Motor Biomarkers to predict cognitive decline and dementia

“There is something in the way you walk”

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ON

Objectives

1. To summarize the current knowledge of the relationship between early motor, mood & cognitive decline in aging and disease.

2. To show the value of the dual-task paradigm to evaluate cognitive and motor relationships.

3. To demonstrate that gait assessment is a complementary window to evaluate brain function.

4. To discuss that gait performance is a motor biomarker that can be used to predict dementia

What makes a person look old?

- Slow Gait
- Mental Slowing
- Low Mood

Thinking, Feeling, and Moving must be studied together

- Extensive epidemiological evidence supports links between cognition and movement
- Brain networks for movement overlap with networks for cognition
- Thinking, Feeling, and Moving share behavioral and etiological factors that can drive new insights into prevention and treatment

Particularly, to understand the relation with cognitive decline and dementia

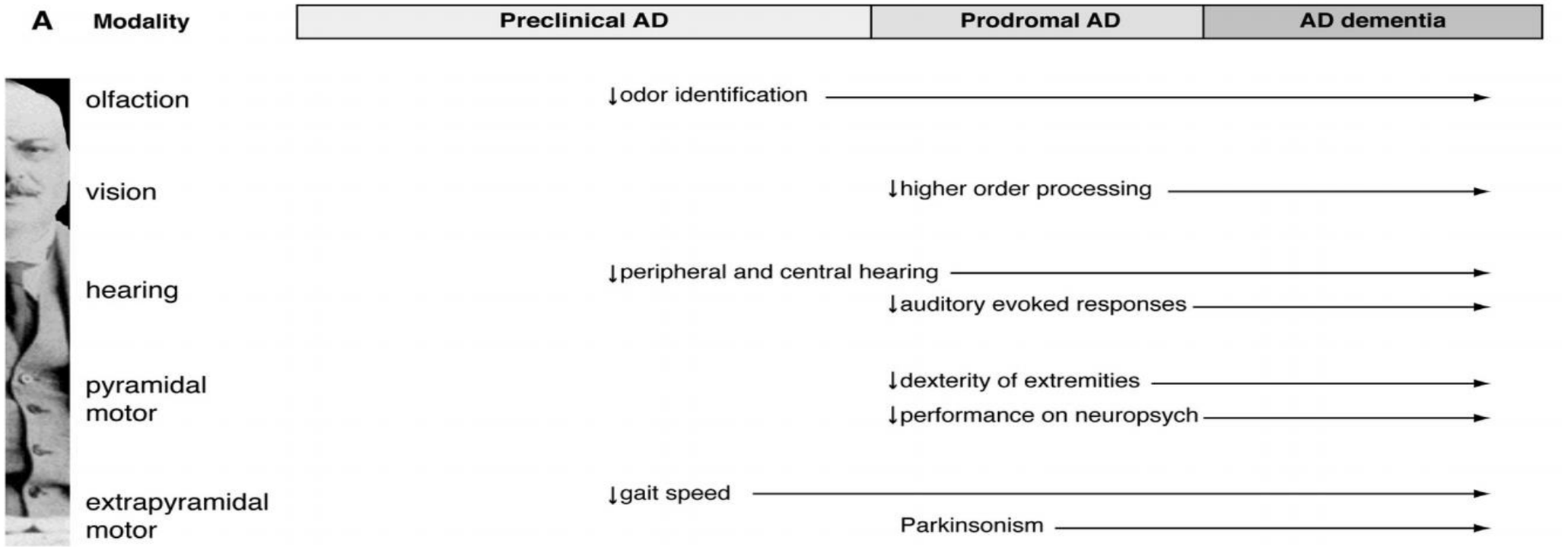


Fig. 1. Models of the relationship between sensory/motor dysfunction and AD. (A) A clinical model. Seminal observations of dysfunction of each sensory/motor modality are documented at the earliest reported stage during the clinical course of AD based on the studies referenced in this review. Parallel progression of these initial sensory or motor dysfunctions to advanced AD dementia raises the question of whether AD may be a heterogeneous disease in origin or a disease with heterogeneous clinical courses. A comprehensive assessment of all relevant sensory and motor measures from the preclinical stage of AD to the advanced dementia stage may help to test this possibility. Future research may also aim to extend these findings to earlier periods of the preclinical AD stage with better sensitivity and specificity by either improving the measurement methodology for detecting sensory and motor changes or by combining sensory/motor measures with other biomarkers, such as cerebrospinal fluid, neuroimaging, and genetic risk factors for AD. (B)

Albers et al 2015 (At the interface of sensory and motor dysfunctions and Alzheimer's Disease) Alzheimer's and Dementia, 70-98.

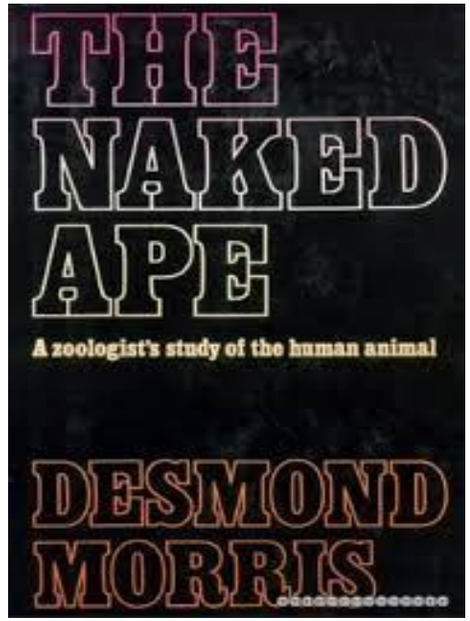
Main Questions

- What are the non-cognitive changes has been associated with developing dementia?
- What are the potential, sensory, motor, behavioral, or sleep, frailty markers that have been shown to serve as potential predictors of dementia?
- Are there prediction models for dementia using these non-cognitive markers?

Outline of this presentation

- Why walking is fundamental
- Gait and Brain Connection
- Predementia syndromes (MCI) and gait
- Walking while talking as a “Brain stress test” to predict dementia

Gait and Brain Connection



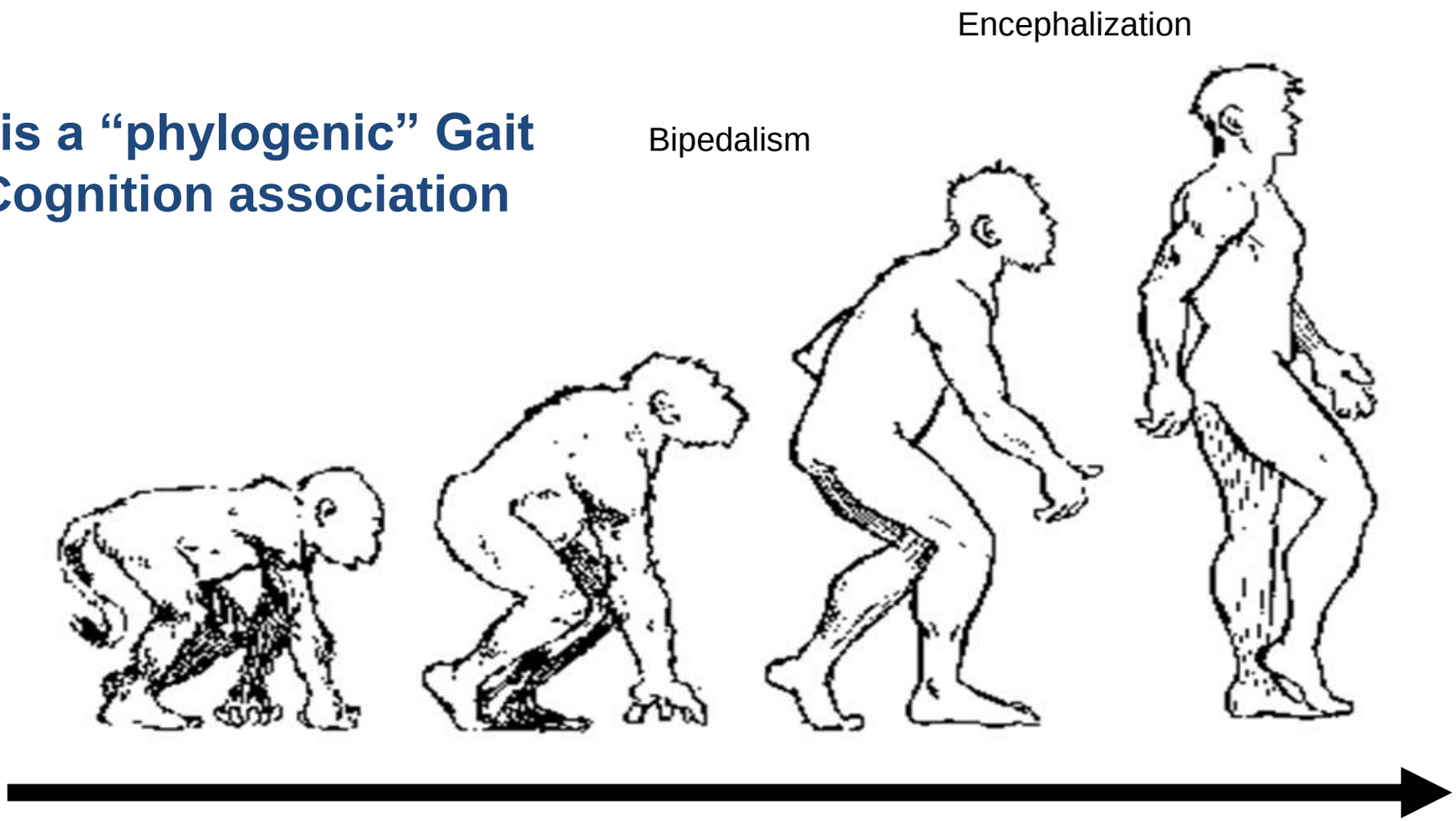
...If he was able to keep his body in an upright position,
to move his hands in one way and their feet in another.
To keep improving his brain and to use his mind as best as possible,
he stood a chance of success...”

Desmond Morris

“The Naked Ape”
A Zoologist’s Study of the Human Animal. 1967

Bipedalism, Encephalization and Gait

There is a “phylogenic” Gait and Cognition association



Montero-Odasso M. [*Gait Disorders in the Elderly Persons under the Scope of the Falls Syndrome*] [PhD thesis]. Faculty of Medicine Library. University of Buenos Aires. (2003)

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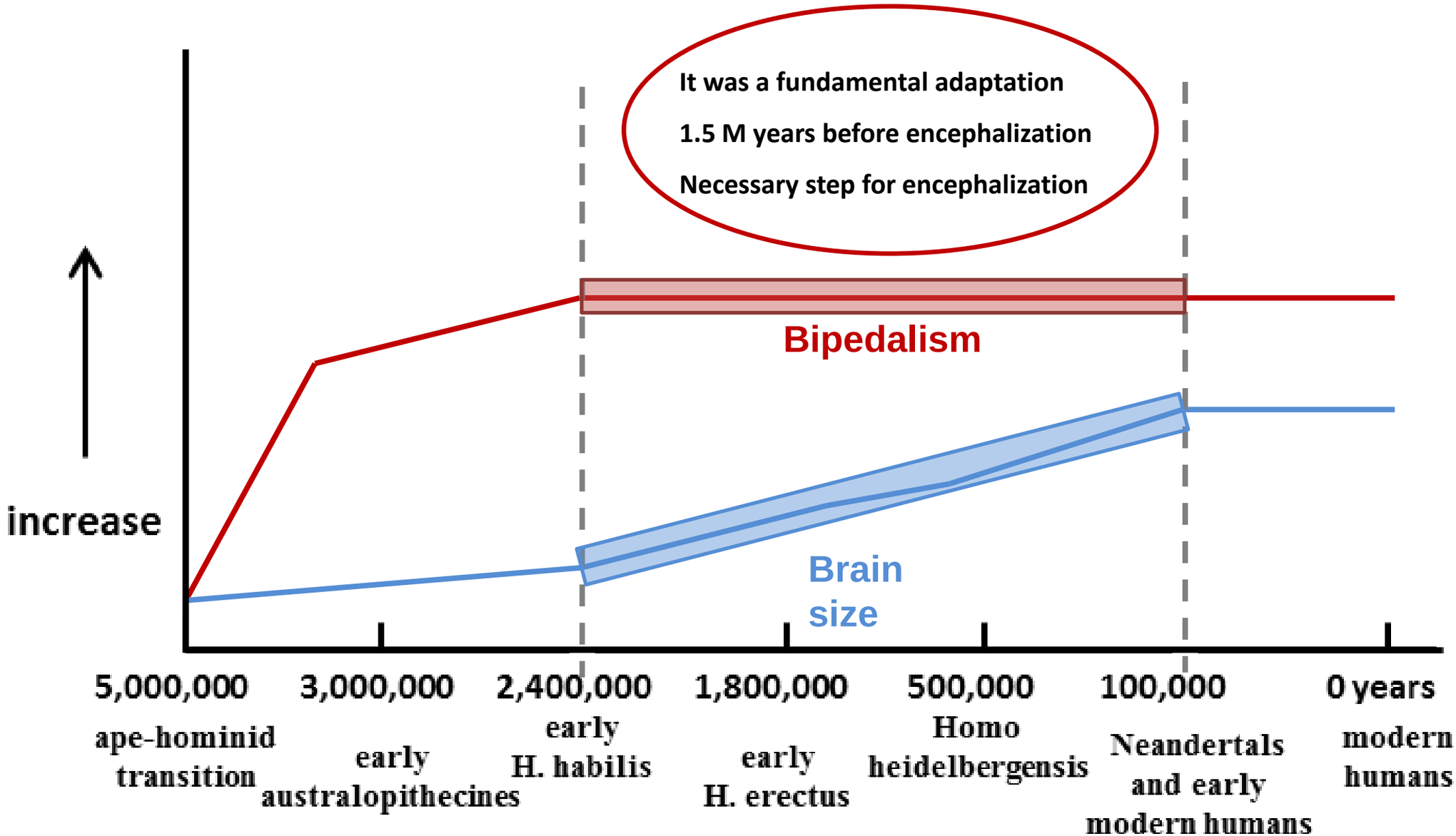
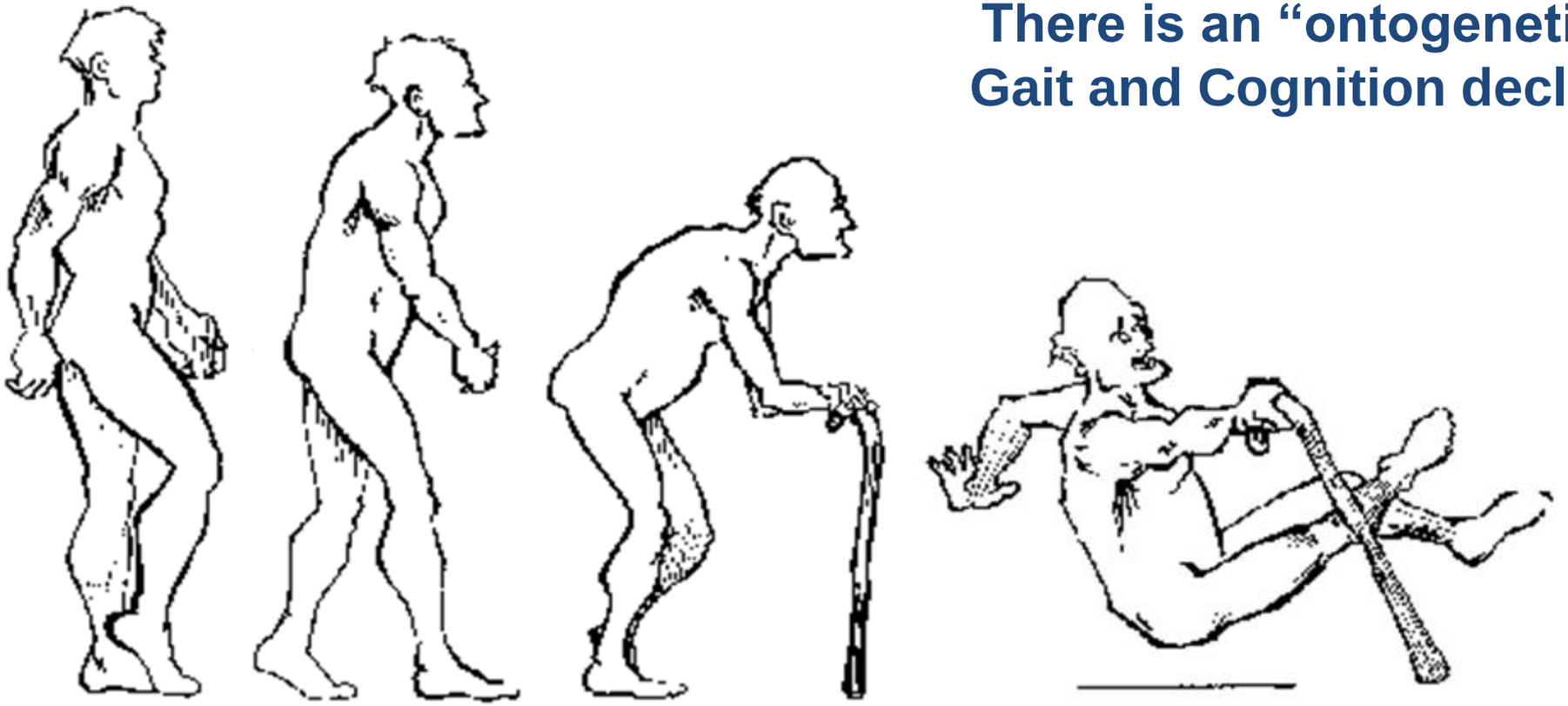
Bipedalism, Encephalization and Gait



