

## Introduction

- The modified barium swallow (MBS) is the "gold standard" for assessing swallowing function, determining physiological impairments, and identifying aspiration. However, there are concerns regarding:
  - radiation exposure [1].
  - challenging assessment of aerodigestive kinematics and airway protection due to patient motion and size [2].
  - differences between the consistencies of barium mixtures used during MBS vs. infant formula or breastmilk [3,4].
  - unclear significance of findings on MBS in infants such as laryngeal penetration, pooling, or delayed clearance [3].
- Most previous research comparing a clinical swallowing evaluation (CSE) to MBS included retrospective studies [5-9]. One prospective study that found high sensitivity and average specificity for a CSE to predict penetration and aspiration included children ages 0-14 years [10]. A systematic review examining the diagnostic accuracy of detecting aspiration in children found only six eligible studies, with only one including children < 12 months old [11].
- There is currently a lack of standardization in CSEs [11] with studies reporting a range of sensitivity and specificity for their ability to detect penetration and/or aspiration [5,9]. We aimed to determine whether a standardized CSE is a viable alternative to the current practice of using an MBS to identify aspiration in infants.

## Methods and Materials

- Design: observational case series at a tertiary care children's hospital, Nov 2021-Aug 2023
- Inclusion: underwent CSE at <51 weeks post-menstrual age; completed MBS
- Figure 1. Standardized CSE developed by expert consensus of 6 senior speech-language pathologists

Patient Name:	DATE:	SLP Initials:
Overt Signs	YES NO DID NOT ASSESS	COMMENTS
Cough		
Wet Vocal Quality		
Behavioral Response/Stress Cues		
Shutting Down		
Bottle Refusal		
NNS on bottle/Self-limiting Volume		
Pulling Away		
Facial Grimace		
Finger Splaying		
Fussiness with Extraction		
Hiccups		
Lip Pursing		
Nasal Flaring		
Increased Work of Breathing		
Tracheal Tugging		
Retractions		
Head Bobbing		
Color Change		
Dusky/Cyanotic		
Flushed		
Change in Vital Signs		
Downtrend HR, O <sub>2</sub> , RR (see comment)		
Bradycardia (below set alarm limits)		
Desaturation (below set alarm limits)		
Respiratory rate of concern (note RR)		
Noisy Breathing		
Stridor		
Congestion Chest/Back (tactile/auditory)		
Congestion Upper Airway		
Congestion Nasal (tactile/auditory)		
Eye Response		
Widening Eyes		
Watery Eyes		
Red-Rimmed Eyes		
Eval d/c'ed Due to Concerns		
Concerned for Aspiration		
During the Feeding		
Overall		
Modified Barium Swallow	Check all that apply	Date:
Consistency	Silent Aspiration Penetration* w/cough	Comments (indicate if not tested with this consistency)
Thin		
1.5 tsp: 1 oz		
2 tsp: 1 oz		
3 tsp: 1 oz		
Recommended Diet (Circle One)	Thin / 1 tsp: 1 oz / 1.5 tsp: 1 oz / 2 tsp: 1 oz / 3 tsp: 1 oz	

\*Penetration significant enough to alter recommendations

## Results

- N=34
- 19/34 (55.9%) -> male
- 15/34 (44.1%) -> born prematurely (<37 weeks gestational age).
- 37.1 weeks (range 23.7-40.0 weeks) -> median gestational age at birth
- 6.0 weeks (range 1.0-21.3 weeks) -> chronological age at CSE

