

# Acoustic Measures in Natural Speech of Progressive Supranuclear Palsy

## and Corticobasal Spectrum Disorders

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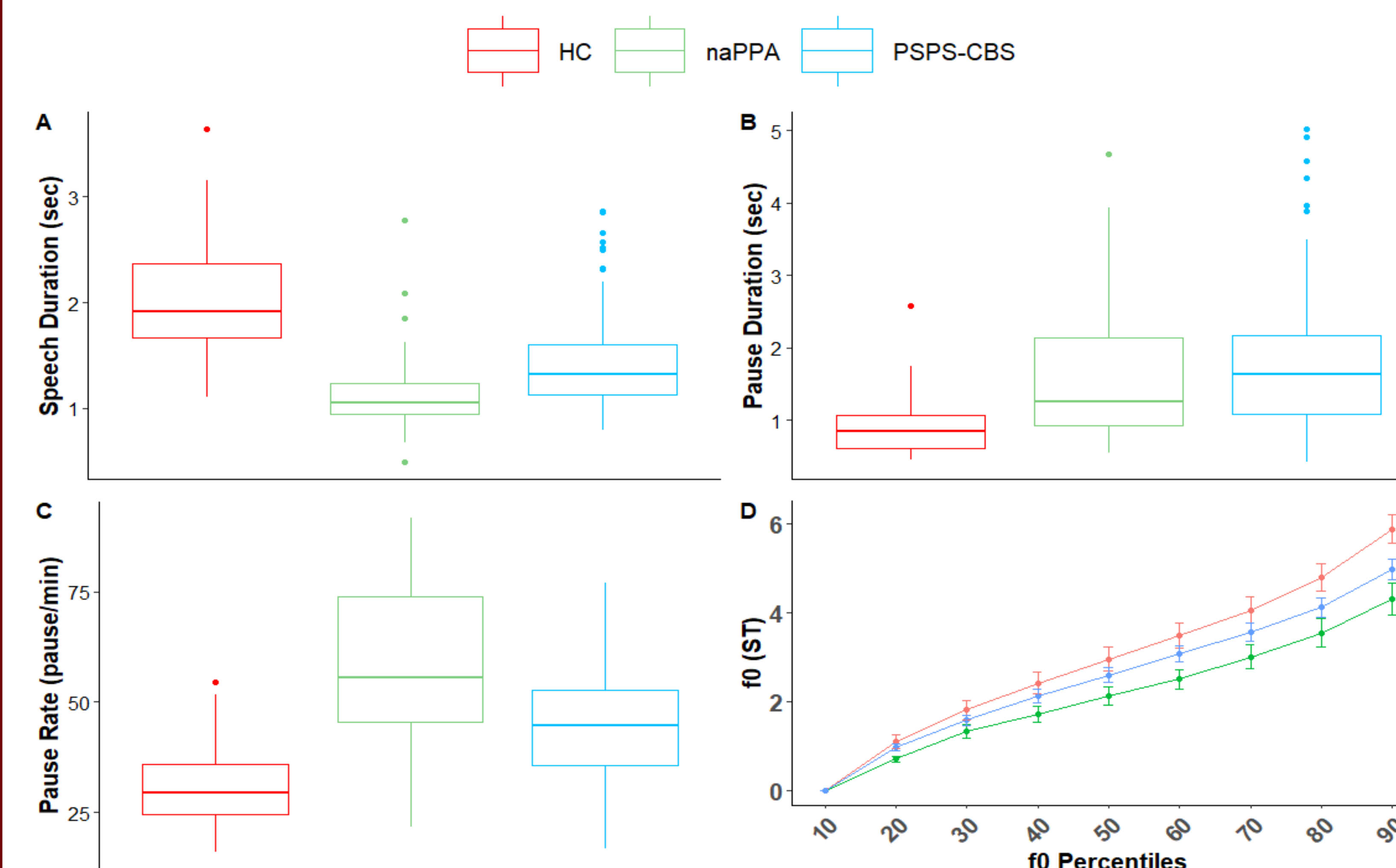
### Introduction

- Progressive supranuclear palsy and corticobasal syndrome (PSPS-CBS) are neurodegenerative disorders and tauopathies with motor and cognitive deficits, that may have concomitant non-fluent/agrammatic primary progressive aphasia (naPPA).
- Yet, few studies have compared speech profiles in PSPS-CBS and naPPA using automated acoustic analyses.
- In this study, we used novel automated acoustic speech analysis methods to quantify ~1 min. speech samples in PSPS-CBS and naPPA.
- An exploratory analysis of PSPS-CBS with concomitant naPPA (PSPS-CBS+naPPA) was done to investigate how the combination of diseases manifest.
- We hypothesized that PSPS-CBS would show a subset of speech impairments of naPPA, including shorter speech and longer pauses, which would be exacerbated in PSPS-CBS+naPPA.