Bipedalism, Encephalization and Gait



There is an “ontogenetic” Gait and Cognition decline

80 years

Montero-Odasso M. [*Gait Disorders in the Elderly Persons under the Scope of the Falls Syndrome*] [PhD thesis]. Faculty of Medicine Library. University of Buenos Aires. (2003)

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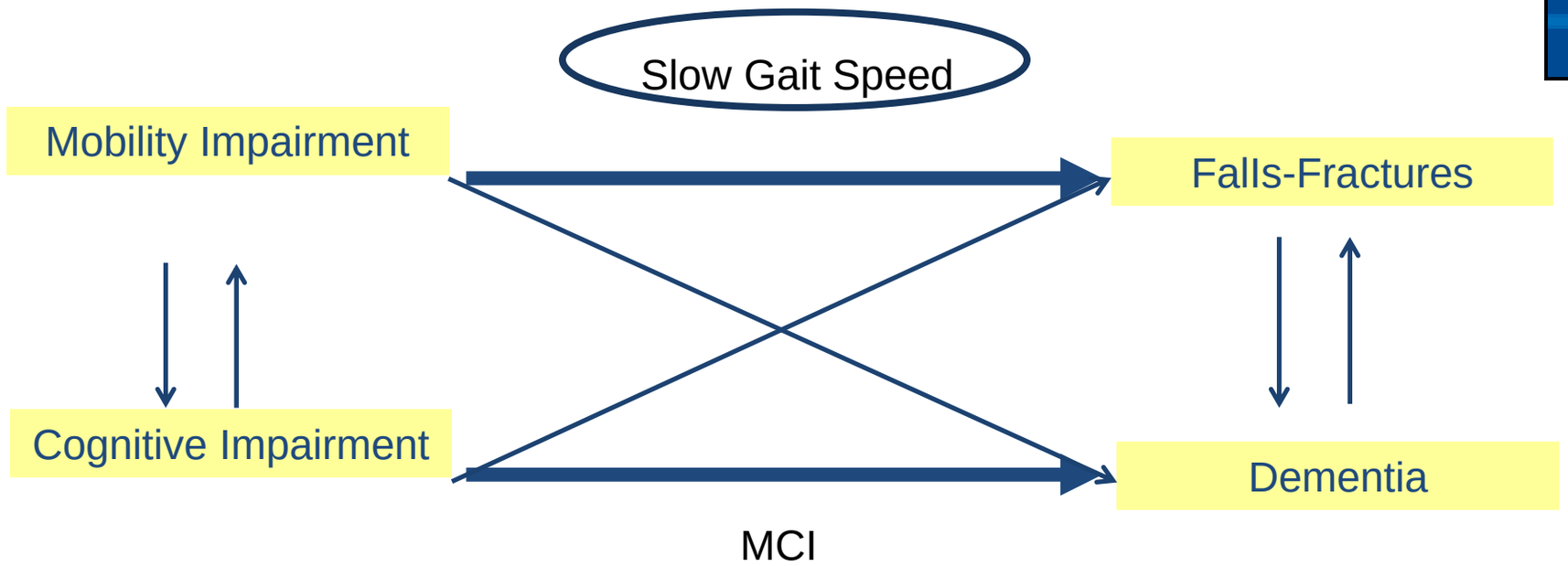
Gait and Cognition

PROGRESS IN GERIATRICS

Gait and Cognition: A Complementary Approach to Understanding Brain Function and the Risk of Falling

Manuel Montero-Odasso, MD, PhD, AGSF,†* *Joe Verghese, MB, BS,‡* *Olivier Beauchet, MD, PhD,§* *and Jeffrey M. Hausdorff, PhD*||#**



Traditional View
Emerging View

J Am Geriat Soc 2012; 60(11):2127-36.

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Walking is fundamental

Unrecognized Clinical Reality

An 86 year old man is brought to clinic for several years history of decline. He has withdrawn from life and spends all his time sitting in a chair dozing. He has had several recent falls.

PMH: diabetes on oral agent, HBP

Meds: HCTZ, glipizide

Exam shows deficits in cognition, construction, sequencing, recall and language.

He has a slow shuffling gait and increased tone. His affect is flat, he states that life is not worth living.

He is diagnosed with dementia and depression and given a cane.

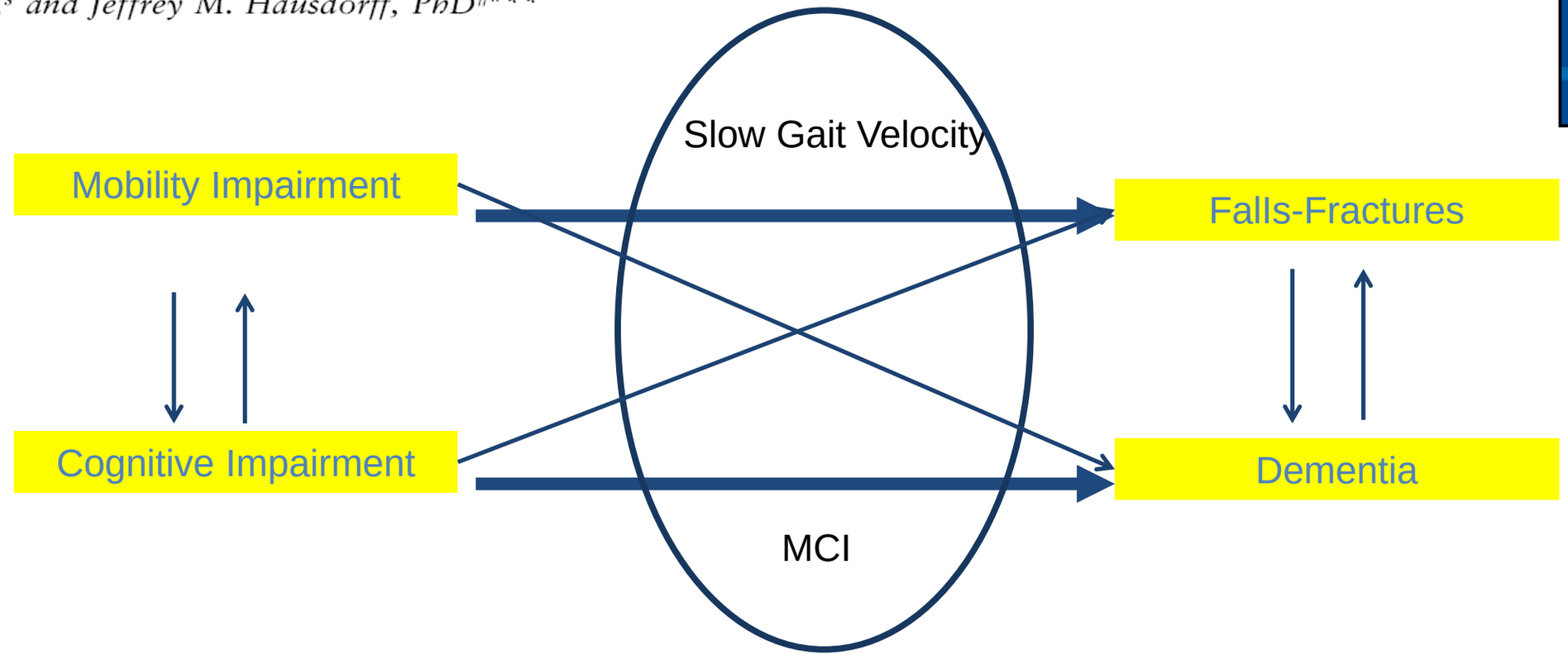
Brain-related gait abnormalities in older people are often ignored or attributed to "normal aging".

"senile gait"

PROGRESS IN GERIATRICS

Gait and Cognition: A Complementary Approach to Understanding Brain Function and the Risk of Falling

Manuel Montero-Odasso, MD, PhD, AGSF,† Joe Verghese, MB, BS,‡ Olivier Beauchet, MD, PhD,§ and Jeffrey M. Hausdorff, PhD∥#**



Traditional View
Emerging View

J Am Geriat Soc 2012; 60(11):2127-36.

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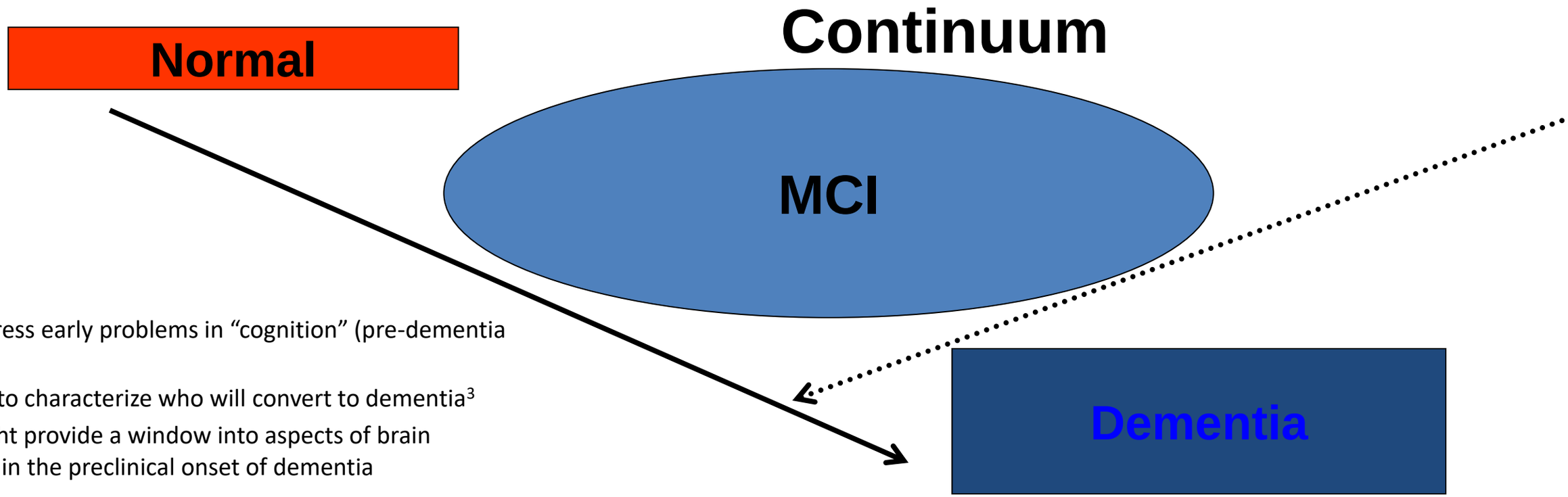
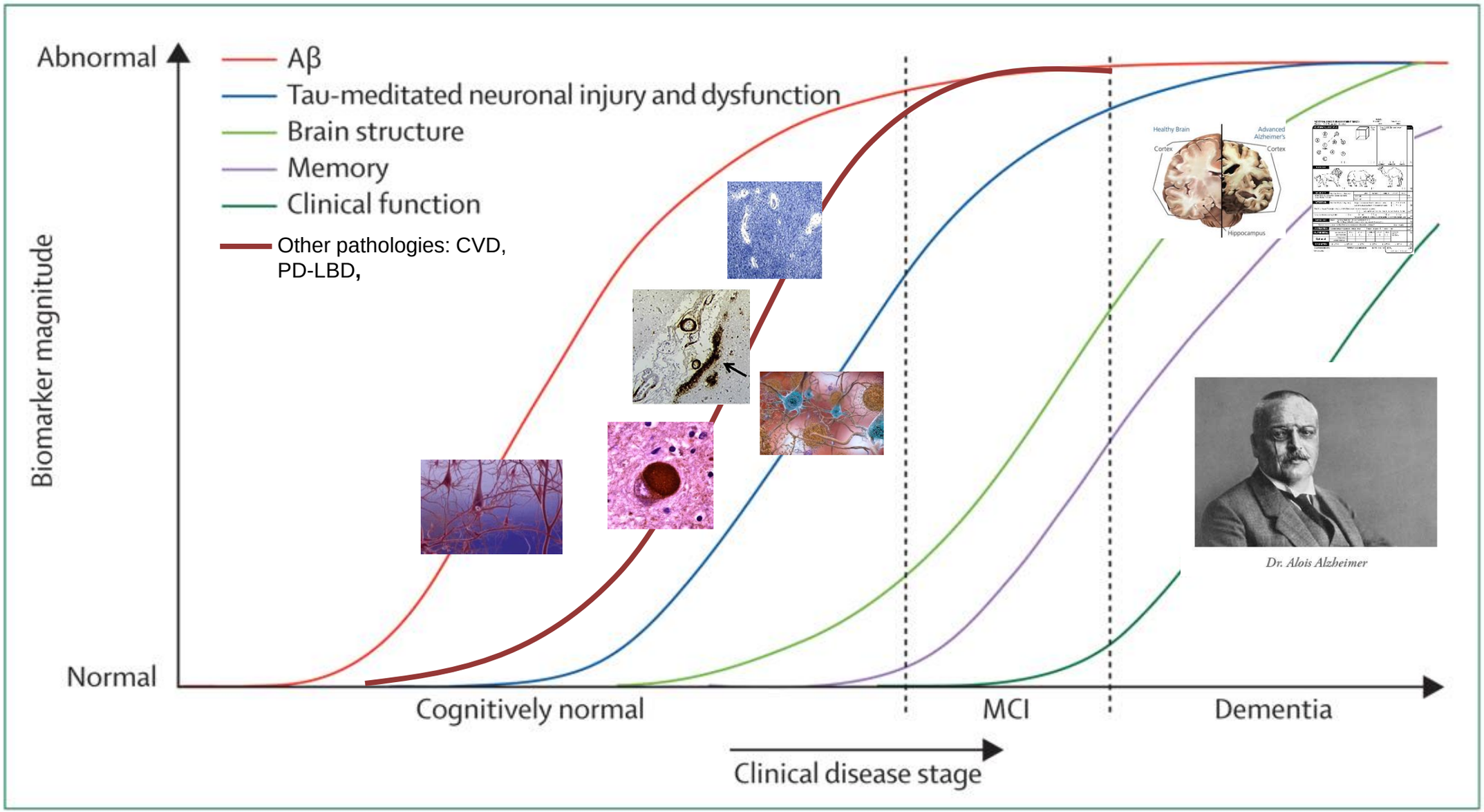
Mild Cognitive Impairment =MCI



- MCI express early problems in “cognition” (pre-dementia state).[1,2]
- Difficult to characterize who will convert to dementia[3]
- Gait might provide a window into aspects of brain function in the preclinical onset of dementia

1. Budson AE, Price BH. Memory Dysfunction. *N.Engl J Med* 2005; 352:692-699
2. Dubois B, Albert M. MCI or prodromal dementia? *Lancet Neurol* 2004; 3:246-248-1133
3. Petersen RC. *Journal of Internal Medicine* 2004; 256: 183–194

The road to Dementia. Changes before clinical manifestations



*Adapted from Jack et al. model. *Lancet Neurology* 2010

Gait & Brain Study – Overall goals

Can motor biomarkers predict dementia?

