



Symposium

Outcome measures in MS physical rehabilitation

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Pathophysiology of MS

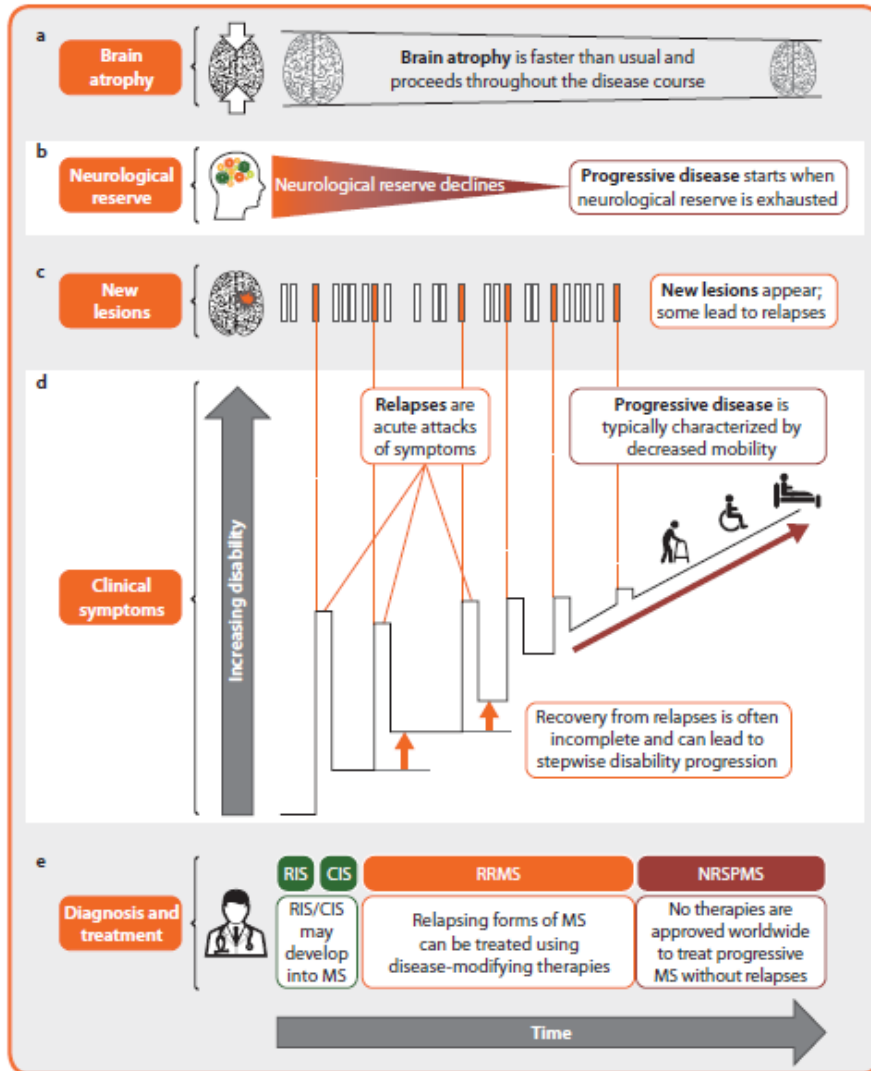
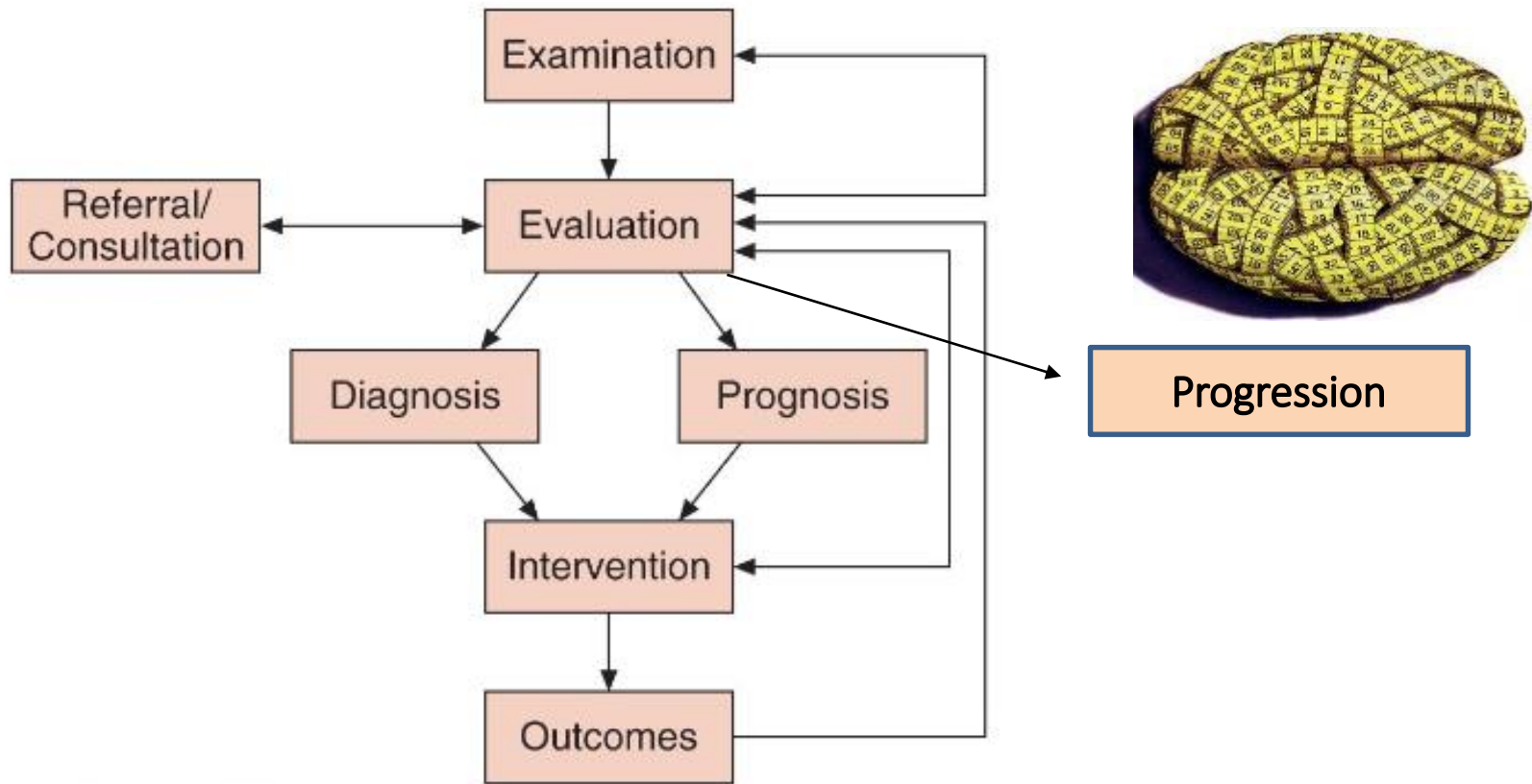


