# Respiration-Triggered Olfactory Stimulation Reduces Obstructive Sleep Apnea Severity: A Prospective Pilot Study

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Background

Obstructive sleep apnea (OSA) is a prevalent sleep-disordered breathing condition characterized by repetitive reduction in breathing during sleep, resulting in significant consequences on health and life quality. Current standards of care for OSA have limited adherence, side effects and carry various risks. Thus, novel solutions for OSA management are much needed. Capitalizing on the unique neurocircuitry of the olfactory system and its retained function during sleep, we tested whether presenting transient, respiration-based olfactory stimulation can be used as a treatment for OSA markers.

Methods

Thirty-two OSA patients underwent two polysomnography sessions, 'Odor' and 'Control', counterbalanced for order. In 'Odor' nights, patients were presented with transient respiratory-based olfactory stimulation delivered via a computer-controlled olfactometer. The olfactometer, equipped with a wireless monitoring unit, analyzed respiratory patterns and presented odors upon detection of respiratory events. No odors were presented in 'Control' nights. Following exclusions, 17 patients entered the analyses (49.2+/-10.2 yr).
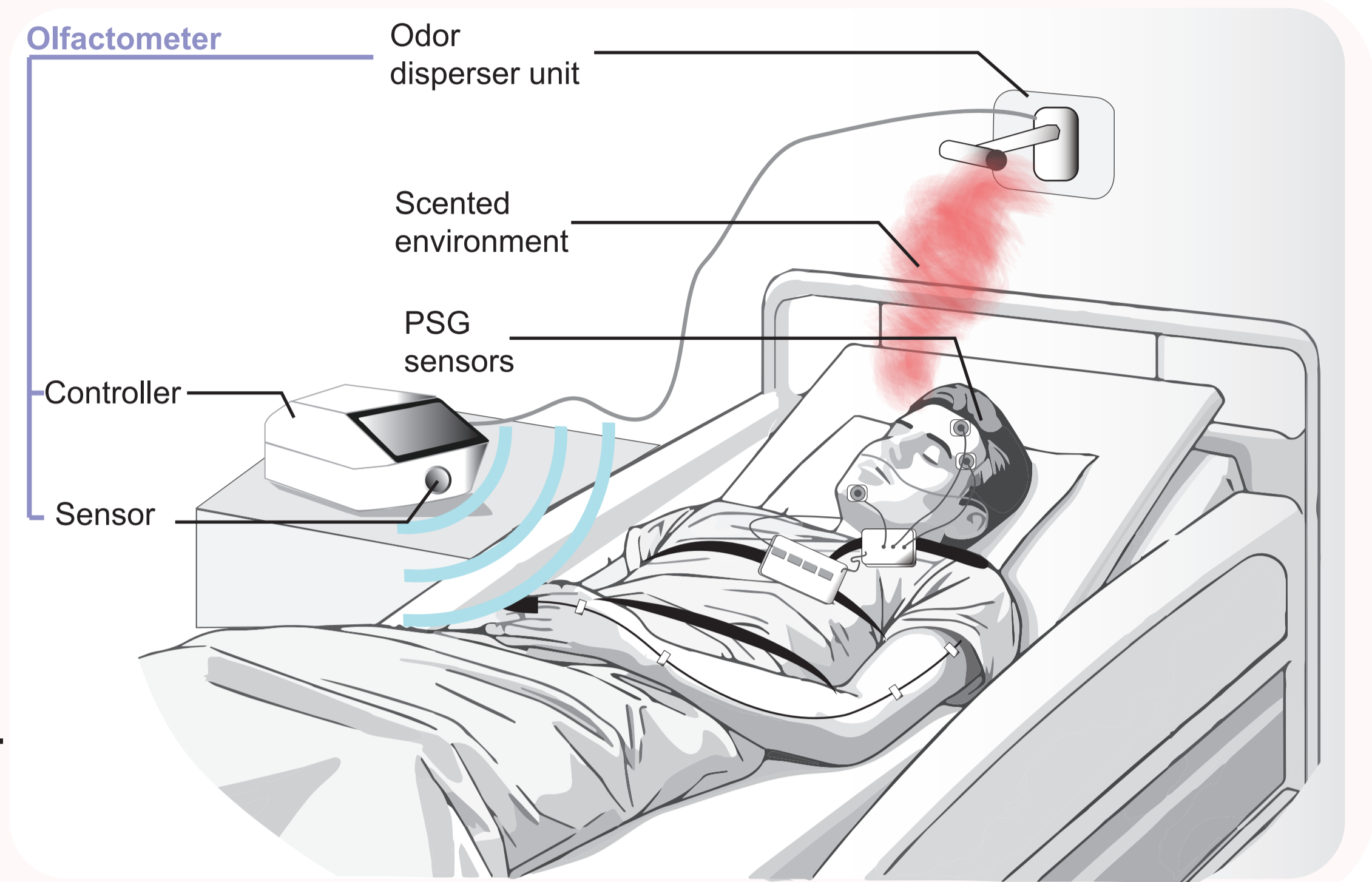

Odor stimulation protocol
- Apnea detection was based on 392 IRUWB signal features optimized to a 20-feature pool
- Odor delivery in synch. with apnea detection
- Disperser unit located 50cm about user's head
- 20 sec. stimulation followed by a minimum of 40 sec. interval
