CHAPTER 4

RESULTS

4.1 Participant Characteristics

Seventy-five elders were recruited into the study. After subsequent clinical examination by the physicians, one participant revealed lumbar spondylolithesis and thus was excluded from the study. The demographics and characteristics of the participants are shown in Table 1. On average, participants were 73 years old, had a middle school education, took about 4 drugs per day, had good balance and high balance confidence in daily activities, had no depressive symptom, and were cognitively intact. The majority of participants (74%) were female. Of 74 older adults, 34 (46%) reported one or more falls in the past year. The mean number of falls was 3.79. Of 34 elders who fell, 15 (44%) fell while doing one task and 19 (56%) fell while doing two tasks at once. For imbalance events, 51 (69%) older adults reported one or more imbalance in the past year. The mean number of imbalance was 3.48. Of 51 elders who reported imbalance, 38 (75%) lost their balance while doing one task and 13 (25%) lost their balance while doing two tasks at once.

Table 1 Participant Demographics and Characteristics

Variables	Mean ± SD
Demographic data (n = 74)	
Age (year)	72.47 ± 5.47
Gender (women), n (%)	55 (74%)
Body mass index (kg/m^2)	23.02 ± 3.87
Education (year)	8.32 ± 4.85
Mini-Mental State Examination	27.59 ± 2.45
Number of drugs taken per day	3.76 ± 2.39
Number of falls in the past year	3.79 ± 5.81
History of fall in the past year	
- No history of fall, n (%)	40 (54%)
- Fell under single-task condition, n (%)	15 (20%)
- Fell under dual-task condition, n (%)	19 (26%)
Number of imbalance in the past year	3.48 ± 3.70
History of imbalance	
- No history of imbalance	23 (31%)
- Lost balance under single-task condition, n (%)	38 (51%)
- Lost balance under dual-task condition, n (%)	13 (18%)
Cognitive function	
Executive function (ANT, ms)	124.35 ± 73.09
Balance and Mobility	
Balance (BBS)	51.74 ± 2.75
Gait speed (Time 10-Meter Walk Test, m/s)	1.06 ± 0.18
Affect and emotional well-being	
Balance confidence (ABC)	81.61 ± 17.16
Depression (TGDS)	6.00 ± 5.81

Table 1 Participant Demographics and Characteristics (continue)

Variables	Mean + SD
Usual walking (GAITRite)	
Gait speed (m/s)	1.02 ± 0.19
Average swing time (s)	0.44 ± 0.05
Swing time variability (%)	4.52 ± 3.17

4.2 Effect of a cognitive task on gait during level walking

To test the effect of a cognitive task, gait performance under the single-task condition (i.e. walking without any secondary tasks) was compared with those under the dual-task condition (i.e. walking while performing the Serial 3 subtraction task). The results showed decreased gait speed and increased swing time and swing time variability under the dual-task condition compared to the single-task condition ($p<0.001$; Figure 8). Average gait speed was 1.02 ± 0.19 m/s under the single-task condition and 0.65 ± 0.24 m/s under the dual-task condition (Figure 8A). Average swing time was 0.44 ± 0.05 s under the single-task condition and 0.68 ± 0.28 s under the dual-task condition (Figure 8B). Average swing time variability was 4.52 ± 3.17 % and 12.07 ± 10.23 % under the single-task and dual-task condition, respectively (Figure 8C).