Figure 2. The damage caused by MS typically leads to relapses followed by progressive disease.

- Chronic disease
- 'Active' versus 'non-active' disease
 - Relapses
 - Progression
- Motor learning potential & Neuroplasticity

Target of my 'evaluation'

Components of a Conceptual Framework for Clinical Practice



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Within-day and between-day *variability* & Responsiveness: *Clinical meaningful change*

Complexity in MS



70.4% Numbness, tingling

53.7% Headache

Dizziness **41.6%**

49% Cognitive dysfunction

Vision problems **38.9%**

54% Depression

Emotional changes **53.9%**

35.7% Speech/swallowing problems

Hearing loss **15.2%**

13.8% Breathing problems

Pain **63.2%**

89.6% Fatigue

Bladder dysfunction **50.8%**

38.1% Sexual dysfunction

Bowel dysfunction **26%**

60.8% Muscle spasms

Seizures **3.9%**

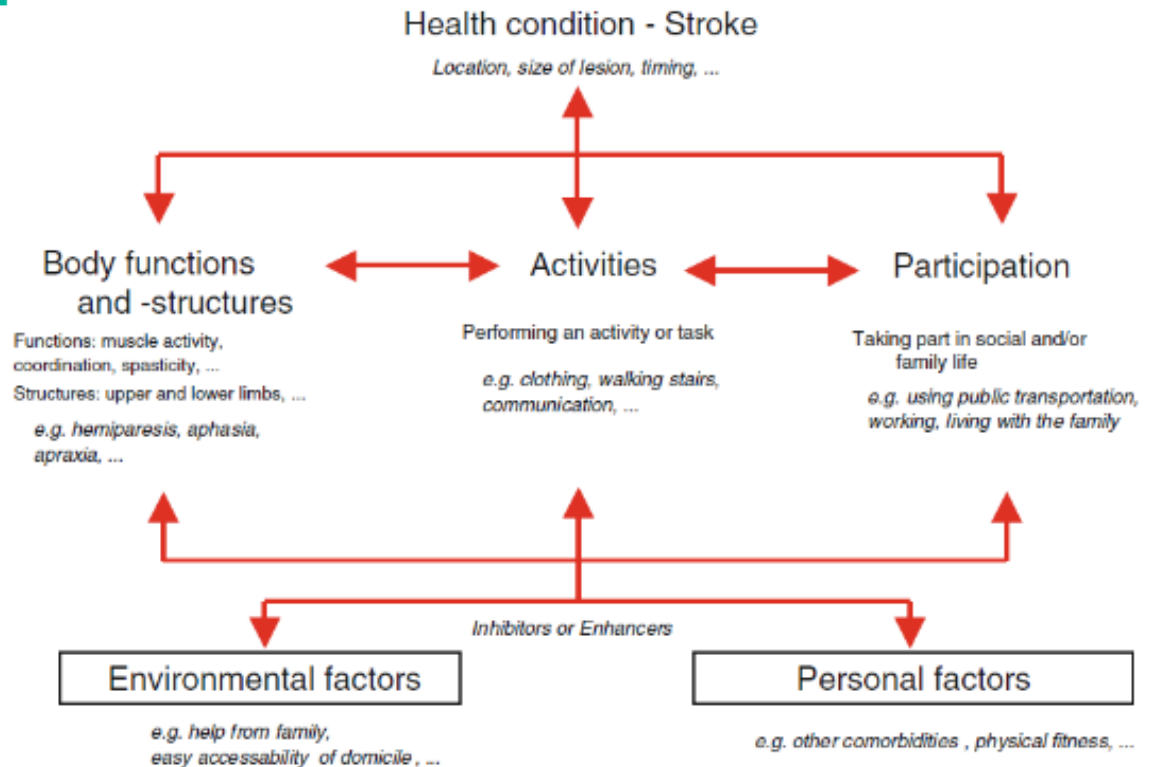
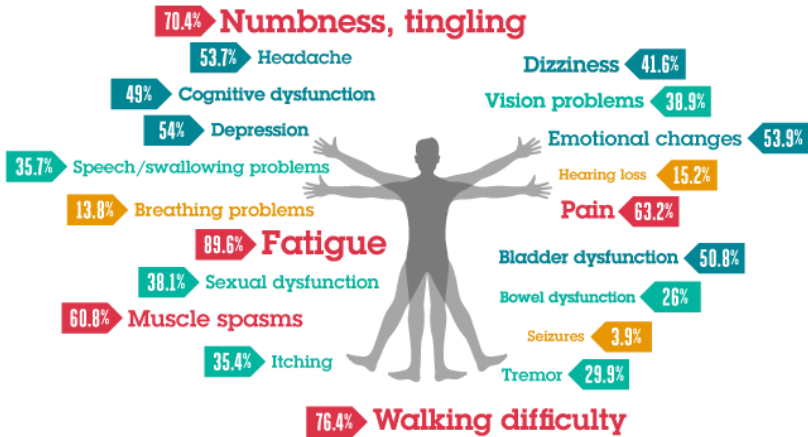
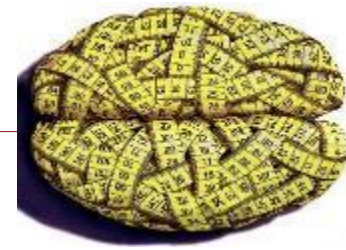
35.4% Itching

Tremor **29.9%**

76.4% Walking difficulty



ICF framework: What's related?



Outcome measures in physical rehabilitation

- Reductionistic by nature
- But necessary
- What to recommend?
 - Motor domain: mobility
 - Motor domain: upper limb
 - Fatigue
 - Health-related quality of life



Table 1. Instruments to measure impairment related to different MS symptoms.

Symptom		Instrument(s)
Balance, walking capacity and endurance		BBS FES 2 or 6MWT T25-FW MSWS-12
Arm functioning		9-HPT ABILHAND MAM
Cognition		BICAMS PASAT
Visual		Visual acuity
Fatigue		FSS MFIS FMSC
Anxiety and depression		HADS STAI Beck's depression
Pain		BPI VAS
Quality of life		MSIS-29 SF-36 EQ-5D

Measuring UPPER LIMB FUNCTION

Upper Limb Assessment in Multiple Sclerosis: A Systematic Review of Outcome Measures and their Psychometric Properties

Ilse Lamers, MSc, Silke Kelchtermans, BSc, Ilse Baert, PhD, Peter Feys, PhD

ICF ACTIVITY Level: CAPACITY



Nine Hole Peg Test

ICF ACTIVITY Level: PERFORMANCE

MANUAL ABILITY MEASURE

Difficulty of performance of
uni- and bilateral activities

ABILHAND

Difficulty to perform **bilateral**
activities



Motor domain: Walking capacity tests

- **10MWT \approx T25FW (timed 25 foot walk; 7,62 meter)**

As fast as possible. Static start.

Clinical benchmarks:

- $\geq 6''$: change in occupation, walking with a cane, need for help with some instrumental ADL
- $\geq 8''$: unemployed, increased use of government health care, walking with walker, inability to do instrumental ADL

However, limited sensitivity to change in mild disability.

