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# Impact of speech naturalness, intelligibility, and referral to speech therapy on quality of life in cerebellar ataxia

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## Objective

Determine factors relating to **referral gap for speech therapy in ataxic dysarthria** and impact on **communicative participation**.

## Background

**Referral gap** for speech therapy across neurodegenerative conditions, including ataxia

- Preliminary study: 15/27 referred for speech therapy
  - All had at least mild dysarthria
  - 22/27 had significant effects on communicative participation (Dysarthria Impact Profile)

**Poor understanding** among healthcare professionals:

- Detrimental impact of dysarthria in ataxia
- Potential for improvement in dysarthria from evidence-based speech therapy

## Methods

### Analysis one:

Received **survey responses** from **118 people with ataxia** in the US

- **Demographics:** age, sex, gender, race, income, location, education
- When did you begin experiencing **difficulty with your speech**?
  - 81% of respondents reported difficulty with speech
- On an average day, how **severe** would you rate your speech difficulties?
  - 1 = mild, 7 = severe
- Did your physician or clinician **refer** you for speech therapy?
  - Yes, No, N/A: I self-referred for a speech therapy evaluation
- Did you complete a **speech evaluation** with a speech-language pathologist?
  - Yes/No
- Rate how much speech therapy **improved** your speech:
  - 1: None at all; 5: A great deal
- Rate your overall **satisfaction** with speech therapy:
  - 1: Very dissatisfied; 5: Very Satisfied

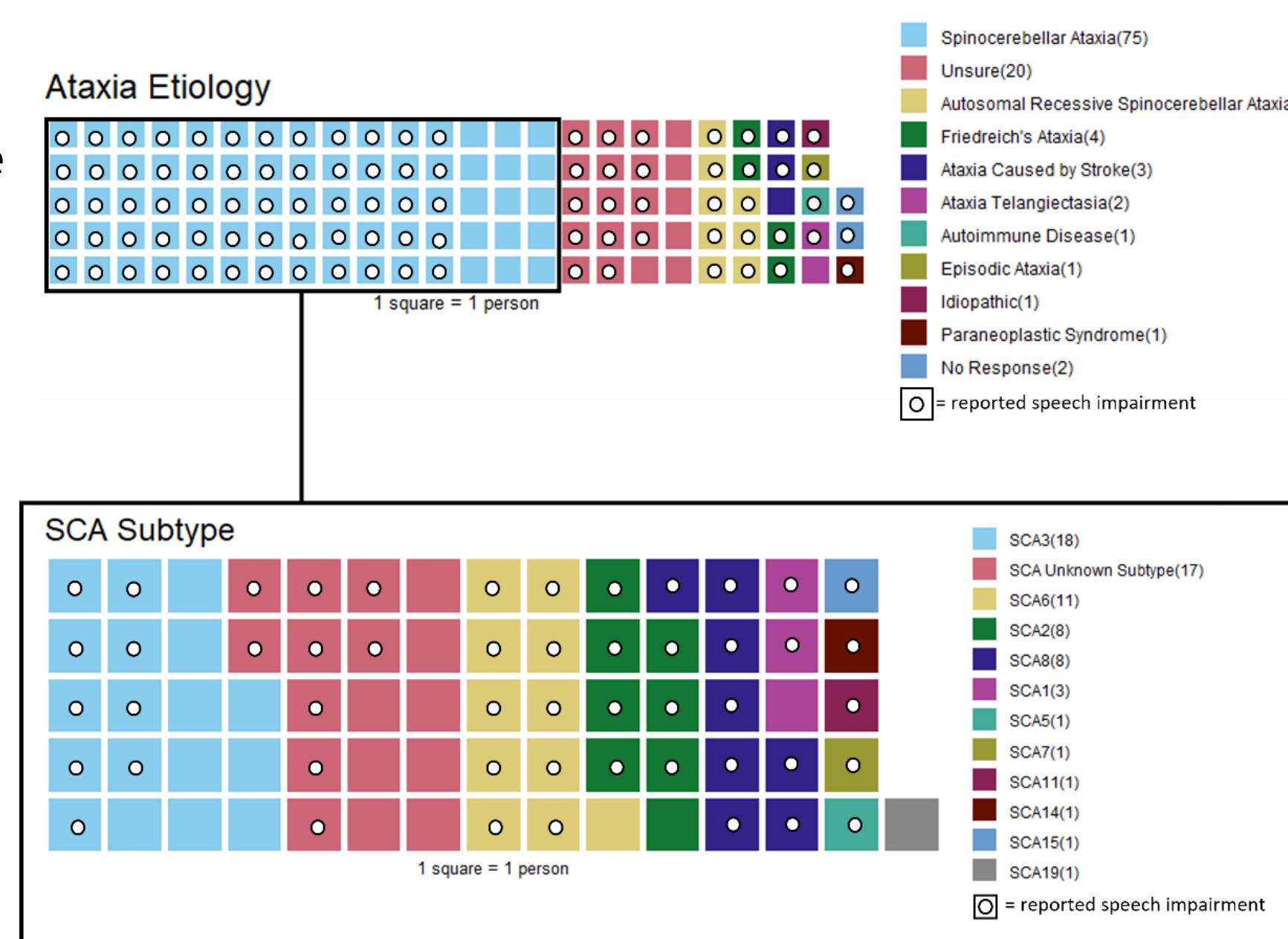
### Analysis two:

