Assessment and Treatment Planning for people with Multiple Sclerosis

Jenny Freeman

Faculty of Health and Human Sciences

Plymouth University

RESEARCH WITH PLYMOUTH UNIVERSITY

Overview

Aimed at junior therapists

Proposed learning outcomes:

1. Key elements of assessment pertinent at different time points in the disease course

2. Overview of evidence for (some) commonly used interventions

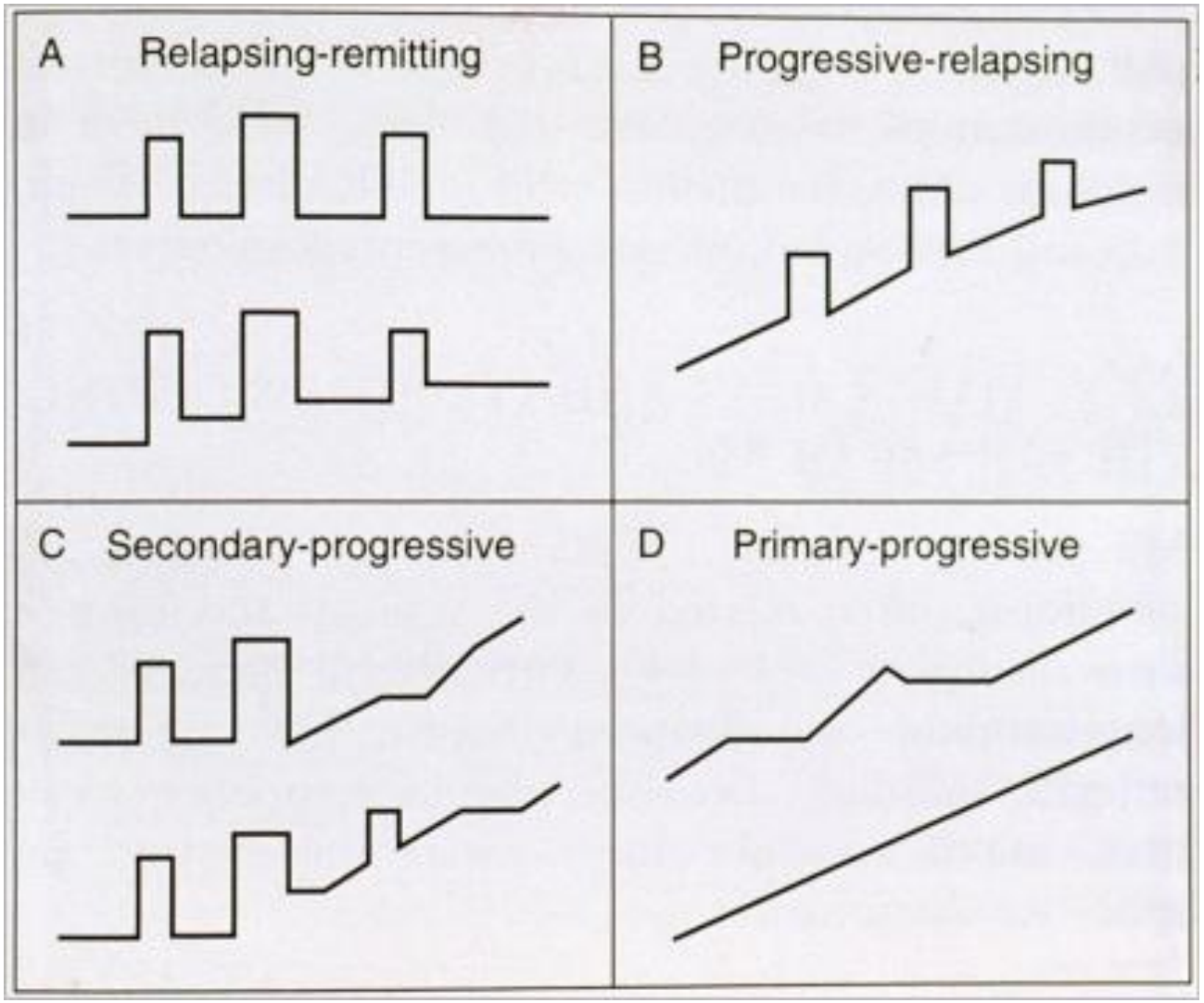
3. Identify (some) measures feasible for clinical practice, and how they can guide management

MS Symptoms

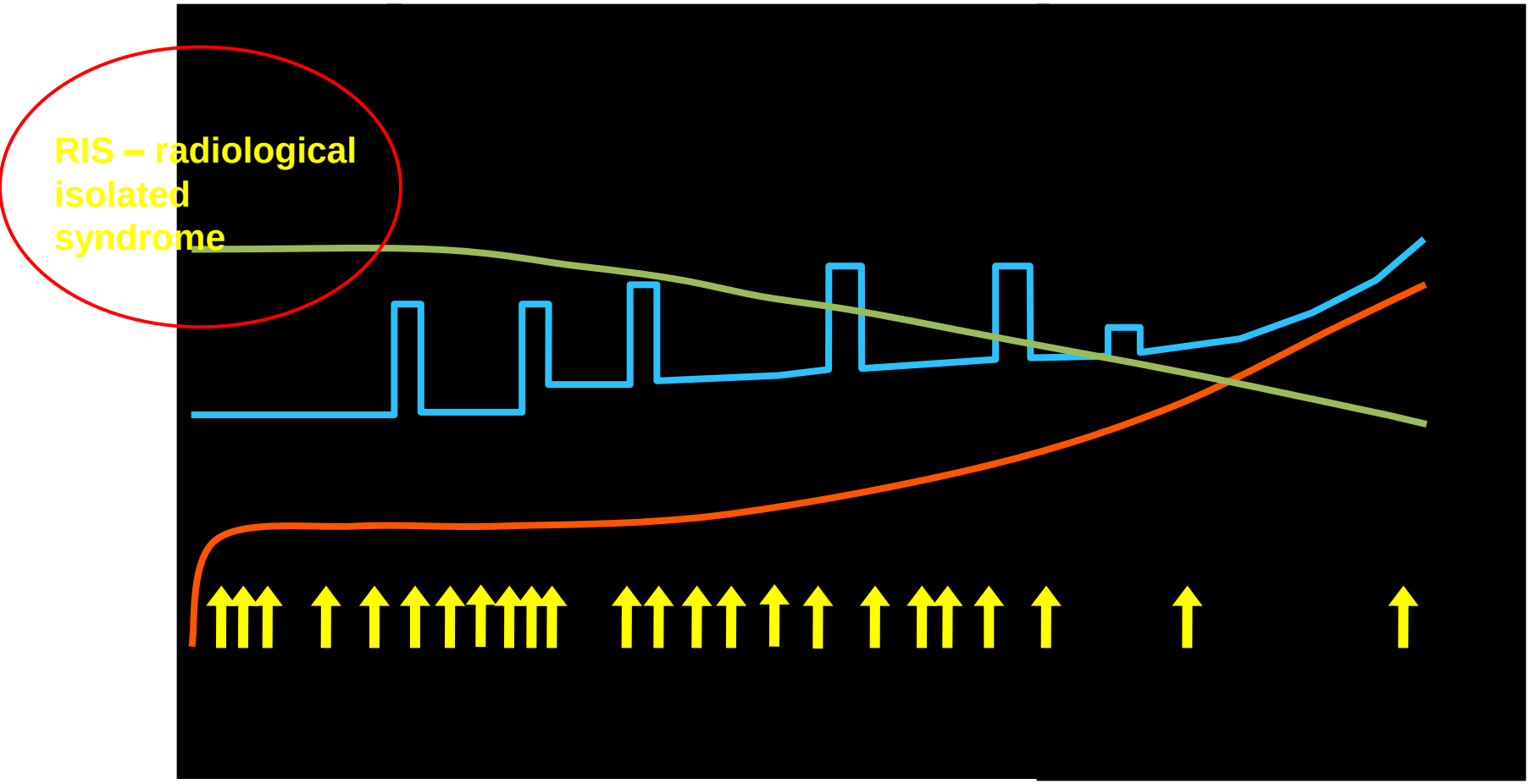
- Fatigue
- Weakness
- Poor co-ordination
- Spasticity
- Sensory disturbance
- Visual disturbance
- Swallowing difficulties
- Bladder & bowel dysfunction
- Sexual dysfunction
- Communication difficulties
- Pain
- Vertigo
- Cognitive difficulties
- Depression & anxiety

Variable, unpredictable, multi-factorial, generally progressive…. constantly changing need over the course of a lifetime

Natural History of MS



Natural History of MS: inflammation & axonal degeneration



ARTICLE

Multiple Sclerosis 2006; 12: 620–628

Gait and balance impairment in early multiple sclerosis in the absence of clinical disability

CL Martin[1,2], BA Phillips[1,2], TJ Kilpatrick[3,4], H Butzkueven[3,4], N Tubridy[3,6], E McDonald[5] and MP Galea[1,2]

This study evaluated the gait and balance performance of two clinically distinct groups of recently diagnosed and minimally impaired multiple sclerosis (MS) patients (Expanded Disability Status Scale range 0–2.5), compared to control subjects. Ten MS patients with mild pyramidal signs (Pyramidal Functional Systems 1.0), 10 MS patients with no pyramidal signs (Pyramidal Functional Systems 0) and 20 age- and gender-matched control subjects were assessed using laboratory-based gait analysis and clinical balance measures. Both MS groups demonstrated reduced speed and stride length ($P < 0.001$), and prolonged double limb support ($P < 0.02$), compared to the control group, along with alterations in the timing of ankle muscle activity, and the pattern of ankle motion during walking,

