Supplementary Data

**Appendix 1.** The Baltimore Longitudinal Study of Aging (BLSA) is a continuous enrollment cohort study of community dwellers aged 20 and older, mostly from the Baltimore-Washington area. The study began in 1958 and more than 3,400 men and women have participated in the study. To be eligible, participants must be free of cognitive impairment, functional limitations, chronic disease, and cancer in the past ten years. BLSA participants are scheduled to return to the National Institute on Aging clinical research unit every four years for those younger than 60, every two years for those aged 60 to 79, and annually for those aged 80 and older, for a variety of clinical, medical, and neuropsychological testing. Mobility assessment of usual gait speed and 400m walk test began in 2007. Cognitive assessment of Trail Making Test began in 1984, California Verbal Learning Test began in 1993, and Digit Symbol Substitution Test began in 2005. In this study, Time 1 was the first concurrent assessment time of both mobility (usual gait and 400m walk) and cognitive (Trail Making Test part B, Digit Symbol Substitution Test, California Verbal Learning Test) measures of interest among those aged 60 and older. Height and weight were measured using a scale (SR725L) and a stadiometer (602VR), respectively.

We focused on participants aged 60 and older because the prevalence and incidence of declines in cognition and mobility are very low before age 60. Therefore, the problem we are addressing is most appropriate for adults in late midlife and late life.

901 participants had both mobility and cognition measures of interest

412 returned to Time 2

812 with usual gait speed >=0.8 m/s, MMSE>24 and free of diagnosed cognitive impairment or dementia at Time 1

* 81 had usual gait speed<0.8 m/s, MMSE≤24, or both.
* 8 were diagnosed with cognitive impairment or dementia at Time 1.
* 143 had Time 1 assessment too recently for inclusion.
* 15 died before Time 2 assessment.
* 242 were missing one or more measures of interest at one or more follow-up visits.

222 returned to Time 3

140 returned to Time 4

* 99 had Time 2 assessment too recently.
* 5 died before Time 3 assessment.
* 63 missed one or more measures of interest at Time 3.
* 23 missed Time 3 but returned at Time 4.
* 88 had Time 3 assessment too recently.
* 17 missed one or more measures of interest at Time 4.

**Appendix 2. Sample selection**

**Appendix 3. Comparisons of characteristics at Time 1 in those who were initially unimpaired and returned at Time 2 and those who did not**

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|  | **Those who returned at Time 2 (N=412)** | **Those who did not return at Time 2 (N=400)** | **p-value** |
| **Characteristics**  |  |  |  |
| Age, years | 71.4 (7.7) | 72.4 (8.5) | 0.091 |
| Female, N (%) | 209 (50.7) | 210 (50.1) | 0.614 |
| Body mass index, kg/m2 | 26.9 (4.6) | 27.3 (4.5) | 0.199 |
| ^Education, years | 17 (2) | 17 (3) | 0.832 |
| **Cognitive impairment or dementia, N (%)** | 0 | 0 | - |
| **Global mental state** |  |  |  |
| MMSE (range 0-30) | 28.8 (1.2) | 28.7 (1.2) | 0.152 |
| **Executive function** |  |  |  |
| DSST (range 0-90) | 47.0 (10.9) | 43.9 (10.5) | **<0.001** |
| TMT-B, s, median (IQR) | 69.5 (33) | 74.0 (41) | 0.145 |
| **Verbal Memory** |  |  |  |
| CVLT immediate recall | 52.5 (12.1) | 50.3 (11.4) | **0.008** |
| CVLT short-delay free recall (range 0-16) | 10.7 (3.3) | 9.9 (3.3) | **0.001** |
| CVLT long-delay free recall (range 0-16) | 11.2 (3.3) | 10.5 (3.3) | **0.002** |
| **Mobility measures** |  |  |  |
| Usual gait speed, m/s | 1.14 (0.18) | 1.13 (0.19) | 0.567 |
| 400m walk time, s | 267.4 (41.3) | 274.8 (50.1) | **0.022** |
| Use of a walking aid, N (%) | 1 (0.1) | 0 (0) | 0.999 |

Note: MMSE=Mini-mental State Exam; DSST=Digit symbol substitution test; TMT-B=Trails Making Test-part B; CVLT=California Verbal Learning Test. Values are mean (SD) unless otherwise noted. ^presented in years of full time education. Comparisons were examined using independent t-tests or chi-square tests as appropriate. Bold number reflects significant associations at p<0.05.

