Overall Nasalance versus Trimmed Selection of Stable Syllable Repetition:
Clinical and Statistical Significance

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Presenter Disclosures

• We have no relevant financial or nonfinancial relationships in the products or services described, reviewed, evaluated or compared in this presentation.

• This study was approved by the Western Michigan University Human Subjects Institutional Review Board.
Background

• Source-filter theory

• Some speech sounds are produced with oral resonance, while others (e.g. “m”) are produced with predominantly nasal resonance

• Nasometry is used to quantify the ratio of nasal to total resonance

• Used as diagnostic and research tool by speech-language pathologists with clinical applications for dysfunctions of speech production, speech after cleft palate repair, as well as motor speech disorders

• Necessitates collection of normative data

• Some collect data by “trimming,” some without
The purpose of this study is to determine if nasalance sample trimming is statistically and/or clinically significant.

Demonstrates a manual (not MATLAB) trimmed sample (surrounded by blue markers) versus a raw sample (full image).
Subject Demographics

- 58 Subjects
- Median age of 19, mean 20.5
- 34 female
- 100% white
- 4 had colds or allergies: 1 had nasal congestion
- 2 told hearing loss, but passed screening
- 8 had previous speech therapy: 0 in active therapy
- 0 had history of cleft
Instrumentation and Methodology

• Subjects produced three trials of sustained vowels, syllables, sentences, and paragraphs to establish reliability

• WAV files captured using KayPENTAX Nasometer II 6450

• Custom MATLAB routine to calculate overall nasalance and to select syllable repetitions

• Compared overall MATLAB result with the KayPENTAX output (r=.999)
Methodology

• Nasalance transformed into rationalized arcsine units (rau) to make proportions more suitable for statistical analysis (Studebaker 1985)

• Overall nasalance and selected 5 syllable sample, compared using STATA
Figure showing differences in nasalance (in rau) between the full and pruned 5-syllable samples. Differences center around 0 with observed differences between -30 and +18 rau.
Results

- Mixed effects multilevel regression $X^2(3, N=2110) = 32.79, p=0.000$

- Accounts for random effects, adjusted conservatively

<table>
<thead>
<tr>
<th>Consonant Class</th>
<th>Coefficient</th>
<th>Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasals</td>
<td>0.145</td>
<td>1.54</td>
</tr>
<tr>
<td>Stops</td>
<td>-.273</td>
<td>-3.07</td>
</tr>
<tr>
<td>Fricatives</td>
<td>-.429</td>
<td>-4.53</td>
</tr>
</tbody>
</table>
Discussion

The Bottom Line

- Results indicate that there is a statistical significance in the difference between trimmed and raw nasalance scores.
- Results indicate that there may be a clinical significance in the difference between these.

Explanation

- Numerical analyses of data indicate that there is strong reliability and internal validity in our data.
- Results between trimmed and full samples were close, diagnostically these differences of z-scores in excess of 3 standard deviations for some consonant categories may result in misdiagnosis or improperly interpreted results.
- Statistically, this is certainly significant within our given a priori p-value.
Discussion

Outcomes

• Clinicians must unify their methods in order to ensure that shared data mean the “same thing.”

• It is advisable that all clinicians and researchers trim their results to ensure purity of data.

• Times and cost may be considerations

Questions and Future Applications

• Explore whether or not the effect of trimming is actually underestimated as a result of subject “self-stopping.”

• Advise hospitals, clinics, and universities of results, encourage replications in other dialectical regions to establish improved external validity.
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References:


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