Contents lists available at SciVerse ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Body-worn motion sensors detect balance and gait deficits in people with multiple sclerosis who have normal walking speed

R.I. Spain[a,*], R.J. St. George[b], A. Salarian[c], M. Mancini[b], J.M. Wagner[d], F.B. Horak[b], D. Bourdette[a]

[a] *Neurology Service and MS Center of Excellence-West, Portland VA Medical Center and Department of Neurology, Oregon Health & Science University, Portland, OR, USA*
[b] *Department of Neurology, Oregon Health & Science University, Portland, OR, USA*
[c] *Balance Disorders Lab, Oregon Health & Science University, Beaverton, OR, USA*
[d] *Department of Physical Therapy and Athletic Training, Saint Louis University, St. Louis, MO, USA*

ARTICLE INFO

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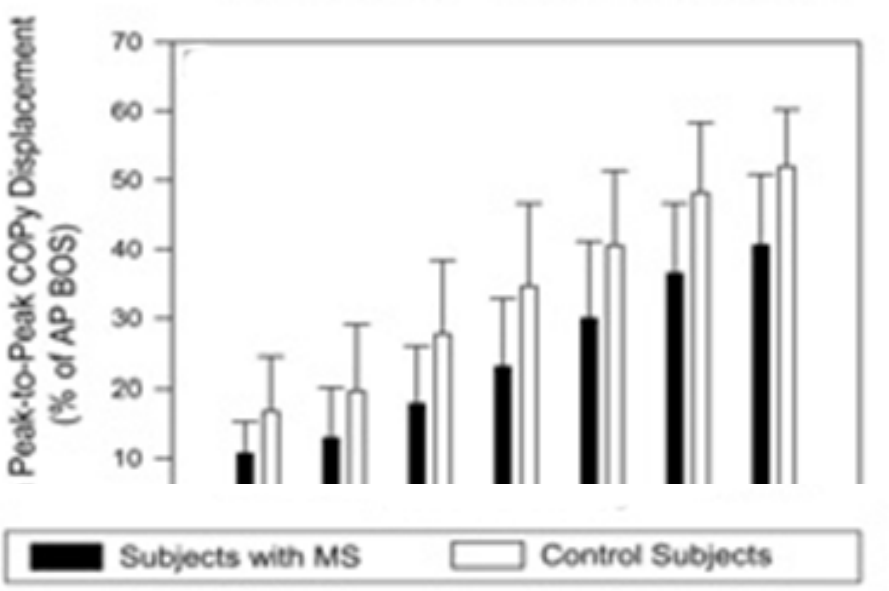
ABSTRACT

While balance and gait limitations are hallmarks of multiple sclerosis (MS), standard stopwatch-timed measures practical for use in the clinic are insensitive in minimally affected patients. This prevents early detection and intervention for mobility problems. The study sought to determine if body-worn sensors could detect differences in balance and gait between people with MS with normal walking speeds and

- Reduced speed
- Shorter strides
- Prolonged double limb support phase
- Altered muscle activity and kinematics
- Skeletal changes

(Gehlsen et al 1986, Benedetti 1999, Morris 2002; Savci 2005, Martin 2006)

Balance impairment in those with no / minimal functional disability



(Kurst 2005, Martin 2006)

Lowered physical activity level

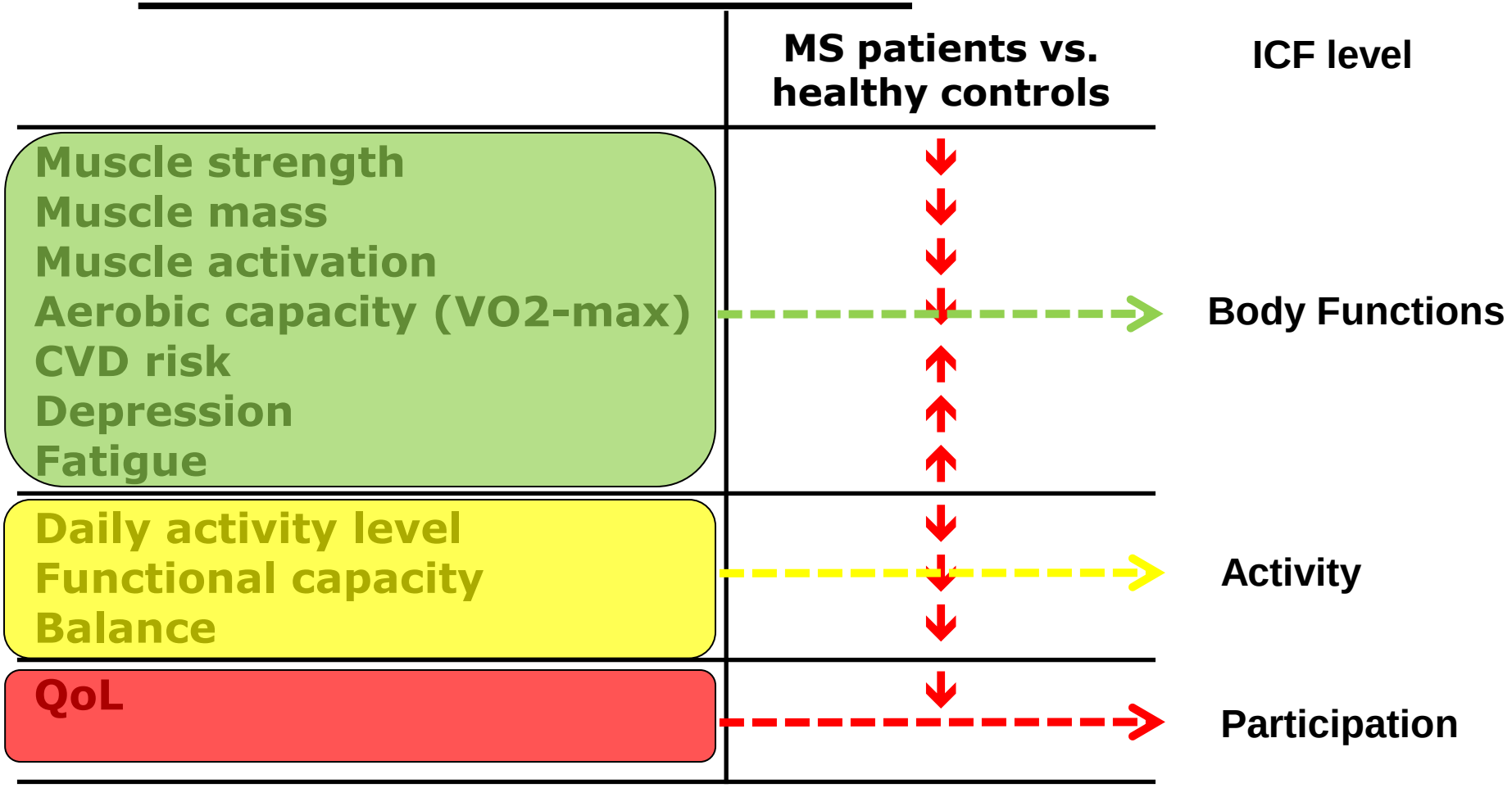
Physical activity and multiple sclerosis: a meta-analysis

Robert W Motl, Edward McAuley and Erin M Snook*
Department of Kinesiology, University of Illinois at Urbana-Champaign, Urbana, IL, USA

Using meta-analytic procedures, this study involved a quantitative synthesis of the difference in physical activity among individuals with multiple sclerosis (MS) compared with nondiseased and diseased populations and then examined factors (i.e., moderators) that explain variation in the overall difference in physical activity. We searched MEDLINE, PsycINFO and Current Contents Plus using the key words physical activity, exercise and physical fitness in conjunction with multiple sclerosis; conducted a manual search of bibliographies of the retrieved papers; and contacted study authors about additional studies. Overall, 53 effects were retrieved from 13 studies with 2360 MS participants and yielded a weighted mean effect size (ES) of −0.60 (95% CI = −0.44, −0.77). The weighted mean ES was heterogenous, Q = 1164.11, df = 52, P <0.0001. There were larger effects with objective versus self-report measures of physical activity, nondiseased versus diseased populations and primary progressive versus relapsing–remitting MS. The cumulative evidence suggests that individuals with MS are less physically active than nondiseased, but not diseased, populations.
Multiple Sclerosis *(2005)* **11**, 459–463

Mult. Scler 2005; 11:4:459-63

MS patients vs. healthy controls



Red arrow = Impaired in MS patients

Motl & Pillutti, Nat Rev Neurol; Sep;8(9):487-97.*2012*

Dalgas et al. Mult. Scler.14(35);35-53:2008

Slide from Dalgas, RIMS 2014

One of the first questions to ask is….

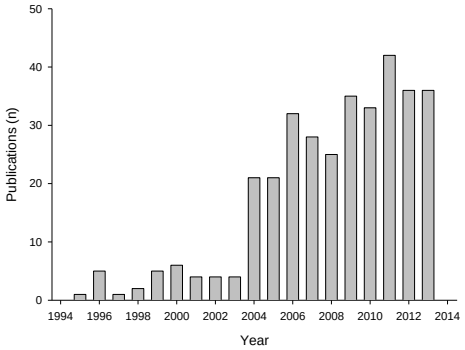
What are you currently doing to manage your health?

