IMSCOGS
2018 BERLIN

PROGRAMME
7th Annual Meeting
of the International MS Cognition Society

13 OCTOBER 2018
BERLIN, GERMANY

IMSCOGS
2018 BERLIN

Contents

Welcome to Berlin

Dear Colleagues,

On behalf of the International Multiple Sclerosis Cognition Society (IMSCOGS) and local organiser, we welcome you to Berlin for the 7th Annual Meeting of IMSCOGS.

This year we will enjoy a one-day conference attached to ECTRIMS and will take the opportunity to review key ECTRIMS presentations on cognition. Other topics covered will be diagnosis of cognitive impairment, pathophysiology and treatment and cognitive dysfunction in related disorders such as neuromyelitis optica spectrum disorders. Brief platform presentations and a poster exhibition covering a broad range of themes will complete the programme.

We are looking forward to welcoming you to IMSCOGS in Berlin and spending a stimulating day with you in the historical lecture hall of Kaiserin-Friedrich-Stiftung near Charité Universitätsmedizin Berlin.

Friedemann Paul
Local Host & Organiser

Ralph Benedict
IMSCOGS President

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IMSCOGS

General Information

Date

Saturday, 13 October 2018

Congress Location

Kaiserin Friedrich-Haus
Robert-Koch-Platz 7
10115 Berlin
Germany

Website

www.imscogs.com

Congress Secretariat

7th Annual Meeting of the International MS Cognition Society
Congrex Switzerland Ltd
Peter Merian-Strasse 80
4002 Basel, Switzerland
info@imscogs.com

Opening Hours	Saturday, 13 October 2018
Registration Helpdesk	07.30 – 17.30
Industrial Exhibition	10.00 – 16.00

Accreditation / Credits / Certificates

The **7th Annual Meeting of the International MS Cognition Society 2018, Berlin, Germany, 13/10/2018–13/10/2018** has been accredited by the European Accreditation Council for Continuing Medical Education (EACCME®) with 6 European CME credits (ECMEC®s). Each medical specialist should claim only those hours of credit that he/she actually spent in the educational activity.

Through an agreement between the European Union of Medical Specialists and the American Medical Association, physicians may convert EACCME® credits to an equivalent number of *AMA PRA Category 1 CreditsTM*. Information on the process to convert EACCME® credit to AMA credit can be found at www.ama-assn.org/education/earn-credit-participation-international-activities.

Live educational activities, occurring outside of Canada, recognised by the UEMS-EACCME® for ECMEC®s are deemed to be Accredited Group Learning Activities (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

For German Participants

The Conference has been accredited by the "Ärztekammer Berlin" with 7 credits. German Participants are kindly asked to bring their barcode label in order to obtain the credits via EIV (Elektronischer Informationsverteiler).

Certificates

Certificates of attendance indicating CME credits are available onsite at the registration helpdesk as of 14.00 on Saturday afternoon.

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Information for Authors and Speakers

Presentations

Please hand in your presentation to the technician via USB compatible memory stick at least 1 hour before the beginning of the session. Speakers in Session 1 are asked to hand in their presentation before 8 am on Saturday morning 13 October 2018.

Poster Exhibition

Mounting and removal times of the posters:

Poster Presentation Day	Poster Mounting Time	Poster Removal Time
Saturday, 13 October 2018	Saturday, 13 October 2018 07.30 – 09.00	Saturday, 13 October 2018 16.00 – 17.00

Poster Viewing

The posters are available from 09.00 to 16.00 during coffee breaks and lunch break on Saturday, 13 October 2018.

Scientific Programme

Saturday, 13 October 2018

08.00 – 08.15 **Host Introduction & President Message**

08.00 **Welcome to Berlin**
F. Paul, MD, Berlin, DE

08.07 **Where are we with IMSCOGS**
R. Benedict, PhD, IMSCOGS President, Buffalo, US

08.15 – 09.00 **Review of ECTRIMS sessions**

08.15 **ECTRIMS Review I**
Innovation in MRI In Relation to Cognitive and Neuropsychiatric Phenomena
J.J.G. Geurts, PhD, Amsterdam, NL

08.35 **ECTRIMS Review II**
Treatment of Cognitive Dysfunction
J. DeLuca, PhD, West Orange, US

08.55 **Discussion**

09.00 – 10.30 **Session 1**
Diagnosis of Cognitive Impairment in MS: Assessment Tools, Computer Based Testing, and Remote Testing

Chairs: R. Benedict, PhD, Buffalo, US
M. Falautano, PhD, Milan, IT

09.00 **BICAMS and Other Brief Batteries**
D.W. Langdon, PhD, London, UK

09.20 **Computer Assisted Testing**
I.-K. Penner, PhD, Düsseldorf, DE

09.40	**Fresh Look at Old Assumptions** *J. Sumowski, New York, US* Platforms and Discussion (10 minutes Presentation including discussion)
10.00	**Brief International Cognitive Assessment of Multiple Sclerosis (BICAMS): Confirmation and Construct Validity of Two-Test Combinations for Patient-Centred Care in Small Neurological Institutions** *S. Baetge, Düsseldorf, DE*
10.10	**Evaluating Work Ability in Individuals with Different Subtypes of Multiple Sclerosis: Considering Factors beyond Physical Impairment** *A. Renner, Düsseldorf, DE*
10.20	**Cognitive-Motor Interaction in Multiple Sclerosis: an Ecological Approach to Patient's Impairment.** *M. Eizaguirre, Buenos Aires, AR*
10.30 – 11.00	COFFEE BREAK
11.00 – 12.30	**Session 2** **Pathophysiology & Treatment** *Chairs: C. Enzinger, MD, Graz, AT* *S. Fredrickson, MD, Stockholm, SE*
11.00	**GM Atrophy, Regions and Temporal Relationships** *M. Schoonheim, Amsterdam, NL*
11.20	**Cognitive Processing Speed, Understanding the Pathophysiological Mechanisms** *B. Brochet, MD, Bordeaux, FR*
11.40	**DMT Effects on Cognition, Overview, Update, How Do We Explain the Treatment Effects** *H.-P. Hartung, MD, Düsseldorf, DE*

Scientific Programme

Saturday, 13 October 2018

12.00 **Cost of Dual-tasking on Task Performance and Cortical Activations in MS Using Functional near Infrared Spectroscopy**
J. DeLuca, PhD, West Orange, US

Platforms and Discussion
(10 minutes Presentation including discussion)

12.20 **Damage to Long-Range Connections is Especially Relevant for Cognitive Impairment in Multiple Sclerosis**
K. Meijer, Amsterdam, NL

12.30 **Preserved Functional Connectivity within Networks of White Matter Tract Disruption Partly Explains Cognitive Reserve in Multiple Sclerosis**
T. Fuchs, Buffalo, US

12.40 – 13.30 LUNCH BREAK and POSTER VIEWING

13.30 – 14.30 **Session 3**
Management of Cognitive Impairment and Related Problems

Chairs: I.-K. Penner, PhD, Düsseldorf, DE
M.P. Amato, MD, Florence, IT

13.30 **Integrating Cognitive Assessment and Quantitative MRI into Routine Clinical Practice**
L. Krupp, MD, New York, US

13.50 **Internet Interventions for Cognition, Depression and Fatigue in MS**
S. M. Gold, PhD, Berlin, DE

Platforms and Discussion
(10 minutes Presentation including discussion)

14.10 **Treadmill Walking Exercise and Computer-Based Cognitive Training Improve Self-Perceived Cognitive Deficits and Information Processing Speed in Patients with Multiple Sclerosis (MS)**
M. Filser, Düsseldorf, DE

14.20 **Assessing Cognitive Changes in Multiple Sclerosis: which Change Index is the most reliable?**
F. Schmid, Reims, FR

14.30 – 15.30 **Session 4**
Related Disorders and Comorbidities

Chairs: L. Krupp, MD, New York, US
C. Enzinger, MD, Vienna, AT

14.30 **Cognition in Neuromyelitis Optica**
F. Paul, MD, Berlin, DE

14.50 **Aging Related Comorbidities, aMCI, Dementia**
L. Hancock, PhD, Madison, US

Platforms and Discussion
(10 minutes Presentation including discussion)

15.10 **Decision-Making is not Impaired in Early Multiple Sclerosis when Controlling for Individual Search Strategies**
A. Johnen, Münster, DE

15.20 **Ageing in MS: Prevalence and Profile of Cognitive Impairment**
M. Branco, Santa Maria da Feira, PT

15.30 – 16.00 COFFEE BREAK

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Scientific Programme

Saturday, 13 October 2018

16.00 – 16.45 **General Assembly**

Panel: R. Benedict, PhD, Buffalo, US
I.-K. Penner, PhD, Düsseldorf, DE
C. Enzinger, MD, Vienna, AT
B. Brochet, MD, Bordeaux, FR
J. Deluca, PhD, West Orange, US

16.45 **Closing and Acknowledgements**
F. Paul, MD, Berlin, DE

Posters

1. Diagnosis and monitoring of MS associated neurocognitive disorder

P01 **Loss of functional brain network hierarchy relates to cognitive impairment in multiple sclerosis: a magnetoencephalography study**
I.M. Nauta, S.D. Kulik, L. Breedt, A.J.C. Eijlers, E.M.M. Strijbis, P. Tewarie, A. Hillebran, C.J. Stam, L. Douw, J.J.G. Geurts, B.M.J. Uitdehaag, B.A. de Jong, M.M. Schoonheim (Amsterdam, NL)

P02 **Validity of cognitive performance outcomes in patients with multiple sclerosis**
I.M. Nauta, D. Bertens, L. Fasotti, B.A. de Jong, M. Klein (Amsterdam, Arnhem, NL)

P03 **Reduced cognitive functioning in RRMS patients at the time of diagnosis suggests initial fronto-temporal network involvement**
M. Pitteri, S. Ziccardi, M. Guandalini, M. Calabrese (Verona, IT)

P04 **Tracking cognitive impairment in multiple sclerosis using the Brain on Track test: a validation study**
L. Ruano, M. Branco, M. Severo, A. Sousa, J. Castelo, I. Araújo, J. Pais, J. Cerqueira, M.P. Amato, N. Lunet, V.T. Cruz (Porto, Braga, PT; Florence, IT)

P05 **Functional and dysfunctional impulsivity in Multiple Sclerosis**
H. Joly, N. Capet, C. Suply, S. Bresch, M. Cohen, and C. Lebrun (Nice, FR)

P06 **Neural-vascular uncoupling explains cognitive slowing in Multiple Sclerosis**
D. Sivakolundu, K. West, D. Abdelkarim, M. D. Zuppichini, M. P. Turner, Y. Zhao, J. Hart, H. Lu, D. Okuda, B. P. Rypma (Dallas, US)