- A rotating repertoire of 5 odor mixtures based on essential oils: orange, eucalyptus, lavender, frankincense-cinnamon, and geranium
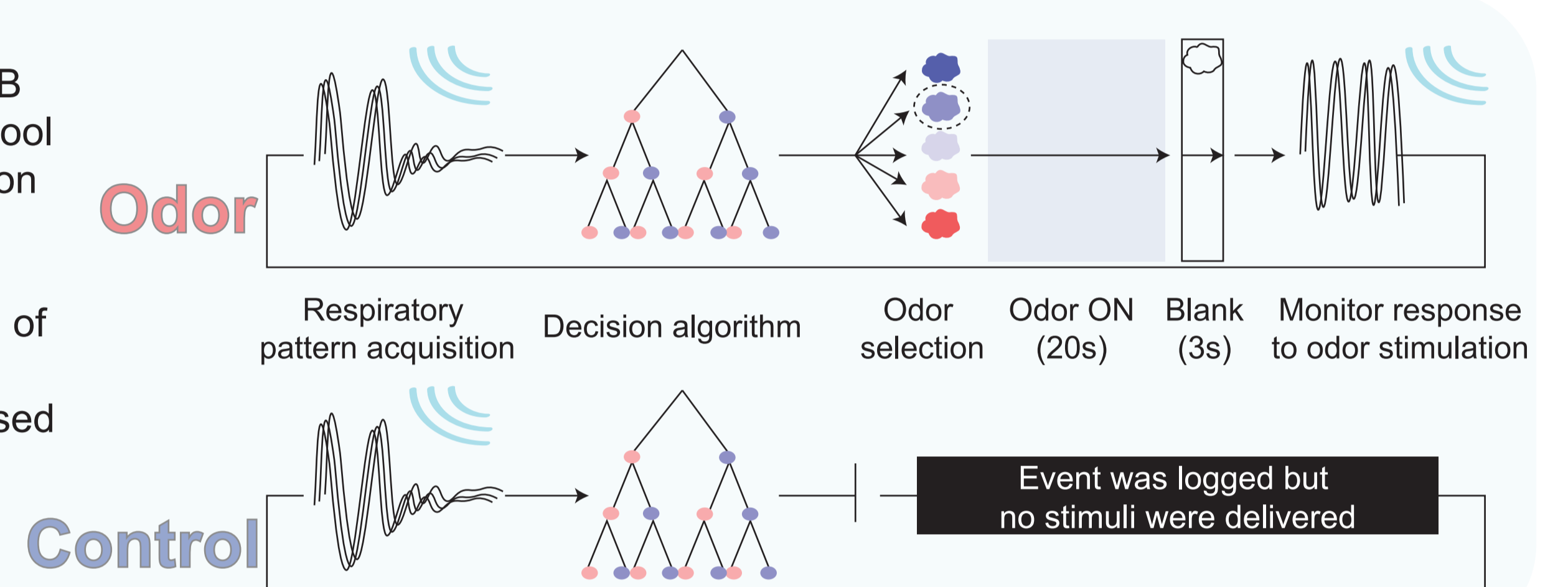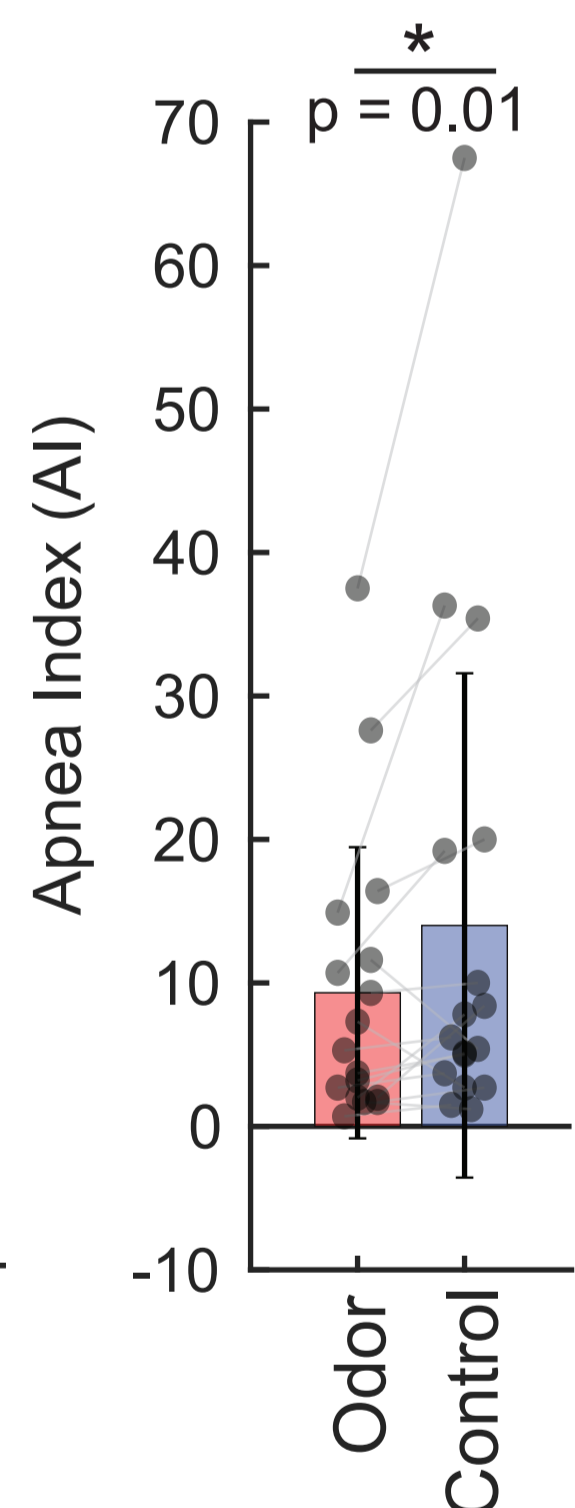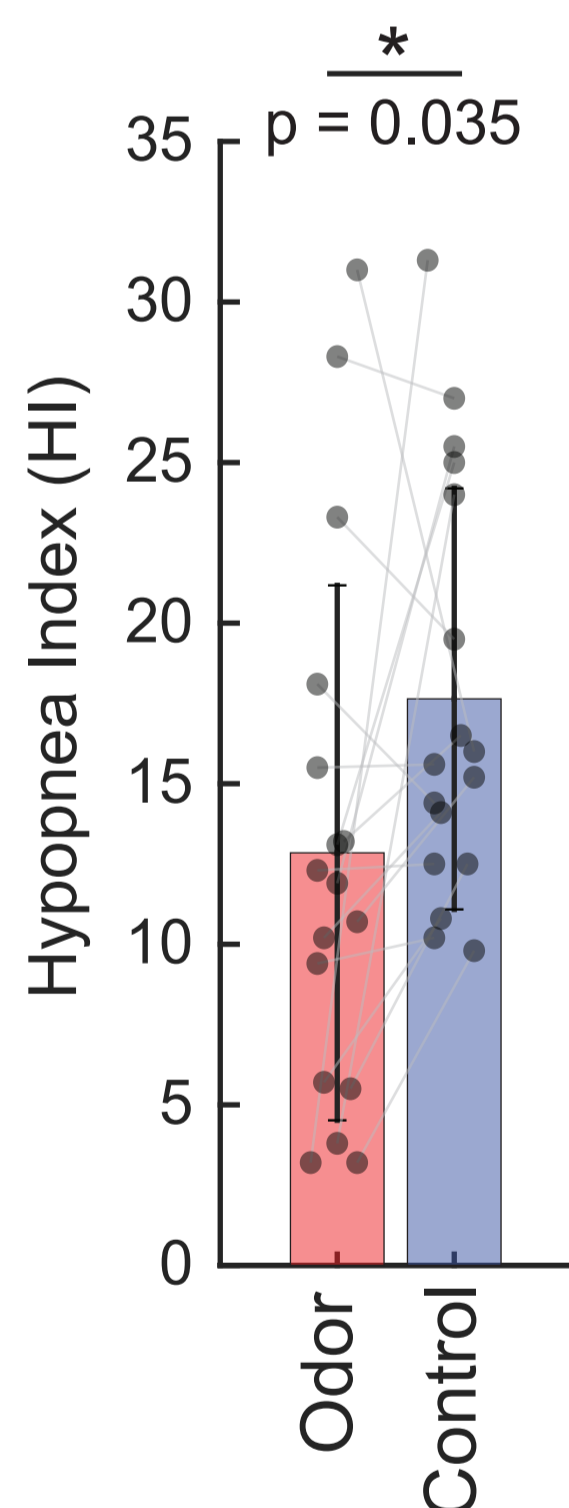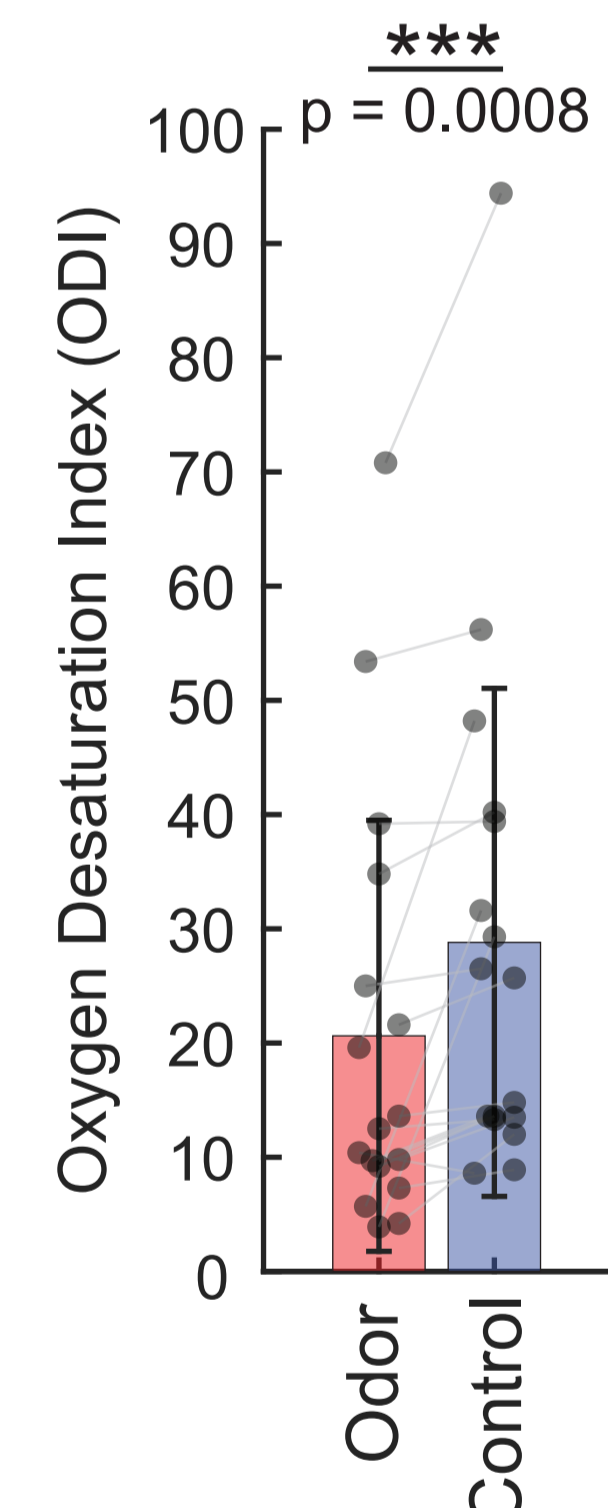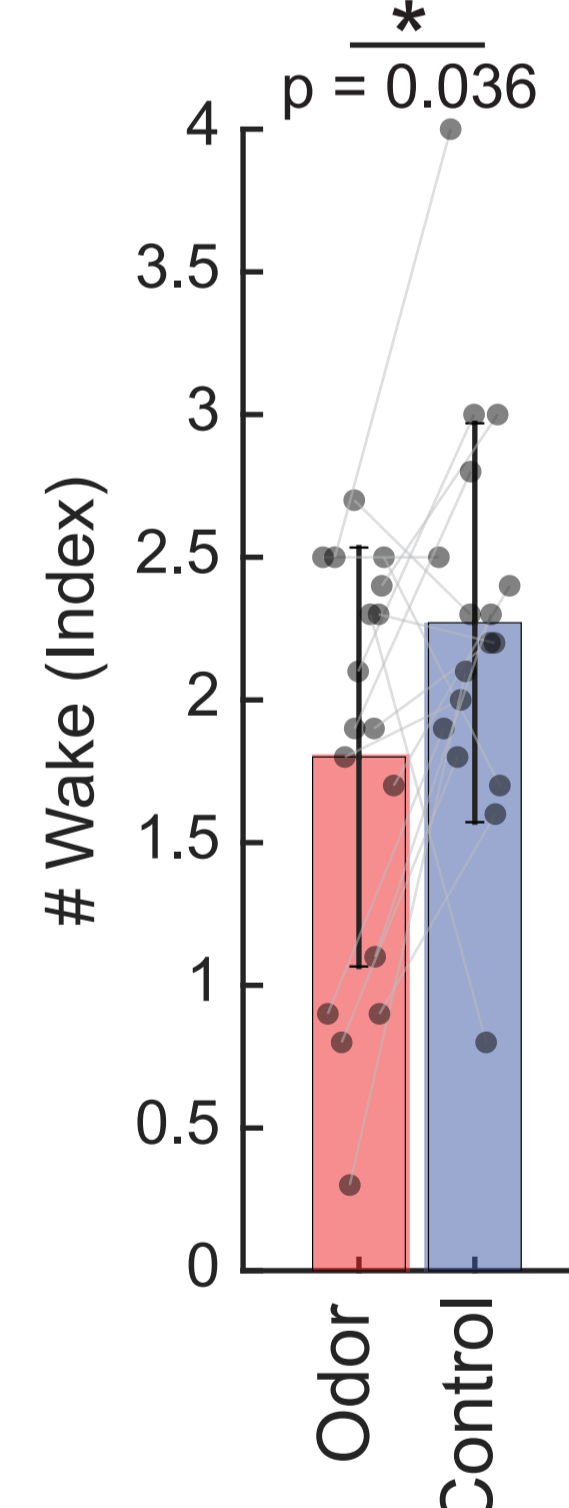

Results

Olfactory stimulation reduced the apnea-hypopnea index — *** p = 0.0008