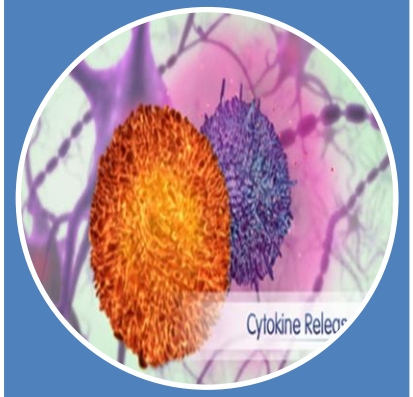
What exercise do you currently undertake?

Is there anything that is putting you off exercising?

Lets see how I can help as exercise has proven to be beneficial.

Exercise Research: Bench to Bedside

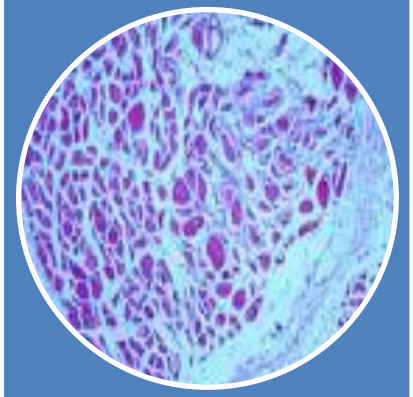




Neuroplasticity

Neural health

Immunology



Muscle

and

neural physiology

Factors impacting

on exercise

capability

Evaluation of

effectiveness

Collaboration between basic scientists, clinical trialists and clinicians

Safety of Exercise

Short Report

JOURNAL | MSJ

Multiple Sclerosis Journal
0(00) 1–4

DOI: 10.1177/1352458511415143
msj.sagepub.com
SAGE

Multiple sclerosis relapses are not associated with exercise

A Tallner[1], A Waschbisch[2], I Wenny[2], S Schwab[2], C Hentschke[1], K Pfeifer[1] and M Mäurer[2,3]

Abstract

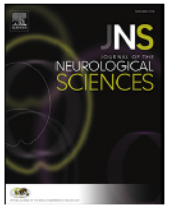
Since multiple sclerosis (MS) often affects physically active young individuals, it is important to know if exercise can result in increased disease activity. Therefore we used a self-report questionnaire to examine the relationship of different levels of sports activity and relapses in 632 patients with MS. In order to analyse whether subjective recall might have biased the results, we performed, in a subgroup of our sample, an objective assessment of clinical data and physical fitness parameters. We were unable to find any association between sports activity and clinical relapses in either of the two analyses. The group with highest activity even shows the lowermost mean values, standard deviations and range concerning the number of relapses. Our data suggest that physical activity has no significant influence on clinical disease activity.

Journal of the Neurological Sciences xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns



Review article

The safety of exercise training in multiple sclerosis: A systematic review

Lara A. Pilutti [a,*], Matthew E. Platta [a], Robert W. Motl [a], Amy E. Latimer-Cheung [b]

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2013;94:1800-28

REVIEW ARTICLE (META-ANALYSIS)

Effects of Exercise Training on Fitness, Mobility, Fatigue, and Health-Related Quality of Life Among Adults With Multiple Sclerosis: A Systematic Review to Inform Guideline Development

Amy E. Latimer-Cheung, PhD,[a] Lara A. Pilutti, PhD,[b,c] Audrey L. Hicks, PhD,[b] Kathleen A. Martin Ginis, PhD,[b] Alyssa M. Fenuta, HBSc,[b] K. Ann MacKibbon, PhD,[b] Robert W. Motl, PhD[c]

From the [a]School of Kinesiology and Health Studies, Queen's University, Kingston, Ontario; [b]Department of Kinesiology, McMaster University

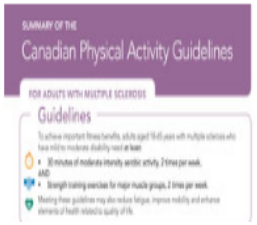
Canadian Physical Activity Guidelines and Canadian Sedentary Behaviour Guidelines

www.csep.ca/guidelines

Use the links below to download or order the Canadian Physical Activity Guidelines and Canadian Sedentary Behaviour Guidelines info sheets and related resources. For more information and background on the Canadian Physical Activity Guidelines and Canadian Sedentary Behaviour Guidelines, please visit the Background Information page.

Link to page: Canadian Physical Activity Guidelines for Adults with Multiple Sclerosis

Canadian Physical Activity Guidelines for Adults with Multiple Sclerosis

Guidelines Info Sheet	UPDATED! September 2013 Guidelines for MS Toolkit	UPDATED! September 2013 Toolkit Insert
		

Resistance Exercise: 2-3/week at moderate intensity (60-80% 1RM, 10 – 15 repetitions, 1-3 sets), minimum 8 weeks

Aerobic Exercise: 2-3/week at moderate intensity (60-80% max HR), 30 minutes, minimum 4 weeks

Effects of Exercise therapy

	MS patients vs. healthy controls		
Muscle strength	↓		↑↑
Muscle mass	↓		↑
Muscle activation	↓		↑
Aerobic capacity (VO2-max)	↓	↑↑	
CVD risk	↑	↓	↓
Depression	↑	↓	↓
Fatigue	↑	↓	↓
Daily activity level	↓	↑	↑
Functional capacity	↓	↑	↑
Balance	↓	↑	↑
QoL	↓	↑	↑

Red arrow = Impaired in MS patients

Green arrow = Improved after exercise in MS patients

Motl & Pillutti, Nat Rev Neurol; Sep;8(9):487-97.*2012*

Dalgas et al. Mult. Scler.14(35);35-53:2008

Slide from Dalgas, RIMS 2014

BrAMS

BS7 gym

A gym based group intervention for people with MS and high level balance dysfunction

Tania Burge, MS Specialist Physiotherapist
Angela Davies Smith, MS Research Physiotherapist
David Cottrell, Consultant Neurologist

UWE

Slide from Tania Burge / BrAMS / October 2014

Circuits and cardio training

Multi tasking element





Hand ball

Cricket

Slide from Tania Burge / BrAMS / October 2014

Research Paper

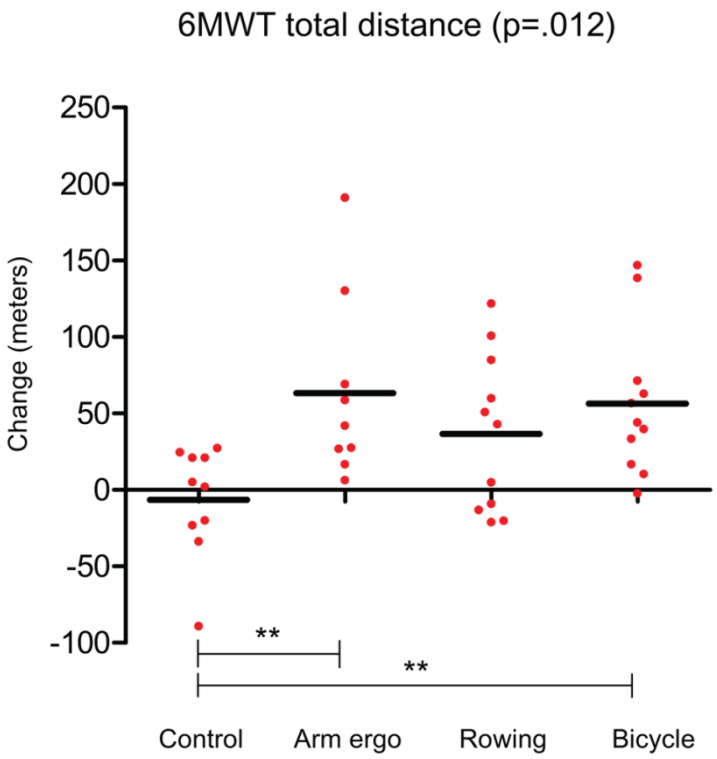
MULTIPLE SCLEROSIS JOURNAL | MSJ

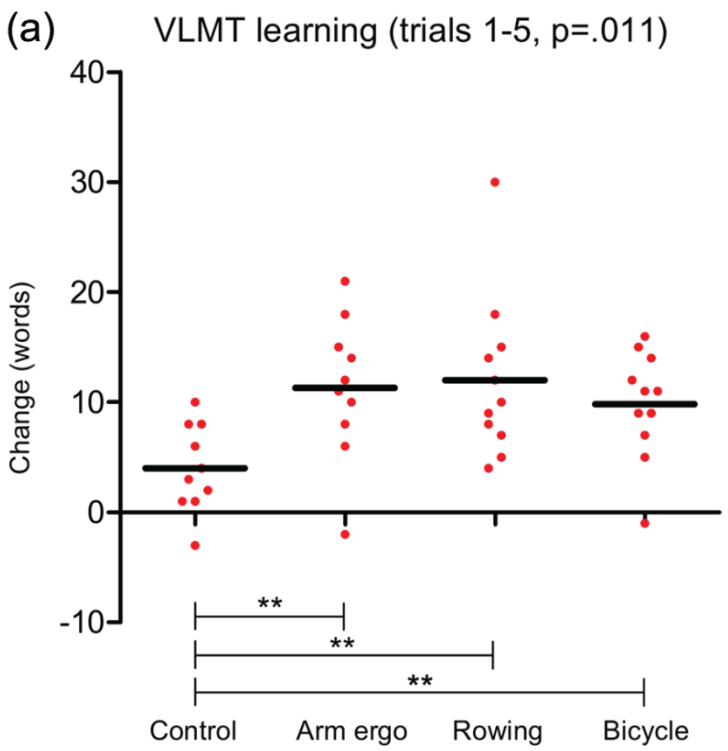
Multiple Sclerosis Journal
2014, Vol. 20(3) 382–390

