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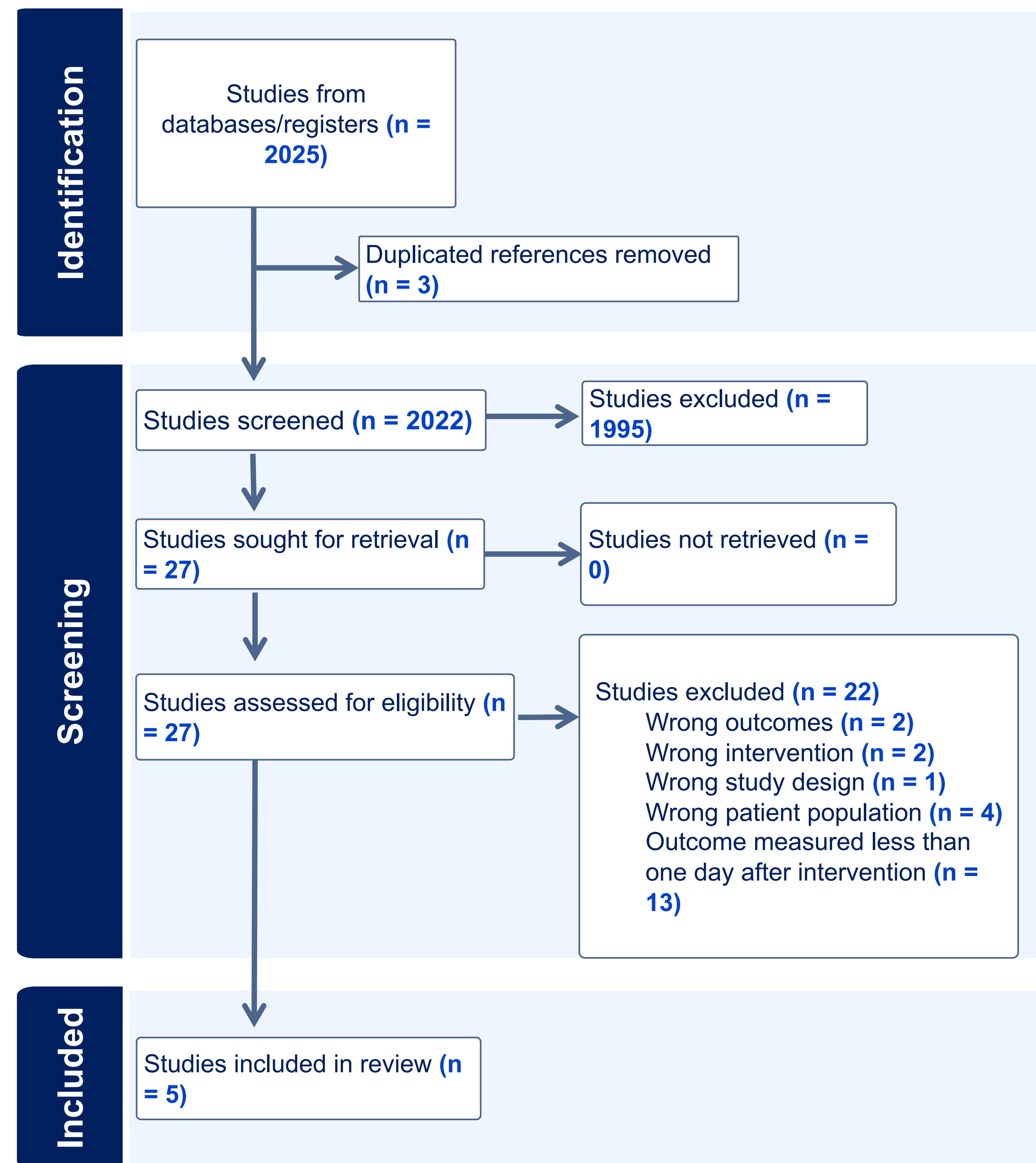
## INTRODUCTION

- Nasal obstruction is one of the most common complaints seen by otolaryngologists.
- There are numerous causes of nasal obstruction due to the static and dynamic nature of the nose.
- Nasal musculature works in conjunction to dilate the nostrils and internal nasal valve during respiration
- Of the nasal musculature, the nasalis is the main muscle responsible for nasal breathing by flaring the nostrils
- Current treatment of nasal obstruction largely focuses on the anatomic and static causes of obstruction via surgery and pharmacotherapy
- Traditional surgical intervention for nasal obstruction has focused on the anatomical causes of nasal obstruction by addressing the septum, and the upper and lower nasal cartilages.
- Pharmacologic therapy largely addresses inflammation of the inferior turbinates and nasal mucosa.
- Relatively few studies have sought to characterize the role of nasal musculature in nasal obstruction
- Due to this understudied topic, we set out to systematically summarize the literature surrounding non-surgical, non-pharmacologic treatment for nasal obstruction.

