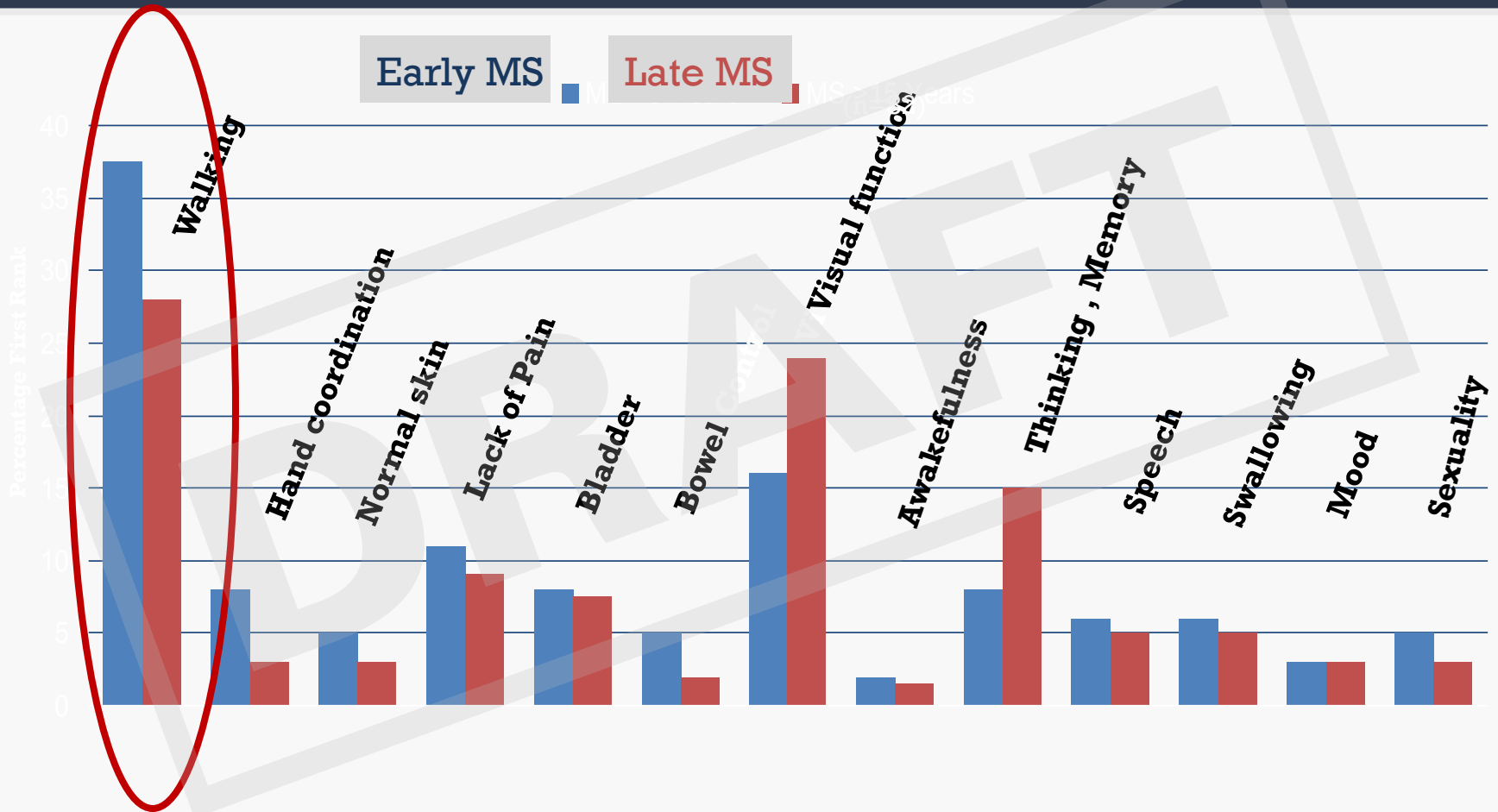


# Poruchy chůze u RS

MUDr Jana Lízrová Preiningerová

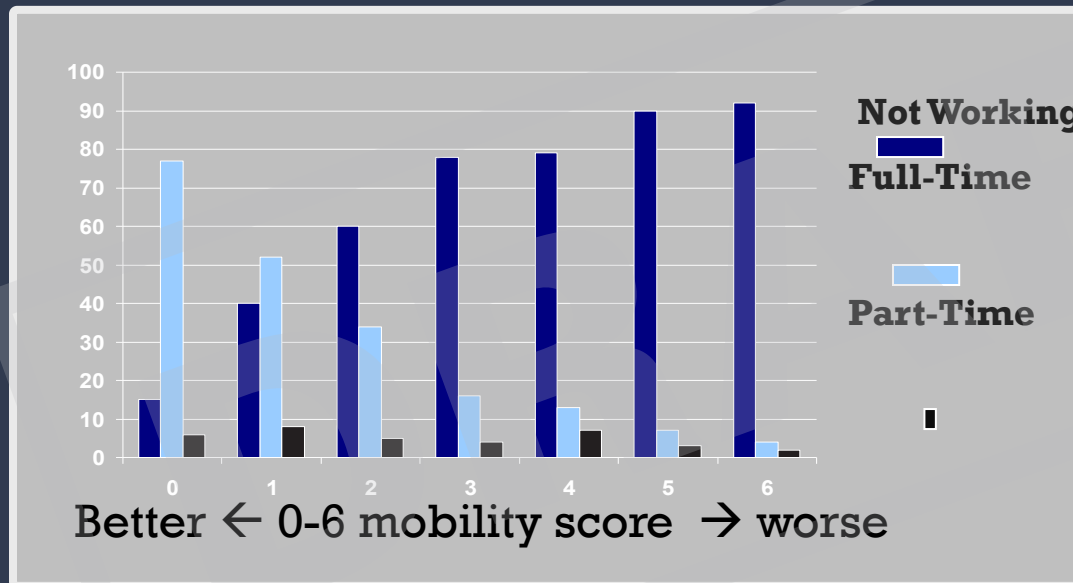
*Víte, kolik je „vyklizovací rychlost pro chodce“ ??*