DOI: 10.1177/1352458513507358
msj.sagepub.com
SAGE

Effects of exercise on fitness and cognition in progressive MS: a randomized, controlled pilot trial

S Briken[1,2], SM Gold[1], S Patra[3], E Vettorazzi[4], D Harbs[3], A Tallner[5], G Ketels[6], KH Schulz[3,7] and C Heesen[1,2]





ORIGINAL ARTICLE

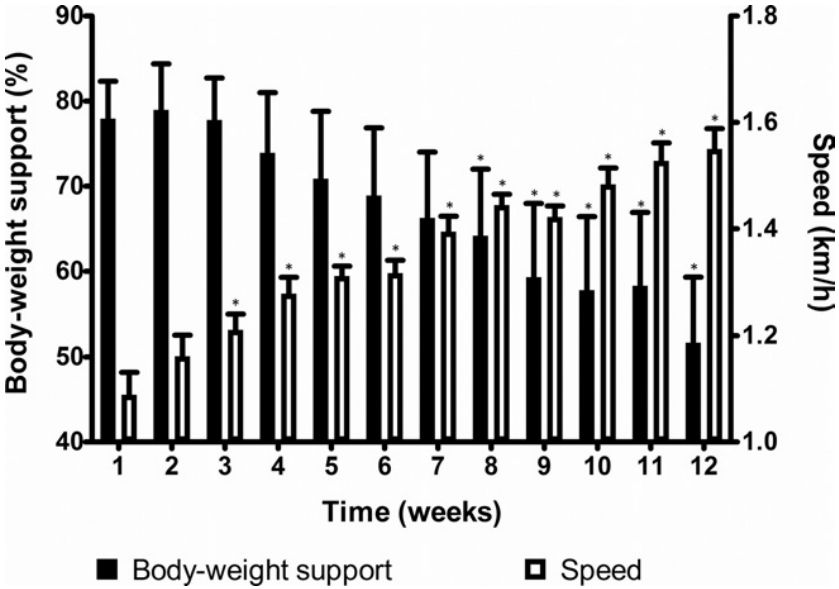
Effects of 12 Weeks of Supported Treadmill Training on Functional Ability and Quality of Life in Progressive Multiple Sclerosis: A Pilot Study

Lara A. Pilutti, BSc, BPHE, Danny A. Lelli, MD, John E. Paulseth, MD, Maria Crome, BKin, Shucui Jiang, MD, PhD, Michel P. Rathbone, MD, PhD, Audrey L. Hicks, PhD

ABSTRACT. Pilutti LA, Lelli DA, Paulseth JE, Crome M, Jiang S, Rathbone MP, Hicks AL. Effects of 12 weeks of supported treadmill training on functional ability and quality of life in progressive multiple sclerosis: a pilot study. Arch Phys Med Rehabil 2011;92:31-6.

Larger trials will be required to confirm these findings and to evaluate further the effects of BWSTT in progressive MS.

Key Words: Exercise; Fatigue; Multiple sclerosis; Quality of life; Rehabilitation.



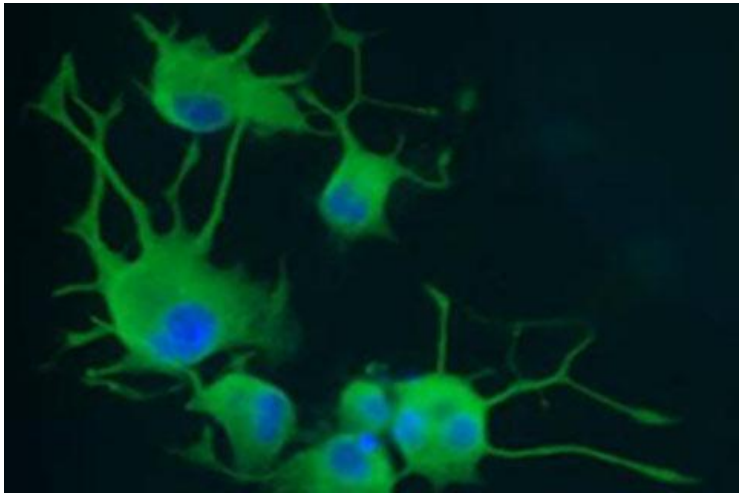
Review Article

Treadmill Training in Multiple Sclerosis: Can Body Weight Support or Robot Assistance Provide Added Value? A Systematic Review

Eva Swinnen,[1,2] David Beckwée,[1] Droesja Pinte,[1] Romain Meeusen,[1,2] Jean-Pierre Baeyens,[1,2] and Eric Kerckhofs[1,2]

[1] *Vakgroep KINE, Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Laarbeeklaan 103*

Impact of Physical Activity on Brain Health and the Immune System



- Neuroprotective,
- Neuroregenerative
- Neuroplasticity

enhancement of neurotrophic factors

enhance stress resistance

influences balance of pro/anti-inflammatory response

(Gold et al 2003; Heesen et al 2003; White et al 2006; White and Castellano 2008; Golzari et al. 2010)

…..what about balance interventions?

- 75% report balance problems, even in the very early stages
  (Martin 2006)

- Balance characteristics
  - ↑ sway in quiet stance
  - delayed anticipatory & automatic postural adjustments
  - ↓ ability to move towards the limits of stability

  (Cattaneo 2009, Huisinga 2012)

- More impairment in progressive forms of MS

  (Soyeur 2006)

- Associated with increased risk of falls

  (Gunn et al 2013, Cattaneo et al)

J Rehabil Med 2012; 44: 811–823

REVIEW ARTICLE

EFFECTS OF PHYSIOTHERAPY INTERVENTIONS ON BALANCE IN MULTIPLE SCLEROSIS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

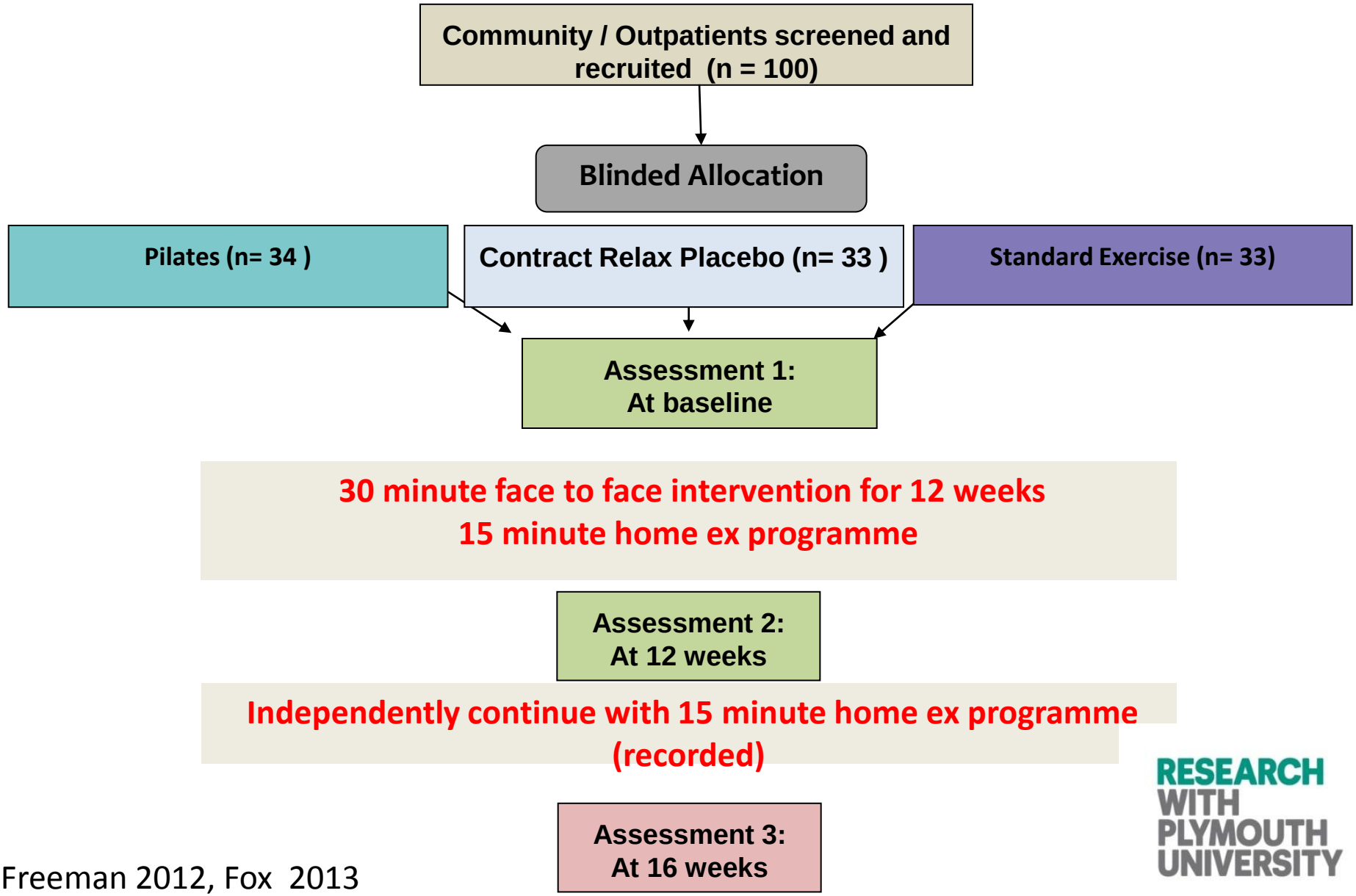
Jaana Paltamaa, PhD, PT[1,2,3], Tuulikki Sjögren, PhD, PT[3], Sinikka H. Peurala, PhD, PT[3,4] and Ari Heinonen, PhD, PT[3]

