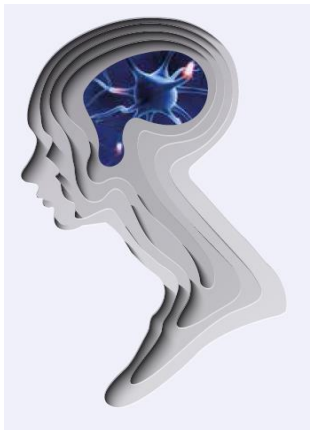

SUNFRAIL Transnational Workshop

Oktober 27, 2016

Naples, Italy

«Motor-Cognitive Frailty»

Reto W. Kressig, MD

Basel, Switzerland

felixplatterhospital
University Center for Medicine of Aging

University of Basel

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Speechley/Tinetti's Frailty Classification based on falls and mortality

Table 1. Speechley and Tinetti's classification system (1991) (7)

Vigorous Attributes	Frail Attributes
Less than 80 years of age	Greater than 80 years of age
Intact Cognition	Impaired Gait/Balance*
Intact Near Vision	No history of Walking for Exercise
Frequent Physical Activity other than walking	Use of Sedatives**
	Poor Near Vision
	Lower extremity disability***

Vigorous: ≥ 3 vigorous and ≤ 2 frail attributes
Frail: ≤ 1 vigorous and ≥ 4 frail attributes
Transitional: Those not meeting the criteria for either vigor or frailty

* Defined as a gross motor impairment
** Defined as use of : benzodiazepines, anti-depressants, phenothiazines
*** Reduced limb strength or disability is defined as impairment in ADL's

Speechley M, Tinetti M: Falls and injuries in frail and vigorous community elderly persons. J Am Geriatr Soc 1991; 39(1):46-52

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Fall:

Symptom of frailty (Speechley & Tinetti, 1991)

Decline in mobility and daily functioning

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Risk factors for falls identified in 16 studies: Summary of univariate analysis

Risk factor	Mean RR	Range
Muscle weakness	4.4	1.5 – 10.3
History of falls	3.0	1.7 – 7.0
Gait deficit	2.9	1.3 – 5.6
Balance deficit	2.9	1.6 – 5.4
Use assistive device	2.6	1.2 – 4.6
Visual deficit	2.5	1.6 – 3.5
Arthritis	2.4	1.9 – 2.9
Impaired ADL	2.3	1.5 – 3.1
Depression	2.2	1.7 – 2.5
Cognitive Impairment	1.8	1.0 – 2.3
Age > 80 years	1.7	1.1 – 2.5

Rubenstein LZ, Josephson KR. Clin Geriatr Med 2002;18:141-158.

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Fall Prevention by Resistance Training?

No !?

Cochrane Review 2009:
120 studies, 6700 older participants

Increase of muscle mass and muscle strength, but no decrease of fall rate.

Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. Cochrane Database Syst Rev 2009

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Involved systems for postural control

Motor Control (Brain)

Vestibular system, Cerebellum

Vision & Hearing

Neuro muscular control
Reaction time

Peripheral Sensibility

Muscle strength and power

Modified from Lord SR et al. Falls in older people: Risk factors and strategies for prevention. Cambridge University Press 2001

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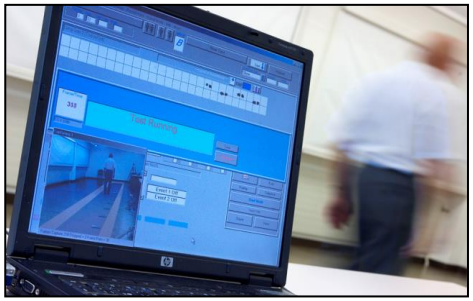

Kressig RW, Beauchet O. Guidelines for clinical applications of spatio-temporal gait analysis in older adults. Aging Clin Exp Res 2006;18:174-6.