P07 **Accelerating cortical atrophy as an explanation for cognitive decline in progressive MS**
A.J.C. Eijlers, I. Dekker, M.D. Steenwijk, K.A. Meijer, H.E. Hulst, P.J.W. Pouwels, B.M.J. Uitdehaag, F. Barkhof, H. Vrenken, M.M. Schoonheim, and J.J.G. Geurts (Amsterdam, NL)

P08 **Predicting conversion to secondary progressive MS: the role of MRI measures**
K.A. Meijer, A.J.C. Eijlers, M.D. Steenwijk, I. Dekker, B.M.J. Uitdehaag, F. Barkhof, J.J.G. Geurts, M.M. Schoonheim (Amsterdam, NL)

P09 **Cognitive decline in MS over a period of six years: subtle or substantial?**
M. Huiskamp, M.D. Steenwijk, H. de Bruin, A.J.C. Eijlers, M.J. Keijzer, Q. van Geest, B.A. de Jong, J.J.G. Geurts, H.E. Hulst (Amsterdam, NL)

P10 **Processing Speed and Related Functions in Younger and Older MS Patients**
B. Lee, L.M. Hancock (Madison, US)

P11 **Introducing Multiple Screening: a self-explanatory digital screening tool for cognitive deficits in MS**
L. van Dongen, B. Westerik, K. van der Hiele, L.H. Visser, M.M. Schoonheim, L. Douw, J.W.R. Twisk, B.A. de Jong, J.J.G. Geurts, H.E. Hulst (Amsterdam, Tilburg, Rotterdam, Leiden, Utrecht, NL)

P12 **Test of Memory Strategies as a memory screening test in multiple sclerosis**
F. García-Vaz, V. Meca-Lallana, M.J. Nova, R. Yubero, C. Aguirre, B. del Río, J. Vivancos (Madrid, Mondragon, Quirón, ES)

P13 **An alternative measure for cognitive fatigue using the paced auditory serial addition task 3": data for healthy controls and people with multiple sclerosis**
F. García-Vaz, Y.H. Hernández, V. Meca-Lallana, A. Meldaña-Rivera, M.J. Nova, J.P. Cuello, J.M. García-Domínguez, H. Goicochea-Briceño, A. Lozano-Ros, C. Aguirre, B. del Río, J. Vivancos, M.L. Martínez-Ginés (Madrid, Mondragon, ES)

P14 **Relationship Between SDMT and Other Cognitive Test Scores in a Brief Evaluation Setting**
L.M. Hancock, B. Lee (Madison, US)

P15 **MRI multiparameter measures as relevant explanatory variables of cognitive but not physical fatigue in Multiple Sclerosis**
C. Guillemin, E. Lommers, G. Delrue, E. Gester, P. Maquet, F. Collette (Liège, BE)

P16 **Emotional regulation and executive functioning in persons with multiple sclerosis**
V. Ignatova, Ts. Stoyanova, L. Todorova, L. Haralanov (Sofia, BG)

2. Consequences of cognitive dysfunction in patient's life (work problems, preventing unemployment, social skills, medication adherence, etc.)

P17 **Memory and Identification of Emotional Expression in Pediatric-Onset Multiple Sclerosis**
T.L. Fabri, R. Datta, J. O'Mahony, R.E. Gur, R.C. Gur, A. Bar-Or, E.A. Yeh, D.L. Arnold, R.A. Marrie, B.L. Banwell, C. Till (Toronto, Montreal, Winnipeg, CA; Philadelphia, US)

P18 **Association of Cognitive Function with Health Related Quality of Life in MS PATHS (Multiple Sclerosis Partners Advancing Technology and Health Solutions)**
C.A. de Moor, J.R. Williams, R.A. Rudick, B.C. Kieseier, D.M. Miller (Cambridge, Cleveland, US)

P19 **Environmental and lifestyle risk factors for cognitive impairment in multiple sclerosis**
I. Righini, C. Niccolai, B. Goretti, L. Pastò, L. Razzolini, M. Giannini, F. Lolli, E. Prestipino, M. Fonderico, R. Fratangelo, A. Bellinvia, L. Tudisco, G.B. Zimatore, N.A. Losignore, E. Portaccio, M.P. Amato (Florence, Prato, Barletta, IT)

P20 **Association of cognitive impairment with magnetic resonance imaging findings and social activities in Japanese patients with multiple sclerosis**
M. Niino, T. Fukazawa, J. Kira, T. Okuno, M. Mori, N. Sanjo, T. Ohashi, H. Fukaura, J. Fujimori, Y. Shimizu, N. Mifune, Y. Miyazaki, E. Takahashi, S. Kikuchi, D. Langdon, R.HB. Benedict, M. Matsui (Sapporo, Fukuoka, Suita, Chiba, Tokyo, Saitama, Sendai, Kochi, Ishikawa JP; London, UK)

P21 **Cognitive reserve is associated with better employment status in both adult and pediatric-onset multiple sclerosis**
L. Razzolini, L. Pastò, B. Goretti, C. Niccolai, B. Hakiki, M. Giannini, I. Righini, A. Ghezzi, L. Pippolo, M. Simone, R.G. Viterbo, M.G. Marrosu, E. Cocco, G. Fenu, F. Patti, C. Chisari, E. Portaccio, M.P. Amato (Florence, Prato, Gallarate, Bari, Cagliari, Catania, IT)

P22 **Contrasting Patterns of Cognition Related to Depression and Anxiety in Persons with MS**
V.M. Leavitt, K. Buyukturkoglu, G. Tosto, E. Gelernt, C.S. Riley

P23 **Vocational monitoring and clinical and cognitive variables. Argentinian adaptation of the Buffalo Vocational Monitoring Survey**
S. Vanotti, N. Ciufia, M.B. Eizaguirre, A. Marinageli, M.C. Pita, R. Alonso, F. Caceres, O. Garcea

P24 **MS and Employment in Argentina: current perspectives and challenges**
S. Vanotti, M.B. Eizaguirre, N. Cabral, C. Yastremiz, B. Silva, M.L. Saladino, O. Garcea, F. Caceres (Buenos Aires, AR)

P25 **Emotional recognition and its relation to cognition, mood and fatigue in Relapsing-Remitting and Secondary-Progressive Multiple Sclerosis.**
O. Argento, V. Pisani, C.C. Incerti, A. Francia, M. Morreale, C. Caltagirone, U. Nocentini

P26 **Communicating Cognitive Problems in MS: The effect of indirect language and stigma consciousness on subjective and objective memory performance**
E. Das, W. Jacobs, J. Aben, L. Tielen, L. van Lent, H.E. Hulst (Nijmegen, Groningen, Rotterdam, Amsterdam, NL)

P27 **Social cognition and psychological/neuropsychological indices in people with multiple sclerosis**
E. Minacapelli, C. Celico, V. Martinelli, G. Comi, M.F. Possa, M. Falautano, (Milan, IT)

P28 **Socioeconomic level and employment status in people with Multiple Sclerosis: Argentine present**
N. Ciufia, N. Cabral, A. Marinangeli, B. Silva, S. Vanotti, F. Cáceres, O. Garcea (Buenos Aires, AR)

3. Effect of disease modifying therapies and other medications on neurocognitive status

P29 **Start to run: The effects of a 12-week community-based running training on hippocampal connectivity and visuospatial memory in persons with MS**
M. Huiskamp, L. Moumdjian, P. van Asch, V. Popescu, M.M. Schoonheim, M.D. Steenwijk, E. Vanzeir, B. van Wijmeersch, J.J.G. Geurts, P. Feys, H.E. Hulst (Amsterdam, NL; Gent, Hasselt, Overpelt, BE)

P30 **Integrative CNS Plasticity with Exercise in MS: The PRIMERS (PRocessing, Integration of Multisensory Exercise-Related Stimuli) Conceptual Framework**
B.M. Sandroff, PhD, R.W. Motl, PhD, W.R. Reed, DC, PhD, A.K. Barbey, PhD, R.H.B. Benedict, PhD, & J. DeLuca, PhD (Birmingham, Urbana, New York, West Orange, Newark, US)

Abstracts – Oral Presentations

Session 1 – Diagnosis of Cognitive Impairment in MS: Assessment Tools, Computer Based Testing, and Remote Testing

Brief International Cognitive Assessment of Multiple Sclerosis (BICAMS): Confirmation and construct validity of two-test combinations for patient-centred care in small neurological institutions

S.J. Baetge[1], M. Filser[1], A. Renner[1], N. Stute[1], S. Ullrich[2], I.-K. Penner[1,3]

[1] COGITO Center for Applied Neurocognition and Neuropsychological Research, Düsseldorf, Germany
[2] .05 Statistikberatung, Düsseldorf, Germany
[3] Department of Neurology, Medical Faculty, Heinrich Heine University, Düsseldorf, Germany

Introduction: BICAMS represents the international gold standard to assess cognitive impairment in patients with Multiple Sclerosis (MS). To facilitate cognitive assessment in standard clinical care where time is limited, a recent study based on a sample of 1200 MS patients proposed the combined two-test administration of Symbol Digit Modalities Test (SDMT) and Brief Visuospatial Memory Test-Revised (BVMT-R) since a strong level of agreement with the total BICAMS battery was achieved.
Objectives: To methodologically confirm the proposed combination of SDMT and BVMT-R on a sample of relapsing-remitting MS (RRMS) and secondary-progressive MS (SPMS) patients.
Methods: The German BICAMS version comprises SDMT, BVMT-R and Rey Auditory Verbal Learning Test (RAVLT;German VLMT). Two-test combinations were examined regarding conformity with the total BICAMS battery including overall hit rates and correct rejections, respectively. To evaluate construct validity, a discriminant analysis was calculated with employment status as external criterion.
Results: The total BICAMS battery identified 30.5% of the 82 screened patients (age:M=43.77, SD=9.47; female:74.4%) as cognitively impaired. The most conform two-test combination (SDMT and BVMT-R) showed an almost perfect level of agreement with the total battery (κ=1.000). All two-test combinations were able to differentiate employed from unemployed patients based on their cognitive status as accurately as the total BICAMS battery (76.8%).
Conclusions: We confirmed that the combination of SDMT and BVMT-R is a recommendable alternative in time-restricted clinical settings. Moreover, cognitively impaired and preserved patients were equally well detected as being work-disabled or employed by the two-test administration as by the total BICAMS battery.

