The Impact of a Lifestyle Intervention on Change in Gait Performance and Cognitive Function

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Introduction

- Higher-order **cognitive decline** is strongly associated with decreased walking speed and increased gait variability (Montero-Odasso et al., 2012).
- Two simultaneously performed tasks **compete for cognitive resources**, especially in cognitively impaired individuals (Montero-Odasso et al., 2012).

Research Objectives

1. Explore a **lifestyle intervention** (intergenerational choir) on change in gait trajectories such as gait velocity and gait variability for Persons with Dementia (PwD).
2. Assess whether **MMSE, PHQ-9, & PANAS scores** at **baseline moderate** individual trajectories of change in gait velocity or gait variability?

Methods

Participants

Community-dwelling older adults with dementia (PwD; n=32) with an average age of 77.4 years (SD=10.5).

Design

Voices in Motion (VIM) is a longitudinal study consisting of weekly choir interventions spanning up to 10 assessments over 18 months.
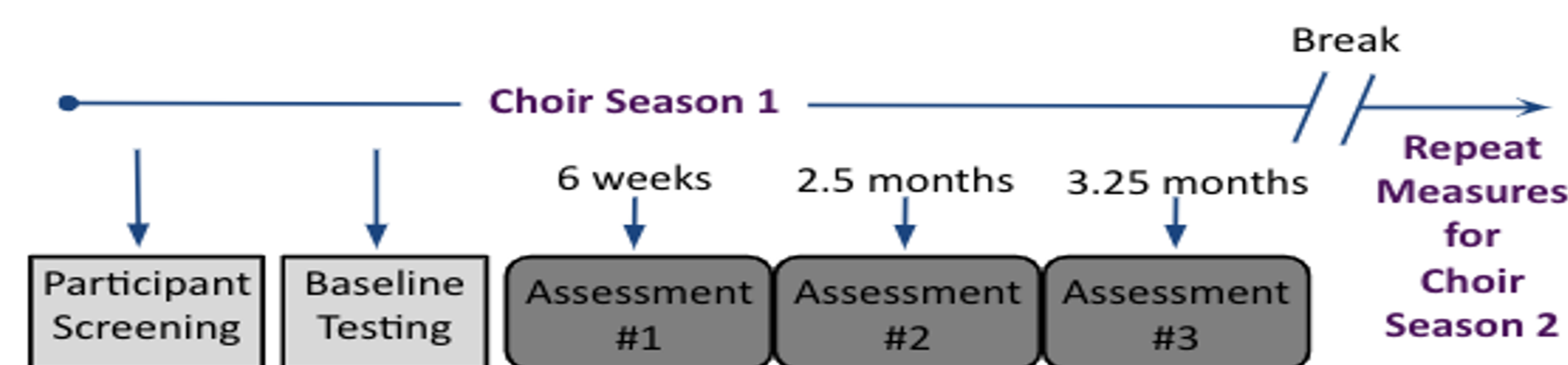

Figure 1. Longitudinal burst design

Measures

Gait: GAITRite computerized walkway indexed velocity (cm/s) for walk-only and dual-task (counting backwards by 7) conditions
PANAS: Measure of positive and negative affect, with higher values reflecting greater levels.
MMSE: Measure of global cognition; used to index severity of impairment (Mild = 0, Moderate = 1, Severe = 2)
PHQ-9: Measure of depressive symptoms, with higher scores reflecting greater amounts (Mild=5-9, Moderate=10-14, Major=15-19 Severe=20+)

Statistical Analysis

Multilevel Modeling

- Linear mixed models were fit to examine **within-person** (Level 1) and **between-person** (Level 2) differences in gait velocity as a function of time of assessment and select moderators, with age, sex, & leg length included as covariates.

