

# Individual Factors that Predict Sensitivity to Vagus Nerve Stimulation

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## Background

- Vagus Nerve Stimulation (VNS) research and clinical use demonstrate its efficacy in treating various health conditions such as epilepsy, depression, and menstrual migraines (Olsen et al., 2023, Grazzi et al., 2016).
- There is a need for further research to understand the full extent of VNS capabilities and limitations.
- The impact of individual factors on VNS efficacy need to be better understood to fully harness its potential as a therapeutic.
- Examining the impact of hormonal birth control use, menstrual cycle phase, childhood socioeconomic status, childhood unpredictability, and childhood adverse experiences on sensitivity and responsiveness to VNS are critical to understanding why there is variation in VNS effectiveness.

## Research Question

- How do individual factors impact 1) sensitivity VNS intensity tolerance and 2) responsiveness to VNS?
- Sensitivity is defined as degree of tolerance to VNS intensity. Individuals with lower sensitivity can tolerate VNS at a higher intensity than individuals with high sensitivity.
- Responsiveness to VNS is measured as the change in Heart Rate Variability (HRV) from baseline to stimulation. This change is a vagal activation proxy. HRV is the variation in time between heartbeats.

## Funding



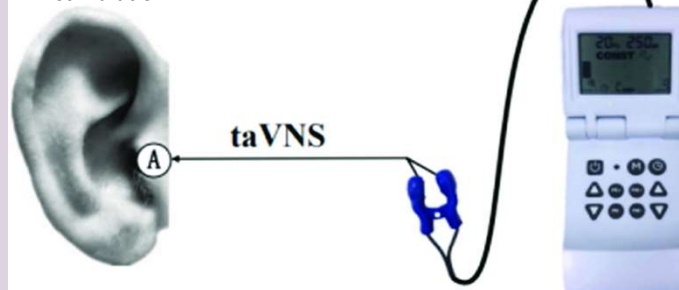
## Methods

- To be eligible for participation, individuals must be aged 18 years or older, without a tragus piercing, and free from pacemakers or any heart conditions. Additionally, participants cannot be pregnant, breastfeeding, or currently using hormonal birth control or an intrauterine device (IUD).
- Participants will complete a consent form and then take a survey which will assess birth control history, cycle phase, and childhood environment including socioeconomic status, unpredictability, and adverse experiences.
- Participants will undergo the below VNS procedure
- Several covariates will be tested for, including participant age, stress level, BMI, medical conditions, hormonal disorders, and the medications that participants are taking.

## VNS Procedure

10-minute rest	<b>Baseline:</b> 5-min HRV recording	<b>VNS:</b> 5-min HRV recording and stimulation	<b>Recovery:</b> 10-min HRV recording
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**Figure 1**  
*Transcutaneous auricular vagus nerve (taVNS) stimulation*



Note. Image from Geng et al., 2022

## Expected Results

- Existing research demonstrates person-based differences in vagal tone (Hao et al., 2021).
- Existing research has found that those with lower vagal tone have a greater responsiveness to VNS (Geng et al., 2022).
- Thus, we expect that those who have lower vagal tone will be less sensitivity to VNS intensity and more responsive (via HRV activation) to VNS.

## Implications

- Understanding individual factors affecting VNS sensitivity and responsiveness has the potential to improve therapeutic outcomes for a wider range of individuals..
- Filling in the gap of individual factors regarding VNS sensitivity can enhance clinical applications and guide future research directions.

## References

- Geng, D., Liu, X., Wang, Y., & Wang, J. (2022). The effect of transcutaneous auricular vagus nerve stimulation on HRV in healthy young people. *Plos one*, 17(2), e0263833.
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- Olsen, L. K., Solis Jr, E., McIntire, L. K., & Hatcher-Solis, C. N. (2023). Vagus nerve stimulation: mechanisms and factors involved in memory enhancement. *Frontiers in Human Neuroscience*, 17.