- **2/6MWT**

Normative data available for 6MWT (golden standard)

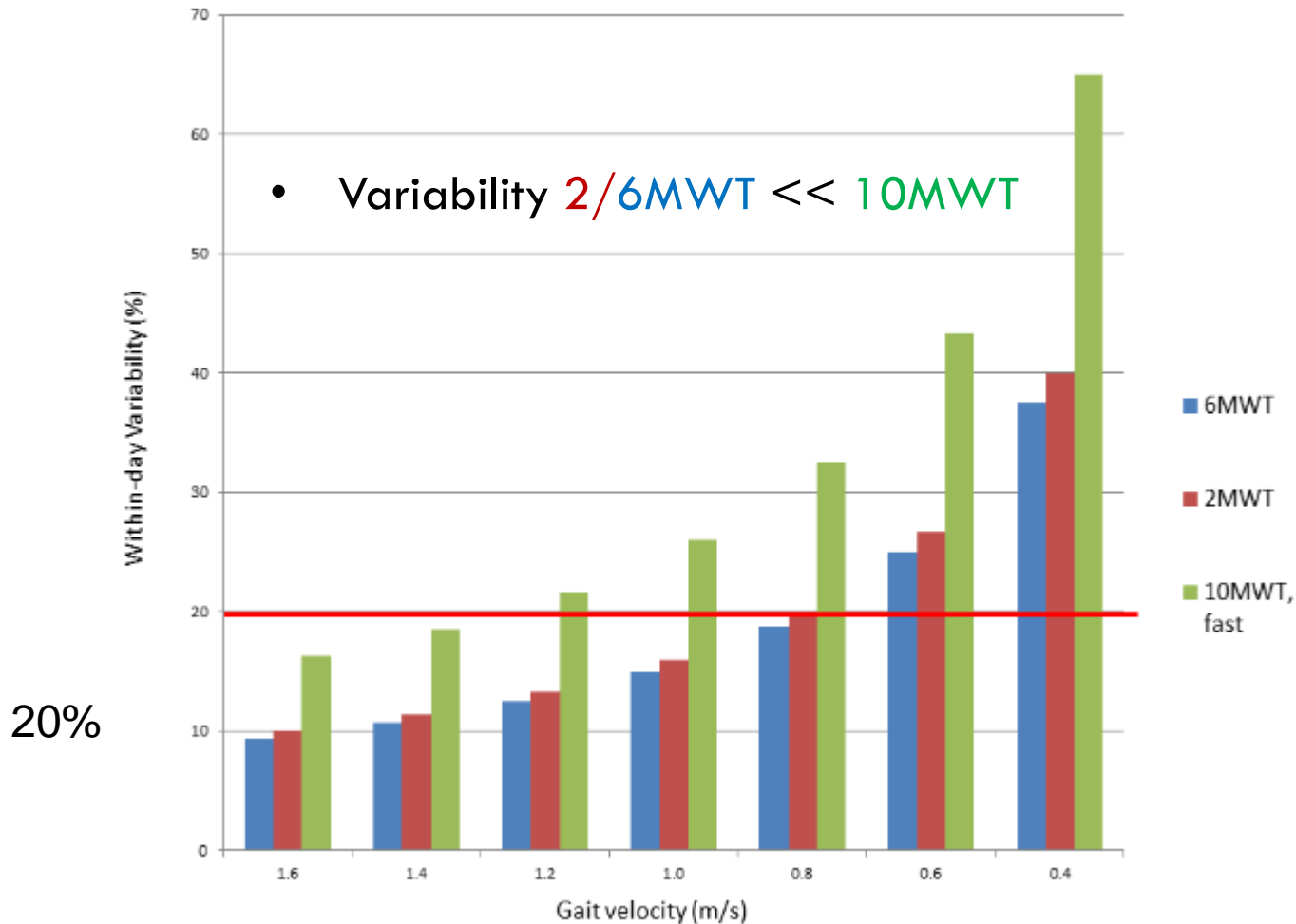
Superior sensitivity to change than T25FW