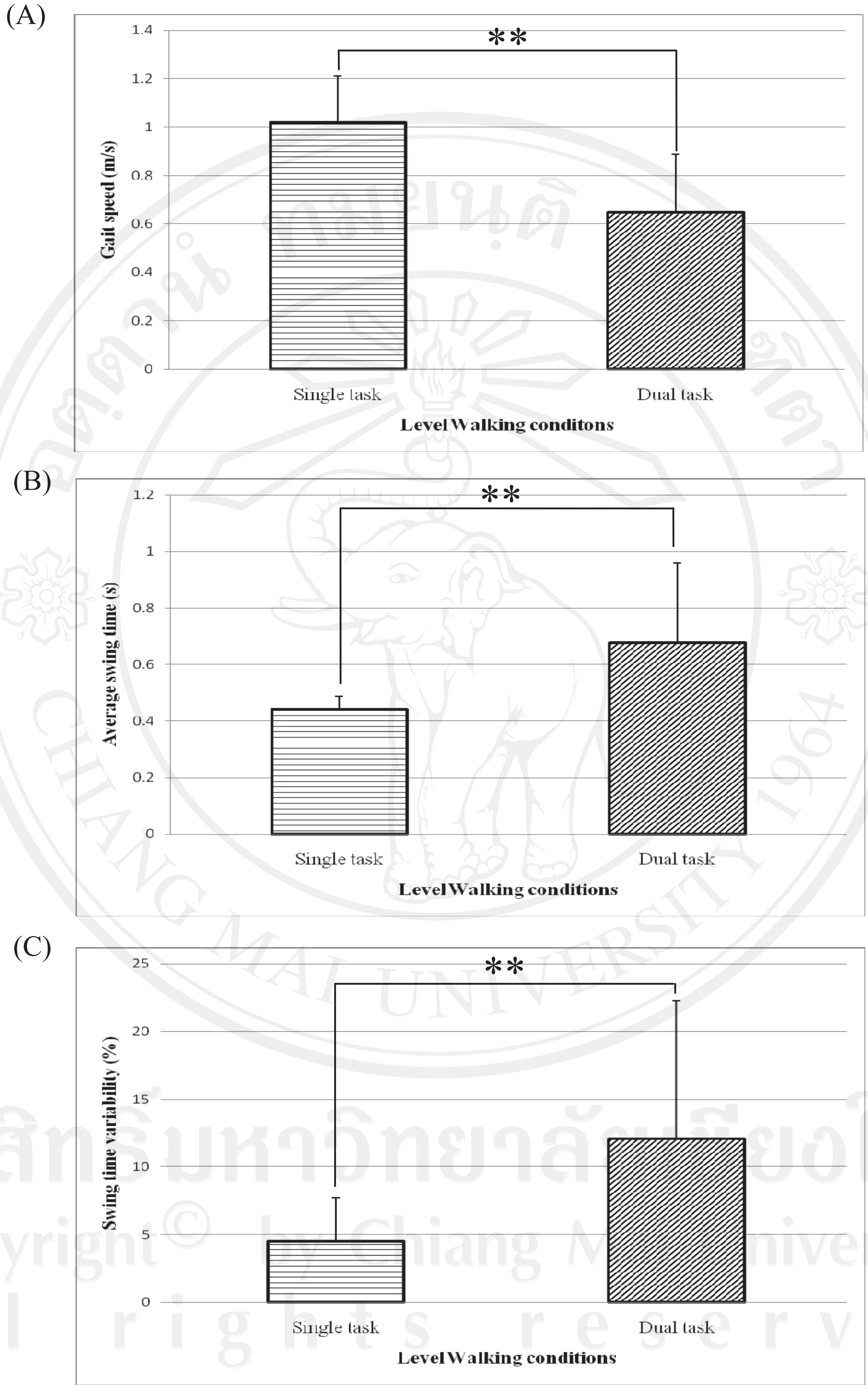


Figure 8 The effects of a cognitive task on level walking: (A) gait speed; (B) average swing time, and (C) swing time variability (** p<0.001)

4.3 Effect of a cognitive task and task prioritization on narrow walking

Univariate analysis of variance showed significant differences between narrow walking conditions. Similar to the effect of a cognitive task on level walking, the results from pairwise comparisons using Bonferroni procedure demonstrated decreased gait speed, increased swing time, and swing time variability under the dual-task condition (i.e. narrow walking while counting backward by 2s) compared to the single-task condition (i.e. narrow walking without any secondary tasks) ($p<0.001$; Figure 9).

In addition to the effect of a cognitive task, the effects of task prioritization were also examined by comparing performances under 3 different prioritization conditions including 1) no priority; 2) gait priority; and 3) cognitive priority. The results from pairwise comparisons revealed that when asked to prioritize the gait task, older adults significantly decreased their gait speed (compared with cognitive-priority condition) and increased their average swing time (compared with no-priority conditions) ($p<0.05$; Figure 9A, B). However, there was no significant difference in swing time variability between prioritization conditions ($p > 0.05$; Figure 9C). In addition, when asked to prioritize the gait task, older adults significantly decreased the rate of missteps (stepping onto or outside either strip of tape) and rate of correct responses compared with both no-priority and cognitive-priority conditions ($p<0.05$; Figure 9D, 9E). Lastly, when instructed to prioritize the counting backward task, the rate of response increased significantly compared with counting backward while seated ($p<0.05$; Figure 9F).

