The Perceptual and Physiologic Correlates of Decreased Sound Tolerance Disorders in Autistic and Non-autistic Adults

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The Perceptual and Physiologic Correlates of Decreased Sound Tolerance Disorders in Autistic and Non-autistic Adults

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Background

- **Decreased Sound Tolerance (DST)**[1] refers to the pathological inability to tolerate sounds in everyday life. DST is a common feature of autism[1], although multiple types exist (including **hyperacusis**[2] and **misophonia**[3]) based on the specific ways in which environmental sounds are perceived as aversive.
- Little is known about the mechanistic underpinnings of DST disorders, particularly in autistic individuals, and electrophysiologic studies to date rarely, if ever, include individuals with multiple distinct DST disorders.
- The present study represents the first relatively large-scale **transdiagnostic study of the (differential) neural mechanisms underpinning DST disorders (hyperacusis and misophonia) in both autistic and non-autistic adults**.

Methods

- **Sample of 113 adults (33 autistic)**
  - M_{age}=33.04, *SD*=9.92; 74.3% female, 71.7% non-Hispanic White; 43.4% at least some graduate school; Full-scale IQ = 116.58, *SD*=11.18, *Min-Max*: 78–141
  - Autistic and non-autistic groups matched on demographics and cognitive functioning
- **Characterized DST status using a structured clinical interview (DISSS) as well as a newly-validated dimensional questionnaire (MIST-A)**[4]
- **Completed comprehensive battery of psychological and audiological tests**
  - Categorical loudness scaling (CLS) with calculation of individual loudness-intensity functions[5]
  - Electrophysiologic tests of central auditory processing (binaural click ABR, 40 Hz ASSR, and N1b ERP to 1-second pure tones during a passive listening task
- **Electrophysiologic "intensity growth slopes" created by taking parameter (amplitude or latency) and regressing it on stimulus intensity for each participant**
  - Bayesian hierarchical models used to calculate growth slope values for all participants simultaneously
- **Comparison of autistic and non-autistic individuals with and without DST disorders using Bayesian hierarchical regression models**