Clinical meaningful change: 2MWT = 9,6m. 6MWT = 21,5m

6MWT also recommended by www.rehabmeasures.org

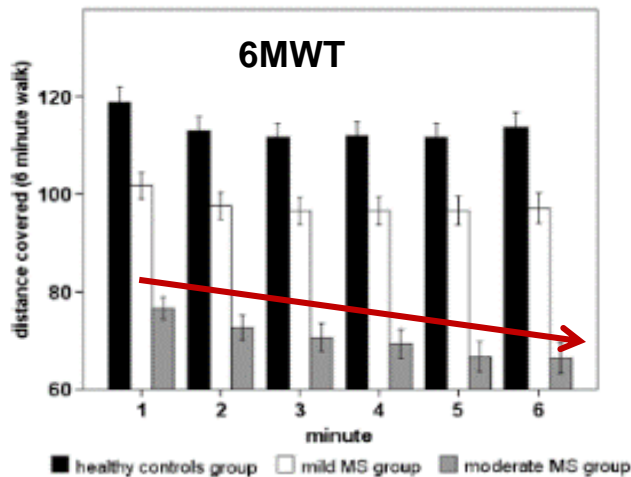


Within-day Variability across the disability spectrum

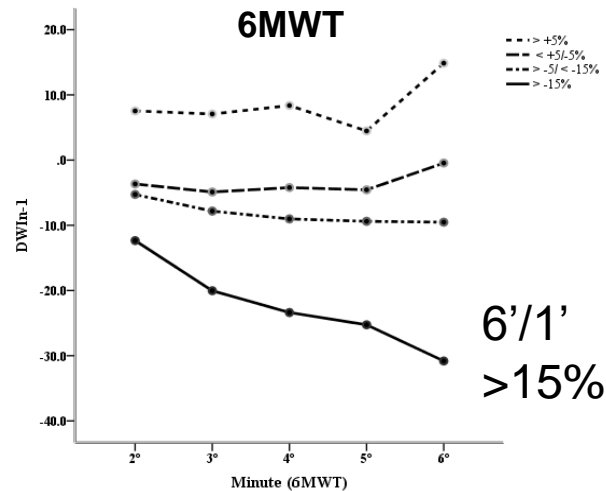


Variability increases with disability level, often >20%

Measuring Motor fatigue during walking in MS



McLoughlin et al. , 2015



Leone, Feys et al (2015) NNR

Review

The Assessment of Motor Fatigability in Persons With Multiple Sclerosis: A Systematic Review

Deborah Severijns, PhD¹, Inge Zijdewind, PhD², Ulrik Dalgas, PhD³, Ilse Lamers, PhD¹, Caroline Lismont¹, and Peter Feys, PhD¹

Severijns et al. (2017) NNR

Neurorehabilitation and Neural Repair
1-19
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DOI: 10.1177/1545968317690831
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Treadmill walking & gait pattern