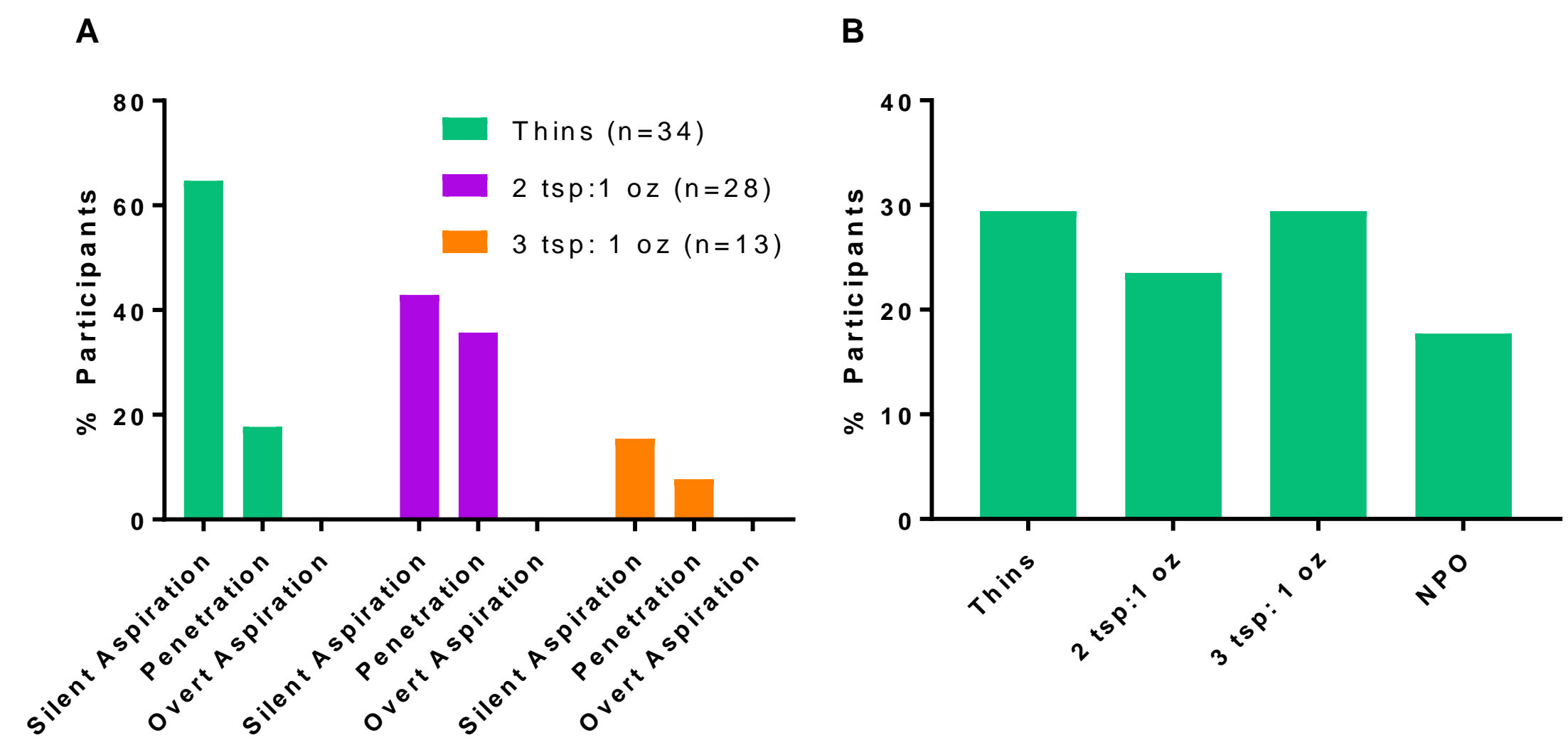


Figure 2. (A) MBS findings (B) feeding recommendations following MBS

