

Talking, walking and falling

J.L. FOZARD (ISG-Grandmaster). **Talking, walking and falling: Technology-based assessments and interventions (Keynote).** *Gerontechnology* 2014; 13(2):66; doi:10.4017/gt.2014.13.02.072.00. **Purpose** Variability in finger and hand movements required in choice reaction and psychophysical tasks increase with both normal and pathological cognitive aging and with traumatic brain injury. The same is true of walking. The hypothesis presented is that increased stride time variability in prescribed paths and movement path variability (path tortuosity) in free ambulation is an early indicator of cognitive decline and dementia, and a short-term predictor of fall risk. **Method** Research is selectively cited and reviewed to support the hypothesis. **Results & Discussion** Variability in performance of repetitive and complex manual tasks accounts for much of the observed age-associated slowing of response speed^{1,2}. Performing simultaneous cognitive tasks slows walking in both normal and pathological cognitive aging¹. When measured in prescribed paths, the slowing reflects greater variability in stride speed³. When measured in unrestricted ambulation where it is possible to simultaneously measure both movement path spatial variability (path tortuosity) and movement speed, increased greater path tortuosity is the important predictor of dementia⁴ and an increased risk for a movement related fall occurring within a week prior to the fall⁵. Path tortuosity is measured by Fractal Dimension (Fractal D) that ranges from one (walking in a straight line) to two (a random walk). The close temporal association of elevated path tortuosity and a subsequent fall makes this assessment of fall risk a useful addition to the use of other known risk factors for implementing medical and environmental interventions (*Figure 1*).

References

1. Fozard JL. Sensatory and cognitive changes with age. In Schaie KW, Pietrucha M editors, *Mobility and Transportation in the elderly*. New York: Springer; 2000; pp 1-44
2. Korteling JE. *Multiple-task Performance and Aging*. PhD Thesis University of Groningen; 1994
3. Kearns WD, Fozard JL. Tracking natural human movements identifies differences in cognition and health. In Augusto JC, editor, *Handbook of ambient assisted living*. Amsterdam: IOS Press; 2012; doi:10.3233/978-1-60750-837-3-4
4. Kearns WD, Fozard JL, Nams VO, Craighead J. Wireless telesurveillance system for detecting dementia. *Gerontechnology* 2011;10(2):90-102; doi:10.4017/gt.2011.10.2.004.005
5. Kearns, WD, Fozard, JL, Becker, M, Jasiewicz, J, Craighead, JD, Holtzclaw, L, Dion, C. Path tortuosity in everyday ambulation of elderly persons increases predictability of fall risk beyond that provided by fall history, medication history and standardized gait and balance assessments. *Journal of the American Medical Directors Association* 2012;13(7): 665.e7-665.e13; <http://www.jamda.com/>; retrieved December 4, 2013

Keywords: Health and self-esteem, movement path variability and speed, fall risk
Address: University of South Florida, Tampa, USA; E: Fozard@tampabay.rr.com

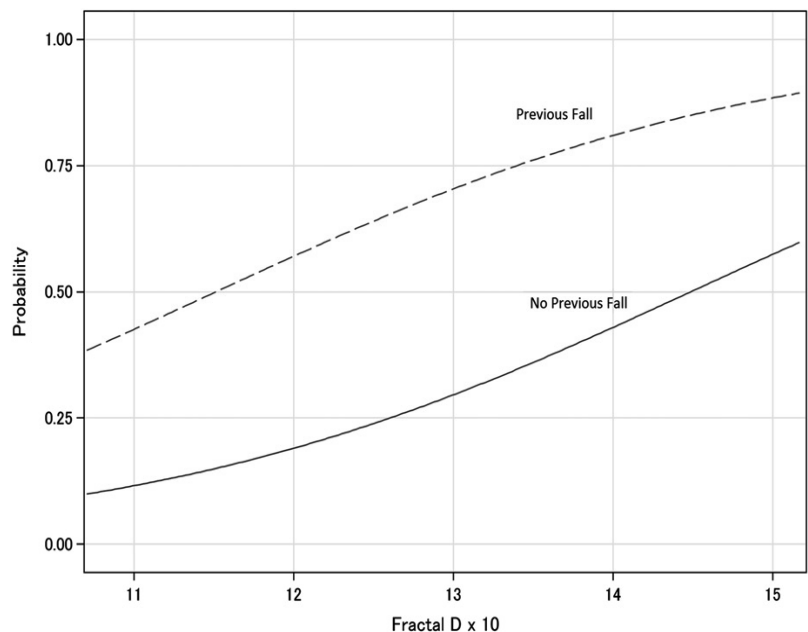


Figure 1. Probability of a movement related fall in relation to elevated Fractal D (path tortuosity) without (lower function) or with (upper function) 1 or more falls in the previous year