Recorded **speech samples** from **27** of the survey respondents over Zoom

- **Perceptual ratings** of intelligibility, naturalness, and severity from **3 SLPs**
- Do **clinician estimates of intelligibility, naturalness, and severity** correlate with **communicative participation**? **Referral** to speech therapy? **Patient self-ratings** of speech severity?

## Analysis One: Full set of 118 survey respondents

As can be seen in the figure to the right by the white circles, **speech impairment is represented in every etiology** from the full survey dataset, indicating that **speech impairment is commonly experienced in cerebellar disease** or damage regardless of etiology.

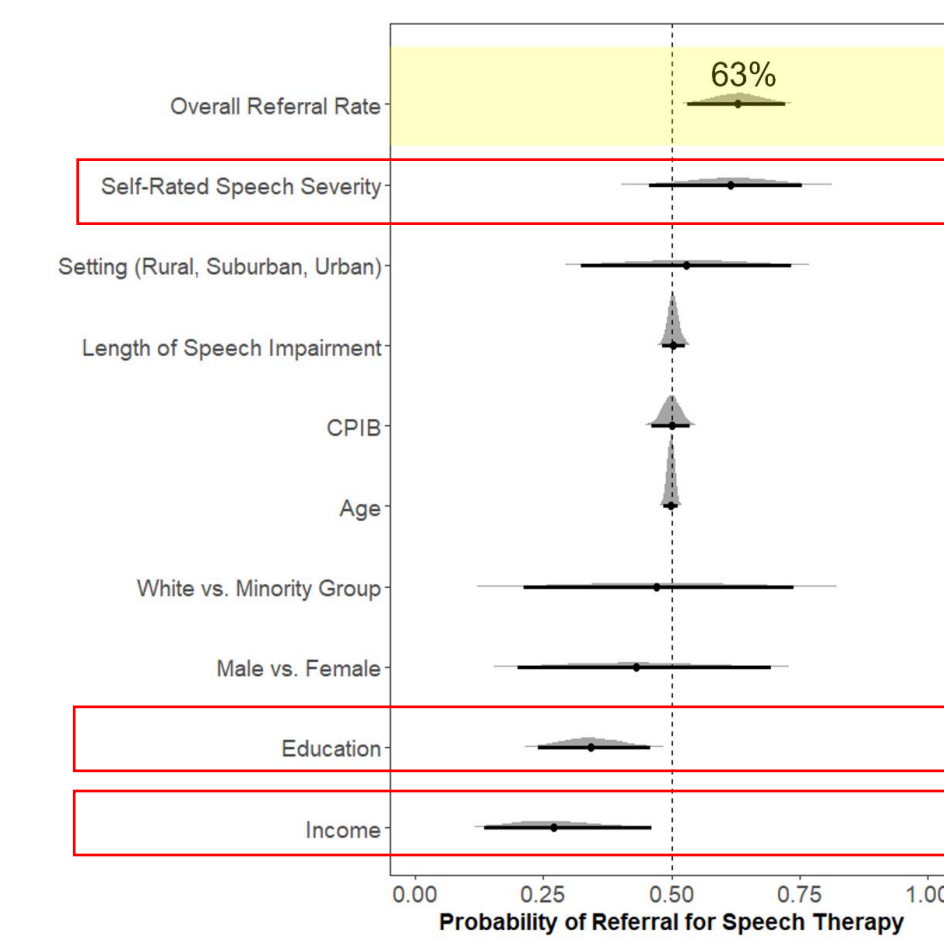


## Analysis One: 96 respondents with reported speech impairment

**Overall speech therapy referral rate = 63%**

- Respondents who rated their speech as **more severe more likely to be referred**
- **Higher education** = lower referral
- **Higher income** = lower referral

- Bayesian logistic regression model
  - Median estimate and 95% credible interval
  - 50% = null effect (50% chance of referral)



