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Submission ID: 4; Submission Group: Other; Submitter: Jan Holmberg

MS Nurse in Finnish Healthcare: Competencies, Job Description, and Future Development Needs

Holmberg Jan[1], Salakari Minna, PhD, RN[2]
[1]Master of Health Care, RN, Board Member of the Finnish MS Nurses' Association, [2]Chairman of the Finnish MS Nurses' Association

Background and Purpose: Multiple Sclerosis (MS) nurses specialize in caring for neurological patients. Nurses have a versatile and purposeful role in caring for MS patients and their relatives.
This study aimed to explore the role of MS nurses in the Finnish healthcare system, focusing on their clinical work and identifying future development needs. The work of MS nurses has not been described similarly in Finnish studies before.
Methods: The research combined quantitative and qualitative methods, implementing a survey (n=28) and thematic interviews (n=5) for nurses working in outpatient clinical nursing. The research hypotheses were:
H1: The clinical nursing work of an MS nurse is characterized by an independent job description, versatile skills, and cooperation.
H2: MS nurse's work experience positively correlates with MS nursing skills.
Results: The findings indicate that MS nurses master the basics of clinical nursing and make independent decisions in their work. The work requires extensive nursing expertise and a multi-professional approach. MS nursing is a versatile, demanding, and special skill-requiring part of neurological nursing.
According to the survey and interview results, an MS nurse's job requires extensive knowledge, strong interaction skills, and the ability to adapt to the developing field of technology and care. MS nursing emphasizes the need for continuous professional development and multi-professional cooperation. Work experience is positively correlated with self-assessed competence.
The skill-based job description of the outpatient MS nurse and the six areas of competence were drawn up based on the results: 1. MS nursing and medical treatment, 2. patient guidance and support, 3. work organization and coordination, 4. use of electronic information systems and documenting, 5. teamwork and multi-professionalism, and 6. further education and lifelong learning.
Conclusions: The work of MS nurses is versatile and requires a wide range of skills. The MS nurse is in a key position in the holistic care of patients and acts as a nursing expert.
Based on the results, future development needs to emphasize work organization, strengthening the MS nurse's expert status, and more efficient utilization of technology.

Submission ID: 5; Submission Group: Technology Supported Rehabilitation; Submitter: Teresa L'Abbate

Fatigue relief in multiple sclerosis by personalized neuromodulation: a multicentre pilot study [FaremusGE]

Franca Tecchio[#1], Massimo Bertoli*[1,2], Elvira Sbragia*[4], Teresa L'Abbate[1,3], Silvia Stara[4], Pierpaolo Croce[2], Arianna Pizzichino[5], Andrea Cancelli[1], Karolina Armonaite[3], Federico Cecconi[1], Luca Paulon[1], Matilde Inglese[4,6]
*[1]Laboratory of Electrophysiology for Translational neuroScience (LET'S), Istituto di Scienze e Tecnologie della Cognizione (ISTC), Consiglio Nazionale delle Ricerche (CNR), Rome, Italy, [2]Department of Neuroscience, Imaging and Clinical Sciences, University 'G. D'Annunzio' of Chieti-Pescara, Chieti, Italy, [3]International Telematics Uninettuno University, Rome, Italy, [4]Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health, and Center of Excellence for Biomedical Research, University of Genoa, Genoa, Italy, [5]Neuroscience and Imaging, Fatebenefratelli Hospital, Isola Tiberina, Rome, Italy, [6]Ospedale Policlinico San Martino – IRCCS, Genoa, Italy, *These Authors contributed equally*

Background: A recent application of the GRADE guidelines indicated Faremus, a 5-day neuromodulation for 15 minutes per day via transcranial direct current stimulation (tDCS), as medium to highly recommendable for alleviating fatigue in multiple sclerosis (MS) .
Methods: With this pilot study we aimed to evaluate the feasibility, acceptance, safety and effectiveness of the Faremus treatment carried out in a multicentre context. The Rome unit prepared the intervention, supplied the personalized electrodes to the San Martino Hospital in Geneva, where the neurological team enrolled the population of fatigued people with multiple sclerosis (PwMS) and carried out the treatment.
Results: All 17 enrolled patients completed treatment, reporting optimal acceptance and safety when using Faremus in the multicentre setting. The team involved, including neurologists, neurophysiopathology technicians, engineers, physicists and psychologists expressed high appreciation (average score 8 out of 10). The treatment improved fatigue symptoms by an average of 27%, to levels comparable with previous studies. Unexpectedly, depressive symptoms improved by an average of 38%.
Conclusions: The Faremus personalized electroceutical intervention, a 5-day anodal tDCS over bilateral whole-body somatosensory cortex with occipital cathode, is well accepted and can be applied feasibly, safely and effectively in a multicentre setting, offering a reliable tool to relieve fatigue-related symptoms, thus supporting the quality of life of fatigued people with MS. The present study lays a

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starting point for the involvement of multiple MS units nationwide in offering therapeutic enrichment for their fatigued patients.
Keywords: Non-invasive brain stimulation (NIBS), transcranial electric stimulation (tES), neuromodulation, personalization, depression.

Submission ID: 6; Submission Group: Other; Submitter: Isaline Eijssen

Occupational Therapy for Multiple Sclerosis: Overcoming Barriers to Implementing Best Practices

Isaline Eijssen[1]*, Ashley Boers[2], Geertruida Bekkering[3], Marja Koen[4], Jenny Freeman[5], Ciara O'Meara[6], Leen de Coninck[7], Sinéad M. Hynes[8], Daphne Kos[9]
[1]Amsterdam UMC, Rehabilitation Medicine, MS Center Amsterdam; Research Institutes Amsterdam Neuroscience, Amsterdam Movement Sciences, Amsterdam Public Health, Amsterdam, [2]KU Leuven, Department of Rehabilitation Sciences - Occupational Therapy, Leuven, [3]Belgian Centre for Evidence-Based Medicine, Cochrane Belgium, Leuven, Belgium. Academic Centre for General Practice, Department of Public Health and Primary Care, KU Leuven, Leuven, [4]MS Telefoon, MS Vereniging Nederland (MS Association of the Netherlands), [5]Faculty of Health and Human Sciences, School of Health Professions, University of Plymouth, Peninsula Allied Health Centre, Plymouth, [6]School of Nursing and Midwifery, University of Galway, Galway, [7]KU Leuven, Department of Rehabilitation Sciences, Leuven; Working Group Development of Primary Care Guidelines (WOREL), Antwerp, [8]Discipline of Occupational Therapy, School of Health Sciences, University of Galway, Galway, [9]KU Leuven, Department of Rehabilitation Sciences; National MS Center Melsbroek

Background: To facilitate successful implementation of evidence into occupational therapy (OT) clinical practice, it is important to assess the facilitators and barriers for this process.
Objective: To identify key determinants for implementing occupational therapy evidence into multiple sclerosis practice.
Method: Through an explorative literature review in five databases (Pubmed, Cinahl, Embase, Eric, OTDbase) and a clinician survey, barriers and facilitators related to the implementation of OT evidence, specific to MS are explored, and strategies to transform barriers into facilitators are outlined.
Results: Of 303 screened titles, none explored implementing evidence specifically for OT in multiple sclerosis. Instead, we selected indirect evidence, implementing evidence on OT for any indication. When looking at the broader focus on using OT evidence in general practice, we found relevant indirect evidence (n=11), which is categorized in barriers and facilitators related to innovation, individual professional, patient, social context, organizational context, and economic and political context. Subsequently, a survey was developed based on the identified barriers and facilitators and on existing questionnaires [Evidence Based Practice Questionnaire and short version of Evidence-based Practice Implementation Scales (competencies, beliefs, attitudes- organisations, implementation, self-efficacy)]. The survey was launched in Spring 2024 among occupational therapists working with people with MS. This survey will contextualize the findings of the explorative review to the OT practice with people with MS and allows for prioritizing important implementation determinants and selecting pertinent strategies to address these through a newly developed implementation plan.
Conclusion: This study represents a first step in the implementation plan, striving for the empowerment of occupational therapists to enhance their knowledge and align their practices with evidence-based interventions, strategically bridging the gap between research findings and practical, real-world application of effective and impactful approaches in occupational therapy settings for individuals with multiple sclerosis.
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Submission ID: 7; Submission Group: Outcome Measures; Submitter: Felipe Balistieri Santinelli

Prevalence and magnitude of distance walking fatigability in people with multiple sclerosis

Felipe Balistieri Santinelli (main author)[1,2], Zuhal Abasıyanık[1,2,3], Ulrik Dalgas[4], Serkan Ozakbas[5], Deborah Severijns[1,2,6], Benoit Gebara[7], Heigo Maamägi[8], Anders Romberg[9], Kamila Řasová[10], Carme Santoyo-Medina[11,12], Cintia Ramari[1,2], Carmela Leone[13], Peter Feys[1,2]
[1]REVAL Rehabilitation Research Center, Faculty of Rehabilitation Sciences, Hasselt University, Hasselt, Belgium, [2]UMSC, Hasselt/Pelt, Belgium, [3]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Turkey, [4]Exercise Biology, Department of Public Health, Aarhus University, Denmark, [5]Izmir University of Economics, Medical Point Hospital, Izmir, Turkey, [6]Noorderhart Rehabilitation and MS Center, Pelt, Belgium, [7]Be Fit-Be Zen, Waterloo, Belgium, [8]Neurology Clinic, West-Tallinn Central Hospital, Tallinn, Estonia, [9]Masku Neurological Rehabilitation Centre, Masku, Finland, [10]Department of rehabilitation, Third Faculty of Medicine, Charles University, Prague, Czech Republic, [11]Neurology-Neuroimmunology Department & Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia, Vall d'Hebron University Hospital, Barcelona, Spain, [12]Department of Physiotherapy, Faculty of Medicine and Health Sciences, Universitat Internacional de Catalunya, Sant Cugat del Vallès, Barcelona, Spain., [13]Department of Neurology, "R. Guzzardi" Hospital –ASP Ragusa, Via Papa Giovanni XXIII, Vittoria (Ragusa), Italy

Introduction: Distance walking fatigability (DWF) is a common motor impairment among people with multiple sclerosis (pwMS). It is characterized by a 10% decline in the distance walked during the last minute of the 6-minute walking test (6MWT) compared to the first minute. Despite this known motor impairment, there is still a need for a deeper understanding of the prevalence and extent of DWF in pwMS.
Objective: To investigate the magnitude and prevalence of DWF in pwMS.
Methods: Two-hundred and two pwMS (EDSS: 4 [0-6.5]) performed the timed 25-foot walking test (T25FW) and; the 6MWT as fast and safe as possible. Minute-by-minute distance walked

was recorded. The distance walked index (DWI) of every minute was calculated in order to investigate the magnitude of change. Frequency analysis was performed to identify the prevalence overall but also for MS phenotype (Relapsing remitting-RR, primary- PP and secondary- SP progressive), EDSS (0-2.5, 3-4, 4.5-5.5, 6 and 6.5), and T25FW benchmarks (<6 seconds, 6-7.99 seconds, and ⩾8 seconds). The $DWI_{6\text{-}1}$ of ⩽-10% was used to define the presence of DWF or non-DWF (NDWF).

Results: DWF was present in 43.5% of pwMS with a magnitude of -23.2% (DWF) and -0.7% (NWDF). In accord to EDSS, DWF was found in 22.2% (0-2.5, $DWI_{6\text{-}1}$=14.8%), 40.5% (3-4, $DWI_{6\text{-}1}$=-17.1%), 63.4% (4.5-5.5, $DWI_{6\text{-}1}$=-22.9%), 49.1% (6, $DWI_{6\text{-}1}$=-26.4%) and 60% (6.5, $DWI_{6\text{-}1}$=-34.4%) pwMS. The prevalence of DWF was found in 34.9% (RR, $DWI_{6\text{-}1}$=-16.4%), 48.5% (SP, $DWI_{6\text{-}1}$=-27.4%), and 63.4% (PP, $DWI_{6\text{-}1}$=-29.3%). For the T25FW benchmarks, DWF was present in 31.9% (<6s, $DWI_{6\text{-}1}$=-15.3%), 47% (6-7.99s, $DWI_{6\text{-}1}$=-21.7%) and 60.7% (>8s, $DWI_{6\text{-}1}$=-31.2%).

Conclusion: DWF is a motor impairment with a high prevalence in overall pwMS. The prevalence and severity of DWF increase with disability, progressive phenotypes, and slower walking speeds. DWF measurement can be incorporated into clinical practice as it can aid in detecting early progression in pwMS.

Submission ID: 8; Submission Group: Outcome Measures; Submitter: Teresa L'Abbate

Functional balance at rest of hemispheric homologs in healthy volunteers and people with multiple sclerosis

Armonaite K[1], Bertoli M.[1-2*], Bini F.[4], Bruni V.[5-6], Cancelli A.[2], Cecconi F.[2], Conti L.[1-7], Cottone C.[2], Gianni E.[2], Grifoni J.[1-2], L'Abbate T.[1-2], Marinozzi F.[4], Pagliara MR.[2-4*], Pascarella A.[5*], Pasqualetti P.[8], Paulon L.[2-9], Porcaro C.[2-10-11], Porziani S.[2-4], Tataranni A.[2-4], Unicini A.[3], Vitulano D.[6], Zappasodi F.[3], Tecchio F.[2*]

[1]Faculty of Engineering and Psychology, International telematics university Uninettuno, Rome, Italy, [2]Laboratory of Electrophysiology for Translational neuroScience and Laboratory for Agent Based Social Simulation, Institute of Cognitive Sciences and Technologies, National Research Council of Italy, Rome, Italy, [3]Department of Neuroscience, Imaging and Clinical Sciences, University 'G. D'Annunzio' of Chieti-Pescara, 66100 Chieti, Italy, [4]Department of Mechanical and Aerospace Engineering, "Sapienza" University of Rome, 00185 Rome, Italy, [5]Istituto per le Applicazioni del Calcolo 'Mauro Picone', National Research Council of Italy, Rome, Italy, [6]Department of Basic and Applied Science for Engineering (SBAI), University of Rome 'Sapienza', Rome, Italy, [7]Istituto Nazionale di Fisica Nucleare, Sezione Roma Tor Vergata, 00133 Rome, Italy, [8]Department of Public Health and Infectious Diseases, Sapienza University of Rome, 00185 Rome, Italy, [9]Engineer Freelance, 00159 Rome, Italy, [10]Department of Neuroscience and Padova Neuroscience Center, University of Padua, Padua, Italy, [11]Centre for Human Brain Health and School of Psychology, University of Birmingham, Birmingham, United Kingdom,

[*]These authors are the first and last authors of the three papers that are compacted into this abstract., The list of authors is written in alphabetical order unless the last author of the three papers.

First, we will examine the concept of homology between dominant and non-dominant hemi-bodies, focusing on corticospinal tracts (CSTs) assessed by transcranial magnetic stimulation (TMS) to evoke resting state motor potentials (MEPs) in healthy volunteers (HV) and people with multiple sclerosis (PwMS). Furthermore, using the concept of resting state as an expression of the functional abilities of brain districts, we further investigate the functional homology of resting state by quantifying the similarity of temporal neurodynamic patterns of the right and left somatosensory areas of the hands (S1). All this to provide new measures of balance between homologous cortical areas of the hemisphere.

For CST homology, Fréchet distance between MEP morphologies in left and right muscles was measured in 40 HV and 10 tired PwMS before and after Faremus, a 5-day neuromodulation procedure against fatigue. Inter-sided similarity was assessed using normalized compression distance (NCD) between left and right S1 neurodynamics derived from magnetoencephalography (MEG) equipped with functional source separation (FSS). We hypothesized greater inter-lateral similarity than intra-lateral similarity.

The results confirmed our working hypothesis. With a smaller distance between sides than within Fréchet in the HV, Faremus changed physiological direction in the CST homology. The interhemispheric morphology increased with the prevalence of the right. In the somatosensory study, NCD evaluation verified the function hypothesis, and functional homology showed greater variability in older individuals.

Our findings confirm the significance of inter-lateral balanced homologous districts in learning processes, introducing a novel measure of circuit recruitment patterning.

The present exploration sheds light on how to measure the balance between homologous hemi-lateral structures, relevant for learning processes, by introducing measures of circuit recruitment patterning either via TMS or E/MEG. These tools allow an understanding of the origin of conditions where impaired neurodynamics occur, like fatigue, and the intervention mechanisms of personalized therapy.

Pagliara MR, Cecconi F, Pasqualetti P, Bertoli M, Armonaite K, Gianni E, Grifoni J, L'Abbate T, Marinozzi F, Conti L, Paulon L, Uncini A, Zappasodi F, Tecchio F. On the Homology of the Dominant and Non-Dominant Corticospinal Tracts: A Novel Neurophysiological Assessment. Brain Sci. 2023 Feb 7;13(2):278. doi: 10.3390/brainsci13020278. PMID: 36831821; PMCID: PMC9954672.

Bertoli M, Tataranni A, Porziani S, Pasqualetti P, Gianni E, Grifoni J, L'Abbate T, Armonaite K, Conti L, Cancelli A, Cottone C, Marinozzi F, Bini F, Cecconi F, Tecchio F. Effects on Corticospinal Tract Homology of Faremus Personalized Neuromodulation Relieving Fatigue in Multiple Sclerosis: A Proof-of-Concept Study. Brain Sci. 2023 Mar 29;13(4):574. doi: 10.3390/brainsci13040574. PMID: 37190539; PMCID: PMC10136421.

Annalisa Pascarella, Vittoria Bruni, Karolina Armonaite, Camillo Porcaro, Livio Conti, Federico Cecconi, Luca Pulon, Domenico Vitulano, Franca Tecchio; Functional balance at rest of hemispheric homologs assessed via normalized compression distance; Front. Neurosci., 25 January 2024 Sec. Neuroprosthetics Volume 17 - 2023 |

Submission ID: 10; Submission Group: Rehabilitation Effectiveness; Submitter: Mildred Tan

Communication Interventions for Individuals with Multiple Sclerosis. What is out there? Towards empowerment and inclusivity of Individuals with Multiple Sclerosis and their care partners

Mildred Tan[1], Hans Bogaardt[2], Stacie Attrill[2]
[1]University of Adelaide, Singapore, [2]University of Adelaide, Australia

Background: Persons with MS (PwMS) can often experience communication impairments pertaining to speech, voice and language. These PwMS are at risk of being unable to adequately function and participate in their everyday life roles, with detrimental consequences to their psychosocial and emotional wellbeing. There is thus a necessity for evidence-based communication interventions and research for quality management.
Objectives: To explore and collate current rehabilitative solutions pertaining to communication dysfunctions for PwMS at all stages of disease condition via published clinical studies pertaining to prevalent communication constructs of speech, voice and language over the last 20 years at all stages of the disease process, necessary for timely and appropriate management.
Methods: Resources were sourced from biomedical databases. Unpublished studies and grey literature were included and screened using Covidence. Sources were searched from 2003 to 2023 (20 years) specifically for communication interventions for PwMS. The quality appraisal and reporting of the evidence from the studies were evaluated using the National Service Framework Typology of Evidence as well as via literature guiding evidence-based practice and with guidelines from Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA).
Results: The search yielded 124 publications after removal of duplicate. From these publications selected for screening 10 satisfied the eligibility criteria. These included 10 full text publications, comprising of 2 randomised controlled trials (RCTs) and 5 controlled clinical trials and 3 case studies.
Conclusion: Current potential communication intervention models present with suggestive evidence with more robust intervention and trials needed. Language interventions are underexplored and requires further investigations to what is currently known.
Keywords: Multiple Sclerosis, Communication Interventions, Communication Impairments, Ecological Validity.

Submission ID: 11; Submission Group: Outcome Measures; Submitter: Mildred Tan

Rate of word finding difficulties in MS as an isolated language problem and association with cognition, fatigue, disability and depression

Mildred Tan[1], Hans Bogaardt[2], Stacie Attrill[2], Mark Gudesblatt[2]
[1]University of Adelaide, Singapore, [2]University of Adelaide, Australia

Background: Persons with MS (PwMS) can often experience language-impairments that can have a major impact upon the **quality of life**, perceptions of health as well as upon the efficiency of rehabilitation. PwMS often reported word-finding difficulties even in the early stages. In literature, language weaknesses involving acquisition and word retrieval are mainly attributed to cognitive impairment (CI).
Objectives: To determine the associations between CI, fatigue, disability (EDSS), and depression word-finding difficulties (WFD) using a standardised naming task as part of a computerised cognitive assessment battery (CAB) (NeuroTrax©) with age- and education-adjusted cognitive domain scores.
Methods: 586 PwMS (137 males and 449 females, mean age 47.1 (SD+10.34) with a median EDSS-score of 2.0 (var=2.0) completed the CAB and the Fatigue Severity Score and Beck Depression Inventory. The rate of CI was 43% in all PwMS. On the naming test, a score of 85 (i.e. 100 – 1 SD) was considered an abnormal score.
Results: The average score for naming in the CI group was 83.9 (SD±24.2) compared to 100.6 (SD±13.2) in the group without CI ($p<.001$). In the CI group, 41% of PwMS had an abnormal score on the naming task, whereas, in the non-CI group, 14% scored abnormal ($p<.001$). No correlation between naming scores and disease duration, EDSS-score, fatigue scores and depression scores were found in both groups.
Conclusion: PwMS presenting with WFD might also have CI. The higher rates of WFD in PwMS with CI drives a need for greater awareness in management and therapy for inclusion and empowerment. A large group of PwMS without CI (14%) has WFD. No correlation with EDSS status, fatigue or depression scores was found. Results suggest that WFD may occur as an isolated language disturbance in PwMS.
Keywords: Multiple Sclerosis, Wordfinding Difficulties, Cognitive Impairment, Speech Pathology

Submission ID: 13; Submission Group: Other; Submitter: Johanna Bylinder

Feasibility and experiences of the train-the-trainer program for group leaders in the randomized controlled trial "Fewer Falls in MS"

Johanna Bylinder, Charlotte Ytterberg, Marie Kirkegaard, Maria Flink, Kristina Gottberg, Susanna Tuvemo Johnson
Department of Neurobiology, Care Sciences and Society, Sweden

Introduction: Falls in multiple sclerosis (MS) are common and have multifactorial causes. Thus, people with MS need self-management skills to reduce their fall risks. We have developed a group-based digital self-management intervention to be delivered by health-care professionals as group leaders. To ensure intervention fidelity, a train-the-trainer program (TTT-P) was created by researchers experienced in MS, fall prevention and educational science.
Aim: To evaluate feasibility and explore experiences of the TTT-P.
Methods: The TTT-P includes eight educational modules covering topics regarding MS, fall prevention and behavioral change presented in various didactic forms. The initial seven modules are designed for self-paced, asynchronous completion, while the eighth module is conducted as a roleplay in real-time through the Zoom platform. Seven group leaders (four physiotherapists, one

occupational therapist and two social workers) participated in the TTT-P during February 2024. A mixed-method design was employed. Data on self-reported knowledge, technical skills, self-confidence and readiness was collected before and after the TTT-P by structured questionnaires. Semi-structured interviews were performed within one week after completion of the TTT-P.
Results: Preliminary findings indicate that the TTT-P is feasible and supports knowledge, technical skills, and self-confidence in the group leaders. The TTT-P was experienced as easy to follow, appealing regarding the variation in didactic forms and components. Roleplay, including practice with other group leaders and feedback, was of great importance in supporting learning and to increase readiness to be a group leader in Fewer Falls.
Conclusion: This study has highlighted the strengths of the TTT-P, showing that it helps to increase knowledge and confidence for healthcare professionals with various levels of experience in MS, digital group facilitation, and fall prevention. The TTT-P seems to efficiently prepare group leaders to lead a fall prevention intervention.

Submission ID: 14; Submission Group: Other; Submitter: Alon Kalron

Acute effects of eccentric training on the cytokine response in people with multiple sclerosis

Yasmin Alt[1], Monique Wochatz[2,3], Anne Schraplau[2], Tilman Engel[2], Michael Gurevich[4], Shay Menascu[4], Frank Mayer[2], Alon Kalron[1,4]
[1]Department of Physical Therapy, School of Health Professions, Faculty of Medicine and Health Sciences, Tel-Aviv University, Tel-Aviv, Israel, [2]University of Potsdam, University Outpatient Clinic, Sports Medicine and Sports Orthopaedics, Potsdam, Germany, [3]Division of Therapy Science and Physiotherapy, University of Applied Sciences for Sports and Management Potsdam, Potsdam, Germany, [4]Multiple Sclerosis Center, Sheba Medical Center, Tel-Hashomer, Israel

Background: Eccentric muscle contractions elicit distinct physiological responses, including modulation of the cytokine profile. Although relevant for rehabilitation, the effect of eccentric muscle training on the immune system has never been investigated in people with multiple sclerosis (pwMS).
Objective: Examine the acute cytokine response of IL-4, IL-6, IL-10, IL-17a, INF-γ, and TNF-α following an eccentric training session with pwMS. Furthermore, to examine the relationship between the cytokine values at rest and the clinical measures of mobility and lower limb functional strength.
Methods: The first session included blood sampling for baseline cytokine measures. Subsequently, the participant completed a battery of clinical assessments related to mobility and lower limb strength, i.e., the Timed-Up-and-Go Test (TUG), Five-Repetition-Sit-to-Stand-Test (5STS), Four-Square-Step-Test (FSST); Two-Minute-Walk-Test (2MWT). The second session included the eccentric exercise training, followed by a second blood sampling to assess the acute cytokine response to the eccentric training bout. This session comprised ten exercises concentrating on the strength of the trunk and lower extremities.
Results: Twenty-seven pwMS participated in the study, with a mean age of 40.1 (SD=8.8) years, 13 women, and a median EDSS score of 2.5. The 5STS test was significantly associated with three (out of six) cytokine values. The 5STS explained 30.3% of the variance associated with IFN-γ (R^2=0.304), 14.8% of the variance associated with IL-4 (R^2=0.148), and 13.8% of the variance associated with IL-10 (R^2=0.138). The TUG was significantly associated with the TNFα, explaining 23.3% of the variance (R^2=0.233) and associated with IL-10 (in addition to the 5STS). No significant difference was demonstrated in the cytokine concentration values between baseline and immediately after the eccentric training session.
Conclusions: An eccentric training bout does not impact cytokine concentration in the blood and, consequently, does not boost a pro-inflammatory response, thus, it can be performed on pwMS in a rehabilitation setting.
Keywords: multiple sclerosis, cytokine response, eccentric training, muscle strength

Submission ID: 15; Submission Group: Technology Supported Rehabilitation; Submitter: Barbora Grosserová

The effect of individual telerehabilitation on postural stability in people with multiple sclerosis, a pilot study

Barbora Grosserová[1], Klara Novotna[1,2], Dana Horakova1, Marketa Janatova[3,4]
[1]Department of Neurology and Center of Clinical Neuroscience, First Faculty of Medicine, Charles University and General University Hospital in Prague, Czech Republic, [2]Department of Rehabilitation Medicine, First Faculty of Medicine and General University Hospital in Prague, Czech Republic, [3]Spin-off Application Centre, The First Faculty of Medicine, Charles University in Prague, [4]Czech Technical University in Prague, Czech Republic

Background: The aim of our pilot study was to assess the feasibility and effectiveness of individual balance telerehabilitation for people with multiple sclerosis (MS).
Methods: In this pilot study 20 individuals with MS with balance impairment were included (10 in experimental, 10 in control group). The experimental group underwent 12 weeks of individual telerehabilitation (with direct synchronous contact between the physiotherapist and the patient). The control group received conventional outpatient physiotherapy. The standardized tests of balance and functional mobility were assessed at baseline and after intervention.
Results: Comparing the two groups, the experimental group achieved statistically significant improvement in balance: the BBS test (p=0.002), TUG (p=0.048), functional test standing on one leg (p=0.01), and subjectively perceived balance with the ABC Scale questionnaire (p=0.041). The substantive significance (Cohen's d) when comparing the two groups reached a large effect size in the BBS (d=0.83) and standing on one leg (d=1.06) and in the MSWS-12 (d=0.78) and ABC Scale questionnaire (d=0.78).
Conclusion: Telerehabilitation interventions represent an increasing trend and our data suggest that individually delivered online telerehabilitation can be effective in the treatment of balance and functional mobility disorders in MS.
Key words: Multiple sclerosis, balance, postural stability, rehabilitation, telerehabilitation

Submission ID: 16; Submission Group: Rehabilitation Effectiveness; Submitter: Phuong Linh Dang

Transdiagnostic Psychological Treatments For Depression And Anxiety In Multiple Sclerosis: A Systematic Review And Meta-Analysis

Dang PL[1], Krug I[2], Pourliakas A[1], Kiropoulos L[1]
*[1]Mood and Anxiety Disorders Lab, Melbourne School of Psychological Sciences, [2]Eating Disorder Lab, Melbourne School of Psychological Sciences, *main author*

Depression and anxiety are highly prevalent in individuals with multiple sclerosis (MS). The co-existence of depression and anxiety in MS populations has been associated with adverse psychosocial outcomes, including social and cognitive dysfunction, increased disability, reduced treatment adherence and quality of life, and increased suicidal ideation. Although transdiagnostic interventions targeting depression and anxiety have been demonstrated to be effective for the general population, their efficacy remains unclear in people living with MS. The current meta-analysis evaluated the effects of transdiagnostic psychological treatments for depression and anxiety, as well as personality and cognitive processes underlying depression and anxiety in individuals with MS. Across 39 studies, large uncontrolled effects (pre- to post-treatment) were found for depression and anxiety (g = .89 and .87 respectively). Uncontrolled effect sizes were stable at follow-up. Results from 31 eligible RCTs suggested that transdiagnostic treatments outperformed control conditions for depression and anxiety, with the smallest differences found comparing transdiagnostic treatments to active control conditions in reducing depression and anxiety symptoms. Examination of the high heterogeneity across studies showed that there was a significant difference favouring clinician-guided compared to self-managed interventions for depression, but not anxiety. Neither treatment type (CBT versus mindfulness-/acceptance-based) nor treatment delivery format (individual versus group-based) influenced outcomes for anxiety or depression. An examination of interventions targeting common personality and cognitive processes underlying depression and anxiety suggests preliminary effectiveness of process-based interventions in reducing anxiety sensitivity, intolerance of uncertainty, rumination, pain catastrophising as well as improving emotion regulation and promoting more frequent use of adaptive emotion regulation strategies. Implications for future research and clinical practice will be discussed.

Submission ID: 17; Submission Group: Other; Submitter: Maria Grytvik Hartvedt

The meaning and feasibility of engaging in physical activity while being employed in people with mild to moderate disability due to multiple sclerosis: A qualitative study

Maria Grytvik Hartvedt[1*], Britt Normann[12], Shaun Gallagher[34], Ellen Christin Arntzen[15]
**Main author, [1]Faculty of Nursing and Health Sciences, Nord University, Bodø, Norway, [2]Nordland Hospital Thrust, Bodø, Norway, [3]Department of Philosophy, University of Memphis, Memphis, United States, [4]School of Liberal Arts, University of Wollongong, Wollongong, NSW, Australia, [5]Department of Physiotherapy, Kongsgården Physiotherapy, Bodø, Norway*

Purpose: To understand pwMS' perceptions of the meaning and feasibility of physical activity (PA) while being employed.
Materials and methods: A qualitive design, using individual in-depth interviews of 26 employed persons with mild to moderate MS. The interviews are analyzed in a phenomenological hermeneutic framework within the interpretative tradition, using systematic text condensation and a Pattern theory of self.
Results: Three categories emerged: (1) Meaningfulness of PA for work (2) Balancing daily life, PA and work when energy is low, and (3) Leisure PA within work hours is beneficial but challenging to implement. The findings highlight that experiences from PA can influence how pwMS perceive themselves, including their abilities, possibilities and challenges in relation to work. They also highlight that the feasibility of PA is perceived to be influenced by challenges related to life balance, physical disabilities, family and work structures, and social and normative practices.
Conclusion: PA can be perceived as meaningful for health and employment by employed pwMS, influencing the individual's self-perception. The feasibility of PA is often constrained by individual, environmental, and/or social aspects, indicating the importance of individualized accommodations that consider both PA and work, such as incorporating leisure PA during work hours.

Submission ID: 18; Submission Group: Rehabilitation Effectiveness; Submitter: Ashley Boers

Occupational therapy in adults with Multiple Sclerosis: a Cochrane systematic review

Ashley Boers[1*], Ciara O'Meara[2], Isaline Eijssen[3], Geertruida Bekkering[4], Marja Koen[5], Jenny Freeman[6], Sinéad Hynes[7], Leen de Coninck[8], Daphne Kos[9]
[1]KU Leuven, Department of Rehabilitation Sciences - Occupational Therapy, Leuven, [2]School of Nursing and Midwifery, University of Galway, Galway, [3]Amsterdam UMC, Rehabilitation Medicine, MS Center Amsterdam; Research Institutes Amsterdam Neuroscience, Amsterdam Movement Sciences, Amsterdam Public Health, Amsterdam, [4]Belgian Centre for Evidence-Based Medicine, Cochrane Belgium, Leuven, Belgium. Academic Centre for General Practice, Department of Public Health and Primary Care, KU Leuven, Leuven, [5]MS Telefoon, MS Vereniging Nederland (MS Association of the Netherlands), [6]Faculty of Health and Human Sciences, School of Health Professions, University of Plymouth, Peninsula Allied Health Centre, Plymouth, [7]Discipline of Occupational Therapy, School of Health Sciences, University of Galway, Galway, [8]KU Leuven, Department of Rehabilitation Sciences, Leuven; Working Group Development of Primary Care Guidelines (WOREL), Antwerp, [9]KU Leuven, Department of Rehabilitation Sciences; National MS Center Melsbroek

Background: People with multiple sclerosis (PwMS) report benefits from occupational therapy (OT). With the last Cochrane systematic review conducted two decades ago, there is a critical need for updated evidence.
Aims: This Cochrane review aims to synthesize the benefits and harms of OT interventions on daily functioning, participation, and

quality of life in PwMS. It also explores variations based on intervention format (individual or group) and service delivery location (outpatient, inpatient, or home-based therapy).
Methods: Standard Cochrane (OF rigorous) systematic review methods were used. Two authors independently conducted systematic searches across databases (CENTRAL, MEDLINE, Embase, CINAHL, PsycINFO, Web of Science) for controlled clinical trials of OT in PwMS. Primary outcome measures (daily functioning, quality of life, participation and adverse effects) were assessed, and risk of bias and overall quality were evaluated using Cochrane RoB2/ROBINS-I and GRADEproGDT.
Results: The electronic search yielded 12,570 articles (7,388 after de-duplication). Based on title and abstract 7170 items were excluded, remaining 218 articles for full-text screening. Results, expected by May 2024, will be presented, encompassing a summary of findings table, potential meta-analysis results in a forest plot, and insights into health equity considerations.
Discussion: The review findings are expected to benefit people with MS by influencing the evidence-based decisions of occupational therapists, policymakers, and healthcare organizations. They will inform guideline development, and aid researchers by pinpointing knowledge gaps.

Submission ID: 19; Submission Group: New Research Methodologies; Submitter: Yvonne Learmonth

Perceptions and expectations of healthcare provider training to enable exercise prescription and behaviour change support in persons with multiple sclerosis: Theory development through realist evaluation

Learmonth, YC[1,2], Van Rens FECA[1], Rees, CE[3,4], Mavropalias, G[1], Donkers, SJ[5] Teo SYM[1]
[1]Discipline of Exercise Science, School of Allied Health, Murdoch University, Murdoch, WA, Australia, [2]Centre for Molecular Medicine and Innovative Therapeutics, Murdoch University, Murdoch, WA, Australia, [3]School of Health Sciences, College of Health, Medicine and Wellbeing, The University of Newcastle, Callaghan, NSW, Australia, [4]Monash Centre for Scholarship in Health Education (MCSHE), Faculty of Medicine, Nursing & Health Sciences, Clayton, VIC, Australia, [5]School of Rehabilitation Science, College of Medicine, University of Saskatchewan, Saskatoon, Canada

Purpose: While formative research has identified healthcare providers (HCPs) as an avenue for exercise behaviour change in persons with multiple sclerosis (MS), with some work developing initial theories, no research has examined HCPs' perceptions and expectations about their training needs to promote exercise behaviour change. Therefore, we aimed to undertake an exploratory realist analysis to build initial program theories regarding HCP training on home-based exercise prescription and behaviour change support for persons with MS; to understand how training works, for whom and under what circumstances.
Methods: Four online focus groups were conducted with fifteen HCPs who were either in public or private practice, including physiotherapists (PT; n=8), accredited exercise physiologists (AEP; n=4) and occupational therapists (OT; n=3). Two independent researchers conducted a realist evaluation with realist analysis of interview transcripts through identifying and developing CMOCs (context, mechanism and outcome configurations) codebooks, synthesised as demi-regularities (DRs).
Results: We identified 14 recurring patterns (DRs) illustrating multiple perceived outcomes of training (e.g., engagement, utilisation, satisfaction, and knowledge) generated by various mechanisms (e.g., training program content, delivery, mixed pedagogies, inclusion of content related to other health conditions and time constraints). Interestingly, these mechanisms were triggered by all three professional contexts (PTs, AEPs and OTs).
Conclusions: Preliminary theories from this realist evaluation indicate that online training for exercise behavioural change prescription can be a feasible part of HCPs' professional development and routine care for persons with MS. Training incorporating evidence-based principles and benefitting HCP's knowledge and skills facilitates participation. However, several extrinsic factors (e.g., client adherence, content limited only to MS) are barriers requiring attention to allow for the broader implementation of HCP training on exercise promotion as part of routine MS care.