Disclosure:
S.J. Baetge: nothing to disclose
M. Filser: nothing to disclose
A. Renner: nothing to disclose
N. Stute: nothing to disclose
S. Ullrich: nothing to disclose
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Evaluating work ability in individuals with different subtypes of multiple sclerosis: considering factors beyond physical impairment

A. Renner[1], S.J. Baetge[1], M. Filser[1], N. Stute[1], I.-K. Penner[1,2]

[1] Cogito Center for Applied Neurocognition and Neuropsychological Research, Düsseldorf, Germany
[2] Heinrich-Heine University Düsseldorf, Medical Faculty, Department of Neurology, Düsseldorf, Germany

Introduction: In neurological standard care, mobility is still considered the most important predictor for multiple sclerosis (MS) patients' work ability. Regarding the huge impact of unemployment (i.e. decreased quality of life, socioeconomic burden), more detailed information about responsible factors is needed.
Aim: To differentiate the influence of key symptom-related factors (mobility, cognition, fatigue, depression) on employment status in relapsing-remitting (RRMS), primary- (PPMS) and secondary-progressive MS patients (SPMS).
Methods: 120 participants (age: M=46.32, SD=9.27) completed the Brief International Cognitive Assessment for MS battery, mood and fatigue questionnaires. These measures, along with Expanded Disability Status Scale (EDSS) scores and subjective evaluations of cognitive deficits were compared between unemployed and employed patients. For further validation, variables were entered into stepwise linear regression models predicting employment in each disease subtype.
Results: Unemployed patients performed lower in information processing speed (RRMS, SPMS), verbal (RRMS, PPMS) and visuospatial memory (RRMS), had higher EDSS scores (RRMS, SPMS), and reported more severe motor (RRMS, SPMS, PPMS) and cognitive fatigue (RRMS), depression (RRMS) and subjective cognitive problems (RRMS). Working hours in RRMS patients were predicted by EDSS, visuospatial memory and subjective cognitive problems, in SPMS by EDSS and information processing speed, in PPMS by motor fatigue and verbal memory.
Conclusions: Cognitive function (objective and subjective), fatigue and depression add substantial value in work ability prognosis beyond mobility. Since unemployment is associated with different major factors among disease subtypes, more comprehensive and customized assessments are needed to refine characterization of individual work ability and to adjust strategies targeting employment maintenance.

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Alina Renner: nothing to disclose
Sharon Jean Baetge: nothing to disclose
Melanie Filser: nothing to disclose
Nathalie Stute: nothing to disclose
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Cognitive-motor interaction in Multiple Sclerosis: an ecological approach to patient's impairment

M.B. Eizaguirre, A. Marinangeli, R. Alonso, B. Silva, S. Vanotti, O. Garcea

Multiple Sclerosis Clinic. University Centre of Neurology – J. M. Ramos Mejía Hospital. Buenos Aires, Argentina

Background: Cognitive and motor deficits in Multiple Sclerosis (MS) are regularly assessed separately, however recent studies have found an interaction when these tasks are performed simultaneously (Cognitive-Motor Interaction, CMI). The research in CMI allows an ecological approach.
Objectives: 1) To compare performance in CMI between MS patients and healthy controls. 2) To examine the relationship between CMI and activities of daily living (ADL).
Methods: sixty two patients with RRMS and 20 healthy controls were included. Patients age: 37.05 ± 11.11; education: 13.34 ± 3.24; EDSS: 2.45 ± 1.29; Evolution: 9.53 ± 9.02. Controls age: 34.00 ± 14.25; Education: 14.75 ± 2.17. Outcome measures: Clinical variables: EDSS; BDIII. Cognitive variables: BICAMS Battery. Dual tasks: Two cognitive–motor interaction tasks (walking while performing verbal fluency/counting). The measure of the difference between subject performance in the simple task versus dual task was obtained. It was quantified: time, number of steps and cognitive performance; ADL: MS Quality of life (MusiQol).
Results: Patients and controls were matched by age and education (p=0.268; p=0.083). Significant differences were found between patients and controls in CMI, in the time (fluency p=0.044; counting p=0.024), the steps of the counting task (p=0.024) and in the performance of both cognitive tasks (fluency p= 0.017; counting p=0.001). Significant negative correlations were found between CMI and ADL (r=-.557-.568). ICM constituted as a predictor of performance in ADL (R2: .529, p: .002).
Conclusions: MS patients show alterations in CMI tasks. This performance has an impact in ADL that should be considered in patient's treatment.

Session 2 – Pathophysiology & Treatment

Damage to long-range connections is especially relevant for cognitive impairment in multiple sclerosis

K.A. Meijer, M.M. Schoonheim, L. Douw, M.D. Steenwijk, J.J.G. Geurts

Department of Anatomy & Neurosciences, Amsterdam Neuroscience, MS Center Amsterdam, Amsterdam University Medical Center, Amsterdam, the Netherlands

Introduction: An efficient network, like the human brain, features a combination of signal integration driven by long-range connections and local processing involving short-range connections. In this study, we investigated the impact of structural damage to short- and long-range connections on both the functional connectome and cognitive function in MS.
Methods: From the Amsterdam MS cohort, 133 MS patients and 48 healthy controls (HC) were included. Structural connectivity was estimated from diffusion tensor images (DTI) using probabilistic tractography (MRtrix 3.0). The average fractional anisotropy (FA) as well as the average fiber length was determined for each tract. Connections were divided into short (<Q1), middle (Q1-Q3) and long (>Q3) range, based on the mean distribution of tract lengths in HC. The correspondence between individual functional connectivity matrices and the average connectivity matrix (based on all HC) was quantified. Group comparisons were corrected for age, sex and education.
Results: In MS, the longest connections showed the largest reduction in integrity ($z(FA)=-1.14$; $p<0.001$), whereas shorter connections were less severely affected ($z(FA)=-0.29$; $p=0.03$). In MS, integrity of long-range connections was more strongly related to cognition than integrity of short-range connections ($r=0.411$; $p<0.001$ and $r=0.176$; $p=0.04$, respectively). Integrity loss of long-range connections was associated with a more abnormal functional network ($r=0.204$; $p<0.001$), whereas damage to short-range connections did not.
Conclusion: Our findings indicate that long-range connections are more vulnerable to MS-specific damage than short-range connections. Moreover, compared to short-range connections, damage to long-range connections has a larger impact on the functional network and cognitive performance.

Disclosure:
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Linda Douw has nothing to disclose.
Martijn D Steenwijk has nothing to disclose.
Jeroen JG Geurts is an editor of MS journal and serves on the editorial boards of Neurology and Frontiers of Neurology and is president of the Netherlands organization for health research and innovation. He has served as a consultant for Merck-Serono, Biogen, Novartis, Genzyme and Teva Pharmaceuticals.

Preserved Functional Connectivity within Networks of White Matter Tract Disruption Partly Explains Cognitive Reserve in Multiple Sclerosis

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Introduction: Cognitive reserve is the ability to remain cognitively unimpaired despite accrual of structural neuropathology. The neural basis of this phenomenon in people with multiple sclerosis (PwMS) is unclear.
Aims: To determine whether preserved functional connectivity within networks of white matter (WM) tract disruption explains cognitive reserve in PwMS.
Materials and Methods: 74 people with multiple sclerosis (pwMS) and 29 age- and sex-matched healthy controls (HC) underwent MRI and neuropsychological assessment. WM tract disruption was quantified between pairs of gray matter (GM) regions for 86 brain regions. A larger inclusive sample of PwMS (n=137) was used to identify networks of tract disruption significantly associated with cognitive processing speed (SDMT) or visual/spatial memory (BVMTR). Deviations in resting-state functional connectivity relative to HCs for region-pairs within these networks were assessed. Regression models were applied to determine whether preserved functional connectivity attenuates the correlation between network-specific WM tract disruption and cognition. Additional models were applied to investigate whether lifetime intellectual enrichment attenuates the impact of WM tract disruption on functional connectivity.
Results: A significant interaction between WM tract disruption and deviations in functional connectivity was observed in models predicting cognitive processing speed (standardized-β= -0.237,$p<0.030$) and visual/spatial memory (standardized-β=-0.238,$p=0.034$). Lifetime intellectual enrichment significantly lowered the impact of WM tract disruption on functional connectivity within the networks associated with cognitive processing speed (standardized-β=0.984,$p<0.001$). This effect was trending for visual/spatial memory-associated networks (standardized-β=0.197,$p=0.098$).
Conclusions: Cognitive reserve is partly explained by preserved functional connectivity in networks of structurally disrupted GM regions. This effect relates to lifetime intellectual enrichment.
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Session 3 – Management of Cognitive Impairment and Related Problems

Assessing cognitive changes in Multiple Sclerosis: which change index is the most reliable?

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Introduction: Assessing cognitive change by the means of reliable methods is difficult but essential to evaluate the progression of different diseases. The reliability of change indexes is particularly important in Multiple sclerosis (MS) as the progression of the cognitive impairments usually remains uncertain, at least in part due to important inter-individual variabilities.
Aim of study: Our goal was to confront different methods assessing cognitive change (clinical judgment of a neuropsychologist and several single case analysis methods) in a MS sample.
Methods: Cognitive functions which are frequently affected in MS (i.e., long term verbal memory, working memory, processing speed and verbal fluency) were assessed twice in 123 patients with clinically definite MS. For each patient, and for each cognitive measure, we compared 5 single case methods to determine the significance of the cognitive changes.

Results: Concordance between the neuropsychologist and single case methodology is rather low in most cases. The standard deviation method and Crawford, Howell, and Garthwaite's (1998) modified t test have the highest agreement with the neuropsychologist's judgment. Among the neuropsychological measures, the agreement between the neuropsychologist and statistical methods was highest for verbal fluency.
Conclusion: The interpretation of a patient's cognitive progression depends on the criteria taken into account (neuropsychologist or statistical methods). This highlights the importance for future research to establish standardized cut-off points of significant cognitive change to interpret longitudinal designs. The results of our study could be used to suggest a combination of indexes rendering the interpretation of cognitive change more reliable.
Keywords: Multiple sclerosis; Single case method; Cognitive evolution; Neuropsychological Assessment

Treadmill walking exercise and computer-based cognitive training improve self-perceived cognitive deficits and information processing speed in patients with multiple sclerosis (MS)

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Introduction: Many patients with MS experience cognitive deficits and hence suffer from decline in work productivity. Effective therapies for patients suffering from cognitive impairment are lacking.
Aim: To evaluate the effectiveness of different combinations of non-pharmacological treatment approaches on self-perceived cognitive deficits (PCD) and objective information processing speed (IPS).
Methods: Participants received one of the following interventions: a) treadmill walking exercise, b) computer-based cognitive training (twice a week for 45 min. each) or c) a combination of both. The perceived cognitive deficits questionnaire (PDQ-20) was applied to determine PCD before and after the training period. Symbol digit modalities test (SDMT) was used to measure IPS. To evaluate treatment effects, the Wilcoxon signed-rank test was applied.
Results: 44 MS patients (39 relapsing-remitting MS and 5 secondary-progressive MS, 33 females; mean age 43.70, SD= 10.35; mean EDSS 2.44) have been included so far. First analyses indicate a significant improvement in both outcomes: PDQ-20: z=-3.093, p=.002; SDMT: z=1.961, p=.05. Cohen's d supported these findings by strong effect sizes: PDQ-20 (d= -1.63) SDMT (d= 0.87), with no differences between the groups. The analysis of the PDQ subscales revealed significant effects on the following domains: attention and concentration (z= -2.890, p= .004); retrospective memory (z= -2.589, p= .010); prospective memory (z=-2.894, p= .004). Planning and organization displayed no significant improvement (z=-.969, p= .333).
Conclusions: Based on subjective and objective outcome measure results physical exercise and cognitive training are effective and can be recommended in treating MS patients with cognitive problems.