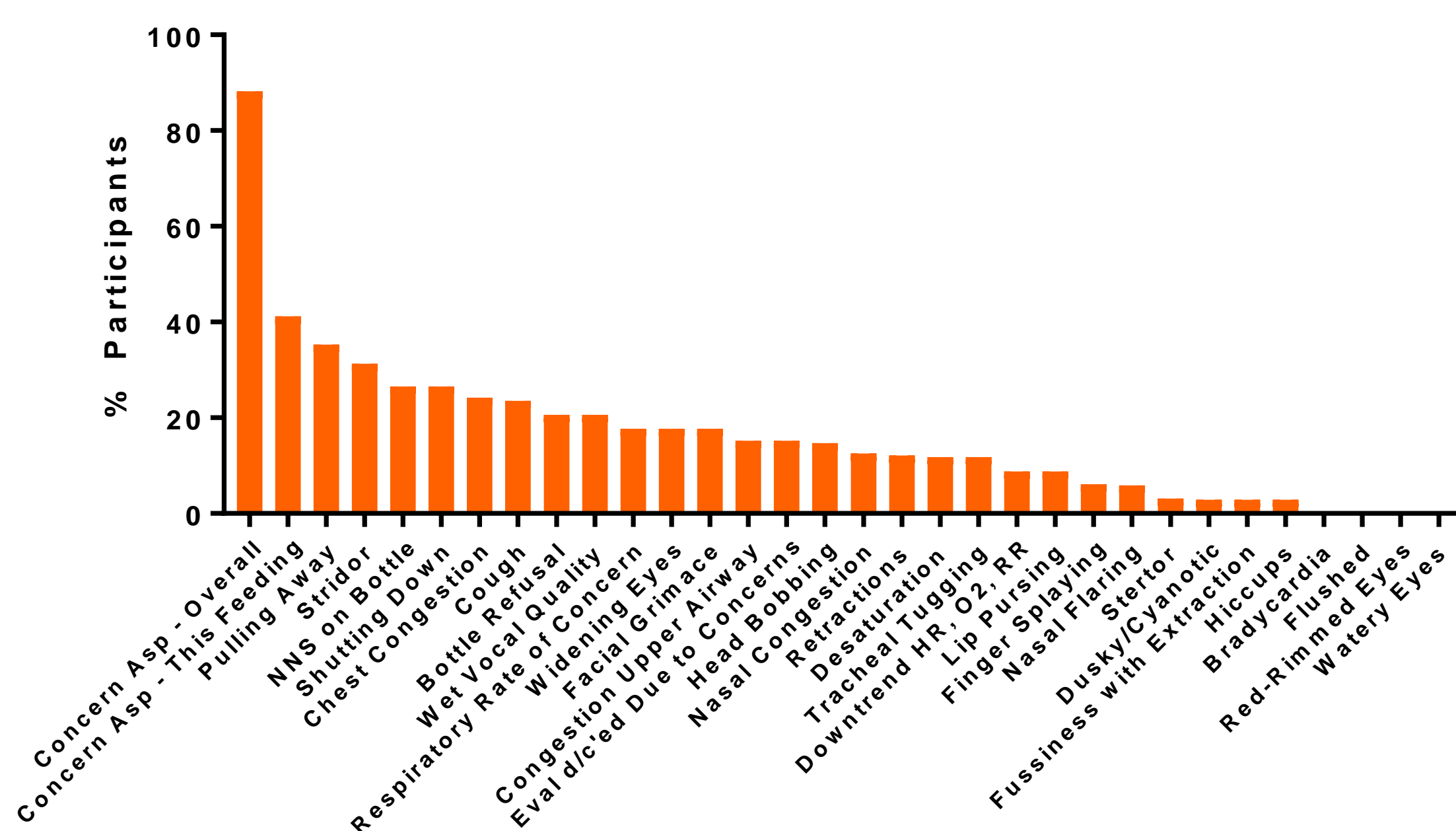


Figure 3. CSE Observations

## Results