**Appendix 4. The cross-sectional associations between cognition and mobility**

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|  |  | Usual gait at Time 1(N=412) | Usual gait at Time 2(N=412) | Usual gait at time 3(N=222) | Usual gait at time 4(N=140) |
| DSST | β (SE)p-value | 0.095 (0.050)0.060 | **0.146 (0.049)****0.004** | **0.212 (0.075)****0.005** | 0.092 (0.085)0.285 |
| TMT-B | β (SE)p-value | -0.071 (0.047)0.132 | **-0.134 (0.045)****0.003** | **-0.250 (0.069)****<0.001** | -0.225 (0.089)0.013 |
| CVLT immediate recall | β (SE)p-value | 0.046 (0.048)0.337 | 0.068 (0.048)0.158 | 0.168 (0.067)0.013 | 0.076 (0.083)0.365 |
| CVLT short-delay free recall | β (SE)p-value | 0.032 (0.047)0.496 | 0.083 (0.048)0.084 | 0.113 (0.068)0.098 | 0.041 (0.085)0.633 |
| CVLT long-delay free recall | β (SE)p-value | 0.064 (0.047)0.178 | 0.041 (0.049)0.408 | 0.083 (0.068)0.222 | -0.031 (0.081)0.707 |
|  |  | 400m timeat Time 1(N=412) | 400m timeat Time 2(N=412) | 400m timeat Time 3(N=222) | 400m timeat Time 4(N=140) |
| DSST | β (SE)p-value | **-0.140 (0.041)****<0.001** | **-0.153 (0.050)****0.002** | **-0.311 (0.097)****0.002** | -0.005 (0.113)0.966 |
| TMT-B | β (SE)p-value | **0.116 (0.038)****0.002** | 0.107 (0.046)0.020 | **0.412 (0.088)****<0.001** | 0.226 (0.118)0.058 |
| CVLT immediate recall | β (SE)p-value | **-0.114 (0.039)****0.004** | **-0.148 (0.048)****0.002** | **-0.349 (0.086)****<0.001** | -0.281 (0.107)0.010 |
| CVLT short-delay free recall | β (SE)p-value | -0.058 (0.038)0.132 | -0.106 (0.048)0.027 | **-0.354 (0.086)****<0.001** | -0.152 (0.111)0.172 |
| CVLT long-delay free recall | β (SE)p-value | -0.086 (0.038)0.025 | -0.118 (0.049)0.016 | **-0.337 (0.086)****<0.001** | -0.082 (0.106)0.441 |

Note: Models adjusted for age, sex, body mass index, and education. Bold number reflects significant associations with Bonferroni corrections.

**Appendix 5. Cross-lagged associations between mobility and cognition among those who had data on usual gait speed whether or not they had data on the 400m walk**

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| Cross-lagged associations between cognitive measures and gait speed |
|  | β (SE)p-value |  | β (SE)p-value |
| DSST🡪gait speed | **0.172 (0.028)****<0.001** | gait speed🡪DSST | **0.065 (0.017)****<0.001** |
| TMT-B🡪gait speed | **-0.137 (0.028)****<0.001** | gait speed🡪TMT-B | **-0.124 (0.023)****<0.001** |
| CVLT immediate🡪gait speed | 0.042 (0.028)0.128 | gait speed🡪CVLT immediate | 0.052 (0.020)0.009 |
| CVLT short-delay🡪gait speed | 0.056 (0.028)0.045 | gait speed🡪CVLT short-delay | 0.052 (0.021)0.014 |
| CVLT long-delay🡪gait speed | 0.042 (0.029)0.149 | gait speed🡪CVLT long-delay | 0.030 (0.021)0.147 |

Note: N=484 at Time 1, N=484 at Time 2, N=278 at Time 3, N=187 at Time 4. Models adjusted for the dependent variable measure at the prior time point, baseline age, sex, body mass index, and years of education. Bold number reflects significant associations with Bonferroni corrections.