From the [1]JAMK University of Applied Sciences, School of Health and Social Studies, Jyväskylä, [2]Peurunka Medical Rehabilitation Center, Laukaa, [3]Department of Health Sciences, University of Jyväskylä, Jyväskylä and [4]Lahti Rehabilitation Centre, Lahti, Finland

Objective: **To determine the effects of physiotherapy interventions on balance in people with multiple sclerosis.**
Data sources: **A systematic literature search was conducted in Medline, Cinahl, Embase, PEDro, both electronically and by manual search up to March 2011.**

symptoms associated with MS cause mobility limitations (2), e.g. gait and balance disorders in later stages of the disease (1), and sometimes even early stages of the disease in recently diagnosed people with MS who present with no clinical disability (3, 4)

Pilates versus standardised exercise versus control ; a blinded randomised multi-centre controlled trial



Freeman 2012, Fox 2013

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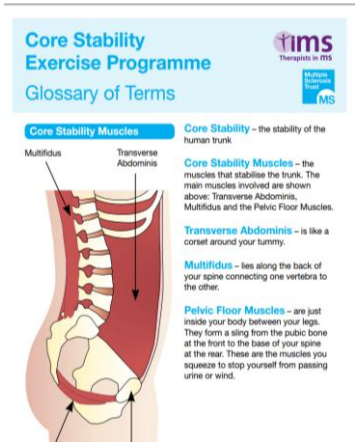
Pilates Versus Relaxation Control versus Standard Exercise



Balance and mobility improved with both exercise interventions (but not control)
Standardised exercises produced a larger magnitude of change, affected a broader range of measures, with a longer lasting effect

Fox 2013

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Dual Tasks

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Walking while talking—Difficulties incurred during the initial stages of multiple sclerosis disease process☆

Alon Kalron [a,c,*], Zeevi Dvir [b,c], Anat Achiron [a,c]

[a] Multiple Sclerosis Center, Sheba Medical Center, Tel Hashomer, Israel
[b] Institute of Motor Functions, Sheba Medical Center, Tel Hashomer, Israel
[c] Sackler Faculty of Medicine, Tel-Aviv University, Israel

J Neurol (2012) 259:1166–1176
DOI 10.1007/s00415-011-6321-5

ORIGINAL COMMUNICATION

Effects of dual tasking on the postural performance of people with and without multiple sclerosis: a pilot study

Jesse V. Jacobs · Susan L. Kasser

Received: 7 September 2011 / Revised: 4 November 2011 / Accepted: 7 November 2011 / Published online: 8 December 2011

Slower velocity
Increased double stance
Increased effort / concentration
Increased risk of falls

ORIGINAL ARTICLE

Walking and Thinking in Persons With Multiple Sclerosis Who Vary in Disability

Jacob J. Sosnoff, PhD, Morgan K. Boes, BS, Brian M. Sandroff, BS, Michael J. Socie, BS, John H. Pula, MD, Robert W. Motl, PhD

ABSTRACT. Sosnoff JJ, Boes MK, Sandroff BM, Socie MJ, Pula JH, Motl RW. Walking and thinking in persons with multiple sclerosis who vary in disability. Arch Phys Med Rehabil 2011;92:2028-33.

Objective: To examine the effect of a cognitive task on

MULTIPLE SCLEROSIS (MS) is a chronic, potentially disabling neurologic disease common among adults worldwide and in the United States. The relapsing form of disease involves episodes of focal inflammation in the central nervous system (CNS)[1] that result in demyelination and possible transection of axons. This progressive axonal damage

Clinical implications:

- Assess under different conditions
- Dual task activities need practice
- Specificity of balance & gait training

Wii / exergaming

Theoretical basis:

- Frequent, repetitive, varied movement essential for plasticity
- Ongoing feedback and progression of activities to ensure they are challenging

Typically:-

- 3-5 sessions/week
- 30 minute sessions
- Supervised / Not supervised
- Balance activities progressed
- Patient choice of games incorporated
- Telephone support / monitoring provided in some studies (eg Prosperini 2013)

Results of Wii studies suggest ….

- Standing balance (static and dynamic) improved
  - clinical (Berg, TUG, 4Sq Step Test, Gait variability, Timed balance tests)
  - lab based measures (force platform – reduced sway)

- Results compare to conventional balance training (but are not better)

- Increasing the training stimulus by playing on an unstable surface further enhances improvements with dual task conditions

  (Dettmer 2014)

- Adherence is very good in short term; although wanes over time

- Safety good (no incidents while training in any study) – some adverse events related to knee pain / hip pain similar to healthy literature

  (Prosperini 2013; Plow 2011)

- May reduce falls

- more than 50% fall within a 6 month period
- 30-45% prone to recurrent falls
- a progressive disease course is associated with a twofold increased odds of falling
- twofold increased risk of fall-related injuries compared to healthy individuals
- and a fear of falling which can lead to a loss of confidence and restriction in activity levels

(Nilsagard 2009, 2014; Gunn et al 2013, 2014)

Another key question to ask is….

Do you ever fall?

Falls

Clinical studies

- Establishing extent of problem
- Predicting those at risk
- Exploring patient perceptions

(Nilsagard 2009, 2014; Martin 2006. Matsuda et al 2012; Gunn et al 2013, 2014)

Outcome measurement

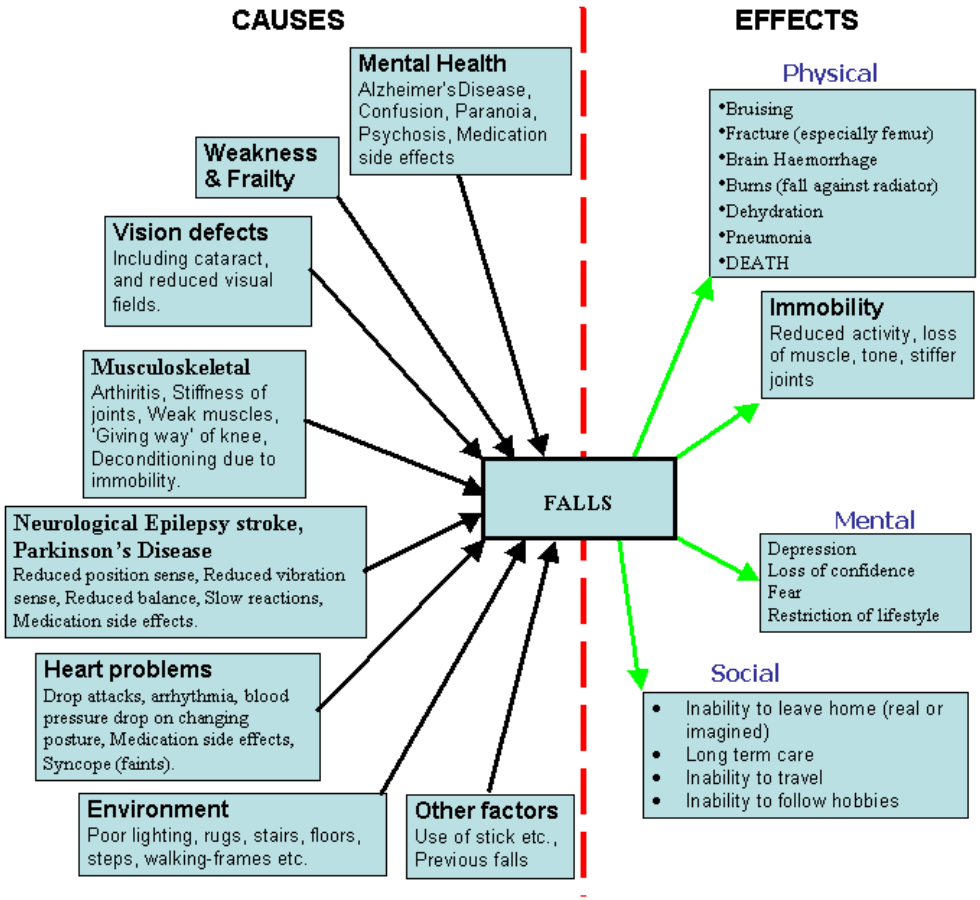
(Cattaneo 2006, 2007; Nilsagard 2009; Lord 2010)

Laboratory studies

Postural control & balance

(Casadio 2008, Cattaneo 2009, Cameron 2010 , Van Emmerik 2010, Porosinska 2010, Prosperini et al 2013)

Falls



- Impaired balance especially during transitions
- Alteration of two sensory inputs sharply impacts on balance scores
- Delayed motor responses
- Use of a walking aid (transition from not using a walking aid to using one)