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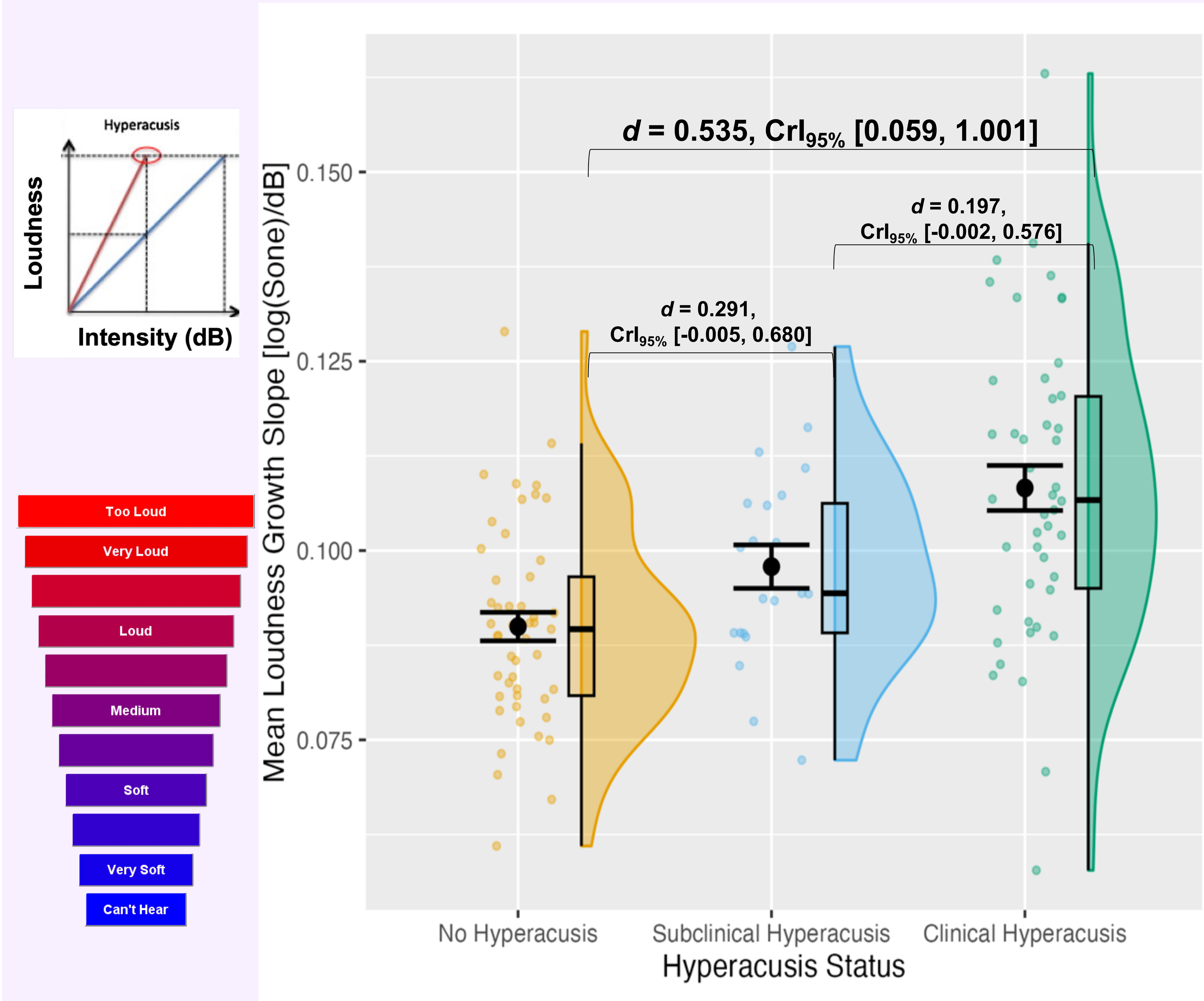
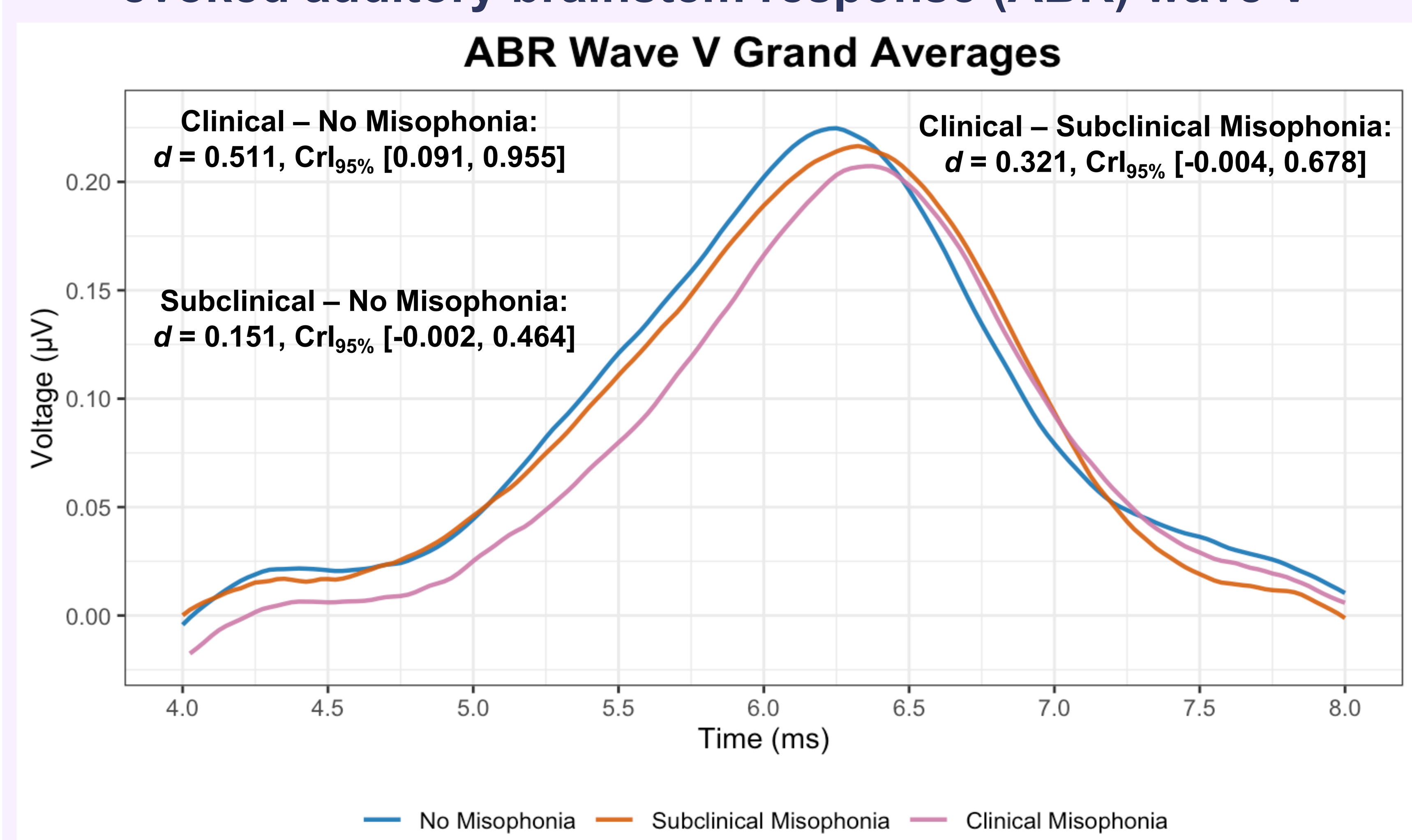
Competing Interests
ZJW has received consulting fees from Roche. He is also a member of the Autism Intervention Research Network on Physical Health (AIR-P) ANSWER Committee. TGW is the parent of an autistic adult.

