Statistical Power and Swallowing Rehabilitation Research: Current Landscape and Next Steps

James C. Borders, MS, CCC-SLP & Michelle S. Troche, PhD, CCC-SLP

Laboratory for the Study of Upper Airway Dysfunction, Teachers College, Columbia University

Laboratory for the Study of Upper Airway Dysfunction
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

Poster SessionOnline.com
Poster presented at: DYSPHAGIA RESEARCH SOCIETY 29TH ANNUAL MEETING

BACKGROUND

- Clinically significant findings do not always align with statistical significance.
- Power is the probability of finding an effect when a true effect exists. Thus, low power affects a study's ability to detect a treatment effect, meaning that smaller (potentially clinically meaningful) effects may be undetected[1, 2].
- A recent review[3] found that only 9% of deglutition research using the penetration-aspiration scale reported power analyses. Thus, it's unclear if swallowing rehabilitation research is adequately powered to reliably detect a range of effect sizes.
- This review aimed to examine the current landscape of statistical power in swallowing rehabilitation research.

METHODS

- Databases were searched to identify intervention studies across seven treatments using the PAS.
- Sensitivity power analyses based on the statistical test and sample size determined the minimum effect size detectable with 80% power.

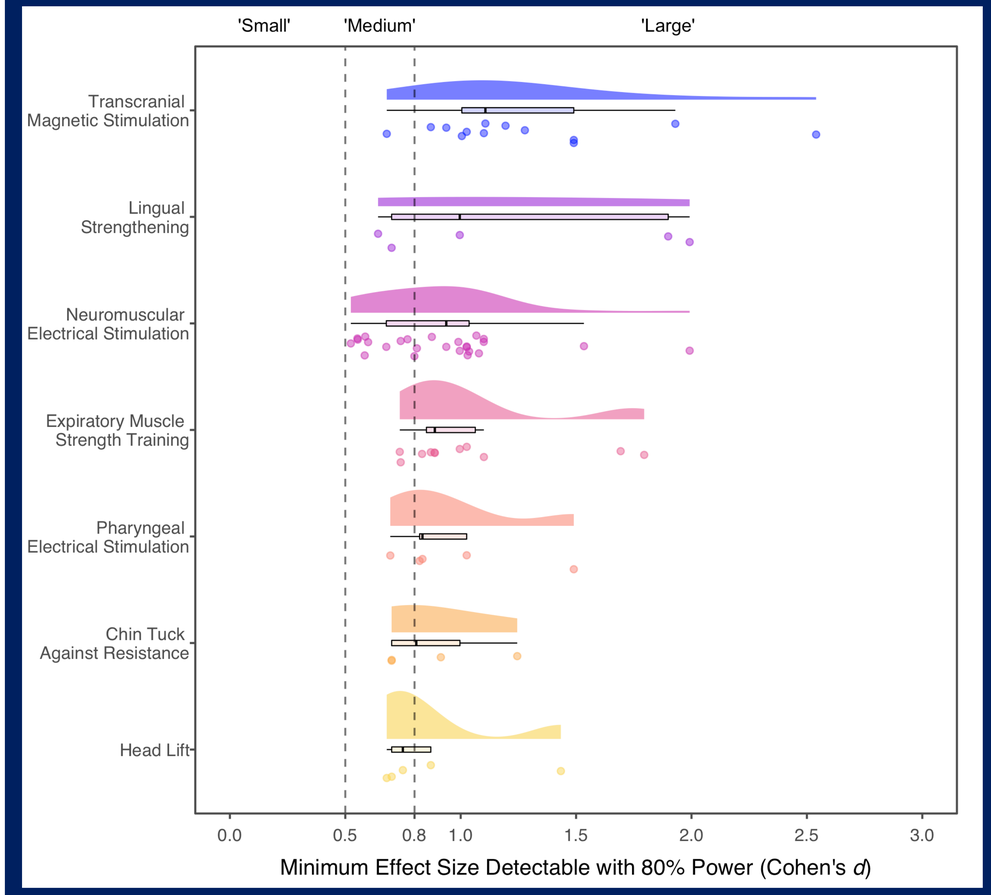
RESULTS

- 68 intervention studies met inclusion criteria.
- Across all studies, the median minimum detectable effect size with 80% power was $d = 0.96$ (Fig 1).
- No studies were powered to detect "small" effect sizes ($d < 0.5$) and 21 (31%) studies were powered to detect a "moderate" effect size ($d = 0.5 – 0.8$).
- Within treatment types, the median minimum detectable effect size* with 80% power was:
  - $d = 1.11$ for TMS
  - $d = 1.00$ for lingual strengthening
  - $d = 0.94$ for NMES
  - $d = 0.89$ for EMST
  - $d = 0.84$ for PES
  - $d = 0.81$ for chin tuck against resistance
  - $d = 0.75$ for head lift

*Note that smaller detectable effect sizes are desired and indicative of higher statistical power.

