

MOBILITY CHANGES AMONG ELDERLY WITH AD/ADRD USING CONTINUOUS GAIT DATA

Nicholas Kalaitzandonakes¹, Mohamed Zaid¹, Erik Stone¹, George Chronis¹

1. Foresite Healthcare, LLC Missouri, USA

Email: Nicholas@foresitehealthcare.com

foresite

PROBLEM STATEMENT & OBJECTIVE

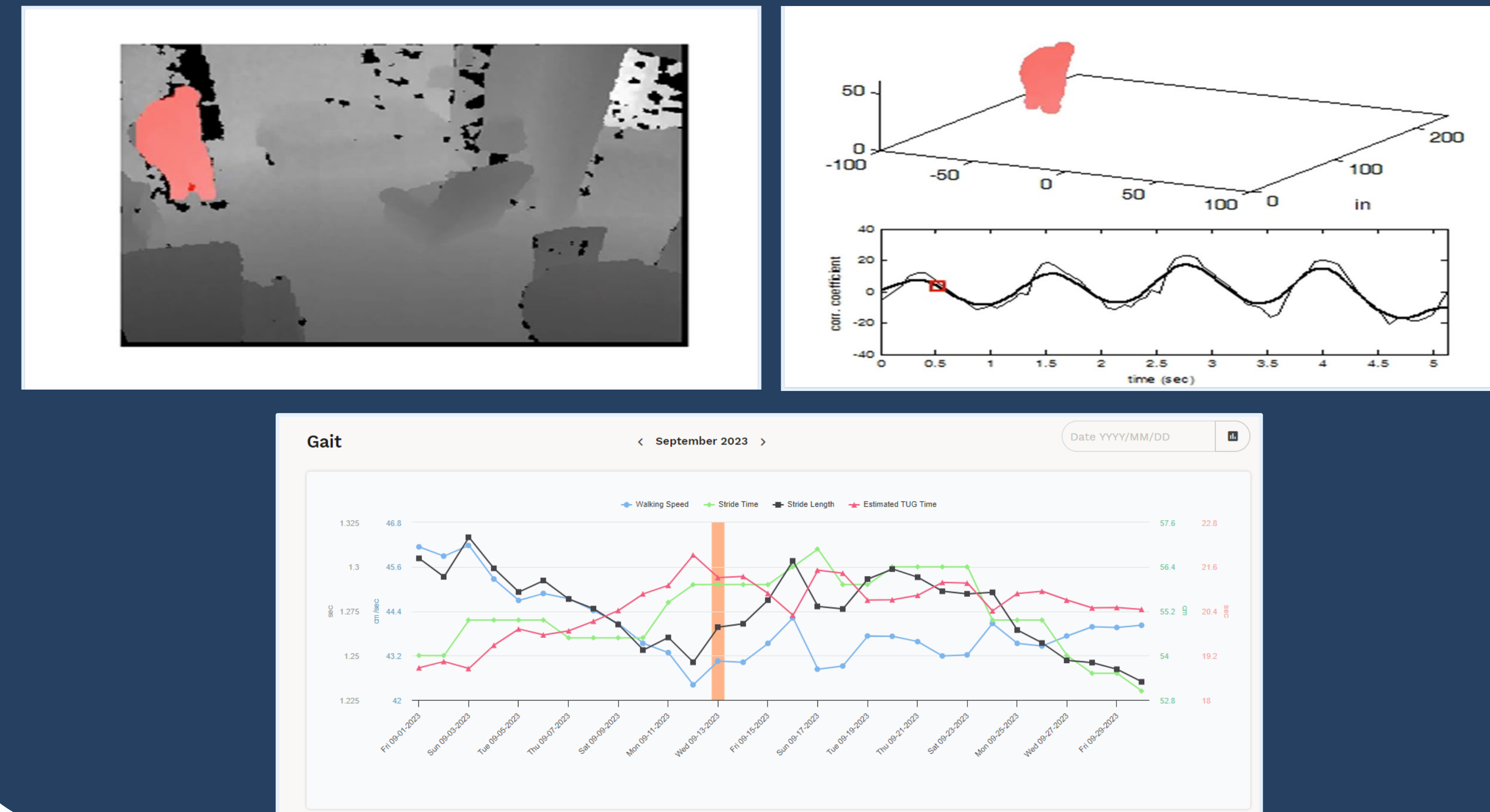
- A number of studies have identified gait and motion abnormalities as potential early indicators of Alzheimer's disease and Alzheimer's disease-related dementias (AD/ADRD) onset and progression.
- The main objective of the project is the discovery of gait- and motion-related predictive biomarkers of AD/ADRD to be used as digital diagnostics through continuous gait measurement via passive physiological sensors.
- Here we report preliminary results from statistical analyses of longitudinal gait data from a large panel of individuals with and without AD/ADRD diagnosis