A

Overall Parkinsonism

Study name	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Camicioli (2007)a	3.170	1.733	5.799	3.744	0.000	40.62
Camicioli (2007)b	8.160	2.477	26.884	3.451	0.001	25.30
Waite (2005)	1.400	0.606	3.233	0.788	0.431	34.07
	3.048	1.313	7.076	2.594	0.009	

Statistics for each study — Odds ratio and 95% CI

$I^2 = 65.99$, $\tau^2 = 0.359$

0.01 0.1 1 10 100

Lower Odds Higher Odds

B

Tremor

Study name	Hazard ratio	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Lee (2016)	0.514	0.196	1.349	–1.352	0.176	30.71
Shill (2014)	0.460	0.171	1.237	–1.538	0.124	30.20
Thawani (2009)	1.710	0.971	3.012	1.857	0.063	39.08
	0.795	0.312	2.027	–0.480	0.631	

Statistics for each study — Hazard ratio and 95% CI

$I^2 = 73.76$, $\tau^2 = 0.500$

0.01 0.1 1 10 100

Lower Risk Higher Risk

C

Gait Velocity

Study name	Hazard ratio	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Camargo (2016)	2.530	1.113	5.753	2.214	0.027	10.24
Dumurgier (2016)	2.280	1.758	2.957	6.214	0.000	27.75
Gray (2013)	1.270	0.957	1.685	1.657	0.098	26.81
Montero-Odasso (2016)	4.930	1.710	14.212	2.953	0.003	7.00
Verghese (2014)	1.770	1.380	2.270	4.497	0.000	28.20
	1.936	1.414	2.650	4.123	0.000	

Statistics for each study — Hazard ratio and 95% CI

$I^2 = 69.63$, $\tau^2 = 0.075$

0.01 0.1 1 10 100

Lower Risk Higher Risk

From: **Motor function and incident dementia: a systematic review and meta-analysis** **Age Ageing**. May 25, 2017.1-10 doi:10.1093/ageing/afx084

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Evidence

JAMDA

journal homepage: www.jamda.com

Review Article

Poor Gait Performance and Prediction of Dementia: Results From a Meta-Analysis

Olivier Beauchet MD, PhD [a,b,c,*], Cédric Annweiler MD, PhD [d], Michele L. Callisaya PhD [e,f], Anne-Marie De Cock MD [g], Jorunn L. Helbostad PhD [h], Reto W. Kressig MD [i], Velandai Srikanth PhD [f], Jean-Paul Steinmetz PhD [j], Helena M. Blumen PhD [k], Joe Verghese MD, MBBS [k], Gilles Allali MD, PhD [k,l]

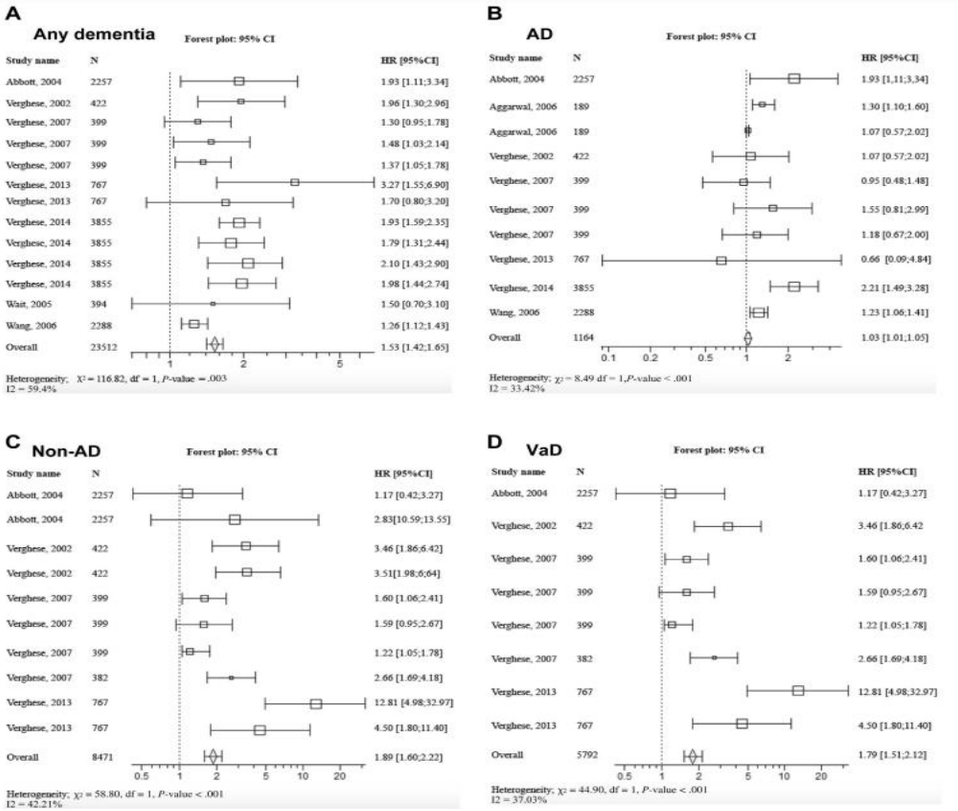
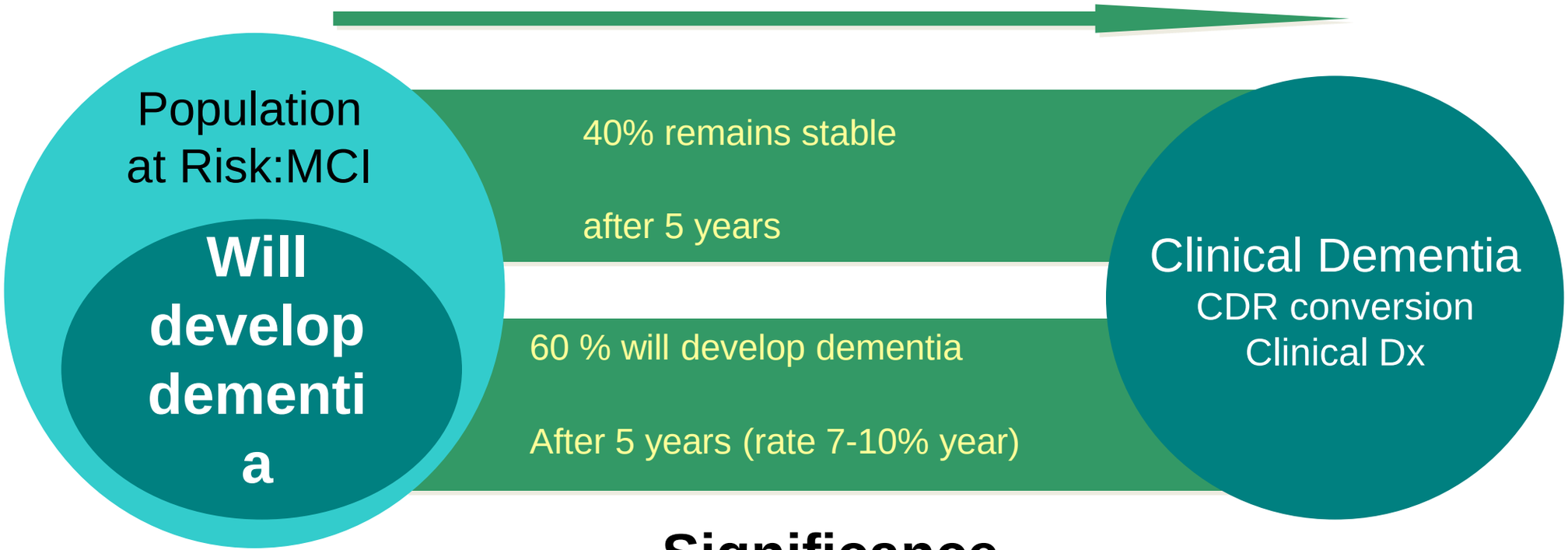


Fig. 2. Forest plot of pooled estimated HR for risk of incident dementia. (A) Any dementia, (B) AD, (C) non-AD, and (D) VaD in participants with abnormal gait at baseline compared with those with normal gait. Square box area proportional to the sample size of each study; horizontal lines corresponding to the 95% CI; diamond representing the summary value; vertical line corresponding to a HR combined with RR of 1.00, equivalent to no difference.

“The Gait and Brain Study”



Significance

Early prognosis
Early treatment
Delay disability
Delay placement

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Gait & Brain Study - Design and follow-up

N = 130
(1st wave 2007-2010)

N = 270
(2nd wave 2010-ongoing)

Total Since 2007
N = 414
MCI=211, SCI=115,Controls=88

N = 250
in follow- up

N = 57 progressed to dementia
N = 77 drop out
N = 16 deceased

Design and Participants:

- Ongoing cohort, up to 15 years
- Seniors (>65 y/o) with SCI, MCI, Cognitive Healthy controls
- No frailty, no dementia at baseline, able to ambulate independently

Mean follow-up: 34 months
Range follow up: 6 months to 78 months

Bi annual assessments:

- Battery of Cognitive tests
- Gait (electronic walkway), Balance, Blood tests, MRIs every 18 mo

Montero-Odasso M, et al. BMC Geriatr. 2009 Sep 1;9:41
Montero-Odasso M et al. *J. Am Geriatr Soc* 2012

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Gait & Brain Study

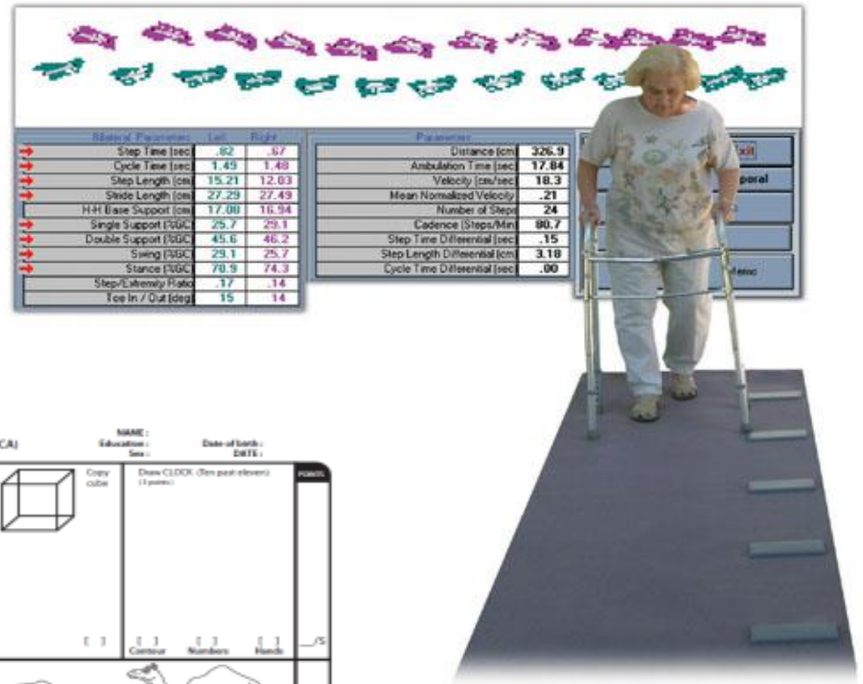
Methods & Assessments

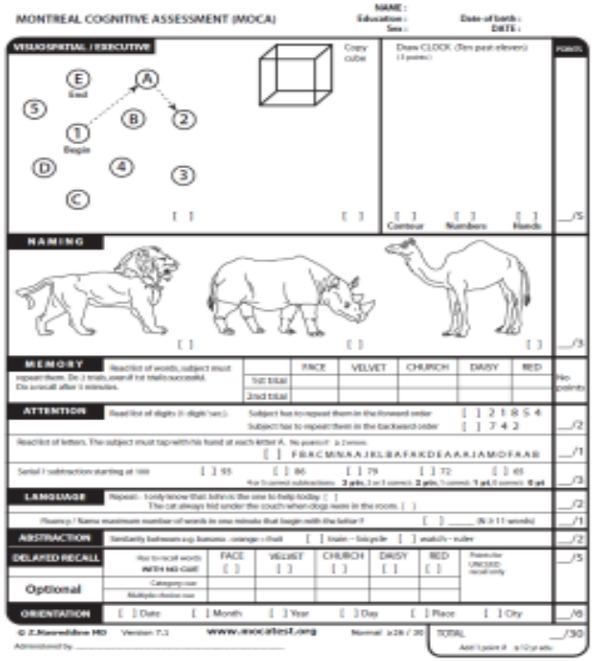
- **Gait performance**
  - Electronic walkway (Zeno Mat® and GAITRite® System)
    - Gait velocity (cm/s)
    - Dual-task gait test

- **Cognitive Assessments:**
  - MoCA, MMSE , CDR, RAVLT, TMT A/B

- **Incident Dementia**
  - DSM-IV criteria + when CDR progressed to 1.0 or higher in follow-up

- **Analysis**
  - Cox proportional hazard models





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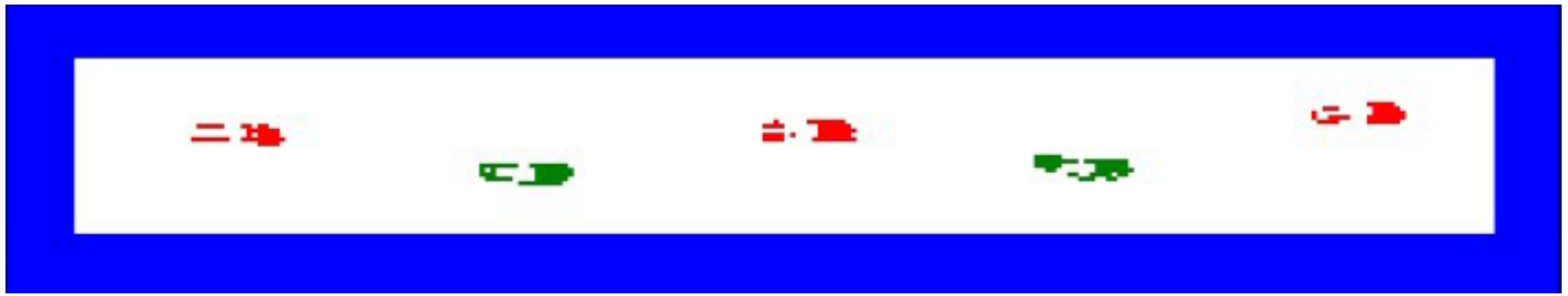
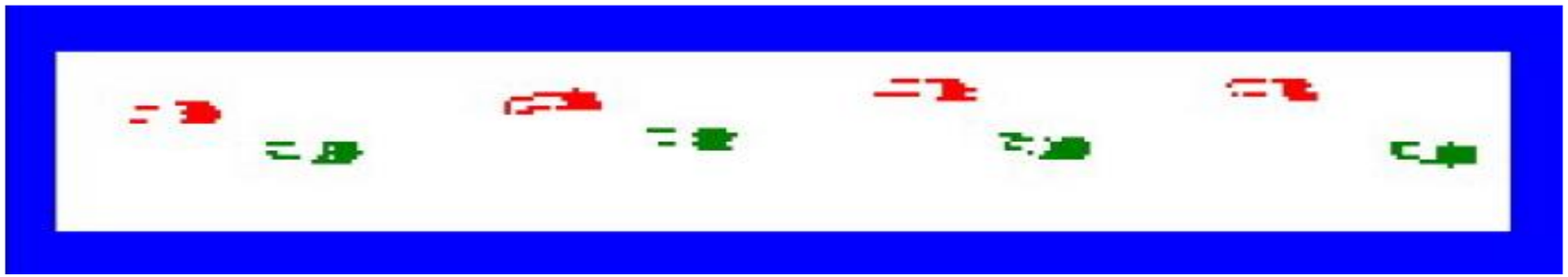
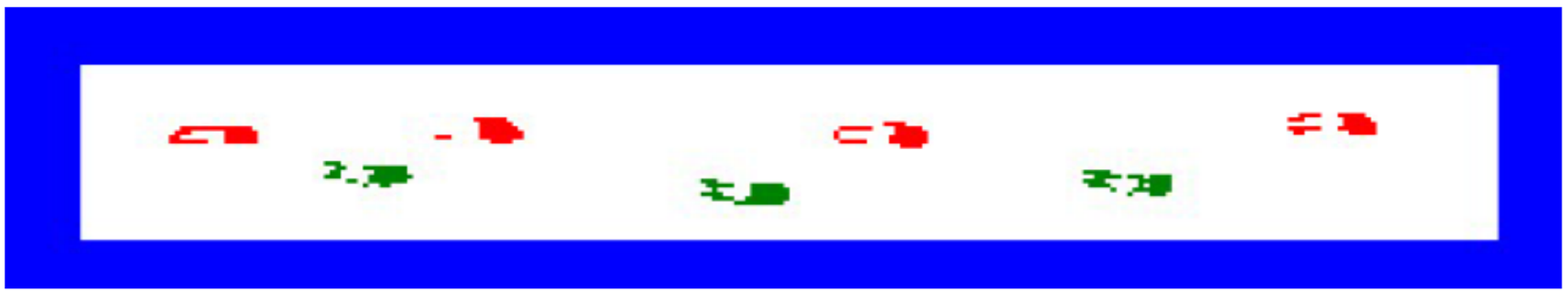
A. Usual gait: right and left step lengths approximately equal.