Level 1:
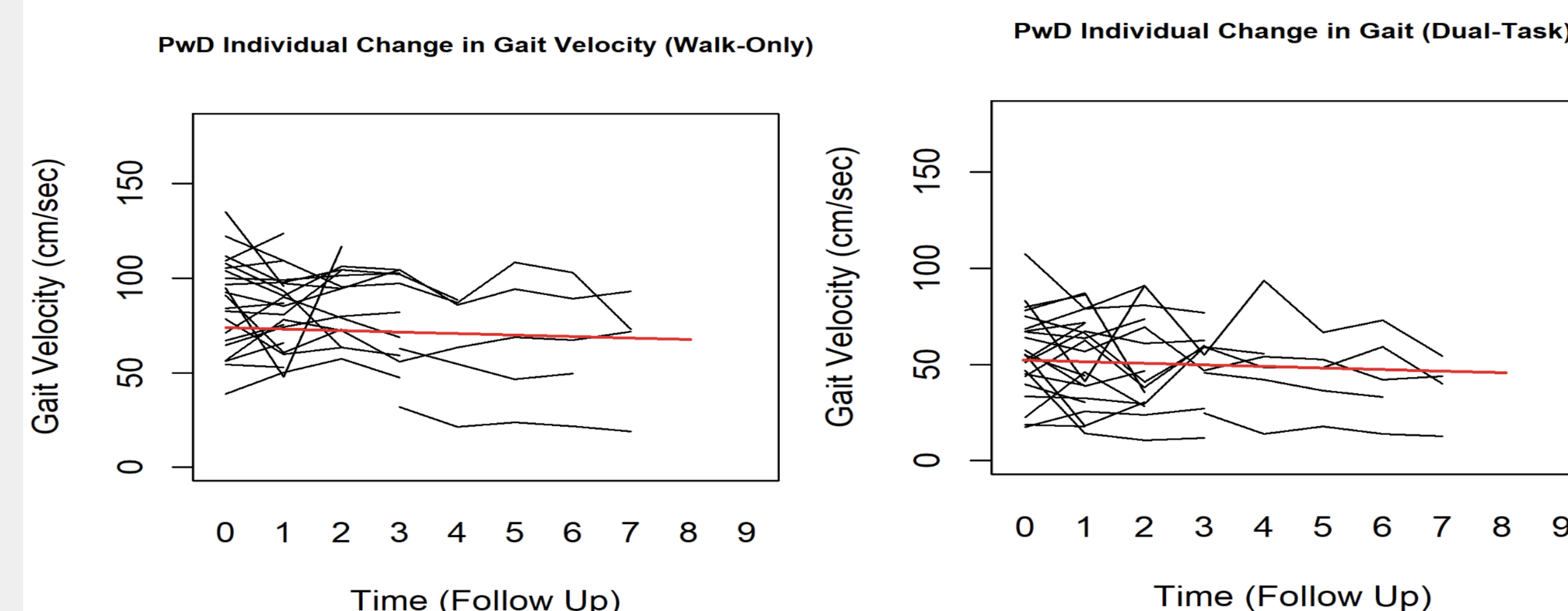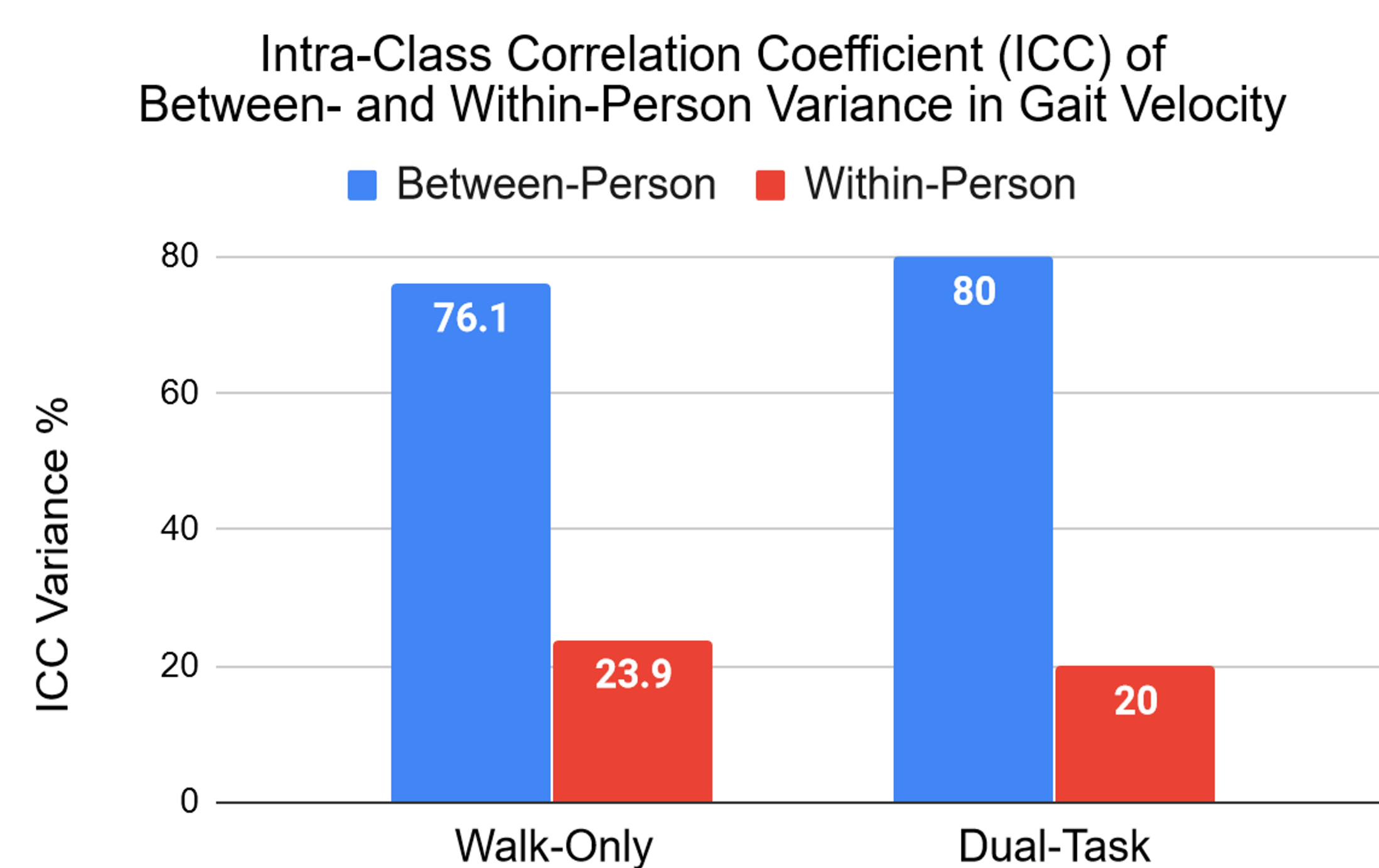$$\text{Gait Velocity}_{ij} = \beta 0i + \beta 1i(\textbf{Time in Study\_months}) + e_{ij}$$