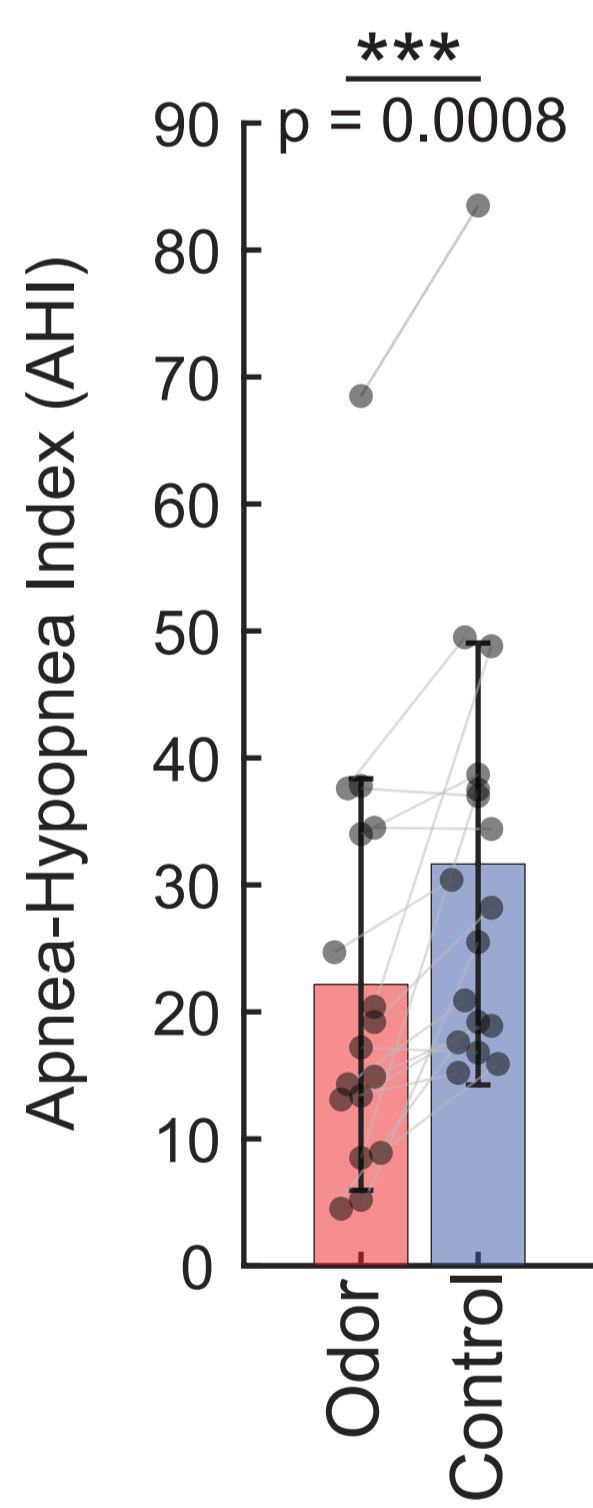
Olfactory stimulation reduced both apneas and hypopneas events — * p = 0.035, * p = 0.01

Olfactory stimulation reduced oxygen desaturation — *** p = 0.0008

Olfactory stimulation reduced number of wakes — * p = 0.036
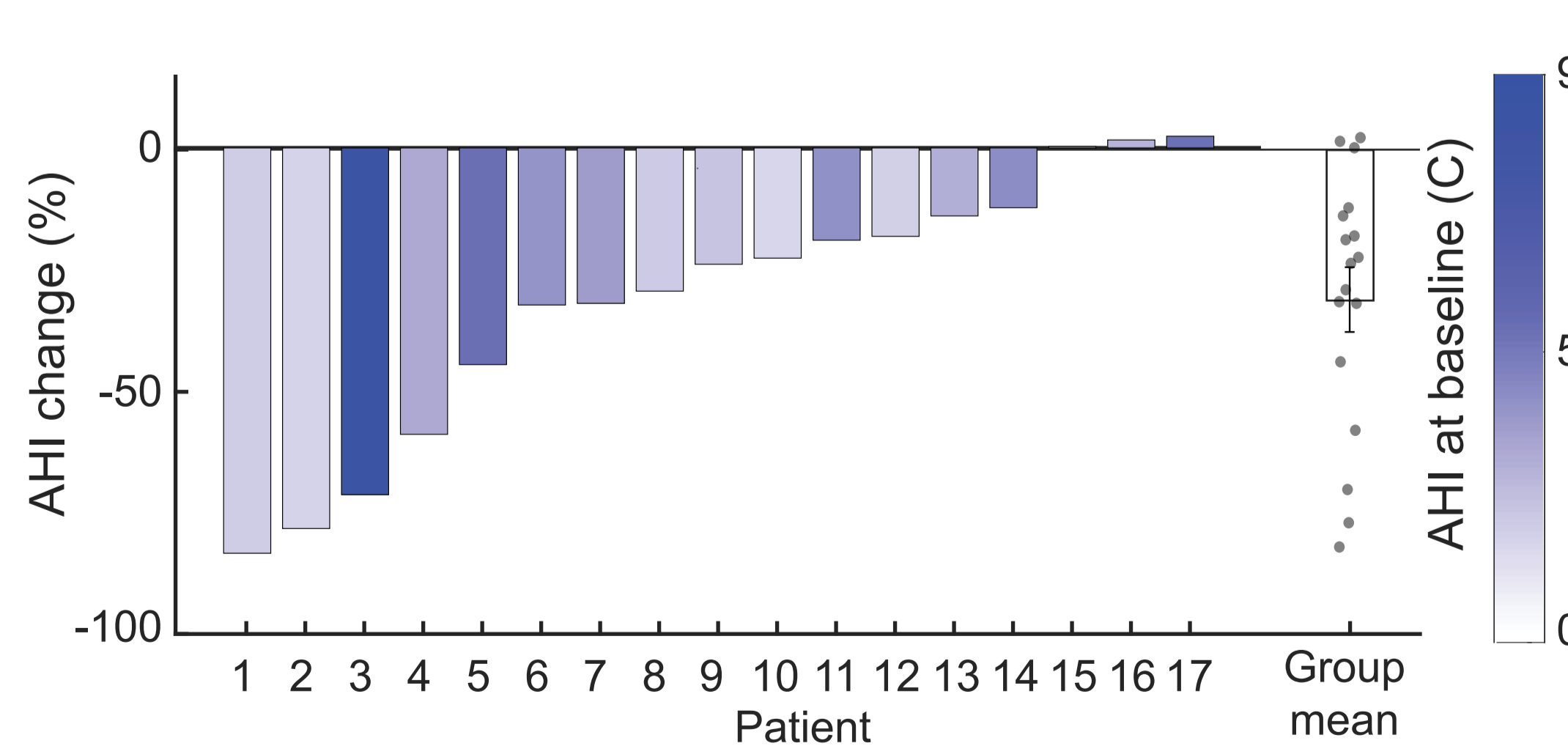
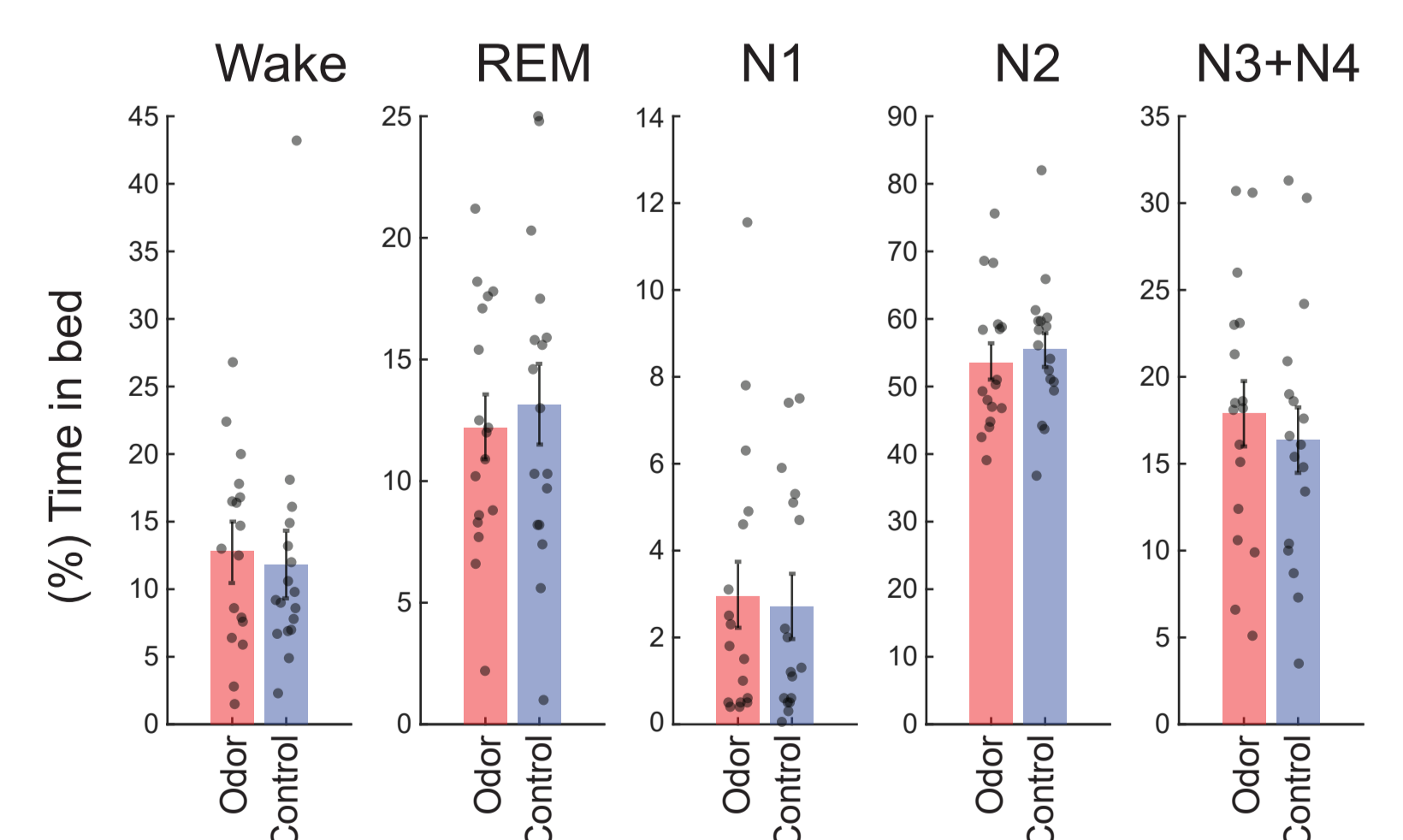**Olfactory stimulation did not change the number of arousals** — p = 0.11
