

The Cognitive Component in Falls Prevention.

Falls are a major concern in the older adult demographic. In 2010, Shubert, McCulloch, Hartman, and Guiliani (2010) predicted that more than one-third of older adults would experience a fall for that year. Falls are complex; 70% of falls are due to multiple factors including home hazards, environmental hazards, medication side-effects, comorbidities, and physiological changes (e.g. sarcopenia, dynopenia, postural control, sensory impairments) in aging contributing to decreased functional capacity of older adults (Granacher, Muehlbauer, Gollhofer, Kressig, & Zahner, 2011; Shubert et al., 2010). Falls prevention programs have typically and traditionally focused on muscle strengthening and balance—both proven to be effective in reducing fall risks (Granacher et al., 2011). However, in addressing issues especially with demographics classified as "special populations" (e.g. older adults, rehabilitation), Kristensen and Franklyn-Miller (2012) and Rhea (2014) emphasize the need for the professional to stay current with new evidence-based research in order to provide the best care and services to those most needing special help.

Current fall risk studies have included the cognitive [acuity] component, particularly the concept of executive function (EF) impairment, as a fall risk contributor. Executive function is generally understood as the processes/abilities involved in decision-making, critical thinking, problem solving, the ability to prioritize, attention requirements, dividing attention, memory, abstract reasoning, the ability to weigh benefits, the ability to process sensory information and act appropriately, the ability to plan, and the ability to respond to dynamic changes in the environment (Kearney, Harwood, Gladman, Lincoln, & Masud, 2013; Muir-Hunter et al., 2014).

Mignardot, Beauchet, Annweiler, Cornu, and Deschamps (2014) recruited 611 older adults to participate in their study of the effects of various forms of cognitive impairment on postural sway (as measured by center-of-pressure, COP). Older adults with mild cognitive impairment (MCI) and mild-to-moderate Alzheimer's disease (MMAD) tend to have problems in postural control (increased sway), increased gait variability (e.g. stride-to-stride times as a biomarker of MCI patients), and balance difficulties (Mignardot et al., 2014). Older adults with MCI and MMAD have had higher fall rates (Mignardot et al., 2014). Mignardot et al. (2014) noted that poor balance is a predictor of falls in older adults.

The goal of the study by Mignardot et al. (2014) was two-fold: compare the limits of COP velocity in cognitively healthy individuals (CHI), MCI, and MMAD; and compare COP velocity, cognitive status, and fall history of subjects. Subjects were instructed to stand on a force plate and look at a target (eyes open and then eyes closed). Mignardot et al. (2014) found that "the absolute maximal velocity in the antero-posterior direction increased with the highest levels of cognitive impairment" and fallers showed the "highest absolute values of velocity, suggesting that the control of postural sway is implicitly corrected and reversed at high velocity thresholds" (p. 435). Changes in postural sway (velocity-based postural control) and difficulties with dynamic balance indicated potentially higher risk for falls (Mignardot et al., 2014).

Shubert et al. (2010) noted that maintaining balance required cognitive abilities to process dynamic changes/adjustments (speed of processing is important) quickly enough to react and coordinate with executive control. Shubert et al. (2010) also noted that growing numbers of

research show that neural speed of processing is important to balance and the "decline" of such ability is age-related. When EF is challenged in older adults (e.g. concurrent tasks, or task interference), the ability to maintain balance and postural control is also challenged (Muir-Hunter et al., 2014). EF impairments are also linked to gait variability and gait speed decline (Kearney et al., 2013). Both gait variability and gait speed decline are associated with increased falls risk (Kearney et al., 2013).

The study by Mignardot et al. (2014) concurs with other studies exploring the interrelationships between cognition, balance, and falls risk. In order to provide a well-rounded falls-risk reduction exercise program, one needs to "challenge" and provide cognitive stimulus in addition to balance and muscle strengthening exercises. The cognitive component may have been underrated in the past, but in the design of future programs, "brain health" and "brain games" (to provide stimulus and help retain as much mental acuity as possible) should definitely be considered as part of whole-person health and wellness as well as part of "preventative health".

References

- Granacher, U., Muehlbauer, T., Gollhofer, A., Kressig, R. W., & Zahner, L. (2011). An intergenerational approach in the promotion of balance and strength for fall prevention—A mini-review. *Gerontology*, 57(4), 304-315.
- Kearney, F. C., Harwood, R. H., Gladman, J. R., Lincoln, N., & Masud, T. (2013). The relationship between executive function and falls and gait abnormalities in older adults: A systematic review. *Dementia & Geriatric Cognitive Disorders*, 36(1/2), 20-35.
- Kristensen, J., & Franklyn-Miller, A. (2012). Resistance training in musculoskeletal rehabilitation: A systemic review. *British Journal of Sports Medicine*, 46(10), 719-726.
- Mignardot, J. B., Beauchet, O., Annweiler, C., Cornu, C., & Deschamps, T. (2014). Postural sway, falls, and cognitive status: A cross-sectional study among older adults. *Journal of Alzheimer's Disease*, 41(2), 431-439
- Muir-Hunter, S. W., Clark, J., McLean, S., Pedlow, S., Van Hemmen, A., Montero Odasso, M., & Overend, T. (2014). Identifying balance and fall risk in community-dwelling older women: The effect of executive function on postural control. *Physiotherapy Canada*, 66(2), 179-186.
- Rhea, M. [CGHSdesigners]. (2014, 11, 20). *Special populations exercise prescription* [Video file]. Retrieved from <http://youtu.be/-szupY70bDM>
- Shubert, T. E., McCulloch, K., Hartman, M., & Guiliani, C. A. (2010). The effect of an exercise-based balance intervention on physical and cognitive performance for older adults: A pilot study. *Journal Of Geriatric Physical Therapy*, 33(4), 157-164.