Sehle, Dettmers et al. , 2011

Motor domain: perceived walking ability

MSWS-12 items: 0-60

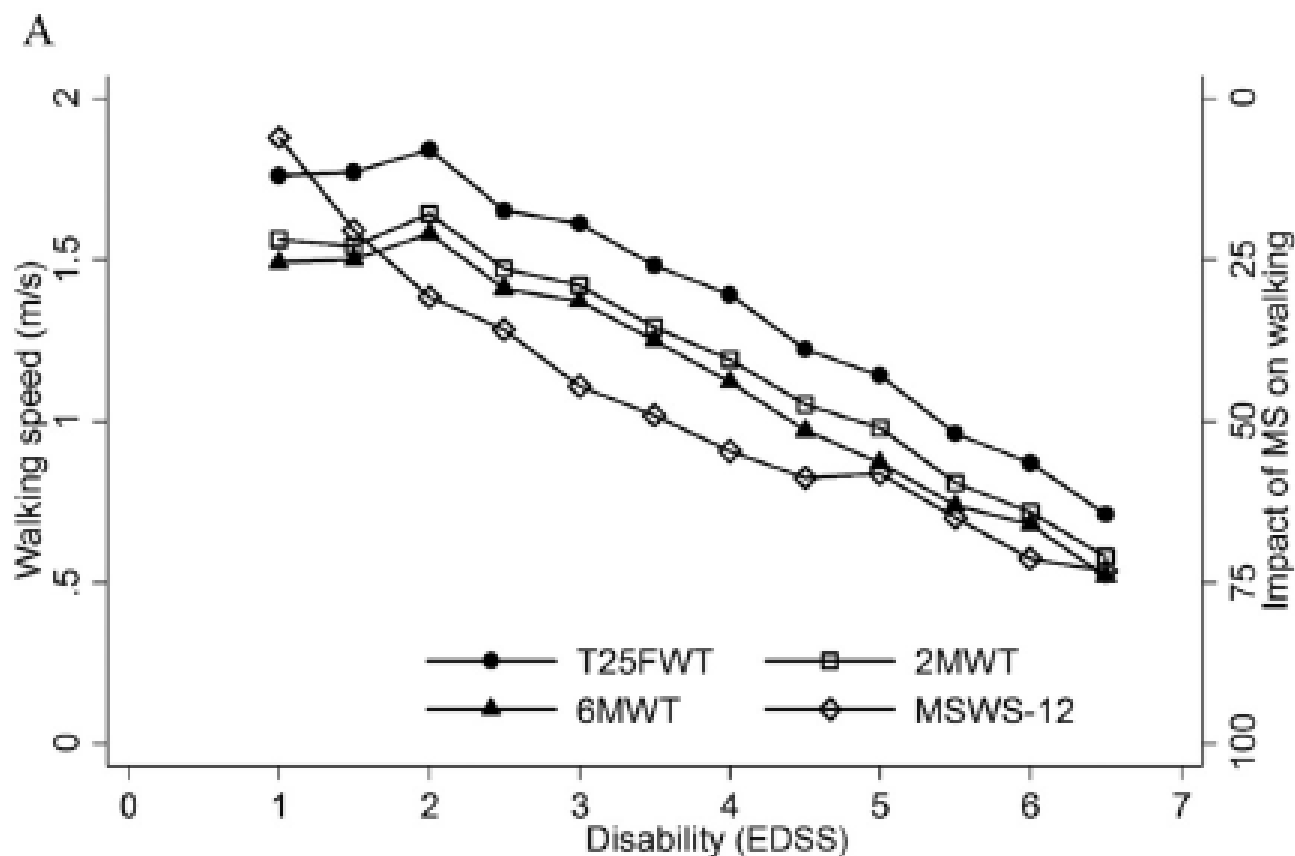
MS walking scale. Score 0-1

‘How much impact has MS on your ...’ (0-4)

- Standing
- Ability to run
- Need for support
- Moving around the home
- Concentration needed to walk
- Walking speed
- Maintaining balance
- Climbing stairs
- Walking distance
- Effort needed to walk
- Ability to walk
- Gait

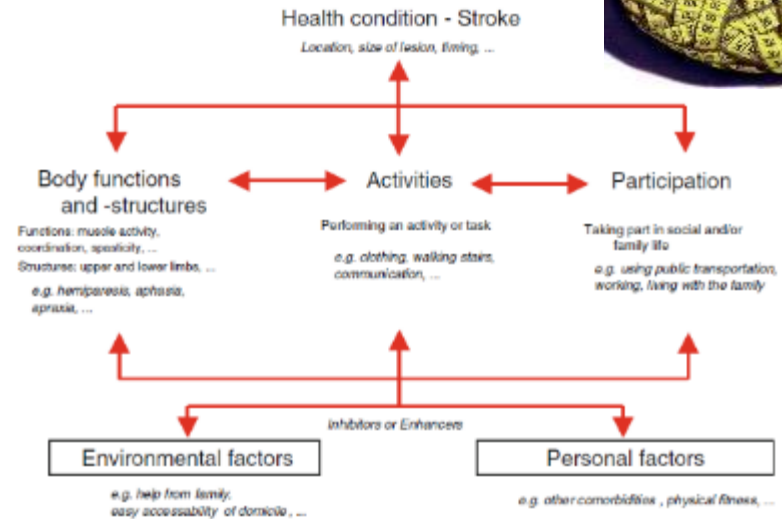
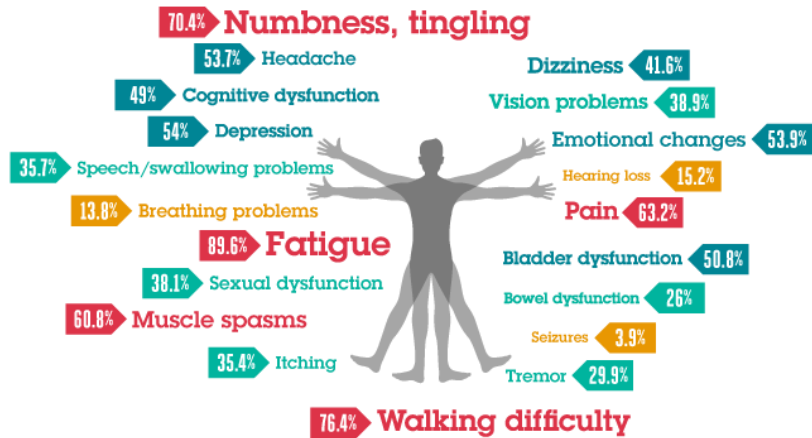
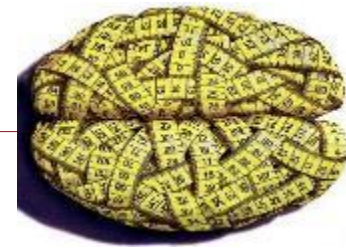


MSWS-12 is best related to neurological disease in the early MS phase compared to tests



Meaningful change values of MSWS-12: **8-10**

ICF framework: What's related?



Walking capacity is NOT related to overall subjective fatigue in pwMS.

Walking capacity measured by 2/6MWT relates to daily walking activity in disabled persons with MS.

Walking may be impacted by underlying impairments as muscle weakness, hypertonia, incoordination, dizziness and balance.

Feys et al (2012) Effect of time of day on walking
Gijbels et al (2010) Predictive value of walking capacity tests



Multiple Sclerosis Spasticity Scale (MSSS-88)

- SELF-REPORT QUESTIONNAIRE

- 88 items

- 8 domains // ICF

- This questionnaire asks how **bothered** you have been by your spasticity in the **past two weeks**.
- **By spasticity we mean muscle stiffness and spasms.**
- By **bothered** we mean how distressed or upset you have been by any of the following problems.