Gunn 2013, 2014; Nilsagaard 2009, 2014, Gianni et al 2014; Matsuda et al 201

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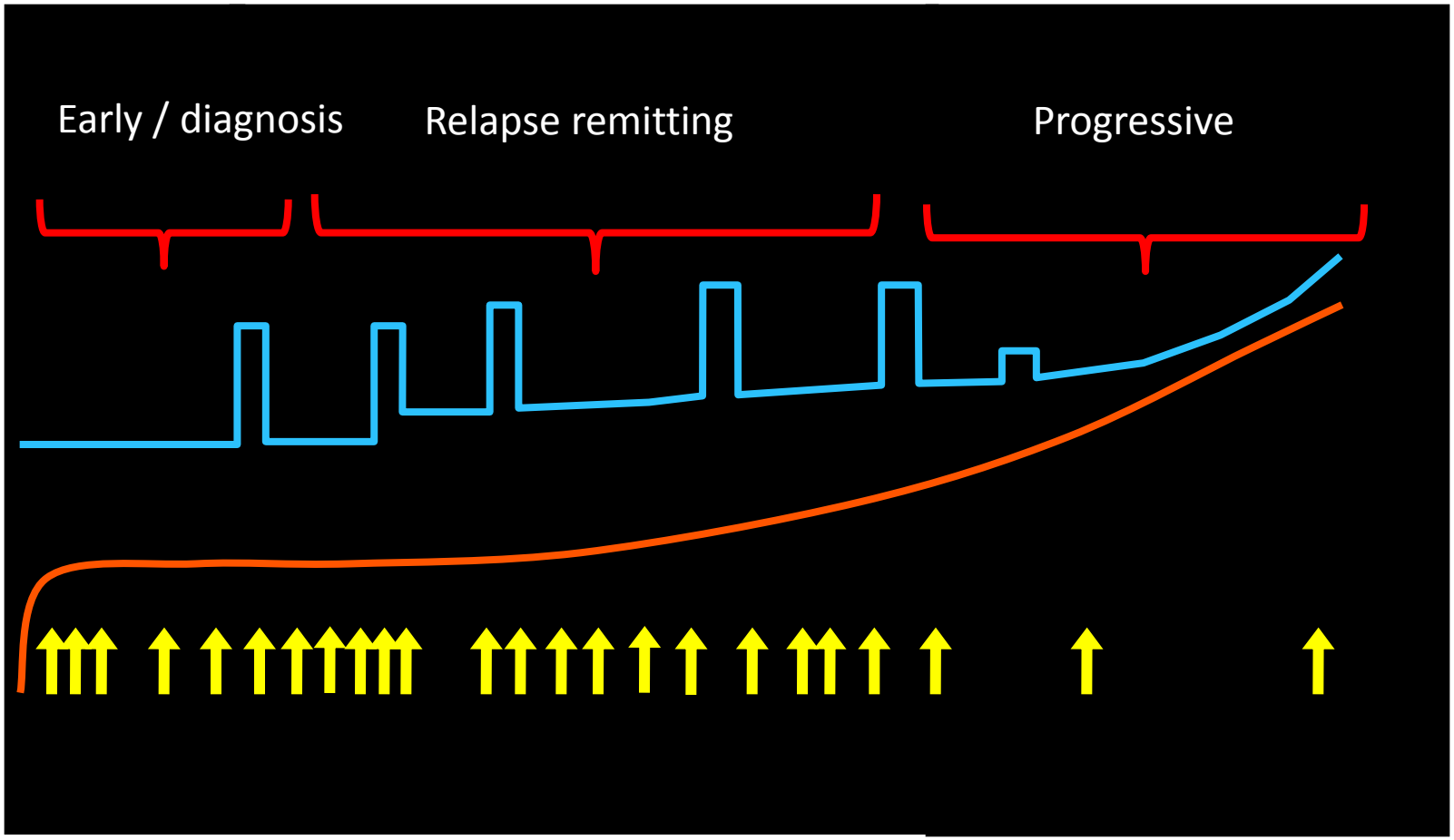
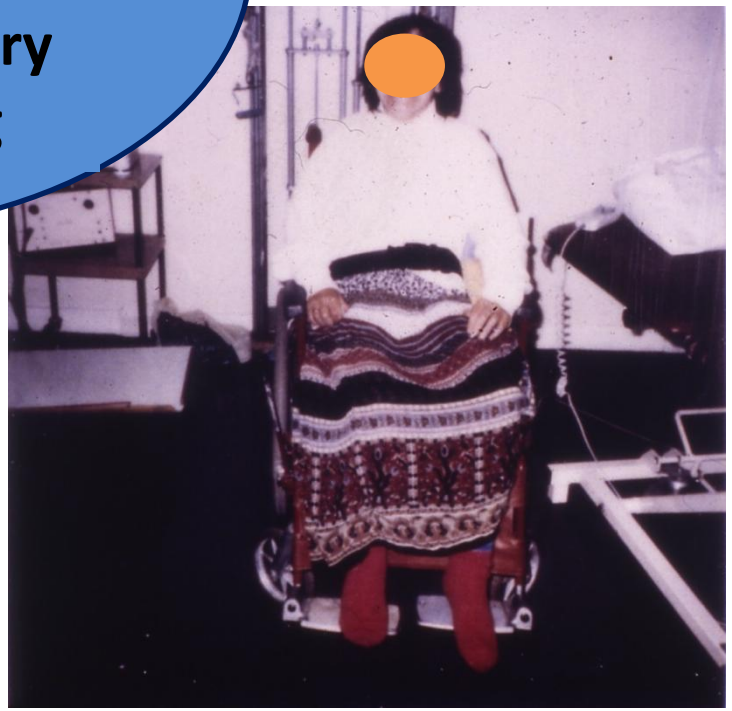
Natural History of MS



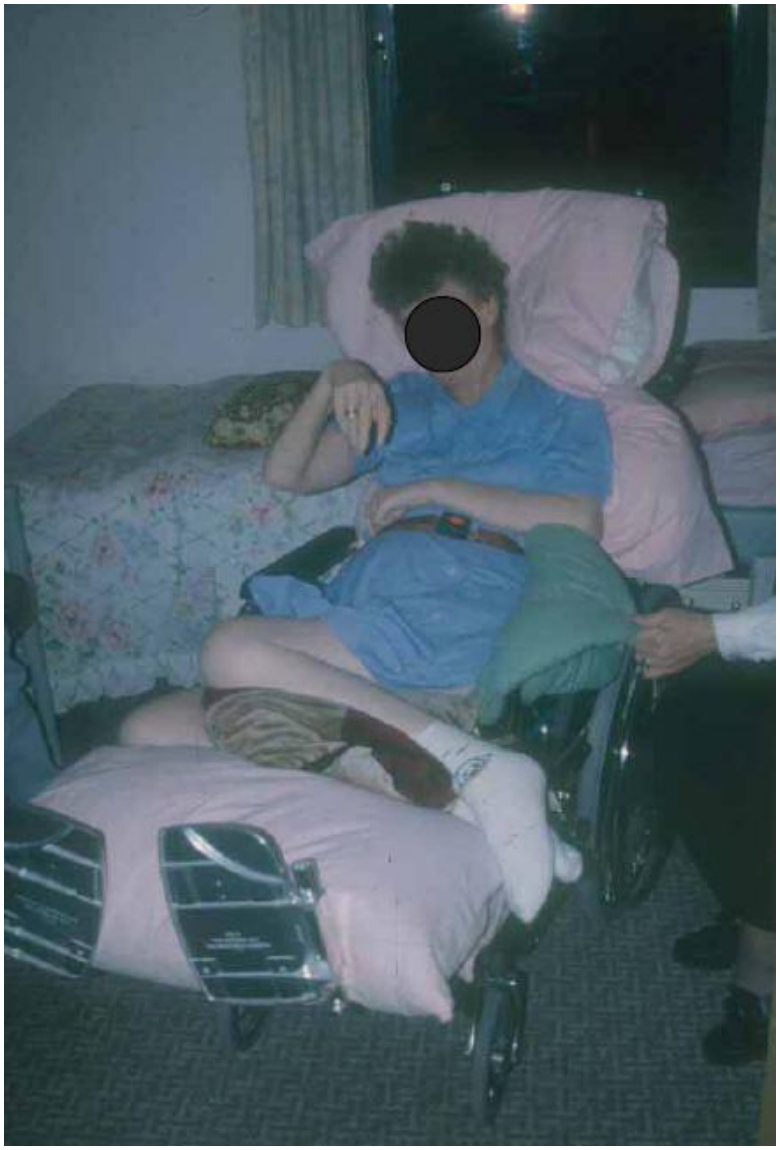
Postural management

Multi-disciplinary team working



Pope 1991, 1997, 2006; Dolan 2014

Baker 2007; Hendrie 2013



Postural management is needed to prevent people becoming unseatable

BMJ 2014;349:g6019 doi:10.1136/bmj.g6019 (Published 3 October 2014)

NEWS

Contribution of allied health professionals to NHS care goes unrecorded

Matthew Limb

London

The NHS lacks evidence to show whether the £2bn (€2.5bn; $3bn) it spent on allied health professionals (AHPs) in 2013 improved care quality, analysts have said.

The Health Foundation and Nuffield Trust said that AHPs were a growing part of the NHS workforce and were likely to deliver more care in future, often supporting people with long term conditions.

But Holly Dorning, a Nuffield research analyst, said, "We are hampered by a huge data gap when we seek to understand the contribution allied health professionals make to people's care." She coauthored a report that found "little systematic information at a national level about the quality of care delivered by AHPs."[1]

"In fact, there is a shortage of even basic information about activity, waiting times, and appointments at a national level to

The report said that their contribution to care was often overlooked. Some evidence showed that AHPs improved quality in the few areas where data were collected—for example in stroke care, with the inclusion of speech and language therapy, physiotherapy, and occupational therapy metrics in the National Stroke Audit.

Dorning said that such staff were well placed to support integrated care in a variety of roles but that, given pressure on resources, it was crucial to design datasets that showed whether care was good and how it could get better.

The authors said that several measures could be taken to collect meaningful and consistent data, record a broader range of activities that go beyond basic hospital care, use data to compare and improve practice, and look at short and long term outcomes.

Clinician Rated Measures

10 Metre Timed Walk

Single Leg Stance

Lateral Reach

Forward Reach

Timed up and go

Self report measures

FIGURE 2. The Activities-Specific Balance Confidence (ABC) Scale

Rate each item on a scale of 0% (no confidence) to 100% (complete confidence), indicating your confidence in performing the task without losing balance or becoming unsteady.