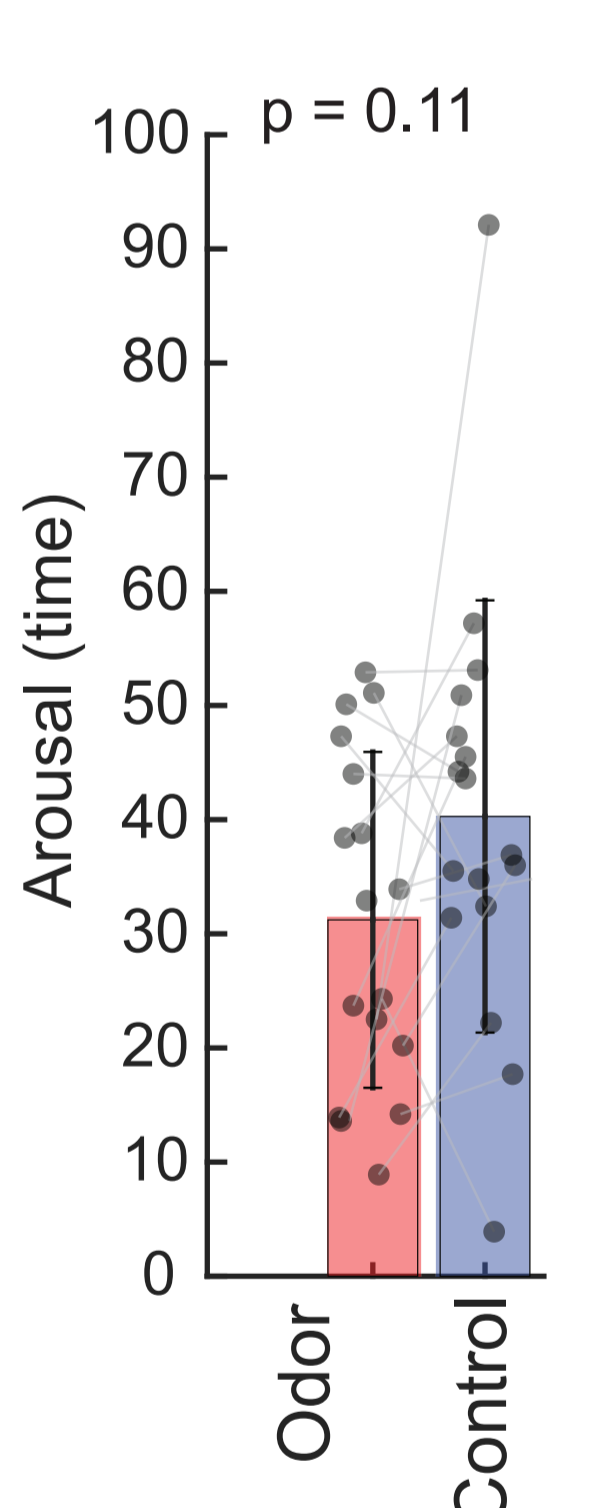
Olfactory stimulation improved categorical severity of OSA
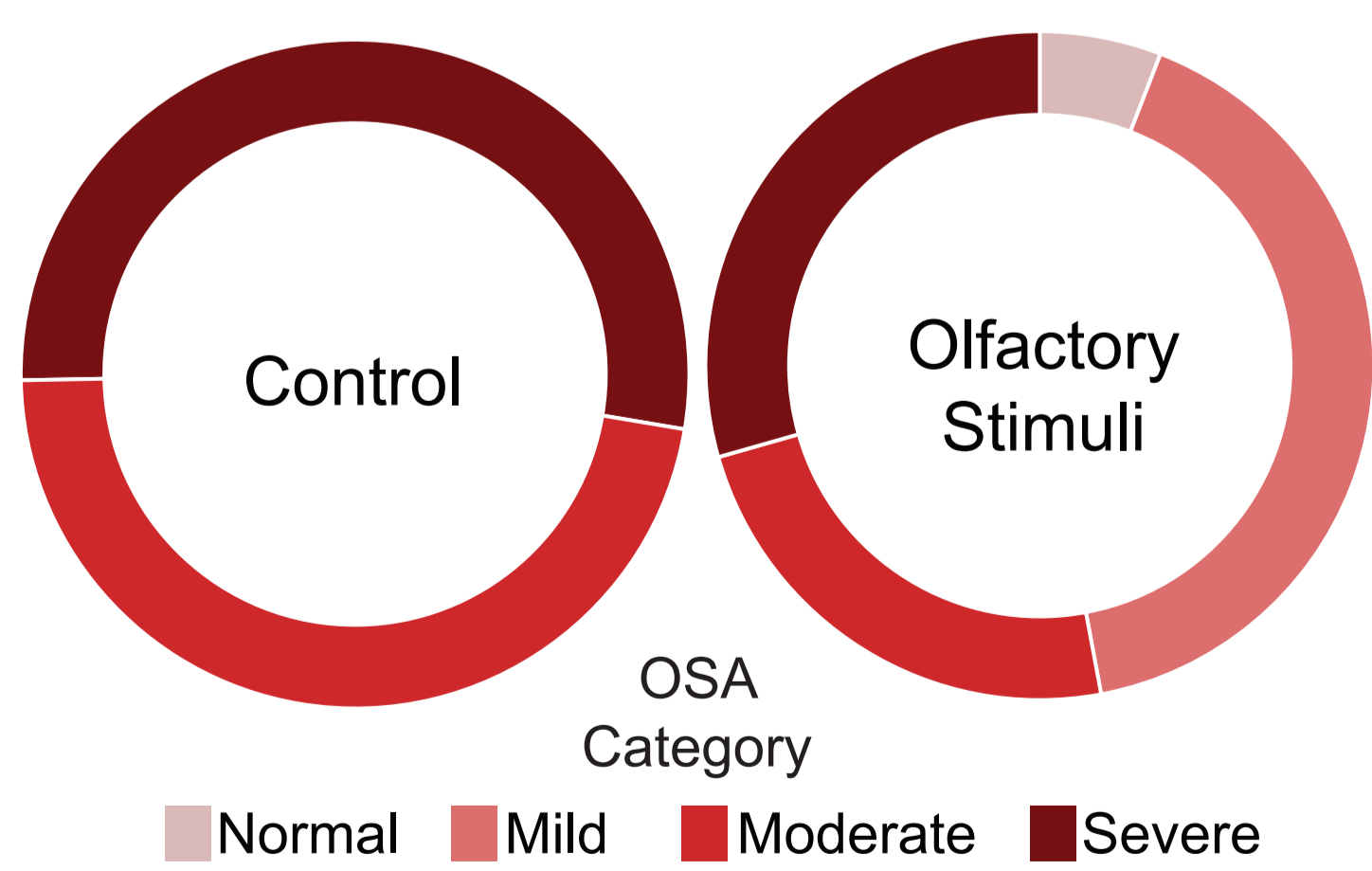
Olfactory stimulation reduced AHI in 82% of the patients

Olfactory stimulation did not change sleep architecture $(F(1,16) = 0.088, p = 0.77)$

Summary

The high prevalence of OSA combined with current insufficient solutions warrant the search for alternative treatments a high priority. Olfactory stimulation during sleep was effective in reducing OSA markers severity without inducing arousals and may provide a novel treatment modality for OSA. Although preliminary, our results suggest that contactless transient respiratory-based olfactory stimulation during sleep is a viable alternative, prompting continued research on this front.

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