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*April 2018*

*Vol. 20, No. 4*

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***Our Mission:*** Helping to prepare Iowa's health practitioners to care for our growing population of elders. *E-NEWS* is one of our methods of teaching through technology.

Each month, *E-NEWS* delivers abstracts from current multidisciplinary healthcare journal articles related to a specific geriatric topic. This month's *E-NEWS* focuses on **GAIT AND BALANCE: A WALK IN THE PARK.**

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### **GAIT AND BALANCE: A WALK IN THE PARK**

**In this issue of the *E-NEWS*, you will find abstracts for:**

- An article that presents information regarding management of gait changes and fall risk in mild cognitive impairment and dementia.
  - A review that addresses the impact of mild cognitive impairment on gait and balance.
  - A study that investigates the reliability and validity of the Community Balance and Mobility (CB&M) Scale in a community-dwelling older adult population.
  - A study that assesses spatiotemporal gait characteristics associated with cognitive impairment.
  - A study that analyzes gait characteristics under different walking conditions and the association with the presence of cognitive impairment in community-dwelling older adults.
  - A study that aims to establish "Timed up and Go" test (TUG) normative values of older adults based on cognitive status, gender, and age groups.
  - An article that discusses gait and balance in the aging population.
  - An article that explores whether gait speed predicts incident disability.
  - A study that examines the trajectory of mobility decline by type of dementia.
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- Allali G, Verghese J. Management of Gait Changes and Fall Risk in MCI and Dementia. *Curr Treat Options Neurol*. 2017 Sep;19(9):29.

Gait disorders and falls are very prevalent in aging, especially in older adults with cognitive impairment: older adults with dementia are 2-3 times more likely to fall than their non-demented counterparts. The management of gait disorders and falls in older adults with mild cognitive impairment (MCI) or dementia begins by their identification with the use of specific screening tools, such as measuring gait speed, use of dual-task gait tests, or diagnosing motoric cognitive risk syndrome, a newly described pre-dementia syndrome. This clinical approach is useful to reveal subtle gait changes that may lead to an increased risk of falls in older adults. Various non-pharmacological interventions have been tested in older adults with MCI or dementia to reduce risk of falls. Physical activity interventions are feasible in older adults with cognitive impairments, and may improve gait, and thereby decrease risk of falls. Besides non-pharmacological interventions, identification and removal of potentially inappropriate medications (i.e., psychotropic drugs) is part of a comprehensive falls management strategy in older patients. The use of anti-dementia drugs, such as cholinesterase inhibitors or memantine, may help to improve gait in demented older adults. Adopting a multidisciplinary care strategy that integrates general practitioners, geriatricians, neurologists, cardiologists, physical therapists, and occupational therapists to identify older adults at increased risk of falling or with subtle gait changes, prior to applying individualized non-pharmacological and/or pharmacological interventions, is essential to reduce the burden of gait disorders and falls in older adults with cognitive impairment.



- Bahureksa L, Najafi B, Saleh A, Sabbagh M, Coon D, Mohler MJ, Schwenk M. The Impact of Mild Cognitive Impairment on Gait and Balance: A Systematic Review and Meta-Analysis of Studies Using Instrumented Assessment. *Gerontology*. 2017;63(1):67-83.

**BACKGROUND:** In addition to cognitive deficits, people with mild cognitive impairment (MCI) can experience motor dysfunction, including deficits in gait and balance. Objective, instrumented motor performance assessment may allow the detection of subtle MCI-related motor deficits, allowing early diagnosis and intervention. Motor assessment under dual-task conditions may increase diagnostic accuracy; however, the sensitivity of different cognitive tasks is unclear. **OBJECTIVE:** To systematically review the extant literature focusing on instrumented assessment of gait and balance parameters for discriminating MCI patients from cognitively intact peers. **METHODS:** Database searches were conducted in PubMed, EMBASE, Cochrane Library, PsycINFO and Web of Science. Inclusion criteria were: (1) clinically confirmed MCI; (2) instrumented measurement of gait and/or balance; (3) English language, and (4) reporting gait or balance parameters which could be included in a meta-analysis for discriminating between MCI patients and cognitively intact individuals based on weighted effect size (d). **RESULTS:** Fourteen studies met the inclusion criteria and reported quantitative gait (n = 11) or postural balance (n = 4) parameters to be included in the meta-analysis. The meta-analysis revealed that several gait parameters including velocity (d = -0.74, p < 0.01), stride length (d = -0.65, p < 0.01), and stride time (mean: d = 0.56, p = 0.02; coefficient of variation: d = 0.50, p < 0.01) discriminated best between MCI and healthy controls under single-task conditions. Importantly, dual-task assessment increased the discriminative power of gait variables wherein gait variables with counting tasks appeared to be more sensitive (range d = 0.84-1.35) compared to verbal fluency tasks such as animal naming (range d = 0.65-0.94). Balance parameters identified as significant discriminators were anterior-posterior (d = 0.49, p < 0.01) and mediolateral (d = -0.34, p = 0.04) sway position in the eyes-open condition but not eyes-closed condition. **CONCLUSION:** Existing studies provide evidence that MCI affects specific gait parameters. MCI-related gait changes were most pronounced when subjects are challenged cognitively (i.e., dual task), suggesting that gait assessment with an additional cognitive task is useful for diagnosis and outcome analysis in the target population. Static balance seems to also be affected by MCI, although limited evidence exists. Instrumented motor assessment could provide a critical opportunity for MCI diagnosis and tailored intervention targeting specific deficits and potentially slowing progression to dementia. Further studies are required to confirm our findings. ©S. Karger AG, Basel.