Ride escalator holding rail	_____
Ride escalator not holding rail	
Get in/out of car	_____
Pick up slipper from floor	
Reach at eye level	_____
Reach on tiptoes	_____
Stand on chair to reach	_____
Sweep the floor	_____
Walk across parking lot	_____
Walk around the house	
Walk in crowd/bumped	_____
Walk in crowded mall	_____
Walk on icy sidewalks	_____
Walk outside to nearby car	_____
Walk up and down ramp	_____
Walk up and down stairs	_____

Score

Average the responses to the questions to obtain a percentage score, with lower scores being indicative of less confidence in task performance (ie, greater perceived handicap).

Data from Powell LE and Myers AM.[4]

MS – 12 Walking Scale

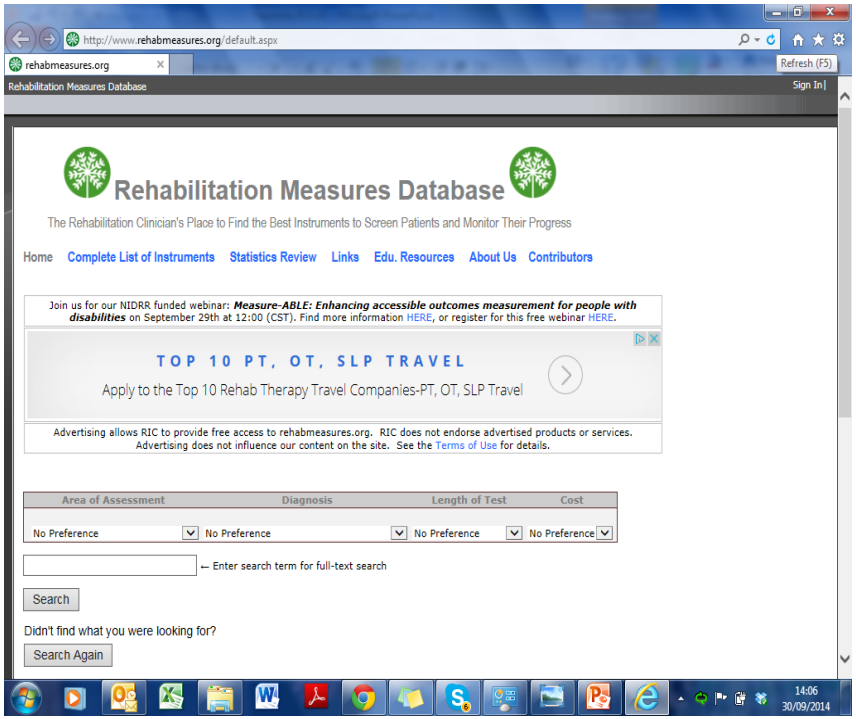
Walking Scale Questionnaire (Walk–12)

Please complete and hand to the doctor at the start of your consultation, thank you.

- These questions ask about limitations to your walking due to peripheral neuropathy *during the past 2 weeks*
- For each statement please circle the one number that best describes your degree of limitation
- Please answer all questions even if some seem rather similar to others, or seem irrelevant to you
- If you cannot walk at all please tick this box □

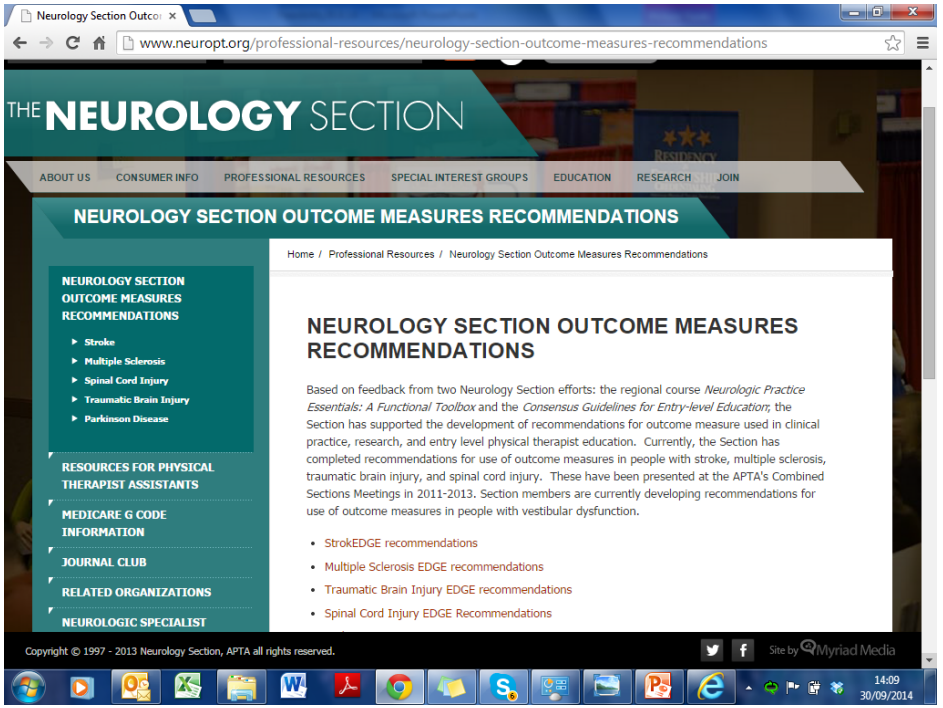
In the past 2 weeks how much has your peripheral neuropathy...	Not at all	A little	Moderately	Quite a bit	Extremely
Limited your ability to walk?	1	2	3	4	5
Limited your ability to run?	1	2	3	4	5
Limited your ability to climb up or down stairs?	1	2	3	4	5
Made standing when doing things more difficult?	1	2	3	4	5
Limited your balance when standing or walking?	1	2	3	4	5
Limited how far you are able to walk?	1	2	3	4	5
Increased the effort needed for you to walk?	1	2	3	4	5
Made it necessary for you to use support when walking indoors, eg holding on to furniture, using a stick, etc?	1	2	3	4	5
Made it necessary for you to use support when walking outdoors, eg using a stick or frame, etc?	1	2	3	4	5
Slowed down your walking?	1	2	3	4	5
Affected how smoothly you walk?	1	2	3	4	5
Made you concentrate on your walking?	1	2	3	4	5

Databases of outcome measures



http://www.rehabmeasures.org/default.aspx

http://www.neuropt.org/professional-resources/neurology-section-outcome-measures-recommendations



MS–Edge Outcome measures

Impact of MS on Walking:

- At 15 years 50% require a walking aid +/- wheelchair

(Runmarker & Andersen 1993)

- By 30 years this has increased to 83%

(Weinshenker 1989)

- In progressive MS, 50% require a walking aid within 5 years

(Weinshenker et al 1989)

- People with MS rate walking as the most important function

(Heesen 2007)

Kiesseir 2012, Learmonth 2013

Table 2. Reliability of objective walking measures in multiple sclerosis.

Assessment	Inter-rater	Intra-rater	Test-retest
Walking time			
T25FW[a]	• Same day ICC: 1.0 (95% CI, 0.99–1.0)[16] • Same day ICC: 0.942[18]	• 1 week interval ICC: 0.99 (95% CI, 0.98–1.0)[16]	• Same day ICC: 0.96[15]
10MTW			
Normal speed	• 1 week interval ICC: 0.93 (95% CI, 0.72–0.98)[12] • SEM[b]: 0.10 m/sec[12] • CV[c]: 8.6 m/sec[12]	NR	• Same day ICC: 0.97[20] • 1 week interval ICC: 0.91 (95% CI, 0.81–0.96)[12] • SEM: 0.09 m/sec[12] • CV: 5.5 m/sec[12] • CV: 20% ± 8%[35] • Same day ICC: 0.92 (95% CI, 0.86–0.95)
Fastest speed	• 1 week interval ICC: 0.96 (95% CI, 0.84–0.99)[12] • SEM: 0.08 m/sec[12] • CV: 4.4 m/sec[12]	NR	• 1 week interval ICC: 0.95 (95% CI, 0.90–0.98)[12] • SEM: 0.11 m/sec[12] • CV: 5.1 m/sec[12]
EDSS ≤4	NR	NR	• Same day ICC: 0.87 (95% CI, 0.74–0.94)
EDSS >4	NR	NR	• Same day ICC: 0.91 (95% CI, 0.82–0.96)
30MTW	NR	NR	• Same day ICC: 0.93 (95% CI, 0.89–0.96)
EDSS ≤4	NR	NR	• Same day ICC: 0.96 (95% CI, 0.92–0.98)
EDSS >4	NR	NR	• Same day ICC: 0.89 (95% CI, 0.77–0.95)
100MTW	• Same day ICC: 0.953[18]	NR	NR
Walking distance			
6mWT	• Same day ICC: 0.91[23] • 1 week interval ICC: 0.93 (95% CI, 0.74–0.98)[12]	• Same day ICC: 0.94[23]	• 1 week interval ICC: 0.96 (95% CI, 0.91–0.98)[12] • SEM: 30.65 m[12]