Submission ID: 20; Submission Group: Rehabilitation Effectiveness; Submitter: Arianne Gravesteijn

The association between physical fitness and brain MRI outcomes in secondary progressive multiple sclerosis – cross sectional results from the Exercise PRO-MS study

Arianne S Gravesteijn[1,2,3], Amber van der Kruit[4], Heleen Beckerman[1,2,3], Brigit A de Jong[2,5], Vincent de Groot[1,2,3], Hanneke E Hulst [6]
[1]MS Center Amsterdam, Rehabilitation Medicine, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [2]Amsterdam Neuroscience research institute, Neuroinfection & Neuroinflammation, Amsterdam, The Netherlands, [3]Amsterdam Movement Sciences research institute, Rehabilitation & Development, Amsterdam, The Netherlands, [4]MS Center Amsterdam, Anatomy and Neuroscience, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [5]MS Center Amsterdam, Neurology, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [6]Leiden University, Faculty of Social Sciences, Institute of Psychology, Health, Medical and Neuropsychology unit, Leiden, The Netherlands

Background: Neurodegeneration in multiple sclerosis (MS) is often characterized by reduction in brain volume. Evidence suggests that physical activity and exercise interventions might positively influence brain volume.
Aim: To assess the association between markers of physical fitness (i.e. cardiorespiratory fitness, leg muscle strength, and level of physical activity) and brain volume in people with relapse onset MS with confirmed disease progression (SPMS).
Methods: In this cross-sectional analysis cardiorespiratory fitness, leg muscle strength, level of physical activity and sitting time, and structural MRI measures, i.e. total brain volume, white matter volume, cortical grey matter volume, deep grey matter volume, were assessed in participants enrolled in the Exercise PRO-MS study. The relationship between physical fitness measures and brain

imaging parameters was assessed with partial Spearman correlations (r), corrected for age and disease duration.
Results: In 30 people with SPMS, median age 54 years (IQR: 48-61), 70% female, mean disease duration of 20 years (SD: 10), cardiorespiratory fitness was moderately associated with cortical grey matter volume ($\rho = 0.551$), total brain volume ($\rho = 0.327$), and white matter volume ($\rho = -0.302$). Level of physical activity moderately correlated with cortical grey matter volume ($\rho = 0.346$). Sitting time and muscle strength were weakly correlated to brain volumes.
Conclusion: In people with SPMS a better cardiorespiratory fitness was associated with larger brain volumes, particularly within cortical grey matter. Physical activity also showed positive associations with grey matter volumes. These findings underscore the potential of physical fitness interventions in mitigating neurodegenerative processes in MS.

Submission ID: 21; Submission Group: Rehabilitation Effectiveness; Submitter: Blanca De Dios Perez

Improving the quality of Vocational Rehabilitation and Neuropsychological Rehabilitation in MS clinical trials

De Dios Perez, B.[1,2], Kos, D.[3,4], Podda, J.[5], Hämäläinen, P.[6], Løyning, IG[7], Jidborg, H.[8], Ford, H.[9,10], das Nair, R.[1,11]
*[1]School of Medicine, University of Nottingham, Nottingham, UK, [2]NIHR Nottingham Biomedical Research Centre, Nottingham, UK, [3]Department of Rehabilitation Sciences, KU Leuven, Leuven, Belgium, [4]National MS Center Melsbroek, Belgium, [5]Italian Multiple Sclerosis Foundation, Scientific Research Area, Genoa, Italy, [6]Masku Neurological Rehabilitation Centre / Finnish Neuro Society, Masku, Finland, [7]MS-Senteret Hakadal, Hakadal, Norway, [8]Multiple Sclerosis Trust, Hertfordshire, UK, [9]Leeds Teaching Hospital NHS Trust, Leeds, UK, [10]University of Leeds; Leeds, UK, [11]Health Division, SINTEF, Trondheim, Norway, *main author*

Background: There is a lack of high-quality evidence on the effects of Vocational Rehabilitation (VR) and Neuropsychological Rehabilitation (NPR) in multiple sclerosis (MS). The APPECO (Applied Evidence with Confidence) RIMS project summarised randomised controlled trials (RCTs) on rehabilitation in MS in a digital platform (www.appeco.net). However, RCTs may not always be the perfect research design for evaluating the effects of VR and NPR interventions but are considered the gold standard for assessing effectiveness. Most trials are still designed and judged by criteria developed for medical and pharmaceutical trials instead of trials on rehabilitation. While there have been some developments in providing guidelines for designing complex intervention trials, these tend to be generic and do not address some of the specific challenges in VR and NPR interventions.
Aims: To explore barriers and facilitators identified amongst researchers and clinicians in conducting VR and NPR trials and develop guidelines for trials on VR and NPR interventions.
Methods: A workshop with 40 participants was organised at a recent RIMS Special Interest Group (SIG) on Occupation and Psychology & Neuropsychology meeting. Based on feedback received and through meetings with a core group of multidisciplinary researchers and clinicians, a questionnaire was developed to explore barriers and facilitators in conducting VR and NPR trials. The questionnaire was circulated among RIMS SIG members. Through a consensus process, the first draft of the guidelines is developed.
Results: Participants at the SIG meeting highlighted issues related to the complex nature of the intervention, including challenges with the selection of participants (e.g., diversity of sample recruited), different intervention components and reliance on behaviour change in different stakeholders, control groups, and outcome variability (e.g., job retention vs. return to work; retrain vs. compensate).
We will further present an overview of the main challenges identified by RIMS SIG members.

Submission ID: 22; Submission Group: Rehabilitation Effectiveness; Submitter: Blanca De Dios Perez

Integrating Vocational Rehabilitation for people with Multiple Sclerosis in the national health service of the United Kingdom: A mixed-methods study

Blanca De Dios Perez[1,2], Jain Holmes[1], Rebecca Lindley[1], Nikos Evangelou[3], Roshan das Nair[3,4,5], Caolan Senior[1], Vicky Booth[1,6], Juliet Hassard[7], Helen L. Ford[8,9], Ian Newsome[10] & Kate Radford[1]
[1]University of Nottingham (Centre for Rehabilitation and Ageing Research, School of Medicine), Nottingham, UK; [2]NIHR Nottingham Biomedical Research Centre, Nottingham, UK; [3]University of Nottingham (Mental Health & Clinical Neurosciences, School of Medicine); [4]Nottinghamshire Healthcare Trust (Institute of Mental Health); [5]SINTEF (Health Division), Trondheim, Norway; [6]Nottingham University Hospitals NHS Trust, Nottingham, UK; [7]Queen's University Belfast, Belfast, Northern Ireland; [8]Leeds Teaching Hospital NHS Trust, Leeds, UK; [9]University of Leeds; Leeds, UK; [10]Lay co-author, York, UK.

Purpose: To explore how a job retention vocational rehabilitation (VR) intervention for people with multiple sclerosis (MS) and their employers can be implemented in the UK National Health Service (NHS).
Methods: Multicentre, single-arm feasibility study with embedded post-intervention interviews. An occupational therapist (OT) was trained to deliver the three-month intervention (MSVR) and participated in monthly VR expert mentoring to support intervention delivery. Feasibility was assessed via recruitment and retention rates, compliance with the intervention, and feasibility of delivering the intervention alongside NHS services. Acceptability was assessed with interviews. Vocational outcomes (vocational goals, work instability, reasonable adjustments, mood, fatigue, cognition, work self-efficacy and quality of life) were assessed post-intervention and three-month follow-up.
Results: Twenty participants with MS and three employers were recruited for the intervention. Recruitment was extended by two months, and only one participant dropped out. Participants with MS and employers received approximately 5.2 (2.5) and 1.6 (0.9) hours of support, respectively, over the three-month intervention. Most time was spent identifying reasonable adjustments, managing fatigue, and cognition. The intervention did not affect access to other NHS services.

Participants experienced improved vocational goal attainment immediately following (t(18)=7.41, p=<.001) and three months after completing the intervention (t(17)=6.01, p= <.001). There were no changes in the rest of the vocational outcomes. Post-intervention interviews identified six themes relating to the impact of intervention at work, accessibility of support, the role of the MSVR OT, readiness for support, supportiveness of the workplace, and barriers to NHS delivery.
Conclusion: There were challenges associated with recruitment, identifying newly diagnosed participants with MS, and understanding the training needs of the OT delivering the intervention. The intervention was acceptable to receive, but participants suggested a longer intervention length to address all their employment needs. Future research should explore skills needed to deliver VR and best fit within NHS services.

Submission ID: 23; Submission Group: Rehabilitation Effectiveness; Submitter: Cristina Ustrell

Use of the Mississippi Aphasia Screening Test (MAST) in the assessment of people with Multiple Sclerosis and communication disorders

Ustrell C, Meza-Murillo R, Galán I, Santoyo C, Montalban X.
Multiple Sclerosis Center of Catalonia (Cemcat). Barcelona, Spain.

Background: Communication disorders are frequent in people with Multiple Sclerosis (PwMS) and can be related to cognitive and linguistic dysfunction (30% to 72% of PwMS) interfering in patients daily lives and decreasing participation and quality of life.
Objective: To use the Spanish version of the Mississippi Aphasia Screening Test (MASTsp) in people with Multiple Sclerosis and communication disorders and to analyze the pre- and post- intervention changes.
Material and methods: From September to December 2023, 18 PwMS attending the Neurorehabilitation Unit of Cemcat were included in one weekly group speech therapy session for 16 weeks. The participants were evaluated using the MASTsp, which includes two subtests: expression (MASTsp-E) and reception (MASTsp-R) at admission and discharge and the Brief International Cognitive Assessment for MS (BICAMS) battery for cognitive assessment.
The content of the sessions focused on strategies to improve the expressive and comprehensive language and to diminish the impact of their communication difficulties on daily life.
Results: The MASTsp showed a statistically significant difference MASTsp (p=0.034) pre-post intervention. A slight improvement was found in the mean of the expression subtest MAST-E while the reception subtest MAST-R did not change significantly. In terms of percentages, in the MASTsp, 61.11% of the sample improved, 27.78% remained stable and 11.11% worsened.
Conclusions: The MASTsp could be a feasible tool to assess PwMS with communication disturbances and detect changes after a speech therapy program. Some limitations of the present study include the lack of a blinded assessment and a control group, the small sample analyzed, and the limited frequency of the sessions. Further research is wanted to analyze the validity and reliability of the MAST in PwMS.

Submission ID: 24; Submission Group: Rehabilitation Effectiveness; Submitter: Samuel Sanchez Pous

Quality of life in patients with multiple sclerosis and neurogenic overactive bladder

Samuel Sánchez*, Lorena López, Montserrat Garcia, Javier Domeño, Ingrid Galán, Edwin-Roger Meza-Murillo, Xavier Montalban.
*Centre d'Esclerosi Múltiple de Catalunya (Cemcat). Department of Neurology / Neuroimmunology, Hospital Universitari Vall d'Hebron. Universitat Autònoma de Barcelona. Spain, *Main author*

Background: Most people with multiple sclerosis (PwMS) experience bladder dysfunction. Use of percutaneous tibial nerve stimulation (PTNS) could contribute to improving the impact in their quality of life (QoL).
Objective: To evaluate the effect on QoL after application of PTNS protocol in PwMS with symptoms of neurogenic overactive bladder (OAB).
Methodology: A cohort of PwMS experiencing OAB dysfunction with postvoid residual < 100 ml or postvoid percentage ⩽ 20% measured by ultrasound and scores ⩾ 3 on Actionable bladder symptom screening tool was recruited. Patients were treated with twelve 30-minute PTNS sessions, 3 times a week, for 4 weeks following Stoller's criteria. Before and after intervention 3-day voiding diary and perceived QoL were evaluated using King's Health Questionnaire (KHQ).
Continuous variables were described with central tendency and dispersion, categorical variables in terms of absolute and relative frequencies and Wilcoxon tests were used to compare paired date.
Results: Involving 13 patients, 11 completed the protocol (81% women). Median age was 42 (Q1-Q3: 41-64), disease duration 11 years (Q1-Q3:7-26), relapsing remitting form 7 (63.6%) and median EDSS score 4.0 (Q1-Q3:2.5-5.5). No significant residual volume was found among the 11 patients, with an average retention percentage of 6% (Q1-Q3:0-37).
QoL perception significantly improved across 7 of 9 dimensions assessed by KHQ (77.7%): general perception heath (p=0.008), impact incontinence (p=0.008), physical and social limitations (P=0.003), emotional problems (p=0.001), sleep and energy disorders (p=0.002) and severity of symptoms (p=0.001). Not for role limitations (p=0.12) and personal relationship (p=0.52).
Post-intervention, improvement in urinary symptoms was observed: urinary frequency (63vs45), nocturia (51vs33), urinary urgency (45vs36), urge incontinence (39vs27), effort incontinence (27vs18), initiation difficulties (30vs9), enuresis (12vs6), infections (18vs9) and incontinence during sexual activity (12vs6). Pain remained unchanged (12).

Conclusions: Our findings suggest that the application of PTNS can improve QoL in PwMS with symptoms of neurogenic OAB.

Submission ID: 25; Submission Group: Rehabilitation Effectiveness; Submitter: Noemí Martínez Lerín

Therapeutic Pilates program as an empowerment tool for people with multiple sclerosis with mild disability

Noemí Martínez Lerín, Encina Pérez Caballero
Fundació Esclerosi Múltiple, Spain

Background: 70% of PwMS are diagnosed at an important moment of life for family, professional and work development. They may present physical, emotional and cognitive alterations that impact their quality of life and social participation.
This study (Ref CEIM: 104/2018) aimed to evaluate the effects of a simultaneous therapeutic Pilates and neuropsychology intervention on functional and cognitive capacity to improve empowerment in PwMS with mild disability.
Material and method: 7 PwMS who did not perform any neurorehabilitation modality with a mild degree of disability were selected. They received a health education session with information on a healthy lifestyle to promote empowerment and for 12 weeks two weekly sessions of therapeutic Pilates treatment and cognitive stimulation simultaneously. The intervention proposal was based on the "dual task" concept, considering that, when two tasks are carried out simultaneously, one can interfere with the other, optimizing motor function and helping to respond adequately to the changing demands of the environment. Exercises progressed in difficulty and new ones were introduced based on individual performance; as well as different encyclopedic Bits were shown in each session. Perception of fatigue (MFIS), balance (ABC Scale), quality of life (EuroQol-54) and cognitive processing speed (SDMT) were evaluated at the beginning and the end of the program using standardized scales.
Results: The mean of change of the scales showed improvements in physical (2 points) and cognitive fatigue (0,8 points), balance (0,94%), quality of life (12,2%) and speed of cognitive processing (16,67%).
Conclusions: The results suggest that the program could be a safe method to manage fatigue, improve balance, quality of life and cognition by optimizing the time dedication of the PwMS to their treatment. Activities of daily living require attention and a rapid motor planning process, so in addition to the physical approach, the cognitive approach must also be considered.

Submission ID: 26; Submission Group: Technology Supported Rehabilitation; Submitter: Edwin Roger Meza Murillo

Evaluation of Usability and Safety in Robotic-Assisted Gait Therapy for Multiple Sclerosis Patients

Edwin-Roger Meza-Murillo, Gaizka Loyola Sanmillán, María Jesús Arévalo Navinés, Montse Janer i Cabo, Carme Santoyo-Medina, Samuel Sánchez Pous, Ricard Soriano, Sergio Aguilar Alegre, René Carvajal, Agustín Pappolla, Lorena Lopez, Victoria Fernández, Ingrid Galán Cartañá, Jaume Sastre-Garriga, Carmen Tur Gómez, Xavier Montalbán
Neurology-Neuroimmunology Department; Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia, Vall d'Hebron University Hospital, Barcelona, Spain

Background: This study assesses the usability and safety of Robotic-Assisted Gait Therapy (RAGT) with the Atalante self-balance exoskeleton for Persons with Multiple Sclerosis (PwMS), crucial for understanding user-device interactions in specific contexts.
Methods: A prospective, open-label study conducted 12 one-hour RAGT sessions over 4 weeks, three times a week, was carried out by specialized physiotherapists. Usability was quantified using a dedicated questionnaire with 41 statements across seven domains. Depression and motor impact were evaluated pre and post-intervention using the Hospital Anxiety and Depression Scale (HADS) and 10-meter Walk Test (10-mWT), Berg Balance Scale (BBS). Safety was monitored by documenting adverse events for each session and maintaining a pain or sores registry.
Results: Out of 20 PwMS, 14 finalized treatment, 93% were progressive MS. Mean (SD) age 53.7 (7.8); EDSS: 6.5 (range 6.0-7.0); years since diagnosis: 18.7 (8.9), Patients reported high satisfaction and usability with mean total satisfaction score of 89.8 (SD=23) and mean total usability score of 78.7 (SD= 17.88). Most perceived positive health effects and minimal risks during training. Majority ($N > 70$) surpassed 70% threshold in satisfaction, usability, perception of health effects, and perception of risks during training. No statistical differences in pre and post-intervention for HADS, BBS, or 10-mWT were observed.
Of 169 sessions, shoulder pain occurred in 5 sessions (2.96%), neck pain in 1 session (0.59%), upper back pain in 5 sessions (2.96%), lower back pain in 9 sessions (5.33%), no reports of hip pain, knee pain in 1 session (0.59%), no reports of foot pain, and muscle pain in 2 sessions (1.18%).
Conclusions: Robotic-Assisted Gait Therapy with the Atalante exoskeleton demonstrated significant usability and safety. Participant adherence was favorable, with minimal adverse events and absence of sores. High satisfaction levels without increased fatigue, anxiety, or depression were reported. Emphasizing the need for further comprehensive research.

Submission ID: 27; Submission Group: Other; Submitter: Barbara Lewicka

The modifiable and nonmodifiable correlates of acceptance of illness in multiple sclerosis patients

Barbara Lewicka[1], Kamila Czepczor-Bernat[2], Katarzyna Maciejowska[3,4], Paulina Kowalcze[5] Edyta Matusik[6]
[1]Department of Rehabilitation, Doctoral School, Medical University of Silesia, Katowice, Poland, [2]Department of Pediatrics, Pediatric Obesity and Metabolic Bone Disease, Faculty of Medical Sciences in Katowice, Medical University of Silesia, Katowice, Poland, [3]Department of Neurology, Faculty of Health Sciences in Katowice, Medical University of Silesia,

Katowice, Poland, [4]MA-LEK Clinical, Katowice, Poland, [5]Department of Therapeutic Rehabilitation, Upper-Silesian Medical Centre, 40-635, Katowice, Poland, [6]Department of Rehabilitation, Faculty of Health Sciences in Katowice, Medical University of Silesia, Katowice, Poland

Background: Multiple sclerosis (MS) is a chronic, neurodegenerative disease leading to a progressive disability, that can affect not only the physical but also the mental state of patients. The psychological adaptation to the illness plays an important role in the general effectiveness of treatment.
Aim of the study: The study aimed to determine modifiable and nonmodifiable correlates of acceptance of illness.
Materials and methods: A total of 96 patients with MS (75 females) with a mean age of 41.9 ± 11.1 was included. The Acceptance of Illness Scale (AIS), the Body Appreciation Scale (BAS-2), and the Depression, Anxiety and Stress Scale – 21 items (DASS-21) together with socio-demographic and clinical data, including the Expanded Disability Status Scale (EDSS), were used. The data were collected in multiple sclerosis centers in Katowice, Poland between January 2023 and January 2024.
Results: Lack of acceptance of illness was reported in 20 individuals (20.1%), the average level of acceptance was presented by 19 individuals (19.8%) and 57 patients (59.4%) presented the acceptance of illness at a good level. The AIS score was significantly, negatively correlated with age ($rs = -0.35$, $p < 0.001$), EDSS ($rs = -0.43$, $p < 0.001$), and time since the diagnosis ($rs = -0.27$, $p < 0.01$). Moreover, the AIS score was positively associated with the BAS-2 score ($rs = 0.54$, $p < 0.001$) and negatively associated with all three subscales of DASS-21: depression ($rs = -0.50$), anxiety ($rs = -0.50$), and stress ($rs = -0.46$), all $p < 0.001$. In addition, the AIS score was positively correlated with employment status: the working or studying patients had higher AIS score than homemakers ($rs = 0.42$, $p < 0.001$).
Conclusion: The acceptance of the disease is correlated with both modifiable and nonmodifiable factors. The work on the modifiable factors should be taken into account in creating a complex program of rehabilitation and treatment of MS patients.

Submission ID: 28; Submission Group: Rehabilitation Effectiveness; Submitter: Carme Santoyo-Medina

"Fall prevention program for people with multiple sclerosis at high risk of falls: experience of a comprehensive physical and educational intervention"

Carme Santoyo-Medina[1, 2], Sergio Aguilar Alegre[1], Montserrat Janer i Cabo[1], Samuel Sánchez Pous, Gaizka Loyola Sanmillán[1], Ricard Soriano Baliarda[1], Ingrid Galán Cartañá[1], Edwin-Roger Meza-Murillo[1], Xavier Montalban Gairin[1]
[1]Neurology-Neuroimmunology Department & Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia, Vall d'Hebron University Hospital, Barcelona, Spain, [2]Department of Physiotherapy, Faculty of Medicine and Health Sciences, Universitat Internacional de Catalunya, Sant Cugat del Vallès, Barcelona, Spain

Background: Falls are common among people with Multiple Sclerosis (PwMS) significantly affecting their physical, emotional, and relational well-being. Different interventions to reduce modifiable personal and environmental risk factors and prevent falls and related complications have been published.
Aim: To describe a comprehensive physical and educational intervention to prevent falls in PwMS at high risk of falls and analyze its feasibility and effectiveness.
Methods: A descriptive analysis was conducted on the content and effect of a fall prevention program carried out in 2023 for PwMS at high risk of falls. High risk was defined as experiencing at least one fall during the last 6 months, and/or presenting balance impairment (Berg Balance scale score ⩽ 45), slow gait (10MWT⩾ 8 sec), and use of a walking assistive device. The program consisted of 16 weeks of thrice-weekly ambulatory physical therapy complemented by 5 educational online group sessions, guided by a physical therapist. These sessions aimed to promote risk awareness, analyze personal and environmental risk factors, and devise prevention strategies. Data from patient-performed balance and gait tests, patient-reported measures, and satisfaction surveys were analyzed.
Results: Thirty-one PwMS [72% female, mean age 53.22 (SD 11.91), mean years since diagnosis 17.61 (SD 11.68)] were included. At discharge, a significant improvement was shown in the patient-performed measures: Berg Balance Scale (BBS): p⩽0.01; 10 Meter Walk Test (TMWT): p ⩽0.028; 6-Minute Walk Test (6MWT): p⩽ 0.028. From the patient-reported outcomes, the Falls Efficacy Scale (FES) improved significantly: p⩽0.025. Moreover, patients reported high satisfaction and usefulness of the educational sessions.
Conclusions: The results of our experience show that this comprehensive fall prevention program is feasible and effective for improving performed-based and patient-reported outcome measures and it is highly evaluated by the participants. Further research is needed to know its effectiveness in long-term falls reported.

Submission ID: 29; Submission Group: Outcome Measures; Submitter: Carme Santoyo-Medina

"Exercise self-efficacy in people with multiple sclerosis: psychometric properties of the spanish translation of two exercise self-efficacy scales"

Carme Santoyo-Medina[1, 2], Montserrat Janer i Cabo[1], Ingrid Galán Cartaña[1], Edwin-Roger Meza-Murillo[1], María Jesús Arévalo Navinés[1], Xavier Montalbán Gairin, Caritat Bagur Calafat[2], Jaume Sastre-Garriga[1]
[1]Neurology-Neuroimmunology Department & Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia, Vall d'Hebron University Hospital, Barcelona, Spain, [2]Department of Physiotherapy, Faculty of Medicine and Health Sciences, Universitat Internacional de Catalunya, Sant Cugat del Vallès, Barcelona, Spain

Background: Self-efficacy has been shown to predict health-related behavior changes in several areas of different pathologies. In people with Multiple Sclerosis (PwMS), it seems to be a consistent predictor of physical activity maintenance over time.

Two scales have been used in PwMS to measure individual's confidence to continue exercising at the end of an exercise program: the Exercise Self-Efficacy Scale (ExSES) by Neupert (2009) and the Exercise Self-Efficacy (EXSE) by McAuley (1993).
Aim: To assess the reliability and validity of the Spanish version of both exercise self-efficacy scales in PwMS.
Methods: Exercise self-efficacy questionnaires were translated and culturally adapted to Spanish following Beaton et al.'s guidelines (2000). Ninety-three PwMS [56 female (60.2%), mean age 51.03 ± 9.69, mean EDSS 5.09 ± 1.64] completed the Spanish versions ExSES-Sp and EXSE-Sp twice at the end of the rehabilitation period. Demographics, MS features, and functional and emotional status data were also recorded. Psychometric properties of the ExSES-Sp and EXSE-Sp were assessed and compared with those of the original English-language version (ICC ExSES (Neupert) α =0.88; EXSE (McAuley) α =0.92).
Results: The ExSES-Sp and EXSE-Sp had excellent internal consistency (Cronbach's α: 0.89 and 0.97, respectively) and excellent test-retest reliability (ICC: 0.98 and 0.99) based on Fleiss recommendations (1981). For validity, a moderate statistically significant correlation was found between both scales (Spearman's: -0.56 $\rho<.001$). No correlations were found between the exercise self-efficacy scales and the functional and emotional status measures.
Conclusions: The results of this study support the use of ExSES-Sp and EXSE-Sp as reliable and valid measures of exercise self-efficacy in PwMS. The psychometric properties of both exercise self-efficacy scales were found to be similar to the original English version.

Submission ID: 30; Submission Group: Rehabilitation Effectiveness; Submitter: María Jesús Arévalo

"Motor and psychosocial impact of robot assisted gait training in a pilot rehabilitation trial"

María Jesús Arévalo, Gaizka Loyola, Montse Janer, Carme Santoyo-Medina, Samuel Sánchez, Ricard Soriano, Sergio Aguilar, René Carvajal, Agustín Pappolla, Lorena Lopez, Victoria Fernández, Ingrid Galán, Jaume Sastre-Garriga, Carmen Tur, Xavier Montalban, Edwin-Roger Meza-Murillo
Neurology-Neuroimmunology Department & Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia, Vall d'Hebron University Hospital, Barcelona, Spain

Background: Robot-assisted gait training (RAGT) is a promising intervention for improving motor function in individuals with gait disorders. Despite evidence supporting its efficacy in motor outcomes, little is known about its impact on psychosocial well-being.
Aim: This pilot study aimed to evaluate the motor and psychosocial impact of RAGT in people with multiple sclerosis (PwMS) using two validated questionnaires: The Perceived Impact of Assistive Devices (PIADS) and the Survey of Technology Use by Consumers (SOTU). Motor outcomes are not presented on this poster.
Methods: Psychosocial effects of RAGT were assessed using PIADS and SOTU at the end of the intervention period. Demographic data, MS characteristics, and functional and emotional status were also collected. PIADS evaluates the impact of assistive equipment on quality of life across three domains: competence, adaptability, and self-esteem. SOTU assesses users' attitudes and perceptions toward technology, including ease of use, efficacy, and conformity to social norms.
Results: Fourteen people with MS (PwMS) were included (6 female; mean age [standard deviation, SD]: 53.1 [SD 7.8] years). Thirteen patients had progressive MS. Median EDSS score was 6.5 (range: 6.0-7.0) and mean disease duration was 18.7 (SD 8.9) years. Post-training PIADS scores indicated a positive psychosocial impact (median 1.31, mean 1.22 [SD 0.63], maximum 2.35, minimum 0.31), as well as across its three subscales: "competence" (mean 1.083 [SD 0.74]), "adaptability" (mean 1.610 [SD 0.87]) and "self-esteem" (mean 1.33 [SD 0.61]). SOTU results similarly revealed a positive psychosocial impact of assistive device usage.
Conclusions: Our findings support the utility of PIADS and SOTU in gauging the psychosocial impact of RAGT among PwMS. These assessments offer valuable insights into the comprehensive effects of rehabilitation interventions, thereby facilitating tailored care and enhanced patient outcomes.

Submission ID: 31; Submission Group: Technology Supported Rehabilitation; Submitter: Claudia Latella

IFeel Wearable Technology for the Assessment of Pathology-Specific Spatiotemporal Indicators in People with Multiple Sclerosis

Claudia Latella[1], Lorenzo Fiori[1], Antonella Tatarelli[1], Enrico Valli[1], Lorenzo Rapetti[1], Daniele Pucci[1], Andrea Tacchino[2], Erica Grange[2], Ludovico Pedullà[2], Giampaolo Brichetto[2,3], Jessica Podda[2]
[1]AMI, Artificial and Mechanical Intelligence, Istituto Italiano di Tecnologia, Genoa, Italy, [2]Italian Multiple Sclerosis Foundation, Genoa, Italy, [3]AISM Rehabilitation Service, Genoa, Italy

Introduction. Gait and balance disorders are the most troublesome motor symptoms preventing people with MS (PwMS) from performing activity of daily living, with negative effects on working status and social relationships. Current evaluation for PwMS mobility is based on clinical scales and performance tests. However, these measurements are subjective and not suitable for continuous recording and fine assessment of motor impairment.
Aim. The objective is to define metrics for PwMS quantitative assessment based on computation of pathology-specific spatiotemporal Key Performance Indicators (KPIs). Algorithms for KPIs have been designed to process the measurements recorded by iFeel technology, a whole-body wearable system developed at

AMI. iFeel consists of a network of devices embedding inertial sensors for motion tracking and sensorized shoes for forces/torques acquisition.
Methods. A first subset of 5 PwMS followed as outpatients at AISM with Expanded Disability Status Scale (EDSS) ⩽ 6.5 has been considered for a preliminary analysis. Participants (equipped with the iFeel) have been asked to perform the 30-seconds Figure of 8 Walk Test (F8WT) and the Timed-Up and Go Test (TUG). The following KPIs and biomechanics quantities have been computed: antero-posterior, medial-lateral and vertical components of the ground reaction forces; stance/swing phases as percentage of cycle duration; vertical forces normalized to bodyweight and to stance phase; stride length; swing width. In addition, iFeel software architecture allows for the online visualization of the whole-body kinematics, the center of mass and center of pressure. Furthermore, a preliminary inter-subject KPIs analysis on the correlation with EDSS has been performed for cadence, velocity, stride time and gait phases.
Conclusions. Preliminary outcomes configure iFeel as a promising tool for quantitative motor assessment in PwMS. To strengthen this analysis, a comparison with the state-of-art correlation between KPIs and EDSS has been performed. Preliminary results and trends are compatible with the literature references outcomes.
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Submission ID: 32; Submission Group: New Research Methodologies; Submitter: Nele Vanbilsen

Tapping to music and metronome ticks at high and low tempi in persons with progressive MS

Nele Vanbilsen*[1,7], Peter Feys[1,7], Daphne Kos[2,6], Bart Van Wijmeersch[1,4,5,7] Marc Leman[3], Lousin Moumdjian[1,3,7]
*[1]Faculty of Rehabilitation Sciences, REVAL Rehabilitation Research Center, University of Hasselt, Agoralaan Gebouw A, 3590 Diepenbeek, Belgium; [2]National MS Center Melsbroek, Melsbroek, [3]IPEM Institute of Psychoacoustics and Electronic Music, Faculty of Arts and Philosophy, University of Gent, Miriam Makebaplein 1, 9000 Gent, Belgium, [4]Rehabilitation and MS Center, Pelt, Belgium, [5]BIOMED Biomedical Research Institute, Hasselt University, Diepenbeek, Belgium, [6]Department of Rehabilitation Sciences, KU Leuven, Tervuursevest 101, PO Box 1501, Leuven 3001, Belgium, [7]Universitair Multiple Sclerosis Centrum (UMSC), Hasselt-Pelt, Hasselt, Belgium, *presenting author*

Background: Exploring the use of rhythmic patterns coupled to motor systems has been of great interest in rehabilitation of neurological patients, specifically for walking. Research has shown that participants with higher perceptual sensorimotor synchronization abilities, quantified by behavioural sensorimotor tapping tasks such as finger tapping, show better outcomes on walking parameters after walking to auditory stimuli. We investigated perceptual synchronization abilities and the impact of disability in Persons with Progressive MS (PwPMS) using a tapping task to beats in music and metronomes. Additionally, to examine adaptability and taking auditory central processing delays into account, tempi higher and lower than the preferred tapping speed were included.
Methods: Participants were asked to tap with the index finger of their dominant hand to music and metronomes at preferred comfortable speed (0%), -8%, -4%, +4% and +8%), while synchronization consistency (Resultant Vector Length (RVL), median Inter-Tap-Interval (ItI)) were measured. Additionally, the 9HPT and EDSS were correlated with RVL for music and metronomes.
Results: 19 PwPMS (median EDSS 4.4, 9HPT dominant hand 26.06s) and 16 healthy controls (HC's) were included. All participants synchronised consistently at all tempi, yet higher consistency was found when tapping to metronomes (RVL=0.94) compared to music (RVL=0.90) ($p<0.001$). This result is further reflected by the significant effect of tempi for median ItI ($p<0.001$), indicating that ItI was significantly shorter for high tempi compared to low.
Last, Spearman rank correlations showed a significant negative relationship between 9HPT performance and RVL for metronomes (r=-0.40, $p<0.001$) and between EDSS score and RVL for metronomes (r=-0.37, $p<0.001$) and music (r=-0.40, $p<0.001$).
Conclusion: The results show intact synchronization abilities of PwPMS, indicative that perceptual abilities are present and spared. This provides feasibility for using auditory-motor coupling during rehabilitation of PwPMS. However, synchronization abilities can be affected by disability score and upper limb skills.

Submission ID: 33; Submission Group: Technology Supported Rehabilitation; Submitter: Carlotte Kiekens

PREPARE: Personalized rehabilitation via novel AI patient stratification strategies

Kiekens Carlotte[1*], Negrini Stefano[1,2]
*[1]IRCCS Galeazzi-Sant'Ambrogio Research Hospital, Milan, Italy, [2]University of Milan, Milan, Italy, *Presenting author*

Background: Rehabilitation is person-centered (based on prediction and stratification). Validated prediction models are lacking for many health conditions and outcome domains and developed with simple statistical tools, based on small data sets from single institutions, without external validation. They lack intelligent application programming interfaces (APIs) that allow them to be

fed with new data. They cannot be improved as datasets of different origins become available.
Aim: PREPARE (https://prepare-rehab.eu/) aims to advance rehabilitation care by developing, validating, and implementing robust, clinically relevant, and data-driven computational prediction and stratification tools.
Methods: PREPARE is a HaDEA-Horizon European project (7 million Euro, 4-years, 20 partners, nine countries). We will apply machine learning (ML) techniques on nine large scale patient datasets. Real-world collections of routinely collected data will be treated in a federated way. We will develop a platform for sharing model results, exploiting the open-science EHDEN platform and using the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) standard. We will develop prediction and stratification machine-learning strategies for rehabilitation data, that will be validated via nine demonstration pilots.
Results: Current results are the user requirements, the clinical prediction scenarios, the pilot cases planning and evaluation of the impact on the end-users. Final expected results are 1) A unified advanced decision-support platform for the management of big data and federated access to clinical data; 2) Novel patient stratification methods and prediction models enhanced by advanced ML/Artificial Intelligence (AI) tools; 3) Medical Device Regulation roadmap for any (software as a) medical device embedding.
Discussion and Conclusions: Exploiting clinical, socio-behavioural and public health research, data science, and advanced statistical and AI learning methods, PREAPRE will enhance personalized, reliable rehabilitation considering external circumstances and patient factors to improve quality of care and life. The results are relevant also in the field of Multiple Sclerosis.
Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or European Health and Digital Executive Agency (HADEA). Neither the European Union nor the granting authority can be held responsible for them. Grant Agreement 101080288 PREPARE HORIZON-HLTH-2022-TOOL-12-01

Submission ID: 34; Submission Group: Other; Submitter: Katherine Knox

Physical activity levels in people living with Multiple Sclerosis from a real world setting in Saskatchewan, Canada

Katherine B Knox,*[1] Thuy Le, (PhD),[2] Pauline Venturina Ordonez,[1] Charity Evans,[3] Sarah J Donkers[4]
[1]*Department of Physical Medicine and Rehabilitation, College of Medicine, University of Saskatchewan;* [2]*Clinical Research Support Unit, Department of Community Health and Epidemiology, College of Medicine, University of Saskatchewan;* [3]*College of Pharmacy and Nutrition, University of Saskatchewan*, [4]*School of Rehabilitation Science, College of Medicine, University of Saskatchewan, *main author*

Background: Physical activity has many health benefits for people living with multiple sclerosis (MS). New recommendations for physical activity in MS were published in 2020. Baseline physically active levels from real world settings could have practice implications for implementing recommendations.
Methods: This study aimed to determine the physical activity levels in people living with MS who accessed a provincial government MS drugs funding/support program in Saskatchewan, Canada between February 22, 2022 and February 2, 2024. People diagnosed with MS were prospectively invited by mail to complete an online REDCap or paper-based questionnaire over the two-year period. The primary outcome was the proportion of participants sufficiently active for substantial health benefits on the Godin Leisure Time Exercise Questionnaire (GLTEQ), according to established criteria. Participants' response rate and baseline demographics at the time of questionnaire completion (sex, age, age at MS onset, disease duration from MS onset, and current or previous use of an MS disease modifying drug (DMD) were analyzed with descriptive statistics.
Results: Response rate was 27 % (n=300/1105). Among respondents, 73% were female, mean age 50.0 (± 12.8) years, median MS disease duration 11.4 (interquartile range: 4.9 – 20.4) years; 32.7% were currently on a DMD, 25.3% were previously on a DMD and 42.0% had not yet started a DMD. Forty-one percent of participants were sufficiently physically active, 15.0% were moderately active, and 44.0% were insufficiently active for substantial health benefits.
Conclusions: We report a higher proportion of people sufficiently active for health benefits in comparison to prior literature. However, a large proportion of people accessing an MS drugs program remain insufficiently active for substantial health benefits. Future directions include implementation research to determine how to best support physical activity in combination with initiation of MS services, including MS drug services.

Submission ID: 35; Submission Group: Rehabilitation Effectiveness; Submitter: Antonia Kaltsatou

Be Cool: Preliminary Results of a Comprehensive and Innovative Multiple Sclerosis Hybrid Rehabilitation Program

Antonia Kaltsatou[1], Sofia Theodorou[1], Kalliope Georgakouli[2], Anastasios Orologas[1]
[1]*Greek Multiple Sclerosis Society, Thessaloniki, Greece,* [2]*University of Thessaly, Greece*

To manage the symptoms of Multiple Sclerosis (MS) that medications cannot alleviate, we applied the "Be Cool" hybrid rehabilitation program to improve individuals' symptom management and quality of life. Thirty MS-diagnosed individuals were randomized into the control group (n=15, 43.8±10.6 years) and the "Be Cool" group (n=15, 48.5±10.5 years), which engaged in a structured hybrid comprehensive rehabilitation program for three months. The program included weekly psychologist-led sessions based on Acceptance Commitment Therapy, bi-weekly consultations with nutritionists or exercise physiologists, and encouraged enhancement of daily activity, monitored through a newly developed application. Additionally,

they received weekly educational content on psychology, exercise and nutrition. Participants were also required to apply a cooling cup (Headcool Power, Inuteq) and a neck towel (Neckcool Tie, Inuteq) for two hours daily. Functional capacity was evaluated before and after the three-month period via the Two-minute Walk Test, Sit-to-Stand Test, Berg Balance Scale, 9-hole Peg Test, and Timed 25-foot Walk. Similarly, core and skin temperature were recorded by the e-Celsius Performance capsule and the iBUTTON sensors. Psychological well-being and nutritional impact were assessed using the Perceived Stress Scale, Cognitive Fusion Questionnaire, Multiple Sclerosis Quality of Life-54, a 7-day food diary, and a 36-item Food Frequency Questionnaire. After three months, significant improvements were observed across all functional capacity tests, demonstrating a notable time and group effect ($p<0.05$), while a significant increase in the number of weekly steps by 20% ($p<0.05$) was observed. Additionally, the Be Cool group decreased 5% and 3% in core and skin temperature, respectively ($p<0.05$). Furthermore, there were statistically significant improvements ($p<0.05$) in the Perceived Stress Scale, Cognitive Fusion Questionnaire, and Multiple Sclerosis Quality of Life-54 questionnaires. The quality of nutrition was also improved ($p<0.05$). In conclusion, a comprehensive and multidisciplinary rehabilitation program can effectively help individuals with MS in managing their symptoms.