(A)

(B)

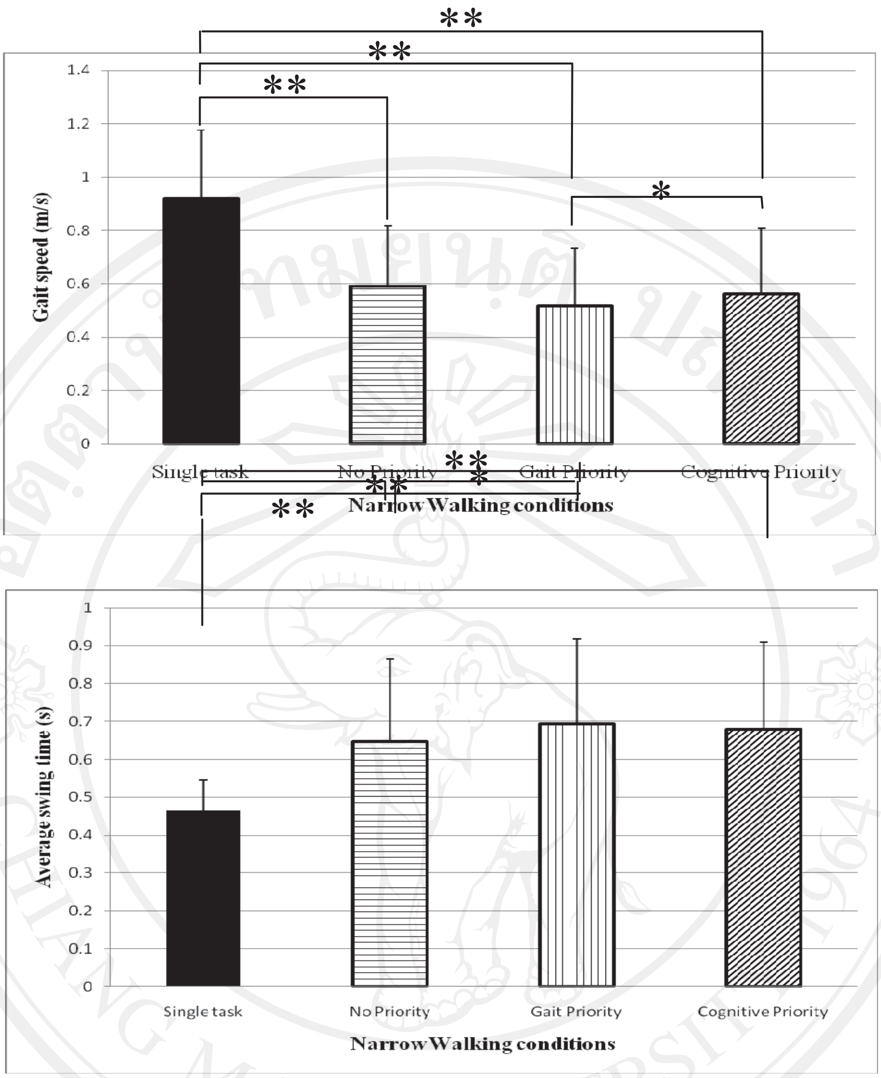
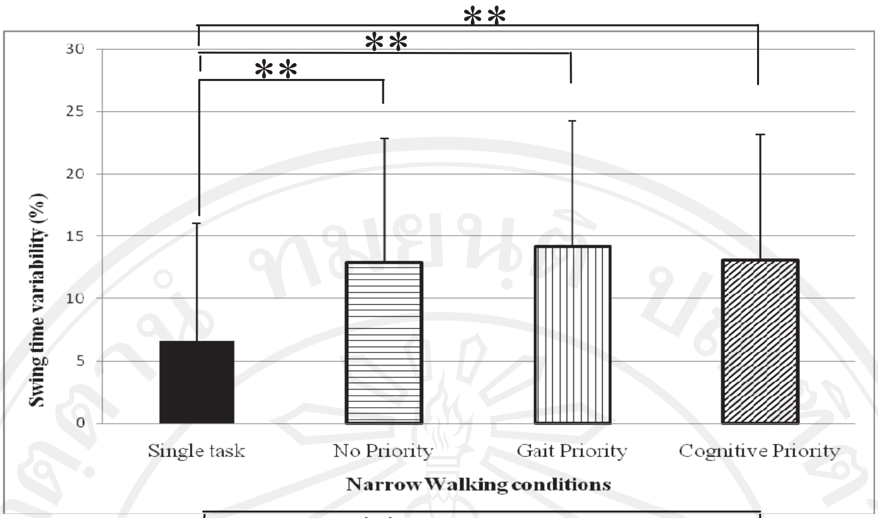