# Jak hodnotí pacienti důležitost svých tělesných funkcí



# Zaměstnanost a pohyblivost

## NARCOMS 6-Point Mobility Performance Subscale



NARCOMS 2007  
(N = 8180)

Patient reported outcome

- Employment decreased with increasing mobility scores ( $P < 0.0001$ )
- Association even at low mobility scores of 0, 1, & 2 (mild gait disability) ( $P < 0.0001$  for all)

# Chůze u RS

- 64%<sup>1</sup>–85%<sup>2</sup> RS pacientů má poruchy chůze
- Geriatrická populace (>70): 9-18% má poruchy chůze

*Víte, co to je „vyklizovací rychlost pro chodce“ ??*

# Chůze

- Chůze je komplexní funkce => mnoho úrovní postižení
  - Svalová síla
  - Svalové napětí
  - Koordinace
  - Rovnováha
  - Čití
  - Zrak
  - Kognice
  - Kardiovaskulární kondice
- CPGs pro pohyb— central pattern generators

# Schopnost aktivního pohybu

- Běh, poskok, chůze bez pomoci, chůze s pomocí, schody, použití vozíku, přesun na lůžko – rozměr v m, sec ...

• Ale i další rozměry :

- Schopnost změny rychlosti
- Variabilita výkonu
- Stabilita
- Povrchy



Jaká měřítko omezení schopnosti pohybu máme  
a jak je uplatňujeme ??

# Hodnocení chůze u RS

- ◉ Subj údaje od pacienta
- ◉ Neurologický nález
  - svalová síla, tonus, reflexy, koordinace, čítí, chůze v místnosti, chůze o úzké basi, špičky, paty
  - Kvalitativní, ale ne kvantitativní výstup
- ◉ EDSS škála
  - Skórování zatížené mobilitou, avšak skóre není citlivé na změnu v celém spektru
- ◉ MSWS 12

# MSWS 12 Questionnaire

Rate 1-5: over the last 2 weeks, how much has your MS

Walking function

- limited your ability to **walk**?
- limited your ability to **run**?
- limited your ability to **climb up and down stairs**?
- made **standing** when doing things more difficult?
- limited your **balance** when standing or walking?
- limited **how far** you are able to walk?
- increased the **effort needed** for you to walk?

Walking quality

- made it necessary for you to **use support** when walking **indoors**?
- made it necessary for you to **use support** when walking **outdoors**?
- **slowed down** your walking?
- affected how **smoothly** you walk?
- made you **concentrate** on your walking?

Multiple Sclerosis Walking Scale (MSWS-12)					
If you cannot walk at all, please tick this box: ☐					
In the past two weeks, how much has your MS...	Not at all	A little	Moderately	Quite a bit	Extremely
1. Limited your ability to walk?	1	2	3	4	5
2. Limited your ability to run?	1	2	3	4	5
3. Limited your ability to climb up and down stairs?	1	2	3	4	5
4. Made standing when doing things more difficult?	1	2	3	4	5
5. Limited your balance when standing or walking?	1	2	3	4	5
6. Limited how far you are able to walk?	1	2	3	4	5
7. Increased the effort needed for you to walk?	1	2	3	4	5
8. Made it necessary for you to use support when walking indoors (e.g., holding on to furniture, using a stick, etc.)?	1	2	3	4	5
9. Made it necessary for you to use support when walking outdoors (e.g., using a stick, a frame, etc.)?	1	2	3	4	5
10. Slowed down your walking?	1	2	3	4	5
11. Affected how smoothly you walk?	1	2	3	4	5
12. Made you concentrate on your walking?	1	2	3	4	5

Please check that you have circled ONE number for EACH question.

Source: Hobart JC, Rinaldi A, Lamping DL, et al. Measuring the impact of MS on walking ability: the 12-item MS Walking Scale (MSWS-12). *Neurology*. 2003;60:31-6.



# Kvantifikace poruch chůze

- Dosah chůze – bez omezení, 5 km, 1 km, 500m, 300m, .....
- Rychlost chůze na krátkou vzdálenost
  - Timed 25 FW test – statický start, max rychlost, výsledek: počet sec na 8.8 m
  - Chůze na 10m – dynamický start, max rychlost,
- Timed 2 minute walk test
- Timed 6 minute walk test
- TUG (timed up and go test)
- SSST (six spot step test)