Submission ID: 36; Submission Group: Other; Submitter: Edyta Matusik

The impact of multiple sclerosis on employment: challenges and future directions

Edyta Matusik[1], Jean-Francois Gehanno[2]
[1]Department of Rehabilitation, Faculty of Health Sciences in Katowice, Medical University of Silesia, Katowice, Poland, [2]Institute of Occupational Health, Rouen University Hospital, France

Introduction: Multiple sclerosis (MS) is one of the most common causes of neurological disability in young adults. The diagnosis itself is a heavy psychological burden on the patient. The time of receiving the diagnosis (20-50 y.o) is the time in the patient's life that is associated with making decisions about education, taking up professional work, career and promotion. The probability and frequency of a relapse in a given patient is unpredictable. When the relapse occurs, it has a significant impact on the quality of work performance. People with MS are more exposed to unemployment and are forced to retire early.
The aim of this study is to evaluate the numer of publications on the correlation of MS with quality of employment
Materials and methods: We searched Pubmed for articles on the impact of MS on work ability and solutions to improve the working conditions of patients. We used the sequence developed by Gehanno et al. In the first step we searched PubMed using two search strings.
Results: In the first step, 146 articles met our criteria. In the second step, after the search evaluation, we added 101 articles not identified in the first step. Ultimately, 295 articles were collected as the Gold Standard Database (GSD). The most frequently discussed issues include the type of work performed, salary, disability, clinical symptoms and their impact on employment status and, consequently, the quality of patient's life.
Conclusions: Nowadays the significant progres is made in the diagnosing the disease, its course, symptoms and occurrence. Additionaly progress in the pharmacological treatment has been clearly visible in recent years. Despite this, in the available literature there is still very little of work addressing the ways to improve the situation of a patient with MS on the labor market.

Submission ID: 37; Submission Group: Outcome Measures; Submitter: Heleen Beckerman

Which type of patient-reported measures to use in multiple sclerosis routine clinical care: the validity of PROMIS CAT questionnaires

Heleen Beckerman (main author)[1,2], Isaline Eijssen[1,2], Roos Walraven[3], Vincent de Groot[1,4], Brigit de Jong[5,6]
[1]MS Center Amsterdam, Rehabilitation Medicine, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [2]Amsterdam Public Health research institute, Societal Participation and Health, Amsterdam, The Netherlands, [3]Bachelor Health and Life sciences, Faculty of Science, VU University Amsterdam, The Netherlands, [4]Amsterdam Movement Sciences research institute, Rehabilitation & Development, Amsterdam, The Netherlands, [5]MS Center Amsterdam, Neurology, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [6]Amsterdam Neuroscience research institute, Neuroinfection & Neuroinflammation, Amsterdam, The Netherlands

Objective: To evaluate the construct validity of seven Patient-Reported Outcomes Measurement Information System® Computer Adaptive Testing (PROMIS CATs) assessing anxiety, depression, pain interference, fatigue, sleep disturbance, physical function, and the ability to participate in social roles and activities in multiple sclerosis outpatients.
Methods: In this cross-sectional study PROMIS CATs and PROMs data from adult people with multiple sclerosis (MS) consulting the outpatient clinics of neurology or rehabilitation medicine of the MS Center Amsterdam were analysed. Construct validity of PROMIS CATs was evaluated with hypotheses testing based on expected Spearman correlations with HADS anxiety and depression, MSWS-12, MSIS29, EQ5D, CIS20r fatigue, AMSQ-sf (with a fixed number of 78 items in total).
Results: Outcome data from 498 MS outpatients (average age 47.2 years [IQ 37.4-55.2]; 69% females) were available. All constructs, but depression (Spearman's rho = 0.68), that measured identical constructs correlated highly (Spearman's rho $\geqslant$0.70). The questionnaires that had related, but dissimilar constructs showed a correlation of $\geqslant$0.50. Convergent validity was considered adequate

as more than 75% of the hypotheses were confirmed. Four PROMIS CAT items were on average needed to complete each PROMIS questionnaire.
Conclusion: This study investigated the comparability of scores of PROMIS CATs with well-known MS-specific and generic PROMs. All seven PROMIS CATs (assessing physical function, pain interference, fatigue, sleep disturbance, anxiety, depression, and the ability to participate in social roles and activities) demonstrated evidence for sufficient construct validity in people with MS at the MS outpatient clinics neurology and rehabilitation medicine. In addition, completion of PROMIS CATs required far less items than the commonly used PROMs.
Abbreviations: AMSQ-sf, Arm Function in Multiple Sclerosis Questionnaire-Short Form; CIS20r Checklist Individual Strength 20-item revised version; EQ5D-5L, EuroQol 5 dimensions, 5 levels of answering; HADS, Hospital Anxiety and Depression Scale; MSWS-12, MS Walking Scale-12 items; MSIS-29, MS Impact Scale-29 items; PROMIS CATs, Patient-Reported Outcomes Measurement Information System® Computer Adaptive Testing; PROMs, patient-reported outcome measures.

Submission ID: 38; Submission Group: Rehabilitation Effectiveness; Submitter: Ingrid van der Mei

Enhancing workplace empowerment for people with multiple sclerosis via MS WorkSmart**: Findings from a randomized controlled feasibility study**

Alisée Huglo[1], Sarah Thomas[2], Sue Shapland[1], Laura Laslett[1], Bruce Taylor[1], Cynthia Honan[3], Holly Emery[3], MS WorkSmart Investigator Group*, Ingrid van der Mei[1]
[1]Menzies Institute for Medical Research, University of Tasmania, Australia; [2]Bournemouth University Clinical Research Unit, Faculty of Health and Social Sciences, Bournemouth University, United Kingdom; [3]School of Psychological Sciences, College of Health and Medicine, University of Tasmania, Australia

*MS WorkSmart Investigator Group includes Isabelle Bauer, Holly Emery, Desmond Graham, Rebecca Graham, Jodi Haartsen, Cynthia Honan, Alisée Huglo, Laura Laslett, Leigh McCaffrey, Bree Mitchelson, Andrew Potter, Karin Ridgeway, Sue Shapland, Kerri Tomlin, Sarah Thomas, Bruce Taylor, Ingrid van der Mei

Background: Many people with multiple sclerosis (MS) face early exit from the workforce, reduced working hours, and/or changes in employment role due to MS, yet there are currently no interventions tailored to addressing barriers to continued employment. *MS WorkSmart* was developed to help people with MS remain in the workforce.
Aim: To evaluate the feasibility of implementing *MS WorkSmart*, a 10-week online program with individualized coaching support designed to empower people with MS in the workplace, and to inform the design of a larger clinical trial.
Methods: A parallel-arm randomized controlled feasibility study recruited 44 employed Australians with MS aged 18-60 years, who reported work instability. Participants were randomized to receive MS WorkSmart plus usual care (MSWS, n=22) or usual care only (UC, n=22). Structured interviews and surveys (baseline, 1-month post-intervention and feedback survey) were used to obtain feedback and evaluate change in measures such as work instability, work difficulty, and work self-efficacy. Retention rates and intervention adherence were also recorded. Descriptive statistics, qualitative analysis and mixed models were used to assess the feasibility and preliminary effectiveness of *MS WorkSmart.*
Results: Some drop out in MSWS occurred early, with 73% completing the intervention; adherence to all core components was extremely high. Feedback data showed high levels of satisfaction with *MS WorkSmart*, and many participants effectively implemented self-care and workplace strategies, reported a better awareness of their thoughts and actions, or altered their employment. Post-survey completion rates were 73% and 82% for MSWS and UC, respectively. Preliminary effect sizes were promising with the MSWS group showing greater improvements in work instability, work self-efficacy, and fatigue, and experiencing a shift to the action stage in their awareness of work change.
Conclusion: *MS WorkSmart* improved work outcomes with high adherence and participant acceptability, and thus warrants a full trial.

Submission ID: 39; Submission Group: Technology Supported Rehabilitation; Submitter: Giacinto Barresi

ENACT-EXO: Design of a Neuroergonomic Exosuit for Research and Rehabilitative-Assistive Applications in Multiple Sclerosis

Giacinto Barresi[1*], Mirco Di Salvo[2], Andrea Tacchino[3], Jessica Podda[3], Erica Grange[3], Nicolò Boccardo[1], Yelena Tonoyan[1], Massimo De Vittorio[4], Luca Berdondini[5], Claudio Lorini[2], Lorenzo De Micheli[1], Giampaolo Brichetto[3], Marco Crepaldi[2]
[1]*Rehab Technologies Lab, Istituto Italiano di Tecnologia, Genoa, Italy*, [2]*Electronic Design Laboratory, Istituto Italiano di Tecnologia, Genoa, Italy*, [3]*Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy*, [4]*Center for Biomolecular Nanotechnologies, Istituto Italiano di Tecnologia, Arnesano, Italy*, [5]*Microtechnology for Neuroelectronics, Istituto Italiano di Tecnologia, Genoa, Italy,*

Cerebellar tremors in Multiple Sclerosis (MS), typically marked by low-frequency trembling during intentional movements, severely impact patients' daily lives and social interactions. Often invasive or unwieldy, current treatments fall short in effectiveness and practicality. This gap is currently addressed by Istituto Italiano di Tecnologia (IIT) and the Italian Multiple Sclerosis Association (AISM) through the ENACT project, supported by the Italian Multiple Sclerosis Foundation (FISM). ENACT works on non-invasive, adaptable, and user-friendly solutions for investigating and managing symptoms of people with MS (PwMS), particularly the cerebellar tremor. In particular, ENACT proposes an exosuit

(soft exoskeleton) for upper limbs, integrating multiple sensors (e.g., for electroimpedance myography, EIM) and stimulators (e.g., for functional electrical stimulation, FES, and haptic feedback) selected for their potential, according to literature and neuroergonomic principles, to enhance human-system interactions in real-world. We also envision to integrate this system - ENACT-EXO - with an electroencephalographic (EEG) cap and a head-mounted display for virtual and augmented reality applications. These elements are critical for enriching digital exergames with multisensory stimulations, thereby making rehabilitation procedures more engaging. Furthermore, eye-tracking features will enable the study of eye-hand coordination. Finally, we expect to use this system in the NRTWIN (NeuroRobotic TWINning) activity of the RAISE ecosystem for innovation in Liguria (Italy). In synergy with ENACT, NRTWIN focuses on studying the sensitivity to motion cost in PwMS during rehabilitation and ENACT-EXO will employ features like the FES for easing the exercising according to an assist-as-needed robotic strategy. A first prototype of ENACT-EXO is undergoing rigorous before moving from laboratories to clinical and home settings to ensure its effectiveness and its seamless integration into clinical procedures and activities of daily living, contributing significantly to understanding MS, with potential implications for personalized assistance and rehabilitation.

Keywords: multiple sclerosis, exosuit, rehabilitation technology, assistive technology, wearable robotics, virtual reality

Submission ID: 40; Submission Group: Technology Supported Rehabilitation; Submitter: Giacinto Barresi

NeuroRobotic TWINning: NRTWIN

Giacinto Barresi[1], Andrea Tacchino[2], Jessica Podda[2], Daniele Pucci[3], Ferruccio Pisanello[4], Yelena Tonoyan[1], Nicolò Boccardo[1], Lorenzo De Micheli[1], Giampaolo Brichetto[2], Massimo De Vittorio[4], Luca Berdondini[5], Raffaella Tonini[6]

[1]Rehab Technologies Lab, Istituto Italiano di Tecnologia, Genoa, Italy, [2]Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy, [3]Artificial and Mechanical Intelligence, Istituto Italiano di Tecnologia, Genoa, Italy, [4]Center for Biomolecular Nanotechnologies, Istituto Italiano di Tecnologia, Arnesano, Italy, [5]Microtechnology for Neuroelectronics, Istituto Italiano di Tecnologia, Genoa, Italy, [6]Neuromodulation of Cortical and Subcortical Circuits Laboratory, Istituto Italiano di Tecnologia Genoa, Italy

Limited engagement and an excessive workload or fatigue can make a rehabilitation session for a person with Multiple Sclerosis (MS) a real challenge. However, another obstacle to perform the planned exercises can be the motion cost sensitivity, based on the neural (subcortical and cortical) evaluation of the energy costs associated with ongoing or upcoming actions, connected to the individual "vigor" in performing a task. Since this implicit comparison between advancing in a task or switching to another activity can be affected by the difficulties experienced by people with MS (PwMS), this phenomen must be investigated to: (i) understand its mechanisms in animal models and human beings (with and without impairments), (ii) explore the potential of wearable and implantable technologies to collect data on it, (iii) predict any increases in motion cost sensitivity through computational systems like digital twins (digital replicas of physical systems, being the first designed to predict the present and future states of the second). Such digital twins would (iii-a) inform the clinicians about patient's issues during each clinical session and to (iii-b) provide assistance as needed through rehabilitative technologies (e.g., robots, virtual and augmented settings). These are goals of NRTWIN (NeuroRobotic TWINning), an activity of the Spoke 2 of RAISE – Robotics and Artificial Intelligence for the Socio-economic Empowerment – ecosystem for innovation in Liguria, supported by the National Recovery and Resilience Program (funded by EU) in Italy. NRTWIN is a joint effort of Istituto Italiano di Tecnologia (IIT) and Italian Multiple Sclerosis Foundation (FISM). This abstract presents a contribution to discuss current results and ongoing tasks of NRTWIN, including the development of novel sensors and setups for mouse studies, the virtual settings for human data collection (in synergy with ENACT, a special project of FISM and IIT), and the related computational models.

Keywords: multiple sclerosis, digital twins, rehabilitation, robotics, virtual reality, sensors, animal models, human studies

Submission ID: 41; Submission Group: Other; Submitter: Conor Kerley

Design and rational of NeuroPhix: a food supplement for multiple sclerosis

Conor Kerley

Phytaphix, Ireland

Introduction:

- Food supplement queries were the 3rd most common on MS websites, social media[1]
- Most people with MS (~82 to 89%) take food supplements[2-4]
- We wanted to examine why PwMS take food supplements
- We set out to design an 'ideal' food supplement for PwMS based on the available evidence and what people with MS prefer

Methods:

- We engaged with the MS community via online surveys and focus groups
- We used semi-quantitative methods to assess food supplement use, reasons and desires

Results:

- 153 PwMS responded via Jotform
- Of these, 76 took part in online focus groups

Reasons for using food supplements in PwMS

- Help with persistent symptoms
- Feel empowered
- Try slow MS progression
- Perceive food supplements as effective and safe
- Effective therapies not always available e.g. cost

Preferences regarding a food supplement according to PwMS

- Plant based, gluten, no added sugar
- Capsule as opposed to tablet, powder etc.
- Science based with potential to help with symptoms
- Comprehensive, to avoid having to take many products

Nutrients with documented benefits for PwMS

- **9 nutrients were identified from 18 intervention research trials in PwMS.**
- **The documented benefits included:** Reduce lesion load[5,7]
  - Reduce brain atrophy[5,7]
  - Improve cognitive function[8,9]
- Improve physical function and decrease disability[7,10,11,12]
  - Decrease inflammation[5,9,11-14]
  - Improve gut issues[21]
  - Decrease serum Neurofilament Light Chain (NfL)[11]
  - Decrease Fatigue[6,12]
  - Improve mental health and mood[9,10]
- 96% of respondents had never heard of 5 nutrients in Neuro Phix

Discussion:

- The Neuro Phix formula contains 9 nutrients
- Safety and effectiveness were documented in 18 intervention trials with 841 PwMS
- The 9 nutrients in Neuro Phix have similar benefits in: Humans with non-MS immune/inflammatory conditions
  - Animal models of MS
  - In vitro models of MS

Conclusion;

Neuro Phix has potential to improve many symptoms in people with MS

Submission ID: 42; Submission Group: Rehabilitation Effectiveness; Submitter: Arianne Gravesteijn

Physical training for people with Parkinson's disease and multiple sclerosis: Effect on mind and body – HersenFit study protocol

Arianne S Gravesteijn (main author) [1,2,3], Elvira S Amaral Gomes[1,3], Marc B Rietberg[1,3], Vincent de Groot[1,2,3], Chris Vriend[4,5,6,7], Wilma DJ van de Berg[4,8], Odile A van den Heuvel[4,5,6,8], Erwin EH van Wegen[1,3], HIIT-PD Consortium

[1]MS Center Amsterdam, Rehabilitation Medicine, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [2]Amsterdam Neuroscience research institute, Neuroinfection & Neuroinflammation, Amsterdam, The Netherlands, [3]Amsterdam Movement Sciences research institute, Rehabilitation & Development, Amsterdam, The Netherlands, [4]Department of Anatomy and Neuroscience, Amsterdam UMC location Vrije Universiteit, Amsterdam, The Netherlands, [5]Department of Psychiatry, Amsterdam UMC location Vrije Universiteit Amsterdam, The Netherlands, [6]Amsterdam Neuroscience research institute, Compulsivity, Impulsivity & Attention, Amsterdam, The Netherlands, [7]Amsterdam Neuroscience research institute, Brain Imaging, Amsterdam, The Netherlands, [8]Amsterdam Neuroscience research institute, Neurodegeneration, Amsterdam, The Netherlands

Introduction: Next to motor deficits, people with Parkinson's disease (PD) and Multiple Sclerosis (MS) experience non-motor problems (e.g., depression, anxiety). Pharmacological treatment is available for symptom relief; however, various disease complaints respond insufficiently to medication and considering the gradual worsening of symptoms, there is an urgency for additional non-pharmacological interventions. Physical exercise is increasingly recognized as an assisting therapy but the optimal dose is not known.

Aim: To investigate differences in response patterns of, primarily, depression and anxiety as well as motor and other non-motor symptoms, functional brain connectivity, and blood-based neuroplasticity (brain-derived neurotrophic factor (BDNF)) and neurodegeneration (neurofilament light (NfL)) biomarkers to high intensity interval training (HIIT), continuous aerobic exercise (CAE), and movement advice (MA) in people with PD and MS.

Method: People with PD (n=24) and MS (n=24) will be randomized to 8 weeks of HIIT (2x/week, 30min/session, ⩾85% Wmax), CAE (2x/week, 50min/session, ~55% Wmax), or MA (+3000 daily steps for 5 days) with baseline and wash-out phases of 4 weeks. Frequently repeated assessment of the outcome measures (depression, anxiety, cognition, fatigue, sleep, well-being, motor capacity, quality of life, activities of daily living, level of physical activity, BDNF and NfL concentration, functional brain connectivity) will be conducted. Changes in outcome measures will be analyzed using visual inspection of trends in level, slope, and variability for each outcome intervention, confirmed by longitudinal regression analysis.

Results: We expect improvement in motor and non-motor symptoms as well as an increase and a decrease in biomarkers of neuroplasticity and neurodegeneration in blood, respectively, and enhanced functional brain connectivity in response to physical training; however, HIIT is expected to be significantly more effective in doing so.

Conclusions: The goal is to, ultimately, develop clinical guidelines and tangible training protocols for people with PD and MS to reduce disease burden.

Submission ID: 43; Submission Group: Other; Submitter: Nicole Krause

Digital lifestyle management application for emPOWERment in early multiple sclerosis – Results of the randomised controlled POWER@MS1 trial

Nicole Krause[1]*, Carlotta Derad[2], Barbara von Glasenapp[1], Karin Riemann-Lorenz[1], Herbert Temmes[3], Markus van de Loo[3], Stefan Gold[4], Tim Friede[2], Christoph Heesen[1] and the POWER@MS1 study group

*[1]Institute of Neuroimmunology and Multiple Sclerosis (INIMS), University Medical Center Hamburg-Eppendorf (UKE), [2]Department of Medical Statistics, University Medical Centre Göttingen, Göttingen, Germany, [3]German Multiple Sclerosis Society, Federal Association, Hannover, Germany, [4]Department of Psychiatry (CBF), Charité Universitätsmedizin Berlin, Germany, *main author*

Background: After a multiple sclerosis (MS) diagnosis, some persons with MS (pwMS) need individualised support for disease management and lifestyle choices. We investigated the effect of a digital lifestyle management application ("levidex") on inflammatory disease activity, quality of life (QoL) and health behaviour of pwMS in a multicentre randomised controlled trial ("POWER@MS1").

Methods: From July 2019 to April 2022, 234 newly diagnosed pwMS from 20 study centres located across Germany were randomised to an intervention group (IG) with access to levidex or to a control group (CG) programme. Follow-up data was obtained over 12-24 months. The effect on the combined primary endpoint (new T2 lesions or relapses) was analysed using a Cox proportional hazard model. Secondary endpoints were analysed using group mean comparisons between IG and CG adjusted for baseline assessments and centre with ANCOVA models.

Results: There was no difference in number of new T2 lesions or relapses between IG and CG (Hazard Ratio: 0.91; 95%-CI: [0.66,1.27], p=0.596). After three months, dietary behaviour was healthier in the IG according to a healthy diet screener (0.43; 95%-CI: [0.14,0.72], p=0.0037). However, there was no difference in dietary behaviour after 12 months (0.02; 95%-CI: [-0.33,0.37], p=0.9083). Moreover, there was no difference in QoL, anxiety, depression, empowerment or physical activity after 12 months.

Discussion: The trial failed to meet its primary endpoint. High QoL, empowerment and physical activity levels at baseline might have hindered detection of an effect. Clinical relevance of short-term improvement in dietary behaviour (0.43 points on a scale of 0-10) requires further investigation.

Conclusion: In this cohort of pwMS with high QoL, usage of levidex did not lead to a reduction of inflammatory disease activity or change in health behaviour. Interventions such as levidex might be more effective in pwMS with lower QoL and higher need for health behaviour adjustments.

Keywords: multiple sclerosis, digital health application, lifestyle management, randomised controlled trial

Submission ID: 44; Submission Group: Technology Supported Rehabilitation; Submitter: Alessia Susini

Testing validity and usability of a new mHealth app for self-assessment of cognitive functions in people with Multiple Sclerosis: DIGICOG-MS®

A new app for cognitive deficits: DIGICOG-MS®.

Susini A[1], Tacchino A[1], Di Antonio F[1], Ponzio M[1], Pedullà L[1], Battaglia MA[2], Brichetto G[1,3], Podda J[1]

*[1]Italian Multiple Sclerosis Foundation, Scientific Research Area, Genoa, Italy, [2]University of Siena, Siena, Italy, [3]AISM Rehabilitation Service, Genoa, Italy, University of Siena, Siena, Italy *main author*

Introduction and Aim. Easy-to-use digital solutions as mobile health applications (mHealth apps) are now strongly required to assess cognitive impairment (CI), one of the most disturbing symptoms in MS, experienced by almost 43-70% of people with MS (PwMS). In this view, this study aimed to test validity and usability of DIGICOG-MS®, a mHealth app for cognitive self-assessment in MS.

Methods. DIGICOG-MS® includes four digital tests assumed to evaluate the most affected cognitive domains in MS as visuospatial memory (VSM), verbal memory (VM), semantic fluency (SF) and processing speed (PS), inspired by traditional paper-based tests known to assess the same cognitive functions (i.e., SPART, RAVLT, WLG and SDMT). Convergent validity was analyzed using the Pearson coefficient (r) to determine the strength of the association between digital and traditional tests. To test app reliability, the agreement between two repeated measurements was addressed with the intraclass correlation coefficients (ICC). System Usability Scale (SUS) and mHealth App Usability Questionnaire (MAUQ) were thus administered after the digital evaluation to test DIGICOG-MS® usability.

Results. The final sample consisted in ninety-two PwMS (female: 60; mean age: 51.38±11.36 years; educational level: 13.07±2.74 years; disease duration: 12.91±9.51 years; EDSS: 3.58±1.75), followed at the AISM Rehabilitation Service of Genoa (Italy). Pearson correlation indicated significantly strong correlations for VSM, VM, SF and IPS (all ps<.001), with r values ranging from 0.58 to 0.78 for all cognitive domains. Test-retest reliability of the mHealth app was excellent (ICCs>0.90) for VM and IPS, and good for VSM and SF (ICCs>0.80). Moreover, SUS score averaged 84.5±13.34, and total score from MAUQ was 104.02±17.69, suggesting that DIGICOG-MS® was highly usable and well appreciated by PwMS.

Discussion. Results indicated that DIGICOG-MS® is a valid, reliable and highly usable digital tool for self-cognitive assessment, supporting the use of such novel mHealth app into clinical practice.

Submission ID: 45; Submission Group: Technology Supported Rehabilitation; Submitter: Silvia Poli

Non-pharmacological interventions using Digital Health Technologies to improve biopsychosocial wellbeing in people with MS: A systematic review and meta-analysis

Silvia Poli[1*], Isolde Busch[1], Giulia Di Domenico[2], Maria Angela Mazzi[1], Roshan das Nair[3,4], Michela Rimondini[1]
*[1]Department of Neurosciences, Biomedicine and Movement Sciences, University di Verona, [2]Unit of Neuroepidemiology, Fondazione IRCCS Istituto Neurologico Carlo Besta, [3]Department of Health Research, Trondheim, SINTEF, Norway, [4]School of Medicine, University of Nottingham, Nottingham, UK, *main author*

Background: Digital health technologies (DHTs) use information and communication techniques to improve prevention, diagnosis, monitoring, treatment, and management of health-related issues and lifestyle-habits. DHTs are becoming increasingly relevant to deliver Multiple Sclerosis (MS) care. However, their implementation and their effectiveness require further investigation.
Aim: This systematic review and meta-analysis aimed to summarize and describe the types of DHTs used in non-pharmacological interventions (NPI) for people with MS, focusing on intervention feasibility, acceptability, and efficacy.
Method: The review was prospectively registered. PubMed, Web of Science, Scopus, and PsycINFO were systematically searched, without any restrictions on publication date. We included peer-reviewed studies describing the evaluation, implementation or piloting of NPI, based on DHTs, for adults (age⩾18) diagnosed with any type of MS . We did not include articles using DHTs exclusively for assessment. We included all types of interventional evaluation research designs. We prioritized assessing quality of life and well-being, but also included other measures such as psychosocial, physical, clinical, and cognitive variables as outcome measures. Two independent reviewers conducted the initial screening, reviewed the full texts, and extracted the data. The review is ongoing.
Results: We expect to produce: 1) a summary of how DHTs are used in NPI; 2) a narrative synthesis and/or meta-analysis (based on data availability and appropriateness) on acceptability, feasibility efficacy of interventions; 3) a description of under-represented groups (e.g., ethnic minorities, people with progressive MS).
Conclusion: The systematic review will provide valuable insights on the available DHTs for MS care and inform researchers, policy makers and clinicians about their acceptability, efficacy, potential challenges, while also highlighting gaps in the current literature. This will help guide future intervention development.

Submission ID: 46; Submission Group: Outcome Measures; Submitter: Silvia Poli

Fatigue in young adults living with Multiple sclerosis and its correlation with mindfulness, Illness perception and resilience

Silvia Poli[1*], Valeria Donisi[1], Alberto Gajofatto[1], Roshan das Nair[2,3], Maria Angela Mazzi[1], Michela Rimondini[1]
*[1]Department of Neuroscience, Biomedicine and Movement Science, University di Verona, [2]Department of Health Research, Trondheim, SINTEF, Norway, [3]School of Medicine, University of Nottingham, Nottingham, UK, *main author*

Background: Fatigue is one of the most common and disabling symptoms reported by people with Multiple Sclerosis (MS) and has a significant impact on patients' functioning. Young adults with MS (YawMS) have specific needs in terms of their functioning. Understanding the psychosocial factors related to fatigue in this population is crucial for designing effective interventions to manage it.
Aim: To describe fatigue in a sample of YawMS and explore its association with psychosocial factors, while adjusting for the impact of anxiety and depression.
Methods: Participants were recruited at the Verona University Hospital according to the following inclusion criteria: age 18–45 years, MS diagnosis, EDSS score lower than 3.5. Validated self-report questionnaires were used to measure fatigue, resilience, mindfulness traits (Observe, Describe, Act with Awareness, Non-judge and Non-react), illness perception, anxiety and depression. Descriptive (mean, standard deviation) and inferential statistics (Spearman and partial correlation) were performed.
Results: Fifty-one YawMS were enrolled (women=77%, relapsing-remitting MS=96%, EDSS⩽1.5=69%). The mean age was 33.5±6.7 years. Total fatigue scale had a mean score of 61.9±17.9 (range 23-97). The majority of YawMS had moderate/severe cognitive fatigue (58%) and motor fatigue (69%). The total fatigue was associated with the illness perception total scale ($\rho=0.54;p<0.05$), identity ($\rho=0.66;p<0.05$), consequences ($\rho=0.57;p<0.05$), and Non-judge ($\rho=-0.48;p<0.05$). Motor fatigue was associated with the illness perception total scale ($\rho=0.58;p<0.05$), identity ($\rho=0.72;p<0.05$), consequences ($\rho=0.72;p<0.05$), Non-react ($\rho=-0.54;p<0.05$). Cognitive fatigue was associated with consequences ($\rho=0.56;p<0.05$) and identity ($\rho=0.53;p<0.05$), and Non-judge ($\rho=-0.49;p<0.05$). The correlation sizes remained the same or slightly decreased after adjusting for anxiety and depression. Resilience showed a negative low correlation with fatigue ($\rho=-0.41;p<0.05$), which was not maintained after partial correlation.
Conclusion: YawMS report high levels of motor and cognitive fatigue. After adjusting for anxiety and depression, fatigue was found to be associated with illness perception and mindfulness traits. These results might guide future intervention development.

Submission ID: 47; Submission Group: Technology Supported Rehabilitation; Submitter: Heidi Stölzer-Hutsch

Sensor validation of a smart leggings concept for people with walking impairments

Heidi Stölzer-Hutsch[1], Maximilian Rechenberg[1], Katrin Trentzsch[1], Hung Le Xuan[2,3], Chokri Cherif[2,3], Tjalf Ziemssen[1]

[1]Centre of Clinical Neuroscience, Department of Neurology, Faculty of Medicine and University Hospital Carl Gustav Carus, Technische Universität Dresden, Germany, [2]Institute of Textile Machinery and High Performance Material Technology (ITM), Faculty of Mechanical Science and Engineering, Technische Universität Dresden, Germany, [3]CeTI—Cluster of Excellence, Centre for Tactile Internet with Human-in-the-Loop, Technische Universität Dresden, Germany

Background: Walking impairments due to foot drop are a common symptom of multiple sclerosis (MS). It affects gait stability and increases the risk of falling. Functional electrostimulation is recommended to activate peroneal muscles for rehabilitation. In a complex research project supported by the German Federal Ministry for Economic Affairs and Climate Action, an inconspicuous smart leggings is being developed to improve gait and gait safety in the use case of MS. The device concept is designed to stimulate the peroneal nerve in the swing phase and to allow muscle strengthening via a training mode.

Aims: Aim of this pilot study was to validate the sensors of the smart leggings used for gait detection against state-of-the-art wearable sensors.

Methods: In an initial study, 6 healthy participants wearing the smart leggings and walked along a 27 m path. Integrated into the smart leggings are 2 inertial measurement units (IMU) and 1 novel textile strain sensor on each leg. In addition, 7 wearable OPAL sensors were attached for simultaneous recording. The measurement systems were compared using Bland-Altman plots.

Results: Gait parameters of 5 subjects (age 32.60 ± 8.82; female n=4) could be analysed. We were able to determine cadence, as well as the temporal parameters step time and stride time with the presented sensor systems. When comparing the integrated IMU sensors to the OPAL sensors, the mean differences were -0.09 steps/minute, -0.306 ms, and 0.696 ms, respectively. The mean differences for cadence, step time, and stride time between the integrated strain sensors and the OPAL sensors were determined to be -0.45 steps/minute, -0.260 ms, and 1.378 ms, respectively. In addition, the point clouds in the plots showed a regular distribution.

Conclusion: The analysed gait parameters of the smart leggings can be considered valid. The results suggest that the integrated strain sensors could be sufficient determining gait parameters.

Submission ID: 48; Submission Group: Rehabilitation Effectiveness; Submitter: Alice Bellosta

Efficacy of a rehabilitation program for walking aid users in multiple sclerosis

Main author: Alice Bellosta[1,2], Ludovico Pedullà[2], Costanza Iester[1], Laura Bonzano[1], Monica Biggio[1], Ambra Bisio[3], Andrea Tacchino[2], Giampaolo Brichetto[2,4], Marco Bove[3]

[1]Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health, University of Genoa, Genoa, Italy, [2]Scientific Research Area, Italian Multiple Sclerosis Foundation, Genoa, Italy, [3]Experimental Medicine Department, University of Genoa, Genoa, Italy, [4]AISM Rehabilitation Centre of Liguria, Italian Multiple Sclerosis Society, Genoa, Italy

This study investigated the efficacy of a technology-supported rehabilitation program to address fatigue-related motor impairments affecting walking ability in people with multiple sclerosis (PwMS).

24 PwMS (age=57.8±9.8 years, all EDSS=6) underwent a 20-session rehabilitation program focusing on gait, balance, and proper assistive device use. The experimental group (FB_group) used a crutch with real-time feedback based on user support, whilst the control group (NOFB_group) used a standard crutch. Two subgroups were also analyzed based on the aid used before enrollment, i.e., cane (PRE_cane) or crutch (PRE_crutch)

Assessment included Timed 25 Foot Walk (T25FW), Timed Up and Go (TUG) and Modified Fatigue Impact Scale (MFIS). In a sample of 14 PwMS, gait parameters (number of steps-STEP and contact time-CT) were recorded using sensorized insoles.

At baseline, PRE_crutch reported higher physical fatigue than PRE_cane ($p<0.05$). In this group increased fatigue was associated to better motor performance in both affected (aff) and non-affected (noaff) limbs as shown by higher STEP (aff:r=0.857,p=0.014; noaff:r=0.964,p<0.01) and lower CT (aff:r=-0.893,p=0.007; noaff:r=-0.857,p=0.014).

Following rehabilitation, we observed an improvement in fatigue regardless of the previous aid and the rehabilitation group (p=0.038). After treatment, FB_group performed better than NOFB_group in T25FW and TUG (p=0.028 and p=0.038, respectively). In addition, in both groups and limbs we found that higher STEP was associated to lower fatigue in the physical (PRE_crutch: r=-0.821,p=0.08) or cognitive domain (PRE_cane: r=-0.943,p=0.005) and lower CT was associated to lower physical fatigue (PRE_crutch:r=0.821,p=0.08; PRE_cane:r=0.90,p=0.037).

A 20-session rehabilitation period effectively reduces fatigue among PwMS. The shift in fatigue-performance trend suggests that after treatment good performance can be achieved experiencing less fatigue. Moreover, a real-time feedback crutch seems to have a positive impact on walking ability despite the prior aid used.

The study highlights the crucial role of healthcare professionals in guiding patients toward informed decisions about assistive devices, emphasizing personalized solutions.

Submission ID: 49; Submission Group: Other; Submitter: Barbara von Glasenapp

Digital lifestyle counseling in MS: a qualitative substudy of the POWER@MS1 trial

Barbara v. Glasenapp[1]*, Nicole Krause[1], Karin Riemann-Lorenz[1], Tim Friede[2], Markus van de Loo[3], Herbert Temmes[4], Stefan Gold[5] and Christoph Heesen[1]
*[1]Institute of Neuroimmunology and Multiple Sclerosis (INIMS), University Medical Centre Hamburg-Eppendorf (UKE), Martinistraße 52, 20246 Hamburg, Germany, [2]Department of Medical Statistics, University Medical Centre Göttingen, Göttingen, Germany, [3]German Multiple Sclerosis Society, Federal Association, Hannover, Germany, [4]German Multiple Sclerosis Society, Federal Association, Hannover, Germany, [5]Department of Psychiatry (CBF), Charité Universitätsmedizin Berlin, Germany, *main author,*

Background: Lifestyle factors, i.e. physical activity, diet, sleep and stress behavior as well as smoking and alcohol consumption are increasingly considered as modifiers of prognostic risk in MS. A digital lifestyle management application ("levidex") designed to help people with MS (pwMS) cope with the diagnosis and facilitate health behavior changes was evaluated in a randomized controlled trial (RCT; "POWER@MS1").
Methods: Semi-structured telephone interviews were conducted with n=15 health professionals (HPs; neurologists, study nurses) and n=16 pwMS as part of an accompanying process evaluation of the POWER@MS1 RCT. Participants were selected according to the maximum variation sampling strategy. Data was analyzed thematically.
Results: Non-adherent participants and dropouts were not reached during recruitment. PwMS experienced close monitoring through regular clinical visits and magnetic resonance imaging (MRI) as reassuring after MS diagnosis. A healthy lifestyle was considered as an important component of MS treatment by both HPs and pwMS. Although quantitative trial data revealed no significant behavioral changes, pwMS reported improvements in their diet, physical activity, stress management and sleep. PwMS regarded evidence-based information, meditation instructions and self-monitoring as particularly helpful for implementation of these changes. Although both groups perceived levidex as a useful addition to standard care, they reported a need for additional personal consultation.
Discussion: Change in lifestyle behavior was identified as a highly relevant aspect of MS treatment and levidex facilitated behavioral changes among interviewed pwMS. Nevertheless, participants in both groups underlined the importance of personal consultation as an essential factor for behavioral changes.
Conclusion: Lifestyle counseling through a digital lifestyle management application was perceived as beneficial. However, exclusive digital counseling might not be sufficient to achieve and maintain behavioral changes.