Figure 9 The effects of a cognitive task and task prioritization on narrow walking:(A) gait speed; (B) average swing time (* p<0.05, ** p<0.001)

(C)



(D)

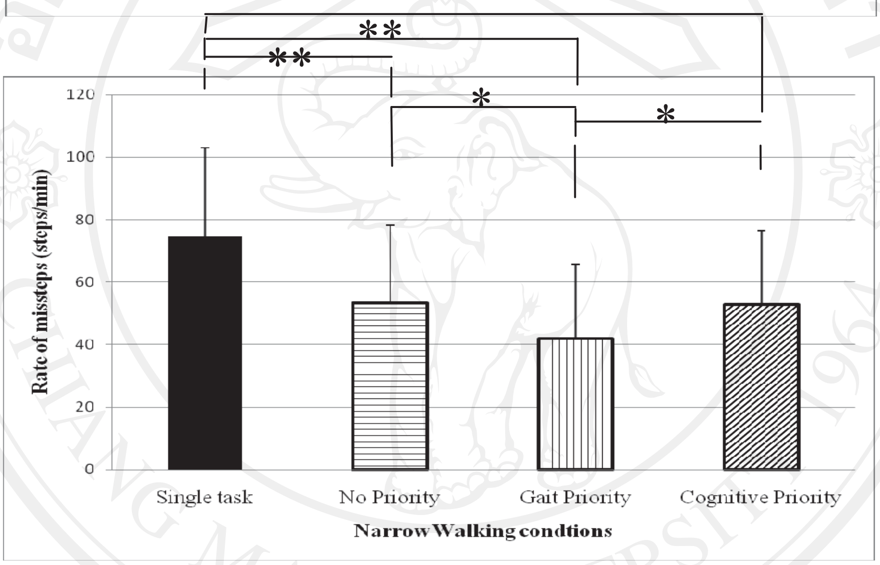
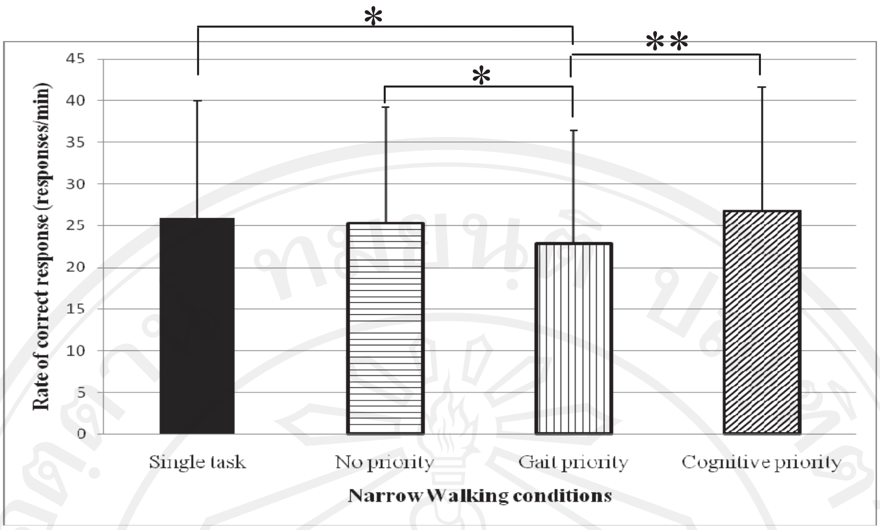


Figure 9 The effects of a cognitive task and task prioritization on narrow walking:

(C) swing time variability; D) rate of missteps (* p<0.05, ** p<0.001)

(E)



(F)