### Factors influencing communicative participation (CPIB)

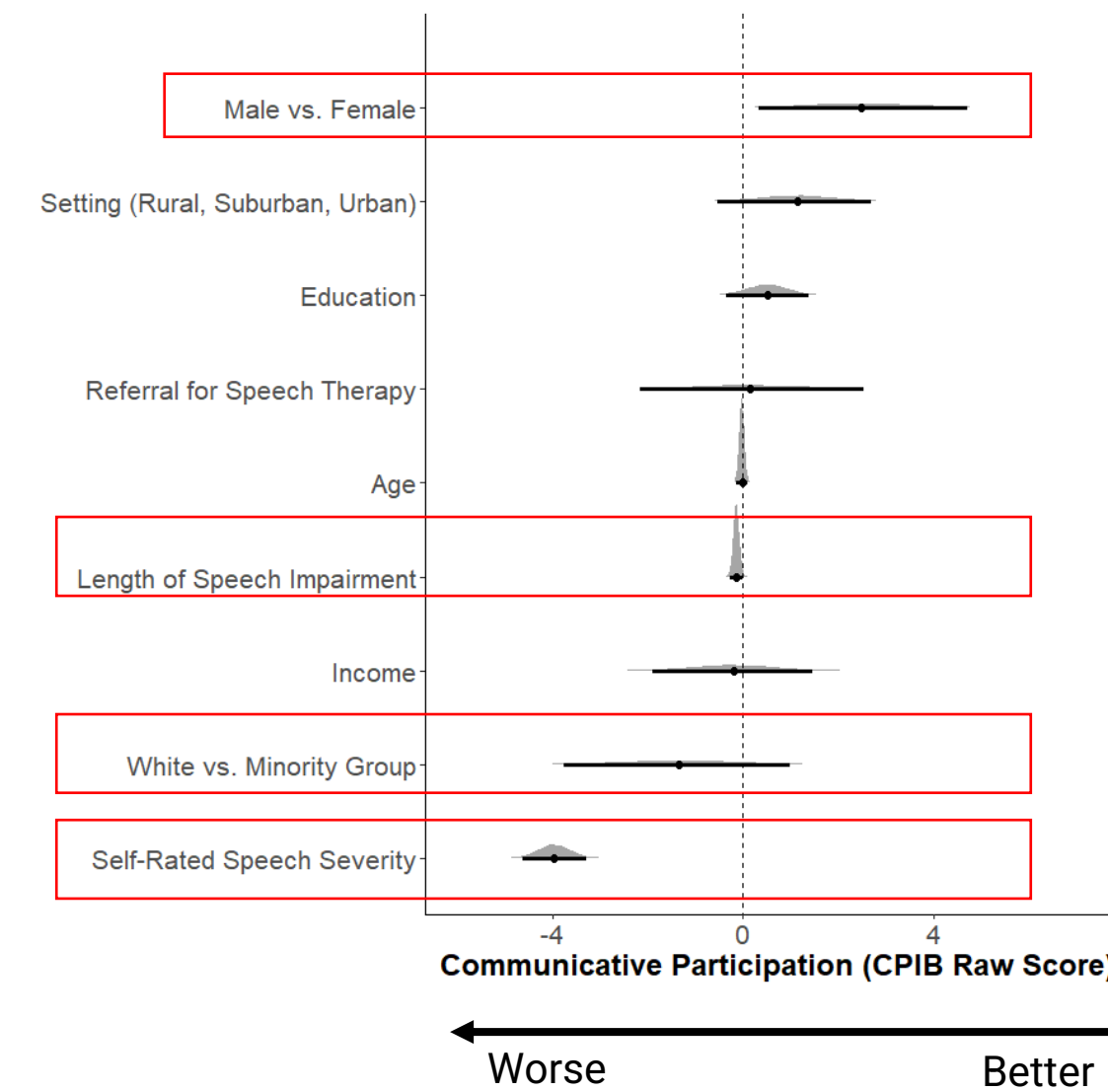
Mean estimate = 13.91, T Score = 45.50

Normal range for CPIB (40-60)

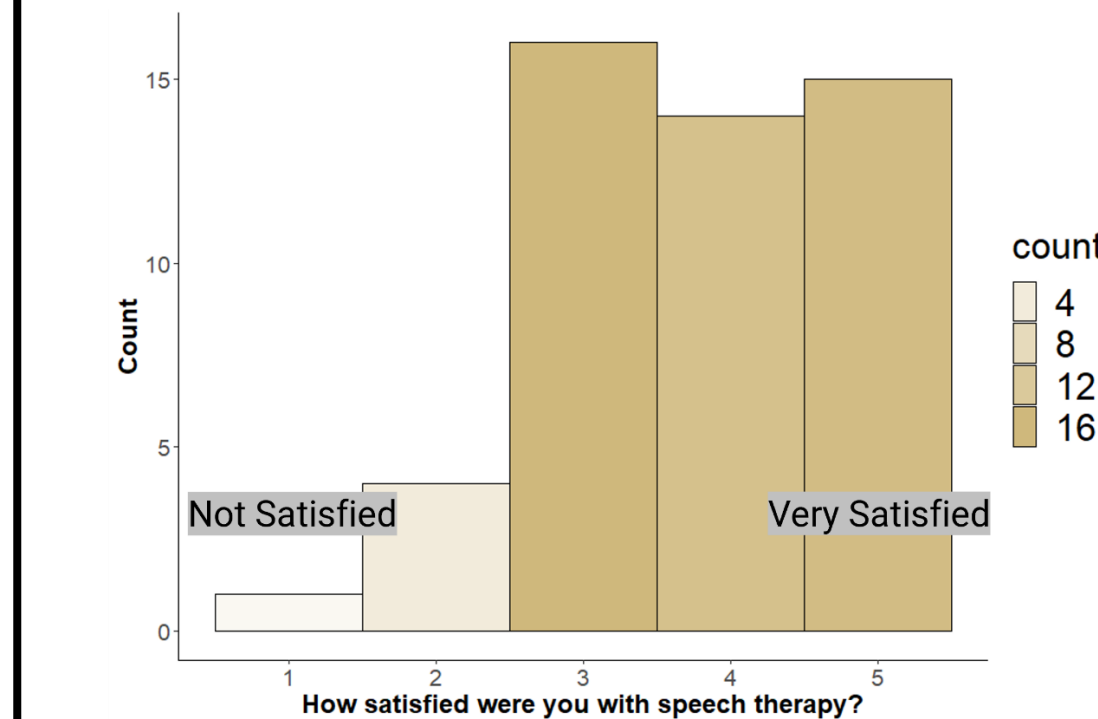
Communicative participation more detrimentally impacted for:

- Respondents who rated their speech as **more severe**
- **Longer length** of speech impairment
- **Female** respondents
- **White** respondents