Submission ID: 50; Submission Group: Other; Submitter: Alex Maximilian Keller

Development of a MS-specific smoking cessation intervention: preliminary results of a mixed-methods study

A.M. Keller (main author)[1], B. v. Glasenapp[2], C. H. Marck[2], D. Kotz[3], C. Heesen[1], K. Riemann-Lorenz[1]
[1]University Medical Center Hamburg-Eppendorf (UKE), Germany, [2]University of Melbourne, Australia, [3]Medical Faculty of the Heinrich-Heine-University Düsseldorf, Germany

Background: Tobacco smoking is a relevant determinant of multiple sclerosis (MS) onset and smokers have increased risks for faster progression of MS compared to non-smokers. Among people with MS (pwMS), smoking is associated with lower quality of life, increased depression, and worse cognitive function. Smoking cessation significantly reduces the risk of reaching disability milestones. However, no smoking cessation programs have been developed in MS populations to date.
Aims: We aimed to assess the barriers, motivators and needs of pwMS for a MS-specific smoking cessation intervention.
Methods: We conducted semi-structured interviews with pwMS about their smoking behaviour. Recruitment was done via MS-websites and the email-newsletter of our institution. Participants were eligible if they had self-reported MS-diagnosis and if they currently smoked or quit smoking within the last two years but after their MS-diagnosis. Interviews were conducted online and via telephone during May and June 2023. Data was analysed using thematic analysis.
Results: Eight women and seven men participated in our interviews. Eleven were current, four were former smokers. Median age was 47 (range: 27-68). Interviews identified the MS-diagnosis as a relevant motivator to stop smoking, and worries about negative consequences when quitting as a great barrier towards smoking cessation. Knowledge about the connection between MS and smoking, and satisfaction with communication with MS-clinicians were low. PwMS wished for better conversations with neurologists and for expert-led smoking cessation interventions.
Conclusion: Our results confirm findings of previous studies, identifying lack of knowledge, dissatisfactory communication with MS-clinicians and worries about negative consequences when quitting as barriers, and the MS-diagnosis as a motivator for smoking cessation. Additionally, we found that the wish for peer-exchange and the willingness to participate in smoking cessation programs was high. In a next step, we will use our findings for the development of a MS-specific online smoking cessation program.

Submission ID: 51; Submission Group: Rehabilitation Effectiveness; Submitter: Andrea Giordano

Advance Care Planning in Multiple Sclerosis (ConCure-SM): results of a multicenter feasibility trial

Andrea Giordano[1], Ludovica De Panfilis[2], Giorgia Presicce[3], Riccardo Orlandi[4,5], Simona Toscano[6,7], Federica Pinardi[8], Giulia Di Domenico[1], Mariangela Farinotti[1], Alberto Gajofatto[4,5], Luca Ghirotto[9], Maria Grazia Grasso[3], Alessandra Lugaresi[8,10], Katia Mattarozzi[11], Sara Montepietra[12], Francesco Patti[6,7], Marta Perin[2], Michela Rimondini[13], Roberta Martina Zagarella[2,14], Claudio Solaro[15], Simone Veronese[16], Alessandra Solari[1], on behalf of the ConCure-SM project

[1]Unit of Neuroepidemiology, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan, Italy, [2]Bioethics Unit, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy, [3]Multiple Sclerosis Unit, IRCCS S. Lucia Foundation, Rome, Italy, [4]Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, [5]Unit of Neurology, Borgo Roma Hospital, Azienda Ospedaliera Universitaria Integrata Verona, Verona, Italy, [6]Department GF Ingrassia, University of Catania, Italy, [7]UOS Sclerosi Multipla, Policlinico " G Rodolico", University of Catania, Italy, [8]IRCCS Istituto delle Scienze Neurologiche di Bologna, Bologna, Italy, [9]Qualitative Research Unit, Azienda USL-IRCCS, Reggio Emilia, Italy, [10]Dipartimento di Scienze Biomediche e Neuromotorie, Università di Bologna, Bologna, Italy, [11]Department of Medical and Surgical Science, University of Bologna, Bologna, Italy, [12]Multiple Sclerosis Center, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy, [13]Section of Clinical Psychology, Department of Neuroscience, Biomedicine and Movement Science, University of Verona, Verona, Italy, [14]National Research Council (CNR), Interdepartmental Center for Research Ethics and Integrity (CID Ethics), Rome, Italy, [15]Department of Rehabilitation, M. L. Novarese Hospital, Moncrivello, Vercelli, Italy, [16]Fondazione FARO, Turin, Italy

Background. Implementation of Advance Care Planning (ACP) in people with progressive multiple sclerosis (pwPMS) remains limited. The ConCure-SM project aims to assess the effectiveness of a structured ACP intervention (health professional [HP] training and use of a booklet during the ACP conversations) using a multi-phased design.

Methods. A single-arm pilot/feasibility trial with nested qualitative study [ISRCTN48527663] was conducted involving pwPMS, their significant others, and HPs from six Italian centers. The primary study outcome was completion of an advance care plan document (ACPDoc). Other outcomes included safety, feasibility of enrollment and assessment, Hospital Anxiety and Depression Scale (HADS), 4-item ACP-Engagement survey (4-item ACP-E), Quality of Communication (QOC), health-related quality of life (HRQoL) (MSQOL-29), and caregiver burden (ZBI).

Results. Between March 2022 and March 2023, 164 pwPMS were screened, and 89 were excluded. Of 75 eligible patients, 19 (25%) accepted to participate. Nineteen pwPMS (mean age 61 years, 42% women) were included, and 11/19 (58%) completed the ACPDoc. Three out of 25 adverse events were possibly related to the intervention, all consisting of increase in anxiety. This mirrored a median increase in the HADS-Anxiety score of 2 after the first ACP conversation and no change after six months (intention-to-treat analysis, $p=0.02$). Changes over time were significant for MSQOL-29 Mental Health composite ($p<0.05$), and unremarkable for HADS-Depression, 4-item ACP-E, QOC, and MSQOL-29 Physical Health composite. Analysis of the first (audio-recorded) ACP conversation and of the nested qualitative study are ongoing.

Conclusions. The ACPDoc was completed by 58% of the pwPMS vs. a hypothesized value of 30%. The intervention was safe, however there was a slight worsening in anxiety symptoms and in HRQoL mental health sub-domain. Findings of the pre-recruitment stage, with only 25% of the eligible pwPMS refusing participation, indicate the need to enhance the ACP preparedness of pwPMS.

Submission ID: 52; Submission Group: Rehabilitation Effectiveness; Submitter: Michela Ponzio

Protocol of Vocational Rehabilitation intervention for the management of work difficulties in Workers with Multiple Sclerosis: RiaL SM project

Ponzio Michela[1], Grange Erica[1], Pignattelli Elena[1], Manacorda Tommaso[1], Inglese Matilde[2], Durando Paolo[3,4], Grasso Maria Grazia[5], Persechino Benedetta[6], Brichetto Giampaolo[1,7]

[1]Research Area, Italian Multiple Sclerosis Foundation, Genoa, Italy, [2]Department of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DiNOGMI) and Center of Excellence for Biomedical Research (CEBR), University of Genoa, Genoa, Italy, [3]Department of Health Sciences, University of Genoa, Genoa, Italy, [4]Occupational Medicine Unit, IRCCS Ospedale Policlinico San Martino, Genoa, Italy, [5]IRCCS Santa Lucia Foundation, Rome, [6]Italian Workers' Compensation Authority (INAIL), Rome, Italy, [7]Italian Multiple Sclerosis Society, AISM Rehabilitation Service, Genoa, Italy

Background: One of the main social consequences of Multiple Sclerosis (MS) is the reduction/abandonment of work, already present in the early stages of the disease. Vocational Rehabilitation (VR) intervention is a multi-professional/multidimensional approach provided by different professionals in different settings, services, and activities to working-age individuals with impairments, limitations, restrictions with work functioning. The project aims to draft VR protocol to reduce work-related difficulties and promote job retention of workers with MS.

Materials and methods: The project is divided into different steps: 1) national/international survey addressed to rehabilitation centers to investigate how problems relating to job retention/reintegration are treated; 2) cross-sectional study to assess work abilities and related needs; 3) interventional study to assess the efficacy of a VR intervention.

The cross-sectional study will recruit 200 subjects with MS, aged 18-65 years, work engaged. The sample will be contacted online to filled following questionnaires: Work Ability Index, Utrecht Work Engagement Scale, Work Productivity and Activity Impairment, Multiple Sclerosis Questionnaire for Job Difficulties (MSQ-Job), Need and Provision Complexity Scale and EuroQol.
A sample of 30 workers with job difficulties (MSQ-Job>=15) will be recruited for interventional study among subjects participating in the cross-sectional study. The VR intervention will be based on individual needs, covering three areas of intervention: the medical-rehabilitation area, the reasonable accommodation area, and the education area. For each subject, during baseline evaluation, will be identified a maximum 5 priority work difficulties. At the end of the VR intervention, will be evaluated: resolution of work difficulties, satisfaction and effectiveness of the intervention through the Global Perceived Effect.
Results/Conclusion: The expected study results will contribute to the drafting of specific protocols for each of the 3 areas of intervention and the proposal of an integrated process involving all professional figures involved in VR intervention.

Submission ID: 53; Submission Group: Outcome Measures; Submitter: Erica Grange

Cluster Analysis and Multiple Sclerosis Workers Phenotypes

Erica Grange[1], Jessica Podda[1], Federica Di Antonio[1], Benedetta Persechino[2], Tommaso Manacorda[1], Matilde Inglese[3], Paolo Durando[4,5], Mario Alberto Battaglia[1,6], Giampaolo Brichetto[1,7], Michela Ponzio[1]
[1]Scientific Research Area, Italian Multiple Sclerosis Foundation, Genoa, Italy, [2]Italian Workers' Compensation Authority (INAIL), Rome, Italy, [3]Department of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DiNOGMI) and Center of Excellence for Biomedical Research (CEBR), University of Genoa, Genoa, Italy, [4]Department of Health Sciences, University of Genoa, Genoa, Italy, [5]Occupational Medicine Unit, IRCCS Ospedale Policlinico San Martino, Genoa, Italy, [6]Department of Life Science, University of Siena, Siena, Italy, [7]AISM Rehabilitation Service, Italian Multiple Sclerosis Society, Genoa, Italy

Background: While job maintaining/reintegrating are clearly complex issues in multiple sclerosis (MS), where many aspects (physical, psychological, relational and personal resources) can play a key role, they offer scope for potential interventions. This study aimed to identify and describe phenotypes of workers with MS considering specific work-related domains such as work-related difficulties, anxiety and depressive symptoms, and coping strategies.
Methods: A cross-sectional online survey on MS workers was conducted in Italy.
Hierarchical cluster analysis was performed by the Ward method followed by k-means cluster analysis.
Results: A total of 209 workers with MS were included in the analysis. We identified four phenotypes: phenotype 1 had low work difficulties, low depressive symptoms and mild anxiety, with a moderate tendency to use problem focus and positive attitude and a mild one to use social support as coping strategies (n=82, 39.2%); phenotype 2 had low-to-mild work difficulties, mild anxiety and low depressive symptoms, with a high tendency to use positive attitude and religion, moderate problem focus and social support, and mild denial (n=38, 18.7%); phenotype 3 had low-to-mild work difficulties, moderate anxiety and depressive symptoms, with a mild tendency to use problem focus, positive attitude, religion, social support, denial as coping strategies (n=50, 23.9%); phenotype 4 had mild-to-moderate work difficulties, moderate anxiety and depressive symptoms, with a moderate tendency to use problem focus, positive attitude, and mild social support and denial as coping strategies (n=39, 18.7%)
Conclusion: This explorative analysis aimed to find distinct workers with MS profiles in a working-age population based on work-related domains such as work-related difficulties, coping strategies, and psychological aspects. This could lead to a better tailoring of the vocational rehabilitation interventions for workers with MS.

Submission ID: 54; Submission Group: Rehabilitation Effectiveness; Submitter: Nadine Patt

Predictors of six-month change in health-related quality of life in persons with multiple sclerosis undergoing inpatient rehabilitation - secondary analysis of a randomized controlled trial

Nadine Patt[1], Marie Kupjetz[2], Marit Lea Schlagheck[2], Ruth Hersche[3], Roman Gonzenbach[1], Niklas Joisten[2], Philipp Zimmer[2], Jens Bansi[1,4]
[1]Department of Neurology, Clinics of Valens, Rehabilitation Centre Valens, Taminaplatz 1, 7317 Valens, Switzerland, [2]Division of Performance and Health (Sports Medicine), Institute for Sport and Sport Science, TU Dortmund University, Otto-Hahn-Straße 3, 44227 Dortmund, Germany, [3]Rehabilitation Research Laboratory 2rLab, Department of Business Economics, Health and Social Care, University of Applied Sciences and Arts of Southern Switzerland, Via Violino 11, 6928 Manno, Switzerland, [4]OST – Eastern Swiss University of Applied Sciences, Department of Health, Physiotherapy, Rosenbergstrasse 59, 9001 St.Gallen, Switzerland

Background: Symptomatic treatment in persons with multiple sclerosis (pwMS) requires comprehensive multidisciplinary rehabilitation. However, participant- and disease-specific factors that predict sustained improvement in health-related quality of life (HRQoL) in pwMS after an inpatient rehabilitation stay remain to be investigated in order to provide more specific and individualised intervention recommendations for multidisciplinary rehabilitation in pwMS.
Objective: To identify factors that predict change in HRQoL from clinic entry for a three-week inpatient rehabilitation stay to the six-month follow-up in pwMS.
Methods: This is a secondary analysis of a randomized controlled trial (NCT04356248) conducted at the Valens Rehabilitation Centre,

Switzerland. HRQoL was assessed with the Medical Outcome Study 36-item Short Form Health Survey (SF-36) at entry to clinic (T_0) and six months after (T_3; six-month follow-up). Ninety-nine pwMS were analysed using multiple linear regression (enter method). Outcome variables were six-month change in physical (ΔPCS) and mental component scale (ΔMCS) scores of the SF-36 (T_3 score – T_0 score). Predictor variables were baseline PCS and MCS scores, fatigue, anxiety, depressive mood, cardiorespiratory fitness ($\dot{V}O_{2peak/kg}$), self-efficacy for performing energy conservation strategies, smoking status and education level.

***Results*:** The first regression model explained 20.3% (adjusted R^2=0.203) of the variance of the ΔPCS score ($F(8,90)$=4.123, $p<0.001$, R^2=0.268). Lower PCS score ($p<0.001$, unstandardized coefficient (B)=-0.424, standardized coefficient (β)=-0.410), lower depressive mood (p=0.013, B=-1.146, β=-0.273), and higher $\dot{V}O_{2peak/kg}$ (p=0.042, B=0.381, β=0.214) at baseline predicted higher ΔPCS score. The second regression model explained 24.6% (adjusted R^2=0.246) of the variance of the ΔMCS score ($F(8,90)$=4.988, $p<0.001$, R^2=0.307). Lower MCS score at baseline ($p<0.001$, B=-0.592, β=-0.595) predicted higher ΔMCS score.

***Conclusion*:** PwMS with lower physical and mental HRQoL, lower depressive mood and higher cardiorespiratory fitness at clinic entry for a three-week inpatient rehabilitation stay improved the most in physical and mental HRQoL over six months.

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Disclosures: Nothing to disclose.

Submission ID: 55; Submission Group: Rehabilitation Effectiveness; Submitter: Frank Houlmont

Effectiveness of robotic rehabilitation in improving muscular strength and mobility in patients with multiple sclerosis: Preliminary results of a randomized controlled open-label trial

Frank Houlmont[1], Helena Cassol[1], Benoît Maertens de Noordhout[1], Aurore Thibaut[2,3], Jordan Roncin[1], Daniel Guillaume[1], Jean-François Kaux[1]

[1]Physical and Rehabilitation Medicine Department, University Hospital of Liège, University of Liège, Avenue de l'Hôpital, 1, Liege, Belgium, [2]Coma Science Group, GIGA-Consciousness, University of Liège, Liège, Belgium, [3]Centre du Cerveau[2], University Hospital of Liège, Liège, Belgium

Background: Patients with multiple sclerosis (MS) may suffer from balance and gait impairments, which affect their quality of life (Oh et al., 2018). New approaches such as robot-assisted rehabilitation show promising results in the management of MS but require further validation through more in-depth research, including larger-scale studies (Zasadzka et al., 2021). One of these techniques is the LUNA- EMG (Samcom®), a multifunctional upper and lower limb rehabilitation robot for patients with neurological or orthopaedic conditions (e.g., Oleksy et al., 2022).

Aim: This randomized controlled open-label study aims to assess the effects of the LUNA-EMG rehabilitation robot (RR) on MS patients' muscular strength, balance and gait.

Methods: 35 patients with MS were randomly assigned to the RR (n=19) or the control group (n=16). The RR group received forty minutes of RR once a week for twelve weeks in addition to conventional physical therapy, whereas the control group underwent conventional physical therapy only. Patients' balance (Timed-Up and Go), speed (25 feet walking test), quadriceps (Q) and hamstring (H) muscular strengths and proprioception were collected at baseline, after four, eight and twelve weeks. We used two-ways repeated measures ANOVAs to analyse the treatment effect and performed analyses in intention to treat.

Results: Results revealed a statistically significant interaction between the effects of time and group regarding muscular strength for Q and H. Regarding H, post hoc Tukey tests revealed better scores at 4, 8 and 12 weeks compared to baseline within the RR group. Regarding Q, results also showed better scores in the RR group compared to the control group at 8 weeks. Other variables did not differ significantly between groups.

Discussion: Results show that RR improved MS patients' muscular strength. Analyses will be confirmed once the total sample is collected (n=40).

Submission ID: 56; Submission Group: Outcome Measures; Submitter: Ludovico Pedullà

Individual and environmental predictors of adherence to passive and active remote monitoring in people with multiple sclerosis

Pedullà L[1]*, Di Antonio F[1], Polidori A[1], Bollini A[1], Prada V[1], Grange E[1], Paolucci R[1], Monti Bragadin M[1,2], Tacchino A[1], Podda J[1], Zaratin P[1], Brichetto G[1,2].

*[1]Italian Multiple Sclerosis Foundation, Scientific Research Area, Genoa, Italy, [2]AISM Rehabilitation Service, Genoa, Italy, *main author*

Technology allows to remotely monitor people with Multiple Sclerosis (PwMS) and collect real-life data using wearables and mobile patient-reported outcomes (mPROs). Patients' engagement is crucial to maximize adherence throughout long data collection journeys.

Aims of this work were: (i) to evaluate participant adherence to and usability of a smartphone- and smartwatch-based monitoring protocol; (ii) to identify individual and environmental predictors of passive (PM, through wearables) and active monitoring (AM, through mPROs).

20 PwMS (aged 27-45 years; Expanded Disability Status Scale-EDSS 0-4) were asked to continuously wear a smartwatch and answer to 10 mPROs/week for nine months. PM (days with valid smartwatch data, %) and AM adherence (completed/scheduled mPROs, %) were calculated. Solution's usability was measured

with a validated questionnaire. Linear regressions with multiple predictors were performed including demographic, clinical, motor, cognitive and mood variables that may influence AM and PM adherence. Further, adherence across the different seasons (winter, spring, summer, autumn) was compared using Kruskal-Wallis test. Mean adherence was 76.9±21.4% and 45.3±25.6% for PM and AM, respectively. Usability score was 146.30±15.40/190. Although not statistically significant, higher PM adherence was associated to greater objective and self-reported disability, measured by EDSS (β=7.68,p=0.059) and Perceived Health Questionnaire (β=3.03,p=0.054), respectively. However, higher anxiety levels may lead to reduced PM adherence (β=-1.17,p=0.051).
Age was inversely associated to AM adherence (β=-2.12,p=0.059). Moreover, season had an impact on mPROs response rate ($p<0.001$): participants were less engaged during winter (all $p<0.001$) and more active during summer than during spring (p=0.025).
PM adherence was in line with previous works. PwMS that may need more assistance seem to show higher adherence, but anxiety can be a detrimental factor. Although well tolerated, the data collection journey proposed showed low AM adherence, mainly during winter. Next studies on individual and environmental factors affecting adherence are needed towards PwMS' empowerment in health management.

Submission ID: 57; Submission Group: Other; Submitter: Luc Vleugels

Personality disorders, cognitive impairment, and intensity of care in a hospitalized MS population

Hostyn, J.*, CNS, MSc, Van Hoof, P., MD, Peeters, N., OT, MSc, Kos, D., PhD and Vleugels, L., PhD
*Main author
Institution: National Center for MS, Melsbroek, Belgium

Introduction: In a hospitalized setting, not only the number of patients is considered for nursing staff planning and perceived workload, also the intensity of care is important. Physical disabilities may impact physical intensity, whereas personality disorders and cognitive impairment may impact the psychological intensity of care.
This study is to examine 1) the occurrence of personality disorders, 2) the nature of these disorders and 3) their relation to nursing care intensity in a hospitalized MS sample.
Methods: In all NMSC inpatients over a period of three months, we assessed the level of personality functioning (Level of Personality Functioning Scale-Brief Form, LPFS-BF-NL_2.0), the nature of personality (Personality Inventory for DSM-5—Brief Form, PID-5-BF-NL), well-being (Mental Health Inventory, MHI); depression (Zung) and cognitive functioning (Rao's Neuropsychological Screening Battery for Multiple Sclerosis). Intensity of care of each inpatient was registered by nurses with the NMSC instrument including four items on physical care and three on psychological care.
Results: In our sample (n=102), 42% showed personality disorders. These personality disorders were associated to only the psychological care intensity ($p < 0.05$) and to mental well-being ($p<0.001$) (Zung, MHI). Conversely, cognitive impairment was associated to physical care intensity ($p<0.001$) but not to psychological care intensity. The nature of these personality disorders will be discussed, as will be the effect of cognitive impairment on reliability of the FPLS-BF-NL 2.0.
Conclusion: As in other non-psychiatric patient populations, personality disorders are common in a hospitalized MS-population. These disorders are highly related to mental well-being and relate significantly though not as strongly to psychological aspects of intensity of caregiving. Contrarily, MS-related cognitive disorders seem to specifically relate to physical and not to psychological caregiving intensity. Considering personality and cognitive disorders in care planning and training of staff is recommended.

Submission ID: 58; Submission Group: Rehabilitation Effectiveness; Submitter: Mauro Crestani

The effectiveness of combining a home-based Digital Telerehabilitation program with conventional in-hospital therapy in Progressive Multiple Sclerosis: a multicenter, randomized controlled trial

Mauro Crestani[1], Francesca Salaorni[1], Gabriele Perachiotti[1], Alberto Gajofatto[1], Michela Rimondini[1], Valeria Donisi[2], Stefano Landi[3], Giovanni Morone[4], Sofia Straudi[4], Marialuisa Gandolfi[1,5]
[1]Department of Neurosciences, Biomedicine and Movement Sciences, University of Verona, Verona, Italy, [2]Department of Business Administration, University of Verona, Verona, Italy, [3]Department of Life, Health and Environmental Sciences, University of L'Aquila, L'Aquila, Italy, [4]Department of Neuroscience and Rehabilitation, University of Ferrara, Ferrara, Italy & Department of Neuroscience, Ferrara University Hospital, Ferrara, Italy, [5]Neuromotor and Cognitive Rehabilitation Research Centre (CRRNC), University of Verona, Italy & Neurorehabilitation Unit, AOUI Verona, Italy

Introduction: Multiple Sclerosis (MS) is a highly disabling chronic, inflammatory, demyelinating disease of the Central Nervous System (CNS). The limited research focusing on Progressive MS (PMS) and the lack of ecological validity highlight the need for a bolder approach that combines more than one intervention intending to produce synergistic effects. The primary aim is to test the effectiveness of combining a home-based Digital Telerehabilitation program with in-hospital rehabilitation on mobility against in-hospital rehabilitation alone.
Methods: This single-blind, randomized, controlled trial (FISM Research Project 2023/R-Multi/010) will involve 78 subjects with PMS (EDSS<7). All patients will receive ten in-hospital rehabilitation sessions (1 hour/day, three days/week). Then, the Experimental Group (EG) will receive a 12-week home-based Telerehabilitation program (three sessions/week). Instead, the Control Group (CG) will not receive any additional therapy except for general instructions for self-management. The primary outcome will be the Timed Up and Go (TUG). Validated measures for gait, upper extremity function, cognition, number of falls, dual tasking, anxiety and depression, fatigue, balance, manual ability, pain, health-related quality of life, and self-rated perception of change will be assessed as secondary outcomes. A blinded rater will evaluate patients before (T0) and after (T1) the in-hospital

rehabilitation program, 12 weeks (T2), and 24 weeks (follow-up, T3) after discharge. Moreover, we will explore the patient's perspective and experience with Digital Telerehabilitation in the EG using quantitative-qualitative methods and cost-effectiveness.
Results: Home-based Digital Telerehabilitation could represent a powerful tool to offer patients both cognitive and motor training, increasing access to care, within an engaging environment supporting patient empowerment and self-management, while reducing healthcare costs.
Conclusion: Our results could provide significant implications to support clinical guidelines on managing patients with PMS toward a more sustainable MS rehabilitation and provide preliminary data on cost-effectiveness to inform policymakers and the National Health System.
Keywords: Multiple Sclerosis, Telerehabilitation, Quality of Life, Falls, Gait disorders.

Submission ID: 59; Submission Group: Rehabilitation Effectiveness; Submitter: Gogem Topcu

Brief online neuropsychological rehabilitation for people with Multiple Sclerosis with mild or moderate cognitive problems: A mixed-methods multicentre feasibility randomised controlled trial

Gogem Topcu[1], Jacqueline R.Mhizha-Murira[1], Nia Goulden[2], Shaun Harris[3], Avril Drummond[4], Denise Kendrick[5], Zoë Hoare[2], Deborah Fitzsimmons[3], Shirley Thomas[1], Rod Middleton[6], Jennifer Martin[1], Stephen Timmons[7], Paul Leighton[8], Clare Bale[9], James Turton[9], Jonathan Hancock[10], Haley Morris[11], Polly Swain[11], Lauren Taylor[1], Laura Price[12], Jenna Hill[12], Dawid Rutkowski[12], Kimberley Fletcher[1], Paul Bradley[12,13], Kimberley Allen-Philbey[10,14], Andrea Stennett[10,14], Emma Tallantyre[12,13], Klaus Schmierer[10,14], Nikos Evangelou[1,11] & Roshan das Nair*[1,15,16], on behalf of the NEuRoMS collective
**Main Author*
Presenting Author: Gogem Topcu and Roshan das Nair
[1]Mental Health and Clinical Neurosciences, School of Medicine, University of Nottingham, Nottingham, UK, [2]North Wales Organisation for Randomised Trials in Health and Social Care, Bangor University, Bangor, UK, [3]Swansea Centre for Health Economics, School of Health and Social Care, Faculty of Medicine, Health and Life Sciences, Swansea University, Swansea, UK, [4]School of Health Sciences, University of Nottingham, Nottingham, UK, [5]Centre for Academic Primary Care, Unit of Lifespan and Population Health, School of Medicine, University of Nottingham, Nottingham, UK, [6]Population Data Science, Swansea University Medical School, Swansea, UK, [7]Nottingham University Business School, University of Nottingham, Nottingham, UK, [8]Centre of Evidence Based Dermatology, School of Medicine, University of Nottingham, Nottingham, UK, [9]Multiple Sclerosis Patient and Public Involvement Group, Nottingham, UK, [10]Clinical Board Medicine (Neuroscience), The Royal London Hospital, Barts Health NHS Trust, London, UK, [11]Department of Neurology, Nottingham University Hospitals NHS Trust, Nottingham, UK., [12]Department of Neurology, Cardiff and Vale University Health Board, Cardiff, UK, [13]Division of Psychological Medicine and Clinical Neurosciences, School of Medicine, Cardiff University, Cardiff, UK., [14]The Blizard Institute, Centre for Neuroscience, Surgery & Trauma, Faculty of Medicine and Dentistry, Queen Mary University of London, London, UK, [15]SINTEF Digital, Trondheim, Norway, [16]Institute of Mental Health, Nottinghamshire Healthcare NHS Foundation Trust, Nottingham, UK

Introduction: Cognitive problems in people with multiple sclerosis (pwMS) can negatively impact mood, daily activities, and work. While there is some evidence of effectiveness of neuropsychological rehabilitation (NR), most studies have been with those with more severe cognitive problems. The NEuRoMS programme (www.neuroms.org) is a brief online NR intervention for pwMS with mild or moderate cognitive problems.
Objective: To assess the feasibility of delivering NR and inform the design of a definitive randomised controlled trial (RCT) to investigate clinical and cost-effectiveness of brief NR in reducing the impact of cognitive problems.
Methods: This was a two-arm, parallel group, multicentre feasibility RCT, comparing NR plus usual care to usual care only, in pwMS with mild or moderate cognitive problems recruited from three UK hospitals. We assessed feasibility outcomes, perceived impact of MS, cognitive difficulties, mood, quality of life, function, self-efficacy and work difficulties at 3- and 6-months post-randomisation. We also interviewed pwMS, clinicians, and therapists involved in the RCT.
Results: 79 pwMS were randomised (mean age 54.5 (SD=11.5) years, 70% women, 28% men). Retention rates for 3 and 6-month follow-ups were 87% and 81%, respectively. The observed difference on Multiple Sclerosis Impact Scale – Psychological subscale (primary outcome for full RCT) was 3.42 (0.48 effect size [ES]), favouring the NR group. Perceived cognitive difficulties, mood and self-efficacy outcomes had ESs between 0.31 to 0.77, favouring the NR group. Interview data suggested the trial was feasible, and NR acceptable, with some amendments needed.
Conclusion: The NEuRoMS NR was feasible and acceptable to pwMS with mild or moderate cognitive problems, and there was a signal of efficacy in terms of perceived psychological impact. An ES of 0.33 was used in the sample size calculation for a full RCT, therefore it is possible that it would be able to detect a minimally clinically important ES.
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Submission ID: 60; Submission Group: Other; Submitter: Gogem Topcu

Patient and Public Involvement in Multiple Sclerosis Rehabilitation and Healthcare Research

Roshan das Nair[1,2,3]*, Gogem Topcu[2], Clare Bale[4], James Turton[4] & Nikos Evangelou[2,5]
**Main Author*

Presenting Authors: Roshan das Nair and Gogem Topcu
[1]SINTEF Digital, Trondheim, Norway, [2]Mental Health and Clinical Neurosciences, School of Medicine, University of Nottingham, Nottingham, UK, [3]Institute of Mental Health, Nottinghamshire Healthcare NHS Foundation Trust, Nottingham, UK, [4]Multiple Sclerosis Patient and Public Involvement Group, Nottingham, UK, [5]Department of Neurology, Nottingham University Hospitals NHS Trust, Nottingham, UK.

Introduction: Patient and Public Involvement (PPI) aims to empower service users, increase representation and inclusivity, and improve quality of research by embracing principles of good citizenship, accountability, and transparency. Increasingly, PPI in healthcare research is being seen as an essential part of good research practice, and the value of PPI has been outlined in research publications. Indeed, some research funders are making PPI a mandatory aspect of research. However, there are several areas of uncertainty regarding PPI roles and activities in rehabilitation research, and how such activities should be funded.
Objectives: To share our experience of developing and sustaining one of the largest multiple sclerosis (MS) PPI groups in the UK to help develop, conduct, and disseminate MS healthcare and rehabilitation research.
Materials and methods: We used a collaborative autoethnographic-oriented approach, where we engaged in iterative cycles of individual and group reflections that were documented through our meeting notes. One final focus group between our group (that involved clinicians, researchers, and 2 PPI members) consolidated the thematic organisation of our findings.
Results and conclusions: We outline 3 key themes. 1. Successes: e.g., the growth and popularity of our PPI groups (from a few people with MS to almost 100 now) who contribute to project idea development, research protocols, data collection, analyses, and dissemination; increased number of students, researchers, and clinicians engaged in the PPI groups; good feedback from grant/ethics reviewers. 2. Challenges: e.g., reaching minority/underrepresented groups, funding and payment issues. 3. Lessons learnt: e.g., mistakes made in terms of terminology used, training need for people engaging with PPI groups. While we have come a long way in improving PPI in our research, we still have issues related to diversity in PPI groups and remuneration issues.

Submission ID: 61; Submission Group: Rehabilitation Effectiveness; Submitter: Susan Coote

Move Smart MS– Symptom focused, stratified, online exercise and Education Programmes for people with MS

Hugh O'Loughlin[1], Mary Burke[1], Jack McGlynn[1], Susan Coote[1,2]
[1]Multiple Sclerosis Society, Ireland, [2]Physical Activity for Health, Health Research Institute, University of Limerick, Ireland

Background: Move Smart MS (MSMS) offers specialised, tailored, online exercise programmes for people living with Multiple Sclerosis (PwMS) across Ireland. This innovative programme provides group physiotherapy programmes to promote health, manage symptoms, reduce symptom severity and improve quality of life. The specialist team delivers exercise and education to groups with similar symptom focus, age and ability.
Participants: Participants self-referred or were referred by health professionals. Participants were screened for safety to exercise, balance and falls risk and placed into an appropriate program with tailored content for their particular symptoms and mobility levels. 262 participants took part over three blocks of 10 weeks. The programme provided 290 1.5 hour long sessions across thirty-five programmes.
Methods: Strength was assessed with the 30 second sit to stand test (STS) and walking endurance with a six-minute walk test (6MWT). The Multiple Sclerosis Impact Scale (MSIS-29), Modified Fatigue Impact Scale (MFIS), Multiple Sclerosis Walking Scale (MSWS-12), Quick Inventory of Depressive symptoms (QIDS), State and Trait Anxiety Index – Trait (STAI), and Godin Leisure Time Exercise Questionnaire (GLTEQ) were used for patient reported measures. Paired t-tests were used to evaluate the change over the 10 week programme. programme.
Results: The 6MWT increased on average by 22(SD 153.5) meters ($p=0.022$). STS score improved by 2.0(3.9) ($p<0.001$), an improvement of 16.2% in strength. The change in all PROMS was $p<0.01$, MSIS-29 physical impact improved by 12.0(19.7) points, and psychological impact by 10.8(20.5) points. MFIS improved by 9.26(12.6), indicating 21.3% improvement. MSWS-12 improved 6.95(14.6) points, QIDS by 2.0(3.14) which was a 28.2% improvement in depression STAI improved 3.4(6.9) points (16.3%) and GLTEQ scores by 12.4(47.3).
Conclusion: The MSMS programmes are effective in a range of both mental and physical health outcomes. The Specialist physiotherapy team, online environment and peer learning and social support were key to MSMS's success.

Submission ID: 62; Submission Group: Rehabilitation Effectiveness; Submitter: Susan Coote

Increasing intensity of physiotherapy through innovative hybrid systems is effective for strength and walking endurance

Mary Burke, Monica McDonnell, Jack McGlynn, Susan Coote
MS Society of Ireland.

Background: MS Ireland's hybrid semi-supervised programme offers high intensity individual programmes, optimising participation using telehealth and physiotherapy assistants.
Participants: 45 participants took part and 558 sessions were provided. Clients living with MS who may have experienced a recent change in their abilities are the target group. Treatment was online and in person up to 3 times per week over a 10-week period with exercise programmes were developed based upon individual goals.
Methods: Participants self-referred or were referred by health professionals and were assessed by a specialist physiotherapist. Objective measures were collected pre- and post-programme for strength, balance and endurance. Outcome measures used were 30 second sit to stand test; single leg stance (SLS) test when appropriate and six-minute walk test using the "map my walk" app. Participants completed a satisfaction survey post programme. Paired t-tests were used to evaluate change over the programme.

Results: STS pre-programme was 9.9(205) stands and post was 12.1(3.6). Mean change of 2.3(2.6) approached significance (p=0.06, 23.2%). SLS on the left leg improved from 6.7(2.3) pre-programme to 18.7(22.9) seconds post programme (change 8.0(16.3) SLS right leg improved from 12.3(10.1) to 21.7(21.7), mean change 6.2(15.8) improvement of 50% but was neither were statistically significant.
The mean distance for 6MWT increased from 176.0(205.6) to 417.5(204.5) meters, an improvement of 197.5(60.8)m/(112.2%, p=0.02) 85% of participants were satisfied with their experience scoring it 9 or 10 out of 10. When asked how likely they were to recommend the service on a scale of 1-10, 85% of participants rated 10/10.
Conclusion: This programme is highly valued by PwMS and data suggests improvement in quality of life and symptoms. The key aspects are the specialist physiotherapy team, high intensity individual programmes, optimising participation through the online environment and the use of physio assistants.

Submission ID: 64; Submission Group: New Research Methodologies; Submitter: Marcia Finlayson

Applying the method of journey mapping to describe usual MS rehabilitation in Canada

Marcia Finlayson[1], Afolasade Fakolade[1], Dorothy Kessler[1], Martina Franz[1], Leyan Al-Mashita[1], Sarah Donkers[2], Michelle Ploughman[3]
[1]Queen's University, Canada, [2]University of Saskatchewan, Canada, [3]Memorial University, Canada

Background: Randomized control trials of rehabilitation interventions often use "usual care" as the comparator condition. Yet, what constitutes usual MS rehabilitation can be quite variable across settings and jurisdictions and can lead to challenges interpreting trials, particularly from multi-site investigations. Finding a way to describe usual MS rehabilitation consistently and meaningfully is necessary for advancing use and interpretation of rehabilitation trial findings.
Objectives: Describe how the method of journey mapping was used to begin the process of describing usual MS rehabilitation in Canada.
Methods: Journey mapping is a research method typically used in the field of marketing to understand customers' use of and experiences with a service. Recently, researchers have started to use the method to understand patients' experiences with specific healthcare services. We used journey mapping interviews with adults with MS who received rehabilitation services in Canada in the past 3 months. We created a journey map template, using qualitative content analysis, to document the steps, processes, and feelings people with MS experienced as they worked to find, access, and use rehabilitation services to achieve their desired outcomes.
Results: Journey mapping is a useful method for examining MS rehabilitation. Application of the journey map template to individual cases illustrated that there are some overarching similarities in the steps adults with MS go through to access MS rehabilitation. Yet, individually experienced processes, feelings, and outcomes are quite variable given the different settings, providers, and funding models. The idea of "usual" MS rehabilitation may be a misnomer in the Canadian context.
Conclusions: The use of journey mapping provided important insights into the complexity and variability of "usual" MS rehabilitation in Canada. Findings point to the critical need for a standard approach to describing "usual care" comparator conditions in rehabilitation trials so that results can be meaningfully interpreted and applied in practice.