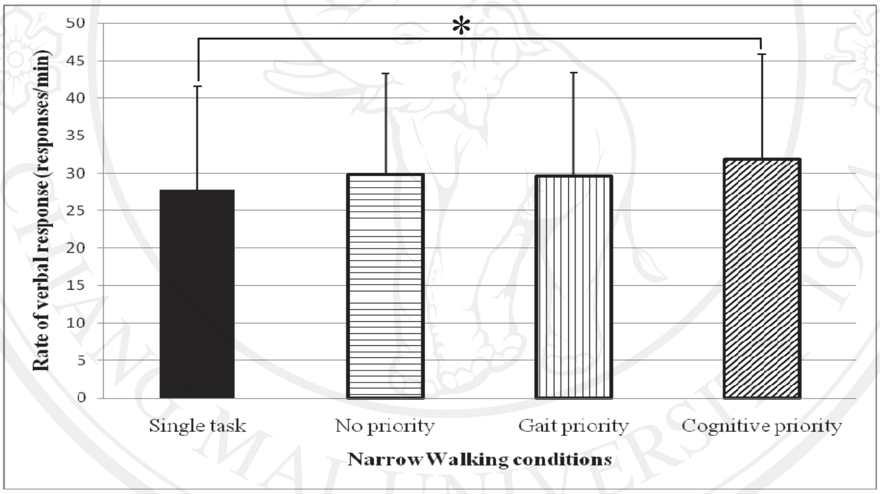


Figure 9 The effects of a cognitive task and task prioritization on narrow walking: (E) rate of correct responses; F) rate of verbal responses (* p<0.05, ** p<0.001)

4.4 The relationships between the dual-task decrements (DTD) and the participant characteristics

As shown in Table 2, the DTD in gait speed were mildly correlated with history of imbalance ($r = -0.33$; $p<0.01$) and cognitive-priority cost on average swing time ($r = 0.30$; $p<0.05$), and moderately correlated with cognitive-priority cost on gait speed ($r = -0.43$; $p<0.01$) and the Timed 10-Meter Walk Test ($r = 0.44$; $p<0.01$). The increases in average swing time in response to dual task were mildly correlated with number of drugs taken per day ($r= 0.24$; $p<0.05$), history of imbalance ($r = 0.28$; $p<0.05$), cognitive-priority cost on average gait speed ($r = 0.33$; $p<0.01$), cognitive-priority cost on average swing time ($r = -0.32$; $p<0.01$), and the Timed 10-Meter Walk Test ($r = -0.26$; $p<0.05$). The DTD in swing time variability was weakly correlated with number of imbalance in the past year ($r = 0.17$; $p<0.05$). In addition, the DTD in swing time variability were weakly correlated with history of imbalance ($r = 0.33$; $p<0.01$).

Table 2 Correlation between the dual-task decrements and variables

Variables	DTD in gait speed	DTD in average swing time	DTD in swing time variability
Demographic data			
- Age	-0.09	0.08	-0.03
	(0.436)	(0.519)	(0.827)
- Education	0.04	-0.05	0.01
	(0.722)	(0.692)	(0.928)
- Body mass index	-0.01	0.13	0.03
	(0.942)	(0.258)	(0.792)
- Number of drugs taken per day	-0.21	0.24*	0.07
	(0.073)	(0.039)	(0.531)
- Number of falls in the past year	-0.01	0.06	0.06
	(0.947)	(0.601)	(0.587)
- History of fall	0.01	0.02	0.05
	(0.952)	(0.864)	(0.672)
- Number of imbalance in the past year	-0.20	0.20	0.17*
	(0.083)	(0.092)	(0.142)
- History of imbalance	-0.33**	0.28*	0.33**
	(0.004)	(0.017)	(0.004)

*p<0.05, **p<0.01

Notes: Data were presented as Spearman's correlation coefficients (p value).