- Balasubramanian CK. The community balance and mobility scale alleviates the ceiling effects observed in the currently used gait and balance assessments for the community-dwelling older adults. *J Geriatr Phys Ther.* 2015 Apr-Jun;38(2):78-89.

**BACKGROUND AND PURPOSE:** Currently used balance assessments show a ceiling effect and lack activities essential for community mobility in higher-functioning older adults. The aim of this study was to investigate the reliability and validity of the Community Balance and Mobility (CB&M) Scale in a high-functioning community-dwelling older adult population since the CB&M Scale includes assessment of several challenging tasks and may alleviate the ceiling effects observed in commonly used gait and balance assessments for this cohort. **METHODS:** A convenience sample of 40 older adults ( $73.4 \pm 6.9$  years) participated in this cross-sectional study. Previously standardized balance and mobility assessments measuring similar constructs as the CB&M were used for validation. Outcomes included Timed Up and Go Test, Berg Balance Scale (BBS), Dynamic Gait Index (DGI), Functional Reach Test (FRT), Short Physical Performance Battery (SPPB), 6-Minute Walk Test (6MWT), Activities Specific Balance Confidence scale (ABC), gait speed, and intraindividual gait variability. A falls questionnaire documented the history of falls. **RESULTS:** Rater reliability (ICC > 0.95) and internal consistency ( $\alpha = .97$ ) of the CB&M scale were high. CB&M scores demonstrated strong correlations with DGI, BBS, SPPB, and 6MWT ( $\rho = 0.70-0.87$ ;  $P < .01$ ); moderate correlations with falls history, TUG, ABC, and gait speed ( $\rho = 0.44-0.65$ ;  $P < .01$ ); and low correlations with FRT, swing and stance time variability ( $\rho = 0.34-0.37$ ;  $P < .05$ ). Dynamic Gait Index, BBS, SPPB, and ABC assessments demonstrated ceiling effects (7.5%-32.5%), while no floor or ceiling effects were noted on the CB&M. Logistic regression model showed that the CB&M scores significantly predicted falls history ( $\chi^2(2) = 6.66$ , odds ratio = 0.92;  $P < .01$ ). Area under the curve for the CB&M scale was 0.80 (95% CI: 0.65-0.95). A score of CB&M  $\leq 39$  was the optimal trade-off between sensitivity and specificity (sensitivity = 79%, specificity = 76%) and a score of CB&M  $\leq 45$  maximized sensitivity (sensitivity = 93%, specificity = 60%) to discriminate persons with 2 or more falls from those with fewer than 2 falls in the past year. **DISCUSSION AND CONCLUSIONS:** CB&M scale is reliable and valid to evaluate gait, balance, and mobility in community-dwelling older adults. Unlike some currently used balance and mobility assessments for the community-dwelling older adults, the CB&M scale did not show a ceiling in detection of balance and mobility deficits. In addition, cutoff scores have been proposed that might serve as criteria to discriminate older adults with balance and mobility deficits. The CB&M scale might enable assessment of balance and mobility limitations masked by other assessments and help design interventions to improve community mobility and sustain independence in the higher-functioning community-dwelling older adult.



- Beauchet O, Blumen HM, Callisaya ML, De Cock AM, Kressig RW, Srikanth V, Steinmetz JP, Verghese J, Allali G. Spatiotemporal Gait Characteristics Associated with Cognitive Impairment: A Multicenter Cross-Sectional Study, the Intercontinental "Gait, cOgnitiOn & Decline" Initiative. *Curr Alzheimer Res.* 2018 Jan 23;15(3):273-282.