B. asymmetric gait (limp): right step length consistently shorter than left step length.

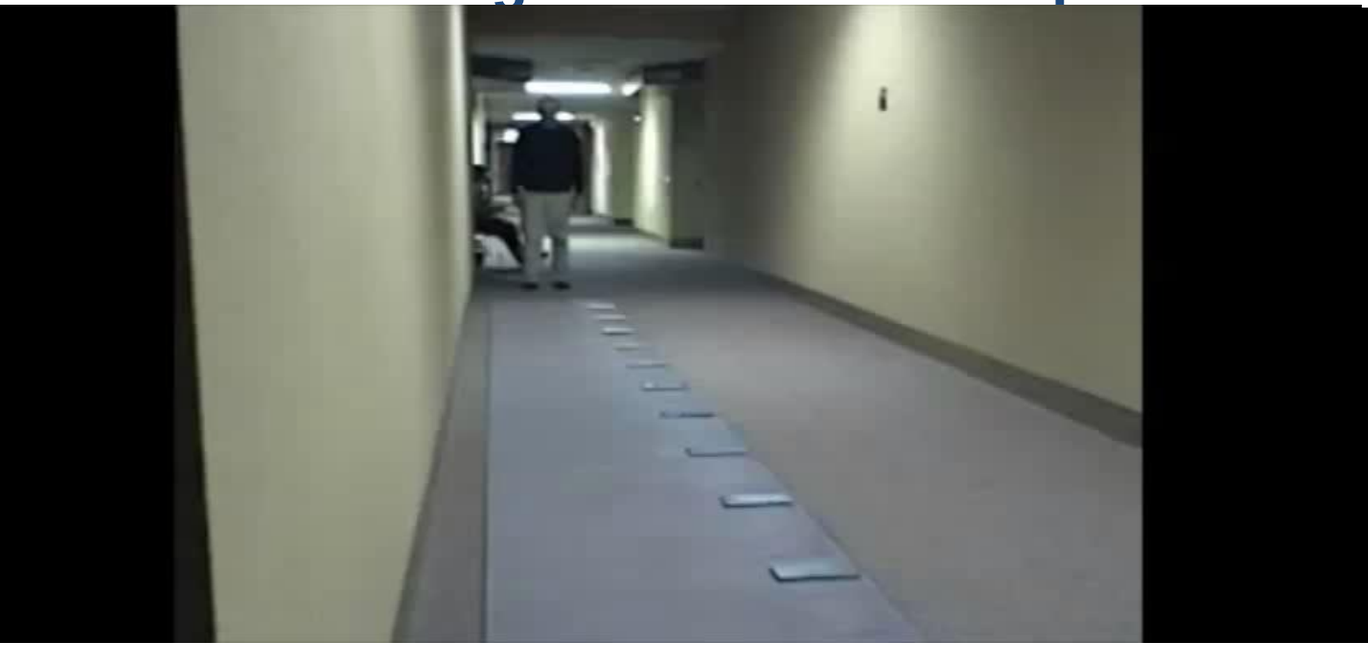


C. Variable gait: inconsistent right and left step lengths



Red = Left footprints, Green = Right footprints

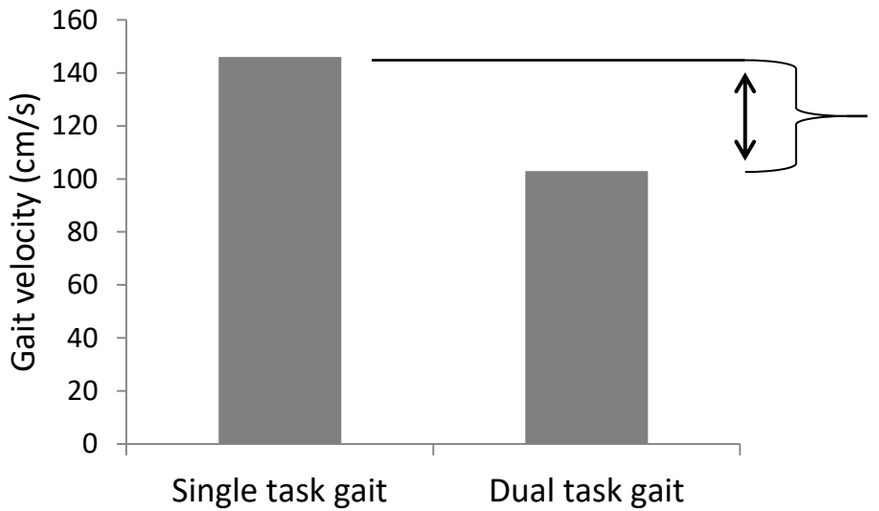
Single-Task Gait Example



Gait velocity: 1.46 m/sec
Gait variability: 2.83% CoV

Dual-Task Gait Example (Serial 7s)

Gait velocity: 1.03 m/sec
Gait variability: 13.06% CoV



Dual task cost $= \frac{Single\ gait - Dual\ task\ gait}{Usual\ gait}$ x 100= **30%**

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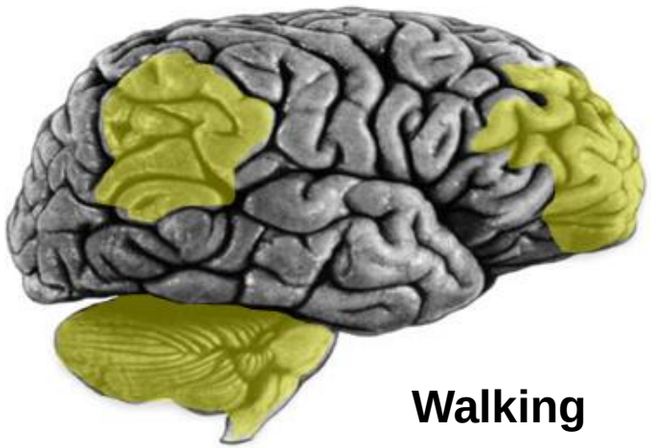
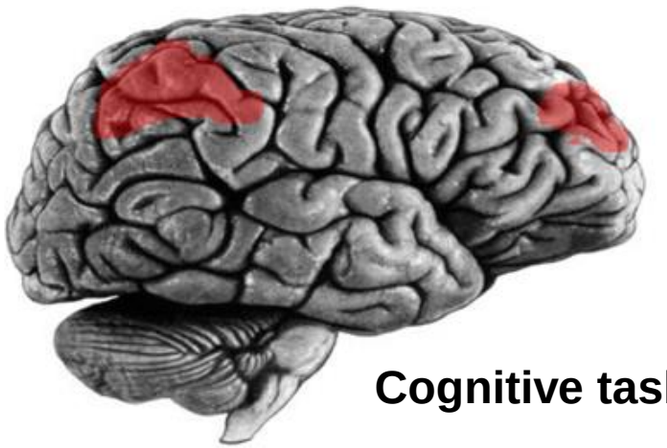
Dual-task paradigm - How does it work?

Brain areas activated while…



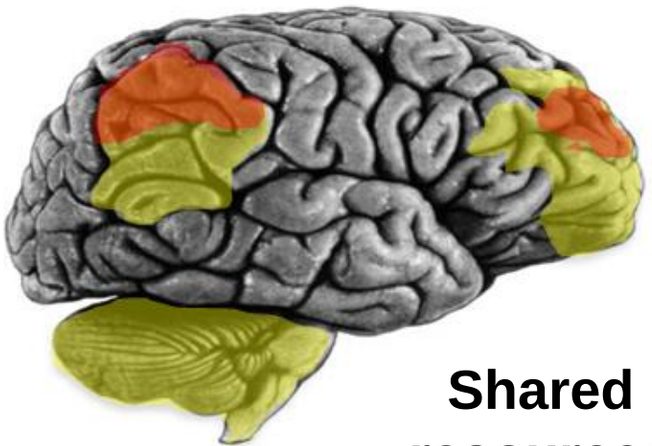
Walking

Single task



Cognitive task

Single task

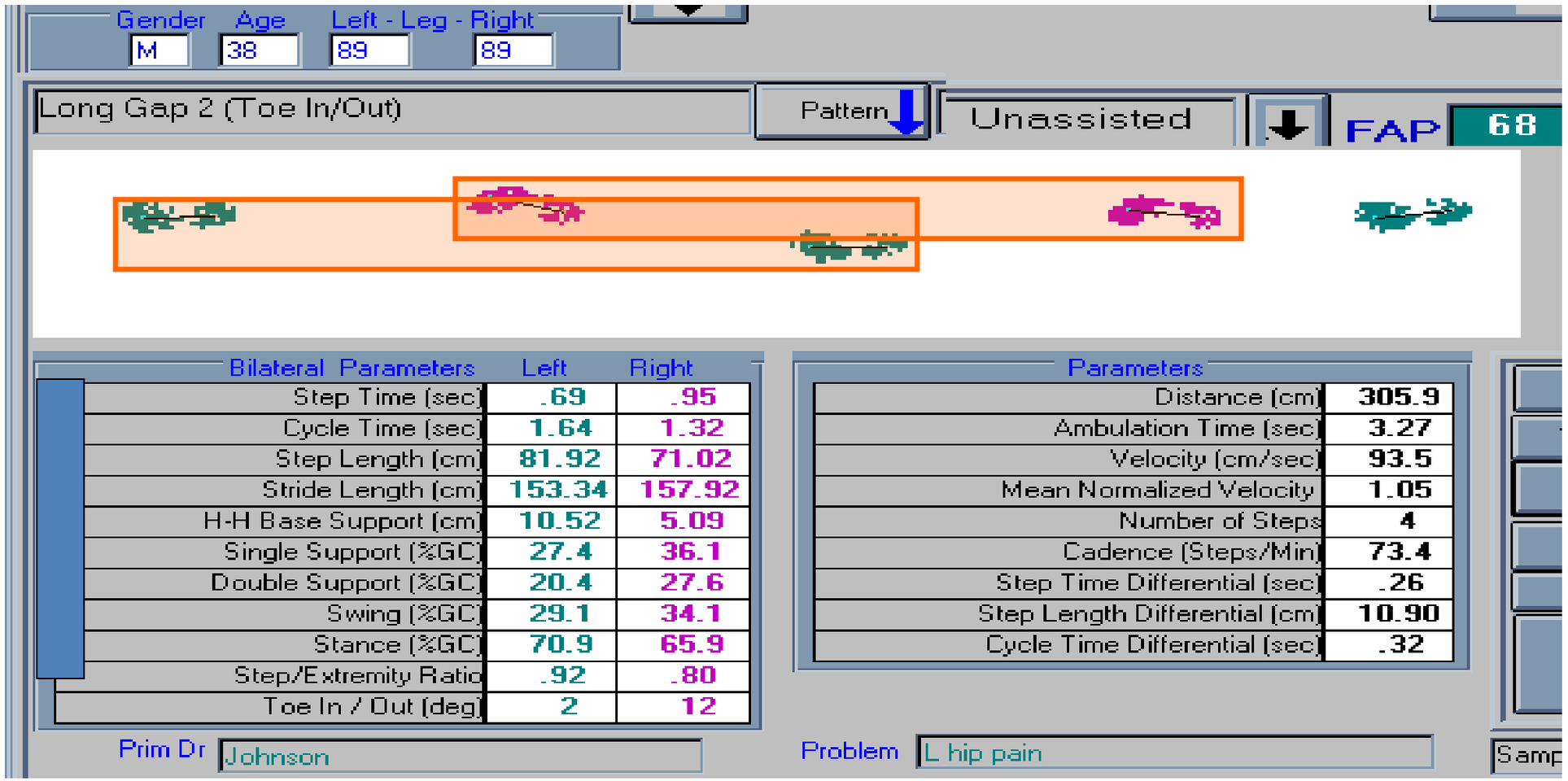


Shared resources

Dual-task

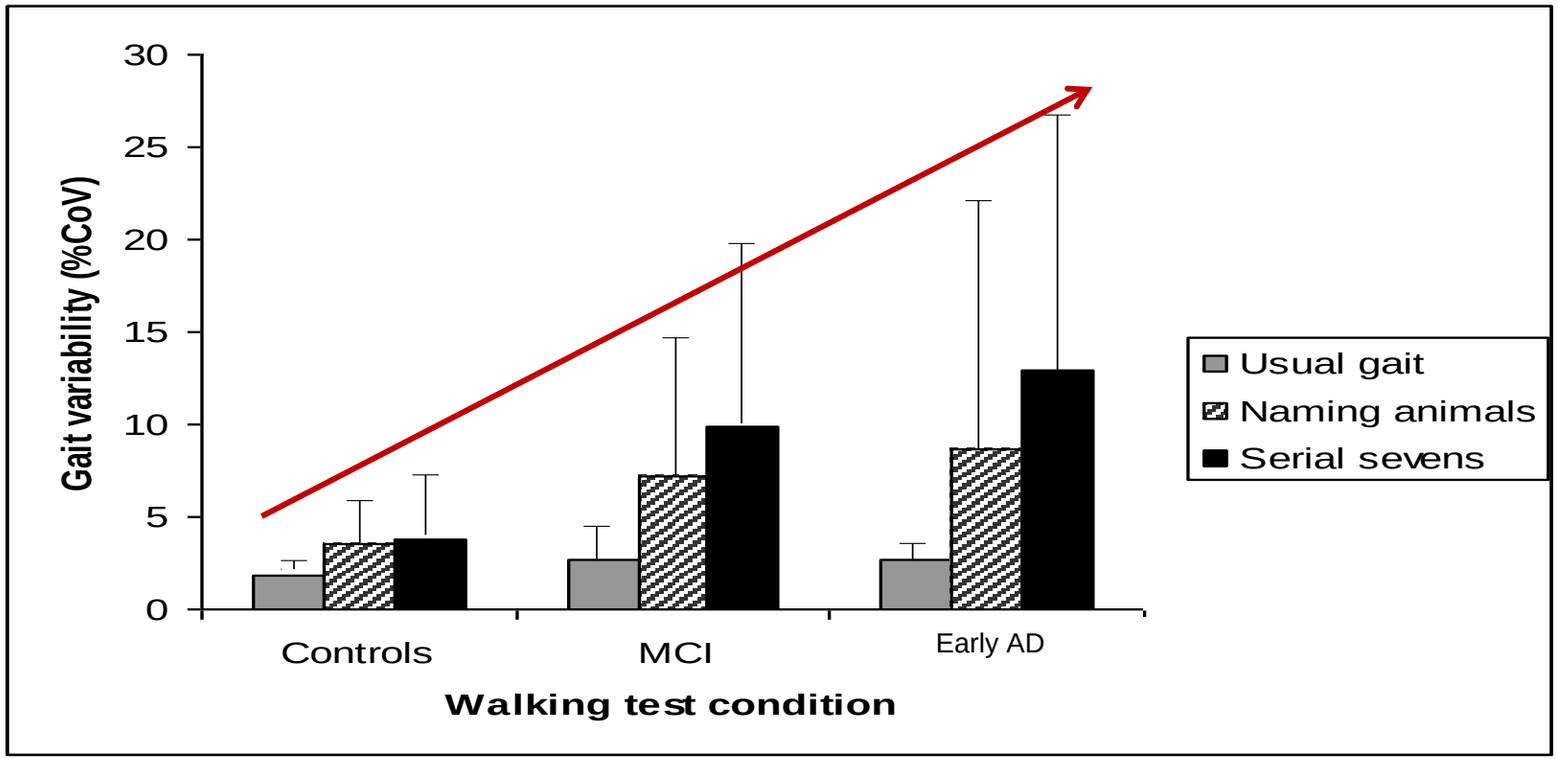
Pashler H. Psychol Bull. 1994

Gait Assessment



Stride time is a fine parameter of cortical control of gait

Gait Variability in the Cognitive Spectrum



Gait variability in older adults with normal cognition (n=30), Mild Cognitive Impairment (n=45) and very mild Alzheimer's disease (n=34) while usual walking and with two dual-task walking conditions.

Muir, Speechley, Wells, Borrie, Gopaul, Montero-Odasso. Gait in Mild Cognitive Impairment and Alzheimer's disease: the effect of dual-task challenges across the cognitive spectrum. Gait Posture. 2012 Jan;35(1):96-100.

Research

JAMA Neurology | Original Investigation

Association of Dual-Task Gait With Incident Dementia in Mild Cognitive Impairment

Results From the Gait and Brain Study

Manuel M. Montero-Odasso, MD, PhD, FRCPC; Yanina Sarquis-Adamson, PhD; Mark Speechley, PhD; Michael J. Borrie, MBBS, FRCPC; Vladimir C. Hachinski, MD, DPhil, FRCPC; Jennie Wells, MD, FRCPC; Patricia M. Riccio, MD; Marcelo Schapira, MD; Ervin Sejdic, PhD; Richard M. Camicioli, MD, FRCPC; Robert Bartha, PhD; William E. McIlroy, PhD; Susan Muir-Hunter, PT, PhD

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Gait & Brain Study - Design and follow-up

N = 130
(1
20

N = 210

Design and Participants:

To be included in this study, participants had to:

- Have at least 2 assessment visits
- Fulfill MCI criteria

} N = 112

Total Since 2007
N = 400

Bi annual assessments:

- Battery of Cognitive test
- Gait, Balance, Blood tests, MRI

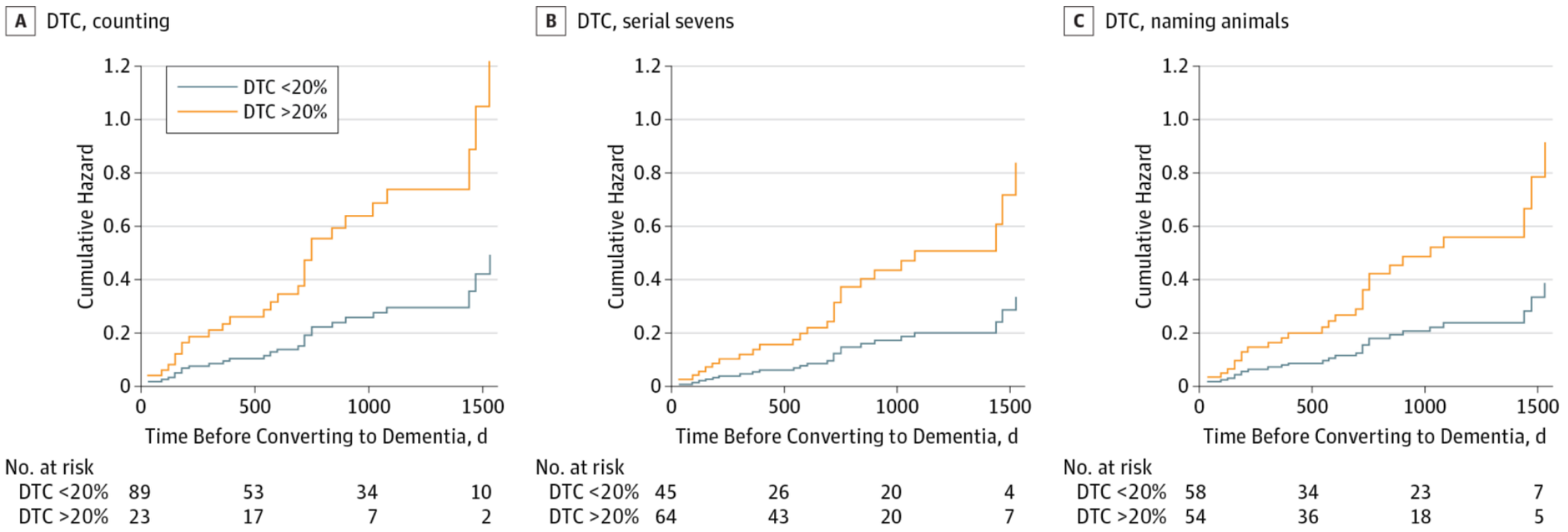
N = 250
in follow- up

N = 47 progressed to dementia
N = 60 drop out
N = 6 deceased

Montero-Odasso M, et al. BMC Geriatr. 2009 Sep 1;9:41

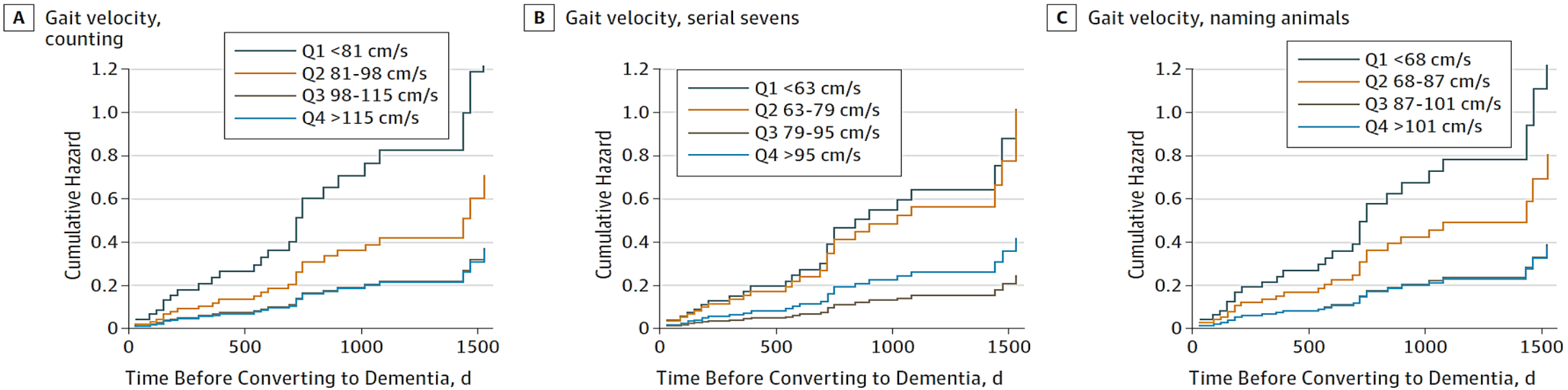
From: **Association of Dual-Task Gait With Incident Dementia in Mild Cognitive Impairment: Results From the Gait and Brain Study**

JAMA Neurol. Jul 1;74(7):857-865. doi:10.1001/jamaneurol.2017.0643



Cumulative Hazard Ratio for Progression to Dementia for Low and High Dual-Task Cost in Gait Velocity (n = 112) A, Dual-task gait cost (DTC) while counting backward. B, While performing serial sevens subtractions. C, While naming animals.

Figure 2. Risk of Dementia Stratified By Gait Velocity (centimeters per second) Quartiles in 3 Dual-Tasks Conditions



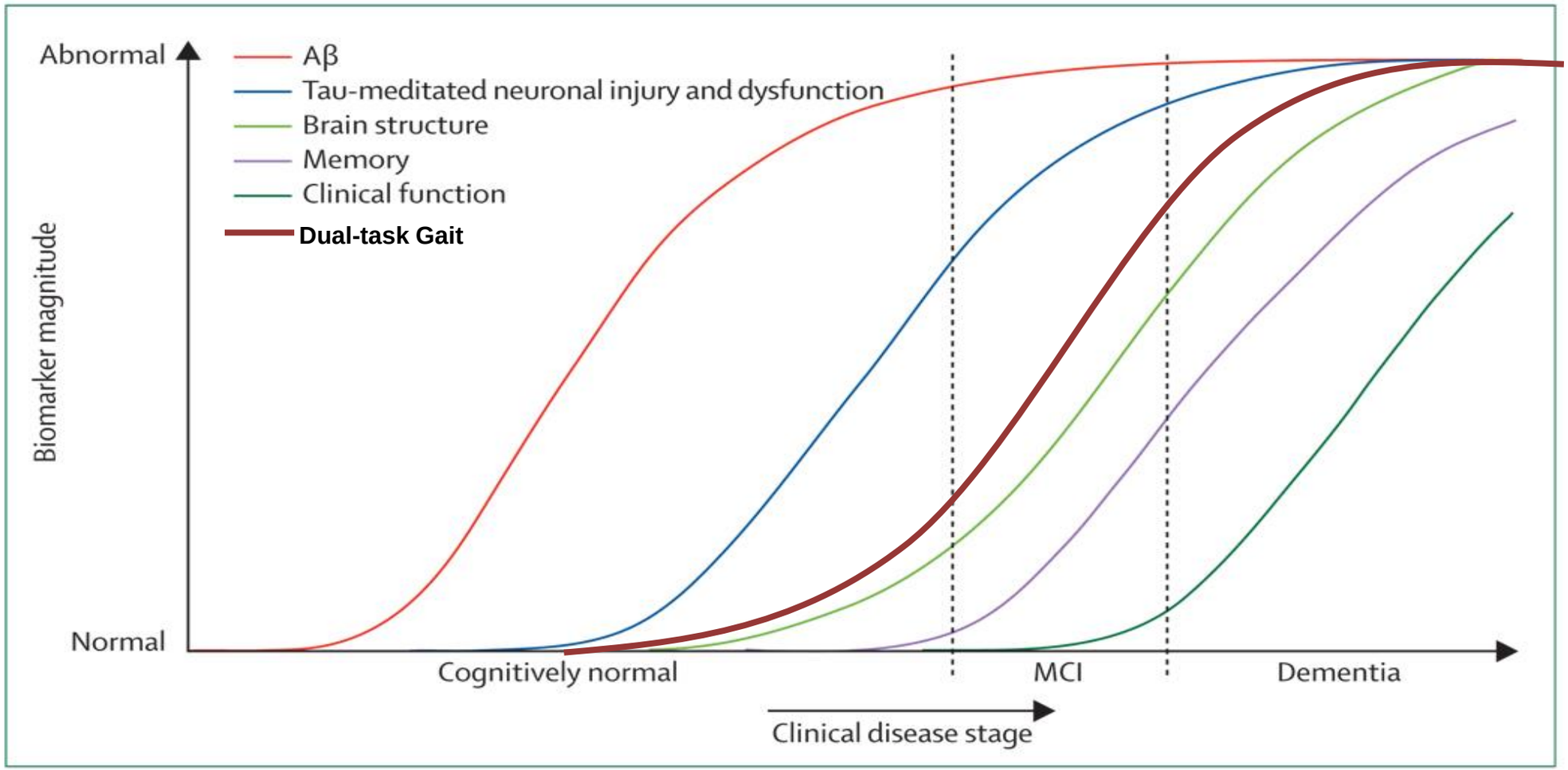
No. at risk				
Q1	28	14	5	2
Q2	28	18	11	2
Q3	28	19	9	3
Q4	28	19	16	5

No. at risk				
Q1	27	18	7	4
Q2	28	16	7	2
Q3	28	18	14	4
Q4	27	18	13	2

No. at risk				
Q1	28	15	6	2
Q2	27	15	7	2
Q3	29	22	13	3
Q4	28	18	15	5

The 3 dual-tasks conditions are counting backward (A), serial sevens subtractions (B), and naming animals (C).

Proposal that Dual-Task gait (dark red) can be an early biomarker for Dementia progression before cognitive and brain structural changes happen.



*Adapted from Jack et al model. Lancet Neurology 2010

Gait & Brain Study –

Trajectories of decline gait and cognition

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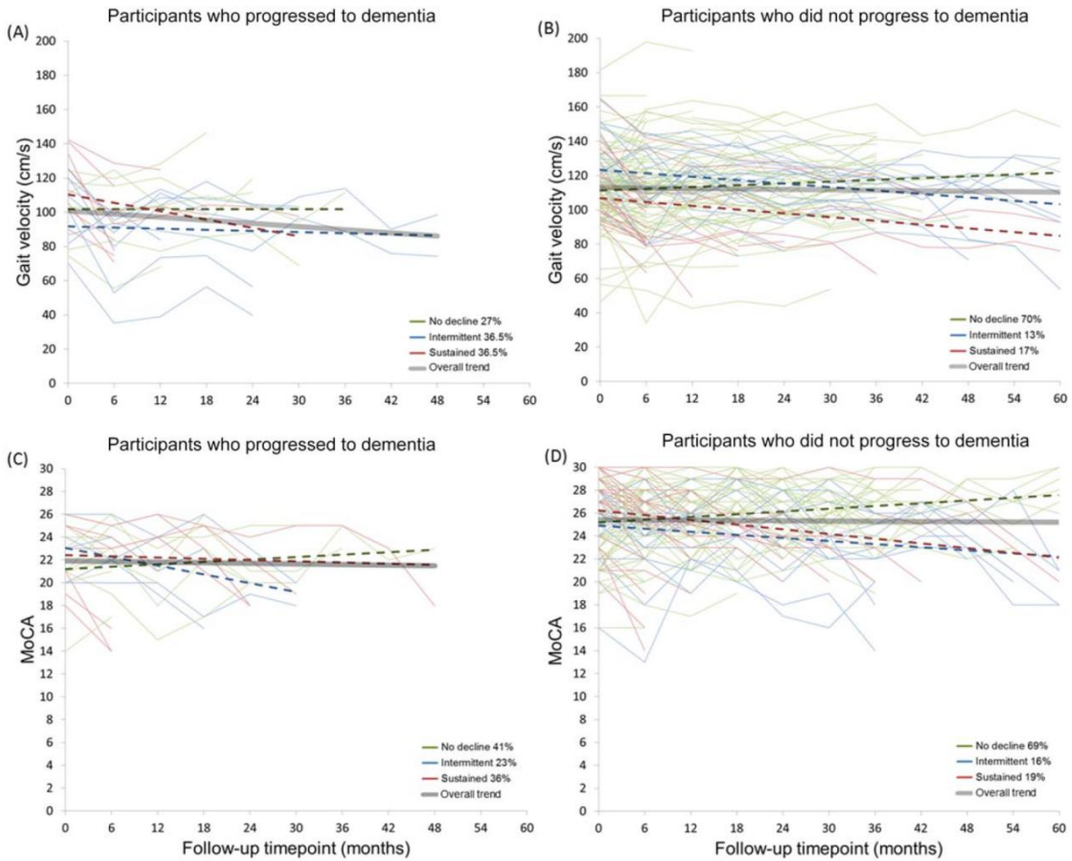
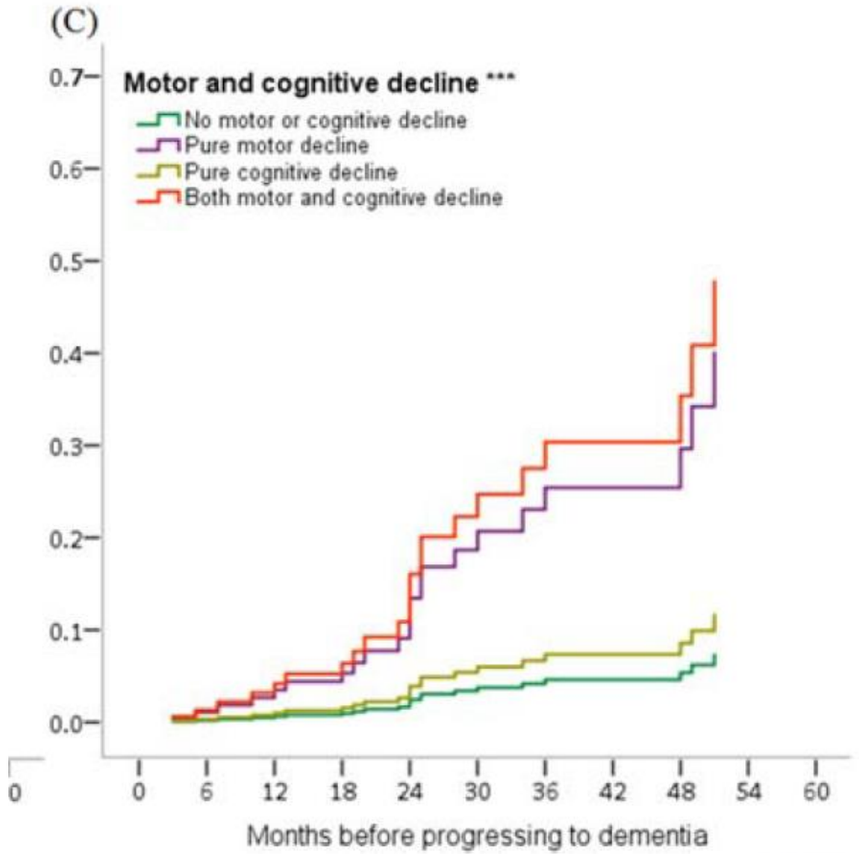
CLINICAL INVESTIGATION

Motor and Cognitive Trajectories Before Dementia: Results from Gait and Brain Study

Manuel Montero-Odasso, MD, PhD, AGSF,[†‡] *Mark Speechley, PhD,*[*‡]
Susan W. Muir-Hunter, PT, PhD,[*†] *Yanina Sarquis-Adamson, PhD,**
Luciano A. Sposato, MD, MBA,[‡§¶‖] *Vladimir Hachinski, MD, DPhil,*[§] *Michael Borrie, MBBS,*[†]
Jennie Wells, MD,[†] *Alanna Black, MSc,** *Ervin Sejdić, PhD,*** *Louis Bherer, PhD,*[††]
Howard Chertkow, MD,[‡‡] *and The Canadian Gait and Cognition Network*





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Evidence

Journal of the American Geriatrics Society

CLINICAL INVESTIGATION

Motor and Cognitive Trajectories Before Dementia: Results from Gait and Brain Study

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Table 2. Risk of Progression to Dementia According to Motor Decline, Cognitive Decline, and Motor and Cognitive Decline

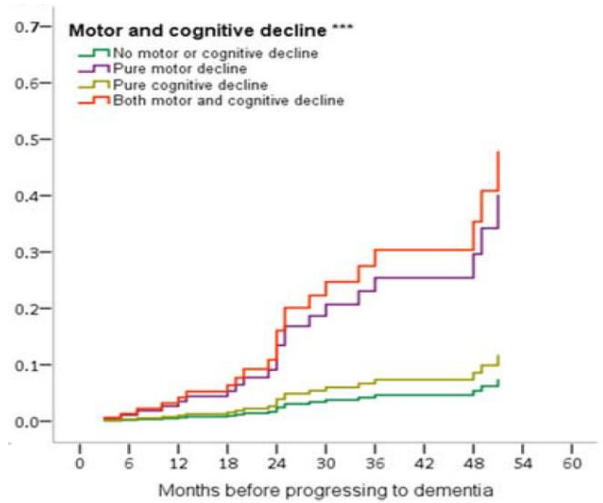
Decline Pattern	Unadjusted	Model 1	Model 2	Model 3	Model 4
	Hazard Ratio (95% Confidence Interval) P-Value				
Motor[a]					
Intermittent	2.60 (0.89–7.60) .08	3.52 (1.14–10.84) .03	2.72 (0.80– 9.24) .11	2.54 (0.72–8.97) .15	2.29 (0.60–8.75) .22
Sustained	7.02 (2.42–20.35) <.001	6.21 (2.08–18.61) .001	5.70 (1.91–17.01) .002	5.53 (1.84–16.62) .002	6.89 (2.18–21.75) .001
Cognitive[b]					
Intermittent	1.30 (0.44–3.82) .63	1.20 (0.40–3.56) .75	1.31 (0.44–3.87) .63	1.60 (0.53–4.81) .41	1.58 (0.53–4.76) .41
Sustained	3.03 (1.23–7.48) .02	2.78 (1.11–6.95) .03	2.32 (0.88–6.07) .09	3.18 (1.16–8.67) .02	3.61 (1.28–10.13) .01
Combined[c]					
Pure motor	2.25 (0.60–8.46) .23	3.77 (0.96–14.91) .06	5.41 (0.98–29.91) .05	5.50 (0.98–30.89) .05	6.31 (1.08–36.87) .04
Pure cognitive	0.97 (0.18–5.30) .97	0.79 (0.14–4.53) .79	1.35 (0.21–8.47) .75	1.59 (0.25–10.13) .62	2.18 (0.33–14.39) .42
Motor and cognitive	5.33 (1.69–16.88) .004	5.41 (1.69–17.30) .004	6.26 (1.76–22.23) .005	6.57 (1.85–23.38) .004	7.83 (2.10–29.24) .002

No decline is the reference category.