Level 2:
$$\beta 0i = \gamma 00 + \gamma 01(\textbf{Age\_75 years, Sex, Leg Length}) + \gamma 02(\textbf{Moderators}) + U0_i$$
$$\beta 1i = \gamma 10 + \gamma 11(\textbf{Moderators})$$

Results

- For PwD, significant gait decline was observed for only the dual-task condition (p<.05; one-tailed).
  - Walk-only gait declined by 8.7 cm /sec per year
  - Dual-task gait declined by 10.32 cm/sec per year
- For the second research objective, no significant interactions between time in study and any of the moderators (PHQ-9, MMSE, PANAS) were observed.

Intra-Class Correlation Coefficient (ICC) of Between- and Within-Person Variance in Gait Velocity

PwD Individual Change in Gait Velocity (Walk-Only)

PwD Individual Change in Gait (Dual-Task)

Conclusions & Future Research

- Our findings are consistent with the redundancy hypothesis (MacDonald et al, 2011) that once an individual has probable dementia, any subsequent rate of decline is not influenced by formerly significant predictors (e.g., biological, genetic, social).
  - variance estimates for individual differences in change were both small and non-significant
- A longitudinal study investigating gait decline in patients with Alzheimer's disease showed patients declined at a speed of 0.09m/s per year (Cedervall et al, 2014).
  - Our participants declined at a rate of 0.087m/s per year.
  - This slower rate of decline may have been the social singing intervention alleviating comorbidities for PwD.
- In future research, we plan to explore whether systematic within-person improvements in comorbidities (e.g., diminished depressive affect) share a time-varying association with improvements in gait, as 20% of the variation was within-persons.

Limitations

- The intervention was targeted toward improving quality of life, as opposed to improving gait.
- Small sample size (but up to 10 assessments)
- Convenience sample:
  - Strong support from caregivers
  - Higher socioeconomic status

References

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