**BACKGROUND:** The study aims to determine the spatiotemporal gait parameters and/or their combination(s) that best differentiate between cognitively healthy individuals (CHI), patients with mild cognitive impairment (MCI) and those with mild and moderate dementia, regardless of the etiology of cognitive impairment. **METHODS:** A total of 2099 participants (1015 CHI, 478 patients with MCI, 331 patients with mild dementia and 275 with moderate dementia) were selected from the intercontinental "Gait, cOgnitiOn & Decline" (GOOD) initiative, which merged different databases from seven cross-sectional studies. Mean values and coefficients of variation (CoV) of spatiotemporal gait parameters were recorded during usual walking with the GAITRite® system. **RESULTS:** The severity of cognitive impairment was associated with worse performance on all gait parameters. Stride velocity had the strongest association with cognitive impairment, regardless of cognitive status. High mean value and CoV of stride length characterized moderate dementia, whereas increased CoV of stride time was specific to MCI status. **CONCLUSION:** The findings support the existence of specific cognitive impairment-related gait disturbances with differences related to stages of cognitive impairment, which may be used to screen individuals with cognitive impairment. ©Bentham Science Publishers



- De Cock AM, Fransen E, Perkisas S, Verhoeven V, Beauchet O, Remmen R, Vandewoude M. Gait characteristics under different walking conditions: Association with the presence of cognitive impairment in community-dwelling older people. *PLoS One*. 2017 Jun 1;12(6):e0178566.

BACKGROUND: Gait characteristics measured at usual pace may allow profiling in patients with cognitive problems. The influence of age, gender, leg length, modified speed or dual tasking is unclear. METHODS: Cross-sectional analysis was performed on a data registry containing demographic, physical and spatial-temporal gait parameters recorded in five walking conditions with a GAITRite® electronic carpet in community-dwelling older persons with memory complaints. Four cognitive stages were studied: cognitively healthy individuals, mild cognitive impaired patients, mild dementia patients and advanced dementia patients. RESULTS: The association between spatial-temporal gait characteristics and cognitive stages was the most prominent: in the entire study population using gait speed, steps per meter (translation for mean step length), swing time variability, normalized gait speed (corrected for leg length) and normalized steps per meter at all five walking conditions; in the 50-to-70 years old participants applying step width at fast pace and steps per meter at usual pace; in the 70-to-80 years old persons using gait speed and normalized gait speed at usual pace, fast pace, animal walk and counting walk or steps per meter and normalized steps per meter at all five walking conditions; in over-80 years old participants using gait speed, normalized gait speed, steps per meter and normalized steps per meter at fast pace and animal dual-task walking. Multivariable logistic regression analysis adjusted for gender predicted in two compiled models the presence of dementia or cognitive impairment with acceptable accuracy in persons with memory complaints. CONCLUSION: Gait parameters in multiple walking conditions adjusted for age, gender and leg length showed a significant association with cognitive impairment. This study suggested that multifactorial gait analysis could be more informative than using gait analysis with only one test or one variable. Using this type of gait analysis in clinical practice could facilitate screening for cognitive impairment.

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- Ibrahim A, Singh DKA, Shahar S. 'Timed Up and Go' test: Age, gender and cognitive impairment stratified normative values of older adults. *PLoS One*. 2017 Oct 3;12(10):e0185641.

AIMS: The aim of this study was to establish 'Timed up and Go' test (TUG) normative data among community dwelling older adults stratified based on cognitive status, gender and age groups. METHODS: A total of 2084 community dwelling older adults from wave I and II were recruited through a multistage random sampling method. TUG was performed using the standard protocol and scores were then stratified based on with and without mild cognitive impairment (MCI), gender and in a 5-year age groups ranging from ages of 60's to 80's. RESULTS: 529(16%) participants were identified to have MCI. Past history of falls and medical history of hypertension, heart disease, joint pain, hearing and vision problem, and urinary incontinence were found to have influenced TUG performance. Cognitive status as a mediator, predicted TUG performance even when both gender and age were controlled for (B 0.24, 95% CI (0.02-0.47),  $\beta$  0.03, t 2.10, p = 0.36). Further descriptive analysis showed, participants with MCI, women and older in age took a longer time to complete TUG, as compared to men with MCI across all age groups with exceptions for some age groups. CONCLUSION: These results suggested that MCI needs to be taken into consideration when testing older adults using TUG, besides age and gender factors. Data using fast speed TUG may be required among older adults with and without MCI for further understanding.