Submission ID: 65; Submission Group: Outcome Measures; Submitter: Andrea Giordano

Engagement of People with Multiple Sclerosis in research: insights from the INITIALISE project

Andrea Giordano[1], Ambra Mara Giovannetti[2], Giulia Di Domenico[1], Edoardo Donarelli[2], Rachele Paolucci[3], Federica Balzani[3], Alessia De Filippo[3], Stefania Tavoletti[3], Marco Solimano[3], Nicolò Zorich[3], Giampaolo Brichetto[4,5], Eleonora Cocco[6,7], Silvia Testa[8], Alessandra Solari[1], Rosalba Rosato[2]
[1]Unit of Neuroepidemiology, Fondazione IRRCS Istituto Neurologico Carlo Besta, Milan, Italy, [2]Department of Psychology, University of Turin, Turin, Italy, [3]Italian Multiple Sclerosis Society (AISM), [4]Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy, [5]AISM Rehabilitation Service, Italian Multiple Sclerosis Society, Genoa, Italy, [6]Department of Medical Science and Public Health, University of Cagliari, Cagliari, Italy, [7]Multiple Sclerosis Center, ASL Cagliari, ATS Sardegna, Cagliari, Italy, [8]Department of Human and Social Sciences, University of Aosta Valley, Aosta, Italy

Background: The Importance of Patient and Public Involvement and Engagement in public health and research is well-recognized. We aimed to engage people with MS (pwMS) to discuss/improve key research steps within the INITALISE project, which aims to identify health-related quality of life (HRQOL) domains to develop an item bank for multidimensional computerized adaptive testing in MS. Here we report the findings of an online meeting which involved a representative group of pwMS with experiential knowledge to assess the comprehensibility, appropriateness and acceptability of a focus group meeting (FGM) guide.
Methods: Ten days before the meeting, pwMS received the FGM guide to read and provide individual comments. The guide consists of five sections that investigate the impact of MS on HRQOL. Field notes were taken and integrated according to the issues identified to modify the guide. On February 2nd 2024, a 2-hour online meeting was held involving 6 pwMS (median age 35 years [range 31-64], 67% women, 84% single, all with college education and full-time work, 67% relapsing-remitting, median EDSS 2.0 [1.0-6.5], median years from MS diagnosis 11.5 [2-19]) and 4 INITIALISE researchers.
Results: Overall, the FGM guide was deemed clear. Main modifications regarded rephrasing questions about the impact of MS on HRQOL (e.g. 'rehabilitation' was added in the definition of treatment of MS), and specific ones on HRQOL domains (e.g., rephrasing of the definition of activities of daily living, and making a clear distinction from the instrumental activities of daily living).
The group appreciated the inclusion of inquiries addressing both detrimental and beneficial factors impacting HRQOL.

Conclusions: The FGM guide was considered content-wise and pwMS were active in identifying its strengths and issues. The engagement of pwMS was key to producing the revised version of the guide. The same pwMS will be further involved in future project steps.

Submission ID: 67; Submission Group: Rehabilitation Effectiveness; Submitter: Claudia Marck

Understanding clinical practice guideline application in multiple sclerosis care

Isabelle Weld-Blundell[1], Yvonne C Learmonth[2], Darshini Ayton[3], Marlena Klaic[1], Jodi Haartsen[4], Allan Kermode[2], Yasmine Probst[5], Christopher Heesen[6], Claudia H Marck[1] (presenting author)
[1]University of Melbourne, Australia, [2]Murdoch University, Australia, [3]Monash University, Australia, [4]MS Plus, Asutralia, [5]University of Wollongong, Australia, [6]University Medical Center Hamburg, Germany

Introduction: Considerable resources are invested to produce clinical practice guidelines (CPGs) for management of MS, to improve the quality and standard of care. However, uptake among clinicians in Australia remains unclear. We aimed to investigate MS clinicians' awareness, acceptance and use of CPGs; and related barriers and facilitators.
Methods: Semi-structured interview guides were developed using Fisher's framework to assess personal, guidelines-related, and external barriers to CPGs use; based on the knowledge-attitude-behaviour model embedded in social psychology. MS clinicians were recruited through professional bodies and MS societies. Three researchers conducted online interviews between June-October 2023. NVivo was used for inductive and deductive analysis using the framework.
Results: We interviewed 10 MS nurses and six neurologists from public and private settings; 12 women and four men, and nine had >10 years neurology-specialty experience. Despite most clinicians believing that CPGs can improve consistency, safety and quality of care; the use of CPGs was highly variable. Personal barriers included low awareness and familiarity. Guideline-related barriers included accessibility, layout and complexity. External barriers included organisational constraints and lack of resources. Facilitators to using CGPs included relevance to local protocols, covering complex treatment or unfamiliar topics; and when CPGs were up-to-date and developed by a trusted source. Most clinicians reported the need to apply CPGs in conjunction with clinical reasoning and considering the individual's circumstances and preferences, in the context of a heterogenous disease such as MS. Team collaboration, and professional education, were potential strategies to better apply CPGs as well as alternatives to CPGs use. Clinicians reported a lack of CPGs on pregnancy and breastfeeding.
Conclusion: This study found low awareness of, and variability in the use of CPGs. With considerable resources invested in the development of CPGs, these should in future be better aligned with local needs, easily accessible and regularly updated.

Submission ID: 68; Submission Group: Rehabilitation Effectiveness; Submitter: Sarah Donkers

Individualized Physiotherapy and Activity Coaching in MS (IPAC-MS): a randomized controlled trial with a cross over extension

Sarah Donkers[1], Kyra Ives[1], Charity Evans[2], Thuy Le[1], Katherine Knox[1]
[1]College of Medicine, University of Saskatchewan, Canada, [2]College of Pharmacy and Nutrition, University of Saskatchewan, Canada

Background: Lack of support from healthcare providers is a key modifiable barrier for physical activity in people with multiple sclerosis (PwMS). Behavioural interventions may have the largest effect sizes for increasing PA.
Methods: A parallel-group study randomized participants 1:1 to a 12-month behavioural change coaching intervention or wait-list control. After month 12, the wait-list control group crossed over for 6 months of the intervention. Participants were recruited from a database targeting individuals not currently active. The primary outcome was change in PA level on the Godin Leisure Time Exercise Questionnaire (GLTEQ). Secondary outcomes include change in MS symptoms (MSIS-29), confidence with managing MS (MSSE) and exercise self-efficacy (EXSE) over 12 months. Exploratory analysis included change in PA levels in the cross over group at 6 months.
Results: 120 participants were enrolled and groups were similar at baseline. Three participants withdrew (unrelated reasons), 117 participants completed primary outcome. Based on mixed effect models the change in GLTEQ differed between groups at all post-baseline time points (3, 6, 9, and 12-months). Mean change at 12 months on the GLTEQ was 15.62 (intervention group) vs. -0.33 (control group) ($p<0.001$). Significant between group differences for improvement on the MSIS-29, MSSE and EXSE where observed at 12 months in favor of the intervention group ($p<0.0001$). Demographics were not associated with change in activity. The 6-month cross-over group showed a similar increase in PA as the original 12-month intervention group.
Conclusion: PA levels and exercise self-efficacy in the intervention group significantly improved clinically and statistically. This improvement occurred regardless of age, sex, if on an MS drug, time since relapse, or co-morbidity history, supporting the wide applicability of the intervention. Further research is needed to explore optimal length of physical activity behavioural coaching interventions and the timing and effectiveness of "booster" interventions.

Submission ID: 69; Submission Group: Rehabilitation Effectiveness; Submitter: Sarah Donkers

Participants perspectives of the Individualized Physiotherapy and physical Activity behaviour Coaching in Multiple Sclerosis (IPAC-MS) intervention

Sarah Donkers[1], Kyra Ives[1], Rochelle Savard[1], Charity Evans[2], Katherine Knox[1]
[1]College of Medicine, University of Saskatchewan, Canada, [2]College of Pharmacy and Nutrition, University of Saskatchewan, Canada

Introduction: Physical activity (PA) has numerous benefits for persons with multiple sclerosis (PwMS), but most are not active enough to attain substantial health benefits. Effective ways to increase PA includes implementing behaviour change strategies (BCS). The IPAC-MS study combined 3 intervention components 1) access to a healthcare provider (neuro physiotherapist [neuro-PT])support, 2) a method of being physically active and 3) integration of BCS, in an individualized manner to increase PA.
Objectives: To explore PwMS experiences with participating in the IPAC-MS study and IPAC-MS extension study (an individualized behavioural coaching intervention delivered by physiotherapists (PTs) to increase PA levels).
Materials & methods: PwMS insufficiently active for health benefits were enrolled in the IPAC-MS twelve month RCT. At month 12, the control group then crossed over to receive 6-months of the intervention. All participants (n=120) were invited to participate in a post-intervention interview about their experience with the intervention. This qualitative study was ground in an Interpretive Description approach and thematic analysis was used.
Results: Eighty participants completed interviews (40 from the original IPAC-MS study and 40 from the extension cross over). 90% reported increased confidence and physical and mental well-being. 70% reported improvements in mood and symptom management. Three key themes about participants experience were identified: 1) *the importance of specialized care*, 2) *the value of individualized care*, and 3) *the ability of connection to motivate.*
Conclusion: PwMS accessing a neuro-PT trained in BCS reported an overall increase PA in an enjoyable manner. This was credited to the specialized and individualized nature of the program, and a connection with the neuro-PT prompted accountability and motivation to be physically active. Participants requested that this service be made available to other PwMS.

Submission ID: 70; Submission Group: Other; Submitter: Sarah Donkers

Appraisal of Existing International Clinical Practice Guidelines for Rehabilitation in MS

Sarah Donkers[1], Maya Berscheid[1], Mark Bayley[2], Tania Bruno[2], Robert Simpson[2], Katherine Knox[1]
[1]College of Medicine, University of Saskatchewan, Canada, [2]Division of Physical Medicine, Temerty Medicine, University of Toronto & KITE research Institute, Toronto Rehabilitation Institute, University Health Network
**We would like to acknowledge the contributions of the MS clinicians, researchers, and people with MS from across Canada who contributed to completing the AGREE ratings.*

Background: There is no comprehensive clinical practice guideline (CPG) for MS rehabilitation and/or symptom management. The MSBEST team in partnership with MS Canada and the Canadian Network of MS Clinics aim to create the first comprehensive MS Rehab Best Practice Guideline. As an initial step, this study identified and critically appraised the quality of existing CPGs with recommendations pertaining to rehab and symptom management in MS.
Methods: Multiple databases and grey literature were systematically searched to identify existing CPGs. Identified guidelines were separately screened by 3 researchers based on inclusion criteria. Included guidelines were then appraised separately by 4 reviewers using the updated Appraisal of Guidelines for Research and Evaluation (AGREE) tool. The AGREE is comprised of 23 items organized into 6 quality domains used to assess the quality and reporting of CPGs. AGREE ratings were calculated per quality domain. The content area and number of recommendations per guideline were also extracted.
Results: 15 guidelines were included housing ~350 recommendations. Main topics included spasticity, fatigue, bowel, bladder, pregnancy, physical activity, cognition, and multi-disciplinary care. 8 guidelines were from USA, 3 UK, 2 Canada, and 2 Europe. Guidelines were published from 1998-2020. Standardized mean scores and ranges per quality domain were as follows: 1) scope and purpose 83.2%, range 53.7% -100%; 2) stakeholder involvement 64.2%, range 31.9%-100%; 3) rigour of development 55.7%, range 12%-93.8%; 4) clarity of presentation 79.6%, range 56.9%-100%; 5) applicability 34.9%, range 13.9%-78.1%, and 6) editorial independence 60%, range 0%-100%. The highest scoring domains were #1 and 4 with every guideline scoring moderate to high. Applicability was the lowest scoring domain with 12/15 guidelines scoring low in this domain.
Conclusion: Although strong in reporting objectives, target population, and recommendations, guidelines were poor at presenting information related to clinical applicability. Comprehensive up-to-date guidelines emphasizing clinical application are needed.

Submission ID: 71; Submission Group: Rehabilitation Effectiveness; Submitter: Yvonne Learmonth

The impact of COVID-19 disruption on Multiple Sclerosis related healthcare in Australia

Jocelyn Tan[1] (main author), Claudia H. Marck[2], Brook Galna[1,3,4,6], Laura Laslett[5], Ingrid van der Mei[5], Yvonne C. Learmonth (presenting author)[1,3,4,6]
[1]School of Allied Health (Exercise Science), Murdoch University, Murdoch, WA, Australia, [2]Disability and Health Unit, Melbourne School of Population and Global Health, University of Melbourne, VIC, Australia, [3]Centre for Molecular Medicine and Innovative Therapeutics, Health Futures Institute, Murdoch University, Murdoch, WA, Australia, [4]Menzies Institute for Medical Research, University of Tasmania, Hobart, TAS, Australia, [5]Centre for Healthy Ageing, Health Futures Institute, Murdoch University, Murdoch, WA, Australia, [6]The Perron Institute for Neurological and Translational Science, Perth, WA

Background: Understanding how the COVID-19 pandemic impacted healthcare delivery for people with multiple sclerosis (MS) may inform crisis planning and response. This study aimed to determine 1) the extent to which the COVID-19 pandemic

disrupted the healthcare of individuals with MS in Australia; and 2) the personal and service-related factors associated with the impact of healthcare disruption.
Method: Using 2022 data from the Australian MS Longitudinal Study survey, participants reported on disruption to relevant healthcare services during the pandemic, and the impact of disruption on their health. Impact of disruption on health was scored on a scale from 1 (no impact) to 5 (extreme impact). An overall impact score was calculated for participants by multiplying the number of services they used by impact score. Analysis was performed using chi-square and *t*-tests or Kruskal-Wallis tests.
Results: Of the 1,484 survey participants, 36.9% reported healthcare disruption, with disruption reported in a mean of 2.85 services. Higher frequency of disruption was experienced for physiotherapy (63.5%) and neurology (54.1%). Severe impact was seen for the "other" services category which included exercise physiologists, massage and in-home support. Disruption to pharmaceutical access, allied health (including physiotherapy and occupational therapy), and support services (including in home care and respite care) had a moderate impact on health. Higher overall impact was experienced by people with four or more comorbidities (d_{cohen}=0.5 95% CI 0.2 to 0.7), more severe symptom loads (d_{cohen}=1.7 95% CI 1.0 to 2.4) and disability (d_{cohen}=0.7 95% CI 0.4 to 0.9).
Conclusion: Our findings indicate that disruption to allied health and support services during the COVID-19 impacted the health of people with MS the most. Planning for future crisis should prioritise access to these services and prioritise those most vulnerable from healthcare disruption, particularly those with more severe symptoms, disabilities and comorbidities.

Submission ID: 72; Submission Group: Rehabilitation Effectiveness; Submitter: Lars Hvid

Benefits of MS Ballroom Fitness ™ on balance, walking capacity, and well-being in multiple sclerosis – a randomized controlled trial

Lars G Hvid[1,2*], Josephine L Steenberg[3], Alexander V Ng[4], Lasse Skovgaard[3]
*[1]The Danish MS Hospitals, Ry and Haslev, Denmark, [2]Exercise Biology, Dept. of Public Health, Aarhus University, Denmark, [3]The Danish MS Society, Copenhagen, Denmark, [4]Exercise Science Program, Marquette University, WI, USA, *main author*

Introduction: Multiple sclerosis (MS) is accompanied by balance and walking dysfunction alongside deterioration of mental well-being and health-related quality of life (QoL). MS Ballroom Fitness™ ($MS_{B\text{-}Fit}$) is a personalized dance/fitness-based concept targeting exactly these challenges. However, few studies involving persons with MS (pwMS) have investigated the effects of $MS_{B\text{-}Fit}$ (or other dance/fitness-based interventions).
Objectives: By using a cluster randomized controlled study design, our aim was to investigate the potential benefits of a 7-week $MS_{B\text{-}Fit}$ intervention on balance, walking capacity, and mental well-being in pwMS.
Materials & Methods: A total of n=91 ambulatory pwMS were enrolled (93% females, 54±9 years, patient determined disease steps 2.6±1.5 [range 0-7]) and evenly randomized into intervention ($MS_{B\text{-}Fit}$: n=44, group-based, 2 sessions/week, mix of dance and fitness, moderate-to-high intensity or complexity, 50-60 minutes) or control (CTRL; n=47, continuation of habitual living). Outcomes included the six spot step test (SSST; walking coordination- and balance; *primary outcome*), the four square step test (FSST; dynamic balance and coordination), the 6-minute walk test (6MWT; walking endurance), the VAS 0-100 health-related quality of life (HR-QoL), and the WHO-5 mental well-being index (WHO5).
Results: Between-group improvements (mean [95%CI]) in favor of $MS_{B\text{-}Fit}$ were observed for SSST (0.008 [0.003;0.013] testruns/s, $p<0.01$; *corresponds to a reduction of -0.77 seconds*), FSST (0.018 [0.010;0.027] testruns/s, $p<0.01$; *corresponds to a reduction of -1.04 seconds*), 6MWT (36 [19;52] m, $p<0.01$), HR-QoL (7.7 [2.7;12.8] points, $p<0.05$), and WHO5 (7.4 [1.4;13.4] points, $p<0.05$). This was achieved by improvements in $MS_{B\text{-}Fit}$, whereas CTRL remained unchanged.
Conclusion: In pwMS, 7 weeks of MS Ballroom Fitness™ ($MS_{B\text{-}Fit}$) was very effective in improving balance and walking capacity alongside mental well-being and QoL.

Submission ID: 74; Submission Group: Outcome Measures; Submitter: Jessica Podda

A taxonomy of cognitive phenotypes in people with Multiple Sclerosis: a one-year longitudinal study

Jessica Podda[1], Federica Di Antonio[1], Andrea Tacchino[1], Ludovico Pedullà[1], Erica Grange[1], Mario Alberto Battaglia[2], Giampaolo Brichetto[1,3], Michela Ponzio[1]
*[1]Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy, [2]Department of Physiopathology, Experimental Medicine and Public Health, University of Siena, Siena, Italy, [3]AISM Rehabilitation Service, Italian Multiple Sclerosis Society, Genoa, Italy, *main author*

Introduction and Aim. As meaningful measure of cognitive impairment (CI), cognitive phenotypes lead to an advanced knowledge regarding the number, rate, and type of cognitive deficits in Multiple Sclerosis (MS). Since CI is variable in severity and progression, this retrospective study aimed to identify predominant cognitive subgroups and investigate whether observed phenotypes changed after one year in people with MS (PwMS).
Methods. K-means algorithm was used to determine cognitive phenotypes using ten coordinates, derived from the combination of MoCA dimensions, SDMT, and depression and anxiety subscales from HADS. To detect any changes after one-year, Wilcoxon effect size was computed. Furthermore, demographic (gender, age, years of education) and clinical (MS duration and

course, EDSS) information were collected from each participant to characterize each cognitive phenotype.
Results. The final cohort consisted in 272 PwMS (female= 183; mean age= 61.6 ± 12.1 years). Four cognitive phenotypes were identified: phenotype 1 (44.5%) showed a preserved cognitive profile; phenotype 2 (22.8%) had a mild-cognitive impairment profile with attention difficulties; phenotype 3 (24.3%) included people with marked CI in visuo-executive, attention, language, memory and processing speed; lastly, phenotype 4 (8.4%) grouped individuals with a multi-domain impairment profile (visuo-executive, attention, language, memory, orientation, processing speed and mood disorders). Such cognitive taxonomy tended to converge with a global worsening of health status, based on demographic and clinical information across phenotypes. Although some fluctuations occurred considering the rate of impairment, cognitive phenotypes did not substantially vary at follow-up in terms of number and type of impairments, suggesting that one year is a relatively brief temporal window to observe considerable changes.
Discussion. Investigating cognitive phenotypes and their stability over time would provide valuable information to identify trajectories of CI, and thus increase clinical meaningfulness of outcome measures and their uptake in decision-making and individualized treatment.

Submission ID: 75; Submission Group: Other; Submitter: Martha Ghijselings

Compliance of Caregivers with Dysphagia Recommendations in a Multiple Sclerosis Rehabilitation Center five years after training

Main author: Martha Ghijselings
Ghijselings Martha[1*], Noë Sofie[1], Robberechts Ines[1], Kos Daphne[1,2]
[1]National MS Center Melsbroek, Belgium; [2]KU Leuven, Department of Rehabilitation Sciences, Leuven Belgium
**Presenting author*

Introduction: The estimated incidence of dysphagia in people with multiple sclerosis (PwMS) ranges between 33% and 43%. Caregivers play a crucial role in preventing and managing complications related to dysphagia in daily life. To support this process, speech and language therapists (SLTs) provide dysphagia recommendations for caregivers, based on the needs of each PwMS.
In long-term care continuity of care is especially important in chronic diseases that require management from different service providers, however noncompliance is common.
To improve this continuity in dysphagic patients, SLTs provided and evaluated a training for caregivers in 2019. Caregivers were also asked to complete the 21-item Mealtime and Dysphagia Questionnaire (MDQ) to asses reasons for noncompliance. Based on these results and observations during mealtime, SLT's are nowadays more present in the care units to support caregivers.
This study explores the compliance five years after the training of caregivers with dysphagia recommendations.
Methods: In an observational cohort study, all caregivers (nurses, health care assistants and students) working with inpatients in a period of four weeks are included. The observations are performed using the same method as the 2019 study. While observing meal events, the SLT uses individual swallowing recommendations taken from the patient's file and scores the caregiver's adherence to the applicable recommendations. Mean overall compliance and compliance per recommendation will be calculated. Every caregiver is asked to complete the MDQ.
Results: In 2019, after training caregivers, overall compliance significantly increased from 58% to 81%. These results remained during follow-up, one and six months later (80%). Data collection of the current long-term follow-up study is foreseen until the end of April 2024 and results will be shared.
Conclusion: Training caregivers contributes to the overall compliance of dysphagia recommendations at short and mid-term follow-up. This study will provide insight into the long-term sustainability of these results.

Submission ID: 76; Serum and salivary biomarkers in Multiple Sclerosis: a new way to observe the rehabilitation effects

Biomarkers and Rehabilitation in MS

Valeria Prada[1,2], Elisa Piccardo[1], Margherita Monti Bragadin[1,2], Giulia Mennella[1], Ilaria Larosa[1,2], Giancarlo Serafino[1], Tiziana Vigo[3], Giampaolo Brichetto[1,2]
*[1]Scientific Research area, Italian Multiple Sclerosis Foundation (FISM), Genova, Genova, Italy, [2]Liguria Rehabilitation Service, Italian Multiple Sclerosis Association (AISM), Genova, Genova, Italy, [3]IRCCS Policlinico San Martino Hospital, Genova, Italy, *Main Presenting Author*

Knowledge about the use of biomarkers in MS for clinical practice is now spreading, but only a few studies focused on biomarkers and rehabilitation. The aim of this study is to evaluate the use of serum and salivary biomarkers (NFL, IL-6, BDNF) in MS patients as a tool for monitoring the rehabilitation effects.
Recruited subjects have been evaluated by a blind operator and serum and saliva collected every 2 months. After the first 2 months MS people underwent rehabilitation for 2 months, three times per week.
At the moment, 27 MS patients have been recruited for the study, of which three dropped out for personal reasons and 15 have completed the study to date. Nine of them have not yet finished the study, while 33 have yet to start the project. Blinding has not yet been performed, although baseline assessments were examined and compared with healthy controls.
Serum sNfL in MS patients was higher than in healthy controls. IL-6 in the serum of MS subjects was very similar to controls, and the serum of MS patients was higher than the average of controls. After rehabilitation, serum NFL levels showed an increasing trend; meanwhile no statistical significance was reported for saliva. IL-6

does not appear to be changed in serum; it had a decreasing trend in saliva. BDNF showed an increasing trend. Rehabilitation showed positive effects in the motor indicators used.
Even though the study is already ongoing, and we need more data to show significant results, serum has been proved to be adequate for the study of biomarkers, while saliva does not appear adequate for the evaluation of BDNF. Since we can detect a trend in these molecules after rehabilitation, this could be a promising technique to evaluate the effects of physiotherapy in MS people.

Submission ID: 77; Submission Group: Other; Submitter: Sjoerd Timmermans

"A Delphi study to identify key gait patterns and their underlying causes in patients with multiple sclerosis"

S.T. Timmermans[1, 2], MD, Dr. M.M. van der Krogt[1, 2], Dr. M. Rietberg[1, 2], Dr. H. Beckerman[1, 2], Prof. dr. V. de Groot[1, 2], MD.
*[1]Amsterdam UMC location Vrije Universiteit Amsterdam, Rehabilitation Medicine, Amsterdam, The Netherlands, [2]Amsterdam Movement Sciences, Rehabilitation & Development, Amsterdam, The Netherlands, *main author*

Introduction: Around 60% of people with multiple sclerosis (PwMS) experience walking difficulties within 10 years of diagnosis. Walking problems can be caused by diverse and interacting neurological impairments. Spatiotemporal abnormalities in PwMS have been described clearly, but the heterogeneity in etiology complicates describing typical gait patterns. In the pediatric cerebral palsy population general gait subtypes have been shown to assist clinical decision making. In the MS population practice variation in diagnosing and treating gait disorders may hamper (best practice) patient treatment.
Research Question: To identify key gait patterns that are typical for PwMS, describe their characteristics, and identify their underlying causes.
Methods: An international group of 20 physiotherapists, neurologists, rehabilitation physicians, biomechanical engineers and movement scientists with either clinical or scientifically relevant expertise within MS or gait analysis participated in an online Delphi study. Three rounds of questionnaires were send out, focusing mainly on which patterns are most common in gait disorders in MS patients, their common features, and underlying causes, respectively. Answers were analysed to identify the common gait patterns, their main features and underlying impairments. To unify the given answers we used pre-existing kinematic and kinetic gait terminology.
Results: Six gait patterns in MS were identified: 1) drop foot, 2) insufficient push-off, 3) stiff knee during swing, 4) knee hyperextension during stance, 5) knee and hip flexion in midstance and 6) enhanced gait variability. For each gait pattern the participants were able to define the key characteristics and key potential causes.
Discussion: The identification of gait patterns in MS may support clinical decision making and improve our understanding of disorders that underlie gait problems in PwMS. These gait patterns may help to standardize diagnosing gait problems and clear treatment protocols.

Submission ID: 78; Submission Group: Other; Submitter: Anne Christin Rahn

Evaluation of an interactive web-based decision-making programme on relapse management for people with multiple sclerosis (POWER@MS2) - a randomised controlled trial

L. Wenzel[1], C. Derad[2], J. Scheiderbauer[3], H. Temmes[5], Anna-Lena Röper[4,5], T. Friede[2], C. Heesen[1], S. Köpke[6], A. C. Rahn[7]
[1]Institute for Neuroimmunology and Multiple Sclerosis, University Medical Centre Hamburg-Eppendorf, Hamburg, Germany, [2]Department of Medical Statistics, University Medical Center Göttingen, Göttingen, Germany, [3]Foundation for self-determination and self-advocacy for people with MS, Trier, Germany, [4]German MS-Registry, MS Research and Project development gGmbH, Hannover, Germany, [5]German Multiple Sclerosis Society, federal association, Hannover, Germany, [6]Institute of Nursing Science, University of Cologne, Medical Faculty & University Hospital Cologne, Cologne, Germany, [7]Nursing Research Unit, Institute of Social Medicine and Epidemiology, University of Lübeck, Lübeck, Germany

Introduction: In Germany, relapse therapy usually includes inpatient intravenous therapy with high-dose cortisone, leading to a faster reduction of symptoms in 25 out of 100 people with multiple sclerosis (MS). We developed and evaluated a web-based relapse management programme (ABouts) to promote informed decisions on relapse management and strengthen the empowerment of people with MS.
Methods: ABouts was evaluated in a pragmatic, double-blind RCT and accompanied by a process evaluation and health economic evaluation. We included people with relapsing-remitting MS in 18 centres in Germany between 2020 and 2022. Participants in the intervention group (IG) gained access to a web-based evidence-based health information with dialogue-style decision support, a webinar with an MS nurse and an online guided group chat via the social-platform of the Germany MS Society. Participants in the control group (CG) received optimised standard care. The proportion of relapses not treated or treated with oral cortisone within up to 36 months was assessed as primary endpoint. Key secondary outcomes included the annualised relapse rate (ARR), knowledge and empowerment.
Results: We included 160 participants (80 IG/80 CG). The participants were comparable at baseline, had MS symptoms for an average of 4.1 years and mild disability. Of 160 participants, 113 (60 IG/53 CG) reported at least one relapse during the course of the study. There were no significant differences between groups in relapse treatment (OR=0.87, 95% CI 0.36-2.1, p=0.75). The ARR was 0.52 (95% CI 0.41-0.66) in the IG and 0.39 (95% CI

0.3-0.51) in the CG, with no significant difference between groups (p=0.11). Participants in the IG showed better relapse knowledge (mean difference (MD)=1.63/11, 95% CI 1.1-2.16) and a higher level of empowerment (MD=5.63/100, 95% CI 1.97-9.3).
Conclusion: The programme had no clear influence on the frequency or type of cortisone treatments, but enhanced participants' knowledge and empowerment.

Submission ID: 79; Submission Group: Other; Submitter: Therese Maiken Andersen

Physical activity across disability levels in persons with multiple sclerosis

Andersen Therese M[1]*, Andersen Astrid M[1], Dalgas Ulrik[1], Brønd Jan[2], Riemenschneider Morten[1], Tobias Gaemelke[1], Laurits Taul-Madsen[1], Mette Diechmann[1], Hvid Lars G[1,3]
**Main author*
[1]Exercise Biology, Department of Public Health, Aarhus University, Denmark, [2]Research Unit of Exercise Epidemiology, Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Denmark, [3]The Danish Multiple Sclerosis Hospitals, Ry and Haslev, Denmark

Background: Limited knowledge exists on the differences in physical activity (PA) levels across disability levels in people with multiple sclerosis (pwMS) as well as on the association between PA levels and walking capacity. Therefore, the purposes of this study were (1) to determine PA levels in pwMS across disability-groups in comparison to healthy controls (HC), and (2) to investigate the association between PA levels and walking capacity.
Methods: This study included 280 pwMS (73% females, age 45±13 years, Expanded Disability Status Scale (EDSS) 2.5 [1.5;3.5], time since diagnosis 4 [1;13] years) and 121 HC (68% females, age 45±16 years). PA was assessed by 7-day thigh-worn accelerometry, with outcomes comprising counts per minute (CPM) and time spent in sedentary, light, and moderate-to-vigorous physical activity (MVPA). PwMS were stratified into four EDSS-groups: $MS_{EDSS}^{0-1.5}$, $MS_{EDSS}^{2-2.5}$, $MS_{EDSS}^{3-4.5}$, and $MS_{EDSS}^{5-6.5}$. Statistical analyses included comparison of PA levels across groups (linear mixed model) along with associations between PA levels and walking capacity (multivariate regression analysis).
Results: PA differed markedly ($p<0.001$) between HC and pwMS for CPM (774±297>518±261), sedentary (558±59<588±82 min), light (220±55>198±61 min) and MVPA (47±26>27±22 min). Further, differences were observed across the four EDSS groups (lowest to highest): CPM (607±287≈560±198>471±260>264±189), sedentary (577±93≈575±68≈594±78<647±73 min), light (204±54≈216±59>185±63≈162±63 min), MVPA (34±24≈28±16≈24±23>8±11 min). Whilst all PA outcomes were associated with walking capacity ($p<0.001$), MVPA was the strongest factor (β-values: 0.32-0.38).
Conclusion: Overall, PA levels were lower in pwMS compared to HC, and PA levels decreased with increased disability status. Particularly the most severely affected pwMS ($MS_{EDSS}^{5-6.5}$) spend much time being sedentary and little time being moderate-to-vigorous physically active. Also, strong associations between PA levels and walking capacity were found, particular for MVPA. These findings emphasize the importance of engaging pwMS in MVPA, but also to increase the focus on pwMS with severe disability status.

Submission ID: 80; Submission Group: Other; Submitter: Anne Christin Rahn

Process Evaluation Of An Interactive Web-Based Relapse Management Program For People With Multiple Sclerosis (Power@Ms2) - Mixed-Methods-Study

Anne C. RAHN[1], Lea BREMER,[2] Julia PEPER,[1] Lisa WENZEL,[3] Jutta SCHEIDERBAUER,[4] Markus VAN DE LOO,[5] Christoph HEESEN,[3,7] Sascha KÖPKE,[2]
[1]Institute of Social Medicine and Epidemiology, Nursing Research Unit, University of Lübeck, Lübeck, Germany, [2]Institute of Nursing Science, University of Cologne, Medical Faculty & University Hospital Cologne, Cologne, Germany, [3]Institute of Neuroimmunology and Multiple Sclerosis (INIMS), University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [4]Stiftung für Selbstbestimmung und Selbstvertretung von MS-Betroffenen, Trier, Germany, [5]Deutsche Multiple Sklerose Selbsthilfe Gesellschaft, Bundesverband, Hannover, Germany,

Introduction: Relapsing-remitting multiple sclerosis (MS) is characterized by new or worsening neurological symptoms and periods of recovery. We developed a web-based program (ABouts) to support people with MS (PwMS) in decision-making regarding relapse management, comprising three components (dialogue-based decision aid (DA), nurse-led webinar, online chat). ABouts was evaluated in a randomized controlled trial (RCT) compared to standard web-based information about relapse management. A process evaluation (PE) was carried out to identify implementation barriers and facilitators and understand change mechanisms.
Methods: The mixed-methods PE is based on the MRC's complex interventions framework. Participants were PwMS and experts (neurologists, study nurses) who received questionnaires about the intervention and study organization during the RCT. Based on the results, semi-structured interview guides were developed. Interviews were recorded, transcribed and analyzed thematically. Currently, we are analyzing the interviews with PwMS. Joint displays will be used to merge quantitative and qualitative findings.
Results: Quantitative data are available from n=72 experts and n=159 PwMS (intervention n=79, control n=80). After six months, 90% of n=38 neurologists stated that PwMS in the intervention group participated more actively in relapse management. After three months, 97% of PwMS in the intervention group stated they

liked the dialogue-based approach of the DA. Subsequently, we interviewed 11 experts and 16 PwMS (intervention n=12, control n=4). Both indicated that the organizational aspects of the study were not burdensome. Experts indicated that the program promotes shared decision-making in relapse management. Most PwMS found the DA flexible to use and understandable. Control group participants found the information understandable, but received hardly any new information. Some PwMS in the control group wished for a supportive component on relapse management.
Conclusion: Our web-based program is suitable to support PwMS in making decisions regarding relapse management.

Submission ID: 81; Submission Group: Other; Submitter: Edyta Matusik

Assessment of predictors of changes in sexual functioning in women and men with multiple sclerosis: a preliminary analysis

Edyta Matusik[1,2], Barbara Lewicka[3], Barbara Kściuk [2], Marek Krzystanek[4], Kamila Czepczor-Bernat[5]
[1]Department of Rehabilitation, Faculty of Health Sciences in Katowice, Medical University of Silesia, Katowice, Poland, [2]Multiple Sclerosis Management Center „Novomed" Katowice, Poland, [3]Department of Rehabilitation, Doctoral School, Medical University of Silesia, Katowice, Poland, [4]Department and Clinic of Psychiatric Rehabilitation, Faculty of Medical Sciences, Medical University of Silesia, Katowice, Poland, [5]Department of Pediatrics, Pediatric Obesity and Metabolic Bone Disease, Faculty of Medical Sciences in Katowice, Medical University of Silesia, Katowice, Poland

Aim: The aim of the study was to assess whether changes in sexual functioning (explained variable) in patients with multiple sclerosis (MS) are related to the predictors as: gender, age, disability status, and symptoms of sexual dysfunction related to multiple sclerosis (MS).
Method: 107 Patients with multiple sclerosis (N_{women} = 79, 73.83%); with the mean age 42.85 ±11.14 years completed (a) sociodemographic survey (e.g. gender, age), (b) the Multiple Sclerosis Intimacy and Sexuality Questionnaire (MSISQ; symptoms of sexual dysfunction), (c) the Changes in Sexual Functioning Questionnaire (CSFQ; changes in sexual functioning). MS patient disability status was assessed by the Expanded Disability Status Scale (EDSS). Hierarchical regression were used to analysis our data.
Results: Finally, the significant predictors of changes in sexual functioning were ($F(6, 106) = 14.66$, $p < 0.001$, Adj. $R^2 = 0.44$, $\Delta Fp < 0.001$): (a) male gender (beta = 0.20, $p < 0.01$), (b) age (negative relationship; beta = -0.31, $p < 0.01$), and (c) primary sexual dysfunction symptoms (negative relationship; beta = -0.42, $p < 0.001$).
Conclusion: To sum up our findings, male gender may predispose to better functioning in the context of sexual functioning among MS patients. Moreover, the older the age and the more stronger primary symptoms of sexual dysfunction are (developing related to a neurogenic disorder that directly impact sexual function - i.e. weakened genital sensation, orgasm dysfunction, erectile dysfunction, loss of libido, decreased vaginal lubrication), the worse sexual functioning is. This information may constitute an important guideline in the context of creating preventive and therapeutic activities among patients with SM because they indicate which group may be at increased risk of sexual functioning disorders.

Submission ID: 82; Submission Group: New Research Methodologies; Submitter: Federica Di Antonio

Exploring the Potential of Patient-Reported Outcomes in Predictive Medicine: Disability Accrual in Multiple Sclerosis

Main author: Federica Di Antonio[1], Giampaolo Brichetto[1,2], Andrea Tacchino[1], Ludovico Pedullà[1], Jessica Podda[1], Margherita Monti Bragadin[1,2], Alice Bollini[1], Silvia Morbelli[3], Andrea Chincarini[4]
[1]Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy, [2]AISM Rehabilitation Service, Italian Multiple Sclerosis Society, Genoa, Italy, [3]Department of Health Sciences (DISSAL), University of Genoa, Genoa, Italy, [4]National Institute for Nuclear Physics (INFN), Genoa, Italy

Background and Aim: The topic of artificial intelligence (AI) and its use in medicine is currently of great interest due to its constantly improving expertise. The purpose of this study was to determine whether a dataset mainly composed of patient-reported outcomes (PROs) contains significant information and has predictive ability to monitor multiple sclerosis (MS) progression.
Methods: A regressive random forest was trained using PROs and demographic data as predictors; we only used information from each patient's first clinical visit. The primary outcome involved variation in the Expanded Disability Status Scale (EDSS) from the patient's initial visit to each subsequent follow-up, performed with a frequency of approximately 4 months. K-fold cross-validation was applied.
Results: The final cohort was composed of 902 people with MS (pwMS) (female=573, age=52.8±12.3, mean follow-up=3.9±2.8 [range 0-9] years). The ability of the model to explain the variance of the data is 30.4%. Nonetheless, several relevant facts emerged. Each variable provides valuable information. An assessment of predictor importance reveals the initial set of significantly impactful features, which is composed by time interval from baseline, EDSS baseline, Paced Auditory Serial Addition Test, Modified Fatigue Impact Scale, and Body Mass Index. The prediction evolves over different time intervals, strongest at intervals [3-5] and [5-9] years from baseline

($\rho = 0.53$ and 0.55, respectively). In addition, different disability baselines imply different predictive power, and the better results tie to lower EDSS. Introducing EDSS follow-up at 1 year enhances prediction (variance explanation 46.4%), achieving $\rho = 0.70$ for predictions done between 1.3 and 3 years after baseline.

Discussion. We concluded that the assessment of the efficacy and informational capacity of PROs, together with the development of highly interpretable AI tools, could produce a high-impact instrument. It can, despite its imprecise nature, guide rehabilitation decisions and epidemiologic prediction.

Submission ID: 83; Submission Group: New Research Methodologies; Submitter: Alice Bollini

Intersecting Senses, Divergent Paths: Understanding Multisensory Dysfunction in Multiple Sclerosis

Multisensory Integration Impairments in Multiple Sclerosis.