Hodnocení míry postižení – disability

# 25 FWT + 2 MWT

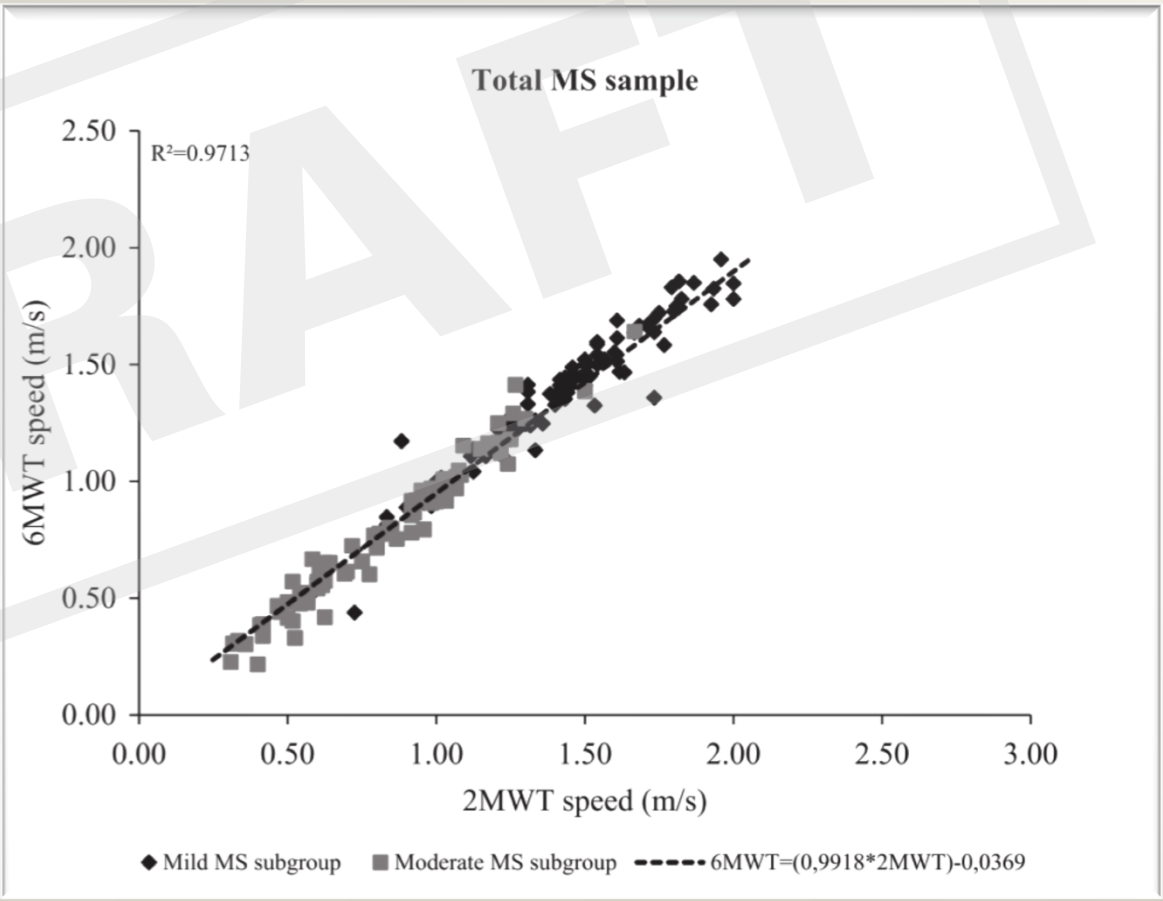
Research Paper

## Which walking test is best for multiple sclerosis patients providing the most accurate estimation of walking speed?

Domien Gijbels<sup>1</sup>, Uwe Groot<sup>4\*</sup>, Francois B. C. Carme Santoyo Méndez<sup>2</sup>, Benoit Maertens de Noorlandt<sup>3</sup>

### Abstract

**Background:** Many different walking tests exist, ranging from short tests, and walk tests. **Objectives:** To determine the relationship between walking speed and 6-Minute Walk Test (6MWT) and 10-Metre Walk Test (10MWT) (fastest speed). Subjects were divided into Mild and Moderate MS subgroups. **Results:** In both subgroups, the correlation between the fastest walking speed and 6-Minute Walk Test (6MWT) ( $p < 0.01$ ). Short tests' relative



affected subjects. Based on the 2-Minute Walk Test, estimation errors significantly reduced to approximately 5% in both subgroups.

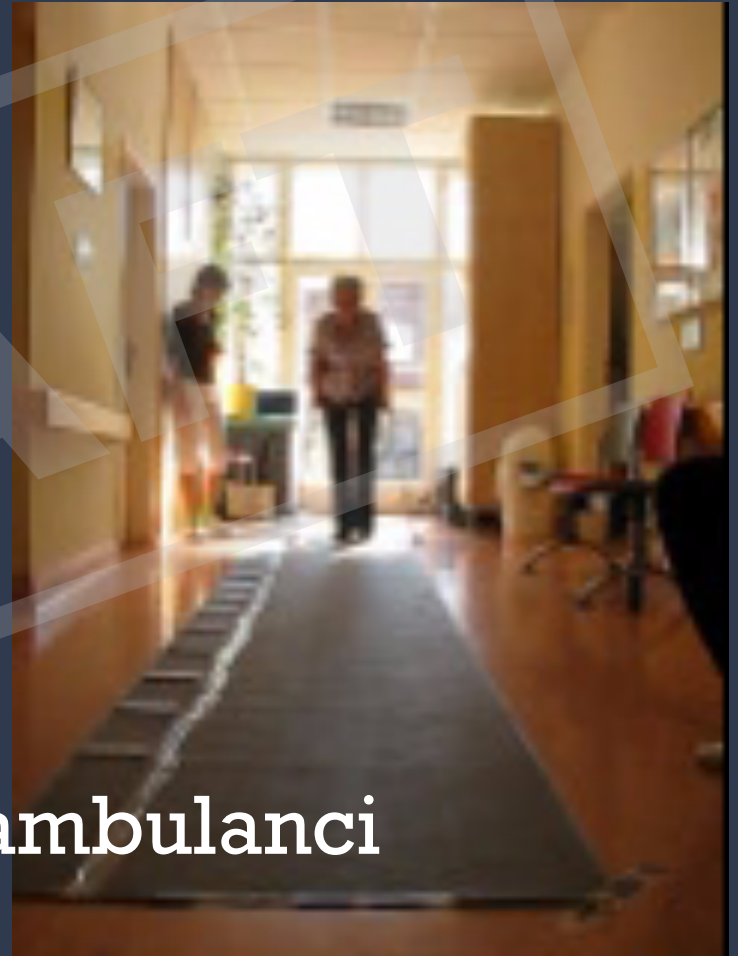
**Conclusions:** A single short test format of fastest speed accurately describes an MS patient's general walking capacity.