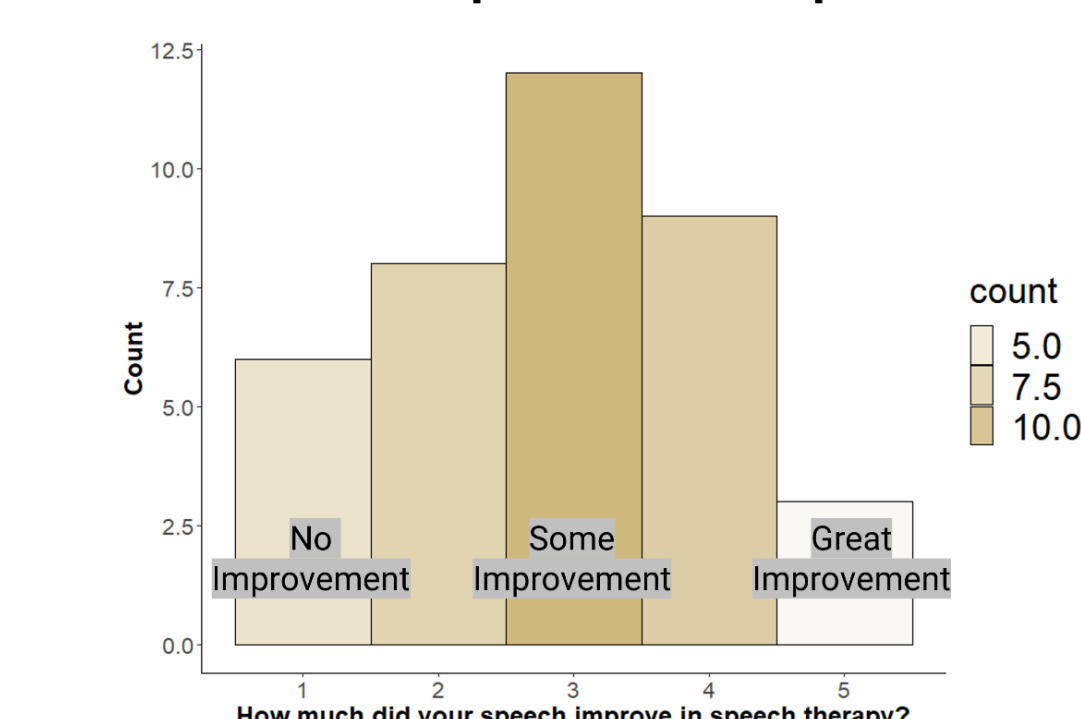
- Bayesian regression model
  - Median estimate and 95% credible interval
  - 0 = null effect



### Satisfaction with Speech Therapy



### Self-Perceived Improvement in Speech Therapy



For the **68 respondents who received speech therapy**, overall neutral-high satisfaction with speech therapy but **little self-observed improvement**.

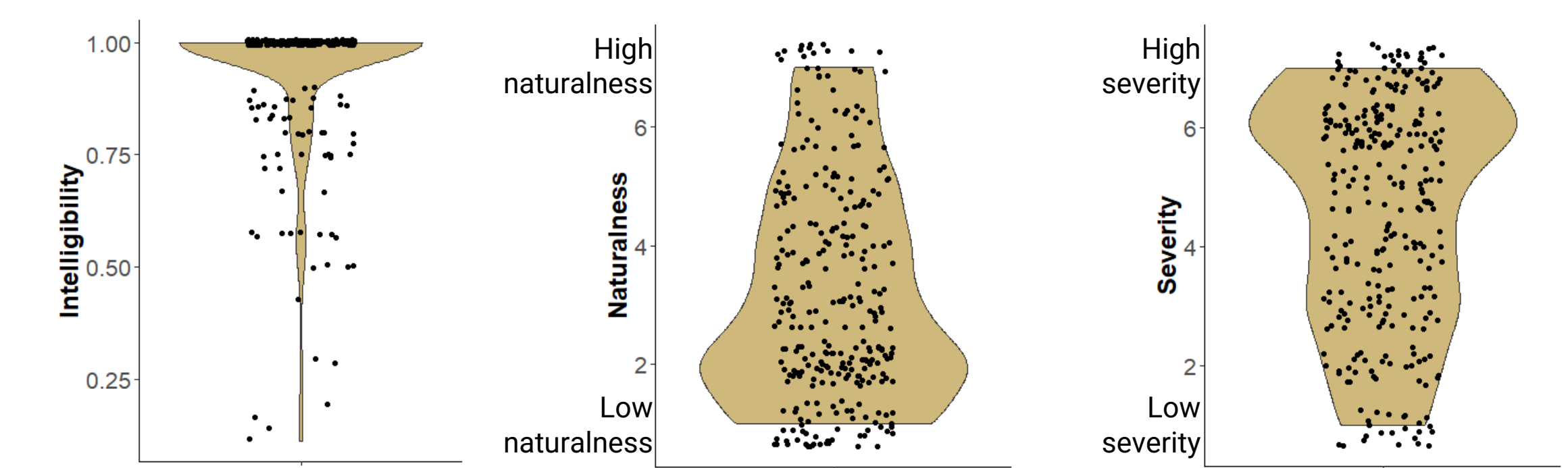
## Analysis Two: subset of 27 respondents