DATA

- We use an unbalanced panel of monthly average gait measurements (walking speed, stride length, stride time, estimated TUG) from almost 4,000 individuals some with AD/ADRD diagnosis and some without.
- All individuals resided in senior living communities and the duration of gait measurements across individuals vary from 3 to 78 months.
- 67% of the individuals were females and 33% males while the average age for those with AD/ADRD diagnosis (memory care residents) was 86 years and those without (assisted living residents) was 87 years.

METHODS

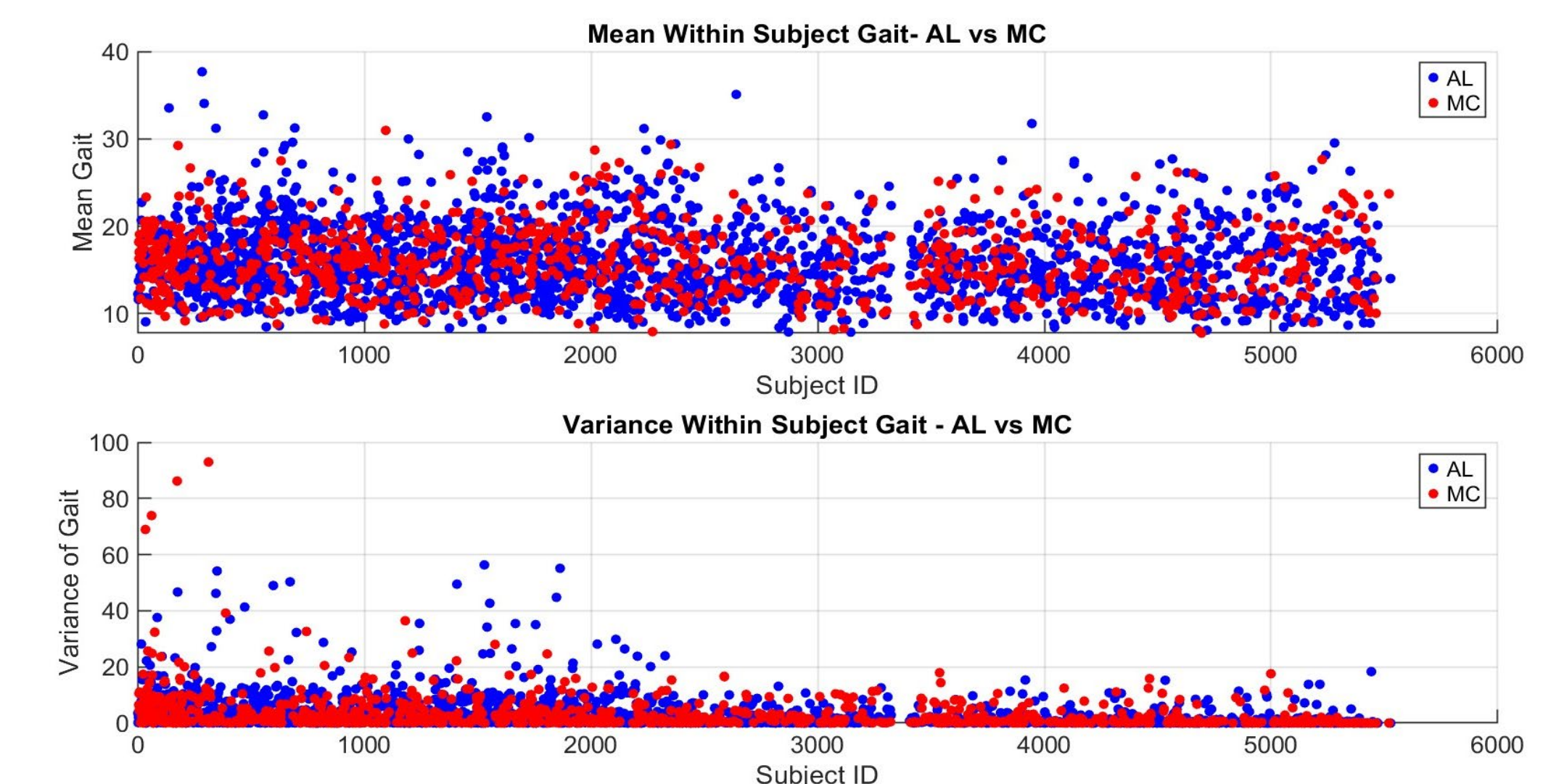
- For this analysis, we examined the temporal progression of mobility for individuals w/wo AD/ADRD diagnosis.
- We used various unbalanced panel models, and we report here *the linear mixed effects* model results for walking speed progression, as representative.
- In the model, the average monthly walking speed of individuals is specified as a function of their initial walking speed, linear and squared time trends, and a dummy variable indicating post-COVID period.