Bollini Alice[1,2]*, Tacchino Andrea[1], Podda Jessica[1], Pedullà Ludovico[1], Brichetto Giampaolo[1,3], Bellosta Alice[1,4], Campus Claudio[2], Gori Monica[2]

*[1]Scientific Research Area, Italian Multiple Sclerosis Foundation, Genoa, Italy, [2]Unit for Visually Impaired People, Istituto Italiano di Tecnologia, Genoa, Italy, [3]AISM Rehabilitation Service of Genoa, Genoa, Italy, [4]Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health, University of Genoa, Genoa, Italy, *Main author*

Our world is primarily multisensory, and our brain constantly needs to integrate information from different senses to create a unique percept. Multiple Sclerosis (MS) alters neural connections in brain areas, disrupting communication and integration of various brain signals. Interrupting the interconnection among sensory cortices may lead to significant impairments such as inaccurate perception, difficulties recognizing objects, or misinterpreting sensory cues. These difficulties can translate into impairments in daily activities such as navigation, crossing streets, or affecting social interaction.

To date, multisensory integration has not been deeply investigated in MS, even though the integration among senses is crucial for the cognitive domain. To test our hypothesis that MS may disrupt the ability to process multisensory stimuli efficiently, we employed the temporal order judgment (TOJ) task in people with MS (PwMS). The TOJ task is a paradigm used to compare perceptual latencies in different sensory modalities where participants judge the temporal order of two stimuli presented at varying timing intervals. This task allows us to measure the temporal binding window (TBW), the specific range of temporal offsets where sensory inputs are merged, and the Point of Subjective Simultaneity (PSS), the time in which the stimuli are rated as presented at the same time.

We calculated the PSS and TBW by fitting a psychometric function on the participant's rate across all timing intervals. Our results showed that PwMS had a larger TBW than healthy controls, indicating more difficulties integrating bimodal stimuli. Instead, there were no differences between patients and controls in the PSS, excluding specific sensory processing impairments. Moreover, results show that audiovisual conditions are more affected than audiotactile and visuotactile. These results can reveal the importance of studying multisensory integration in MS and potentially paving new routes for diagnosis, treatment, and, ultimately, a better quality of life for people with MS.

Submission ID: 84; Submission Group: Other; Submitter: Maaike Ouwerkerk

The longitudinal association between patient characteristics and quality of life in advanced MS

Maaike Ouwerkerk, Marc B Rietberg, Bernard MJ Uitdehaag, Vincent de Groot

Amsterdam UMC, Vrije Universiteit Amsterdam, MS Center Amsterdam, De Boelelaan 1117, Amsterdam The Netherlands

Background: In advanced phases of Multiple Sclerosis (MS), patients have more complex care requirements and more extensively use of long-term care facilities, including both health care services and social care services. Understanding the relationship between quality of life (QoL) and the progression of MS is pivotal in improving personalized care and outcomes.

Objective: To identify variables that are longitudinally associated with *health-related* and *social-care-related* QoL in advanced MS in the first 1.5 years following residential multidisciplinary symptomatic treatment.

Design: Longitudinal cohort study with 5 measurements over 1.5 years.

Method Patients with advanced MS were recruited from a residential and facility center in the Netherlands. QoL was assessed with three patient-reported questionnaires, i.e. Adult Social Care Outcomes Toolkit (ASCOT), EuroQoL five-dimensional questionnaire (EQ-5D-5L), and EQ-VAS score. Variables concerned sociodemographic and illness-specific measures. Multivariable longitudinal regression analyses were performed using linear mixed models. To disentangle the within- and between-subject interpretation, a hybrid model was used.

Results A total of 77 patients with advanced MS, with a mean age 56.4 years and a EDSS median of 7, were enrolled. Higher pain scores and more days in the center were associated with lower *health-related* QoL within a person over time. Lower self-efficacy and mood were associated with lower *social-care-related* QoL. Higher fatigue scores and upper extremity dysfunction were longitudinally related to a lower current *overall health status*.

Conclusion The findings underscore the interconnectedness of various factors—ranging from physical symptoms like pain and

fatigue to psychological elements like mood and self-efficacy—in influencing different dimensions of quality of life within individuals with advanced MS over time. By recognizing and measuring QoL in a broader way, we gain a more nuanced understanding of an individual's needs, paving the way for more inclusive and comprehensive approaches to enhancing overall well-being when MS progresses.

Submission ID: 85; Submission Group: Outcome Measures; Submitter: Karin Riemann-Lorenz

Development and validation of instruments to assess MS food literacy and MS nutrition knowledge among persons with MS in Germany

Karin Riemann-Lorenz[1], Susan Seddiq Zai[1], Jana Pöttgen[1], Anne Daubmann[2], Christoph Heesen[1]
Main author: Karin Riemann-Lorenz
[1]Institute of Neuroimmunology and Multiple Sclerosis (INIMS), University Medical Center Hamburg-Eppendorf (UKE), Germany, [2]Institute of Medical Biometry and Epidemiology (IMBE), University Medical Center Hamburg-Eppendorf (UKE), Germany

Background: Persons with MS (pwMS) are often confronted with contradictory dietary advice, which is not always based on sound scientific evidence. This may lead to poor MS-specific nutrition knowledge (NK) and food literacy (FL). To date, no studies have assessed MS-specific NK and FL among pwMS in Germany. Moreover, no validated tools to measure effects of educational interventions are available.
Aims: The aim of this study was to develop and validate MS-specific instruments to measure NK and FL among pwMS in Germany.
Methods: Based on a validated FL screener for the general population and prior research about the information needs of pwMS, we developed 15 MS-specific FL items. In order to objectify self-rated FL, we additionally developed 11 knowledge questions about nutrition and MS. After cognitive debriefing to explore comprehensibility, both questionnaires were refined and pilot tested with pwMS in an online survey. For the new MS Food Literacy Questionnaire (MSFLQ) item difficulty, discriminatory power of the items, internal consistence and convergent validity was assessed. The new MS nutrition knowledge questionnaire (MSNKQ) was analysed descriptively (mean and percentage of correctly answered questions).
Results: Cognitive debriefing was conducted with 10 pwMS and resulted in a 12-item MSFLQ and an 11-item MSNKQ. PwMS (n=148, 47.1 (SD=12.5) years old, 102 women (69%)) completed the online survey. On average, participants answered 3.51/11 knowledge questions correctly (31.9%). The MSFLQ showed good internal consistency (Cronbach's alpha = 0.85), item difficulty was good and discriminatory power of the items satisfactory. Correlations between the MSFLQ and a general food literacy questionnaire was high (r=0.626, p<0.001), but only small with the MSNKQ (r=0.180; p=0.029).
Conclusion: MS-specific nutrition knowledge among pwMS in Germany is low. The MSNKQ and MSFLQ appear to be suitable instruments to assess NK and FL in MS, and might serve as outcome measures for educational interventions.

Submission ID: 86; Submission Group: Outcome Measures; Submitter: Martin Langeskov-Christensen

Bad sleep = bad life? Sleep quality is clearly associated with health-related quality of life in persons with multiple sclerosis - The Danish MS hospitals rehabilitation study

Langeskov-Christensen, M[1,2], Boesen F[3], Trénel P[3], Kirov F[1], Skjerbæk AG[3,4], Hvid LG[3,4]
[1]Dept. of Neurology, Viborg Regional Hospital, Heibergs Alle 2, 8800 Viborg, Denmark, [2]Dept. of Clinical Medicine, Aarhus University, Palle Juul-Jensens Blvd. 82, 8200 Aarhus N, Denmark, [3]The Danish MS Hospitals, Ry and Haslev, Klostervej 136, 8680 Ry/Ringstedvej 106, 4690 Haslev, Denmark, [4]Exercise Biology, Dept. of Public Health, Dalgas Avenue 4, 8000 Aarhus C, Denmark

Background: Sleep disturbances are prevalent among persons with MS (PwMS). Whilst the relationship between sleep quality and health-related quality of life (HRQoL) in PwMS is currently underexplored, such knowledge seems crucial to optimize rehabilitation/management strategies targeting sleep in PwMS.
Objective: To examine associations between sleep quality and HRQoL in PwMS.
Methods: This was a secondary analysis of the Danish MS Hospitals Rehabilitation Study. PwMS aged 18- 65 years and with an expanded disability status scale (EDSS) score ⩽7.5 participated. Baseline data comprised patient- and disease-related characteristics, sleep quality (Pittsburgh Sleep Quality Index (PSQI)), and MS-specific health-related quality of life (HRQoL; Functional Assessment of MS questionnaire (FAMS)). Simple and multiple (adjusting for age, sex, EDSS) regression analyses were used to examine associations between sleep quality and HRQoL. A linear mixed model was used to compare FAMS scores across sleep quality subgroups (i.e., "good sleepers" = PSQI 0-5, "poor sleepers" = PSQI 6-10, "very poor sleepers" = PSQI 11-21).
Results: In the sample of 405 PwMS (50±9 years, 69% females, EDSS 4.8±1.5) the total PSQI was 6.5±3.6 (55% were categorised as "poor" or "very poor" sleepers). Sleep quality was significantly associated with HRQoL in the simple (r=0.35, slope: -2.5 [-3.1;-1.8], p<0.001) as well as the multiple regression analysis (r=0.36, slope: -2.5 [-3.2;-1.9], p<0.001; *minor influence from age, sex, and EDSS*). Correspondingly, lower FAMS scores were observed in "poor sleepers" (-10.3 [-15.5;-5.2]) and "very poor sleepers" (-20.0 [-26.7;-13.3]) compared to "good sleepers". Also, "very poor sleepers" scored lower (-9.7 [-16.6;-2.8]) compared to "poor sleepers". All differences exceeded what is deemed a minimal clinically important difference (3 point).

Conclusions: The present findings stress the vital role of addressing sleep quality, an invisible symptom, in the rehabilitation of PwMS, as it was significantly associated with HRQoL. Improving sleep quality may substantially improve HRQoL in PwMS.

Submission ID: 87; Submission Group: New Research Methodologies; Submitter: Elisa Gervasoni

The impact of experimentally induced fatigability on motor and cognitive functions: preliminary results from a multicenter cross-sectional study

R. Bertoni[1], R. Cardini[1], I. Carpinella[1], A. Tacchino[2], E. Grange[2], G. Brichetto[2,3], C. Solaro[4], M. Rovaris[1], D. Cattaneo[1,5], E. Gervasoni[1*]
*[1]IRCCS Fondazione Don Carlo Gnocchi, Via Capecelatro 66, 20148 Milan, Italy, [2]Italian Multiple Sclerosis Foundation (FISM), Via Operai 40, 16149, Genoa, Italy, [3]Neurology Unit Galliera Hospital Genova, Italy, [4]AISM Rehabilitation Servicie of Genoa, Via Operai 40, 16149, Genoa, Italy, [5]Department of Pathophysiology and Transplantation, Università Degli Studi di Milano, 20100 Milan, Italy., *presenting author*

Background: Fatigability is one of the most disabling symptoms in People with Multiple Sclerosis (PwMS) possibly contributing to reduced walking, balance, and cognitive capacity. These changes in performance seem to affect quality of life. However, the impact of motor fatigability on balance and cognitive functions has not yet been studied.
Objective: This cross-sectional study assesses the acute effect of experimentally induced motor fatigability on balance and cognitive functions.
Methods: So far, we assessed 20 PwMS aged (mean±standard deviation) 51.7±8.1 years with an EDSS score of 3.6±1.0 points and 9 Healthy Subjects (HS) 44.8±12.7 years in three Italian MS centers. Participants were asked to walk for 30 minutes or until they experienced complete exhaustion (Walking Fatiguing Test), which was monitored by Rate of Perceived Exertion (RPE)>18 points (Borg scale). In addition, participants performed balance tests (maintaining upright posture on a firm and foam surface with eyes open and closed), wearing 3 Inertial Measurements Units (IMUs), and cognitive assessment (Brief International Cognitive Assessment for Multiple Sclerosis, BICAMS) before (T0), immediately after (T1), and 30-minute after (T2) the Walking Fatiguing Test.
Results: PwMS walked for (mean±SD) 23.8±7.3 minutes with a RPE score of 17.4±3.0 points compared to HS (mean RPE 11.8±2.0). Additionally, PwMS worsened their balance performances (in terms of increased sway amplitude and decreased entropy) compared to HS at T1 ($p<0.05$), while no between-group differences were observed at T0 and T2 ($p>0.05$). No changes were also reported in BICAMS between PwMS and HS at three timepoints ($p>0.05$).
Conclusions: Our preliminary data show an acute effect of experimentally induced motor fatigability on balance, while no effect was observed on cognitive functions. A larger sample should confirm these preliminary results.

Submission ID: 88; Submission Group: Outcome Measures; Submitter: Zuhal Abasiyanik

Perceived and performed dual-task ability in persons with multiple sclerosis: an international multi-centered study

Zuhal Abasıyanık[1,2,3], Ludovico Pedullà[4], Bernardita Soler[5], Carme Santoyo-Medina[6,7], Turhan Kahraman[3,8], Mieke D'Hooge[1,2,9], Andrea Tacchino[4], Edwin-Roger Meza-Murillo[6], Renee Veldkamp[1,2], Ilse Lamers[1,2,10], Areen Omar[14], Griet Gysemberg[10], Ingrid Galán[6], Ethel Ciampi[5], Claudia Carcamo[5], Özge Ertekin[11], Serkan Özakbaş[12], Daphne Kos[9,13], Alon Kalron[14,15], Peter Feys[1,2]
[1]REVAL Rehabilitation Research Center, Faculty of Rehabilitation Sciences, Hasselt University, Hasselt, Belgium, [2]UMSC, Hasselt-Pelt, Belgium, [3]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Turkey, [4]Scientific Research Area, Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy, [5]Hospital Doctor Sótero del Río, Pontificia Universidad Católica de Chile, Santiago, Chile, [6]Department of Neurology-Neuroimmunology & Neurorehabilitation Unit, Multiple Sclerosis Centre of Catalonia (Cemcat), Vall d'Hebron University Hospital, Barcelona, Spain, [7]Department of Physiotherapy, Faculty of Medicine and Health Sciences, Universitat Internacional de Catalunya, Barcelona, Spain, [8]Department of Health Professions, Faculty of Health and Education, Manchester Metropolitan University, Manchester, UK, [9]National MS Center, Melsbroek, Belgium, [10]Noorderhart Rehabilitation & Multiple Sclerosis Centre, Pelt, Belgium, [11]Faculty of Physical Therapy and Rehabilitation, Dokuz Eylul University, Izmir, Turkey, [12]Department of Neurology, Medical Point Hospital, Izmir University of Economics, Izmir, Turkey, [13]KU Leuven, Department of Rehabilitation Sciences, Leuven, Belgium, [14]Department of Physical Therapy, School of Health Professions, Faculty of Medicine and Health Sciences, Tel-Aviv University, Tel-Aviv, Israel, [15]Multiple Sclerosis Center, Sheba Medical Center, Tel-Hashomer, Israel.

Background: Cognitive-motor interference is documented using performance-based and self-reported measures in people with multiple sclerosis (pwMS). However, the association and discriminative properties of perceived and performed dual-task (DT) abilities across different disability levels in pwMS remain unclear.
Objective: To investigate association between observed and perceived DT ability and their discriminative properties in pwMS across six countries within the RIMS network (Belgium, Chile, Italy, Israel, Spain, and Turkey).
Methods: We enrolled 175 pwMS with mild disability (EDSS:0-3.5), 181 pwMS with moderate-to-severe disability (EDSS:4.0-6.5), and 184 age- and sex-matched healthy controls (HC).

Perceived DT difficulties were evaluated using Dual-Tasking Questionnaire (DTQ), Dual-Task Screening-List (DTSL), and Dual-Task-Impact on Daily-life Activities Questionnaire (DIDA-Q). DT walking performance was measured by 30-second walking with and without a simultaneous word-list generation task. Motor DT cost (DTC), the percentage change of DT performance compared to single-task performance, was calculated. Discriminative properties were analyzed using area under receiver operating characteristic curve (AUC) and effect size (ES) for group differences.

Results: In the moderate-to-severe disability group, there was a significant but weak correlation between DTC and DIDA-Q (r=0.179) and DTQ (r=0.232). No significant correlation was observed in the mild disability group. Perceived measures exhibited good-to-excellent AUC (0.743 to 0.827) between pwMS with mild disability and HC, and excellent AUC (0.858 to 0.979) between pwMS with moderate-to-severe disability and HC. However, DTC showed poor AUC (0.544 and 0.559, respectively). When comparing perceived measures across the three groups, large ESs were evident, while DTC did not show a significant difference.

Conclusion: The study reveals no-to-weak correlation between self-reported and observed DT abilities in pwMS, potentially attributable to real-life DT involving both motor-motor activities and cognitive-motor components across various tasks. Self-reported outcomes seem well suited to identify pwMS with DT difficulties, indicating the need for interventions.

Submission ID: 89; Submission Group: Outcome Measures; Submitter: Anders Skjerbæk

One-year walking capacity changes in Danish patients with multiple sclerosis

Anders Guldhammer Skjerbæk [1,2], Lars G Hvid [1,2], Egon Stenager[3], Finn Boesen[1], Ulrik Dalgas[2]

[1]*The Danish MS hospitals, Ry and Haslev, Denmark*, [2]*Exercise Biology, Department of Public Health, Aarhus University*, [3]*Department of Regional Health Research, University of Southern Denmark, Odense, Denmark*

Background: Change in walking capacity in persons with multiple sclerosis (pwMS) is an important efficacy marker in medical treatment, rehabilitation and research. However, many different walking outcomes are used in MS research, but little is known about measurement differences between the most frequently used outcomes. Thus, the present study aimed to compare one-year changes in walking capacity across three commonly used walking outcomes in Danish MS patients following inpatient rehabilitation.

Methods: In a longitudinal two-hospital study, walking capacity was assessed within the first week of inpatient rehabilitation (baseline (T1)) and after one year (T2) using the timed 25-foot-walk-test (T25FWT; "walking speed"), the six-minute-walk-test (6MWT; "walking endurance"), and the six-spot-step-test (SSST; "walking balance and coordination"). Using mixed linear models one-year relative within-group changes and effect sizes were compared across outcomes.

Results: At T1 walking capacity was assessed in N=194 pwMS (69% females); age 54.3±11.4 yrs, patient determined disease steps (PDDS) 2.9±1.9, time since diagnosis 14.7±10.3 yrs and MS-phenotype (RRMS/SPMS/PPMS) 62%/18%/20%. At T2, results from 171 (88%) pwMS were available with mean improvements observed across all walking capacity outcomes; T25FWT +0.11 [0.07;0.15] (m/s), 6MWT +8 [-1;17] (m), and SSST 0.009 [0.004;0.013] (rounds/sec.). Relative within-group changes were improved for T25FWT (8.1 [1.3;15.0] %, Z-score=0.21) and SSST (7.7 [-1.1;16.6] %, Z-score=0.16), whereas 6MWT remained stable (2 [-5;8] %, Z-score=0.05). No differences ($p>0.10$) were observed between within-group changes across the three outcomes and no improvements reached clinical meaningful thresholds.

Conclusion: Minor one-year improvements in walking capacity were observed across three commonly used walking capacity outcomes in Danish MS patients following two-three weeks of inpatient rehabilitation. Relative changes were similar across walking capacity outcomes but did not reach clinically meaningful thresholds. MS patients sustained their walking capacity, which is considered important in a progressive disease like MS.

Submission ID: 90; Submission Group: Other; Submitter: Davide Cattaneo

Unraveling functional disorders and cortical activation during gait in non-disabled People with Multiple Sclerosis: preliminary results from a multicenter study

Davide Cattaneo[1,2]*, Alessandro Torchio[2], Rita Bertoni[2], Francesca Baglio[2], Raffaella Chieffo[3], Massimiliano Pau[4], Eleonora Cocco[5], Maria Assunta Rocca[3], Tetzu Morozumi[3], Massimo Filippi[3], Elisa Gervasoni[2], Marco Rovaris[2]

[1]*Department of Pathophysiology and Transplantation, Università Degli Studi di Milano, 20100 Milan, Italy,* [2]*IRCCS Fondazione Don Gnocchi Via Capecelatro 66, 20148 Milan, Italy,* [3]*Department of Neurology, Institute of Experimental Neurology, Division of Neuroscience, San Raffaele Scientific Institute, Vita-Salute San Raffaele University, Milan, Italy,* [4]*Dipartimento di Ingegneria Meccanica Chimica e dei Materiali, Università di Cagliari, Italy,* [5]*Multiple Sclerosis Regional Center, ASSL Cagliari, ATS Sardinia, Department of Medical Sciences and Public Health, University of Cagliari, 09126 Cagliari, Italy, *presenting author*

Background: There has been limited research on balance and gait in non-disabled People with Multiple Sclerosis (PwMS). Moreover, less is still known about cortical activation during an ecological task such as walking, which may be assessed by functional near-infrared spectroscopy (fNIRS).

Objective: To investigate the patterns of functional disorders and cortical activation during walking in non-disabled PwMS.

Methods: We recruited 50 PwMS aged 43.7±11.2 years (mean±standard deviation - SD) with a relapsing-remitting course and EDSS<2.5 (in 3 Italian centers). The EDSS score was 1.1± 0.7 and the disease duration was 13.2±7.4 years.

To assess balance and gait, we used the following clinical scales: Fullerton Advanced Balance scale-short (FAB-s), Six Minute Walking Test (6MWT), and Multiple Sclerosis Walking Scale-12 (MSWS-12). We also compared cortical activation using fNIRS (Brite MKII, Artinis) in a subsample of 24 PwMS and 10 age- and gender-matched Healthy Subjects (HS). We set 18 optodes for a total of 24 channels to monitor the frontal cortex activity while walking on a treadmill compared to upright standing.

Results: Mean scores±SD on FAB-s scale were 22.66±1.77 points (34% of abnormal scores compared with normative data); at 6MWT walked a mean distance of 567.3±69.27 meters (24% of PwMS had abnormal scores) with a mean score of 26.97±10.61points on MSWS-12 (54% of abnormal score). In the whole sample of subjects, 4 symmetrical channels in the Dorso-Lateral Prefrontal Cortex (DLPC) were active during walking compared to standing. HS cortical activation (Mean value [95%CI] during walking: 135.0 [85.3-185.0] mol/mm and duringstanding: 70.9 [21.1-121.0] mol/mm) was much higher than in PwMS (Walking: 83.3[50.4-116.0] mol/mm; Standing: 29.2 [3.7-62.0] mol/mm), but between-group differences were not significant.

Conclusion: Our data showed that balance and gait disorders are already present in non-disabled PwMS. These dysfunctions seem to be associated with a bilateral lower activation in DLPFC during walking compared to HS. However, a larger and more homogeneous sample is needed to confirm these results.

Submission ID: 91; Submission Group: Rehabilitation Effectiveness; Submitter: Josephine Steenberg

Outcomes, mechanisms of action, and contextual factors of MS Ballroom Fitness™ as perceived by people with Multiple Sclerosis

Lasse Skovgaard[1*], Josephine L Steenberg[1**], Lars G Hvid[2,3]

[1]The Danish MS Society, Copenhagen, [2]Exercise Biology, Dept. of Public Health, Aarhus University, Denmark, [3]The Danish MS Hospitals, Ry and Haslev, Denmark, [*]Main author, [**]Presenting author

Introduction: The importance of physical exercise for people with Multiple Sclerosis (pwMS) is well documented. However, as MS is often accompanied by fatigue and other energy-based challenges, the motivational factor constitutes a widespread barrier for exercise. More knowledge on interventions that combine exercise and motivational factors, e.g., music-based interventions, is needed.

Objectives: An MS-specific dance/fitness intervention was developed and tested in a cluster randomized controlled study design. Subsequently, an interview study was conducted to investigate the perceived outcomes as well as various factors linked to the obtaining of outcomes.

Materials & Methods: Among 91 pwMS, participating in a 7-week dance/fitness intervention, 12 informants were randomly selected and included in an interview study. Qualitative interviews were performed based on an interview guide and within a program theoretical framework, elucidating the informants' perceived outcomes as well as their perspectives on associations between the intervention, the mechanisms of action, the contextual factors, and the outcomes.

Results: The informants consistently described the intervention as being characterized by high motivation and multifaceted stimulation of functions. The intervention was experienced as a highly relevant and motivating combination of music, rhythm, coordinated movements, exercise, and social interaction in a safe environment with good atmosphere. This leading to stimulation and strengthening of various functions on a direct level (positive outcomes most often mentioned were balance, mood, coordination, and cognition) as well as on a process-oriented indirect level, supporting general activities as well as supplemental exercise initiatives in an everyday perspective.

Conclusion: A 7-week intervention of MS Ballroom Fitness™ was by the involved pwMS perceived as a very relevant exercise intervention, characterized by a high level of motivation and a multifaceted stimulation of functions, leading to a broad range of direct as well as indirect/process-oriented outcomes.

Submission ID: 92; Submission Group: Rehabilitation Effectiveness; Submitter: Johanna Jonsdottir

Effect of empowerment through wearable devices and motivational coaching during multiple sclerosis motor rehabilitation

Johanna Jonsdottir, Giulia Fusari, Elisa Faccioli, Gloria Perini, Chiara Pagliari, Alessandro Torchio, Davide Cattaneo

IRCCS Fondazione Don Carlo Gnocchi, Italy

Physical activity(PA) levels in persons with multiple sclerosis(pwMS) have been tied to disability levels and self management. PwMS are more sedentary than their healthy peers and tend to not increase their physical activity levels even after receiving therapy aimed at improving their motor potentials.[1,2] Promoting PA in pwMS during and after rehabilitation periods is important and may be possible through empowering theory-based behavior-change techniques(BST). This pilot-intervention study investigated the effect of a therapist-administered empowering components aimed at augmenting PA in pwMS receiving motor-physiotherapy.

Methods: Fifty-one pwMS starting rehabilitation signed an informed consent and were assigned(3:1) to a usual-care motor-rehabilitation(CG:conventional group, n=38) or a usual-care motor-rehabilitation including empowering components (EG:empowered group, n=13) consisting of a wrist-worn activity-tracker(>12 hours/day) and therapist-applied theory-based motivational coaching during rehabilitation sessions.

All were evaluated in first and last week of rehabilitation(lasting 4-5 weeks). Measures included a FITBIT-watch for number of daily passes and minutes of moderate/vigorous activity(MVPA), Two minute walking distance(2MWT) and 10 minute walk tests(10mwt). Participants filled out questionnaires: Godin Leisure-Time Physical Activity(GLTPA), Self-efficacy in Multiple Sclerosis(SEMS), Fatigue Severity-Scale(FSS), SF-12, Multiple Sclerosis Walking Scale(12-MSWS).

Results: Fifty-one persons participated. Median age was 56 years, 30 were females. Median was 6 with a mean disease duration of 21 years. Sixty-five% were inpatients. The EG improved >10% in 10mwt(41%), SF12-physical domain(11%), 12-MSWS(11%), GLPTA(71%), SEMS(12%), and daily steps number(11%). Both groups diminished their daily MVPA by half and the CG diminished on GLPTA(42%). Group differences corrected by baseline were not significant ($p<0.05$).

Conclusion: The use of an activity tracker and a BST empowering intervention administered as part of a rehabilitation session is promising in augmenting self efficacy, perceived health behavior and perceived and actual gait capacity of pwMS. Healthcare professionals/therapists need clear guidelines and responsibilities when it comes to empowering pwMS in taking an active part in augmenting physical activity.

[1]Torchio A. et al. Objective and subjective measures of daily physical activity in persons with Multiple Sclerosis beginning a rehabilitation regime: A cross-sectional study. 2022. DOI: 10.1016/j.msard.2022.104394

[2]Torchio A. et al. Impact of rehabilitation on physical activity and self-efficacy in people with multiple sclerosis. In publication.

Submission ID: 93; Submission Group: Technology Supported Rehabilitation; Submitter: Andrea Polidori

Motor-cognitive rehabilitation in patients with Multiple Sclerosis with temporized flashing lights: a feasibility study

Polidori Andrea*[1], Rogina Giulia[2], Giacalone Rosario[1], Prada Valeria[1], Tacchino Andrea[1], Pedullà Ludovico[1], Podda Jessica[1], Federica Di Antonio1, Bollini Alice[1], Grange Erica[1], Monti Bragadin Margherita[1,2], Brichetto Giampaolo[1,2]

**Main and presenting Author., [1]Scientific research area, Fondazione Italiana Sclerosi Multipla (FISM), Genova, Genova, Italy, [2]Servizio Riabilitazione Liguria, Associazione Italiana Sclerosi Multipla (AISM), Genova, Genova, Italy*

Introduction: Multiple Sclerosis (MS) is an inflammatory-neurodegenerative disease of the central nervous system (CNS), causing variable symptoms in the motor and cognitive domains, compromising the quality of life of people with MS (pwMS). Novel available technologies can improve the cognitive-motor rehabilitation of pwMS. BlazePods are flashing-light devices widely used in sports rehabilitation to improve reaction times and motor and cognitive skills. An application for the smartphone controls these lights through a Bluetooth connection, and the therapist can customize different kinds of exercises.

Aim: To date, there are no studies about using BlazePods in MS. We hypothesize that this device can improve motor and cognitive domains in pwMS, improving dual-task abilities and, therefore, quality of life. The study aims to test the feasibility of the device.

Methods: Five pwMS have been enrolled in the outpatient facility of our rehabilitation center (3F 2M; EDSS 5±1.3) with a prescription for twelve physiotherapy sessions. We have selected and modified three exercises from the BlazePod app: the Random mode, the Sequence mode, and the Focus mode. Each exercise has been performed in a standing or a sitting position following the patients' clinical conditions and has been registered the average reaction time and the number of errors using the BlazePod app.

Results: All the participants have completed the physiotherapy program, and no adverse reactions have been reported. The qualitative data about the patient's satisfaction were all positive and the motor outcomes considered showed improvements in every subject. Moreover, this preliminary study allowed us to build a protocol for effective exercises.

Conclusion: BlazePod is a feasible and safe device, well tolerated by patients, and it is a promising tool in improving the motor-cognitive skills in MS. This feasibility study set the basis for further studies to demonstrate the efficacy of a motor-cognitive training with BlazePods in pwMS.

Submission ID: 94; Submission Group: Rehabilitation Effectiveness; Submitter: Frederike Adammek

Sprint-Interval-Training under hypoxia in persons with Multiple Sclerosis: A feasibility study

Adammek, F.[1,2], Riegel, F[1]., Hohenauer, E.[3,6], Burtscher, J.[4], Clijsen, R.[3], Bansi, J.[1,5]

[1]Department of Neurology, Rehabilitation Centre Valens, Clinics of Valens, Valens, Switzerland, [2]Devision of Performance and Health (Sports Medicine), Institute for Sport and Sport Science, Technical University Dortmund, Dortmund, Germany, [3]Rehabilitation and Exercise Science Laboratory (RES Lab), Department of Business Economics, Health and Social Care, University of Applied Sciences and Arts of Southern Switzerland, Landquart, Switzerland, [4]Institute of Sport Sciences, University of Lausanne, Lausanne, Switzerland, [5]OST – Swiss University of Applied Science, Department of Health (Competence Center Move-IT/ Physiotherapy), St. Gallen, Switzerland, [6]Department of Neurosciences and Movement Science, University of Fribourg, Fribourg, Switzerland

Background: Exercise under hypoxia induces similar training effects at lower workloads than under normoxia. This is beneficial for persons with MS (pwMS) with fatigue and/or reduced mobility and may enhance the already known training effects of time-effective high-intensity endurance training modalities. This study aims to investigate the feasibility of sprint interval training (SIT) under hypoxia in pwMS.

Methods: Eight pwMS (Relapsing-Remitting phenotype) participated in seven SIT sessions under hypoxia (3000m AMSL, 16,3% FiO_2). SIT was performed on a cycle ergometer additionally to standard rehabilitative care during a three-week inpatient stay at the Valens clinic, Switzerland. SIT consist of three min warm-up followed by three series of five sprints à 10s with a break of at least 30s between the sprints and three min between the series and end with three min cool-down. Primary outcome were feasibility of the study protocol (>70% of participants completing >70% of planned sessions), of data collection (>70% of complete data sets), and acceptability of the intervention from participants' perspective (measured via semi-structured interviews). Secondary

outcomes were Peak Power Output (PPO) of a graded exercise test (Watts), 10-Meter-Walk-Test (10MWT), Two-Minute-Walk-Test (2MWT), Six-Minute-Walk-Test (6MWT), Timed-Up-and-Go-Test (TUG) and **Patient-Reported-Outcomes-Measurement-Information-System-Questionnaire (PROMIS)** at baseline (T_0) and discharge after three weeks (T_1).

Results: The study protocol is feasible (80% of participants completed 79% of planned series within planned sessions) and 88% of the data collection could be successfully achieved. Results of the interviews show high acceptability and motivation. The descriptive analysis of the secondary outcomes showed improvements of the mean values of all outcomes: Increase of 6.07% in PPO (T_0: 133.75W, T_1: 141.88W), of 15.28% in 2MWT (T_0: 150.50m, T_1: 173.50m), of 11.61% in 6MWT (T_0: 453.00m, T_1: 505.63m), of 19.85% in PROMIS (T_0: 25.2, T_1: 30.2) and a decrease of 8.70% in 10MWT (T_0: 7.75s, T_1: 7.13s) and of 18.17% in TUG (T_0: 8.13s, T_1: 6.88s).

Conclusion: SIT under hypoxia in pwMS on a cycle ergometer is feasible and improves patient-reported and health-related outcomes.

Submission ID: 95; Submission Group: Outcome Measures; Submitter: Laurits Taul-Madsen

A head-to-head study comparing the effects of aerobic and resistance exercise on fatigue in multiple sclerosis – secondary analyses from the MS Booster trial

Laurits Taul-Madsen[1], Lars G. Hvid[1, 2], Ulrik Dalgas[1]
[1]Exercise Biology, Department of Public Health, Aarhus University, Denmark, [2]The Danish MS Hospitals, Ry and Haslev, Denmark

Introduction: Fatigue is a complex, debilitating, and highly frequent symptom in people with multiple sclerosis (PWMS). The modified fatigue impact scale (MFIS) estimates fatigue and subdivides it into a physical (MFISphysical) and a cognitive component (MFIScognitive). Both aerobic training (AT) and resistance training (RT) reduce fatigue. However, the effects of the two modalities have not been directly compared.

Objective: To perform a head-to-head comparison of the effectiveness of AT and RT on fatigue measured by MFIS in PWMS.

Materials & Methods: A total of 150 PWMS (45±8 years, EDSS score 2.7 ± 1.6, 73 % women) were enrolled and randomized in a 2:2:1 ratio into either 12 weeks of AT (n=60, 30 sessions), RT (n=60, 30 sessions), or control ('usual care', n=30). Pre and post intervention assessments of isometric knee extensor muscle strength (MVC; isokinetic dynamometry), aerobic capacity (VO2peak; incremental exercise test), and fatigue (MFIS) were performed.

Results: Aerobic capacity increased in AT vs. control by 5.6 [2.0;9.2] mL O_2/min/kg (*mean [95CI]*) and in AT vs. RT by 3.6 [0.8;6.6], but not in RT vs. control (1.9 [-1.6;5.5]). Knee extensor muscle strength increased in RT vs. control by 1.03 [0.25;1.80] Nm/kg and in RT vs. AT 0.68 [0.27;1.08], but not in AT vs. control (0.35 [-0.42;1.13]). $MFIS_{total}$ seemed not to be reduced in neither RT vs. control -5.6 [-14.9; 3.7] points nor in AT vs. RT -2.6 [-9.1; 3.9], although a trend was observed in AT vs. control -8.2 [-17.5; 1.1]. $MFIS_{physical}$ seemed not to be reduced in AT vs RT -0.59 [-3.7; 2.5], whereas a trend towards a reduction was observed in RT vs. control -4.3 [-8.8; 0.2] points alongside a reduction in AT vs. control -4.9 [-0.4;-9,4]. $MFIS_{cognitive}$ remained unaffected in all groups.

Conclusion: No apparent differences were observed between the effects of AT and RT on fatigue (or its subcomponents). However, both modalities (AT in particular) seemed superior to control in eliciting reductions in $MFIS_{physical}$.

Submission ID: 96; Submission Group: ehabilitation Effectiveness; Submitter: Tobias Gaemelke

Efficacy of Progressive Power Training in Enhancing Neuromuscular and Physical Function in Older Patients with Multiple Sclerosis: Preliminary Results from the PoTOMS Trial

Tobias Gaemelke[1], Peter Feys[2], Christoffer Laustsen[3], Ulrik Dalgas[1], Lars G. Hvid[1,4]
[1]Exercise Biology, Department of Public Health, Aarhus University, Aarhus, Denmark, [2]REVAL, Rehabilitation Research Center, Faculty of rehabilitaion, Hasselt University, Hasselt, Belgium, [3]The MR Research Center, Department of Clinical Medicine, Aarhus University, Aarhus, Denmark, [4]The Danish MS Hospitals

Introduction: Exercise has demonstrated positive effects in young and middle-aged people with multiple sclerosis (pwMS) as well as healthy older adults. However, there is a paucity of evidence investigating the effects of exercise in older (⩾60 years) pwMS, constituting a substantial and growing MS subpopulation.

Aim: The study aims to compare the effects of 24 weeks of progressive power training (PPT) with a usual care control group in older (⩾60 years) pwMS on neuromuscular- and physical function, assessed at baseline and after 24 weeks.

Methods: The 'Power Training in Older MS patients' (PoTOMS) randomised controlled trial included 41 older pwMS, with 21 randomised to the PPT group (65±4 years, 3.5 [2.75;4.0] EDSS) and 20 to the control group (66±4 years, 3.5 [2.63;4.5] EDSS). Participants underwent leg-press dynamometry to evaluate maximal voluntary contraction (MVC) and rate of force development at 30 ms (RFD_{30ms}), maximal chair rise, timed 25-foot walk test (T25FWT), six-minute walk test (6MWT), and 9-step stair accent (9SSA).

Results: At 24 weeks, between-group difference (mean difference [95%CI]) was observed for all selected outcomes, favouring the PTT group: Maximal chair rise power (4.8 $W \cdot kg^{-1}$ [3.2;6.3], $p<0.001$), leg-press MVC (3.4 $N \cdot kg^{-1}$ [1.6;5.2], $p<0.001$), leg-press RFD_{30ms} (440 $N \cdot s^{-1}$ [8;873], p=0.046), T25FWT (0.44 $m \cdot s^{-1}$ [0.29;0.59], $p<0.001$) 6MWT (54 m [42;67], $p<0.001$), 9SSA (0.03 flight of stairs $\cdot s^{-1}$ [0.01;0.05], $p<0.004$). In the PPT group, clinically meaningful improvements were observed in 57% of older pwMS for the T25FWT and 60% for the 6MWT.