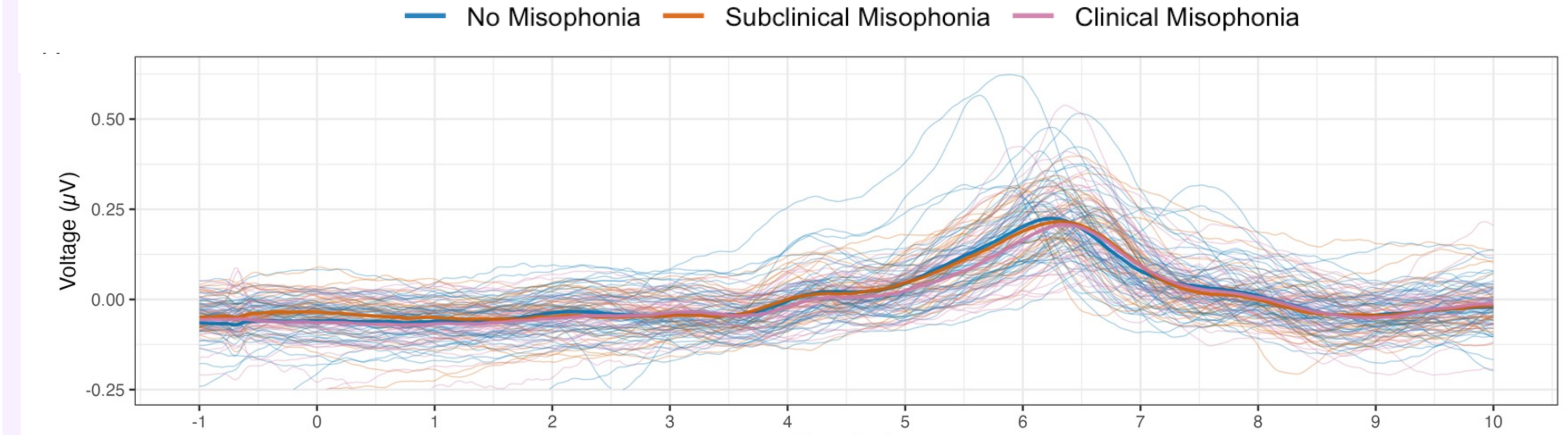
Hyperacusis is associated with steeper psychoacoustic loudness growth



- CLS-based loudness-intensity growth slopes averaged across four tone conditions for each participant