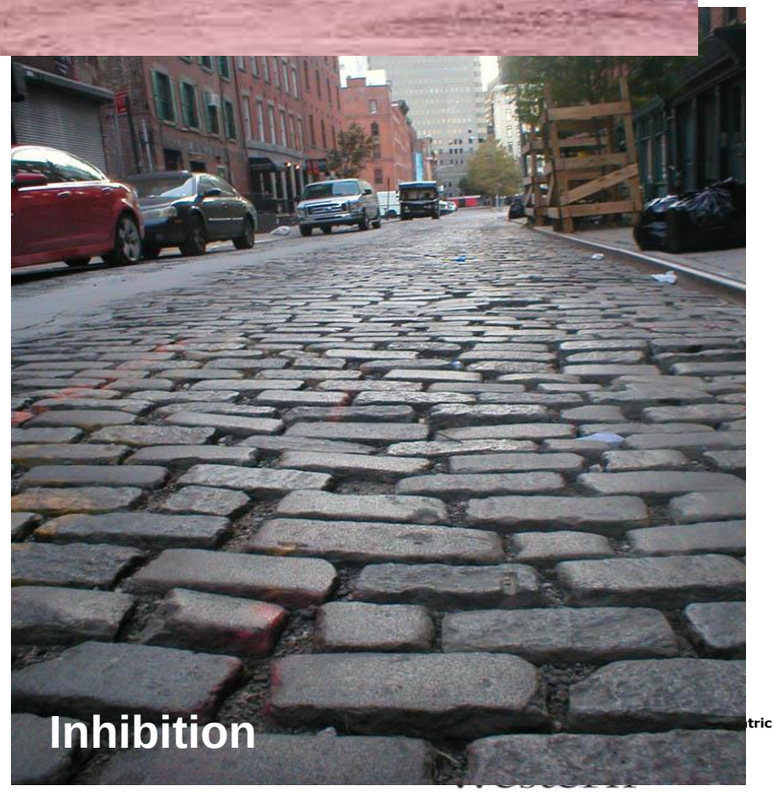
[a]Model 1 adjusted for baseline Montreal Cognitive Assessment (MoCA) score; Model 2 adjusted for age, sex, baseline MoCA score; Model 3 adjusted for age, sex, baseline comorbidities, baseline MoCA score; Model 4: adjusted for age, sex, baseline comorbidities, baseline MoCA score, time-dependent covariate (comorbidities developed during follow-up).

[b]Model 1 adjusted for baseline gait velocity; Model 2 adjusted for age, sex, baseline gait velocity; Model 3 adjusted for age, sex, comorbidities, baseline gait velocity; Model 4 adjusted for age, sex, baseline comorbidities, baseline gait velocity, time-dependent covariate.

[c]Model 1 adjusted for baseline MoCA score, baseline gait velocity; Model 2 adjusted for age, sex, baseline MoCA score, baseline gait velocity; Model 3 adjusted for age, sex, baseline comorbidities, baseline MoCA score, baseline gait velocity; Model 4 adjusted for age, sex, baseline comorbidities, baseline MoCA score, baseline gait velocity, time-dependent covariate.



Walking is cognitively demanding!



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Summary, so far!

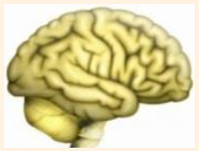
- Gait is cognive dmeinf an dcan be motro marker of cognitive impairment
- Common brain mechanisms underlie gait and cognitive impairments before dementia
- Identification of common modifiable risk factors for gait, motor and cognitive interaction will help develop targeted interventions to prevent cognitive decline and delay progression to dementia

What is the underlying mechanism of gait-cognitive relation and dysfunction?

What do these symptoms have in common?

They rely in similar brain regions and networks

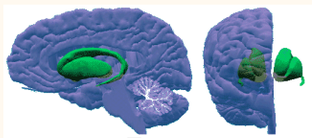
Cortical



Goal direct system: must reach the goal and avoid impeding objects

Regulates propulsion and navigation

Subcortical



Motor system

1-Basal ganglia & Brain stem Level

Generates propulsive movement

Spinal

2-Spinal Level: Central Pattern Generator (CPG); .

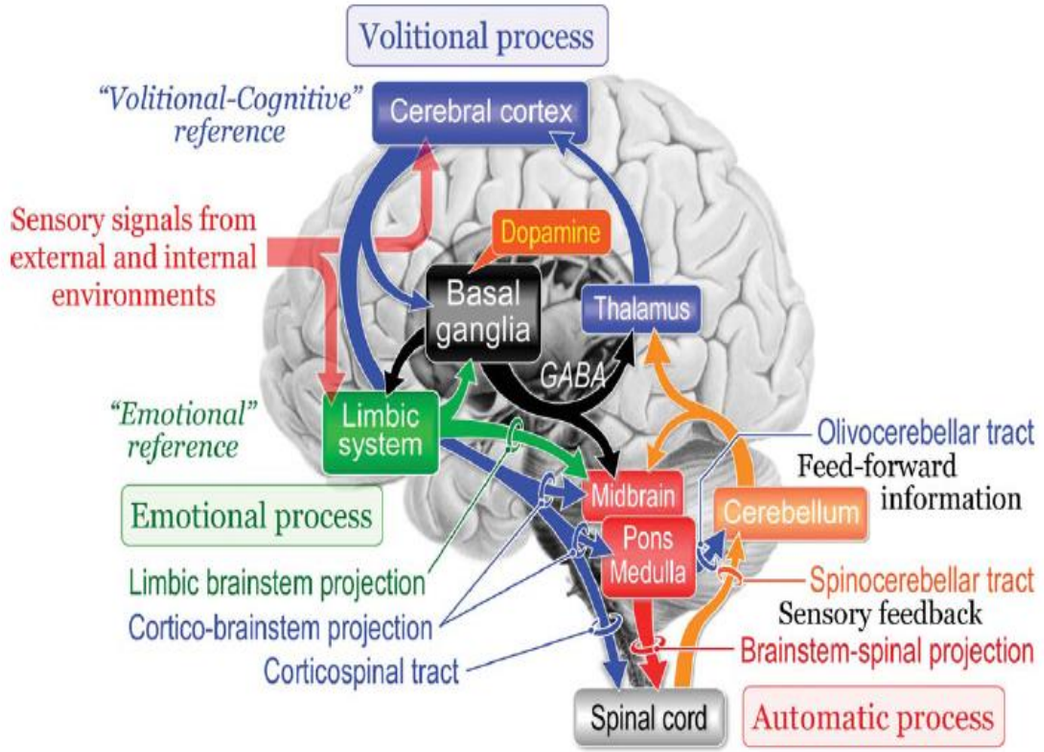
Provides cadence and rhythm

Gait

Postural system and peripheral limbs

1-Muscle and Joints
2-Vestibular
3-Ocular

Helps to position center of gravity
Provides propulsion



Montero-Odasso M, et al. BMC Neurol. 2009;9:42.

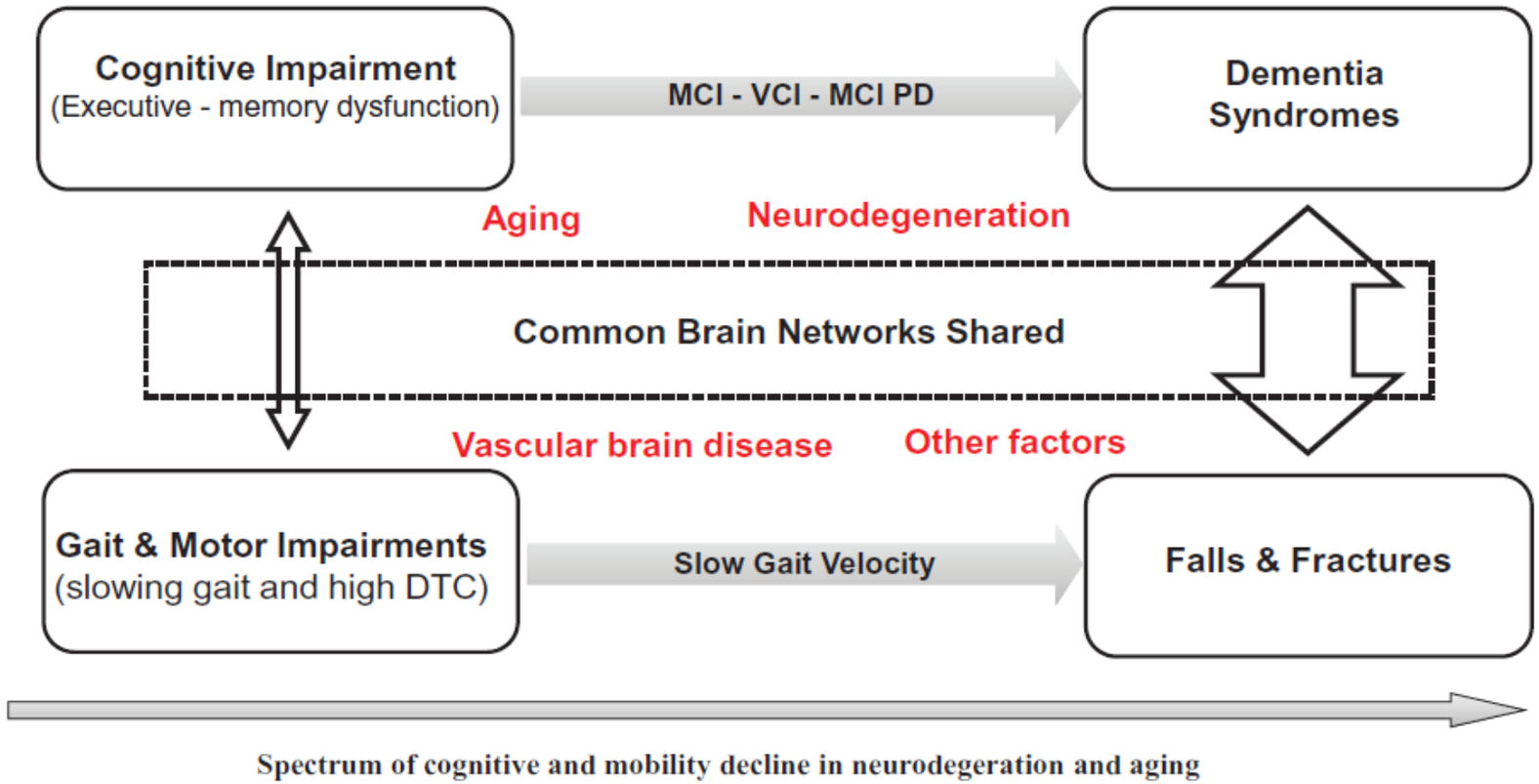


Fig. 3. Potential mechanism affecting the common brain structures and networks that regulate gait control and cognitive performance. Adapted from Montero-Odasso et al. [5].

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Contribution of Brain Imaging to the Understanding Of Gait Disorders in Alzheimer's Disease: A Systematic Review

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Abstract

Although gait disorders are common in Alzheimer's disease (AD), determining which brain structures and related lesions are specifically involved is a goal yet to be reached. Our objective was to systematically review all published data that examined associations between gait disorders and brain imaging in AD. Of 486 selected studies, 4 observational studies met the selection criteria. The number of participants ranged from 2 to 61 community dwellers (29%-100% female) with prodromal or dementia-stage AD. Quantitative gait disorders (ie, slower gait velocity explained by shorter stride length) were associated with white matter lesions, mainly in the medial frontal lobes and basal ganglia. The nigrostriatal dopamine system was unaffected. Qualitative gait disorders (ie, higher stride length variability) correlated with lower hippocampal volume and function. Gait disorders in AD could be explained by a high burden of age-related subcortical hyperintensities on the frontal–subcortical circuits (nonspecific) together with hippocampal atrophy and hypometabolism (specific).

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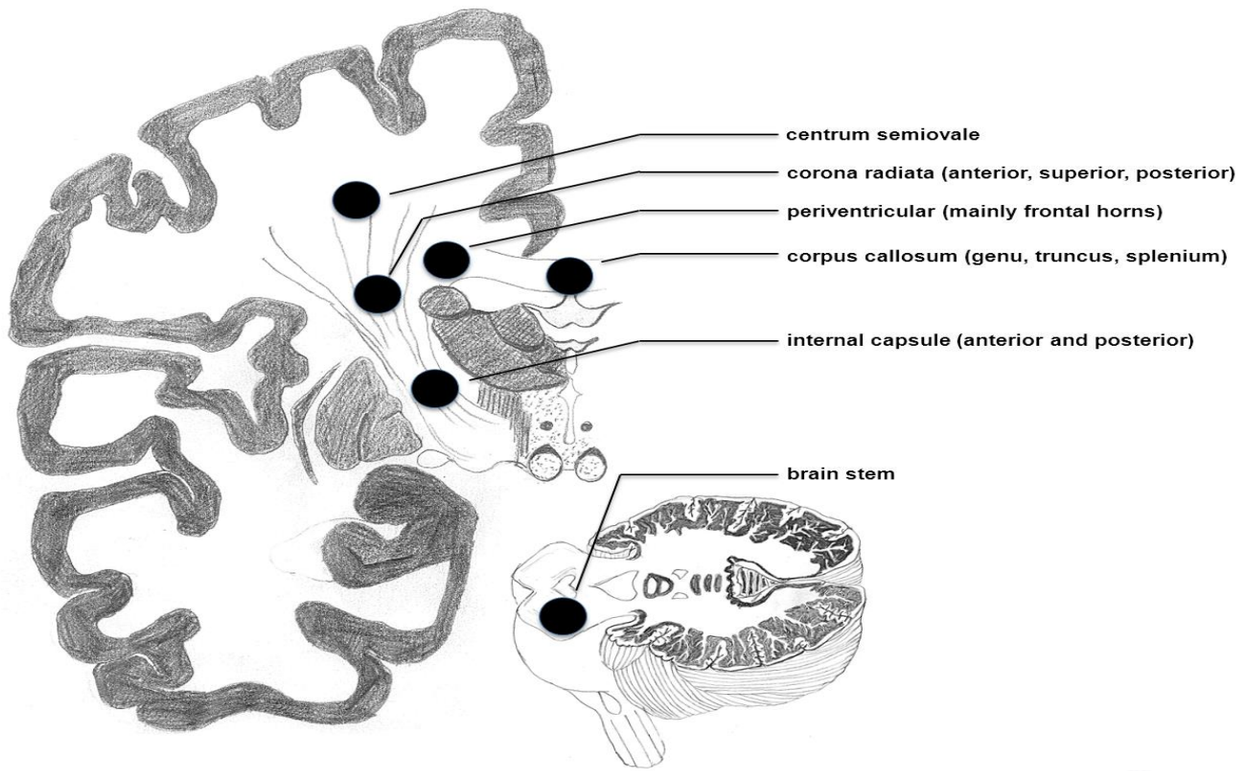
Vascular burden as a substrate for higher-level gait disorders in older adults. A review of brain mapping literature.