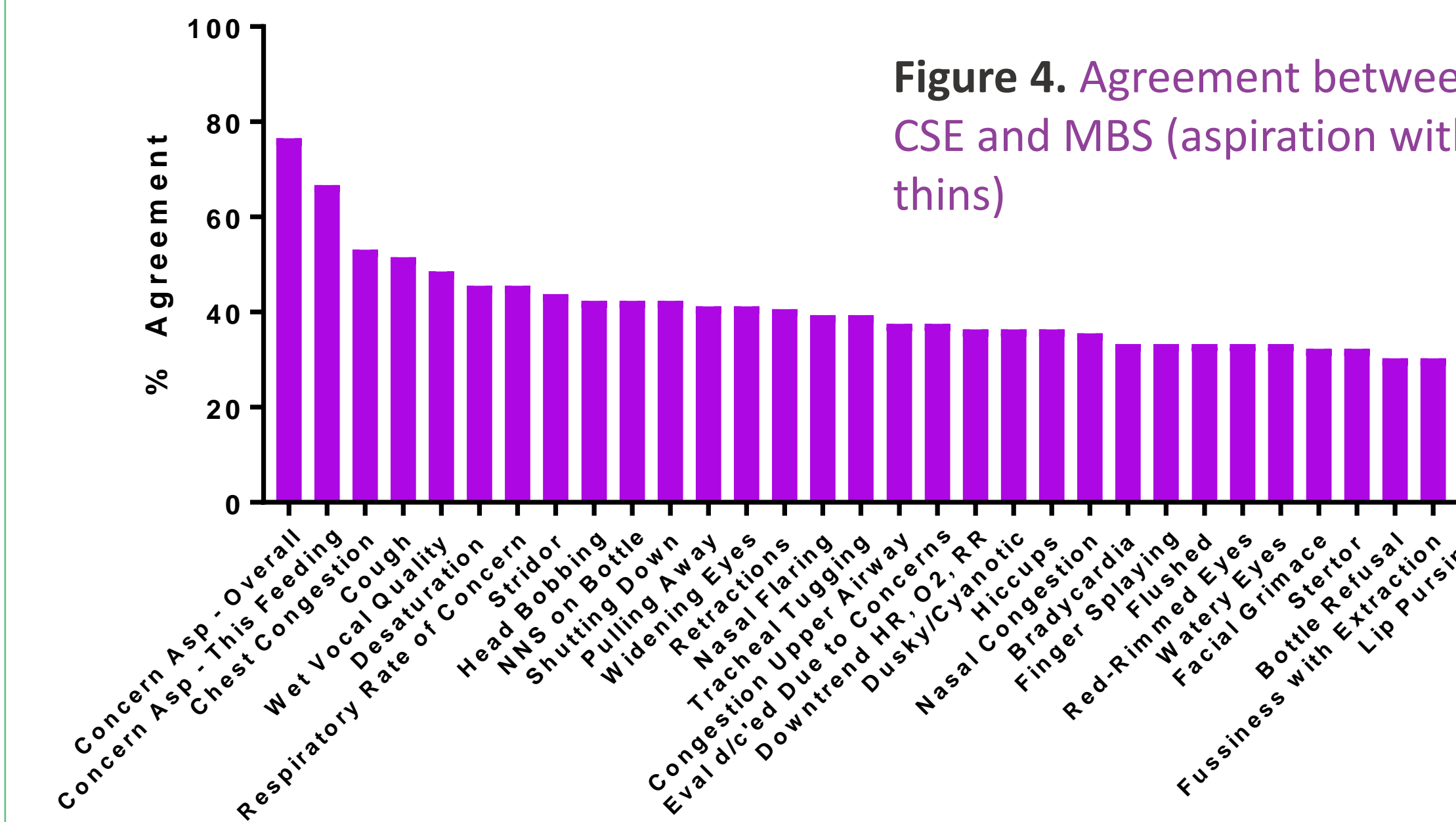


Figure 4. Agreement between CSE and MBS (aspiration with thins)