### Participants & Methods

- Participants: PSPS-CBS (n=87), naPPA (n=25), PSPS-CBS+naPPA (n=8) and healthy controls (HC, n=41)
- Non-native English speakers and longitudinal data was excluded
- Patients were matched for age, sex, education, and disease duration
- Digitized, semi-structured speech samples of the "Cookie Theft" picture description were collected
- Speech Activity Detector automatically segmented speech and pauses
- Praat software tracked pitch and obtained fundamental frequency (f0) estimates, reflecting pitch range
- Segmentation/tracking was visually reviewed
- Grammatical impairment was measured as the average of the number of dependent clauses per utterance and number of well-formed sentences
- Pairwise comparisons (Wilcoxon Rank Sum and Signed Rank Test) were used to compare acoustic properties between groups
- All statistical contrasts p<0.05
- Used linear regression models to associate acoustic properties to grammatical impairment and to cerebrospinal fluid (CSF) phosphorylated tau (pTau) levels in patients

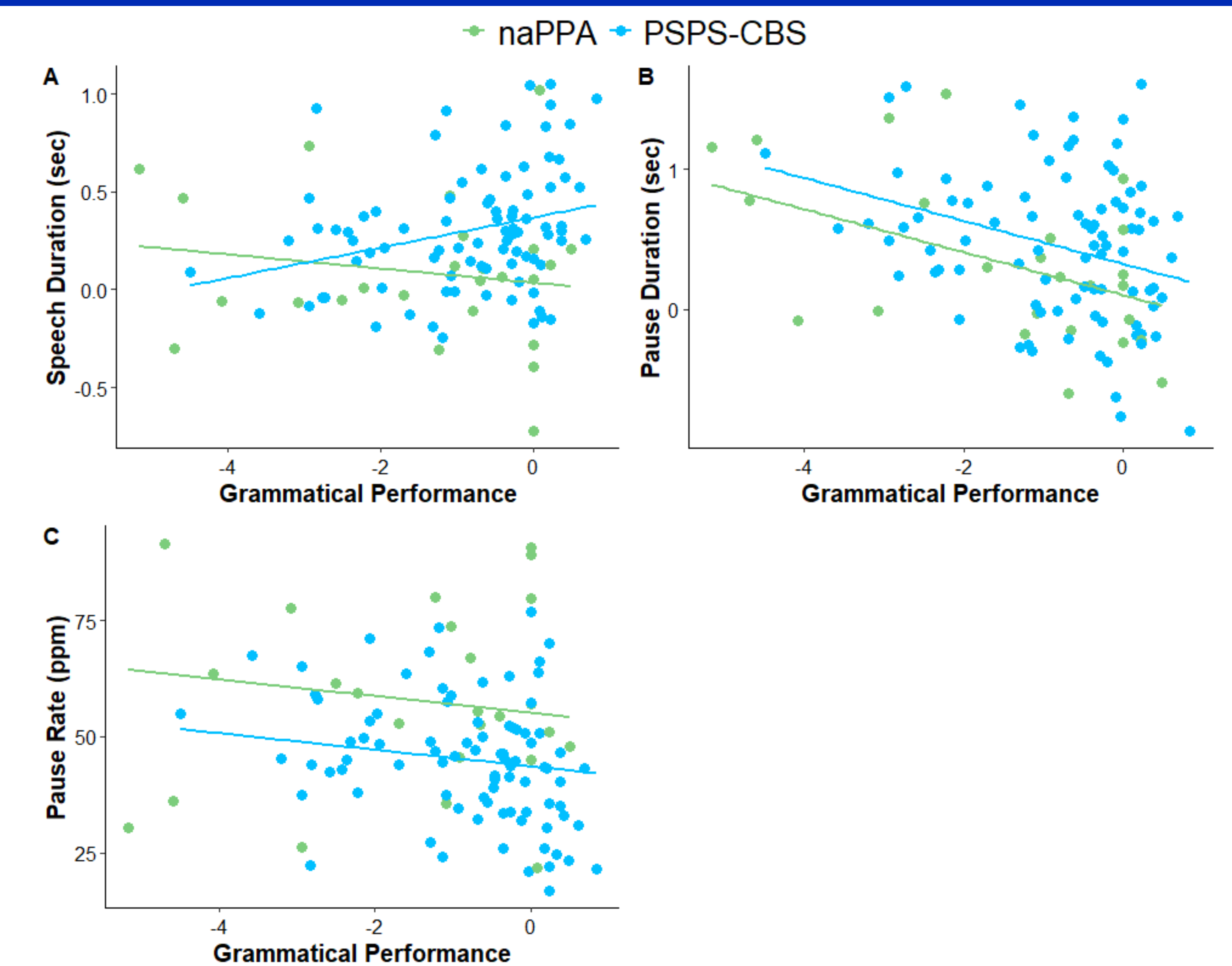
### Results



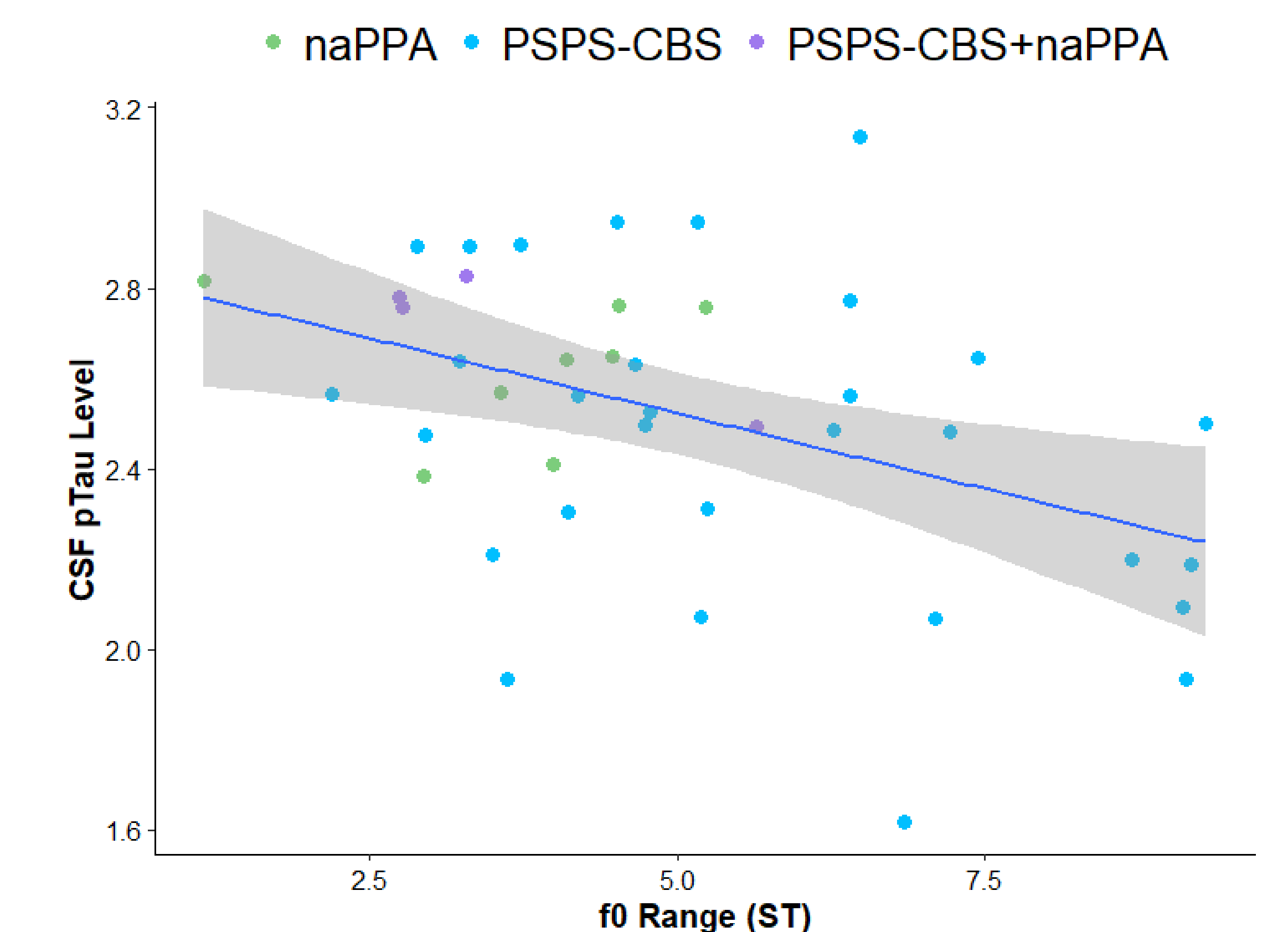
**A-C:** All speech and pause measures are impaired in PSPS-CBS and naPPA compared to HC. PSPS-CBS have higher mean speech segment durations and lower pause rates than naPPA.  
**D:** F0 range (in semitones) is restricted in both patient groups.  
**Exploratory analysis:** PSPS-CBS+naPPA was generally more similar to naPPA, and exhibited the most restricted f0 range.

### Conclusions

- Patients with PSP-CBS have impaired speech as quantified by automated analysis of acoustic measures of natural speech
- PSPS-CBS speech characteristics partially overlap with those of naPPA and are related to underlying cognitive impairment and pTau, a marker of likely pathology.
- Speech impairments in PSPS-CBS can be exacerbated when naPPA is also present.



**A-C:** Mean speech segment duration for PSPS-CBS is associated with underlying grammatical impairment, while, mean pause segment duration and pause rate are associated with grammatical impairment for both PSPS-CBS and naPPA.  
Note: the natural log of mean speech and pause segment duration was used in analyses due to skewed data.



F0 range predicts CSF pTau levels in a subset of PSPS-CBS, naPPA, and PSPS-CBS+naPPA with available analytes.  
Note: the natural log of CSF pTau was used due to skewed data.

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