MSSS-88 scale

Muscle stiffness	Pain and discomfort	Muscle spasms	ADL	Walking	Body movements	Emotional health	Social functioning
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Body function

Activity

Participation

Section 6:

This section concerns the effect of spasticity on your body movements.

As a result of your <i>spasticity</i>, how much in the past two weeks have you been bothered by:	Not at all bothered	A little bothered	Moderately bothered	Extremely bothered
57. Difficulties moving freely?	1	2	3	4
58. Difficulties moving smoothly?	1	2	3	4
59. Limited range of movement?	1	2	3	4
60. Difficulties moving parts of your body?	1	2	3	4
61. Difficulties bending your limbs?	1	2	3	4
62. Your body being resistant to movement?	1	2	3	4
63. Your body or limbs feeling locked?	1	2	3	4
64. Awkward or jerky movement?	1	2	3	4
65. Difficulties straightening your limbs?	1	2	3	4
66. Difficulties relaxing parts of your body?	1	2	3	4
67. No control over your body?	1	2	3	4

Section 5:

This section concerns the effect of spasticity on your ability to walk.

If you cannot take any steps at all, even with help, please tick this box and ignore questions 47 to 56.

As a result of your <i>spasticity</i>, how much in the past two weeks have you been bothered by:	Not at all bothered	A little bothered	Moderately bothered	Extremely bothered
47. Difficulties walking smoothly?	1	2	3	4
48. Being slow when walking?	1	2	3	4
49. Having to concentrate on your walking?	1	2	3	4
50. Having to increase the effort needed for you to walk?	1	2	3	4
51. Being slow when going up or down stairs?	1	2	3	4
52. Being clumsy when walking?	1	2	3	4
53. Tripping over or stumbling when walking?	1	2	3	4
54. Feeling like you are walking through treacle?	1	2	3	4
55. Losing your confidence to walk?	1	2	3	4
56. Feeling embarrassed to walk?	1	2	3	4

Section 4:

This section concerns the effect of spasticity on your daily activities.

As a result of your <i>spasticity</i>, how much have you been limited in your ability over the past two weeks to carry out the following daily activities? (please circle 4 if you are unable to do the activity).				
	Not at all limited	A little limited	Moderately limited	Extremely limited
36. Putting on your socks or shoes ?	1	2	3	4
37. Doing housework such as cooking or cleaning?	1	2	3	4
38. Getting in and out of a car?	1	2	3	4
39. Getting in and out of shower and/or bath?	1	2	3	4
40. Sitting up in bed?	1	2	3	4
41. Getting into or out of bed?	1	2	3	4
42. Turning over in bed?	1	2	3	4
43. Getting into or out of a chair?	1	2	3	4
44. Getting dressed or undressed?	1	2	3	4
45. Getting on or off the toilet seat?	1	2	3	4
46. Drying yourself with a towel?	1	2	3	4

Outcome measures in physical rehabilitation

- Reductionistic by nature
- What to recommend?
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Measuring FATIGUE & FATIGUE IMPACT

- Fatigue Severity (FSS)
- Fatigue Scale Motor Cognitive functioning (FSMC) – 9 points cut-off
- **Modified Fatigue Impact Scale (MFIS)**
38 cut-off point to differentiate normal versus abnormal fatigue
Clinical meaningful change: 10 points

Questions over the period of last 2 weeks

Instructions for Scoring the MFIS

Items on the MFIS can be aggregated into three subscales (physical, cognitive, and psychosocial), as well as into a total MFIS score. All items are scaled so that higher scores indicate a greater impact of fatigue on a person's activities.

Physical Subscale

This scale can range from 0 to 36. It is computed by adding raw scores on the following items: 4 + 6 + 7 + 10 + 13 + 14 + 17 + 20 + 21.

0-36

Cognitive Subscale

This scale can range from 0 to 40. It is computed by adding raw scores on the following items: 1 + 2 + 3 + 5 + 11 + 12 + 15 + 16 + 18 + 19.

0-40

Psychosocial Subscale

This scale can range from 0 to 8. It is computed by adding raw scores on the following items: 8 + 9.

0-8

Total MFIS Score

The total MFIS score can range from 0 to 84. It is computed by adding scores on the physical, cognitive, and psychosocial subscales.