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# Analýza poruch chůzového cyklu

Kvantifikace vs. Analýza

# Analýza poruch chůze v centru



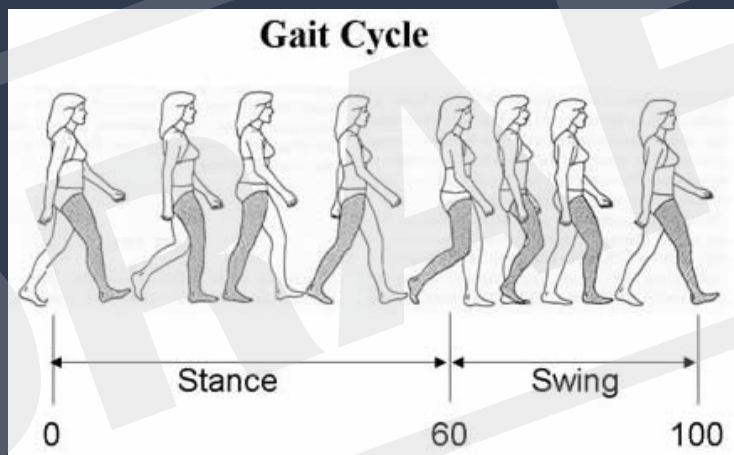
Gaitrite v RS ambulanci

# Časové a prostorové změny chůze

## Časové parametry:

- Step time
- Stride time
- Single support time
- Double support time
- Heal on time
- Heal off time
- % swing phase
- % stance phase
- Step time difference
- ....

Rychlost  
Kadence



## Prostorové parametry:

- Step length
- Stride length
- Heal to heal distance
- Foot size
- Distance walked
- Cadence
- Step length difference
- Step length variability
- Stride length variability
- Heal to heal variability
- ....

# Chůze mezi EDSS 0 – 6.5

- N= 284, sedm skupin EDSS 0-6.5, cross sectional

Lizrova Preiningerova et al. *Journal of NeuroEngineering and Rehabilitation* (2015) 12:14  
DOI 10.1186/s12984-015-0001-0

JNER JOURNAL OF NEUROENGINEERING AND REHABILITATION

RESEARCH Open Access

## Spatial and temporal characteristics of gait as outcome measures in multiple sclerosis (EDSS 0 to 6.5)

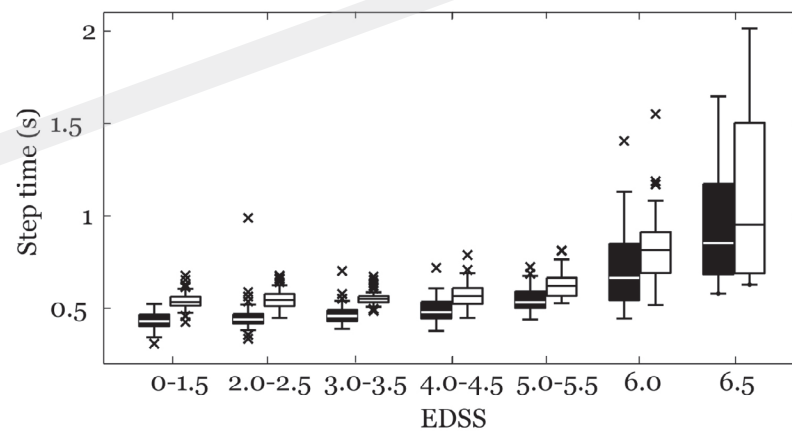
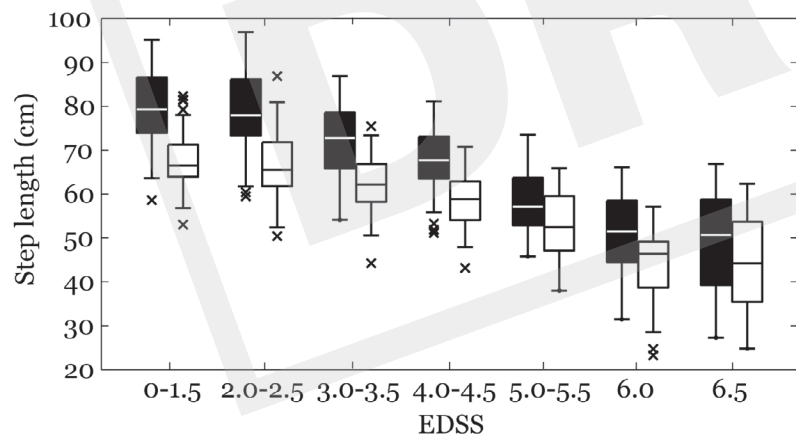
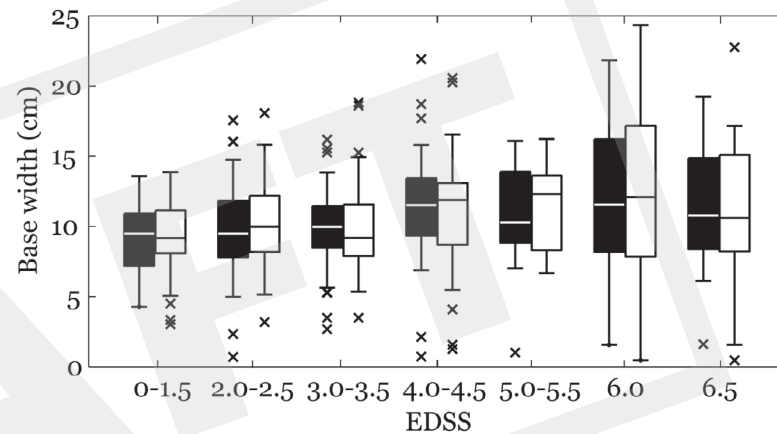
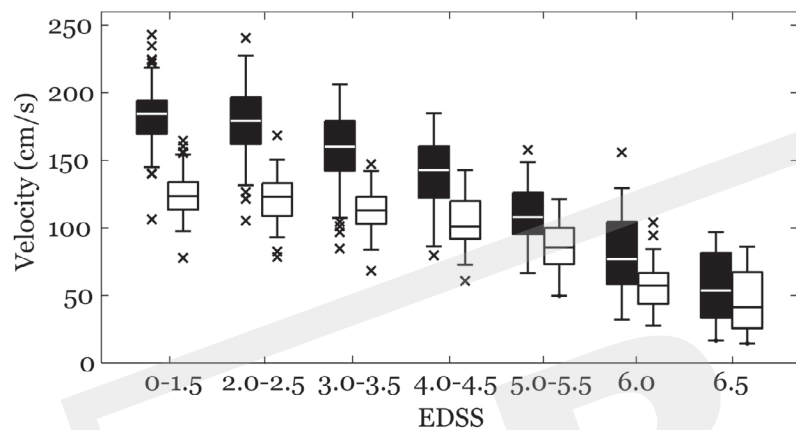
Jana Lizrova Preiningerova<sup>1\*</sup>, Klara Novotna<sup>1</sup>, Jan Ruz<sup>1,2</sup>, Lucie Sucha<sup>1</sup>, Evzen Ruzicka<sup>1</sup> and Eva Havrdova<sup>1</sup>