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- Khanuja K, Joki J, Bachmann G, Cucurullo S. Gait and balance in the aging population: Fall prevention using innovation and technology. *Maturitas*. 2018 Apr;110:51-56.

On a global basis, adults 65 years of age and older experience falls more frequently than younger individuals, and these often result in severe injuries as well as increased healthcare costs. Gait and balance disorders in this population are among the most common causes of falls and negatively influence quality of life and survivorship. Although falls are a major public health problem and guidelines/recommendations are available to physicians, many are fully aware of different assessments, tools, and resources available for intervention. Given the risk for potentially devastating outcomes if severe injuries occur secondary to a fall, fall prevention strategies in clinical offices is a timely consideration in today's health care landscape. This paper presents a three-tier model, comprising assessment, prevention, and intervention, to highlight methods, proactive programs, and innovative tools and technology that have been developed for fall prevention. Awareness of these resources will enhance the clinician's ability to accurately assess balance and gait, which can improve physical function, and decrease the risk of falls for both average-risk and high-risk older adults.

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- Perera S, Patel KV, Rosano C, Rubin SM, Satterfield S, Harris T, Ensrud K, Orwoll E, Lee CG, Chandler JM, Newman AB, Cauley JA, Guralnik JM, Ferrucci L, Studenski SA. Gait Speed Predicts Incident Disability: A Pooled Analysis. *J Gerontol A Biol Sci Med Sci*. 2016 Jan;71(1):63-71.

BACKGROUND: Functional independence with aging is an important goal for individuals and society. Simple prognostic indicators can inform health promotion and care planning, but evidence is limited by heterogeneity in measures of function. METHODS: We performed a pooled analysis of data from seven studies of 27,220 community-dwelling older adults aged 65 or older with baseline gait speed, followed for disability and mortality. Outcomes were incident inability or dependence on another person in bathing or dressing; and difficulty walking ¼ - ½ mile or climbing 10 steps within 3 years. RESULTS: Participants with faster baseline gait had lower rates of incident disability. In subgroups (defined by 0.2 m/s-wide intervals from <0.4 to ≥ 1.4 m/s) with increasingly greater gait speed, 3-year rates of bathing or dressing dependence trended from 10% to 1% in men, and from 15% to 1% in women, while mobility difficulty trended from 47% to 4% in men and 40% to 6% in women. The age-adjusted relative risk ratio per 0.1 m/s greater speed for bathing or dressing dependence in men was 0.68 (0.57-0.81) and in women: 0.74 (0.66-0.82); for mobility difficulty, men: 0.75 (0.68-0.82), women: 0.73 (0.67-0.80). Results were similar for combined disability and mortality. Effects were largely consistent across subgroups based on age, gender, race, body mass index, prior hospitalization, and selected chronic conditions. In the presence of multiple other risk factors for disability, gait speed significantly increased the area under the receiver operator characteristic curve. CONCLUSION: In older adults, gait speed predicts 3-year incidence of bathing or dressing dependence, mobility difficulty, and a composite outcome of disability and mortality. ©The Author

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- Tolea MI, Morris JC, Galvin JE. Trajectory of Mobility Decline by Type of Dementia. *Alzheimer Dis Assoc Disord*. 2016 Jan-Mar;30(1):60-6.

Cognitive and physical aspects of functionality are closely related. However, whether physical decline differs by dementia type and progression rate is debatable. To address these issues, we conducted a longitudinal study of 766 older adults whose physical performance and cognitive status were assessed annually with standard assessment tools [e.g., Physical Performance Test, Clinical Dementia Rate (CDR)] for 8 years. Compared with participants who remained cognitively normal, those progressing to later-stage dementia (CDR=1) declined in their mobility by a factor of 2.82 (P<0.001), followed by those who maintained a later-stage diagnosis (slope=-1.84, P<0.001), those progressing from early-stage to later-stage (CDR=0.5 to CDR=1) dementia (slope=-1.20, P<0.001), and those who progressed to early-stage dementia (slope=-0.39, P=0.038) suggesting a steeper physical decline with dementia progression, particularly in those with the fastest disease progression. Although all types of dementia experienced mobility decline, those progressing to non-Alzheimer disease (AD) dementias, especially vascular dementia declined faster than those who remained normal (slope=-2.70, P<0.001) or progressed to AD (slope=-2.18, P<0.001). These associations were better captured by the gait/balance component of physical functionality. Our findings suggest that rapidly progressing dementia patients particularly those with non-AD subtypes should be targeted for interventions to maintain or improve gait/balance and prevent functional decline and disability although AD patients may also benefit.

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*Next Month's Issue:*

Medication-Related Falls in Dementia

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