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TIMED UP AND GO TEST PREDICTS COGNITIVE DECLINE IN HEALTHY ADULTS AGED 80 AND OLDER IN OKINAWA: KEYS TO OPTIMAL COGNITIVE AGING (KOCOA) PROJECT

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To the Editor: Identifying predictive markers of cognitive decline that are easily assessed has important implications for early detection and prevention of dementia. Although slowing of gait is common in older people, it has been previously found that gait dysfunction may be predictive of the greater likelihood of the subsequent onset of cognitive impairment or dementia.^{1,2} The aim of the current study was to explore the association between cognitive functions classified into three domains (global, executive, and memory) and gait speed and mobility measured by Timed Up and Go (TUG) test³ during a 3-year period in functionally independent, community-dwelling adults aged 80 and older who were free from cognitive impairment at baseline.

METHODS

Participants were members of the Keys to Optimal Cognitive Aging Project (KOCOA), a prospective pilot cohort study of community-dwelling people aged 80 and older living in Ginowan City, Okinawa, Japan. The study recruitment process has been described in detail elsewhere.⁴ The study consisted of three time points: baseline and two annual follow-ups (November 2007 to March 2010). Of 192 participants without frank dementia (Clinical Dementia Rating Scale (CDR) score⁵ ≤ 0.5) at baseline, 137 completed the first follow-up and 111 the second follow-up. Gait speed and mobility at baseline were determined using the TUG test,³ which measured the time (in seconds), that an individual required to stand up from a chair, walk 3 m at their normal walking speed, turn around, walk back, and sit down. Assistive devices were permitted if necessary. The participants ($n = 192$) were classified according to the quartiles of TUG time into fast or normal (TUG time < 14 seconds) and slow (TUG time ≥ 14 seconds) walking groups. A trained interviewer assessed cognitive

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function at baseline and at the followup examinations using the Japanese version of the Mini-Mental State Examination (JMMSE)⁶ for global cognitive function, the Verbal Fluency Initial Letter (VFL)⁷ for executive function, and the Scenery Picture Memory Test (SPMT)⁸ for memory function. Because the distribution of JMMSE was not normal, the square root of the number of errors, as expressed by $(30 - \text{JMMSE})^{1/2}$, was used to normalize the distribution.⁹ The VFL requires participants to generate words beginning with the letter “Ka” (in Japanese) in 60 seconds and has been used widely in Japan as an equivalent test to Initial Letter Fluency.⁷ The SPMT has been described in detail elsewhere.⁸ We compared the estimated mean cognitive test scores at each assessment between the two groups (fast or normal vs slow) defined at baseline using analysis of covariance.

RESULTS

The mean $\pm$ standard deviation age of the participants at baseline was 85.1 ± 3.2 ; 73.4% were female. Comparisons of the test scores for the transformed JMMSE, VFL, and SPMT between the fast or normal and slow TUG groups are shown in Table 1. Although there were no differences in baseline and first follow-up test scores for the transformed JMMSE, the difference between the groups became significant at the second follow-up ($P = .03$), and the result remained unchanged ($P = .03$) after controlling for the baseline value. There were significant differences in VFL and SPMT scores at baseline and in SPMT score at the second follow-up between the fast or normal and slow TUG groups. The difference in SPMT score at the second follow-up lost significance after additionally controlling for the baseline value.

DISCUSSION

This study found that the gait speed and mobility were associated with global cognitive function after 3 years and were cross-sectionally associated with executive and memory functions. The results could suggest that slowing of mobility can be observed before decline in global function and coinciding with impairment in executive and memory functions in people aged 80 and older. These findings based on octogenarians and nonagenarians in Okinawa, Japan, known for their longevity, give additional generalizability to previous findings.^{2,10} This association has potentially important implications for early detection of cognitive impairment in older people.

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Table 1

Estimated Cognitive Test Scores of the Two Groups According to Timed Up and Go (TUG) Test Performance

	Mean (95% Confidence Interval)		
Cognitive Test	Fast or Normal*	Slow*	P-Value
JMMSE [†]			
Baseline	2.38 (2.25–2.51)	2.54 (2.35–2.73)	.17
Model1 [‡]			
1st follow-up	2.06 (1.89–2.23)	2.37 (2.11–2.64)	.05
2nd follow-up	1.98 (1.79–2.16)	2.36 (2.08–2.64)	.03
Model2 [§]			
1st follow-up	2.07 (1.92–2.22)	2.34 (2.11–2.57)	.06
2nd follow-up	2.00 (1.85–2.15)	2.31 (2.08–2.55)	.03
Verbal Fluency Initial Letter			
Baseline	6.43 (5.98–6.88)	5.37 (4.70–6.03)	.01
Model 1 [‡]			
1st follow-up	6.53 (6.00–7.07)	5.72 (4.90–6.54)	.11
2nd follow-up	6.73 (6.04–7.42)	5.74 (4.68–6.81)	.13
Model 2 [§]			
1st follow-up	6.36 (5.90–6.82)	6.11 (5.21–7.02)	.57
2nd follow-up	6.57 (5.99–7.62)	6.12 (5.21–7.02)	.41
Scenery Picture Memory Test			
Baseline	7.44 (6.99–7.89)	6.20 (5.53–6.87)	.003 [¶]
Model 1 [‡]			
1st follow-up	7.41 (6.86–7.97)	6.99 (6.13–7.85)	.43
2nd follow-up	7.67 (7.07–8.26)	6.29 (5.38–7.21)	.01
Model 2 [§]			
1st follow-up	7.25 (6.82–7.68)	7.45 (6.79–8.12)	.62
2nd follow-up	7.45 (6.93–7.97)	6.80 (5.99–7.60)	.19

* Participants were classified according to upper quartile of TUG time into fast or normal (TUG time < 14 seconds) or slow (TUG time ≥ 14 seconds) walking groups.

[†] An increase in the square root of the number of errors in the Japanese version of Mini-Mental State Examination (JMMSE) with time indicates cognitive decline.

[‡] Model 1: controlled for age, sex, and years of education.

[§] Model 2: controlled for baseline cognitive test score in addition to the variables controlled for in the Model 1.

[¶] Significant at $p < .0033$, the Bonferroni multiple comparison adjusted p-value.