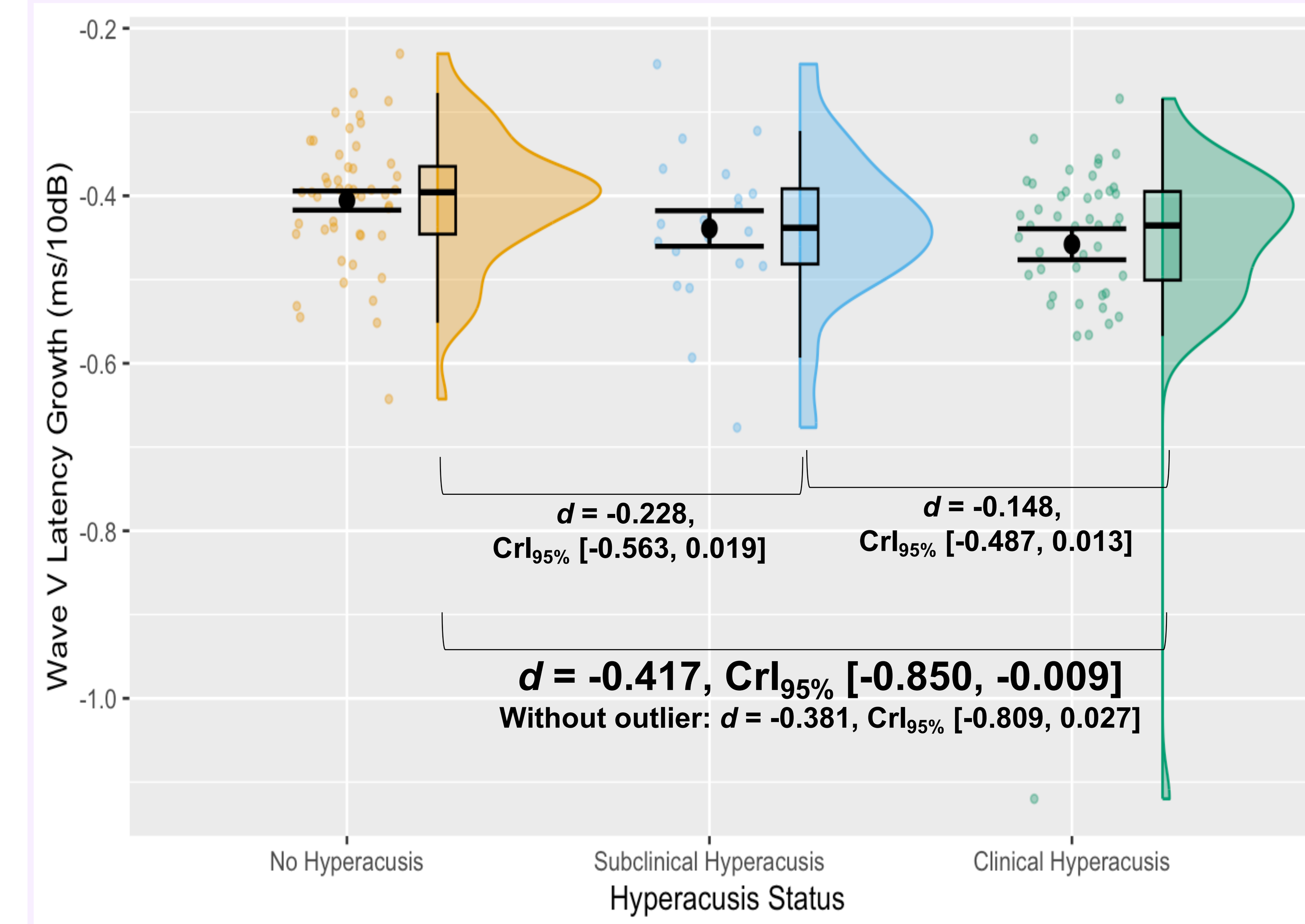
Misophonia is associated with longer latencies of click-evoked auditory brainstem response (ABR) wave V