Conclusion: PPT in older pwMS was safe and effective, eliciting improvements in neuromuscular function and physical function. These improvements in physical function were clinically meaningful in a substantial proportion of older pwMS. These results

highlight the effectiveness of applying PPT in this under-investigated subpopulation of older pwMS.

Submission ID: 97; Submission Group: Technology Supported Rehabilitation; Submitter: Jelka Jansa

The use of Intensive visual stimulation in multiple sclerosis – a case study

J Jansa[1], Z Spiclin[2], G Brecl[1]
[1]UMCL, Slovenia, [2]The Faculty of Electrical Engineering, Slovenia

Objective: Intensive visual stimulation (IVS3) is a modern, computer-based device, assisting in motor planning and central control of movement in upper limb. It has proven useful with various neurological diseases, impacting on hand function. IVS3 was therefore applied to a person with multiple sclerosis (PwMS).
Methods:
Patient and procedure:
A PwMS, female, age of 62, with 32 years history of MS, secondary progressive type and with the Expanded Disability Status Scale of 6.5 was referred to outpatient Occupational therapy (OT). Over the period of last 10 months she was experiencing gradual weakness and tremor in her right/dominant hand, affecting her daily functioning. Self-perception of her performance of daily occupations/activities was assessed by the Canadian Occupational Performance Measure (COPM). Fingers dexterity were measured by the Nine Hole Peg Test (NHPT). In addition, dual-task performance was measured by adding cognitive interference (CI) while performing NHPT. Assessments were performed before starting OT and after 20 outpatient sessions. Each OT visit includes IVS3 (30 minutes) and additional counselling. IVS3 session was mainly targeting her right hand and few bimanual actions.
Results: Average COPM - performance improved from 5,5 to 7.7 (statistically important) and average COPM - satisfaction improved from 5,5 to 6,7 only. NHPT for left hand improved from 34,51sec to 31,63 and for right hand from 36.03 to 25,99 sec. NHPT with CI improved from 52,8 to 40,09 sec for left hand and from 59,05 to 43,66 for right hand. In addition, she spontaneously commented that she had been more aware of her right hand and consequently was including it more into daily activities.
Conclusion: The use of IVS 3 in a PwMS was useful in terms of improving finger dexterity, dual-task performance and integrating of affected hand into daily activities.

Submission ID: 98; Submission Group: Technology Supported Rehabilitation; Submitter: Angela Boschetti

"Pilot study on the feasibility of home-based cognitive remediation in People with Multiple Sclerosis (PwMS)"

Angela Boschetti[1,2], Michelangelo Dini[1,2], Marta Tacchini[1,2], Giulia Gamberini[3], Mariaemma Rodegher[3], Alessandro Gradassi[3], Giancarlo Comi[1,3], Letizia Leocani[1,2]
[1]San Raffaele Vita-Salute University, Milan, Italy, [2]Experimental Neurophysiology Unit, Institute of Experimental Neurology-INSPE, Milan, Italy, [3]Neurorehabilitation Dep.t, Casa di Cura Igea, Milan, Italy

Background & Aims: Multiple Sclerosis (MS) presents with diverse symptoms, including Cognitive Impairment (CI). Traditional approaches to CI involve in-clinic-neurobehavioral protocols. However, researchers have highlighted issues associated with in-person rehabilitation. To address these challenges, remote rehabilitation tools have been proposed. The current study aims to investigate the feasibility of a telerehabilitation intervention utilizing a computer-based software.
Methods: People with MS (PwMS) experiencing objective cognitive deficits on at least one neuropsychological test were recruited from an MS Rehabilitation Centre. They were randomly allocated to either the Intervention Group (IG), receiving 3 months (3 45-minute sessions a week) of home-based rehabilitation with the RehaCom software, or the Control Group (CG), engaging in at-home computerized sham activities for an equivalent duration. Feasibility was assessed by comparing expected training hours to actual training hours.
Results: 12 PwMS in the IG (10 F; mean age= 57; mean education =14) completed on average 17.23 hours of rehabilitation, equivalent to 63.81 % of total planned training. Specifically, 8 PwMS in the IG (72.72 %) completed at least 1/2 of the prescribed training, while 6 (54.54 %) completed at least 2/3 of the expected training. Instead, 9 PwMS in the CG (6 F; mean age= 56; mean education =15) completed on average 19.66 hours, equivalent to 72.83 %. 8 PwMS in the CG (88.88 %) completed at least 1/2 of the prescribed training, while 6 (66.66 %) completed at least 2/3 of the expected training.
Discussion & Conclusion: These results demonstrate encouraging levels of adherence to home-based rehabilitation (and sham treatment) among PwMS, with participants completing, on average, over half of the expected training within the three-month period. This observation is pivotal as the effectiveness of telerehabilitation largely hinges on the practicality of home-based tools. Future research will need to assess efficacy of these techniques in depth.

Submission ID: 100; Submission Group: Other; Submitter: Susan Seddiq Zai

Driving simulator fitness in Multiple Sclerosis and its correlates in a cross-sectional and long-time observation

Susan Seddiq Zai[1], Roshan das Nair[2], Christoph Heesen[1], Carsten Buhmann[3], Anya Pedersen[4], Jana Pöttgen[2]
[1]Institute of Neuroimmunology and Multiple Sclerosis (INIMS), Center for Molecular Neurobiology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [2]Health Division, SINTEF, Trondheim, Norway; School of Medicine, University of Nottingham, Nottingham, United Kingdom, [3]Department of Neurology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [4]Department of Clinical Psychology and Psychotherapy, Institute of Psychology -Christian-Albrechts-University, Kiel, Germany

Background and Objectives: Research on driving ability in multiple sclerosis (MS) suggests that it might be at risk for unsafe

driving due to MS-related impairment. Our aim was to investigate differences in driving ability in a driving simulator between people with MS (PwMS) compared to those without MS (controls) and estimate changes over time in driving performance. In addition, we measured individual perceived driving abilities of participants.

Methods: We compared performance in a driving simulator on a standardized driving route between 97 PwMS (39 ± 11.07 years, 51% women, 69% relapsing remitting MS (RRMS)) and 93 matched controls (37 ± 15.27 years, 60% women) at baseline, and with a subgroup of 45 PwMS (38 ± 10.50 years, 40% women, 69% RRMS) and 57 controls (40 ± 15.91 years, 53% women) at a second time point (12 to 36 months after baseline). Participants completed assessments on driving, and demographic and disease-related measures.

Between-group comparisons of driving performance were done, as well as longitudinal analysis.

Results: Although, PwMS and controls didn't differ in their perceived driving ability (T(245) = -.69, p = .244), in a driving simulator setting, PwMS had more driving accidents (T(188)=2.762, p=0.006), reacted slower to hazardous events (T(188)=2.561, p=0.011), made more driving errors (T(188)=2.883, p=0.004) and had a worse Driving Safety Score (T(188)=3.058, p=0.003) than controls. The long-term observation did not show significant differences in the change for any of the driving outcomes.

Conclusion: Driving performance in a simulator is reduced in PwMS compared to controls, as a result of increased driving errors, reduced reaction time and a higher accident rate. Additionally, PwMS may overestimate their own driving skills. However, there was no significant change found over time in driving performance in the long-term observation.

Submission ID: 101; Submission Group: New Research Methodologies; Submitter: Rosario Giacalone

Aerobic physical activity for person with severe Multiple Sclerosis disability

Giacalone Rosario[1*], Andronaco Marianna[1], Polidori Andrea[1], Margherita Monti Bragadin[1], Prada Valeria[1], Brichetto Giampaolo[1,2]

[*]Main Presenting Author, [1]Scientific Research area, Italian Multiple Sclerosis Foundation (FISM), Genova, Genova, Italy, [2]Liguria Rehabilitation Service, Italian Multiple Sclerosis Association (AISM), Genova, Genova, Italy

Multiple sclerosis (MS) is central nervous system demyelinating disease, causing disorders in motor and cognitive domain. An EDSS score higher than 6,5 request using of walkers or wheelchairs to get around, limiting the quality of life (QoL). In literature there are few studies about severe MS and physical activity, the aim is to demonstrate a feasible program of adapted physical activity, effectiveness in improving QoL and maintaining residual performances in severe SM phenotypes.

Four persons with MS (pwMS, 4 females, EDSS 7.37±0.25) have been enrolled. We included EDSS between 6.5 and 8.5, without cardiologic pathologies. We performed the following tests at T0 (before adapted activity program): HADS, LifeSatisfactionIndex (LSI), FIM, MFIS. We tested the performance with Wheelchair Propulsion Test (WPT) and One Stroke Push (OSP). We added Block and Box and Abiland for Upper limbs ability and Symbol Digit (SDMT) for speed processing ability. We planned 1 hour session per week for 4 months, T1 assessment after 2 months and a T2 at the program end.

To date, nobody has reached the T1 endpoint. All the participants showed an impaired performance in the motor assessment on wheelchair (OSP: 258.92±185.19cm, WPT: 10m forward (mean 58±55.58s), propulsion cycles (mean 28.25±19.41), speed (mean 0.55±0.52m/s) push frequency (mean 0.78±0.42 cycles/s), effectiveness (0.54±0.37)). QoL and fatigue results impaired, also HADS (total mean 7.5±3.70) LSI (mean 10.5±1.91) MFIS (total mean 38.5±12.81). In the first month, the attendance rate was 81.25%.

To our knowledge, this is the first study about physical activity and severe forms. We show that attendance is very high, despite the severity of the disease and physical barriers. We built a tailored program of physical activity for pwMS. More data are needed to verify the effectiveness. Moreover, we would like to encourage the scientific community to develop more projects for pwMS with high disabilities.

Submission ID: 102; Submission Group: Other; Submitter: Josephine Steenberg

Personal costs of managing treatment and care for people with MS and multimorbidity

Josephine L Steenberg[1*], Nana F Hempler[1], Marie Lynning[1]

[1]The Danish MS Society, Copenhagen, Denmark, [*]Main author

Introduction and Aim: Many people with MS (PwMS) suffer from one or more chronic conditions in addition to their MS. Little is known about how this multimorbid patient group experiences and navigates in the healthcare system. The aim of this qualitative study was to explore personal costs related to seeking treatment and navigating the healthcare system for people who have MS and multimorbidity.

Methods: Sixteen qualitative, semi-structured interviews were conducted with informants reporting one or more diseases in addition to MS. Data analysis followed the principles of qualitative content analysis described by Graneheim and Lundman.

Results: Four themes were identified that highlight the personal costs related to seeking treatment and navigating the healthcare system: 1) Patients are compelled to take responsibility for their treatment, 2) High time- and energy costs, 3) MS symptoms add to the burden, and 4) Personal resources and help from relatives are essential.

In this study PwMS and multimorbidity experience a significant burden of responsibility in relation to coordination of care, surveillance and management of treatment errors, and navigation between different medical specialties across the healthcare system.

Informants highlighted that navigating the healthcare system and ensuring optimal treatment when dealing with several chronic conditions requires considerable time, energy, and resources, which may be sparse when dealing with multimorbidity. They emphasized that MS-specific symptoms such as fatigue and cognitive disabilities further limit their resources. Therefore, they are reliant on personal resources such as education and specialized knowledge, as well as help and support from relatives to navigate the healthcare system and receive optimal treatment and care.
Conclusion: PwMS and multimorbidity experience significant personal costs related to their treatment and care. Personal involvement and active participation are essential but difficult for this patient group, especially for those who lack personal resources and support from relatives.

Submission ID: 103; Submission Group: Technology Supported Rehabilitation; Submitter: Natalia Paredes-Acuna

Advancing Assessment Technologies for Movement Disorders in pwMS

Natalia Paredes-Acuna[1], Daniel Utpadel-Fischler[1], Nitish V. Thakor[2], Peter Feys[3], Gordon Cheng[1]
[1]Technical University of Munich, Germany, [2]John Hopkins University, USA, [3]Hasselt University, Belgium

Background: This work delves into the advancements of assistive technologies that address movement disorders in individuals with multiple sclerosis (pwMS). Leveraging recent technological progress, we critically examine the current state of assessment technologies for movement disorders prevalent in neurological conditions and their applicability to MS.
Methods: A comprehensive survey involving over 200 publications is conducted to explore various strategies for quantifying symptoms related to movement disorders in pwMS. The study encompasses designing and developing a sensory substitution device tailored explicitly for individuals lacking somatosensation in their feet. A case study is presented involving a pwMS actively engaged in the development process, utilizing robotic skin soles to measure force distribution during balancing and walking. Also, preliminary data on camera-based movement quantification of five pwMS using a simplified setup with video cameras is discussed, along with the exploration of automatic assessment possibilities for physicians.
Results: The sensory substitution device, incorporating robotic skin soles and vibrotactile stimulation, achieves a 93.1% accuracy in distinguishing feedback patterns related to various gait cycle phases and balancing conditions. The preliminary data on camera-based movement quantification offers insights into alternative assessment methods for pwMS, where physicians could potentially use it as a remote assessment technique.
Conclusions: By presenting these diverse approaches, the study aims to propel advancements in quantifying movement disorders in pwMS. The findings offer valuable insights for physiotherapists and occupational therapists caring for individuals with MS, emphasizing the potential of advancing technologies in enhancing assessment and intervention strategies for movement disorders.

Submission ID: 104; Submission Group: Other; Submitter: Hannelore Vanthuyne

The meaning of work and non-work for persons with multiple sclerosis

Hannelore Vanthuyne*[1], Evi Vijverman[2], Daphne Kos[1,2], Nele De Cuyper[1]
*[1]KU Leuven, [2]National MS Center Melsbroek, *Presenting author*

Introduction: In response to labor market shortages persons with chronic illness are now being recognized as having the potential to increase employment rates. This focus on labor participation differs from previous policies, which primarily emphasized financial compensation and social protection. However, little is known about the experiences of persons with chronic illness for example regarding work-life balance which has been shown to be crucial for life satisfaction and sustainable employment.
Method: Qualitative research was conducted through semi-structured interviews with 12 persons diagnosed with MS. The interviews aimed to reveal what makes working and not working attractive and/or unattractive, and how they can, should or do not want to give work a place in their life in the presence of their chronic illness (illness-work-life balance).
Results: A common pattern of different phases emerged: 1) working without impairment prior to illness onset, 2) continuing to work despite increasing MS symptoms, 3) being unable to work due to MS-related impairments, and 4) working with MS through adjustments to accommodate their illness. Models of disability (the cultural, medical, biopsychosocial, social and affirmation model) provide a theoretical framework to understand this evolution.
While work held significant importance before their illness, its relative importance appears to decline in favor of non-work activities prioritizing health preservation alongside the management of chronic illness. Additionally, persons with MS seek to minimize stress from conflicting roles between work and non-work domains and strive for role enrichment where possible. Finally, an influence of both disease identity and the internalized social norm of the importance of paid work appears.
Conclusion: In our MS sample, being at work was found to be meaningful because it contributes to quality of life in presence of illness-work-life balance. When work is not possible or desirable, the values of work can be found in other activities.

Submission ID: 106; Submission Group: Other; Submitter: Deborah Caudenberg

Empowering and supporting people with multiple sclerosis in sustainable employment: a multidisciplinary approach

Debora Caudenberg*[1]; Niels Peeters[1,2]; Evi Vijverman[1]; Erika Peeters[1,3], Meta Milo[1]; An van Nunen[1], Daphne Kos[1,2]
[1]National MS Center Melsbroek, Belgium;
[2]Department rehabilitation sciences KU Leuven, Belgium;
[3]Rehabilitation Hospital Inkendaal, Vlezenbeek, Belgium,
**presenter*

Introduction: Several physical and invisible symptoms, as well as the way of coping with the disease may change people's work status and job satisfaction throughout the disease course of MS. Rehabilitation approaches aim to support people to stay at work as long as feasible and desirable and to strive for a sustainable employment opportunity.
Methods: Embedded in a biopsychosocial model, we use a multidisciplinary approach to focus on preferences, possibilities and opportunities related to employment. Together with the person with MS, each member of the multidisciplinary team has a different focus towards common work-related goals. The occupational therapist and psychologist discuss individuals' preferences, physical and neuropsychological capacities, employment skills, flexibility, coping strategies and the meaning of employment in their lives. The physician focuses on MS symptoms, medication use and potential side effects, brain reserve and healthy lifestyle. The social worker explores ways of supporting employment at different levels (employer, government/social security, social support etc.). According to individuals' needs and preferences, we use an individualized long-term approach in a (combination of) transmural, inpatient, or outpatient setting.
Results: People with MS often enter the rehabilitation programme with questions on how to deal with working difficulties. However, within the multidisciplinary approach, there is a shift towards the meaning of employment in people's lives and how to stay at work in a sustainable way, in combination with other life roles and engagements. The outcome of the programme may be staying at work (either full-time or part-time, either or not in the same organisation and/or position), but may also be finding the meaning and value of work in other activities (like volunteering or leisure activities).
Conclusion: The multidisciplinary approach facilitates a shift from problem-focused towards meaning-focused employment empowerment and support. Future work may evaluate the benefits and harms of this approach at individual, organisational and societal level.

Submission ID: 107; Submission Group: Technology Supported Rehabilitation; Submitter: Simone Mercurio

Effects of telerehabilitation on balance in people with Multiple Sclerosis: a pilot study

Telerehabilitation on balance in PwMS. Presenting author: Mercurio Simone
Morello F[1]*, Mercurio S[2], Malfitano C[1], Perucca L[1,3], Confalonieri P[2]
**main author, [1]Department of Neurorehabilitation Sciences, Ospedale San Luca, Istituto Auxologico Italiano IRCCS, Milan, Italy., [2]Multiple Sclerosis Centre. Neuroimmunology and Neuromuscular Diseases Unit, IRCCS Fondazione Istituto Neurologico Carlo Besta, Milan, Italy., [3]Department of Biomedical Sciences for Health, Università degli studi di Milano, Milan, Italy.*

Background: While rehabilitation through therapeutic exercise remains the milestone for the treatment of balance impairment in PwMS, in the last few years the development of exergames-based telerehabilitation systems is providing new tools for the management of one of the most common and disabling symptoms. The introduction of these systems within intensive rehabilitation programmes, based on high frequency of treatment, may provide relevant information about their effectiveness.
Materials and Methods: This research study, held at the IRCCS Istituto Auxologico Italiano, aims to evaluate the effectiveness of an exergames programme carried out during intensive rehabilitation in improving balance in PwMS. A pilot study was run, recruiting 10 patients (7 female, median age: 47.9, range 41-54; EDSS: 3-6). Participants received balance training through exergames (5 days/week for 2 weeks) using Rehability Neuro®, a telerehabilitation system based on body tracking via infrared camera. The Equiscale (primary outcome), the m-FIS and the 12 items MSWS were used to assess balance, fatigue and walking ability before (T0) and after (T1). The median and the interquartile distance were used as a central tendency and a measure of dispersion, respectively. The Wilcoxon paired test was used as a verification test.
Results: None of the enrolled patients dropped out of the study. Balance significantly improved at T1 (T1: median = 15, IQR = 1) compared to T0 (T0: median =13, IQR = 2; $p = 0.011$). Fatigue significantly decreased and individual's walking ability significantly improved at T1.
Conclusion: A telerehabilitation system based on body tracking and the adaptation of therapeutic exercise to a video game frame can be an important integrative tool for the management of balance impairment in patients with Multiple Sclerosis. Future applications of the system as a self-managed maintenance treatment in a home setting may provide additional information on safety, feasibility, and adherence.

Submission ID: 108; Submission Group: Rehabilitation Effectiveness; Submitter: Olivia Wills

First insights into the experiences and adoptions of a brain-healthy lifestyle in multiple sclerosis: A longitudinal, mixed methods, multiple case-study design from the perspective of lived experience

Olivia Wills[1], Brooklyn Wright[1], Mark Schira[1], Alok Gupta[2], John Magnussen[3], Yasmine Probst[1]
[1]University of Wollongong, Australia, [2]Wollongong Diagnostic Centre, Australia, [3]Macquarie University, Australia

Rationale: To develop, recommend and support meaningful and long-lasting behaviour changes, we need to understand the complexity of lifestyle factors, their interrelationships and how they collectively affect brain health for MS. We undertook a longitudinal, mixed methods, multiple case-study exploring the lifestyle profiles of adults living with MS to understand patterns of behaviour change compared to intended measures of brain health outcomes.
Methods: Adults with relapsing remitting MS completed one magnetic resonance imaging scan, two online 24-hour dietary recalls and demographic and self-reported lifestyle questionnaires (stress, physical activity, disability). Quantitative data was

collected at baseline and repeated after 12-months in addition to one semi-structured interview with a subset of cases. All data were compiled into an evidentiary database, accompanied by narrative compilations profiling lifestyle behaviours. Measures of central tenancy were used to assess change(s) over time and non-parametric correlation analyses to explore the strength of association(s) between variables. Qualitative data were inductively analysed following Braun and Clark methodology. Quantitative and qualitative data were triangulated to detect key patterns.

Results: Twelve cases (100% female, mean 46.58 years, disease duration 13.95 years) were included, and their lifestyle profiles exhibited significant heterogeneity. Over the 12-months, a significant reduction in UV exposure (p=0.032) and vitamin D supplementation (p=0.014) was observed, alongside a significant increase in adherence to recommended serve sizes for dairy products (p=0.039). There were multiple, moderate correlations between lifestyle variables and outcomes of brain health, measured via brain volume, that persisted at 12-months. Integration of quantitative and qualitative data reflected the interactions that are present when a single behaviour is modified.

Conclusion: Behaviour change does not occur in isolation and the variability in how lifestyle management strategies are experienced and enacted by plwMS, highlight the importance of personalised approaches to MS management that consider individual circumstances and diversity within the MS population.

Submission ID: 110; Submission Group: Outcome Measures; Submitter: Andrea Giordano

Analysis of the Advance Care Planning conversation using the OPTION scale

Andrea Giordano[1], Ludovica De Panfilis[2], Giorgia Presicce[3], Riccardo Orlandi[4,5], Simona Toscano[6,7], Federica Pinardi[8], Mariangela Farinotti[1], Alberto Gajofatto[4,5], Maria Grazia Grasso[3], Alessandra Lugaresi[8,9], Sara Montepietra[10], Francesco Patti[6,7], Claudio Solaro[11], Simone Veronese[12], Alessandra Solari[1], on behalf of the ConCure-SM project

[1]Unit of Neuroepidemiology, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan, Italy, [2]Bioethics Unit, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy, [3]Multiple Sclerosis Unit, IRCCS S. Lucia Foundation, Rome, Italy, [4]Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Italy, [5]Unit of Neurology, Borgo Roma Hospital, Azienda Ospedaliera Universitaria Integrata Verona, Verona, Italy, [6]Department GF Ingrassia, University of Catania, Italy, [7]UOS Sclerosi Multipla, Policlinico "G Rodolico", University of Catania, Italy, [8]IRCCS Istituto delle Scienze Neurologiche di Bologna, Bologna, Italy, [9]Dipartimento di Scienze Biomediche e Neuromotorie, Università di Bologna, Bologna, Italy, [10]Multiple Sclerosis Center, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy, [11]Department of Rehabilitation, M. L. Novarese Hospital, Moncrivello, Vercelli, Italy, [12]Fondazione FARO, Turin, Italy

Background: The ConCure-SM intervention [ISRCTN48527663] consists of an advance care planning (ACP) training program for neurologists and other professionals caring for people with progressive multiple sclerosis (PwPMS). We assessed the shared decision-making behavior of our ACP-trained neurologists.

Methods: Two researchers rated audio-recordings and transcripts of 18 first ACP conversations using the Observing Patient Involvement in Shared Decision Making (OPTION). The scale consists of 12 items and a total score, ranging from 0 (behavior not observed) to 100 (behavior observed to high standard).

Results: Mean duration of the ACP conversations was 62.7 minutes (SD 18.3). Neurologists were between 30 and 62 years old; 5/7 (71%) were women. Mean PwPMS age was 61.8 (SD 7.8, range 50- 77), 39% were women, median EDSS score was 8.0 (range 5.0–9.0). Inter-rater correlation coefficient (OPTION total score) was 0.80 (95% CI 0.54–0.92). The mean OPTION total score was 48.4 (SD 7.5). The most frequently observed behaviors were: "drawing attention to an identified problem requiring a decision" (median score 75; interquartile range 50–75) and "exploring the patient's concerns" (62.5; 50–75). By contrast, in no case did neurologists elicit patient's preferred approach to receiving information. A key step in the ACP dialogue is the understanding of patient's values, a behavior not assessed in the OPTION scale. We added one item "exploring patient's values", which obtained a median score of 50 (interquartile range 50–75).

Conclusions. The mean OPTION total score (48.4) corresponded to a moderate level of patient involvement during the first ACP conversation. Two studies used the OPTION scale in the context of MS consultations. Both were observational studies (did not include any training program), and showed lower levels of patient-involving behaviors (mean OPTION total score around 30) compared to our study.

Submission ID: 111; Submission Group: Technology Supported Rehabilitation; Submitter: Giulia Piovani

Telehealth and digital technologies: the future of cognitive rehabilitation for people with Multiple Sclerosis

Giulia Piovani (main author)[1,2], Jessica Podda[1], Alessia Susini[1], Maura Casadio[2], Giampaolo Brichetto[1,3], Andrea Tacchino[1]

[1]Italian Multiple Sclerosis Foundation, Genoa, Italy, [2]University of Genoa, Genoa, Italy, [3]AISM Rehabilitation Service of Genoa, Genoa, Italy

Background: Cognitive rehabilitation is essential in improving people's functionality and quality of life. New telerehabilitation models based on digital technologies are emerging as effective home-based solutions to enface problems of transfers, insurance coverage and costs of traditional interventions. To date, little evidence is present on telerehabilitation services for the treatment of cognitive symptoms in Multiple sclerosis (MS). Telerehabilitation

could play a central role in the success of rehabilitation of MS cognitive deficits. Here, we will investigate the effectiveness of an at-home cognitive telerehabilitation in comparison with a traditional in-presence approach.
Objectives: The aims of this project are: (1) assessing the effectiveness of a telerehabilitation vs. conventional in-presence intervention for cognitive function; (2) exploring the impact on quality of life of people with MS of cognitive telerehabilitation; (3) proposing practical guidelines for MS cognitive telerehabilitation.
Methods: The study is a two-group RCT study assessing the effectiveness of 16 sessions of 60-min telerehabilitation vs. conventional intervention for cognitive function in people with MS. We plan the recruitment of an average total of 60 participants randomized into EXP or CTRL groups.
Equipment needed for telerehabilitation concerns the simultaneous implementation on a tablet of a first application for cognitive exercise delivery and a second application consenting for remote streaming activities and the possibility for the therapist to control the remote device, collect online feedback from the participants and give them real-time feedback.
All participants are assessed with tests addressing cognitive functions. Additionally, at the end of their participation, they are administered questionnaires investigating the feasibility of telerehabilitation treatment in terms of satisfaction and positive impact on quality of life.
Perspectives: We expect this research will unveil which digital technologies are effective, well-tolerated and appreciated by people with MS to enroll in home-cognitive training interventions and telerehabilitation treatments.

Submission ID: 112; Submission Group: Outcome Measures; Submitter: Andrea Tacchino

Perception of walking limitations, perceived fatigue and fatigability assessed during the 6MWT in people with Multiple Sclerosis

Andrea Tacchino[1], Ludovico Pedullà[1], Mattia Malagoli[2], Alessia Susini[1], Marco Dellacava[2], Jessica Podda[1], Giampaolo Brichetto[1,2]
[1]AISM Rehabilitation Service of Liguria, Genoa, Italy, [2]Italian Multiple Sclerosis Foundation (FISM), Genoa, Italy

Background: Fatigue is a frequent and disabling symptom and can be present already in the early MS stages. Here, we investigated the correlation between fatigability during the 6-minute walking test (6MWT) and the perception of fatigue in PwMS reporting different levels of walking limitations due to MS.
Materials and Methods: The study adopted the following inclusion/exclusion criteria: adulthood, MS diagnosis, any disease course, and Expanded Disability Status Score (EDSS) range 1-6.5.
Participants were administered the MSWS-12 and performed the 6MWT. At the end of each minute of the 6MWT, they were asked to score their fatigue on the 6-20 Borg scale.
Participants were divided into two groups based on the normalized total score obtained on the MSWS-12, i.e. low ($\leqslant$50, MSWS-12_LOW) and high ($>$50, MSWS-12_HIGH) walking limitations. Fatigability was calculated as the difference between the distance walked in minute-1 and minute-6 of the 6MWT.
Results: We recruited 31 PwMS (age: 32-71y; sex: 24/7 F/M; 25 RR, 1 PP, 5 SP), 15 in the MSWS-12_LOW group (age: 50.6$\pm$12.7y; sex: 12/3 F/M; EDSS: 2.1$\pm$0.7; MSWS-12: 32.9$\pm$10.0) and 16 in the MSWS-12_HIGH (age: 50.3$\pm$9.3y; sex: 12/4 F/M; EDSS: 4.2$\pm$1.5; MSWS-12: 62.9$\pm$10.4).
The difference in walking distance between minute-1 and minute-6 in the MSWS-12_LOW group was 7.27$\pm$20.57m, while in the MSWS-12_HIGH group was 9.12$\pm$10.73m; no statistical differences were present between the two groups ($p=0.75$).
The Borg score between minute-1 and minute-6 showed significant difference between groups (MSWS-12_LOW: 0.87$\pm$1.46, MSWS-12_HIGH: 3.5$\pm$3.82, $p<0.05$).
Conclusions: Preliminary results show that PwMS who perceive greater walking limitations report increased perception of fatigue although there is no corresponding result in performance. An expansion of the sample and the analysis of other variables detectable (e.g. from sensorized insoles) will be able to better clarify the relationship between perception and execution in PwMS.

Submission ID: 113; Submission Group: Outcome Measures; Submitter: Michelangelo Dini

Detecting Cognitive Impairment in pwMS using the Montreal Cognitive Assessment: a Validation Study

Michelangelo Dini[1,2], Marta Tacchini[1,2], Angela Boschetti[1,2], Giulia Gamberini[3], Giancarlo Comi[2,3], Letizia Leocani[1,2,3]
[1]Experimental Neurophysiology Unit, Institute of Experimental Neurology-INSPE, IRCCS Scientific Institute San Raffaele, Milan, Italy, [2]San Raffaele Vita-Salute University, Milan, Italy, [3]Department of Neurorehabilitation Sciences, Casa di Cura Igea, Milan, Italy

Background: International guidelines recommend specific neuropsychological batteries like the Brief International Cognitive Assessment in MS (BICAMS) for the assessment of cognitive impairment in pwMS. However, healthcare surveys show that generic screening tests like the Montreal Cognitive Assessment (MoCA) are often administered to pwMS in everyday clinical practice, due to their ease of use and widespread availability.
Objective: To determine the validity of MoCA as a screening tool for cognitive impairment in pwMS.
Methods: We retrospectively analysed anonymised clinical data from 153 pwMS who underwent neuropsychological evaluations with both the MoCA and BICAMS battery, as per routine clinical protocol of our centre. We defined cognitive impairment based on

BICAMS scores (<1.5 SD in at least one test). We evaluated the discriminant validity of MoCA score via independent-samples t-tests. We also trained a machine-learning logistic regression model based on MoCA score, age, and education using 10-fold cross-validation. Synthetic minority over-sampling technique was applied to account for imbalanced classes. Model accuracy, sensitivity and specificity were evaluated using receiver operating characteristics (ROC) analysis.

Results: Patients were mostly females (61.4%), with mean age 53.3±9.5 years, mean education 14±3.8 years, and median EDSS score 6.5 (6.0-6.5). One third (n=52) of patients were classified as cognitively impaired (CI). MoCA score was significantly lower in CI patients (mean difference=-3.11, $p<0.0001$, Cohen's $d=1.05$). The logistic regression model reached 72% accuracy, with an area under the ROC curve=0.78. An optimal threshold was identified, yielding 68% sensitivity and 83% specificity.

Conclusion: MoCA score can detect cognitive impairment in pwMS, but false positives and false negatives are still present, suggesting a non-linear relationship. Further studies with more advanced statistical models will likely lead to increased accuracy, enabling more reliable estimations of cognitive impairment. This could be especially relevant in clinical settings where specialised neuropsychological testing may not be feasible due to lack of time and/or trained personnel.

Submission ID: 114; Submission Group: Outcome Measures; Submitter: Kasper Byskov

Cut-points for walking capacity tests in patients with multiple sclerosis

Camilla Juhl[2], Kasper Byskov[1,2], Lars G Hvid[1,2], Ulrik Dalgas[2], Anders G Skjerbæk[1,2]

[1]The Danish MS Hospitals, Ry and Haslev, Denmark, [2] Exercise Biology, Dept. of Public Health, Aarhus University, Denmark

Introduction: Walking capacity is substantially impaired in patients with multiple sclerosis (pwMS). Assessment and interpretation of walking performance are thus important to both patients, clinical practice, and research. However, limited research exists that has established clinical cut-points for commonly used tests of walking capacity in pwMS specifically 6-Minute Walk Test (6MWT), Six Spot Step Test (SSST), and Timed 25-Foot Walk Test (T25FWT).

Objectives: Our aim was to identify cut-points for 6MWT, SSST, and T25FWT in relation to patient-reported walking ability as measured by the 12-item Multiple Sclerosis Walking Scale (MSWS-12) in pwMS.

Materials & Methods: In this cross-sectional study a total of n=211 ambulatory pwMS were enrolled (68% females, 54±11 years, patient determined disease steps 2.9±1.9 [range 0-7]). Participants were divided into one of two groups based on their MSWS-12 total score (0-100); derived from 12 questions regarding limitations to walking due to MS over the past 2 weeks, scored from 1 'not at all', 2 'a little', 3 'moderately', 4 'quite a bit', 5 'extremely'): no walking impairments (NOWI; 0-37.49) and walking impairments (WI; 37.5-100; corresponding to an average answer of 2.5). Cut-points, area under the curve (AUC), sensitivity (se), and specificity (sp) were identified using receiver operating characteristic (ROC) curve analyses.

Results: Our primary findings showed cut-points distinguishing between the groups NOWI and WI for 6MWT (446m; AUC=0.82, se=0.87, sp=0.78), SSST (0.113 rounds/s; AUC=0.76, se=0.77, sp=0.74 (*corresponding to 8.8 seconds)*) and T25FWT (1.39 meter/s; AUC=0.79, se=0.89, sp=0.69 (*corresponding to 5.5 seconds)*).

Conclusion: Using ROC curve analyses, clinically relevant cut-points were identified for 6MWT (446m), SSST (8.8s), and T25FWT (5.5s) based on patient-reported walking ability. These cut-points provide novel insight on how to interpret different aspects of walking performance in pwMS for use in clinical practice and research.

Submission ID: 115; Submission Group: New Research Methodologies; Submitter: Daphne Kos

Enhancing research and practice in multiple sclerosis: the International Advisory Committee on Clinical Trials in MS

Daphne Kos[1,2] *, Marcia Finlayson[3], Timothy Coetzee[4], Xavier Montalban[5], On behalf of the International Advisory Committee on Clinical Trials in MS (members of the Committee)

*[1,2]Department of Rehabilitation Sciences, University of Leuven; National MS Center Melsbroek, Belgium, [3]School of Rehabilitation Therapy, Queen's University, Kingston, ON, Canada, [4]National Multiple Sclerosis Society, [5]Neurology-Neuroimmunology Department Multiple Sclerosis Centre of Catalonia (Cemcat), Vall d'Hebron Barcelona Hospital Campus, *presenting author*

The International Advisory Committee on Clinical Trials in Multiple Sclerosis is a multi-disciplinary, global body dedicated to advancing high-quality research and implementing best practices in multiple sclerosis (MS). The purpose of this poster is to introduce RIMS participants to the important activities of the Committee and highlight the relevance of the Committee's work for the rehabilitation community.

The Committee is jointly sponsored by ECTRIMS and the US National Multiple Sclerosis Society (NMSS) and has been in operation for over 30 years. The committee is composed of international experts in clinical trials and clinical research in MS who are nominated and selected to serve terms of three years. Members represent diverse skills, experiences, and backgrounds relevant to MS research and practice. The committee and sponsors are also committed to ensuring a membership representing global perspectives along with a commitment to diversity and inclusion. Together, members of the Committee work collaboratively to offer evidence-informed perspectives and guidance to researchers, clinicians, and

policy-makers about issues that impact the design, conduct and interpretation of clinical trials and the application of clinical trial findings into practice. The Committee uses many methods to inform its work including international meetings, systematic reviews, primary data collection, and consensus-building activities. Subcommittees and task forces are regularly employed to help move discussions about complex topics forward.

The work of the Committee played a pivotal role in the development of the McDonald Diagnostic Criteria and clinical course descriptions for MS. Recently, the Committee published several recommendations to enhance clinical trials in MS, including strategies to improve trial efficiency, enhance patient partnerships, increase diversity and inclusivity of trial participants, and use intermediate outcomes. These recommendations, and several upcoming Committee activities, are highly relevant to advancing MS rehabilitation research and practice globally.

Submission ID: 116; Submission Group: Other; Submitter: Yvonne Learmonth

Supporting health behaviours in persons with MS: What does helpful caregiving look like?

Helen Correia [1,2], Pamela Martin-Lynch[1], Marcia Finlayson[3], Yvonne C. Learmonth[4,5,6]

[1]College of Science, Health, Engineering and Education, Murdoch University, Murdoch, Western Australia, Australia [2]Psychological Sciences, Australian College of Applied Professions, Perth, Western Australia, Australia, [3]School of Rehabilitation Therapy, Queen's University, Kingston, Ontario, Canada, [4]Centre for Molecular Medicine and Innovative Therapeutics, and Centre for Healthy Aging, Health Futures Institute, Murdoch University, Murdoch, Western Australia, Australia, [5]Discipline of Exercise Science, Murdoch University, Murdoch, Western Australia, Australia, [6]Perron Institute for Neurological and Translational Science, Nedlands, Western Australia, Australia

Background: Personal caregivers including partners and families play a critical role in supporting persons with MS, including engagement in health behaviours. The role and challenges of carer burden are acknowledged in the research, yet there is less research on what helpful caregiving looks like, what resources and qualities are needed to promote it, and what barriers may emerge.

Methods: In this qualitative study, we explored these questions through interviews with 27 participants in Australia (10 persons with MS, 10 carers, and 7 MS service providers).

Results: All groups described personal qualities of helpful caregiving that would typically align with compassionate care, including patience, knowledge and understanding, empathy, and being non-judgmental. In supporting health behaviours in persons with MS, this translated into caregiving actions such as encouraging autonomy, shared decision making and working together, openness in communication, and listening with attention. Participants identified tensions in caregiving such as managing the balance between providing enough support with encouraging independence, as well as balancing the commitment to caregiving with the need for self-care. Caregivers also recognised personal barriers to helpful caregiving such as self-criticism and guilt, lack of time, energy, and support, and identified resources that would facilitate helpful caregiving including attending to carer wellbeing, managing difficult emotions, seeking support and connection, and respite.