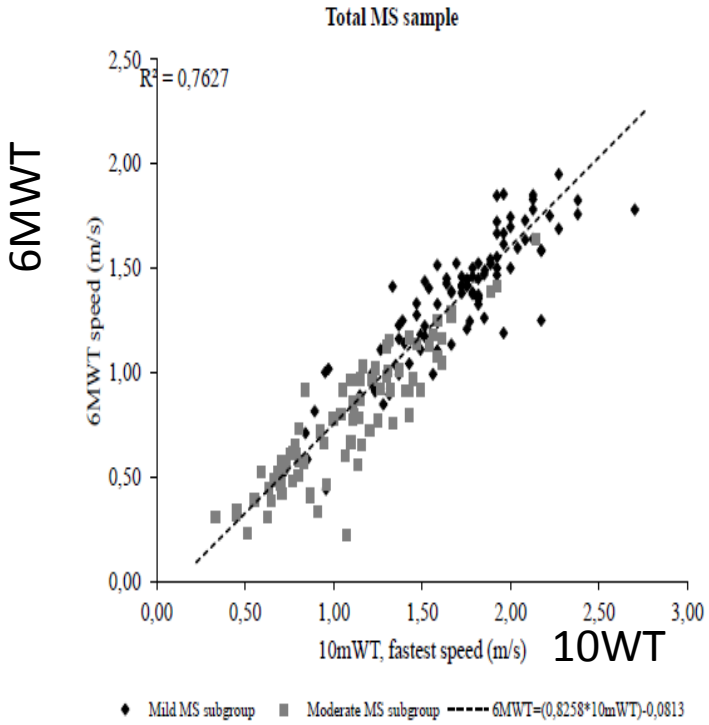
Association between walking tests

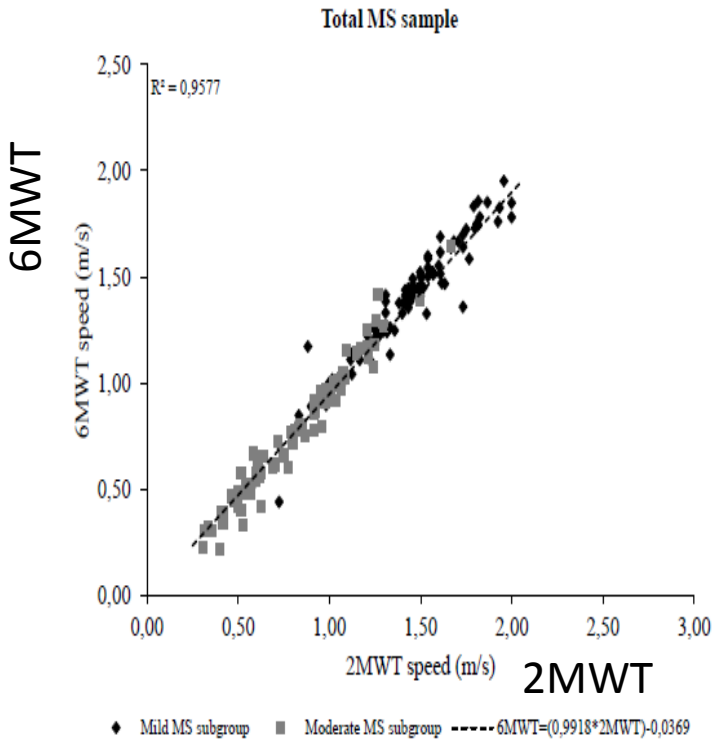
MULTIPLE SCLEROSIS JOURNAL

Which walking capacity tests to use in multiple sclerosis? A multicentre study providing the basis for a core set

Domien Gijbels[1], Ulrik Dalgas[2*], Anders Romberg[3*], Vincent de Groot[4*], Francois Bethoux[5*], Claude Vaney[6*], Benoit Gebara[7*], Carme Santoyo Medina[8], Heigo Maamägi[9], Kamila Rasova[10], Benoit Maertens de Noordhout[11], Kathy Knuts[12] and Peter Feys[1*]

12 centers in 9 different EU countries and 1 US, N=189+22





Gijbels, Dalgas, Feys & RIMS Group (2012) MSJ

Prediction of walking performance based on walking capacity tests

The 5 most predictive variables of walking performance per (sub)group

(Sub)group *Variable*	R^2	B	SE	t-value	p
Mild MS (n=29)					
1) 6-Minute Walking Test (m)	0.187	12.33	5.04	2.44	=0.02
2) Activities and Participation Questionnaire-	0.168	-1407.00	615.10	-2.29	=0.03
3) /	/	/	/	/	/
4) /	/	/	/	/	/
5) /	/	/	/	/	/
Moderate MS (n=21)					
1) 2-Minute Walking Test (m)	0.532	33.01	7.11	4.64	<0.01
2) 6-Minute Walking Test (m)	0.527	11.28	2.45	4.60	<0.01
3) Timed Up and Go (s)	0.481	-142.74	34.04	-4.19	<0.01
4) Timed 25-Foot Walk (s)	0.387	-213.36	61.60	-3.46	<0.01
5) Rivermead Mobility Index	0.376	449.64	133.02	3.88	<0.01

R^2, predictive value; β estimate; SE, standard error

6MWT is the best predictor for habitual walking performance ….(but 2MTW comes a close second)

Gijbels, Feys et al (2010) MSJ

Neurorehabilitation and
Neural Repair
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Responsiveness and Clinically Meaningful Improvement, According to Disability Level, of Five Walking Measures After Rehabilitation in Multiple Sclerosis: A European Multicenter Study

Ilse Baert, PT, PhD[1], Jennifer Freeman, PT, PhD[2], Tori Smedal, PT, PhD[3], Ulrik Dalgas, MSc, PhD[4], Anders Romberg, PT, PhD[5], Alon Kalron, PT, PhD[6],

Abstract

Background. Evaluation of treatment effects on walking requires appropriate and responsive outcome measures. *Objectives*. To determine responsiveness of 5 walking measures and provide reference values for clinically meaningful improvements, according to disability level, in persons with multiple sclerosis (pwMS). *Methods*. Walking tests were measured pre- and postrehabilitation in 290 pwMS from 17 European centers. Combined anchor- and distribution-based methods determined responsiveness of objective short and long walking capacity tests (Timed 25-Foot Walk [T25FW] and 2- and 6-Minute Walk Tests [2MWT and 6MWT] and of the patient-reported Multiple Sclerosis Walking Scale–12 [MSWS-12]). A global rating of change scale, from patients' and therapists' perspective, was used as external criteria to determine the area under the receiver operating characteristic curve (AUC), minimally important change (MIC), and smallest real change (SRC). Patients were stratified into disability subgroups (Expanded Disability Status Scale score ≤4 [n = 98], >4 [n = 186]). *Results*. MSWS-12, 2MWT, and 6MWT were more responsive (AUC 0.64-0.73) than T25FW (0.50-0.63), especially in moderate to severely disabled pwMS. Clinically meaningful changes (MICs) from patient and therapist perspective were −10.4 and −11.4 for MSWS-12 ($P < .01$), 9.6 m and 6.8 m for 2MWT ($P < .05$), and 21.6 m ($P < .05$) and 9.1 m ($P = .3$) for 6MWT. In subgroups, MIC was significant from patient perspective for 2MWT (10.8 m) and from therapist perspective for MSWS-12 (−10.7) in mildly disabled pwMS. In moderate to severely disabled pwMS, MIC was significant for MSWS-12 (−14.1 and −11.9). *Conclusions*. Long walking tests and patient-reported MSWS-12 were more appropriate than short walking tests in detecting clinically meaningful improvement after physical rehabilitation, particularly the MSWS-12 for moderate to severely disabled pwMS.

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REVIEW ARTICLE

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

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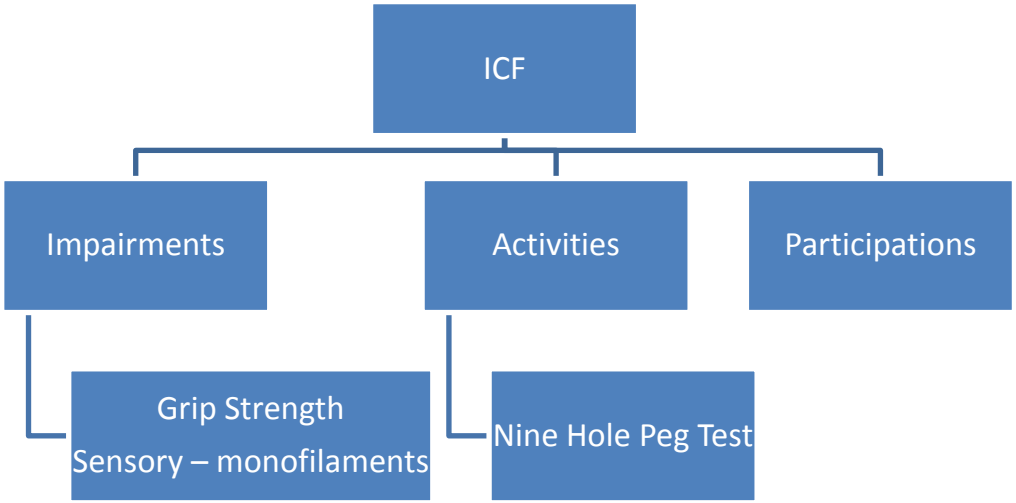

Paucity of measures evaluated for use in MS

Few easily applicable to clinical practice

Lack of measures to assess: -

- **Motor control (selectivity, timing, quality)**
- **Active ROM**
- **Endurance**

In summary:
Considerations for Physiotherapy Practice

- Early intervention is beneficial. Timely referral requires good communication with MS nurses and Neurologists

- Evidence shows that physiotherapy interventions can be beneficial throughout the disease course.

- The principles of frequency, intensity, specificity and progression is required to optimise outcome, regardless of physiotherapy intervention.

- Evaluating effectiveness is essential using psychometrically sound measures that detect change

Thank you for listening

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