0-84



Modified fatigue impact scale (0-84)

	Never	Rarely	Sometimes	Often	Almost Always
1. I have been less alert.	0	1	2	3	4
2. I have had difficulty paying attention for long periods of time.	0	1	2	3	4
3. I have been unable to think clearly.	0	1	2	3	4
4. I have been clumsy and uncoordinated.	0	1	2	3	4
5. I have been forgetful.	0	1	2	3	4
6. I have had to pace myself in my physical activities.	0	1	2	3	4
7. I have been less motivated to do anything that requires physical effort.	0	1	2	3	4
8. I have been less motivated to participate in social activities.	0	1	2	3	4
9. I have been limited in my ability to do things away from home.	0	1	2	3	4
10. I have trouble maintaining physical effort for long periods.	0	1	2	3	4
11. I have had difficulty making decisions.	0	1	2	3	4
12. I have been less motivated to do anything that requires thinking	0	1	2	3	4
13. My muscles have felt weak	0	1	2	3	4
14. I have been physically uncomfortable.	0	1	2	3	4
15. I have had trouble finishing tasks that require thinking.	0	1	2	3	4
16. I have had difficulty organizing my thoughts when doing things at home or at work.	0	1	2	3	4
17. I have been less able to complete tasks that require physical effort.	0	1	2	3	4
18. My thinking has been slowed down.	0	1	2	3	4
19. I have had trouble concentrating.	0	1	2	3	4
20. I have limited my physical activities.	0	1	2	3	4
21. I have needed to rest more often or for longer periods.	0	1	2	3	4



Questions related to physical effort

Health-related Quality of Life

Multiple Sclerosis Impact Scale: MSIS-29

- Total score: 29-145

Clinical meaningful change: 8 points

- Physical score: 20-100
- Psychological score: 9-45

In the <u>past two weeks</u> , how much has your MS limited your ability to...		Not at all	A little	Moderately	Quite a bit	Extremely
1.	Do physically demanding tasks?	1	2	3	4	5
2.	Grip things tightly (e.g. turning on taps)?	1	2	3	4	5
3.	Carry things?	1	2	3	4	5

MSIS-29

In the <u>past two weeks</u>, how much have you been bothered by...		Not at all	A little	Moderately	Quite a bit	Extremely
4.	Problems with your balance?	1	2	3	4	5
5.	Difficulties moving about indoors?	1	2	3	4	5
6.	Being clumsy?	1	2	3	4	5
7.	Stiffness?	1	2	3	4	5
8.	Heavy arms and/or legs?	1	2	3	4	5
9.	Tremor of your arms or legs?	1	2	3	4	5
10.	Spasms in your limbs?	1	2	3	4	5
11.	Your body not doing what you want it to do?	1	2	3	4	5
12.	Having to depend on others to do things for you?	1	2	3	4	5

MSIS-29

In the <u>past two weeks</u>, how much have you been bothered by...		Not at all	A little	Moderately	Quite a bit	Extremely
13.	Limitations in your social and leisure activities at home?	1	2	3	4	5
14.	Being stuck at home more than you would like to be?	1	2	3	4	5
15.	Difficulties using your hands in everyday tasks?	1	2	3	4	5
16.	Having to cut down the amount of time you spent on work or other daily activities?	1	2	3	4	5
17.	Problems using transport (e.g. car, bus, train, taxi, etc.)?	1	2	3	4	5
18.	Taking longer to do things?	1	2	3	4	5
19.	Difficulty doing things spontaneously (e.g. going out on the spur of the moment)?	1	2	3	4	5
20.	Needing to go to the toilet urgently?	1	2	3	4	5

MSIS-29

21.	Feeling unwell?	1	2	3	4	5
22.	Problems sleeping?	1	2	3	4	5
23.	Feeling mentally fatigued?	1	2	3	4	5
24.	Worries related to your MS?	1	2	3	4	5
25.	Feeling anxious or tense?	1	2	3	4	5
26.	Feeling irritable, impatient, or short tempered?	1	2	3	4	5
27.	Problems concentrating?	1	2	3	4	5
28.	Lack of confidence?	1	2	3	4	5
29.	Feeling depressed?	1	2	3	4	5

Take home Messages

- **Main motor domains** at activity level
 - Walking capacity AND perceived ability
 - 6MWT is most recommended for a 'full picture' but 2MWT has also robust psychometric properties
 - MSWS-12 is likely an ecologically valid instrument for overall mobility
 - Upper limb function
 - NHPT is golden standard and easy to apply
 - MAM or ABILHAND have high ecological validity
- **Fatigue**
 - Important symptom in MS
 - MFIS is sensitive to physical interventions, and includes a 'physical' part
- **Health-related quality of life**
 - MSIS-29 is comprehensive and includes the physical domain, both severity of symptoms and perceived impact

COGNITIVE-MOTOR INTERFERENCE

Measuring the cost of cognitive-motor dual tasking during walking in multiple sclerosis

Carmela Leone, Francesco Patti and Peter Feys

$$DTC = \frac{\text{single task} - \text{dual task}}{\text{single task}} \times 100$$



Dual task questionnaires
Evans et al., Schrouwen et al

Single motor task = 15" walking (or longer)
Single cognitive task = subtraction by 7 or 3
or 'word list generation'
(phonetic, semantic)
or 'alternating alfabet task'
Combined dual motor-cognitive task = 15" walking

Percentages >10% may indicate on an abnormal dual task cost

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UHASSELT

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