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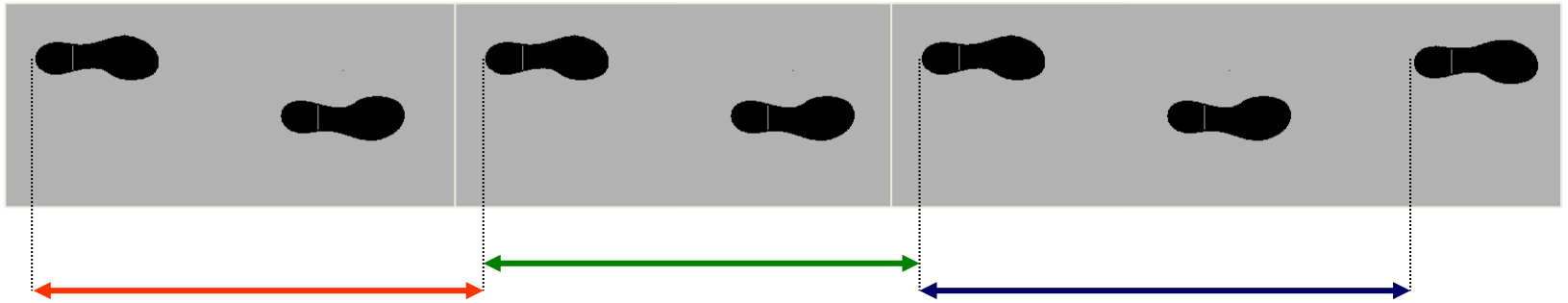
Gait Variability: Stride-to-Stride Variability

Example : Left Stride Length



Coefficient of Variation (%), CoVar = (SD/M) x 100

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Stride Length Variability and Falls Among Older Community-Dwelling Older Adults

Gait Measure	Change	Odds Ratio for Falling (95% Confidence Interval)
Stride-to-Stride-Standard Deviation		
Stride Length	+1.7 cm	1.95(1.08-3.52)
Double-Support	+0.72%	2.05(1.11-3.77)
Stride Velocity	+0.016m/s	2.30(1.17-4.51)

Maki BE. Gait changes in older adults: Predictors of falling or indicators of fear? J Am Geriatr Soc 1997;45:313-320

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Frailty Definition

A stage of physiologic vulnerability resulting from impaired homeostatic reserve and reduced capacity of the organism to withstand stress…

Fried L et al In:
Hazzard W New York 1998:1387-1402

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Brain function, cognition,
and motor control…

« Multi-tasking »

Model for stress resistance testing
Quantification of functional reserve

Theill N, Martin M, Schumacher V, Bridenbaugh SA, Kressig RW. Simultaneously Measuring Gait and Cognitive Performance in Cognitively Healthy and Cognitively Impaired Older Adults: The Basel Motor-Cognition Dual-Task Paradigm.
J Am Geriatr Soc 2011 59:1012-8.

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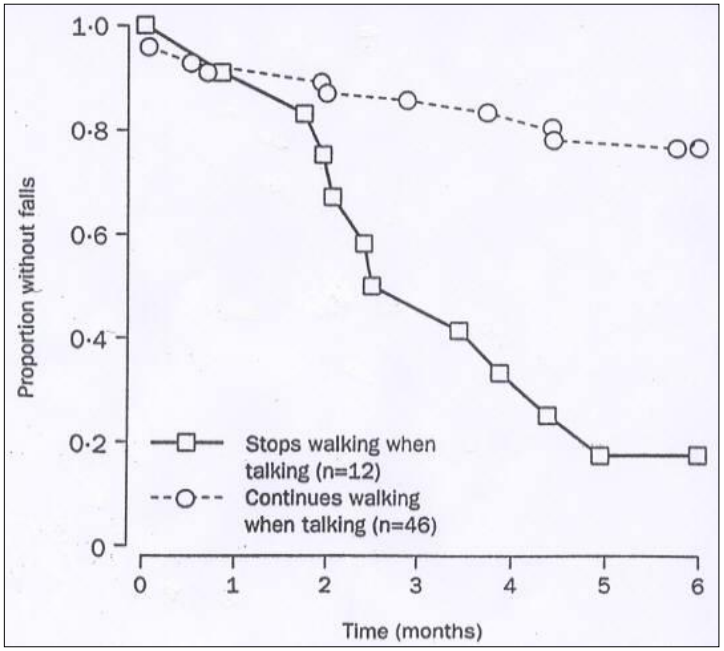
Walk and Talk Test



High fall risk

if person is stopping when answering a question

Lundin-Olsson L et al. “Stops walking when talking” as a predictor of falls in elderly people. Lancet 1997;349:617.