RESULTS

- The two populations in our sample had approximately the same walking speed – just over 0.91 m/h – and we failed to reject the hypothesis they have the same mean (t test =0.11, p value .90)
- The two populations had different individual-level variances with MC residents having, on average, more than twice as high variance as AL residents (F test 1.65 p value 0.00)
- Initial gait at the time of entry at the senior living community was found determinant for the individuals in the sample and for their mobility progression through their stay.
- As a population, those with AD/ADRD diagnosis (MC units) do not experience reduction in their gait through their stay; on average, they tend to experience a modest increase (e.g., 6% over two years).

Variable	Parameter Est.	SE	tStat	pValue
Intercept	1.645	0.087	18.824	0.000
Gait (0)	0.902	0.005	194.574	0.000
Time trend	0.013	0.002	5.092	0.000
Time trend SQ	0.000	0.000	-0.660	0.509
Time Trend * MC	0.030	0.005	6.164	0.000
Time trend SQ*MC	0.000	0.000	2.433	0.015
Post COVID period dummy	-0.051	0.036	-1.426	0.154
R2 -- 0.86				



CONCLUSIONS

- Preliminary statistical analysis of monthly average gait data show no significant differences in walking speed (and other gait indicators) among populations with & without AD/ADRD diagnosis living in MC and AL communities, respectively.
- In fact, the temporal progression in the average mobility of MC residents is found to be better than those in AL.
- At the same time, the average variability over time in the mobility across the MC population was significantly higher than that of the AL population.
- AI/ML (ANN, RNN, CNN) analysis of visual mobility and gait data will focus on identification of biomarkers, next.

REFERENCES

- A. McLaren, M. LaMantia and C. Callahan, "Systematic review of non-pharmacologic interventions to delay speed, cognitive function, and dementia risk in the functional decline in community-dwelling patients with dementia," *Aging & Mental Health*, vol. 17, no. 6, pp. 655-666, 2013.
- M. Tolea, J. Morris and J. Galvin, "Trajectory of mobility decline by type of dementia," *Alzheimer Disease Association Discord*, vol. 30, no. 1, pp. 60-66, 2017
- R. Hackett, H. Davies-Kershaw, D. Cadar, M. Orrell and A. Steptoe, "Walking gait longitudinal study of ageing," *Journal of the American Geriatrics Society*, vol. 66, pp. 1670-1675, 2018. [4] A.-K. Welmer, D.
- Rizzuto, C. Qiu, B. Caracciolo and E. Laukka, "Walking speed, processing speed and dementia: a population-based longitudinal study," *Journal of Gerontology*, vol. 69, no. 12, pp. 1503-1510, 2014.

ACKNOWLEDGEMENTS

Research reported in this presentation was supported by the National Institute On Aging of the National Institutes of Health under Award Number P30AG073105. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health

foresite
Foresite Healthcare