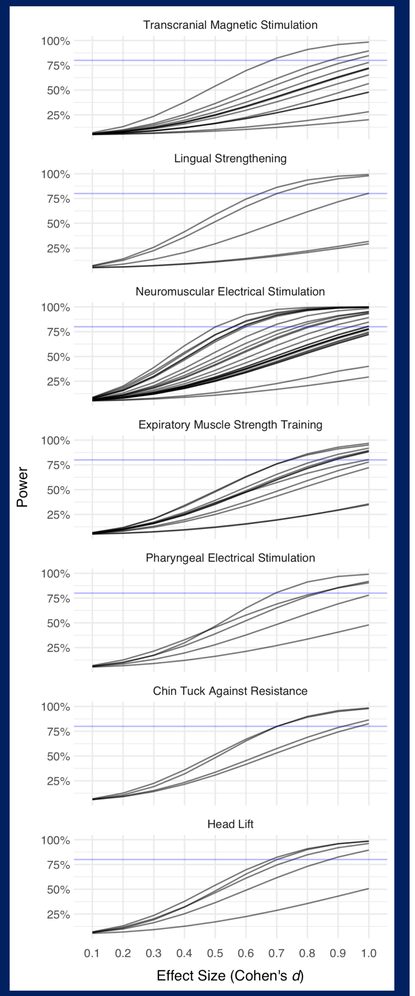
"Small to medium" treatment effect sizes may be of clinical significance, but many swallowing treatment studies are underpowered to detect these effects.

Figure 1: Distribution of Minimum Effect Sizes Detectable with 80% Power across Dysphagia Treatments



Take a picture to access **references**

Figure 2: Sensitivity Power Curves to Detect a Range of Effect Sizes across Treatments



CONCLUSIONS

- This review suggests that swallowing interventions examining the PAS are generally powered to only reliably detect conventionally "large" effect sizes.
- These findings suggest that treatments may be missing important clinical findings due to low detection rates of "small-to-medium" effects.
- This landscape of underpowered research highlights the need for collaborative, well-powered intervention studies that can detect smaller changes in swallowing function which are regarded as clinically significant.

PRACTICAL CONSIDERATIONS

- The *Smallest Effect Size of Interest* (*SESOI*) is the minimum amount of change in an outcome that is considered meaningful for a study to detect. This is a central component of a power analysis, which should replace heuristic effect sizes (e.g., a 'medium' Cohen's *d*)[4]. The SESOI facilitates interpreting results and understanding the limitations of a study's data and design to answer a research question.

- *Sensitivity Power Analyses* can be performed after data collection to understand the sensitivity of a study to detect a range of effect sizes, facilitating falsifiable science[5].

- *Flexible Statistical Models*, such as multilevel models, increase power by accounting for non-independence and avoiding aggregation/summarizing (e.g., max PAS)[6].

- *Nonconventional Study Designs*, such as sequential analyses[7] or one-tailed tests[8], improve power by increasing data collection efficiency. Paired with transparent pre-registration, these analyses optimize power and increase confidence in their implementation.

Service Delivery, Statistical Issues and Overflow from other sessions
Borders James
P-3489111
DRS2021