Conclusions: These findings may help to inform the development of skills and resources to support carer wellbeing as well as supporting care for persons with MS.

Submission ID: 117; Submission Group: Other; Submitter: Stine Susanne Haakonsen Dahl

In search of the pleasure of moving – perceptions of physical activity engagement in people with mild multiple sclerosis: a qualitative study

Stine Susanne Haakonsen Dahl[1*], Ellen Christin Arntzen[1], Britt Normann[1,2]

[1]Faculty of Nursing and Health Sciences, Nord University, Bodø, Norway, [2]Nordland Hospital Trust, Bodø, Norway

Introduction: Reduced physical activity (PA) among people with multiple sclerosis (pwMS) who have high mobility functions is a significant concern. Developing healthcare services to promote PA in this population requires a comprehensive understanding of pwMS's perspectives.

Purpose: To explore how pwMS with mild disability perceive PA and the impact of individual, professional, social, and environmental aspects on their PA engagement.

Methods: Qualitative, in-depth interviews with 27 pwMS (21 women/6 men; aged 31-66; EDSS ⩽3.5) were analyzed via systematic text condensation, a cross-case thematic analysis, and informed by enactive theory.

Results: Three categories were generated: *Perception Shifts after Diagnosis*: Participants adapted their views of and adherence to PA throughout their disease journey. Initial uncertainty concerning bodily capacities, prospects and safety of PA reduced engagement. *Affective Experiences Drive Behavior*: Pleasure associated with movement was a highlighted motivator, however, some individuals perceived PA to be less mentally rewarding after diagnosis leading them to omit activities. MS-associated fear had ambiguous effects on PA engagement. *Influence of Surroundings*: Participants sought positive interactions and environments to shape their PA experiences. Negative interactions reduced engagement. Healthcare professionals were trusted advisors, but early-stage tailored follow-up was lacking.

Conclusion: This study poses a recommendation for health professionals working with pwMS with low disability to acknowledge a complex understanding of PA, emphasizing how affectivity, including experiences of pleasure, enjoyment, uncertainty and fear, drive PA behavior. That participants' perceptions of PA changed after their diagnosis accentuates the need for early, tailored professional follow-up. Participants' narratives highlight that the professional follow-up should include both (1) active

exploration of movements and activities together with a professional to build trust, optimize performance and affective experience of PA, and (2) exploration of the individuals affordances of the relevant social and physical environments that contribute to PA engagement.

Submission ID: 118; Submission Group: Technology Supported Rehabilitation; Submitter: Kamila Řasová

Physiotherapy on principles of neuroproprioceptive "facilitation, inhibition" using virtual reality leads to different brain activity changes

Rasova Kamila [1,2], Miznerova Barbora [1,3], Michaela Raková [2], Herynkova Anna [1], Rodina Lubomir [2,4], Philipp Tom [1], Hlinovska Jana [1], Stetkarova Ivana [5], Vasa Libor [6], Frank Jakub [6], Rydlo Jan [7], Tintera Jaroslav [7]

[1]Clinic of Rheumatology and Rehabilitation, Third Faculty of Medicine Charles University and Thomayer University Hospital, Prague, Czech Republic, [2]Department of Rehabilitation, Charles University, 3rd Faculty of Medicine and FNKV University Hospital, Prague, Czech Republic, [3]Department of Rehabilitation and Sports Medicine, Second Medical Faculty, Charles University and University Hospital Motol, Prague, Czech Republic, [4]Charles University, Faculty of Physical Education and Sport, Prague, Czech Republic, [5]Department of Neurology 3rd Faculty of Medicine Královské Vinohrady University Hospital, Prague, Czech Republic, [6]University of West Bohemia, Faculty of Applied Sciences, Pilsen, Czech Republic, [7]Institute of Computer Science, The Czech Academy of Sciences, Prague, Czech republic, [8]Information Technology Department, Institute for Clinical and Experimental Medicine, Prague, Czech Republic.

Introduction: The current use of virtual reality in physiotherapy is mainly based on principles of sensorimotor learning. Our team has developed an innovative physiotherapeutic approach using specially programmed virtual reality embodying neuroproprioceptive "facilitation, inhibition" principles. The aim of this study is to confirm its effectiveness in multiple sclerosis and document plastic and adaptive processes following the treatment using imaging methods.

Methods: Prospective double-armed randomized assessor-blinded controlled trial comparing 2-month outpatient (1 hour twice a week) physiotherapy using virtual reality or identical physiotherapy in real environment in people multiple sclerosis.

At baseline and after the program completion, Nine-Hole Peg test, Box and Block test, Hand Grip Strength, tremor analysis, the Five Times Sit to Stand test were assessed. Plastic and adaptive processes were monitored using functional magnetic resonance imaging (NCT04807738)

Results: A total of 16 participants (11 experimental, 5 control) were processed. The activity was observed in motor areas corresponding to the moving hand, in contralateral motor areas and bilaterally in the lobus occipitalis. In the experimental group, 8 times an increase in motor activity was found, 6 times remained unchanged, and 8 times there was a decrease in activity. In the control group, this same activity increased 5 times, 5 times remained unchanged, and not once was there a decrease. Clinical functions improved in both groups. The highest correlations were observed for the NHPT test results and the dynamometer measurements of the affected extremities. More significant improvement was achieved by those whose activations decreased.

Conclusion

Physiotherapy had positive effect on clinical functions. After physiotherapy using virtual reality, different changes were observed on fMRI. Only the group that underwent virtual reality showed reduced activation in the observed areas.

Funding statement

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Submission ID: 119; Submission Group: Outcome Measures; Submitter: Burcu Ersoz Huseyinsinoglu

Teleassessment Of Functional Gait Assessment In Patients With Multipl Sclerosis

Perim Zengin[1], Burcu Ersoz Huseyinsinoğlu[2], Burcu Altunrende[3]

[1]Institute of Graduate Studies, Physiotherapy and Rehabilitation Department, Istanbul University-Cerrahpaşa, Istanbul, Turkey, [2]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Marmara University, Istanbul,Turkey, [3]Department of Neurology, Taksim Research and Training Hospital, Istanbul, Turkey

Aim: Researches on Multiple Sclerosis (MS) and tele-medicine suggest that remote neurological assessment may be technically feasible in this patient group, but studies investigating the reliability of assessments via online video conferencing are needed. Although Functional Gait Assessment (FGA) is a reliable and recommended gait assessment for people with MS, to our knowledge its applicability via videoconferencing has not been examined. The aim of this study was to investigate the validity and reliability of remote FGA (Tele-FGA) in people with MS.

Materials and methods: Patients diagnosed with MS (EDSS score between 2-6.5), had not had an attack in the last 30 days, and could use the video conferencing software application were included in the study. For the content validity of Tele-FGA, the patients were assessed face-to-face in the clinic using the Timed Get Up and Go Test, Four Step Square Test, Timed 25 Step Walk Test, 12-item Multiple Sclerosis Walking Scale and Berg Balance Scales and the correlation between these scales and Tele-FGA score was analysed. Tele-assessments were performed after the clinical evaluation using Zoom or WhatsApp video conferencing applications. To analyse the reliability of the tele-assessment, screen recordings were taken during the tele-assessment. These

screen recordings were analysed by two different researchers using motion analysis software.
Results: 34 patients with MS participated in the study. Tele-FGA was demonstrated a high correlation compared to face-to-face assessment (ICC=0.928). Correlation coefficients between Tele-FGA and other outcome measures showed a high correlation (r=0.762-0.893; $p<0.001$). Tele-FGA was also found to be reliable with high Cronbach's alpha for both observers ($\alpha_{1st\ observer}$=0.842; $\alpha_{2nd\ observer}$=0.870).
Conclusions: The use of Tele-FGA in people with MS has been found to be valid and reliable. In the presence of barriers such as pandemic, difficulty in accessing the clinic, Tele-FGA can be used in the evaluation and follow-up process.

Submission ID: 121; Submission Group: Other; Submitter: Marie Lynning

Socio-demographic and MS-specific factors associated with inpatient stays at Danish MS rehabilitation hospitals

Marie Lynning[1]*, Nana F Hempler[1]
[1]*The Danish MS Society, Copenhagen, Denmark, *Main author*

Background/aim: Two Danish MS hospitals offer personalized inpatient multidisciplinary rehabilitation to patients with multiple sclerosis (MS). With this study we explored factors associated with having had a recent inpatient stay at the Danish MS hospitals.
Methods: A nation-wide survey was carried out in January 2024 among members of the Danish MS Society. An online questionnaire was distributed to 8,109 members with MS. 2,907 responses were collected. The survey covered different themes regarding access to MS treatment, care, and rehabilitation, including questions regarding whether respondents had been admitted to the Danish MS Hospitals for inpatient multidisciplinary rehabilitation. We used descriptive statistics and chi[2] tests to determine socio-demographic and MS-specific factors associated with having been admitted to an MS hospital (any length of stay) within the past 5 years.
Results: A total of 1,327 respondents (46%) reported having been admitted for an inpatient stay at one of the MS hospitals within the past 5 years. We found significant positive associations between inpatient stays and living in a region close to the hospital ($p<0.001$), not having a full time job ($p<0.001$), having progressive MS ($p<0.001$), shorter disease duration ($p<0.001$), higher Patient Determined Disease Steps (PDDS) ($p<0.001$), as well as higher levels of fatigue ($p<0.001$) and cognitive challenges ($p<0.001$). Gender, age, educational level, and treatment status (receiving disease modifying treatment or not) were not associated with inpatient stays.
Conclusion: The results indicate that higher levels of disease burden are associated with higher likelihood of being admitted for inpatient rehabilitation at the MS hospitals. To some extent there may be unequal access to inpatient stays based on geographical region of residency as well as employment status (being in full-time employment may be a hindrance to seeking inpatient rehabilitation). However, the results do not indicate inequality in access based on gender, age or level of education.

Submission ID: 122; Submission Group: Rehabilitation Effectiveness; Submitter: Corinne Oosterlinck

Posterior tibial nerve stimulation for the treatment of bowel incontinence symptoms in people with Multiple Sclerosis (MS): retrospective study

Corinne Oosterlinck[1]*, Evelyne Lacquet[1], Piet Eelen[1], Gaëlle Vertriest[1], Daphne Kos[1,2]
[1]*National MS Center Melsbroek,* [2]*KU Leuven, Department of Rehabilitation Sciences, Leuven, *Presenting author*

Studies reported that 29-50% of people with MS (PwMS) have ano-rectal problems, very often resulting in embarrassment, reduced (social) activity and compromised quality of life. Posterior tibial nerve stimulation (PTNS) is a non-invasive method, feasible to use in one's own environment. PTNS has shown good results in bladder dysfunction and seems promising to manage faecal incontinence that can lead to a lower QoL.
This study aims to explore the clinical data collected in the MS-Centre, to investigate the feasibility of the PTNS in reducing faecal incontinence and improving quality of life in people wih MD.
Methods: In this single-centre, retrospective cohort study, clinical data from PwMS who initiate the PTNS are analysed. Nurses refer all inpatients with faecal incontinence (based on Wexnerscale score $>$ 10), to start PTNS therapy, guided by trained physiotherapists. PTNS includes stimulation of the Posterior tibial nerve, 30 minutes per day, during 12 weeks.
Faecal incontinence is monitored by the Wexner scale. Sphincter control and bladder incontinence are assessed with Functional Independence Measure (FIM) sphincter control and Overactive Bladder questionnaire Scale (OBS).
Quality of life and mental health are assessed with the Fecal incontinence quality of life scale (FIQL) and Mental Health Inventory (MHI), and functional impairment is measured with the Melsbroek Disability Scoring Test (MDST).
Results: The PTNS method was introduced in clinical practice in February 2024 and application was started in two patients. A reduction in Wexner score of three over time will be considered a clinically relevant change. Results of the cohort February-May 2024 will be shown and discussed.
Discussion: The PTNS method was introduced in clinical practice in February 2024 and application was started in two patients. A reduction in Wexner score of three over time will be considered a clinically relevant change. Results of the cohort February-May 2024 will be shown and discussed.
Keywords: PTNS, faecal incontinence, nerve stimulation

Submission ID: 123; Submission Group: Technology Supported Rehabilitation; Submitter: Gabriele Perachiotti

A Closed-Loop Extended Reality System to Enhance Balance in people with Multiple Sclerosis: a research protocol

Perachiotti G[1], D'Errico G[2], Moccaldi N[3], Straudi S.[1]
[1]Università di Ferrara, Italy, [2]Politecnico di Torino, Italy, [3]Università degli Studi di Napoli Federico II, Italy

Background: Balance impairments are common in people with Multiple Sclerosis (PwMS)(1) and are related to falls.(2) Effective rehabilitation factors include intensity,(3) total dose, and task-oriented training.(4) Current unsupervised balance programs prioritize safety, limiting their effectiveness.(5)
This research introduces an Extended Reality(XR) System using a Head Mounted Display (HMD) to improve balance in PwMS. This system dynamically adjusts virtual elements based on the patient's postural reactions, providing challenging tasks while maintaining safety.
Methods: This proposal will have the following milestones: 1) Algorithm Development and Testing: The initial phase will establish an algorithm's threshold for identifying near-falls in PwMS (n=20) during exercises. Inclusion criteria will be an EDSS score between 3 and 6.5 and the ability to maintain a standing position without support. Inertial sensors positioned on the heads of PwMS engaged in balance exercises will aid in gathering data for identifying accelerometer patterns indicative of near-fall conditions based on Machine Learning.
2) XR on healthy controls: A closed-loop XR system with a HMD and an external inertial sensor will be tested on healthy controls mimicking PwMS motor behaviour to assess system usability. The task promotes the ability to step quickly and accurately in all directions from standing position.
3) XR on PwMS: The XR closed-loop system will be then tested on PwMS (n=20) using only data from the HMD-integrated inertial sensor. This single-session feasibility study seeks to collect initial data on the correlation between performance measures and the frequency and direction of near falls identified by the previously developed algorithm. Additionally, it aims to assess the system's usability based on the patient's EDSS level.
Results: We expect PwMS will rate positively the usability of the system despite their EDSS level and near falls frequency will be strictly correlated with dynamic balance.
Conclusions: This project will contribute to the evolving field of digital, XR rehabilitation delivered through HMD.(6,7)

Bibliography

1. Martin CL, Phillips BA, Kilpatrick TJ, Butzkueven H, Tubridy N, McDonald E, Galea MP. Gait and balance impairment in early multiple sclerosis in the absence of clinical disability. Mult Scler. 2006 Oct;12(5):620-8. doi: 10.1177/1352458506070658. PMID: 17086909.
2. Matsuda PN, Shumway-Cook A, Ciol MA, Bombardier CH, Kartin DA. Understanding falls in multiple sclerosis: association of mobility status, concerns about falling, and accumulated impairments. Phys Ther. 2012 Mar;92(3):407-15. doi: 10.2522/ptj.20100380. Epub 2011 Dec 1. PMID: 22135709.
3. Pavlikova M, Cattaneo D, Jonsdottir J, Gervasoni E, Stetkarova I, Angelova G, Markova M, Prochazkova M, Prokopiusova T, Hruskova N, Reznickova J, Zimova D, Spanhelova S, Rasova K. The impact of balance specific physiotherapy, intensity of therapy and disability on static and dynamic balance in people with multiple sclerosis: A multi-center prospective study. Mult Scler Relat Disord. 2020 May;40:101974. doi: 10.1016/j.msard.2020.101974. Epub 2020 Jan 30. PMID: 32044695.
4. Corrini C, Gervasoni E, Perini G, Cosentino C, Putzolu M, Montesano A, Pelosin E, Prosperini L, Cattaneo D. Mobility and balance rehabilitation in multiple sclerosis: A systematic review and dose-response meta-analysis. Mult Scler Relat Disord. 2023 Jan;69:104424. doi: 10.1016/j.msard.2022.104424. Epub 2022 Nov 22. PMID: 36473240.
5. Ghahfarrokhi MM, Banitalebi E, Negaresh R, Motl RW. Home-Based Exercise Training in Multiple Sclerosis: A Systematic Review with Implications for Future Research. Mult Scler Relat Disord. 2021 Oct;55:103177. doi: 10.1016/j.msard.2021.103177. Epub 2021 Jul 27. PMID: 34343867
6. Janssen S, de Ruyter van Steveninck J, Salim HS, Cockx HM, Bloem BR, Heida T, van Wezel RJA. The Effects of Augmented Reality Visual Cues on Turning in Place in Parkinson's Disease Patients With Freezing of Gait. Front Neurol. 2020 Mar 24;11:185. doi: 10.3389/fneur.2020.00185. PMID: 32265826; PMCID: PMC7105859.
7. Espay AJ, Baram Y, Dwivedi AK, Shukla R, Gartner M, Gaines L, Duker AP, Revilla FJ. At-home training with closed-loop augmented-reality cueing device for improving gait in patients with Parkinson disease. J Rehabil Res Dev. 2010;47(6):573-81. doi: 10.1682/jrrd.2009.10.0165. PMID: 20848370.

Submission ID: 125; Submission Group: Rehabilitation Effectiveness; Submitter: Barbora Grosserová

Perceived complication after covid-19 infections in people with MS, a pilot study of physiotherepy interventions

Novotna K[1,2], Grosserova B[1], Dandova K[1], Knapova I[2], Stastna D[1], Menkyova I[1]
[1]Department of Neurology and Center of Clinical Neuroscience, First Faculty of Medicine, Charles University and General University Hospital in Prague, Czech Republic, [2]Department of Rehabilitation Medicine, First Faculty of Medicine and General University Hospital in Prague, Czech Republic

Background: Long covid is broadly defined as symptoms and conditions that continue or develop after covid-19. Post-covid syndrome is a condition where symptoms persist for 12 weeks or more. In contrast to the incidence of covid-19, there are not yet many studies on the incidence of post-covid syndrome in

people with MS. Therefore was our aim to find out whether patients still perceive any complications after this infection and to offer them pilot program of targeted physiotherapy.
Methods: In this single-centre study, people with MS who experienced covid-19 between January and March 2022 (when the omicron variant was dominant in Czechia) were contacted and structurally asked about the occurrence of any post-covid symptoms.
Results: In March 2023, 224 (75 men) out of 334 (103 men) patients who experienced covid-19 in previous year responded to the survey. The mean age of peoplewas 43.8 years (SD 8.9), mean disease duration 14.1 years (SD 8.3) and median EDSS 2.5 (range 0-7.5). A total of 68 patients (28%) suffered with symptoms lasting 12 weeks or longer. Most common symptoms included fatigue (54%), dyspnoe (29%), neurological deterioration (20%), joint pain (16%), sleep disturbance (8%), headache (7%) or others (17%). At the time of the survey, 41 people were still suffering from these symptoms.
The group of patients with postcovid difficulties did not differ significantly from the others who had the infection in age (p=0.362), duration of the disease (p=0.425) or level of disability (p=0.175).
A total of 6 patients participated in a pilot program to influence post-covid difficulties. The physiotherapy programme included elements of respiratory physiotherapy, muscle relaxation and instruction on appropriate fitness training. After completing the programme, participants experienced a reduction in fatigue and breathlessness and improved respiratory sterotype. The program was effective in both face-to-face and online versions.
Conclusion: Based on subjective patient reports, some people still suffer post-covid symptoms and therefore could benefit from special physiotherapy intervention.

Submission ID: 126; Submission Group: Technology Supported Rehabilitation; Submitter: Barbora Grosserová

Telerehabilitation options in people with multiple sclerosis

Grosserova B1, Novotna K[1,2]
[1]Department of Neurology and Center of Clinical Neuroscience, First Faculty of Medicine, Charles University and General University Hospital in Prague, Czech Republic, [2]Department of Rehabilitation Medicine, First Faculty of Medicine and General University Hospital in Prague, Czech Republic

Background: Telerehabilitation as one of the forms of telemedicine became widespread especially during the challenging period of the coronavirus pandemic. In the field of neurology, it is mostly used for people with stroke, parkinson disease and especially multiple sclerosis (MS). The aim of the research was therefore to describe and evaluate the possibilities of telerehabilitation in people with MS.
Methods: Medical databases (Medline, Pedro, Cochrane) were searched with the keywords multiple sclerosis and telemedicine or telerehabilitation. The search was limited to publications from the last 15 years. Publications in English available in full-text were included in the analysis. Publications were assessed by 2 reviewers according to PEDRO score and only those with a PEDRO of more than 4 were included.
Results: A total of 56 articles on telerehabilitation in MS meeting the criteria were found. Most of them were devoted to exercises aimed to influence overall mobility (including balance), n=21. This was followed by various educational and motivational support programs, n=16 (most often with aim to increase overall physical activity level or to influence fatigue). Interventions focused on cognitive therapy (n=7) and psychotherapy in the form of cognitive-behavioural therapy (n=4) were of the highest methodological quality. Targeted training of upper limb function (n=3) or home transcranial stimulation (n=3) were also present.
Conclusion: Telerehabilitation is one of the ways to provide therapy to patients who for some reason (distance, disability, etc.) have problems to attend regular face-to-face therapies. The possibilities of these forms of therapy have been expanding, especially in recent years.

Submission ID: 127; Submission Group: Technology Supported Rehabilitation; Submitter: Cintia Ramari

Can real-time visual feedback on walking speed impact gait pattern, perception of effort, affective valence and symptom perception during an intermittent 12-minutes walking in low disabled people with multiple sclerosis? A pilot study

Cintia Ramari*[1,2], Gianluca Florio[1,2], Dorus Charlier[1], Thibaut Robben[1], Lauren Nijskens[1], Dries Molenaers[1], Felipe B Santinelli[1,2], Peter Feys[1,2]
[1]Faculty of Rehabilitation Sciences, REVAL Rehabilitation Research Center, University of Hasselt, Wetenschapspark 7, 3590 Diepenbeek, Belgium; [2]Universitair Multiple Sclerosis Centrum (UMSC), Hasselt-Pelt, Hasselt, Belgium
*Main author and Presenting author

Background: Walking impairments affect over 70% of people with multiple sclerosis (pwMS), with walking-fatigability and attentional deficits expanding this challenge. Adjustments in attentional control using real-time visual feedback is a potential intervention to improve attention during walk, and to apply for walking training to decrease walking-fatigability.
Objectives: The aim of this study was to investigate the impact of the real-time visual feedback of walking speed on spatiotemporal gait parameters, perception of effort, affective valence and symptom inventory.
Participants: Nine pwMS (48 ± 7.3 years, EDSS: 2.0 ± 1.03) and nine healthy controls (37 ± 14.8 years) were included. An intermittent 12-minutes walking protocol (6 x 2min, 40 sec rest) were performed in two conditions: with and without feedback on walking speed. The protocols were applied using the GRAIL (Motek) in a self-paced treadmill with a semi-immersive virtual reality. Spatiotemporal parameters were averaged for each 2-min. Perception of effort and affective valence were reported during

the rests and symptom inventory was collected before and after the protocols.
Results: No significant changes in spatiotemporal parameters and affective response were detected (both groups and conditions), while a significant increase in the perception of effort was observed for HC in both conditions. The total score for the symptom inventory was significantly higher for pwMS after both protocols. Significant differences in walking speed and perception of effort were identified between MS patients and HC in both conditions. Although without significant change, a trend for the increase in walking speed was identified for pwMS in the feedback condition.
Conclusion: The intermittent 12-minutes walking with real-time feedback on walking speed did not significantly change spatiotemporal parameters and symptoms perception, however the identified trend of increment in walking speed suggest that real-time feedback could serve as a strategy for walking rehabilitation to maintain speed and decrease walking-fatigability.

Submission ID: 128; Submission Group: Outcome Measures; Submitter: Marta Tacchini

EEG markers of cognitive impairment in MS: Event-Related Potentials to the Symbol Digit Modalities Test

Marta Tacchini[1,2], Giulia Gamberini[5], Chiara Rossi[3,4], Jeroen Van Schependom[3,4], Guy Nagels[3,6,7], Giancarlo Comi[2,5], Letizia Leocani[1,2]
[1]Experimental Neurophysiology Unit, Institute of Experimental Neurology-INSPE, Milan, Italy, [2]San Raffaele Vita-Salute University, Milan, Italy, [3]AIMS lab, Center for Neurosciences, Vrije Universiteit Brussel, Brussels, Belgium, [4]Department of Electronics and Informatics (ETRO), Vrije Universiteit Brussel, Brussels, Belgium, [5]Neurorehabilitation Dept., Casa di Cura Igea, Milan, Italy, [6]Department of Neurology, Universitair Ziekenhuis Brussel, Brussels, Belgium, [7]St Edmund Hall, University of Oxford, Oxford, UK

Background: Event-related potentials (ERPs) are valuable tools for the early detection and monitoring of cognitive impairment in people with Multiple Sclerosis (pwMS) and towards the evaluation of the effectiveness of treatment. The Symbol Digit Modalities Test (SDMT) is the gold-standard screening tool for cognitive processing speed, often impaired in pwMS. With the aid of ERPs, neurophysiological processes during SDMT can be quantitively assessed, potentially serving as an early biomarker for cognitive impairment.
Aim: To explore the ERPs correlates of the SDMT for the detection and monitoring of cognitive impairment in pwMS.
Methods: We developed an EEG-SDMT paradigm, with a list of symbols corresponding to a number at the top of a PC screen and symbol-digit pairs (180; 50% correct) presented at the center. Keypress reaction times (RTs) for correct/incorrect pairs are measured together with 32-channel EEG obtaining stimulus-averaged ERPs. Thirty pwMS (21 F; age 51.67 ± 10.66 years) and 16 healthy controls (HC) (12 F; age 49.25 ± 13.52 years) were recruited.
Results: SDMT-ERPs presented a positive peak in the centro-parietal regions (amplitude: HC 14.07 ± 5.05 μV; pwMS 11.50 ± 5.63 μV; Wilcoxon test, FDR corrected $p = n.s.$) that displayed a significantly longer latency in pwMS (607.75 ± 117.75 msec) vs HC (506.66 ± 89.15 msec) (Wilcoxon test, FDR corrected $p < 0.05$). Latency was also significantly correlated with RTs in the computerized SDMT ($r = .291$; $p < 0.05$). RTs and raw scores in the clinical SDMT were significantly correlated ($r = -.724$; $p < 0.01$).
Conclusion: Our EEG-SDMT paradigm allowed to obtain an ERP correlate of neuroelectrical activity during SDMT performance, which was significantly affected in pwMS and cognitive impairment. These preliminary findings prompt further validation of this tool for the early detection of cognitive involvement, for monitoring the natural history and response to pharmacologic and non-pharmacologic interventions.

Submission ID: 129; Submission Group: Technology Supported Rehabilitation; Submitter: Cintia Ramari

Deficit In Reaction Time During Virtual Tasks Is Associated With Depression In Patients With Multiple Sclerosis

Ana Maria Canzonieria[1], *Cintia Ramari[2], Tania Brusque Crocetta[3], Carlos Bandeira de Mello Monteiro[1,4]
**Main author and Presenting author*
[1]School of Arts, Sciences and Humanities, University of São Paulo (EACH-USP), São Paulo, Brazil, [2]Faculty of Rehabilitation Sciences, REVAL Rehabilitation Research Center, University of Hasselt, Diepenbeek, Belgium, [3]University of State Santa Catarina, Florianópolis, Santa Catarina, Brazil, [4]Group for Research and Technological Applications in Rehabilitation (PATER), School of Arts, Sciences and Humanities, University of São Paulo. (EACH-USP). São Paulo, São Paulo, SP, Brazil.

Background: Multiple Sclerosis (MS) is a neurological disease, related to different factors and systems.
Symptoms such as fatigue, anxiety and depression impact the quality of life in MS patients. Rehabilitation programs have used virtual reality (VR) to monitor, control, maintain or improve functionality and increase transfer from virtual to reality in people with MS (pwMS). **Objective:** To evaluate the reaction time during a virtual reality task (VR) in pwMS and the association with fatigue, anxiety and depression. **Methods:** This cross-sectional study included 57 pwMS (age range: 23 – 77 years old, EDSS: 0 – 7.5)) and 27 healthy controls (age range: 23 – 57 years old). The beck Inventory was applied to evaluate depression and anxiety. The Modified Fatigue Impact Scale (MFIS) was used to measure fatigue perception. Reaction time was measured during a VR task using a software in computer. The reaction time was measured in milliseconds, and was the time taken between the beginning of the stimulus and the beginning of the motor response. A correlation
Results: Significant correlations were found between MFIS and BDI for anxiety and depression; and, between BDI and reaction

time. PwMS had a worse performance in reaction time, presented higher scores of fatigue and depressive symptoms when compared to the control group. **Conclusions:** pwMS presented increased reaction time indexes, which were associated to depressive symptoms. However, perception of fatigue was not associated with reaction time. VR can be used not only during rehabilitation interventions but also to access motor response (i.e., reaction time during game tasks). In addition, measures of reaction time can be used to monitor disease progression and investigate the related factors of symptoms such as depression and anxiety.

Submission ID: 131; Submission Group: Other; Submitter: Inez Wens

Seas of Clarity: the role of European brown seaweed extracts in combination with rehabilitation exercise in enhancing cognitive function in progressive MS

Jule Richartz[1], Melissa Schepers[1,2,3], Emily Willems[1,2,3], Monique Mulder[4], Inez Wens[1,2,*], Tim Vanmierlo[1,2,3,*]

[1]Department of Neuroscience, Biomedical Research Institute, Hasselt University, Agoralaan building D, 3590 Diepenbeek, Belgium, [2]University MS Center (UMSC), 3590 Diepenbeek – 3900 Pelt, Belgium, [3]School for Mental Health and Neuroscience, Maastricht University, Universiteitssingel 50, 6229 ER Maastricht, The Netherlands, [4]Department of Internal Medicine, Laboratory of Vascular Medicine, Erasmus University Medical Center, Wytemaweg 80, 3015 CN Rotterdam, The Netherlands

**Contributed equally*

Multiple sclerosis (MS) is an autoimmune disease of the central nervous system (CNS), ultimately leading to neurodegeneration. MS affects over 2.9 million people worldwide of which one million patients are in the progressive phase of the disease (pMS), featured by impaired remyelination and neurodegeneration. None of the currently available approved therapies can repair or regenerate CNS damage in pMS. Since cholesterol is the main component of myelin, alterations in cholesterol metabolism can drive myelin synthesis, facilitate remyelination, and hence protect neurons from degeneration. Noteworthy, the nuclear liver X receptors (LXR) are key players in the regulation of cholesterol and lipid turnover by regulating genes involved in cholesterol uptake, efflux, and transport. In addition, LXRs are implicated in modulating (neuro)inflammation, inducing a positive impact on the environment for remyelination. Recent research showed that the European seaweed Hymantalya elongata contains LXR-activating (oxy)phytosterols and is able to prevent cognitive decline and disease progression in a neurodegenerative mouse model, without inducing adverse side effects associated with synthetic LXR-agonists. These findings make them an interesting therapeutic intervention for neurodegenerative diseases, such as MS.

Here, we will investigate the potential (re)myelinating capacity of H. elongata extracts, hypothesizing that these extracts will enhance (re)myelination in vitro and in vivo, and ultimately improve cognition in progressive MS patients. In particular, the latter will be investigated in combination with a rehabilitation exercise intervention, given its positive effects on physical performance, cognitive function, information processing speed, and general and local brain volumes. Currently, preliminary data are collected, which will be reported at the conference.

Keywords: Multiple sclerosis; seaweed extracts; cholesterol metabolism; rehabilitation exercise

Submission ID: 132; Submission Group: Rehabilitation Effectiveness; Submitter: Alejandro Carrabs

Project Active and Mindful: Mind-body exercise for people with Multiple Sclerosis

Alejandro Arturo Coito Carrabs[1], Catarina Alexandra Nunes Martins[2], David Braga de Lima[3], Judith García Tárrago[4], José Francisco Filipe Marmeleira[2,5]

[1]Sociedade Portuguesa de Esclerose Múltipla, Portugal, [2]Departamento de Desporto e Saúde, Universidade de Évora, Portugal, [3]Universidade do Estado de Santa Catarina, Brasil, [4]Asociación de Familiares y Afectados de Esclerosis Múltiple de Burgos, Espanha, [5]Comprehensive Health Research Centre, Portugal

Abstract

Problem: Multiple sclerosis has a significant influence on the individuals' health, well-being and quality of life. It is important to find non-pharmacological therapeutic approaches. This project takes into consideration the main barriers to the participation of individuals with Multiple Sclerosis in exercises, including few adapted programs, lack of information and counseling, symptom management, and transportation needs to health-care centers.

Objective: To design and implement a mind-body exercise program adapted for people with Multiple Sclerosis, using a holistic and online model with the aim of improving participants' quality of life, as well as their physical and mental health.

Methods: The mind-body exercise program will be exclusively developed online (synchronous and asynchronous). It will include groups of 3 to 6 participants with Multiple Sclerosis, organized based on their functional status. Sessions will be conducted in Portuguese and Spanish, twice a week for at least eigth months. The program will consist of exercises involving physical fitness, Pilates, Tai-Chi, mindfulness and relaxation techniques. In the last months of synchronous sessions, clinicians will progressively introduce online resources to the participants during the exercise sessions, which will be hosted on a web platform. Pre- and post-tests will be administered to assess changes in participants' physical and psychosocial dimensions. Feasibility, satisfaction, and acceptability will be also assessed. The program will be carried out in two countries, Portugal and Spain

Keywords: Multiple Sclerosis, Physical activity, Home-based care, Mind-body program, Digital Approach

Submission ID: 133; Submission Group: Rehabilitation Effectiveness; Submitter: Miguel D'haeseleer

Combined cognitive-motor telerehabilitation: a novel strategy to achieve remyelination and neuroprotection in multiple sclerosis?

Miguel D'haeseleer[1,2,3]*, Jens Devogelaere[2], Delphine Van Laethem[3,5], Daphne Kos[1], Jeroen Van Schependom[3,4], Guy Nagels[2,3]

*[1]Nationaal Multiple Sclerose Centrum (NMSC), Melsbroek, BE; [2]Universitair Ziekenhuis (UZ) Brussel, Department of Neurology, Brussels, BE; [3]Vrije Universiteit Brussel (VUB), NEUR research group, Center for Neurosciences, Brussels, BE; [4]VUB, Department of Electronics and Informatics, Brussels, BE; [5]Department of Physical Medicine and Rehabilitation, UZ Brussel, Brussels, BE. *Principal investigator and presenting author.*

Background: Multiple sclerosis (MS) is a leading cause of neurological disability in young adults, affecting almost 3 million people worldwide. Disease pathology is highly characterized by autoimmune inflammatory outbursts directed against the myelin of the central nervous system. Sustained demyelination in chronic MS lesions leads to degeneration of the underlying axons and progressive clinical deterioration. Current pharmacological disease-modifying treatment has been relatively successful in preventing new inflammatory episodes but restorative and/or neuroprotective treatment is still lacking. Motor exercises have been associated with remyelinating properties in MS, based on animal models and preliminary human data, while rehabilitation literature suggests a clinical synergism of combined cognitive-motor training.

Methods: We present a a 1:1:1 randomized controlled trial that will investigate whether a 12-week program of combined cognitive-motor telerehabilitation leads to a significantly decrease in mean diffusivity (MD) and/or increased fractional anisotropy (FA) – both of which are diffuse tensor magnetic resonance imaging (MRI) measures suggestive for remyelination – in the corpus callosum of 90 patients with relapsing-remitting MS, as compared to motor and/or cognitive training alone. Participants will be recruited at the UZ Brussel and NMSC Melsbroek, which are two large and collaborating tertiary MS units, during routine neurological and/or multidisciplinary MS care. Physical assessment, cognitive testing and brain MRI will take place at baseline (T0), immediately (T1) and 12 weeks (+/- 2 weeks) (T2) after completing the 12-week training intervention. Changes in MD and/or FA, as measured between T0 and T1 in the CC, will be compared between the 3 intervention groups and serve as the primary endpoint. All training programs will be performed at home and will be assisted by digital communication technology.

Conclusion: Confirming our hypothesis would provide evidence to employ combined cognitive-motor rehabilitation as a possible remyelination therapy. Such insights, both biologically and therapeutically relevant, are expected to address an actual knowledge gap in MS, potentially preventing functional decline in a large patient group. Repair of inflammatory damage through new myelin formation in chronic lesions is expected to delay/avert neurodegeneration MS, hereby substantially ameliorating the clinical long-term prognosis of affected patients.

Submission ID: 134; Submission Group: Other; Submitter: Ellen Christin Arntzen

Status for and associations between employment, health related quality of life and disability in people with multiple sclerosis: a cross-sectional survey in Nordland County, Norway

Ellen Christin Arntzen[1], Britt Normann[1], Hanne Kristin Fikke[2]

[1]Nord University, Norway, [2]Nordland Hospital Trust, Norway

Introduction: People with multiple sclerosis (pwMS) often face complex challenges that may lead to reduced employment and impaired health-related quality of life (HRQOL). Knowledge is limited regarding status for and associations between employment, HRQOL and disability in pwMS.

Objectives: Explore status for and associations between employment, HRQOL and disability in pwMS.

Materials & Method: Cross-sectional survey. 252 pwMS ⩾18 years old in Nordland County, Norway answered a questionnaire regarding employment status, disability, measured by the Expanded Disability Status Scale (EDSS), MS Work Difficulties Questionnaire-23 (MSWDQ-23) and MS Quality of Life-54 (MSQOL-54). Descriptive statistics and Pearson's correlation in IBM SPSS-27 were used for analysis.

Results: 252 of the 512 invited pwMS responded; mean EDSS was 2.61 (2.08), mean age 49.63 years [SD 11.10], and mean age at diagnosis 38.05 years [10.84]. Among those in working age (⩽67 years), 44% were unemployed, and 58% had various percentages disability leave. The mean current work percentage was 59.94, however, mean preferred work percentage in a job tailored to own needs was 76.99 % [29.40]. Disability leave was reported in all EDSS levels, mean age when receiving it was 43.85 years [10.65]. The most reported employment barriers (MSWDQ-23) were balance problems, becoming sleepy during task-performance, balancing work and home duties, and fear of reduced payment. Correlation between employment barriers and EDSS was low (0,2 p= 0.008). Mean MSQOL-54 Physical Health Composite Score (HCS) was 58.48 [19.47] and the Mental HCS was 69.73 [18.90]. Higher EDSS was associated with lower Physical and Mental HCS. HRQOL was higher in employed pwMS compared to non-employed, and among pwMS diagnosed 10-15 years ago.

Conclusion: Unemployment is common in pwMS. Both employed and unemployed report wanting to work more if the job is adjusted to their needs. Increased EDSS score and unemployment was associated with decreased Physical and Mental HCS.