Table 2 Correlation between the dual-task decrements and variables (continue)

Variables	DTD in gait speed	DTD in average swing time	DTD in swing time variability
Cognitive function			
- Executive function (Attention Network Test)	0.12 (0.315)	-0.07 (0.582)	-0.06 (0.634)
- Ability to allocate attention (task prioritization cost)			
1) Gait-priority cost			
- gait speed	-0.19 (0.106)	0.10 (0.385)	0.03 (0.799)
- average swing time	0.12 (0.293)	-0.14 (0.231)	-0.02 (0.881)
- swing time variability	-0.04 (0.745)	0.13 (0.272)	0.08 (0.504)
- rate of verbal responses	0.13 (0.286)	-0.12 (0.301)	-0.13 (0.277)
2) Cognitive-priority cost			
- gait speed	-0.43** (0.000)	0.33** (0.004)	0.26* (0.025)
- average swing time	0.30* (0.010)	-0.32* (0.005)	-0.18 (0.121)
- swing time variability	0.14 (0.232)	-0.03 (0.808)	-0.15 (0.190)
- rate of verbal responses	-0.01 (0.925)	-0.04 (0.725)	-0.12 (0.329)

*p<0.05, **p<0.01

Notes: Data were presented as Spearman's correlation coefficients (p value).

Table 2 Correlation between the dual-task decrements and variables (continue)

Variables	DTD in gait speed	DTD in average swing time	DTD in swing time variability
Balance and Mobility			
- Berg Balance Scale	0.21	-0.22	-0.16
	(0.076)	(0.055)	(0.174)
- Time 10-Meter Walk Test	0.44**	-0.26*	-0.13
	(0.000)	(0.024)	(0.259)
Affect and emotional well-being			
- Activities-Specific Balance Confidence Scale	0.06	-0.03	0.07
	(0.635)	(0.824)	(0.557)
- Thai Geriatric Depression Scale	-0.05	0.02	0.04
	(0.689)	(0.855)	(0.748)
*p<0.05, **p<0.01			

Notes: Data were presented as Spearman's correlation coefficients (p value).

4.5 Effect of variables on the dual-task decrements in gait

The results of the multiple linear regression analysis are presented in Tables 3, 4, and 5. The 46% of the variation in the DTD in gait speed was accounted by 5 variables including age, number of drugs taken per day, gait speed under the single-task condition (derived from the Timed 10-Meter Walk Test), cognitive-priority cost (on average swing time), and history of imbalance. Gait speed under the single-task condition, the ability to allocate attention to the cognitive task, and history of imbalance accounted for 22%, 10%, and 7% of the variation in DTD in gait speed, respectively. The contribution of age and number of drugs taken per day were weak.

In addition, there were significant effects of age, number of drugs taken per day, cognitive-priority cost (on average gait speed), gait-priority cost (on the rate of verbal responses), and history of imbalance on the DTD in average swing time. These five factors accounted for 37% of the variation in the DTD in average swing time. The ability to allocate attention to the cognitive task was the strongest variable associated with the DTD in average swing time ($p<0.01$). For the swing time variability, the 16% of the variation in the DTD was accounted by age, number of drugs taken per day, and gait speed under the single-task condition.

Table 3 Multiple linear regression analysis predicting the dual-task decrement in average gait speed

Predictors	R^2	R^2change	F change	B
Step 1-Age	0.000	0.000	0.002	0.04
Step 2-Drugs taken per day	0.08	0.08	5.10*	-0.19*
Step 3-Variables				
Gait speed (derived from Timed 10- Meter Walk Test)	0.30	0.22	17.36**	0.49**
Cognitive priority cost (on average swing time)	0.40	0.10	8.76*	0.28*
History of imbalance	0.46	0.07	6.51*	-0.28*

*P<0.05, **P<0.01

Table 4 Multiple linear regression analysis predicting the dual-task decrement in average swing time

Predictors	R^2	R^2change	F change	B
Step 1-Age	0.03	0.03	1.62	0.23
Step 2-Drugs taken per day	0.08	0.05	2.41	0.03
Step 3-Variables				
Cognitive priority cost (on gait speed)	0.21	0.13	7.99**	0.001**
History of imbalance	0.28	0.08	5.09*	0.07*
Gait priority cost (on the rate of verbal responses)	0.37	0.09	6.78*	-0.06*

*P<0.05, **P<0.01

Table 5 Multiple linear regression analysis predicting the dual-task decrement in swing time variability

Predictors	R^2	R^2change	F change	B
Step 1-Age	0.02	0.02	1.38	-0.29
Step 2-Drugs taken per day	0.07	0.05	3.26	0.05
Step 3-Variable				
Gait speed (derived from Timed 10-Meter Walk Test)	0.16	0.09	6.53*	-0.11*

*P<0.05