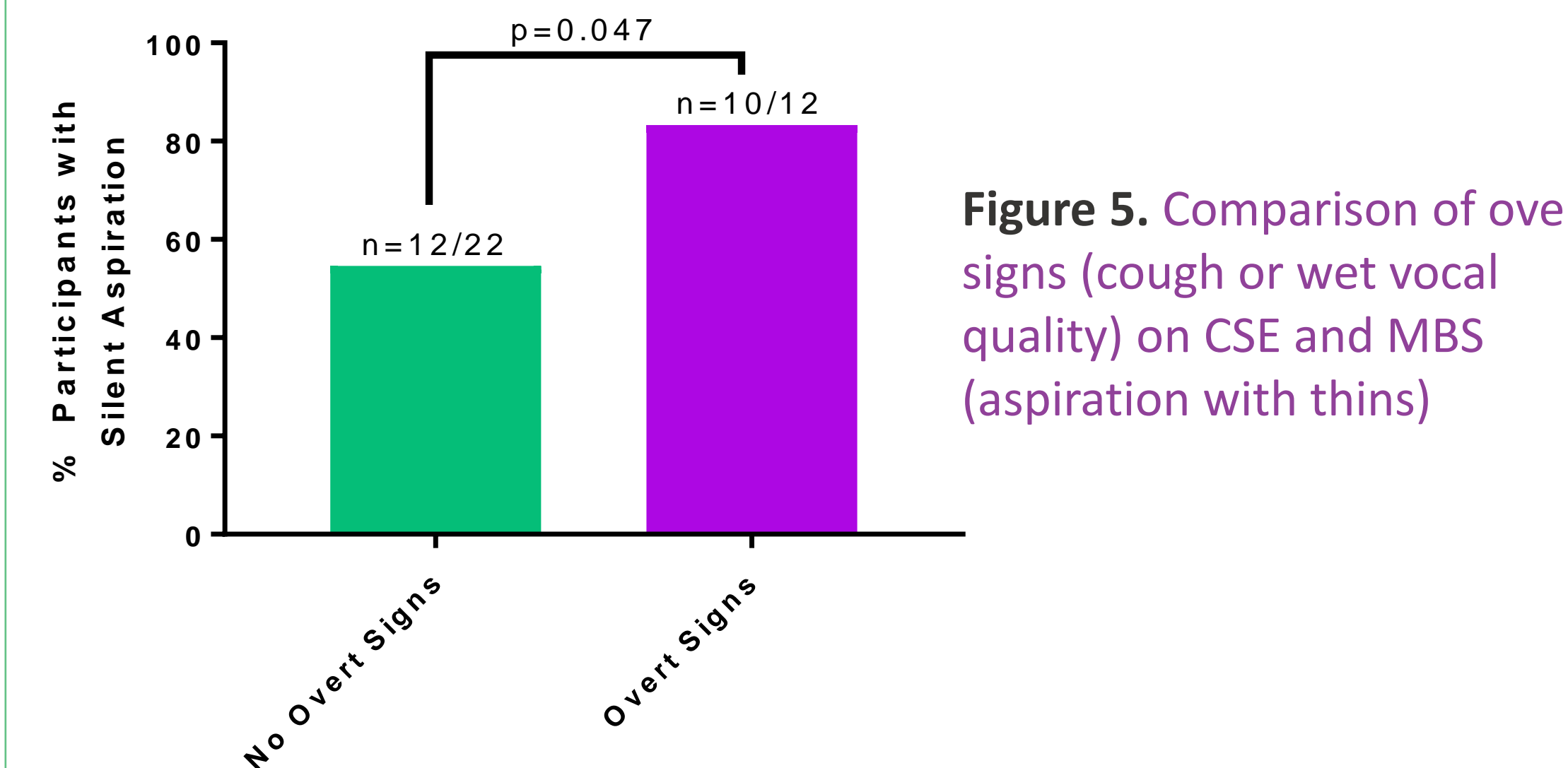


Figure 5. Comparison of overt signs (cough or wet vocal quality) on CSE and MBS (aspiration with thins)