Session 4 – Related Disorders and Comorbidities

Ageing in MS: prevalence and profile of cognitive impairment

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Background: There is little information concerning the neuropsychological profile of older patients with multiple sclerosis(MS), which might difficult the differentiation of MS-related cognitive impairment(CI) from other age-related conditions
Aim of study: To describe the prevalence and profile of CI in older patients with MS and perform a comparison of older and younger patients with CI.
Methods: This is a sub-analysis of a collaborative Italian study, where six centres recruited consecutive patients with MS for six months. Cognitive performance was assessed through the Brief Repeatable Battery and the Stroop Test. CI was defined as impairment in ≥2 cognitive domains.
Results: We identified 111 patients ≥55 years (mean age 59.7 years). The prevalence of CI in older patients was significantly higher than in the younger patients (77.2% vs. 42.8%; p<0.01).
Impairment in information processing speed was the most common deficit (68.8%), followed by verbal learning (49.5%), executive function (47.7%) and visuospatial learning (26.6%). When comparing the cognitive profile of older and younger impaired patients (n=347) we found no significant differences in any cognitive domain (p>0.05).
Average depression and fatigue scores were higher in older than in younger patients (p<0.01 and p=0.02), however they were not associated with increased CI among older patients (p=0.70 and p=0.80).
Conclusions: We identified a high prevalence of CI in older patients; however, the cognitive profile of older and younger patients was similar, suggesting that CI is mostly directly related to MS itself and not to comorbid age-related dementias, which would typically present a different neuropsychological pattern.

Decision-making is not impaired in early multiple sclerosis when controlling for individual search strategies

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Introduction: Decision-making is an executive function defined as the ability to form implicit preferences based on feedback. It is commonly assessed using the Iowa Gambling Task (IGT)[1]. Previous studies point to impaired performance in patients with early relapsing-remitting multiple sclerosis (RRMS) due to deficient learning from feedback[2,3]. However, deficits on this task may also arise from inefficient search strategies during acquisition of risk contingencies.
Aim of the study: We investigated whether patients with early RRMS show impaired decision-making when individual differences regarding search strategies are controlled for.
Methods: 19 patients with early RRMS (≤2 relapses, mean EDSS: 1.5) and 32 age-matched healthy controls (HC) were compared in a computerized, modified IGT[4] employing a total of 120 forced-choice decisions (play or pass of one out of four virtual card decks). This allowed us to control for potential differences regarding search strategies during the acquisition of risk contingencies (first 40 decisions) and to assess more directly the ability to learn from previous decisions.
Results: Patients with early RRMS and HC did not differ on the percentage of advantageous or disadvantageous decisions during the acquisition phase, showing that both groups were exposed to similar feedback. Groups did not differ on the IGT total netscore ($p = 0.191$) or the IGT learning index ($p = 0.621$) indicating equally efficient implicit learning from previous decisions.
Conclusions: Decision-making is not generally impaired in early RRMS. Impaired performances in the original IGT may be due to inefficient exploration of risk contingencies and not due to impaired implicit learning from previous decisions.

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Abstracts – Posters

1. Diagnosis and monitoring of MS associated neurocognitive disorder

P01 Loss of functional brain network hierarchy relates to cognitive impairment in multiple sclerosis: a magnetoencephalography study

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Introduction: Disrupted brain network organisation seems to play an important role in understanding cognitive impairment in multiple sclerosis (MS). However, it remains unclear which network measures are the best indicators of cognitive impairment in MS, and how these measures relate to structural brain measures.
Aim of study: To relate functional brain network organisation to cognitive impairment in MS patients, and to explore its unique effect beyond structural brain measures.
Methods: Magnetoencephalography recordings, magnetic resonance imaging and neuropsychological assessments were analysed in 145 MS patients. Brain network organisation was computed using network properties of the Minimum Spanning Tree (MST; i.e. backbone of the functional brain network). Correlational and regression analyses were performed to relate these measures to cognitive impairment, and to explore the effects of grey matter (GM) atrophy and white matter (WM) lesions.
Results: Cognitive impairment was related to multiple MST network properties ($p<.008$), including a lower tree hierarchy and lower leaf fraction in multiple frequency bands. The best MST predictor of cognition (i.e. tree hierarchy in the alpha2 band) remained an independent predictor when cortical GM atrophy or WM lesion volume were added to the model, but not when deep GM atrophy was added.
Conclusions: A loss of functional brain network hierarchy related to worse cognitive performance in MS patients. While this relation seemed relatively independent of cortical GM atrophy and WM lesion volume, deep GM atrophy did affect the relation between network organisation and cognition. These findings add important insights into the interplay between function and structure.

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B.M.J. Uitdehaag has received personal compensation for consulting from Biogen Idec, Genzyme, Merck Serono, Novartis, Roche and TEVA.
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P02 Validity of cognitive performance outcomes in patients with multiple sclerosis

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Introduction: Neuropsychological evaluation is used as an objective measure to assess cognitive function in patients with multiple sclerosis (MS). However, if patients perform suboptimally during neuropsychological evaluation, the results may not accurately reflect their actual cognitive abilities. In MS, the validity of neuropsychological performance and its implications have rarely been investigated.
Aim of study: To examine which factors relate to invalid cognitive performance in patients with MS.

Methods: Fifty-nine MS patients (64% women; age 48.2±10.4 years; disease duration 13.7±8.9 years; 64% relapsing-remitting MS) who were referred to the 'MS and cognition' outpatient clinic at the MS Center Amsterdam were included. The Amsterdam Short Term Memory Test (ASTM) was used as a performance validity test. Patients with scores indicative of invalid performance (ASTM<85) were compared to the remaining patients on demographic and disease characteristics, cognitive function, and psychological measures.
Results: Eighteen patients (31%) obtained scores indicative of invalid cognitive performance. These patients performed worse on tests that measured verbal ($p<.01$) and visual memory ($p<.01$), and information processing speed ($p<.05$).
In addition, these patients had lower anxiety scores compared to patients with valid cognitive performance ($p<.05$). No other differences were found.
Conclusions: In our MS sample, a substantial number of patients showed indications for invalid cognitive performance. These patients had worse cognitive scores and less anxiety symptoms. Potential reasons for invalid cognitive performance need to be further elucidated. Our results highlight the importance to assess performance validity in MS to enable a reliable interpretation of neuropsychological test results.

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P03 Reduced cognitive functioning in RRMS patients at the time of diagnosis suggests initial fronto-temporal network involvement

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Introduction: Cognitive impairment (CI) affects a large proportion of multiple sclerosis (MS) patients, but clinical attention to neuropsychological aspects usually begins too late, when CI is already evident.
Aim: To assess cognitive functioning at the time of diagnosis of a group of relapsing-remitting (RRMS) patients compared with matched healthy controls (HC).
Methods: Fourteen RRMS patients (mean disease duration: 3.0±4.8) and 14 HC were tested with the Brief Repeatable Battery (BRB), the Verbal Fluency (VF) test, and the Modified Five Point Test (MFPT). Cognitive scores (CS) were attributed based on z-scores of each subtest (for a similar procedure see Camp et al., 1999). A global cognitive score (gCS) were then calculated summing the CS of each test in order to obtain a sensitive index of cognitive functioning overcoming the classification of CI based on cut-off scores.

Results: Considering the whole battery, only three out of 14 patients performed under the cut-off on the MFPT. A significant difference was found between MS and HC on the gCS (p=.028). Considering each CS, significant differences were found on the SRT-LTS (p=.025), SRT-D (p=.012), Phonemic VF (p=.043), Semantic VF (p=.015), and MFPT (p=.014).
Conclusions: We found a significant global decrease in cognitive functioning in MS patients since the time of diagnosis. The specific cognitive domains that contributed more to reduce cognitive functioning suggest an initial fronto-temporal pathway of neurodegeneration (Calabrese et al., 2010) not evident with the classical testing approach.

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All the other authors have nothing to disclose.

P04 Tracking cognitive impairment in multiple sclerosis using the Brain on Track test: a validation study

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Background: Monitoring cognitive performance in multiple sclerosis (MS) patients is critical to develop prevention and management strategies for cognitive impairment(CI). The Brain on Track test (BoT) is a self-administered web-based tool developed for cognitive screening and monitoring.
Aim of the study: The objective of this study was to validate the use of the BOT in MS, by assessing its ability to distinguish between MS patients and matched controls, as well as detect CI among MS patients, by analysing its correlation with standard cognitive tests and its reliability and learning effects in repeatable use.

Methods: The BoT was applied in 30 patients with MS consecutively selected and 30 age- and education-matched controls, first in a hospital clinic, under supervision, and then one week later from home. After these first two trials, MS patients repeated the test from home every four weeks for three months.
A standard neuropsychological battery was also applied to MS patients at baseline.
Results: The Cronbach's alpha was 0.89. Test scores were significantly different between MS patients and controls (Cohen's d=0.87; p<0.01). Among MS patients, scores were significantly lower in those with CI documented in the standard neuropsychological battery than in their cognitively preserved counterparts (Cohen's d=2.0; p<0.001). The BOT scores presented a good correlation with standard neuropsychological tests, particularly for information processing speed. Regarding test-retest reliability, 10/11 subtests presented two-way mixed single intraclass consistency correlation coefficients >0.70.
Conclusion: The BOT showed good neuropsychological parameters in MS patients, endorsing the use of self-administered computerized tests in this setting.

P05 Functional and dysfunctional impulsivity in Multiple Sclerosis

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Introduction: Behavioural aspects of Multiple Sclerosis (MS) are rarely explored. Dickman scale (FIDI) allows distinguishing functional impulsivity (FI), which is the ability to react fast and properly when it is necessary and dysfunctional impulsivity (DI) which is the tendency to miss forethought before acting.
Aim of study: This study aims to explore functional and dysfunctional impulsivity in MS.
Methods: 92 MS patients (16 Clinically Isolated Syndrome, 20 Primary Progressive, 32 Relapsing Remitting, 24 secondary progressive) were evaluated with the FIDI to measure impulsivity, the EMIF scale for fatigue, Short Beck Depression Inventory for depression, and the Computerised Speed Cognitive Test (CSCT) to assess processing speed of information.
Results: Participants (61 women and 31 men, mean age: 46. 6, mean study level 12.6, median EDSS 3 (0-8), and mean disease duration in month 127.9 (SD: 12, 1-588)) did not show pathological mean FI z-score (-0.34), nor mean DI z-score (0.12). 23 patients showed pathological lack of FI, and 8 patients pathologically high DI. The CSCT z-score impacted significantly the FI z-score (F=24, p<00001) and the DI z-score (F=12, p<0.001). Taking into account the CSCT, age, study level, disease duration, Edss, and measures of fatigue and depression though a multiple linear regression analysis low CSCT and high cognitive fatigue induce a significant lack in FI (F=6.7, p<0.000001), and low CSCT and low physical fatigue induce a rise in DI (F=3.1, p<0.01).
Conclusions: Processing speed of information, and cognitive and physical fatigues have a highly significant impact on functional and dysfunctional impulsivity in MS.