— **Objective:**
- To determine the distribution of WMH
- is associated with gait disorders

— **Methods:**
- Medline literature review

— **Results:**
- **n = 21** manuscripts
- **GV** associated with **WMH** on the corticospinal tract



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Annweiler C and Montero-Odasso M. Panminerva Med 2012; 54: 189-204

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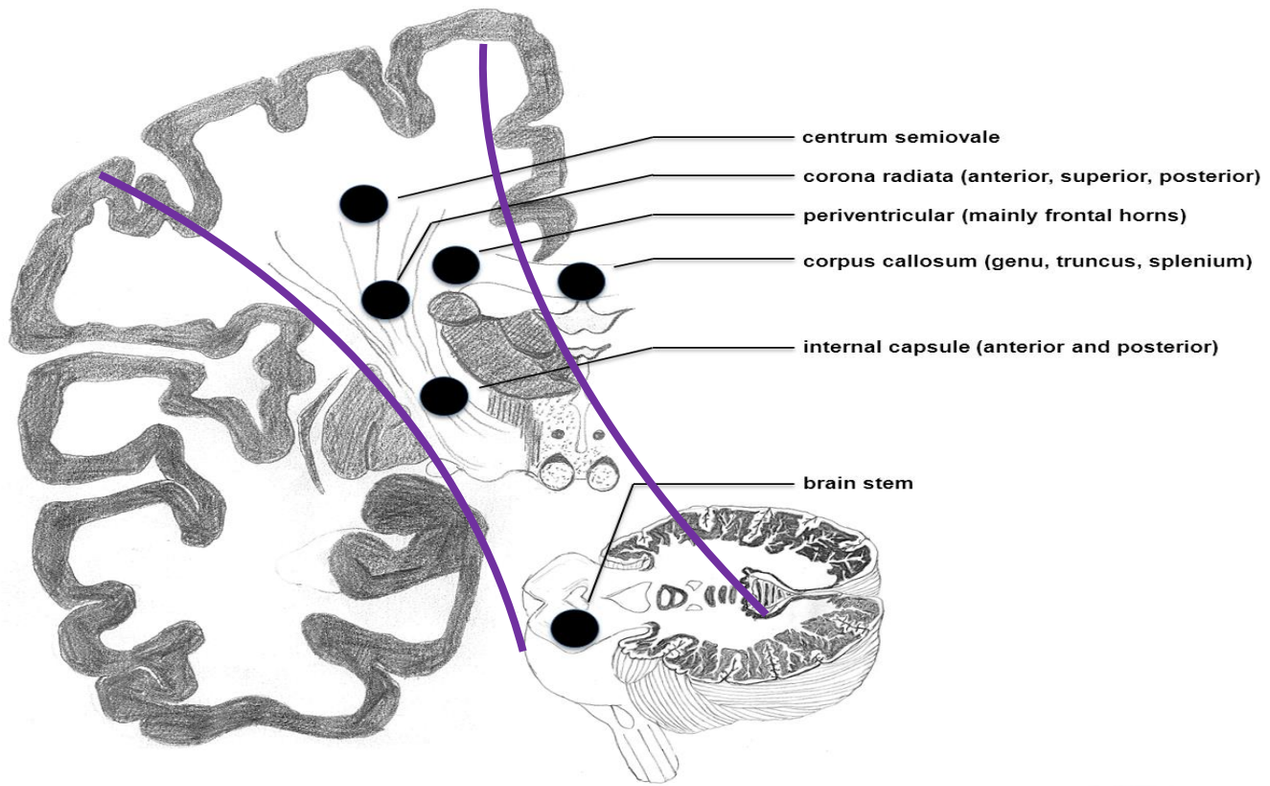

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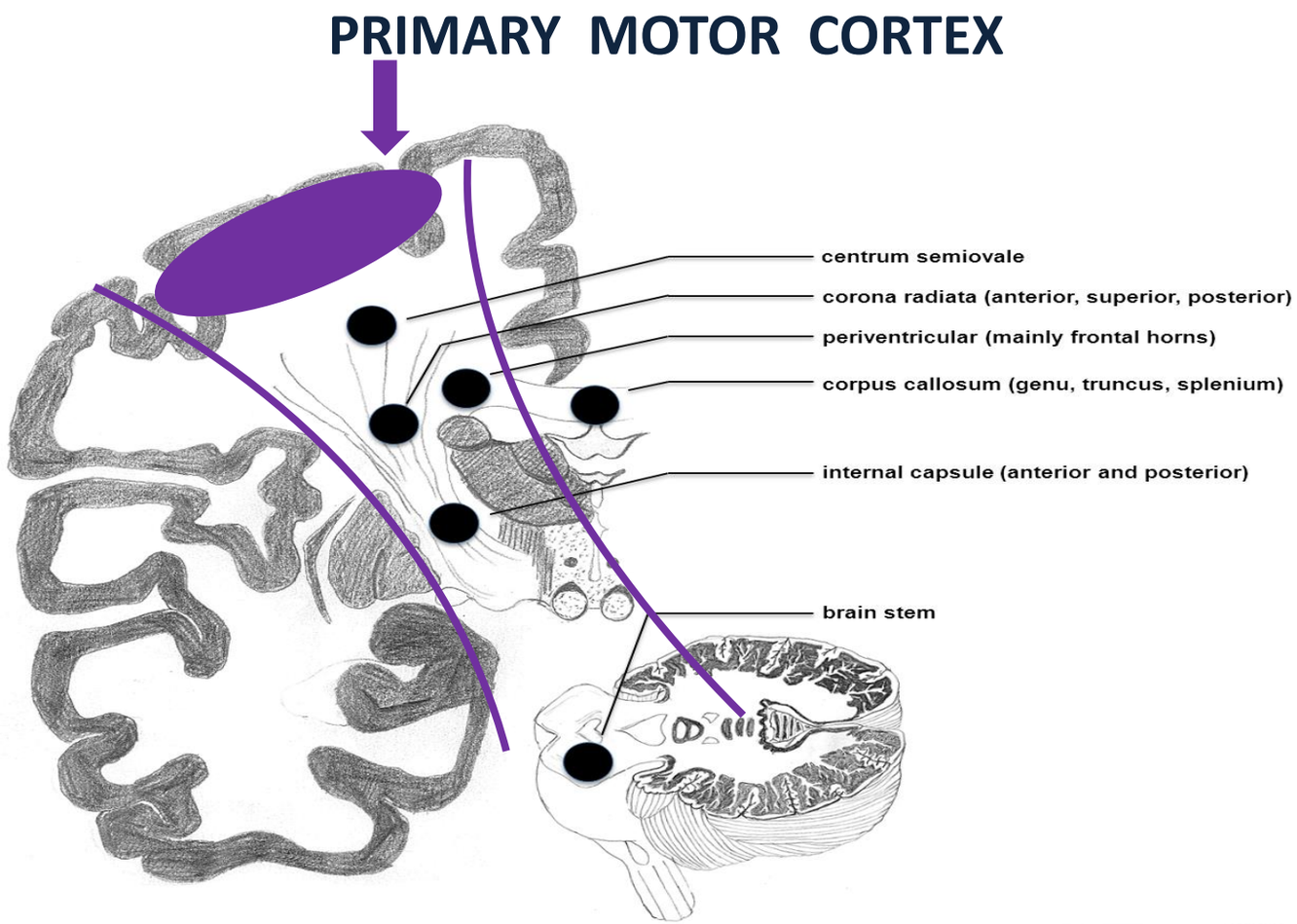

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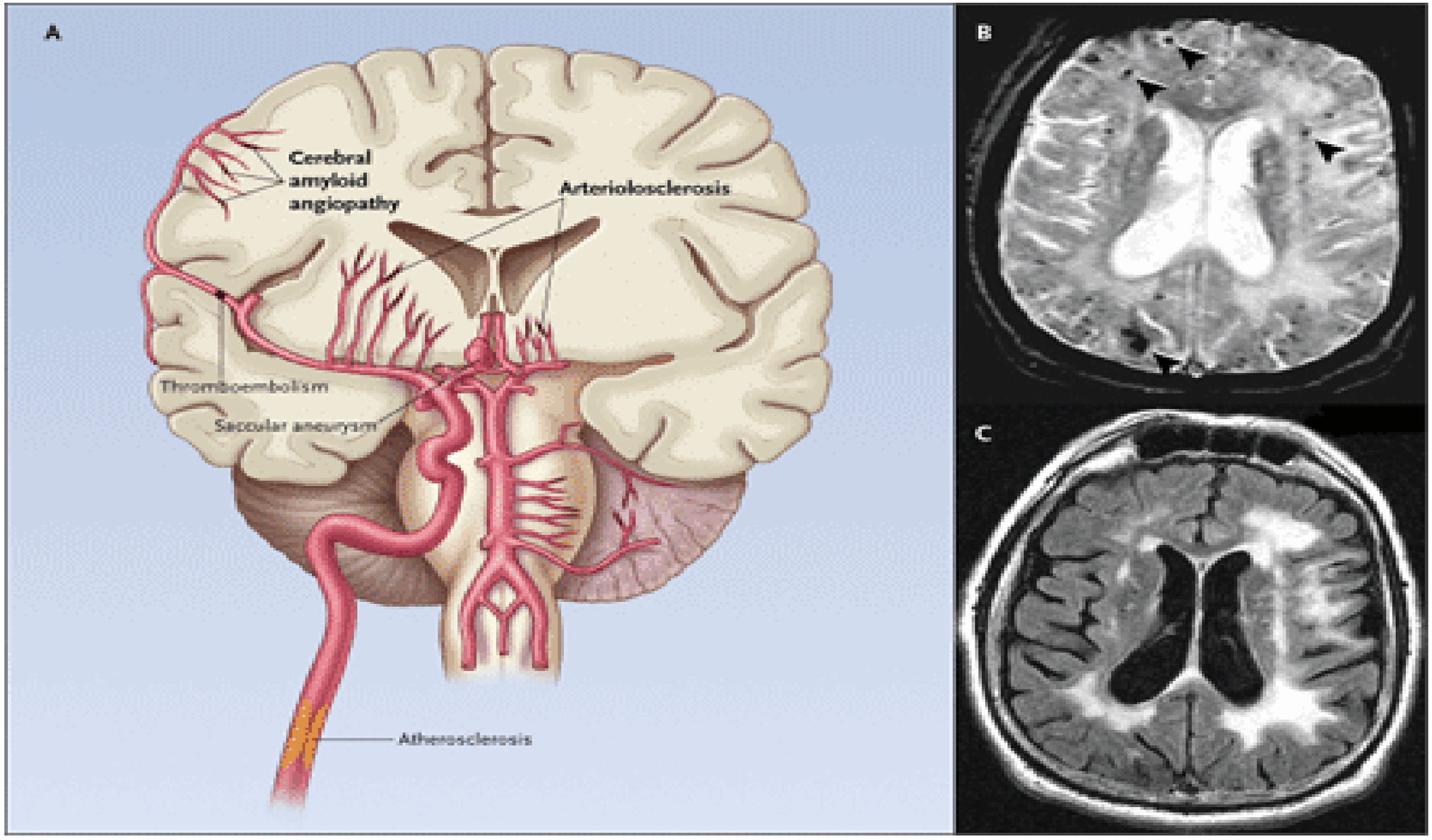

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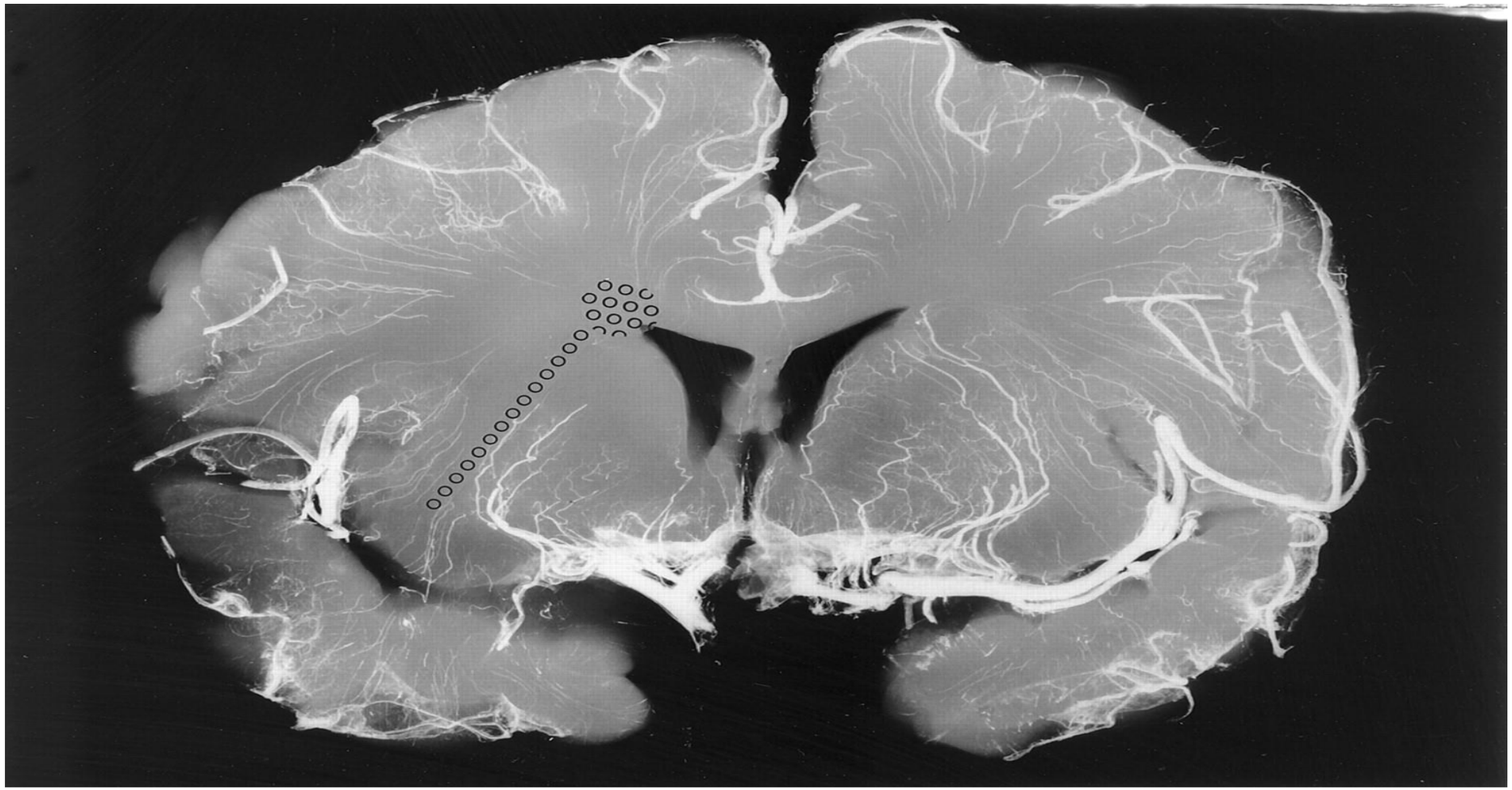
Watershed Areas of the Brain



Wong, HH et al, Stroke 2001; ooo = watershed

Findings in our cohort

J Neural Transm
DOI 10.1007/s00702-012-0926-4

NEUROLOGY AND PRECLINICAL NEUROLOGICAL STUDIES - ORIGINAL ARTICLE

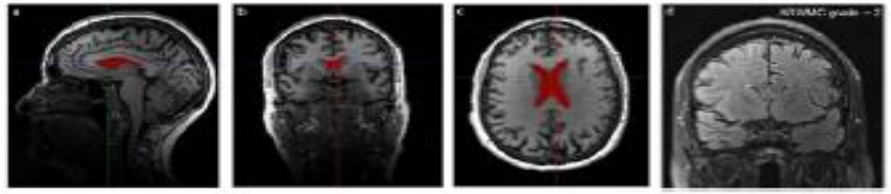
Slow gait in MCI is associated with ventricular enlargement: results from the Gait and Brain Study

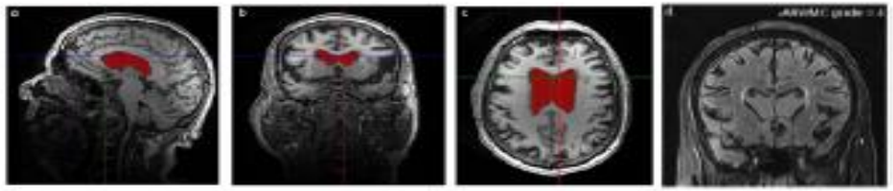
C. Annweiler · O. Beauchet · R. Bartha · M. Montero-Odasso

MCI PARTICIPANT WITH HIGH GAIT VELOCITY AT USUAL PACE

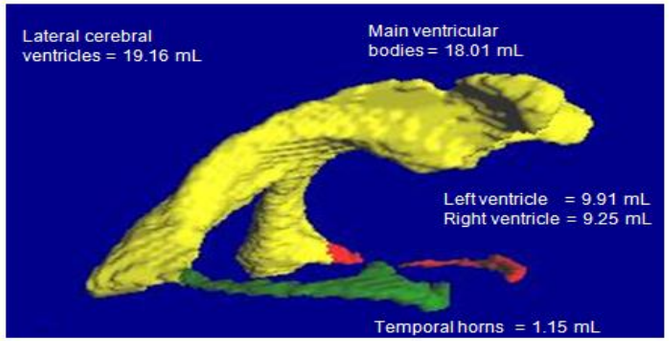
MCI PARTICIPANT WITH LOW GAIT VELOCITY AT USUAL PACE

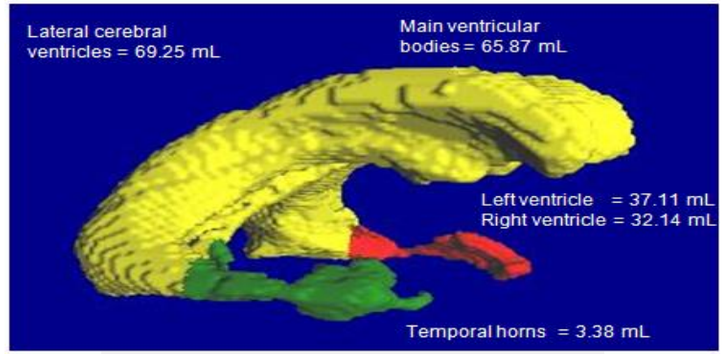
Structural imaging



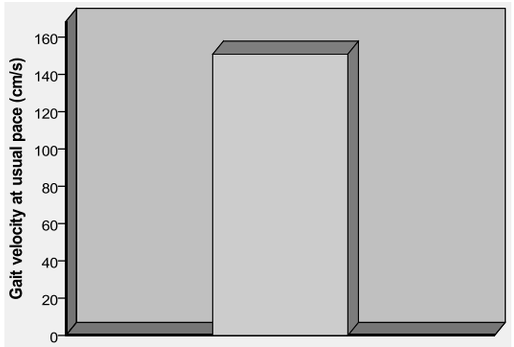


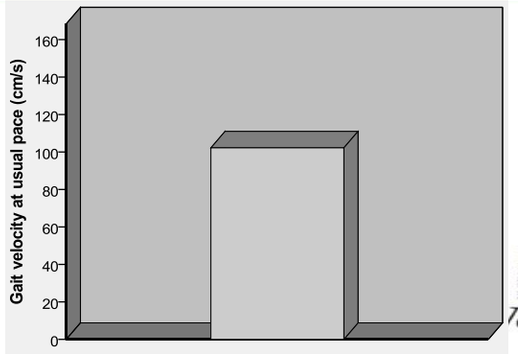
Brain ventricular volume





Gait Velocity





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doi:10.1093/brain/aws373 Brain 2013: 136; 859–871 |

BRAIN
A JOURNAL OF NEUROLOGY

Motor cortex and gait in mild cognitive impairment: a magnetic resonance spectroscopy and volumetric imaging study

Cédric Annweiler,[1,2,3,4] Olivier Beauchet,[4] Robert Bartha,[3] Jennie L. Wells,[1] Michael J. Borrie,[1] Vladimir Hachinski[5] and Manuel Montero-Odasso[1,2]

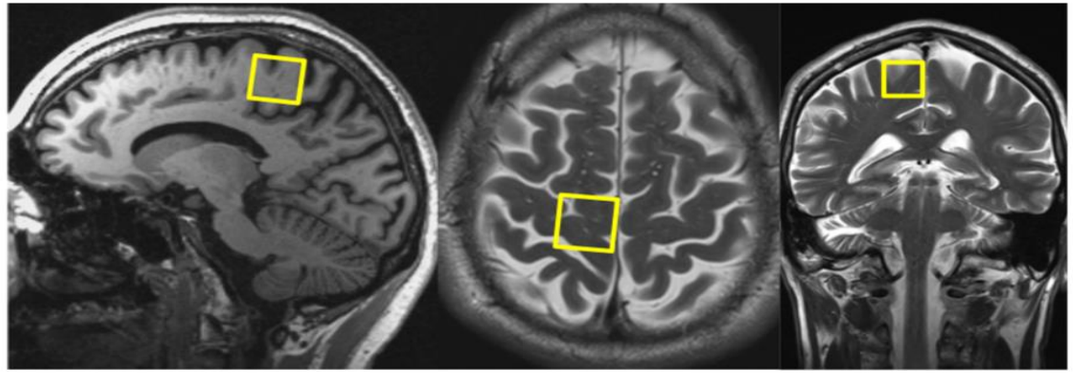


Figure 1. The spectroscopy voxel placed in the right motor cortex is outlined in yellow on sagittal (left), axial (middle), and coronal (right) images.

