Associations of Frailty With Consecutive Gait Speed Trails Measured Both With and Without Additional Stessors

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 backstory
Frailty is a geriatric syndrome defined as an increased vulnerability to stressors. Gait speed is associated with frailty and slow gait speed is commonly used as a criteria in its classification. A persons preferred (usual) gait speed is most often measured for this purpose but speed under additional stressors such as a cognitive task or walking at maximum pace can also be measured. Typically multiple trials are measured and an average value used. In this work however the consecutive nature of the trails are considered as an additional longitudinal stressor and we investigate a hypothesis that higher levels of frailty as classified by a frailty index are associated with greater reduction in speed across consecutive gait speed trials.

Method
Using a 32-item frailty index (FI) we derived non-frail, pre-frail, and frail groups. Gait speed was measured using a 4.88 m walkway (GATRite, CIR Systems, NY, USA). Speed measurements were made for three walking conditions with two trials (1 and 2) per condition: usual gait speed (UGS), walking under the cognitive load of reciting out loud every second letter of the alphabet (CGS), and walking at maximum pace (MGS)

Data from a total of 4055 participants aged 50+ years from Wave 3 of The Irish Longitudinal Study on Ageing were used. Of these 4054 had UGS data, 3884 had CGS data, and 3884 had MGS data. Normality of the gait variables was assessed using the related-samples Hodges-Lehman median difference test. For each trial comparison the test that the walk 1 and walk 2 differences are the same is used. For non-frail vs. frail with respect to MGS returns a statistically significant difference. Indeed in Figure.1 there appears to be a trend in MGS where the less frail groups slow down more than the frail groups across consecutive trials. Whilst the remaining comparisons in Table.2 are not statistically significant and there are overlapping conﬁdences intervals in Figure.1 there appears to be suggestions of trends in Figure.1 when observing the median differences: UGS appears to increase more for the frailer groups and the non-frail CGS seems to increase more than the other two frailty groups.

The table presents the significance p-values for the test that the walk 1 and walk 2 speed distributions are different for each walking condition and frailty group.

For each frailty group in all walking conditions trails 1 and 2 where signiﬁcantly different from each other based on the median of diﬀerences between walk 1 and 2 (Figure. 1) and the related samples Wilcoxon signed rank tests (Table. 2). For UGS and CGS the median diﬀerence in speed was positive, i.e. there was a speeding up, and for MGS the median difference in speed was negative, i.e. there was a slowing down. When comparing the walk 2 – walk 1 distributions across frailty groups (Table. 3) we see that only the non-frail vs. frail with respect to MGS returns a statistically significant difference. Indeed in Figure.1 there appears to be a trend in MGS where the less frail groups slow down more than the frail groups across consecutive trials. Whilst the remaining comparisons in Table.2 are not statistically significant and there are overlapping conﬁdences intervals in Figure.1 there appears to be suggestions of trends in Figure.1 when observing the median differences: UGS appears to increase more for the frailer groups and the non-frail CGS seems to increase more than the other two frailty groups.

CONCLUSION
For the usual, cognitive, and maximum gait conditions there are statistically signiﬁcant diﬀerences between consecutive walking trials for the entire cohort and for each frailty group. These median diﬀerences are however clinically small (a range of ~1 – 2.3 cm/s). This supports the use of taking the average of the two walking trials for analysis. When comparing the diﬀerence in speed across trails we found that only non-frail vs frail for the maximum condition was statistically signiﬁcant with the non-frail group slowing down more than the frail group. This goes against our original hypothesis. We now posit that the less frail groups have a greater physiological reserve that is disproportionately used up in the ﬁrst trial; the more frail groups on the other hand may be arbitrarily operating closer to a full capacity that is lower than the less frail group and thus do not have as much room to slow down in the second trial. Whilst remembering that the remaining group comparison are not statistically signiﬁcant some potential trends are suggested by the results. The suggestion that the frailty groups speed up more in the usual condition could be due to an increased learning eﬀect during the second trial. The potential trend of the non-frail group speeding up in the second trial could be due to a greater learning eﬀect with respect to the cognitive task.

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