P06 Neural-vascular uncoupling explains cognitive slowing in Multiple Sclerosis

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Introduction: Cognitive slowing (CS) occurs in 70% of multiple sclerosis patients (MSP). CS is sustained and progressive and the neural mechanisms are unknown. Neural-vascular coupling, acute localized blood flow increases following neural activity, is essential for efficient cognition.
Aim: We hypothesized that neural-vascular uncoupling contributes to CS in MSP. We isolated the neural, glial, and, vascular components of the neural-vascular coupling system to assess their contributions to MSP-related CS.
Methods: MSP and healthy controls (HC) were scanned on a Philips 3T scanner. A dual-echo calibrated functional MRI sequence permitted measurement of cerebral blood flow (CBF) and blood-oxygen level dependent signal (BOLD). Participants periodically inhaled room-air and carbogen for calculation of cerebral metabolic rate of oxygen (CMRO2). They then performed a visual task in which radial checkerboards periodically flickered at 6Hz. We calculated task- and carbogen-evoked changes in BOLD, CBF and CMRO2. Cerebrovascular reactivity of arteries (CVRa) and veins (CVRv) were calculated as CBF and BOLD increases per unit increase in end-tidal CO2.
Results: We compared slow- and fast- MSP and HC (sex- and age-matched). Slow MSP had a simple reaction time (RT) higher than 1.5 SD from the mean HC RT. Visual task-evoked BOLD was lower in slow MSP (M=2.02, SE=0.2) compared to fast MSP (2.46, 0.2) and HC (2.76, 0.19, $p<0.05$). CBF was lower in slow MSP ($p<0.05$). No differences in CMRO2 were observed between groups. Neural-vascular coupling ratio (CBF/CMRO2) was lower in slow (1.61, 0.06) than fast MSP (1.76, 0.09, $p<0.05$). These results suggest that neural-vascular uncoupling contributes to CS in MS. CVRa was higher in fast MSP (11.85, 1.45) than HC (8.8, 0.54, $p<0.05$). Slow MSP had similar CVRa compared to HC. CVRv was similar to HC in fast MSP and lower in slow MSP ($p<0.05$). These results suggest that fast MSP RTs are supported by increased arterial blood flow compared to slow MSP. In slow MSP, reduced venous compliance also contributed to CS. Because carbogen-evoked BOLD and CBF changes occurred at an isometabolic state, in HC, CVRa increased proportionally with increases in CVRv. Changes in CVRa with CVRv (arterio-venous compliance; AVC) was positive in HC and fast MSP. AVC was lower in fast MSP compared to HC. AVC was negative in slow MSPcompared to fast MSP and HC.
Conclusion: AVC might underlie MS-related CS. Neural-vascular uncoupling following impaired AVC forms the physiologic basis of MS-related CS.

P07 Accelerating cortical atrophy as an explanation for cognitive decline in progressive MS

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Introduction: Previous studies have suggested that grey matter atrophy may accelerate with progression in MS, but whether this is indeed the case and how this relates to cognitive decline is so far unknown. We therefore measured longitudinal cortical and deep grey matter atrophy rates in patients with relapsing-remitting (RRMS) and progressive MS (PMS) and correlated these to cognitive decline over five years.
Methods: We prospectively included 230 patients with MS (179 RRMS and 51 PMS) and 59 healthy controls (HC). Cognitive decline was assessed using the reliable change index (RCI) based on an extended version of the BRB-N at both time points. Cortical and deep grey matter atrophy were measured at both time points on identical 3-dimensional T1-weighted MR images (3T) using SIENAX and FIRST respectively and lesion volumes on fluid-attenuated inversion recovery images.
Results: Deep grey matter atrophy was faster in RRMS (-0.74%/yr) and PMS (-0.82%/yr) compared to HC (-0.31/yr, $p<0.01$ for both), while cortical atrophy was faster in PMS (-0.87%/yr) compared to both RRMS (-0.54%/yr) and HC (-0.41%/yr, both $p<0.01$). Within the RRMS group, cognitive decline was associated with a lesion volumes increase (rho=-0.16, p=0.03) and deep grey matter atrophy (r=0.15, p=0.04, while cognitive decline In the PMS group was associated with cortical atrophy (r=0.35, p=0.01).
Conclusions: These results show that cortical atrophy accelerates in the course of disease progression. Importantly, cognitive decline in RRMS was associated with deep grey matter atrophy and a lesion volume increase, while cognitive decline in PMS was associated with cortical atrophy only.

P08 Predicting conversion to secondary progressive MS: the role of MRI measures

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Introduction: The underlying mechanisms that drive the conversion from relapsing remitting multiple sclerosis (RRMS) to secondary progressive (SP)MS are still poorly understood and the specific point of conversion remains difficult to predict.
The objective of this longitudinal study was therefore to identify structural and functional MRI measures that could predict conversion from RRMS to SPMS.

Method: In the Amsterdam MS cohort, all RRMS patients who converted to SPMS (cRRMS; N=23) between baseline and follow-up measurements (median 4.5 years (4.3-5.3)) to SPMS were individually matched, based on age, sex and education, to RRMS patients who did not convert (ncRRMS; N=23) and to healthy controls (HC; N=23). Cognitive, structural and functional MRI measures at baseline (i.e. before conversion) were compared between groups (FDR-corrected).
Results: cRRMS patients had higher EDSS than ncRRMS patients, while no differences were observed in symptom duration. Attention, verbal and visuospatial memory were only impaired in cRRMS patients relative to HC. In addition, cRRMS patients showed a lower thalamus volume, a higher lesion load and more extensive WM damage than ncRRMS and HC. The functional network was only different between cRRMS and HC. Lower thalamus volume was the strongest MRI predictor for conversion within five years.
Conclusion: RRMS patients, who converted to SPMS within five years, already demonstrated more severe structural changes and a more abnormal functional network compared to matched RRMS patients who did not convert. Atrophy of the thalamus, one of the most important hubs in the brain network, was the primary predictor of conversion to SPMS.

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J.JG. Geurts is an editor of MS journal and serves on the editorial boards of Neurology and Frontiers of Neurology and is president of the Netherlands organization for health research and innovation. He has served as a consultant for Merck-Serono, Biogen, Novartis, Genzyme and Teva Pharmaceuticals

P09 Cognitive decline in MS over a period of six years: subtle or substantial?

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Background: Cognitive deficits are common in persons with multiple sclerosis (pwMS) and occur in all stages of the disease. However, longitudinal studies on the course of cognitive decline are scarce.
Aim: To study cognitive decline in pwMS over approximately 6 years.
Methods: 37 pwMS (mean age 47.3±8.6 years, mean baseline disease duration 12.0±7.1 years) and 20 healthy controls (HCs; 44.9±9.5 years) underwent neuropsychological evaluation at baseline and follow-up (median follow-up duration 5.95 years). Tests for verbal-, visuospatial- and working memory (WM), information processing speed (IPS) and verbal fluency were administered. Cognitive change was calculated per test using the modified practice adjusted reliable change index (RCI). Cognitive decline was defined as an RCI of <-0.25/year on ≥2 cognitive domains.
Result: pwMS performed worse than HCs on tests for verbal memory (p=.01), visuospatial memory (p=.001), WM (p=.013) and IPS (p<.001) at baseline and follow-up. The yearly cognitive change did not differ from HCs (p>.05). Sixteen pwMS (43%) declined on one cognitive domain, five patients (14%) met the criteria for cognitive decline. Most frequently affected were verbal memory (13 pwMS, 35%), IPS (6 pwMS, 16%) and WM (3 pwMS, 8%).
Conclusion: pwMS did not show faster yearly cognitive decline than HCs. It might be that initial cognitive decline had already occurred, subsequently followed by more subtle changes. Still, 43% of the pwMS showed decline in one domain, most frequently in verbal memory, WM and IPS. This emphasizes the need for specific interventions for cognitive deficits in MS at all stages of the disease.

P10 Processing Speed and Related Functions in Younger and Older MS Patients

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Introduction: Impaired processing speed is well-documented in MS. However, few studies have compared processing speed and related skills in differing age groups.
Aim of study: Examine processing speed and executive functioning in younger and older MS patients in a brief battery format.
Methods: 45 patients (aged 26-75, Mage = 49.78, SD = 12.51, 73.3% female) from a MS Multidisciplinary Clinic were separated into two age groups: younger group (< 50 years old, n = 21) and older group (≥ 50 years old, n = 24). 83.3% were cognitively impaired and 16.7% were intact in the older group, whereas 61.9% were cognitively impaired and 38.1% were intact in the younger group.

Participants completed the Stroop test (Golden version), the Symbol Digit Modalities Test (SDMT), and the Trail Making Test (TMT).
Results: Results revealed that the older group scored worse than the younger group on the Stroop color-word subtest (t (39)=3.33, p=.002) and interference subtest (t (38)=2.63, p=.012). However, they performed equally well on other measures, including processing speed (Stroop word and color subtests, SDMT written and oral), and both visuomotor speed and cognitive set-shifting (TMT A & B).
Conclusions: Our findings suggest that older MS patients have greater difficulty inhibiting conflicting responses. Age did not appear to affect performance on measures of processing speed. These findings are consistent with previous research, and provide further insight into age-related cognitive change that may be measured by tasks such as the Stroop.