**Abstract**

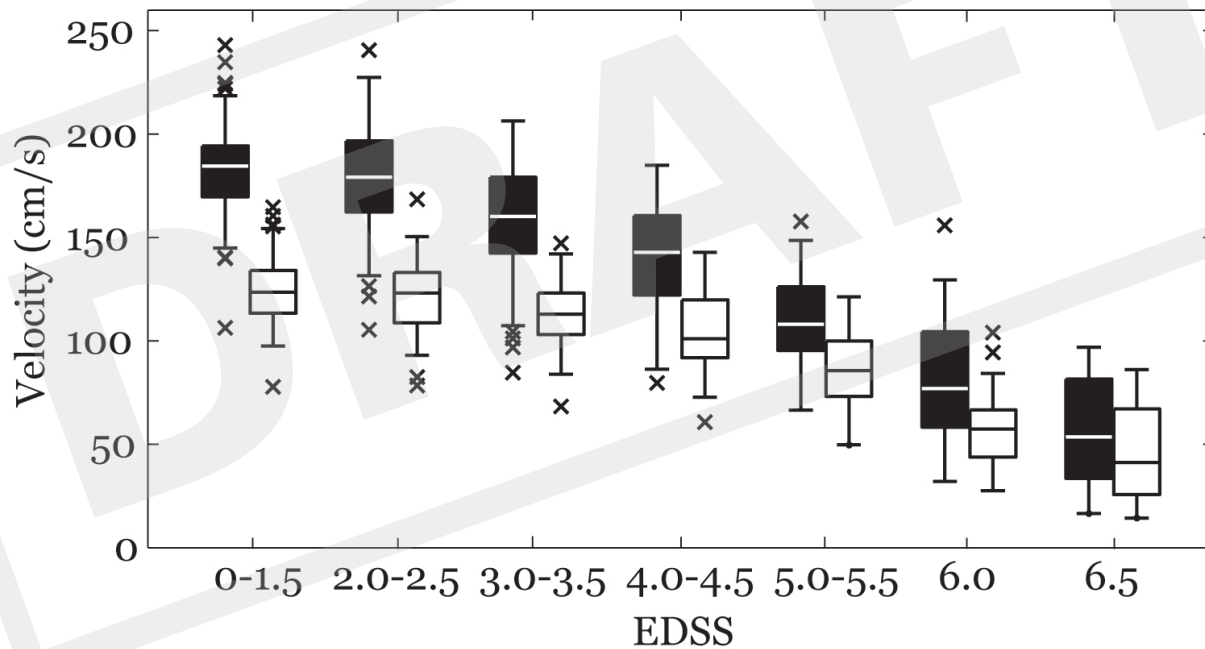
**Background:** Gait impairment represents one of the most common and disabling symptom of multiple sclerosis. Quantification of the gait is an important aspect of clinical trials. In order to identify which temporal or spatial parameters of gait could be used as outcome measures in interventional studies of patients with different levels of disability, we evaluated characteristics of these parameters in MS patients across the whole spectrum of mobility from EDSS 0 to 6.5.

**Methods:** This is a cross-sectional study of spatial and temporal parameters of gait at self selected speed and at fast speed of walking in 284 patients with multiple sclerosis (108 men, mean age 38 years  $\pm$  SD 10.8 years, range 18–64) divided into seven levels of disability (EDSS 0 to 1.5, EDSS 2.0 to 2.5, EDSS 3.0 to 3.5, EDSS 4.0 to 4.5, EDSS 5.0 to 5.5, EDSS 6.0, EDSS 6.5).

**Results:** The velocity of gait decreases with increasing EDSS levels. However, the spatio-temporal parameters of gait that are involved in this process differ across the EDSS levels. The step length is decreased at higher EDSS levels up to the EDSS 6.0, but was not different between EDSS 6.0 and 6.5. The step time is significantly longer at EDSS 6.0 and 6.5, while the step length remains the same at those levels. The increase in percentage of double support time becomes statistically significant at EDSS 3.0-3.5 and continues to increase until EDSS 6.5. Variability of step time, step length or step width did not show significant difference between studied EDSS levels.