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Simultaneously Measuring Gait and Cognitive Performance in Cognitively Healthy and Cognitively Impaired Older Adults: The Basel Motor–Cognition Dual-Task Paradigm

Nathan Theill, MSc,† Mike Martin, PhD,* Vera Schumacher, MSc,*† Stephanie A. Bridenbaugh, MD,‡ and Reto W. Kressig, MD‡*

J Am Geriatr Soc 2011; 59: 1012 – 1018.

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Normal Walking

M.B., 72 years
Multiple falls

Velocity: 123 cm/sec
Cycle time CV: 1%

Kressig RW, Beauchet O. Guidelines for clinical applications of spatio-temporal gait analysis in older adults. Aging Clin Exp Res 2006;18:174-6.

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Working Memory Task

M.B., 72 years
Multiple falls

MCI
Mild Cognitive Impairment

Backward counting out loud

Kressig RW, Beauchet O. Guidelines for clinical applications of spatio-temporal gait analysis in older adults. Aging Clin Exp Res 2006;18:174-6.

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Dual Task-Related Gait Variability and Fall Risk in In-Patients

Table 2B - *Risk estimates of the time to a first fall event occurring during hospital stay based on univariate Cox regression models.*

Variable	Walking alone		Walking backwards counting	
	HR (95% CI)	*p*-value	HR (95% CI)	*p*-value
Coefficient of variation of stride time (coded as a binary variable)*	7.4 (0.9-59.0)	0.060	9.1 (1.9-43.8)	0.006

CI: confidence interval; HR: hazard ratio. *Binary threshold determined by sensitivity analysis (coefficient of variation >4% while walking alone, coefficient of variation >10% while walking backwards counting).

Kressig RW, Herrmann FR, Grandjean R, Michel JP, Beauchet O.
Gait variability while dual-tasking : Predictor of falls in older inpatients ?
Aging Exp Clin Res 2008;20:123-30.

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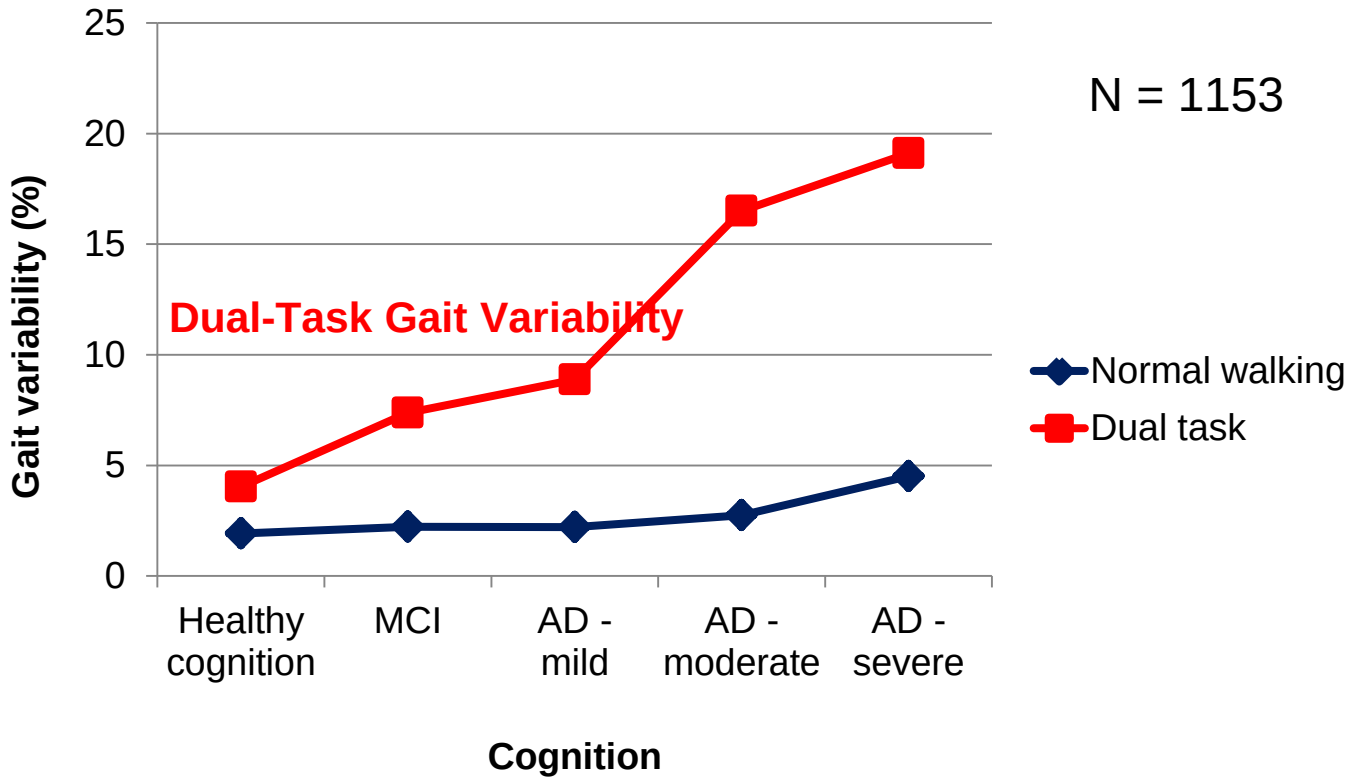
Gait variability increases as cognition worsens