P11 Introducing Multiple Screening: a self-explanatory digital screening tool for cognitive deficits in MS

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Introduction: Neuropsychological evaluations are generally time-consuming and need to be performed by a trained neuropsychologist. This forms a hurdle to timely measure and adequately monitor cognitive decline in MS.
Aim: To develop a time-efficient, unsupervised, digital screening tool to measure cognitive deficits in MS.
Methods: A digital (adjusted) version of the BICAMS, including the Symbol Digit Modalities Test (SDMT, information processing speed), the California Verbal Learning Test (CVLT-II, verbal memory) and the Spatial Recall Test (SPART, visuospatial memory) was developed.
First, 16 patients with MS confirmed the clarity and feasibility of the tool (Multiple Screening, intellectual property of Sanofi Genzyme). Next, in 60 healthy controls (HCs), intraclass correlation coefficients (ICC) were calculated to describe how

strongly the digital version resembled the paper-and-pencil assessment. Lastly, norm scores were obtained in 236 HCs for each test and corrected for effects of age (regression-based approach), sex, and education (bins per group).
Results: ICCs between digital and paper-and-pencil assessment were excellent to good (SDMT (ICC 0.79, p<0.001); CVLT-II (ICC 0.77, p<0.001); SPART (ICC 0.61, p<0.001)). In order to convert raw scores to norm Z-scores, all tests were corrected for age. The SDMT scores additionally needed correction for education and the CVLT-II for education and sex.
Conclusions: The Multiple Screening tool is a self-explanatory, unsupervised, digital screening tool to measure cognitive deficits in MS. Ultimately, it can be used as a conversation starter in a clinical setting, leading to timely identification and adequate intervention for patients with MS suffering from cognitive decline.

P12 Test of Memory Strategies as a memory screening test in multiple sclerosis

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Background: A relevant percentage of patients with multiple sclerosis (PwMS) have memory problems, to evaluate this cognitive functioning several tests have been used, nevertheless they could be time consuming in the daily clinic.
Goal: To validate the Test of Memory Strategies (TEM) as a screening memory test for MS
Method: We selected 100 PwMs and 100 healthy controls (HC) matched in age and educational level. The sample of patients was evaluated with a complete neuropsychological battery including memory and executive functions tests. TEM was administered to both groups, PwMS and HC. The TEM assesses incidental memory and immediate memory, 5 lists of words are presented consecutively with a progressive increase in the external organization of information. We analysed the differences in the performance of the test between PwMS and HC and correlated the results with those of the neuropsychological evaluation.
Result: The results of the ANOVA showed statistically significant differences (p <0.001) for T3, T4 and T5; The post-hoc analysis showed that HC obtained better results than all groups of patients. We found significant relationships between the results of TEM and memory and executive functions tests.
Conclusion: TEM test provides evidence of memory problems and the relationship with executive functions and is useful to distinguish which of both processes is impaired in PwMS. The significant relationship with classical neuropsychological tests points it out as a memory screening test in multiple sclerosis.

P13 **An alternative measure for cognitive fatigue using the paced auditory serial addition task 3": data for healthy controls and people with multiple sclerosis**

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Introduction: Fatigue is one of the most frequent and interfering symptoms in persons with multiple sclerosis (PwMS). Cognitive fatigue (CF) is difficult to be assessed, previous research has suggested PASAT 3" as a measure of cognitive fatigue.
Aims of Study: To corroborate PASAT 3" as a measure of CF considering the first and last 15 items and to provide data of this measure for healthy participants (HC) and PwMS.
Methods: This is an observational, multicenter, case-control study with 190 PwMS and 100 HC of the same age and educational level. We calculated correct responses in the first and last 15 trials of the PASAT and analyzed the performance of HC and PwMS according to their cognitive impairment (CI): no CI (NCI), mild CI (MCI) and moderate CI (ModCI).
Results: Both groups produced less hits in the last 15 trials (HC: HM=9,94; SD=3,44; PwMS: M=9.19, SD=3.3, p<.000) compared to the first ((HC:M=11,22; SD=3,17), PwMS (M=15.52, SD=3.13),p>.000); no significant differences were found between both groups. When considering PwMS´s CI, results were significantly lower for ModCI (M=7.67, SD=3.74) in the last 15trials.
Conclusions: Significant differences were found for PwMS and ModCI suggesting that CF could be related to the level of CI. We offer normative data for this suggested measure of CF: mean, mode, median, standard deviation and percentiles are provided for both HC and PwMS.

P14 **Relationship Between SDMT and Other Cognitive Test Scores in a Brief Evaluation Setting**

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Introduction: Clinicians frequently use the Symbol Digit Modalities Test (SDMT) as a screening measure to determine the likelihood of cognitive impairment. Research has illustrated its validity, reliability, sensitivity, and specificity for identifying cognitive dysfunction across numerous cognitive domains in MS.

Aim of Study: Determine whether SDMT score is consistent with other cognitive impairment in a brief battery format.
Methods: Brief cognitive testing was conducted in a MS Multidisciplinary Clinic, including the SDMT, Stroop Test (Golden version), and Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Participants were identified as cognitively impaired (CI) if they possessed 2+ scores ≥1.5 SD below the normative mean. Others were identified as MS controls.
Results: Our sample (N=45) was largely female (73.3%) and Caucasian (93.3%). Age ranged from 26-75 ($\bar{X}$=49.78,SD=12.51). Disease duration was >15 years ($\bar{X}$=15.4,SD=11.37). Cognitive screening suggested impairment (SDMT $\bar{X}$=43,SD=17.2). 73.3% of the sample was identified as CI. CI were older (t(43)=-2.39,p=.02) and had longer disease duration (t(43)=-2.21,p=.04) than controls. SDMT scores were correlated with measures of learning and recall (RBANS Story Learning r(32)=.388,p=.03; RBANS Story Recall r(32)=.595,p<.000; RBANS Figure Recall r(32)=.671,p<.000), for CI only. The SDMT and other measures of processing speed did not successfully predict cognitive status (CI vs control; x2(8)=8.32,p=.40).
Conclusions: Our results are generally consistent with findings from research settings. Although the SDMT has demonstrated significant utility as a screening tool, clinicians may need to use caution when administering a brief battery, as measures of processing speed alone may not always capture MS-associated cognitive impairment.

P15 MRI multiparameter measures as relevant explanatory variables of cognitive but not physical fatigue in Multiple Sclerosis

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Introduction: Fatigue symptoms are highly frequent in patients with multiple sclerosis (MS). However, the underlying brain and clinical mechanisms associated specifically to feeling of cognitive and physical fatigue remain largely misunderstood.
Aim of study: To investigate whether subjective cognitive and physical fatigue depend on different sets of brain and clinical variables in MS.
Methods: Multiparameter mapping (MPM) MRI data (R1 parameter in central grey matter (GM), R2 in cortical and central GM, R2 in cortical white matter (WM), PD in central GM and in cortical WM), and clinical data (age, depression, anxiety, cognitive and physical fatigue scores at the M-FIS; disease duration and EDSS score for patients) were collected among MS patients (n=35) and healthy controls (n=28). Stepwise regression analysis for the cognitive and physical sub-scores of the M-FIS were performed in each group, using clinical and MRI variables.

Results: Variance of cognitive M-FIS score for patients was explained with a model taking into account anxiety, depression and measures of cortical and central grey matter ($R^2 = 0.5397$, $p < .0001$). For controls, the model included age, depression and R2 parameter in cortical white matter ($R^2=0.4137$, $p = 0.0045$). The model with physical M-FIS score included EDSS and anxiety for patients ($R^2 = 0.3834$, $p = 0.0004$), but age and depression for controls ($R^2= 0.4908$, $p = 0.0002$).
Conclusions: These results suggest (1) that the determinants of subjective fatigue vary between MS and control participants; (2) that only cognitive fatigue is linked to brain characteristics. These results stress the need to study cognitive and physical fatigue as two separate entities in MS.

P16 Emotional regulation and executive functioning in persons with multiple sclerosis

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Introduction: Executive functions, considered to be the basis of coping strategies, are especially vulnerable in persons with multiple sclerosis (PwMS). On the other hand, these subjects experience difficulties in emotional processing and probably in emotional regulation.
Aim: to search a relationship between emotional regulation and coping strategies in PwMS at early stage of the disease.
Material and methods: 27 patients with relapsing-remitting MS (mean age 43.2, 18 women and 9 men) and 20 healthy controls (mean age 38.5, 16 women and 4 men) were included in the study. The mean EDSS was 2.3, the duration of the disease- 10.1 years. The emotional regulation was assessed through Emotional Regulation Questionnaire (ERQ). The executive functions were tested by: Trial Making Test (TMT)-A, TMT-B, Symbol Digit Modality Test (SDMT), verbal fluency (VF). Cognitive Failures Questionnaire (CFQ) assessed patient's perception about cognition.
Results: Better emotional regulation according to ERQ correlated with TMT-B score and disease duration. The relationship between ERQ-score and SDMT, delayed recall, EDSS, Cognitive Failures Questionnaire (CFQ) -score, visual empathy test was not clinically significant. CFQ –score correlated with labyrinth test, evaluating speed of information processing and disease duration.
Conclusion: Our study supports the thesis that successful emotional regulation helps for accurate executive functioning. It should be at the focus of strategies embedded in the general approach to those category patients.

2. Consequences of cognitive dysfunction in patient's life (work problems, preventing unemployment, social skills, medication adherence, etc.)

P17 Memory and Identification of Emotional Expression in Pediatric-Onset Multiple Sclerosis

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Introduction: Memory, often impaired in pediatric-onset multiple sclerosis (MS), is critical for social-cognitive function. Memory deficits may therefore interfere with recognizing the emotional expression of others.
Aim of Study: We investigated the association between memory and identification of emotional expression in patients with pediatric-onset MS.
Methods: Fifty-nine pediatric-onset MS patients (Mean age=18.7 yrs, range: 10-27; Mean age at onset=14.4 yrs, range: 6-17) and 53 healthy controls (Mean age= 16.9 yrs, range: 8-27) completed the Penn Computerized Neurocognitive Battery. We used ANCOVAs to compare patients and controls on accuracy and response time (RT) on tasks of episodic memory (i.e., facial, verbal, and nonverbal memory), emotion recognition, and emotion differentiation. We used Pearson correlations to examine bivariate relationships between each memory and emotion identification task.
Results: Patients did not differ from controls on accuracy or RT when asked to recognize previously presented verbal or visual information. Controlling for accuracy, patients were slower to recognize emotions than controls (MRT: 1926.30 vs. 1777.15msec; $p<0.05$). Among patients, higher accuracy on the facial memory task correlated with better performance on emotion recognition ($r=0.43$, $p=0.001$) and emotion differentiation ($r=0.38$, $p<0.01$). Patients, but not controls, demonstrated a consistent correlation between faster RT on memory tasks and faster RT on the emotion tasks.

Conclusions: Pediatric MS patients have difficulty recognizing features of facial emotional expression. Superior performance on tests of memory is associated with better performance on tasks of emotional recognition.