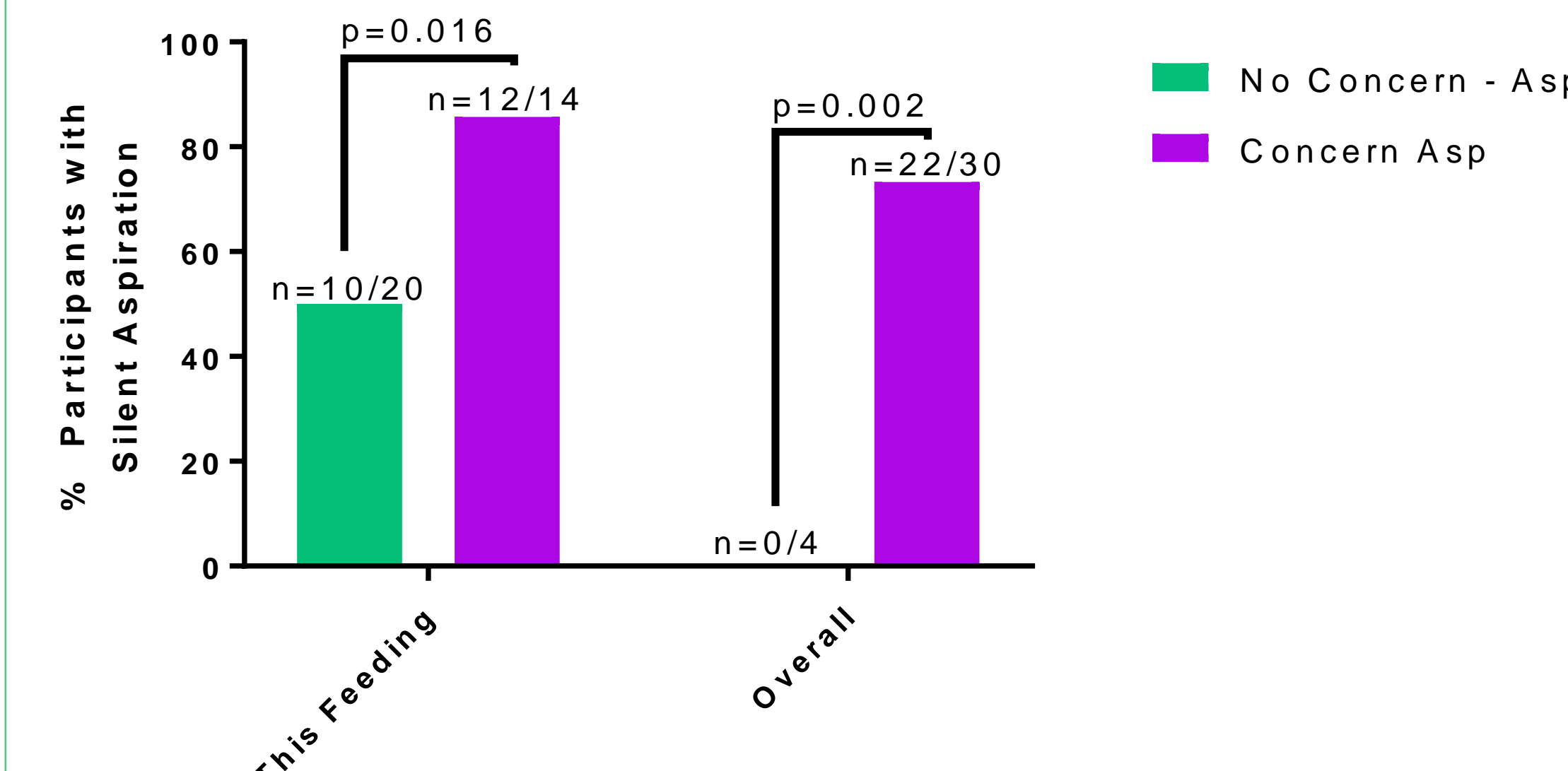


Figure 6. Comparison of speech-language pathologist concern for aspiration and MBS (aspiration with thins)

## Discussion

- Concern for aspiration overall predicts silent aspiration on MBS.**
  - Agreement: 76.5% agreement (kappa 0.393, SE 0.135, p=0.002)
  - Sensitivity: 100.0% (84.6%-100.0%)
  - Specificity: 33.3% (9.9%-65.1%)
  - PPV: 73.3% (64.8%-80.4%)
  - NPV: 100.0% (39.8%-100.0%)
  - 0 false negatives

- Concern for aspiration this feeding predicts silent aspiration on MBS.**
  - Agreement: 64.7% (kappa 0.329, SE 0.153, p=0.016)
  - Sensitivity: 54.6% (32.2%-75.6%)
  - Specificity: 83.3% (51.6%-97.9%)
  - PPV: 85.7% (61.6%-95.7%)
  - NPV: 50.0% (37.2%-62.8%)

- Overt signs predict silent aspiration on MBS.**
  - Agreement: 55.9% (kappa 0.242, SE 0.144, p=0.047)
  - Sensitivity: 45.5% (24.4%-67.8%)
  - Specificity: 83.3% (51.6%-97.9%)
  - PPV: 83.3% (56.6%-95.1%)
  - NPV: 45.5% (34.5%-56.8%)

No significant associations between any patient factors or other CSE findings and aspiration with thins.

## Conclusions

There was fair agreement between speech-language pathologists' concern for aspiration during CSE and silent aspiration on MBS, with improved specificity when a standardized CSE was utilized and prioritized. Future study with larger sample size is needed to validate a scoring system for CSE.

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