladder Control Scores  $\geq 1$ ) to evaluations performed by a neurologist on the same participants concurrently. Chart review categorized the clinical treatment plan.

**Results:** 74% (65/88) of participants met inclusion criteria. They were mostly female (57%), mean age 53.5 years (11.8), median disease duration 19 years (range 1-54), and moderate disability (median EDSS 5.5, range 0-6.5). At baseline, 88% of participants reported BD on their PRO, but only 30% had some treatment documented in the EHR: 44% referred Urology, 50% prescribed medication, 6% provided behavioral techniques. At 6-months, 90% of participants reported BD on their PRO, 38% EHR documented treatment (43% referred Urology, 29% prescribed medication, 28% behavioral techniques); the distribution was similar at the 1-year. 93% of participants reported BD; 33% had treatment plans in the EHR (36% prescribed medication, 36% referred Urology, and 28% behavioral techniques). 0% had a documented referral for PFPT.

**Discussion:** A gap was found between participant reports of BD on PROs and those referred for treatment. No direct PFPT referrals were documented, despite it being an evidenced-based, effective treatment. Quality improvement and education efforts for timely PFPT referrals can potentially improve patient care and close this gap.

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### Multimodal Exercise Training to Reduce Frailty in People with Multiple Sclerosis: Study Protocol for a Pilot Randomized Controlled Trial

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**Background and Purpose:** Frailty, a syndrome characterized by decreased reserve and resistance to stressors across multiple physiologic systems, is highly prevalent in people living with multiple sclerosis (MS), independent of age or disability level. Frailty in MS is strongly associated with adverse clinical outcomes, such as falls, and may aggravate MS-related symptoms. Consequently, there is a pressing necessity to explore and evaluate strategies to reduce frailty levels in people with MS. The purpose of this pilot randomized controlled trial (RCT) will be to examine the feasibility and preliminary efficacy of a multimodal exercise training program to reduce frailty in people with MS.

**Methods:** A total of 24 participants will be randomly assigned to six weeks of multimodal exercise or to a waitlist control group with a 1:1

allocation. People with MS aged 40-65 years and living with frailty will be eligible. The multimodal exercise program will consist of cognitive-motor rehabilitation (i.e., virtual reality treadmill training) combined with progressive, evidence-based resistance training. At baseline and postintervention, participants will complete the Evaluative Frailty Index for Physical Activity (EFIP), measures of fall risk, and quality of life. Frailty-related biomarkers will also be assessed. In addition, the feasibility of the multimodal exercise program will be systematically and multidimensionally evaluated.

**Results:** Not applicable.

**Discussion:** To date, no RCT has yet been conducted to evaluate whether targeted exercise interventions can minimize frailty in MS. The current study will provide novel data on the feasibility and preliminary efficacy of multimodal exercise training as a strategy for counteracting frailty in pwMS.

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