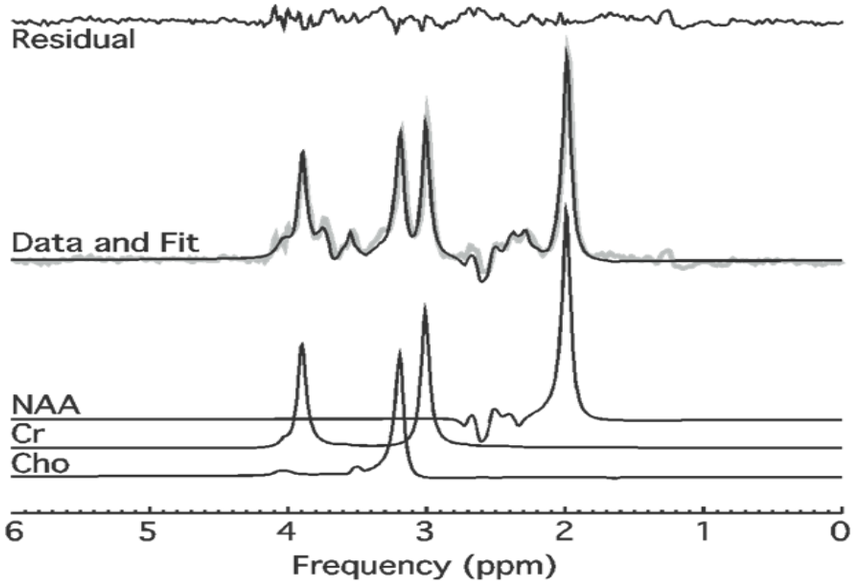
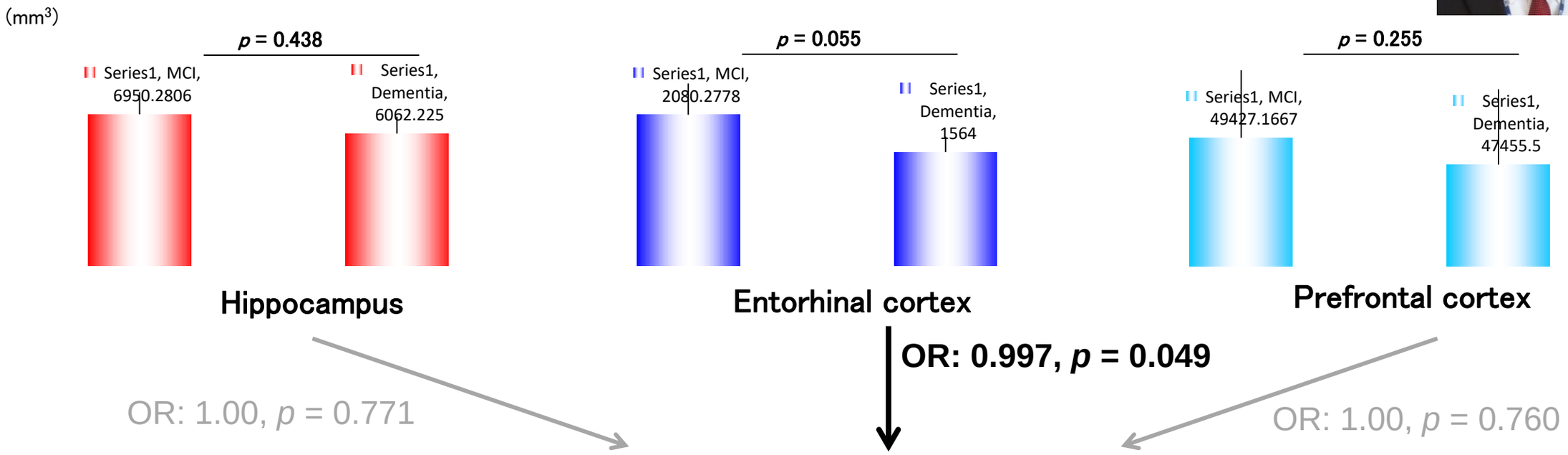


Figure 2. Representative ^{1}H-MRS data from the motor cortex in one subject.

- **PMC neurochemistry:** proton MR spectroscopy
  - **NAA/Cr**: neuron health/function (NAA/Cr<1.17)
  - **Cho/Cr**: inflammation (Cho/Cr>0.58)

Volume of the entorhinal cortex and the onset of dementia

Findings in MCI participants that converted to dementia



Future onset of dementia

(Adjusted for ICV, age, gender, education level, comorbidities, and MoCA score)

The relationship between gait and cognition in MCI older adults may be explained by atrophy of the entorhinal cortex, and it may predict future onset of dementia.

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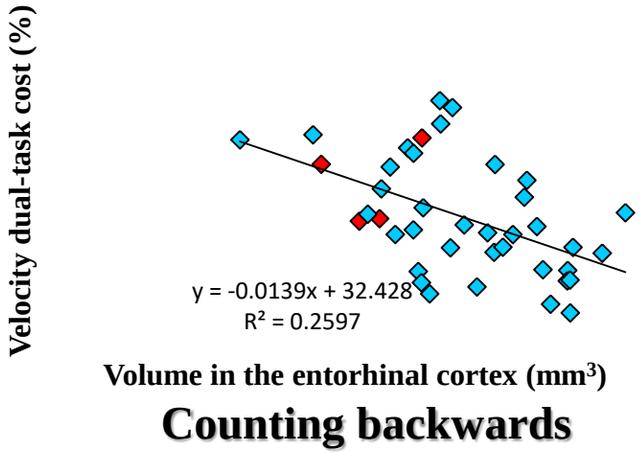
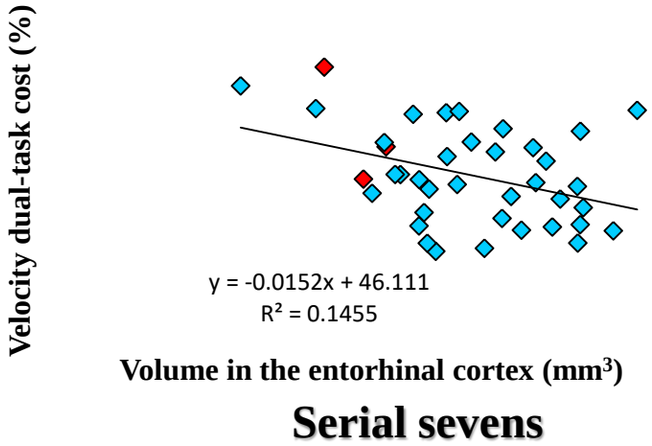
Sakurai R, Bartha R, Montero-Odasso M. J Gerontol A Biol Sci Med Sci. 2019 Apr 23;74(5):698-704.

Findings in our cohort

- Smaller entorhinal cortex was associated with worst dual-task gait and future onset of dementia.





☞ Entorhinal cortex atrophy precedes hippocampal atrophy in SMI, MCI, and AD. (Pennanen, 2004; Jessen, 2006)

Entorhinal cortex plays an important role in dual-tasking gait (working memory and attention) and its atrophy may lead to progression to dementia.

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Sakurai R, Bartha R, Montero-Odasso M. J Gerontol A Biol Sci Med Sci. 2019 Apr 23;74(5):698-704.

Gait and cognition: Is there a relationship?

- Which functions and areas of the brain are involved?

  …*attention, executive function, and memory*

- Which variables of gait are most affected?

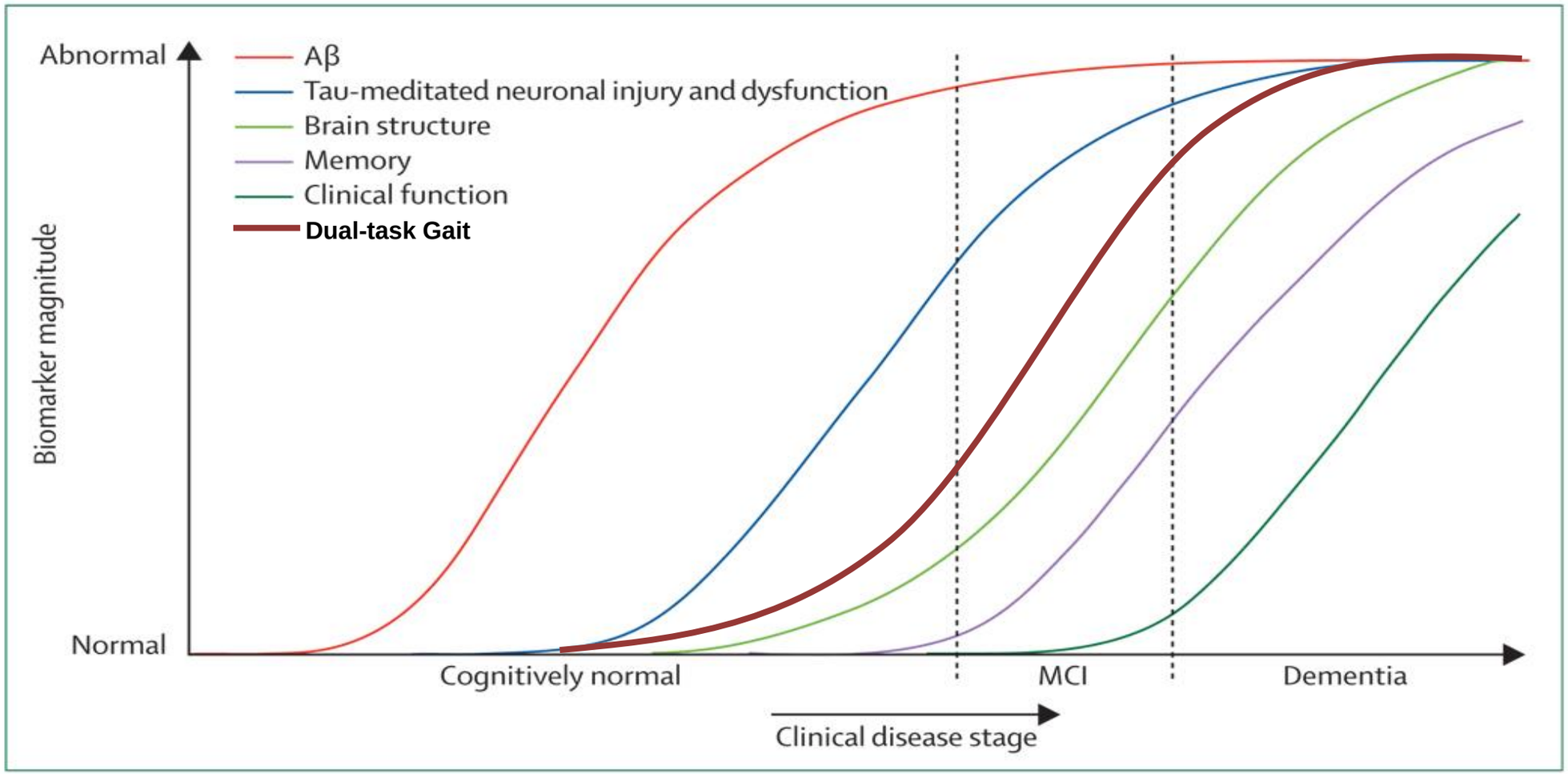
  …*gait variability*

- What are the common underlying factors?

  …*vascular risk factors*

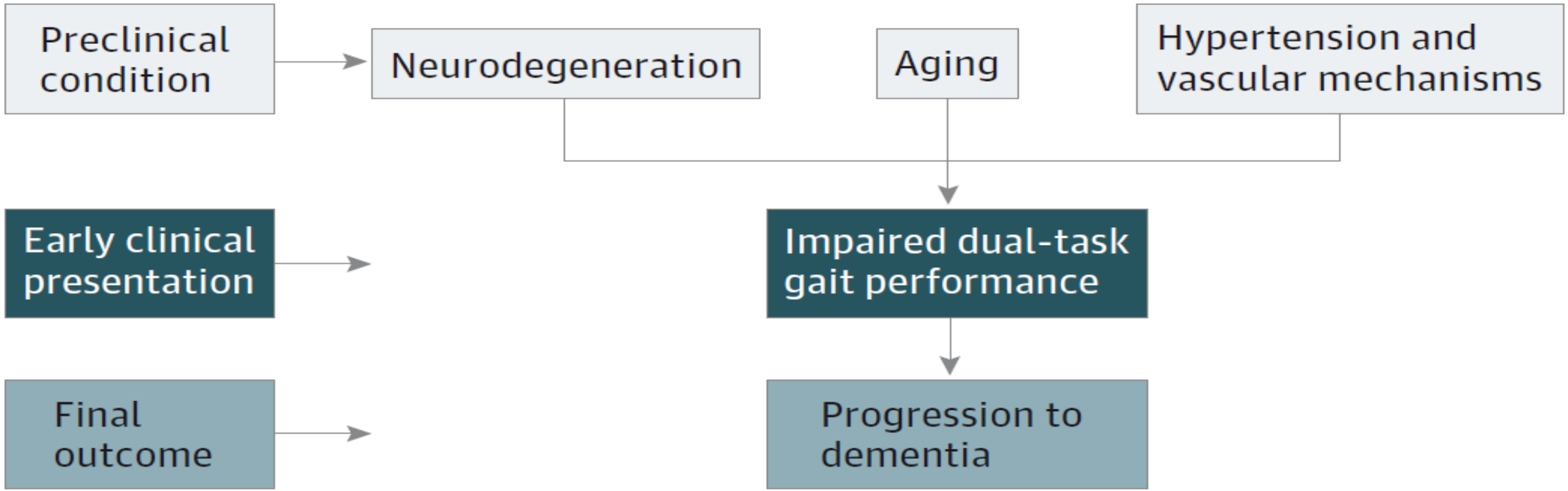
Is Gait a motor biomarker that can predict dementia?

Proposal that Dual-Task gait (dark red) can be an early biomarker for Dementia progression before cognitive and brain structural changes happen.



*Adapted from Jack et al model. Lancet Neurology 2010

Conclusions



Conclusions

- A high dual-task cost was associated with an increased risk of dementia by 3.8 times
- Combining a simple measure (gait velocity) with a cognitive task (counting, naming animals) is superior than solely slow gait to detect risk for dementia
- Dual-task test is easy to perform, low tech, and economical
- Results are in agreement with:
  - “Motor signature” of cognitive decline
  - “Motoric Cognitive Risk” syndrome

Conclusions

Key Points

Question Can dual-task gait testing (assessing gait while performing a challenging cognitive task) identify patients with mild cognitive impairment at risk of progression to dementia?

Findings In this cohort study of 112 older adults with mild cognitive impairment with up to 6 years of follow-up, poor performance in dual-task gait testing was significantly associated with a 2- to 3-fold risk of dementia incidence independent of age, sex, education, comorbidities, and baseline cognition.

Meaning Dual-task gait testing may serve clinicians to detect patients with mild cognitive impairment at higher risk of progression to dementia, allowing for optimization of further biomarker testing and initiation of early interventions.

- Dual- task gait

  is an early clinical marker of progression to dementia

  can be use in screening patients with MCI who could benefit the most from additional testing

  can identify high-risk individuals with MCI to plan frequency of follow-up visits to monitor function

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Canadian Consortium on Neurodegeneration in Aging.
The Canadian Component of CIHR's International Collaborative Research Strategy for Alzheimer's Disease.

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