## METHODS

- Our systematic review was conducted according to PRISMA guidelines on June 27<sup>th</sup>, 2022.
- A comprehensive search of English-language literature from the Pubmed, EMBASE, and Web of Science databases were performed
- Search terms included "nose" AND "obstruction" OR "breathing," "congestion," or "resistance" combined with "exercise therapy," "kinesiotherapy," "behavior therapy," "breathing exercise," OR "transcutaneous electric nerve stimulation."
- The initial search result was first screened via abstracts by two reviewers independently.
- Studies were excluded that involved surgical procedures, pharmacologic therapy, or medical devices requiring continuous use for benefit.
- We also excluded studies that did not include outcome measures at least 24 hours after intervention.
- Disagreements between reviewers were discussed and mutually decided upon.
- After initial abstract review, remaining studies had their full text reviewed for final inclusion

Table 1: PRISMA diagram outlining search process



## RESULTS

- Of the 2025 articles initially identified, 5 met inclusion criteria for the study.
- The level of evidence ranged from II to IV per PRISMA guidelines.
- Study heterogeneity prevented meta-analysis.
- 3 of the 5 studies came from the Vaiman et al. group focused by biofeedback and electromyographic (EMG) stimulation of the nasal musculature (photo shown).
- The two studies using EMG stimulation of the nasal musculature, Buteyko breathing techniques, and nasal biofeedback training with EMG reported improvement in nasal obstruction scores or nasal resistance after treatment and/or the avoidance of surgery.
- The single study of comparing endurance athletes to sedentary individuals did not demonstrate differences in nasal resistance between the two groups.
- The included studies were examined for the possibility of meta-analysis, but were found to be too heterogenous.

## DISCUSSION

- The selected studies all demonstrated improvement in nasal obstruction or nasal resistance except for the comparison of endurance athletes
- This suggests that interventions focused specifically on nasal breathing should have maximum effectiveness
- The major limitation of this review is the relative paucity of data available on the techniques and their effectiveness.
- The Vaiman et al studies were the most rigorous, but the main limitation to implementation is the lack of available equipment and training among occupational therapists in the United States.
- All studies also had small sample sizes, so broad generalization is limited.

## CONCLUSION

- EMG training, breathing techniques, and biofeedback training can be used to treat nasal obstruction and potentially avoid surgery for patients
- Trial of such therapy could be impactful in patients who desire non-pharmacologic therapy or are poor operative candidates
- More research is needed to validate these techniques.

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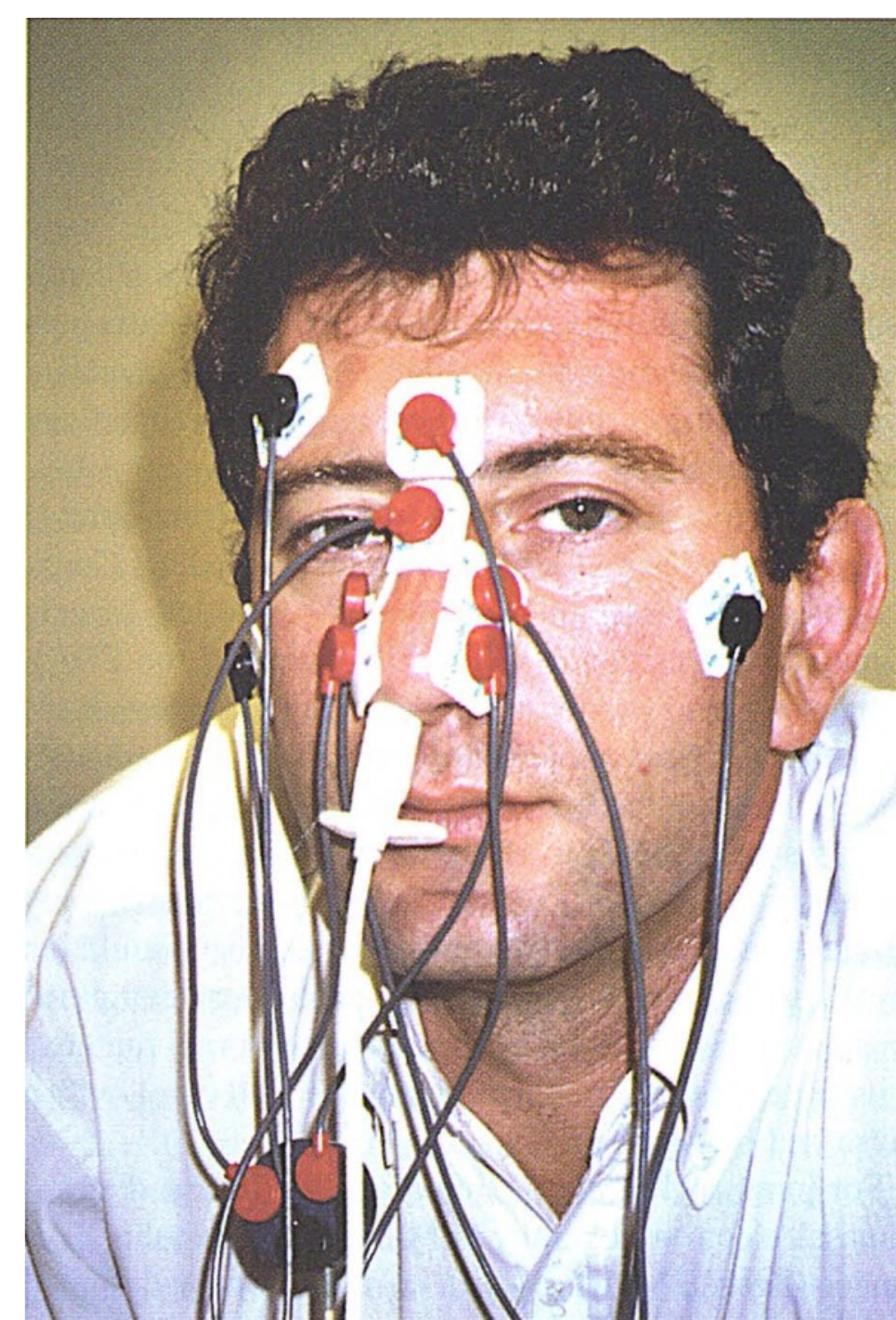


Photo demonstrating intranasal and transcutaneous electrical stimulation from Vaiman et al.