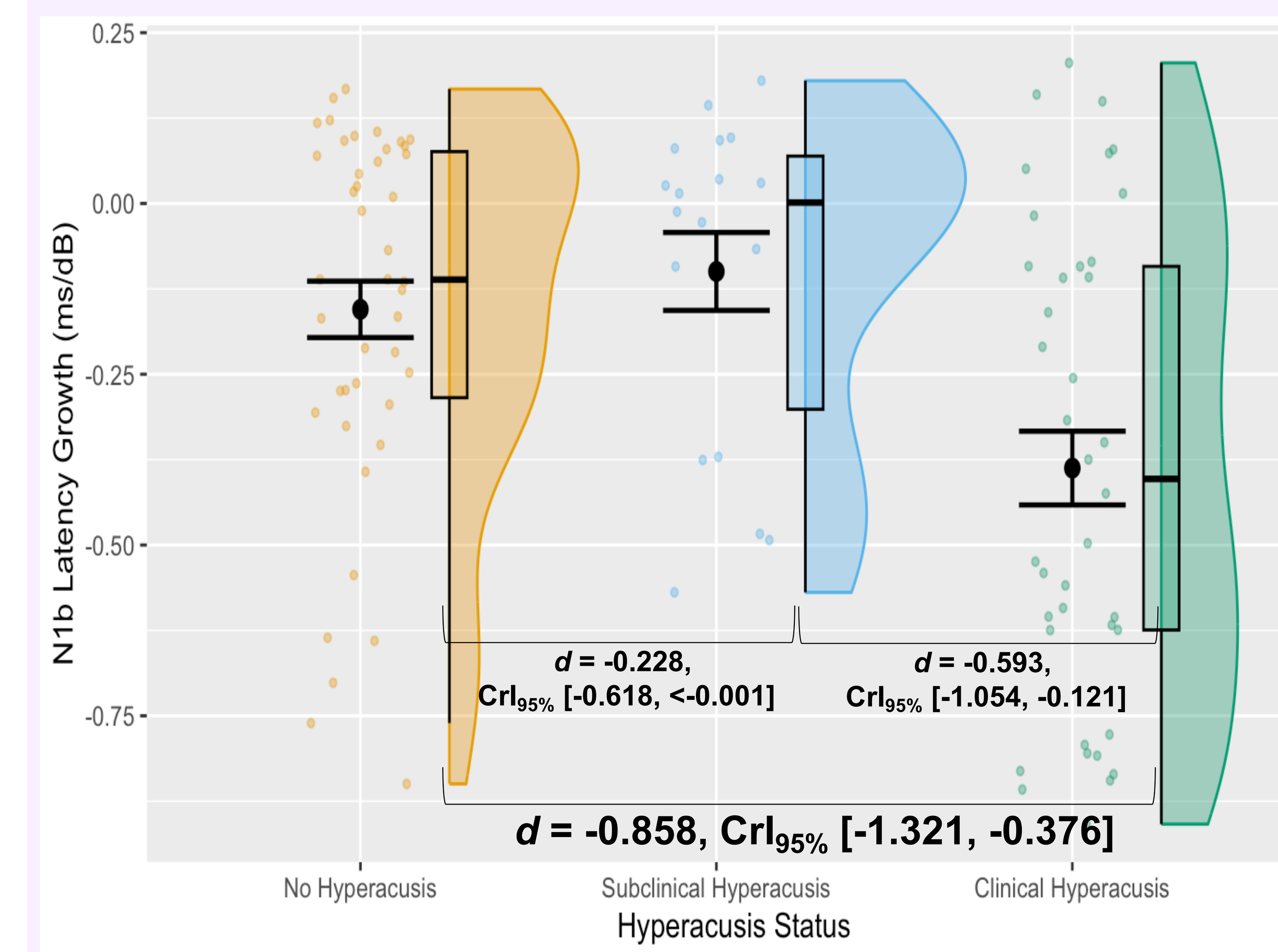


- Correlation with MIST-A Misophonia: r_{rank} = 0.170, $CrI_{95\%}$ [0.008, 0.323]
- No significant misophonia × autism interaction for ABR wave V latencies
- Raises the possibility of "low level" auditory involvement in misophonia rather than this particular DST disorder being purely a disorder of emotion dysregulation

Hyperacusis is associated with steeper electrophysiologic latency-intensity growth slopes in brainstem and cortex



- Correlations with CLS: r_{rank} = -0.220, $CrI_{95\%}$ [-0.420, -0.025] and MIST-A: r_{rank} = -0.220, $CrI_{95\%}$ [-0.391, -0.056]



- Correlation with CLS: r_{rank} = -0.330, $CrI_{95\%}$ [-0.522, -0.120] and MIST-A: r_{rank} = -0.221, $CrI_{95\%}$ [-0.379, -0.041]
- No significant correlation between ABR wave V latency growth and N1b latency growth (r_{rank} = -0.023, $CrI_{95\%}$ [-0.191, 0.142]) or significant hyperacusis × autism interaction for either outcome

Discussion/Conclusion

- Increased loudness-intensity growth slopes and two neural indicators of central auditory gain in hyperacusis provide empirical support for the "central gain theory" of the condition
  - Impressive dimensional association between brain, perception, and subjective symptoms – suggests genuine mechanism
  - Two uncorrelated "subtypes" of central gain (brainstem, cortex)
- Misophonia was associated with longer-latency ABR wave V
  - Potentially points towards an earlier locus of misophonia pathophysiology than previously realized
- No evidence to suggest differences in DST mechanisms between autistic and non-autistic adults
- Findings qualified by limitations, including use of operational DST disorder definitions, convenience samples, low interaction power