# Rychlost chůze EDSS 0 – 6.5





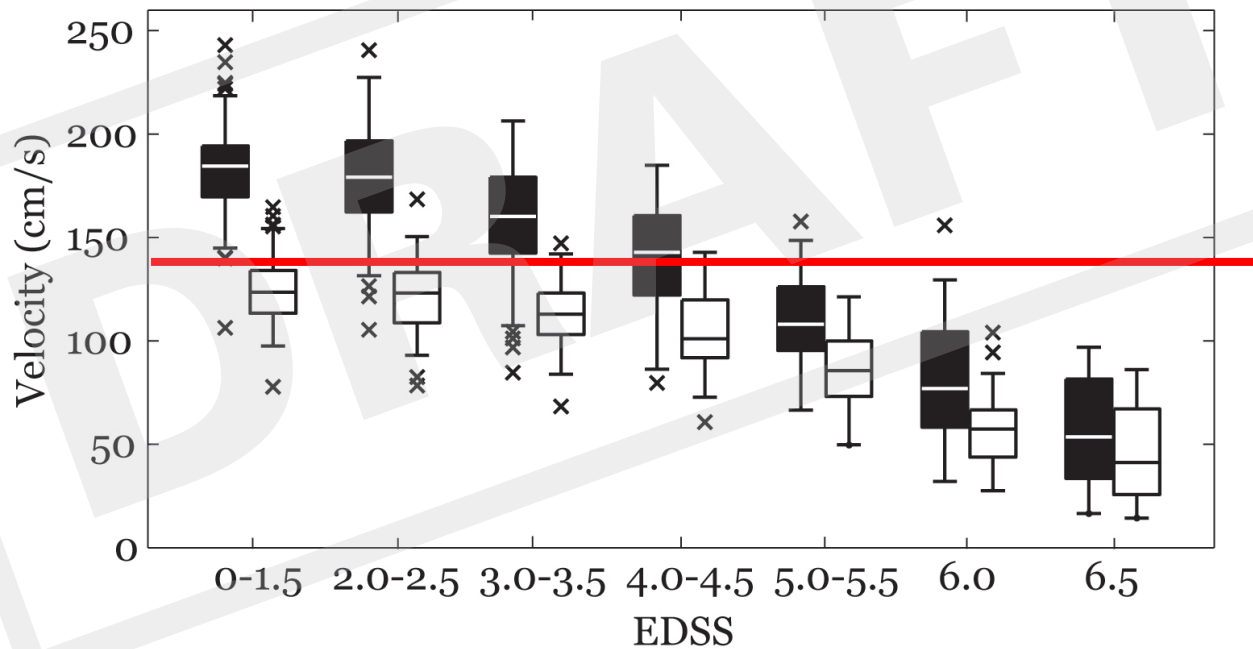
# Rychlost chůze u RS

Velocity of gait (self selected)

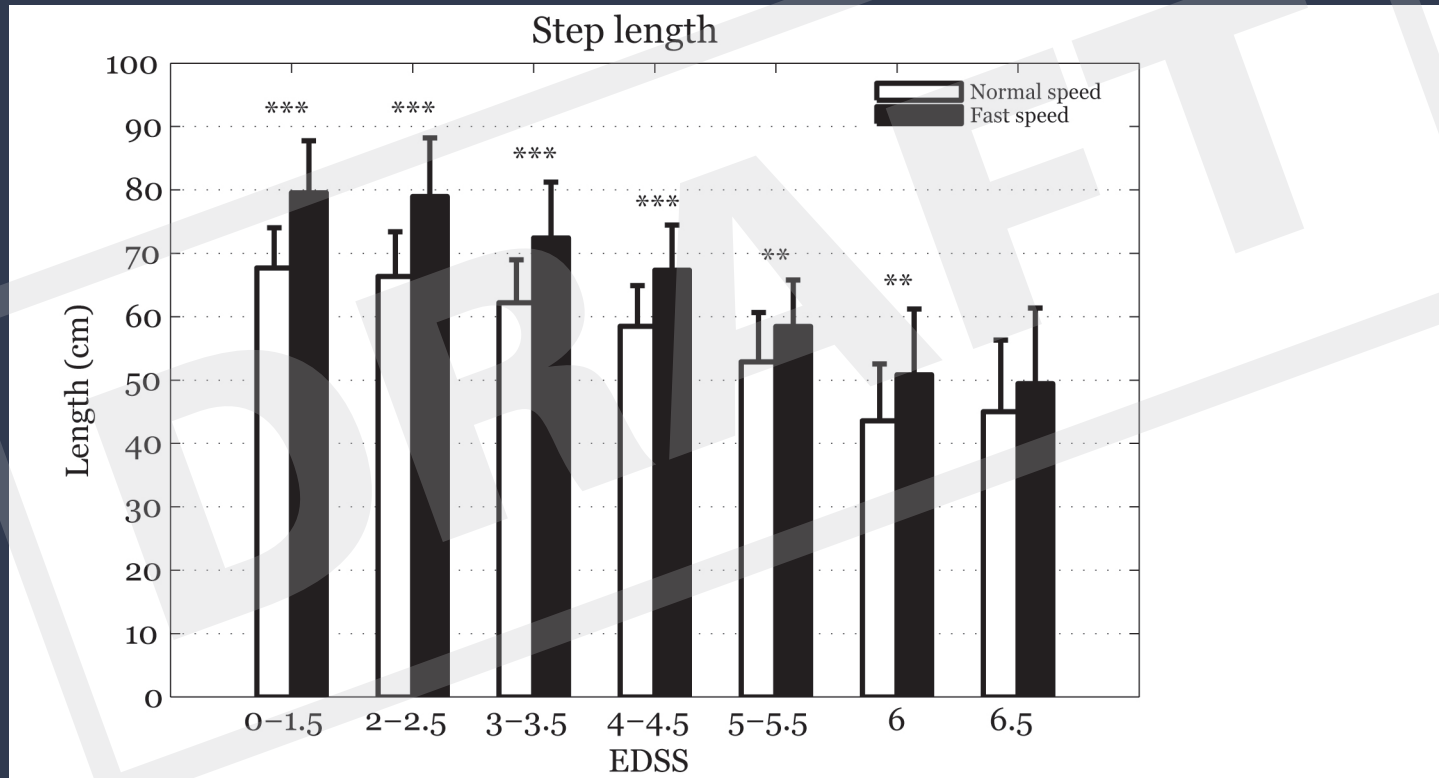
- **EDSS 3.0 – 3.5**  $112.67 \pm 15.95$  cm/sec  
mean age 38.7, SD 9.1
- **Populace 70+ let** 113.2 cm/s (range 107.2 to 119.2)