### Perceptual Task:

- 3 SLPs with no history of hearing loss
- Speech samples from picture description and conversation recorded over Zoom and with Zencaster
- **Intelligibility:** % words transcribed correctly
  - Interrater reliability: 69% agreement
  - Intrarater reliability: 98% agreement
- **Naturalness:** judgment of rate, rhythm, and intonation
  - Interrater reliability: ICC 0.86
  - Intrarater reliability: ICC 0.94
- **Severity:** judgment of dysarthria severity
  - Interrater reliability: ICC 0.82
  - Intrarater reliability: ICC 0.58

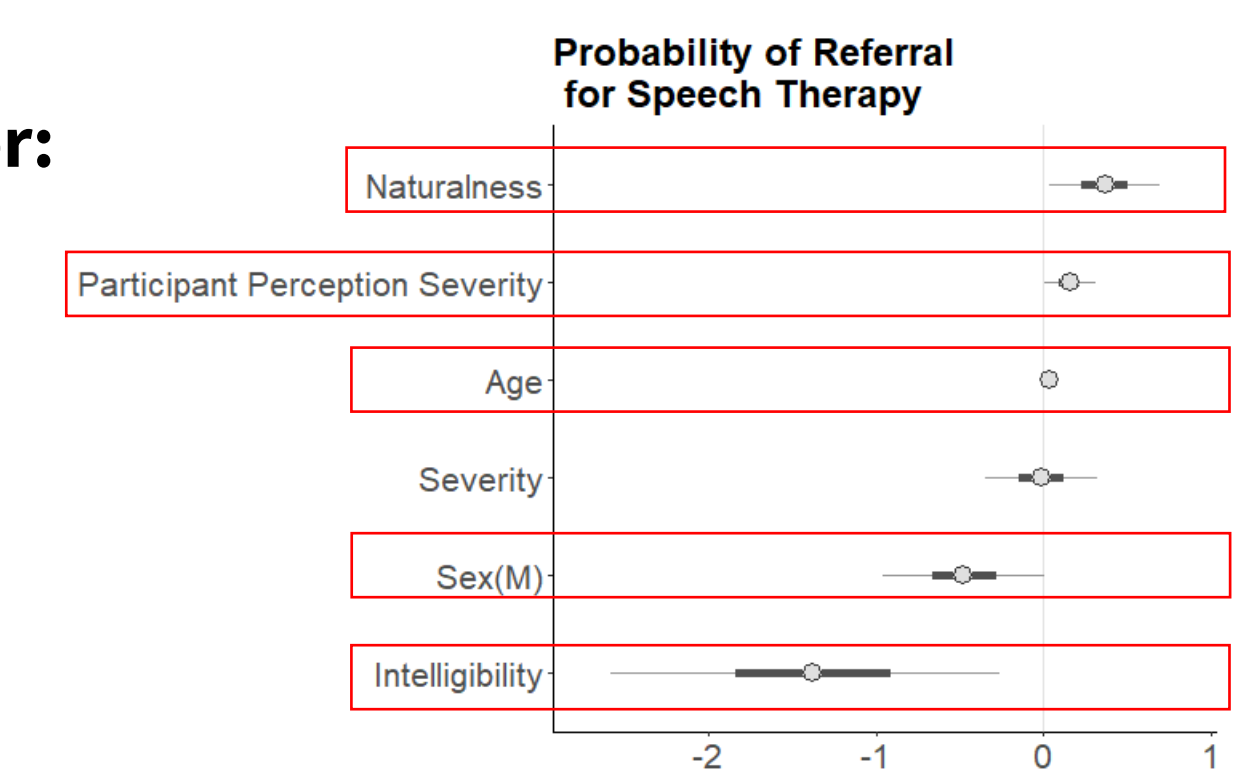
## Analysis Two: subset of 27 respondents