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P18 Association of Cognitive Function with Health Related Quality of Life in MS PATHS (Multiple Sclerosis Partners Advancing Technology and Health Solutions)

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Introduction: Multiple Sclerosis (MS) is associated with poorer health-related Quality of Life (HRQOL). Though cognitive impairment is common in MS, its contribution to HRQOL, above and beyond disease-related characteristics, is not well understood.
Aim of Study: To determine the independent association of cognitive function with HRQOL in MS.
Methods: Patients were enrolled in MS PATHS (Multiple Sclerosis Partners Advancing Technology and Health Solutions), a network of 10 healthcare institutions in the United States and Europe. During routine visits, patients used the Multiple Sclerosis Performance Test to complete a standardized MS history; 12 scales of Quality of Life in Neurological Disorders (Neuro-QoL) assessing physical, mental and social HRQOL; and electronic adaptations of the Multiple Sclerosis Functional Composite. The Processing Speed Test (PST), adapted from the Symbol Digit Modalities Test, measured cognitive function. Associations between PST and HRQOL were estimated using partial correlation coefficients, adjusting for age, sex, education, physical disability, disease severity, disease duration and number of relapses.
Results: The sample comprised 4852 patients. The mean (SD) age was 45.1 (12.2); 78.8% were female, and 48.7% had >= college degree. Statistically significant partial correlations were found between cognitive function and each Neuro-QoL scale, with lower cognitive function associated with poorer HRQOL. The highest partial correlations were found for anxiety ($r = -.15$; $p<.0001$), depression ($r = -.13$; $p<.0001$) and stigma ($r = -.15$; $p<.0001$).
Conclusions: After adjusting for patient and disease-related characteristics, including physical disability and disease severity, lower cognitive function was independently associated with poorer physical, mental and social HRQOL.
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P19 Environmental and lifestyle risk factors for cognitive impairment in multiple sclerosis

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Introduction: a number of genetic, environmental, potentially modifiable risk factors for MS are increasingly investigated. It is not known, however, if these risk factors also apply to MS-related cognitive impairment (CI).
Aim of study: The aim of our study was to assess risk factors for CI in MS patients, focusing on environmental exposures, lifestyle and comorbidities.
Methods: We included RR, SP and PP MS patients referred to Florence MS Center between 2014 and 2017. Neuropsychological assessment was performed on the Rao's battery and Stroop test, fatigue and depression were also assessed. Potential risk factors were investigated through a semi-structured questionnaire. Risk factors for CI (impairment in one cognitive domain) were assessed using stepwise multivariable logistic and linear regression models.
Results: 150 MS patients were included (103 women, age 44.8 +/- 1.79, median EDSS 2.79). CI was detected in 95 (63%) subjects. Cognitively impaired patients were older, had a younger age at MS onset (p=0.005) and exhibited higher fatigue and depression levels (p<0.005). In the multivariable analysis, diabetes and history of brain trauma were significantly associated with CI (p<0.05); the trend of association with thyroid disease was confirmed (p=0.07).
Conclusions: in our MS sample, CI was associated with clinical and demographic features, as well as diabetes, history of brain trauma and a few lifestyle factors. Our findings suggested a number of potential risk factors or protective factors for MS-related CI, related with comorbidities and lifestyle, potentially susceptible to preventive and management strategies.

P20 Association of cognitive impairment with magnetic resonance imaging findings and social activities in Japanese patients with multiple sclerosis

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Background: Validated forms of the Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS) are available in many Indo-European countries. Recently, we showed that the BICAMS is also reliable and valid in Japanese, and is a practical battery for cognitive impairment in MS patients.
Objectives: The aim of this study was to investigate association of MRI findings and social activity with cognitive function evaluated using BICAMS in Japanese MS patients.
Methods: Our previously published BICAMS data of 156 Japanese MS patients were analyzed with MRI data focusing on T2/FLAIR hyperintense lesions, and social activities using the options "student," "employed full time," "employed part time," "homemaker," and "unemployed because of MS". Logistic regression analysis was used to assess causal relationships of social activities with BICAMS scores. BICAMS scores, EDSS, gender, age at examination, education, and duration of the disease served as independent variables and "social activities" as the dependent variable.
Results: Analysis of variance demonstrated MS patients with higher numbers of cerebral lesions on MRI had lower scores in all domains of BICAMS, the SDMT, the CVLT2 and the BVMTR. Further, BICAMS scores of all three domains were significantly lower in patients with brainstem and cerebellar lesions. As for social activities, patients categorized as "unemployed because of MS" had lower BICAMS scores than employed patients. However, scores in domains of BICAMS did not have independent effects on other social activities.
Conclusion: It was demonstrated that associations of BICAMS scores with MRI findings and social activities are important in Japanese MS patients.

P21 Cognitive reserve is associated with better employment status in both adult and pediatric-onset multiple sclerosis

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Introduction: information on the impact of pediatric-onset multiple sclerosis (POMS) on employment status in adulthood is limited.
Aim of study: This study aims at comparing employment status in POMS versus AOMS patients and the role of cognitive performance and cognitive reserve (CR).
Methods: POMS and AOMS patients were recruited. Cognitive function was assessed through the Rao's Brief Repeatable Battery and Stroop Test. Cognitive impairment (CI) was defined as the failure of at least 3 tests. CR was estimated. Rate of unemployment was recorded. Linear and logistic multivariable regression analyses were performed.
Results: 111 adult POMS and 115 AOMS patients were enrolled. Compared with AOMS, adult POMS subjects were younger (32.0+/-9.7 years vs 38.8+/-9.3 years; p<0.001) and had a longer disease duration (16.9+/-9.8 years vs 12.1+/-7.9 years; p<0.001). CR tended to be decreased in POMS vs AOMS (p=0.05). Proportion of CI was 36% in POMS and 33% in AOMS (p=0.64). There was no difference in unemployment rate comparing POMS (30.0%) and AOMS (33.3%, p=0.621) as well as in occupational complexity (p=0.729). In the whole sample, unemployment was associated with higher EDSS score (OR=1.27 95%CI 1.01-1.59, p=0.044) and lower education (OR=0.81 95%CI 0.72-0.91, p<0.001). Higher occupational complexity was associated with higher education (B=0.076,p<0.001) and higher scores on the NART (B=0.020, p<0.040).
Conclusions: CR is a key contributor to better employment attainment in adulthood. Our findings underscore the importance of early interventions focusing on intellectual enrichment enhancement, particularly in the pediatric MS population, in order to contribute to better socio-professional attainment in adulthood.

P22 Contrasting Patterns of Cognition Related to Depression and Anxiety in Persons with MS

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Introduction: Psychiatric comorbidities are common in multiple sclerosis (MS), with much higher prevalence (anxiety: 21.9%, depression: 23.7%; Marrie et al 2015) than the general population. Cognitive decline is also common in persons with MS; distinct relationships of depression and anxiety to cognition are not well understood in MS.
Aim: Examine relationships of elevated depression and anxiety to cognition across multiple domains.
Methods: 51 RRMS patients participated: 41 female (80%); age= 40.5±9.7 years; IQ=112.9±10.2; education= 16.0±1.8 years; disease duration 7.5±6.8 years. Depression (Beck Depression Inventory-II), anxiety (measured as high neuroticism, NEO Five Factor Inventory), and cognition across domains [Symbol Digit Modalities

Test; Digit Span forward+back; Stroop Color Word Test; verbal fluency (FAS, animals), Selective Reminding Test, learning & delayed recall; Brief Visuospatial Memory Test, learning & delayed recall]. Defining high anxiety as a neuroticism score of T≥65 yielded groups of high (n=7) and low (n=44) anxiety; high depression defined as BDI≥20 yielded groups of high (n=24) and low (n=27) depression. MANCOVAs controlling for age, sex, education and IQ evaluated cognitive differences between anxiety / depression subgroups.
Results: Whereas high anxiety group (compared to low) only differed in verbal memory [learning F(1,50)=5.406, p=.025, delayed recall F(1,50) = 5.759, p=.021], high depression group (compared to low) performed worse on SDMT [F(1,50)= 4.835, p=.033] and digit span [F(1,50)= 5.963, p=.019].
Conclusion: Even with limited power to detect differences, our results suggest that depression and anxiety are related to different cognitive functions in MS, possibly reflecting separable neural substrates and implicating distinct treatment targets.

P23 Vocational monitoring and clinical and cognitive variables. Argentinian adaptation of the Buffalo Vocational Monitoring Survey

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Background & Objectives: The Buffalo Vocational Monitoring Survey (BVMS) is a tool to characterize work-challenged patients and identify patients for intervention. Given the lack of an instrument in Spanish, we have proposed: to evaluate the adaptation of the Spanish version of the BVMS; to analyze the relationships between both negative events and clinical and cognitive variables, as well as accommodations and clinical and cognitive variables.
Methods: 83 patients with MS (95.2%RR, 1.2%SP, 3.6%PP) were included. 59% female; average age: 39.51±10.00 years; education: 14.20±2.92 years; EDSS: 2.56±1.90; disease evolution: 10.03±7.23. fatigue: 4.13±1.76; depression: 13.34±10.56. Outcomes measures: Argentina adaptation of the Buffalo Vocational Monitoring Survey; EDSS, BDI II & Fatigue Scale. Cognitive outcomes: *BICAMS* comprises the SDMT, CVLT & BVMT-R; 7/24 Visuospatial Scale, PASAT2"-3" and Verbal fluency. Two factors were obtained: Clinical factor (EDSS-fatigue-depression) with a Cronbach's α 0.358 and Cognitive factor (SDMT-CVLT-BVMT-R) with a Cronbach's α 0.792. Psychometric evaluation included a professional translator, face and content validity procedure performed by an expert, a field test to verify the understanding of the contents and external criterion validity.
Results: Regarding external criterion validity, between employees (dependent and self-employed) vs. unemployed (unemployed-retired) significant differences were obtained: Cognitive Factor (p=.021), SDMT (p=.009), BVMT-R(p=.005), Pasat3 (p=.005) and Pasat2 (p=.001). Depression (p=.044), Fatigue (p=.017), Clinical Factor (p=.005), Verbal Fluency (p=.016), Pasat3 (p=.004) and Pasat2 (p=.008) differentiate patients with and without negative events. Verbal memory (p=.335) and Cognitive factor (p=.407) differentiate the presence of accommodations.
Conclusion: This Spanish version is a new tool to monitor employment difficulties in Spanish-speaking MS patients.