N = 1153

MCI = Mild Cognitive Impairment; AD = Alzheimer's Dementia

Bridenbaugh SA, Monsch AU, Kressig RW. How does gait change as cognitive decline progresses in the elderly? Alzheimer's Association International Conference, Vancouver (Can), July 14 – 19, 2012

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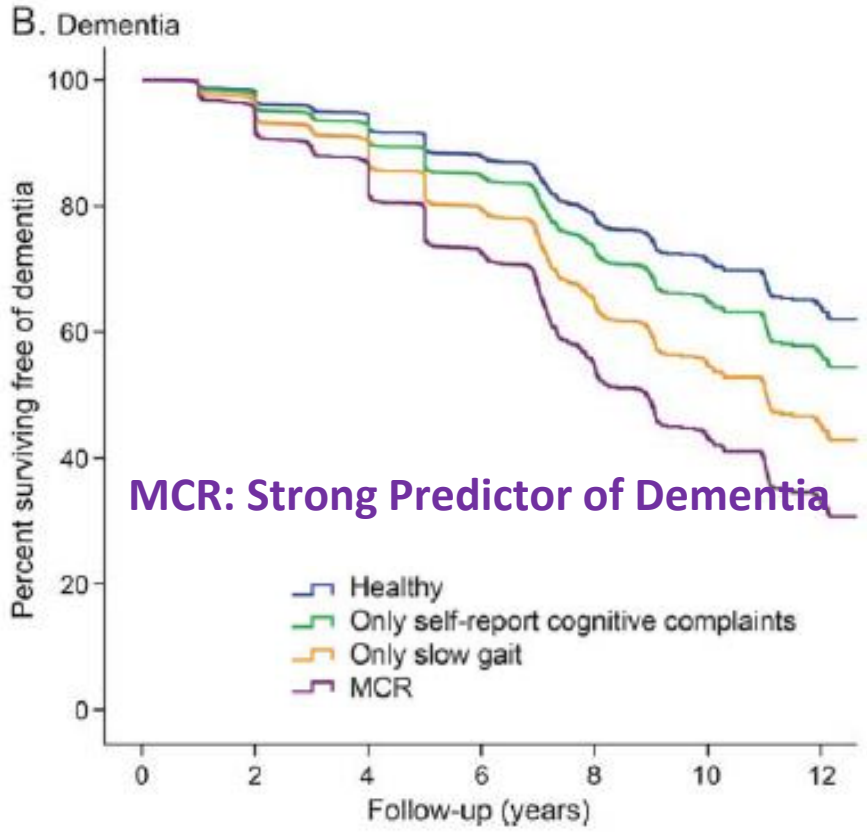
Motoric cognitive risk syndrome: slow gait + cognitive complaints

N = 26’802
MCR: 4’812
(cognitively normal)

Australia, Belgium, Canada, China, France, Ghana, India, Israel, Italy, Japan, Korea, Mexico, Russia, South Africa, Switzerland, United Kingdom, USA



MCR: Strong Predictor of Dementia

Verghese J et al. Motoric cognitive risk syndrome: Multi-country prevalence and dementia risk. Neurology 2014; 83(8):718-26.

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Motor cognitive dual tasking

Early detection of gait impairment, fall risk and cognitive decline

Z Gerontol Geriat 2015 · 48:15–21

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