**Perceptual Task:** high intelligibility but variance in naturalness and severity (by 3 speech-language pathologists)



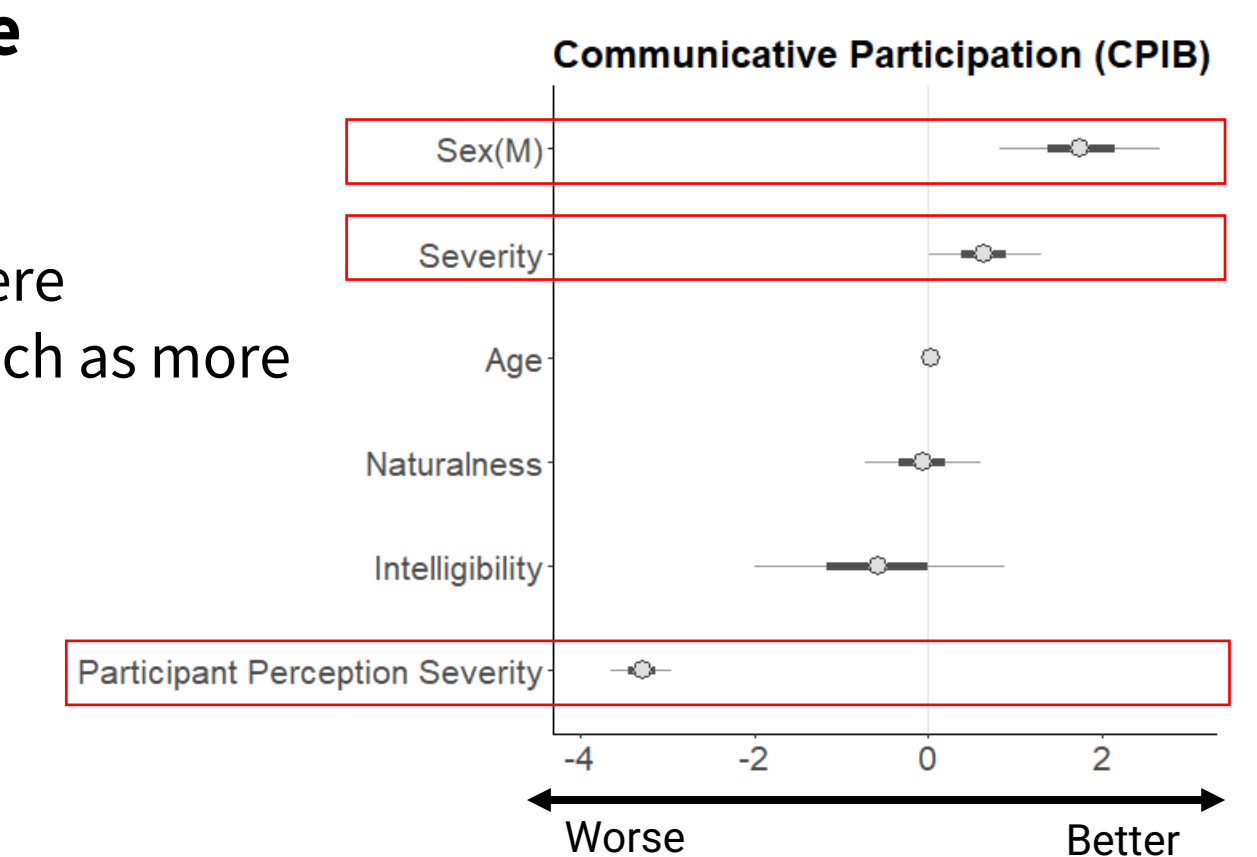
### Increased probability of referral for:

- Higher speech naturalness
- Higher patient perception of severity
- Higher age
- Female participants
- Lower intelligibility