P24 **MS and Employment in Argentina: current perspectives and challenges**

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Background: Cognitive and clinical symptoms can have significative negative effects on employment status. The identification of these factors will allow mitigating unemployment in Multiple Sclerosis (MS) patients.
Objectives: To examine the relationship between employment status (no employment, part-time employment, and full-time employment) and clinical and cognitive variables; to analyze the relationship between work hours and clinical and cognitive variables.
Methods: 83 MS patients (95.2%RR, 1.2%SP, 3.6%PP) were included. 59% female; mean age: 39.51±10.00 years; mean education: 14,20±2.92 years; EDSS: 2.56±1.90; disease evolution: 10.03±7.23. fatigue: 4.13±1.76; depression: 13.34±10.56
Outcomes measures: Argentina adaptation of the Buffalo Vocational Monitoring Survey, EDSS, BDI II, Fatigue Scale. Cognitive outcomes: BICAMS (SDMT-CVLT-BVMTR); 7/24 Visuospatial Scale, PASAT 2"-3" and Verbal fluency.
Results: 18.75% are unemployed and 81.25% employees, of which 36.05% are full-time employees. Education (p= .026), Cognitive factor (p= .007), SDMT (p= .009), BVMTR (p= .003), Pasat3 (p= .026), Pasat2 (p= .008), 7/24 Visuospatial Scale (p= .007) and Cognitive Factor (p= .033), differentiate the unemployed patients from the employed patients.
EDSS (p= .002), disease evolution (p= .003) and depression (p= .022) differentiate between employees full time and part time. According to working hours, it differentiates patients who work than 30 hours per week, EDSS (p=.023), disease evolution (p=.002), CVLT (p=.047) and SDMT (p=.018).
Conclusion: Cognitive factors differentiate between employed and non-employed patients, while physical disability, disease evolution and depression differentiate between full-time and part-time patients. Processing speed and verbal memory, together with the physical disability and disease evolution influence the number of hours worked.

P25 **Emotional recognition and its relation to cognition, mood and fatigue in Relapsing-Remitting and Secondary-Progressive Multiple Sclerosis.**

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Introduction: A recent study of our group evidenced that emotional recognition difficulties in MS patients (pMS) relate with a different GM atrophy pattern in Secondary-Progressive (SP-MSp) and Relapsing-Remitting (RR-MSp). Furthermore, SP-MSp performe significantly worse than matched healthy controls in the emotional recognition task, while RR-MSp do not.
Aim of study: Aim of this study is to understand how the above reported differences between the two MS phenotypes relate with cognition, mood and fatigue aspects.

Methods: A total of 43 pMS (27RR-MSp/ 16 SP-MSp) underwent a clinical assessment and performed the Reading the Mind in the Eyes test (RMEt), the MACFIMS battery and completed mood (STAI; STAXI, BDIfs) and fatigue (MFIS) questionnaires. Both groups' performances on the REMt were then correlated with all these measures.
Results: Analyses revealed that REMt scores of RR-MSp were significantly correlated with the impairment degree in some MACFIMS scores: CVLT-DR (p=.029), D-KEFS card sorting tasks (p=.034; p=.045) and the global degree of cognitive impairment (0.25). REMt scores of SP-MSp correlated with the BVMTR-IR score, but were also significantly correlated with fatigue (.002), anxiety (.002), anger (.003), and depression (.002).
Conclusions: Results of this study offer a possible explanation of the previously found different pattern of emotional recognition between RR-MSp and SP-MSp. Emotional recognition performances relate only to cognitive aspects in Relapsing-Remitting patients while relate mainly to mood aspects in patients with the Secondary-Progressive course. We can hypothesize that emotional dysfunction is a further sign of disease progression.

P26 Communicating Cognitive Problems in MS: The effect of indirect language and stigma consciousness on subjective and objective memory performance

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Background: Communication about cognitive decline in MS may contribute to, or diminish, the occurrence of cognitive problems.
Aims: (1) to examine if the language used in logically equivalent messages about cognitive problems affects cognitive problem reporting and cognitive performance, and; (2) to what extent patients' level of stigma consciousness plays a role in the relationship between communication and cognitive performance.
Methods: 420 MS patients were randomized into one of two experimental conditions that presented information about the occurrence of cognitive problems among MS patients using either a direct negative frame (e.g., "increased memory problems"), or an indirect positive frame (e.g., "decreased memory ability"); or to a no information control group (CG) that did not mention cognitive problems. Subjective cognitive performance and objective memory performance (verbal learning and memory) were assessed. Stigma consciousness was measured using the Stigma Consciousness Questionnaire.
Results: In the direct negative and the indirect positive frame 138 patients were included; 125 patients participated in the CG. Stigma consciousness increased problem reporting (b = -7.10, t=-2.20, p =.0284 [CI -13.45; -0.75]), and decreased recognition scores (b = -1.12, t=-2.24, p =.026 [CI -2.10; -0.14]) following an indirect positive frame. The effects could not be explained by mood.

Conclusions: For highly stigma conscious MS patients, direct negative frames are preferred over indirect positive frames. Indirect communication may backfire for these patients, and contribute to subjective and objective memory problems. The effects differ from, and cannot explain, the often observed problems in encoding among this patient group.

P27 Social cognition and psychological/neuropsychological indices in people with multiple sclerosis

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Introduction: Social cognition(SC) is a complex cognitive construct, which concerns the capacity of read/interpret others' emotions and mental states to provide adequate social responses. Despite the recent interest in multiple sclerosis(MS) literature, results are still conflicting in this field and currently little is known about its relations with neuropsychological, personality and well-being features.
Aim of study: To explore deeply SC's features in people with MS(PwMS) compared to healthy controls(HC) and to analyze potential correlations with neuro-psychological, personality and well-being features.
Methods: Fifty-five PwMS(16SP,2PP,38RR) and forty-nine demographically-matched HC were recruited by phone/mail and interviewed about socio-demographical/clinical data, after giving their consent to study participation.
All subjects underwent: 1)a cognitive assessment, the Brief Repeatable Battery of Neuropsychological Tests, the D-Kefs Sorting, the Stroop and the Brief Intelligence tests; 2)a specific SC investigation, the Story-based Empathy Task, the Empathy Quotient, the Toronto Alexithymia Scale-20 and the Italian Battery of SC; 3) the complation of a series of questionnaires, the Multiple Sclerosis Quality of Life-54 or the Short Form Health Survey-36, the Beck Depression Inventory-II, the State-Trait Anxiety Inventory-Y and the Big Five Inventory.
Results: As expected, PwMS and HC significantly differed but not in alexithymia (PwMS:44.7±12.9, HS:42.5±11.6;p=.388), verbal (PwMS:45.5±9.9, HS:47.7±9.9;p=.274) and non-verbal empathy tasks (PwMS:15.8±2.2, HS:16.3±1.8;p=.172). These results correlate partially with neuropsychological, personality and well-being indices.
Conclusions: In our samples, PwMS present alexithymia and empathy features comparable to controls, with differences partially related to neuropsychological, personality and well-being indices. This understanding could add knowledge to SC in MS, elucidating its relevance in clinical settings.

P28 Socioeconomic level and employment status in people with Multiple Sclerosis: Argentine present

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Background: Socioeconomic Status (SES) can be an indicator of the job opportunities the population may achieve.
Objectives: To examine the SES of a MS population an it´s relationship with employment status; To study the relationship between the SES and the employment characteristics (employed, professional self-employed and non-professional self-employed) and to analyze the relationship between the SES and the type of working area: specialized (which requires formal education) versus non-specialized (which requires experience or training).
Methods: 83 patients with MS (95.2% RR, 1.2% SP and 3.6% PP) were included. 59% women; average age: 39.51±10.00 years; education: 14.20±2.92 years; EDSS: 2.56±1.90; evolution of the disease 10.03±7.23. Outcome measures: Argentinian adaptation of the Buffalo Vocational Monitoring Survey; Socioeconomic Level index (SLI) with five degrees level: high (ABC1), medium (C2), medium-low (C3), low (D1), low-low (D2-E).
Results: The SES of the studied population was distributed as follow: 20.5% ABC1, 24.1% C2, 24.1% C3, 18.1% D1, 7.2% D2-E. An association was found between SES and the employment status ($\chi 2 = 3.96$, $p = .047$), and also between SES and the employment characteristics (employed, professional self-employed and non-professional self-employed) ($\chi 2 = 6.71$, $p = .010$). Another association was found between SES and the type of working areas ($\chi 2 = 19.01$, $p = .000$).
Conclusion: 49.4% of the studied population had a SES of medium-low to low-low, which have a negative impact on their employment status. Those who access an employment develop non-specialized self-employed works.

3. Effect of disease modifying therapies and other medications on neurocognitive status

P29 Start to run: The effects of a 12-week community-based running training on hippocampal connectivity and visuospatial memory in persons with MS

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Introduction: Animal and human studies have demonstrated that exercise induces hippocampal plasticity and improves memory function. In multiple sclerosis (MS), this relationship is less well studied.
Aim: To examine the effects of a community-based running intervention on resting-state functional connectivity (FC) of the hippocampus and its relationship with visuospatial memory.
Methodes Twenty-nine MS patients were assigned either to a 12-week running program (n=15, mean age 38.1 ± 8.1 years) or to a waiting list control group (n=14, 44.2 ± 5.6 years). Before and after 12 weeks participants' visuospatial memory was assessed with the spatial recall test (SPART) and participants underwent resting-state functional MRI (fMRI) at 3 Tesla. FC was calculated between the bilateral hippocampus and the default mode network (DMN). SPART-scores and FC values were analyzed with 2x2 ANOVAs with group and time as factors. Change scores (post-pre) for SPART and FC were calculated.
Results: There was a significant group*time interaction effect on the SPART, in favor of the intervention group (F(1,27)=5.82, p=.023). No significant interaction effects were observed for FC of the bilateral hippocampus with the DMN. However, in the intervention group, the change in SPART scores correlated significantly with the change in FC between bilateral hippocampus and DMN (r=.66, p=.013).
Conclusion: A 12-week running program improved visuospatial memory function in MS patients. Improvements on SPART were associated with increased FC of the hippocampus with the DMN. We conclude that exercise benefits memory function in patients with MS, which might be a result of increased hippocampal connectivity.

P30 Integrative CNS Plasticity with Exercise in MS: The PRIMERS (PRocessing, Integration of Multisensory Exercise-Related Stimuli) Conceptual Framework

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Introduction: There is a proliferation of research examining the effects of exercise on cognition in the general population and those with multiple sclerosis (MS), as well as focal research examining possible neural mechanisms of such effects. However, there is seemingly a lack of focus on what it is about exercise, in particular, that drives adaptive CNS neuroplasticity.

Aim of Study: We propose a novel conceptual framework (i.e., PRIMERS) that describes such adaptations as occurring via activity-dependent neuroplasticity based on the integrative processing of multisensory input and associated complex motor output that is required for the regulation of exercise behavior.
Methods: This framework provides a step-by-step focus on the processing and integration of multisensory input and associated complex motor output required for the regulation of exercise behavior. This framework then describes how the sensorimotor experience of exercise behavior might lead to improved efficiency of communication within and across neural networks and potential downstream improvements in cognition over time.
Results: The PRIMERS conceptual framework can be applied to encapsulate observations in animal and human exercise research in general and MS describing exercise-related changes in brain structure/function. This framework further can be systematically tested in MS.
Conclusions: This conceptual framework sets the stage for the systematic examination of the effects of exercise on brain connectivity, brain structure, and molecular/cellular mechanisms that explain improvements in cognition in general and in MS. We argue that exercise can be viewed as an integrative, systems-wide approach for rehabilitation as impaired cognition is common and debilitating in MS.