VYKLIZOVACÍ A NAJÍŽDĚCÍ RYCHLOSTI	(km/h)	(m/s)
Cyklisté	15	4,2
Chodci	5	1,4

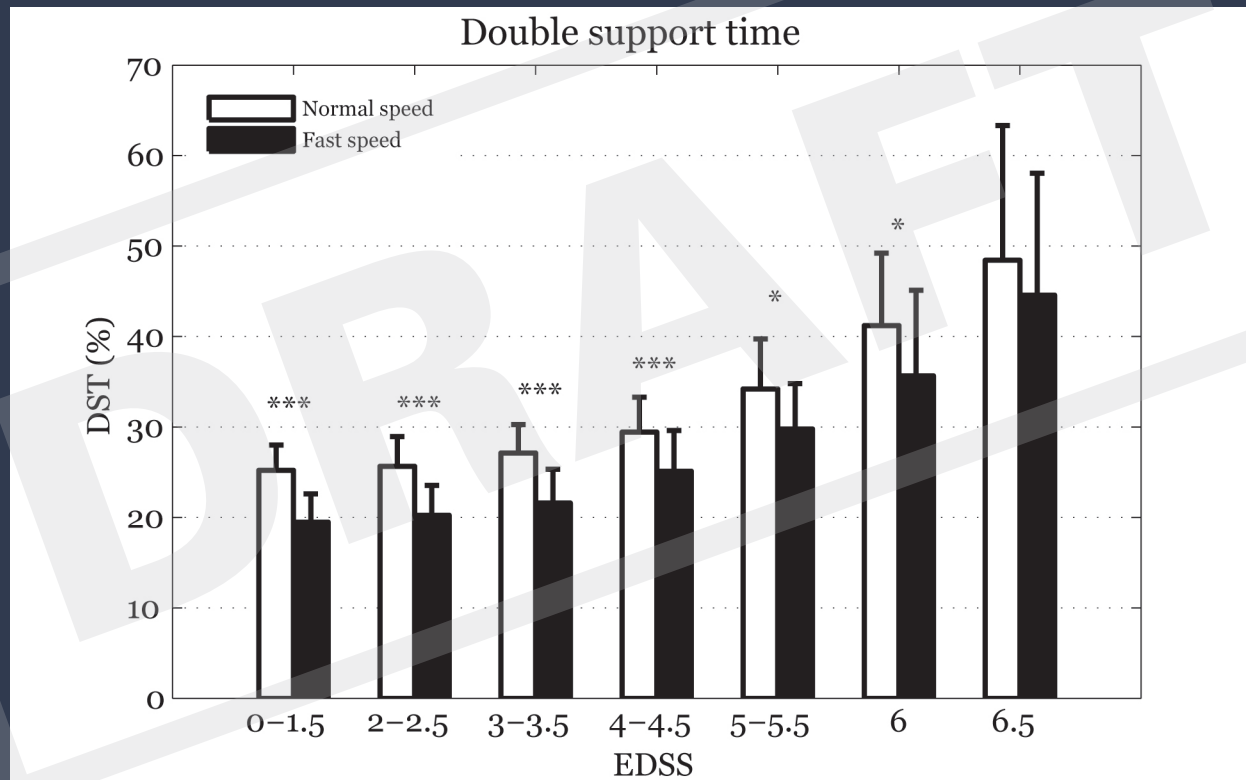
# Rychlost chůze EDSS 0 – 6.5



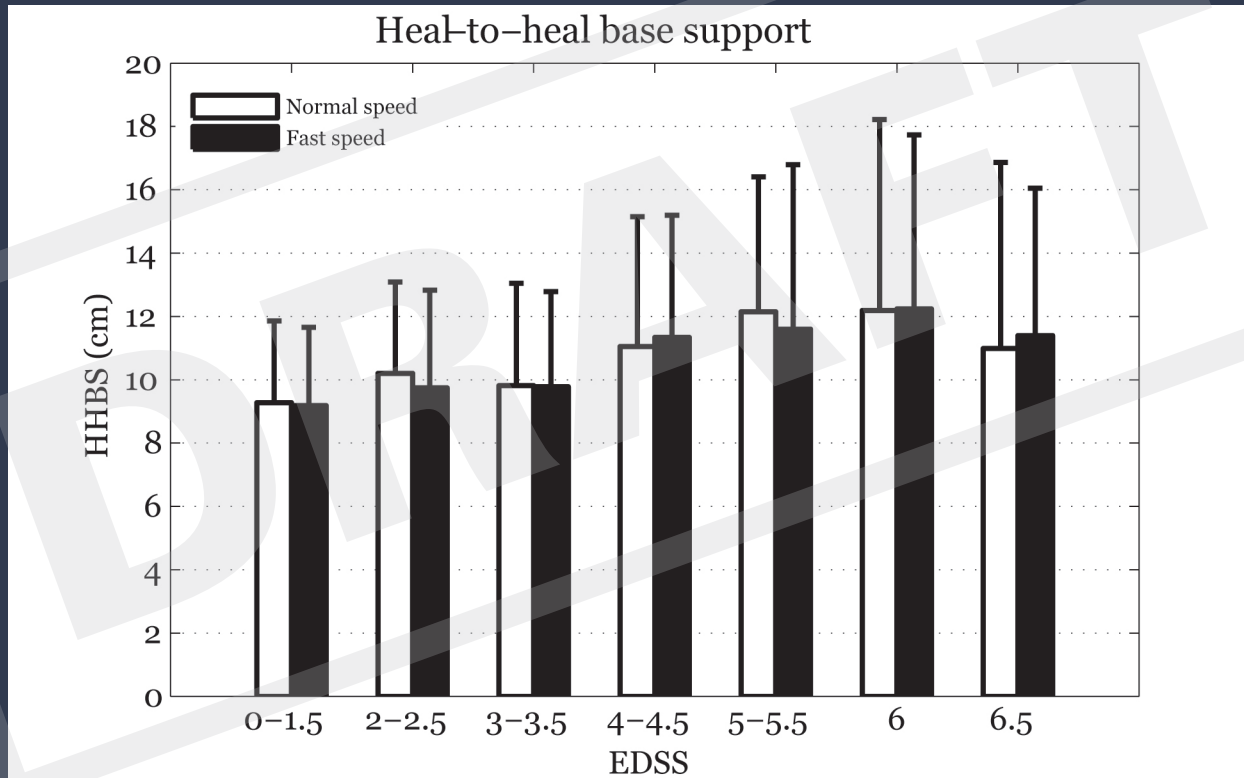
# Step length



# Double support time



# Base width



# Jak se zpomalí chůze u RS ?

- ◉ Nízké EDSS: zkrátí délku kroku
- ◉ Vyšší EDSS: má zkrácenou délku kroku
  - + Prodlouží step time
  - + Prodlouží double support time
- ◉ EDSS 6.0 a 6.5 má maximální rychlost i při tzv. normální chůzi
- ◉ **KLINICKÝ VÝZNAM ? RHB strategie !!**

# Analýza poruch chůze

- 3D Kinematic systems



- Dynamic EMG



Source: Exerc Sport Sci Rev © 2008 American College of Sports Medicine

# Analýza poruch chůze

*Disability and Rehabilitation*, 2010; 32(15): 1242–1250

**informa**  
healthcare

## RESEARCH PAPER

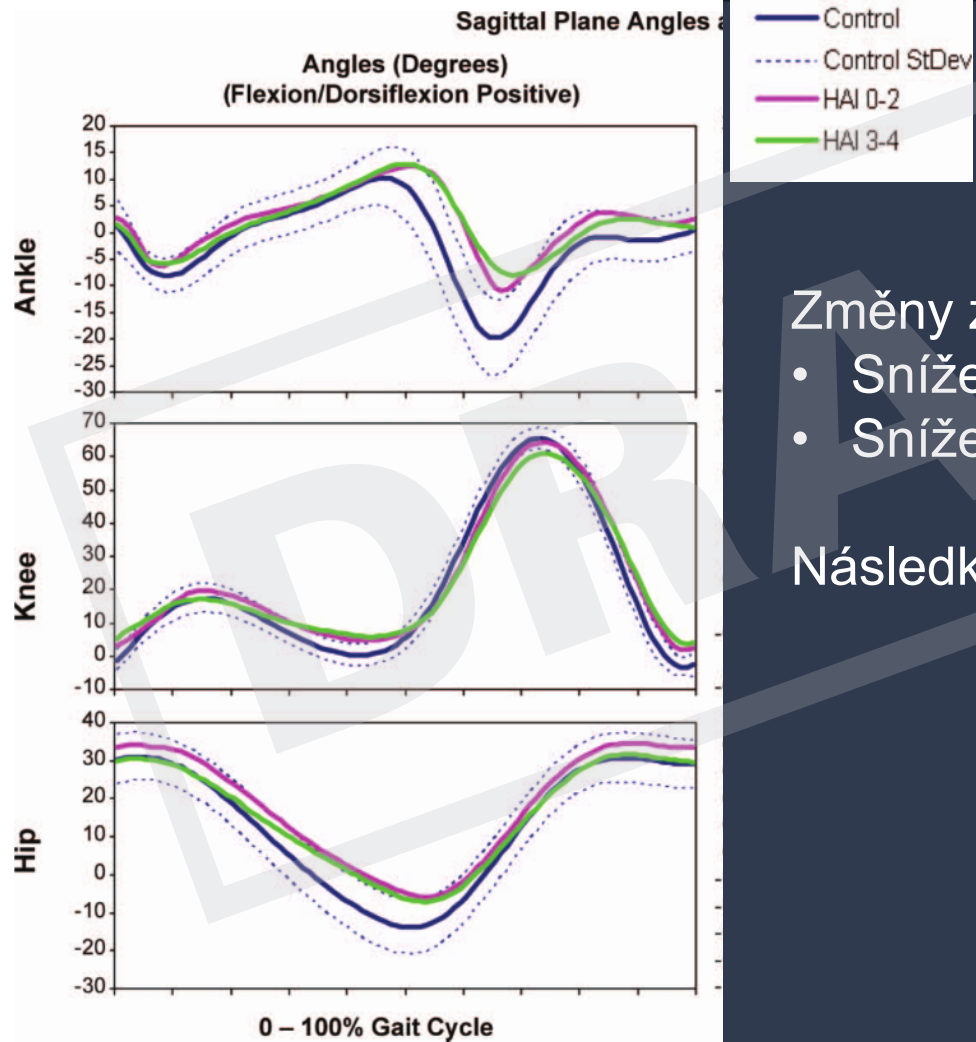
### **The characterisation of gait patterns of people with multiple sclerosis**

KEVIN JOHN KELLEHER<sup>1</sup>, WILLIAM SPENCE<sup>2</sup>, STEPHAN SOLOMONIDIS<sup>2</sup> &  
DIMITRIOS APATSIDIS<sup>1</sup>

<sup>1</sup>*Department of Mechanical and Biomedical Engineering, NUI Galway, Galway, Ireland and* <sup>2</sup>*Department of Bioengineering, University of Strathclyde, Glasgow, UK*

Accepted November 2009





Změny zvláště v hybnosti hlezna a kyčle

- Snížení extenze v kyčli
- Snížení extenze v hleznu

Následkem toho zkrácení kroku !

# Shrnutí:

- Rozměry chůze
- Rozsah postižení u RS
  - Změny chůze jsou měřitelné již u EDSS <2.5 <sup>1</sup>
- Měřítko postižení
  - Snížení rychlosti chůze
  - Zhoršení posturální stability
- Vzorec postižení postižení
  - Snížení amplitudy dorzální flexe hlezna i bez parezy
  - Snížení aktivace motorických jednotek v DKK při chůzi