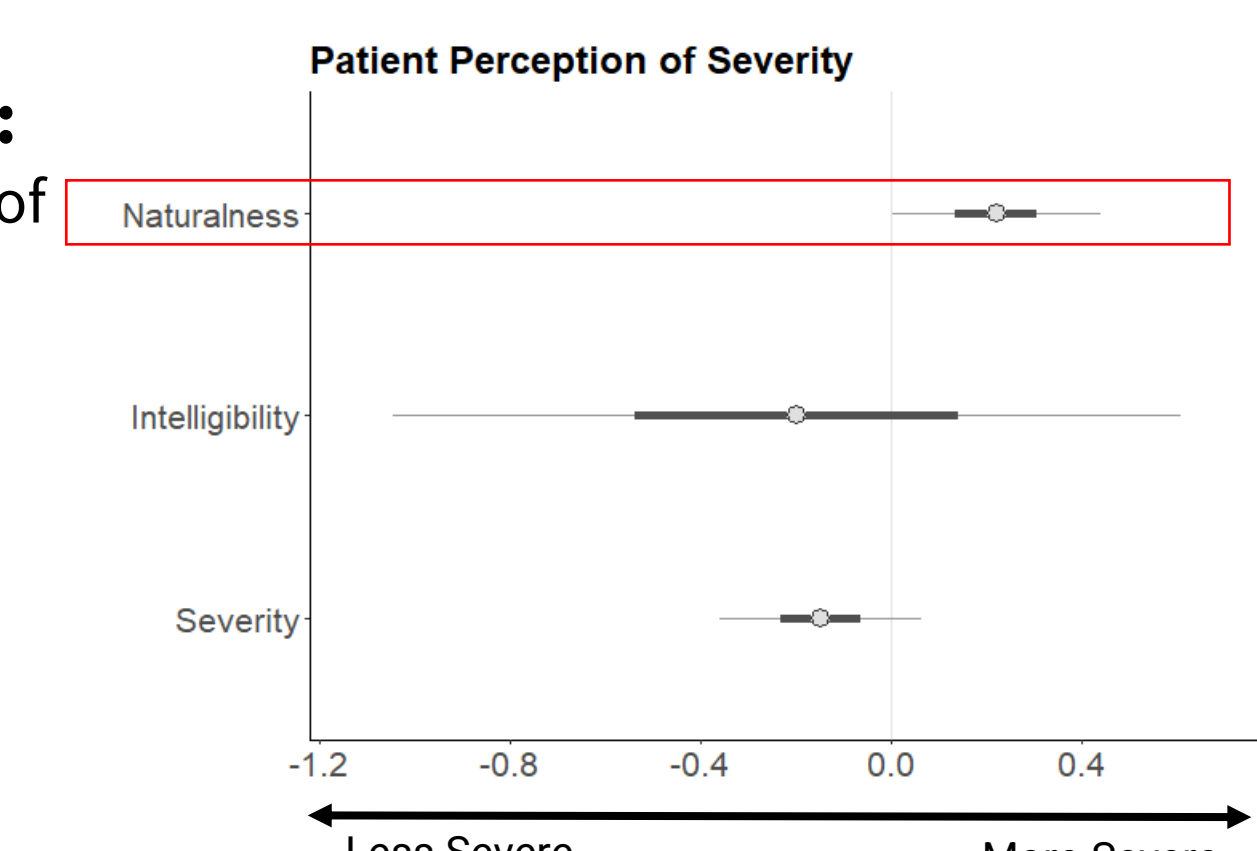
### Communicative participation more impacted for:

- Female participants
- When SLPs rate their speech as less severe
- When respondents rated their own speech as more severe



### Patient perception of severity was:

- Positively correlated with SLP estimate of speech naturalness
  - Higher SLP estimate of speech naturalness, higher patient self-perception of severity
- NOT strongly related to SLP estimate of severity



## Conclusions

- **Referral gap** to speech therapy for ataxia:
  - **81% of total survey respondents reported having a speech impairment** but only **63% of the respondents with impaired speech** were referred for speech therapy
  - Greater probability of referral if **respondent perceives having more severe speech**, NOT if the SLP estimates high severity
- **Communicative participation** more impacted for **women** and respondents who **perceive having more severe speech impairment** but **OPPOSITE** effect of SLP estimate of severity
- **Poor relationship between patient perception of severity and SLP estimate of severity**
  - And counterintuitive relationship for naturalness estimate: higher SLP estimate of naturalness, higher patient self-perception of severity