



Nature Soundscape Immersion vs Virtual Reality for Preoperative Anxiety

A Randomized Non-Inferiority Trial of Low-Cost Psychological Prehabilitation



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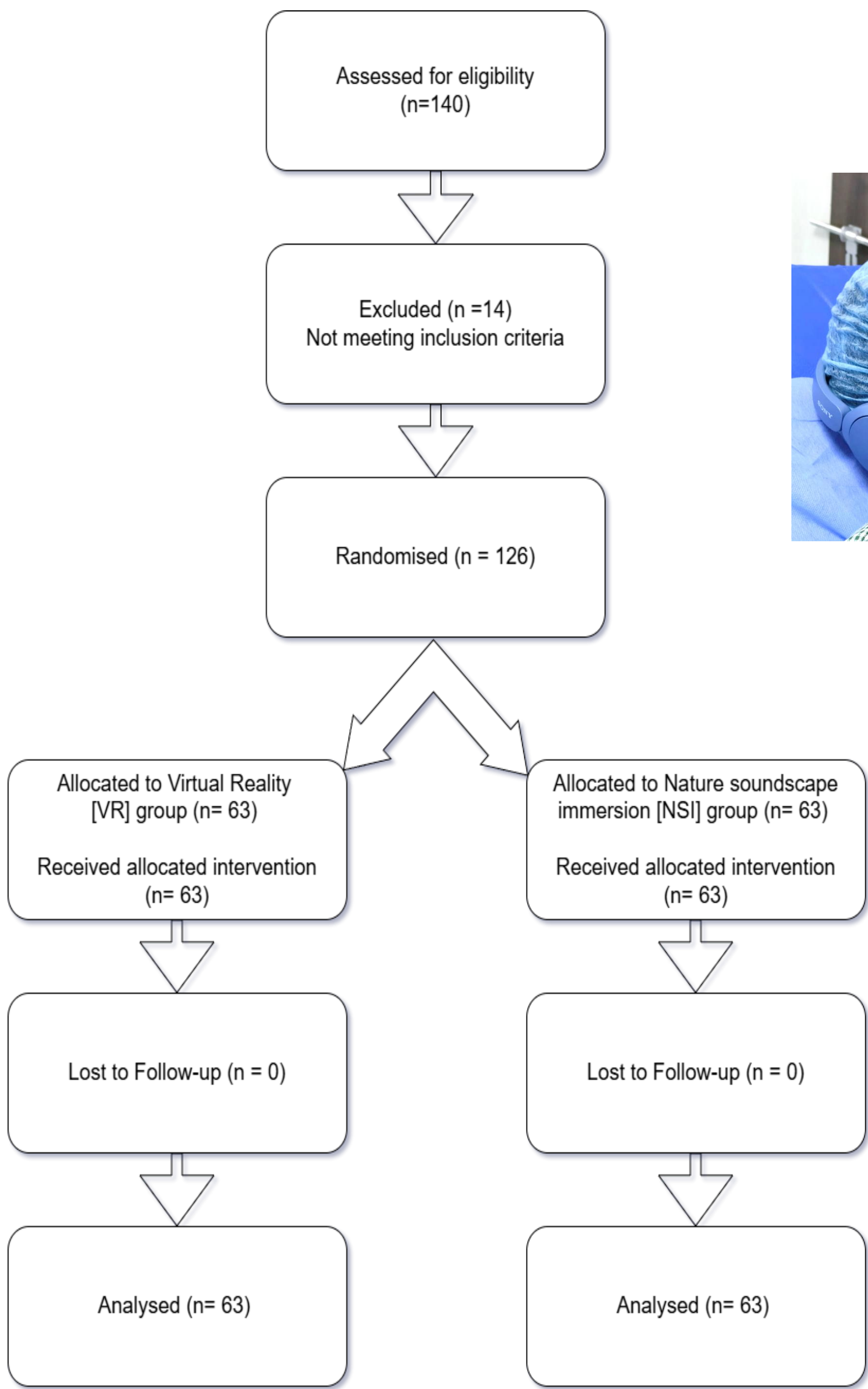
INTRODUCTION/HYPOTHESIS

•Preoperative anxiety is common (up to 80%) and worsens pain, recovery, and hemodynamics.¹
•Virtual Reality (VR) can reduce anxiety but is limited by cost, logistical burden, and simulator sickness.
•Nature Soundscape Immersion (NSI)—freely available high-fidelity natural sounds—is highly scalable.
Aim: To determine whether NSI is **non-inferior** to VR in reducing preoperative anxiety.

STUDY DESIGN/METHODS

Design: Randomized, controlled, non-inferiority trial (N = 126).
Setting: Tertiary academic center, December 2024–June 2025.
Participants: Adults 18–70 years, elective surgery under GA.
Randomization: 1:1 VR vs NSI.
Interventions (10 minutes):
VR: JioDive headset + smartphone (360° nature waterfall).
NSI: Noise-cancelling headphones (ocean + birdsong).
Primary Outcome: APAIS score immediately post-intervention (T₁).
Secondary: VAS-Stress, VAS-Preparedness, HR, BP, SSQ, postoperative pain & satisfaction.

👉 **CONSORT flow chart**



RESULTS

Primary Outcome – APAIS
APAIS reduction (mean ± SD):
VR: -7.7 ± 3.0
NSI: -8.4 ± 3.2
Between-group difference: -0.19 (95% CI -1.36 to 0.98)
→ Falls entirely within non-inferiority margin (+2).



Secondary Outcomes
Stress reduction: NSI significantly greater VR -21.0 vs NSI -29.3 ($p = 0.005$)
Preparedness: Similar improvement ($p = 0.37$).
Hemodynamics: HR, SBP, DBP decreased significantly over time in both groups; **no group difference**.
Simulator sickness:
VR: 918 ± 196
NSI: 100 ± 66
→ **≈9-fold higher** in VR ($p < 0.001$).
Postoperative pain: Comparable ($p = 0.85$).
Satisfaction: High in both groups.

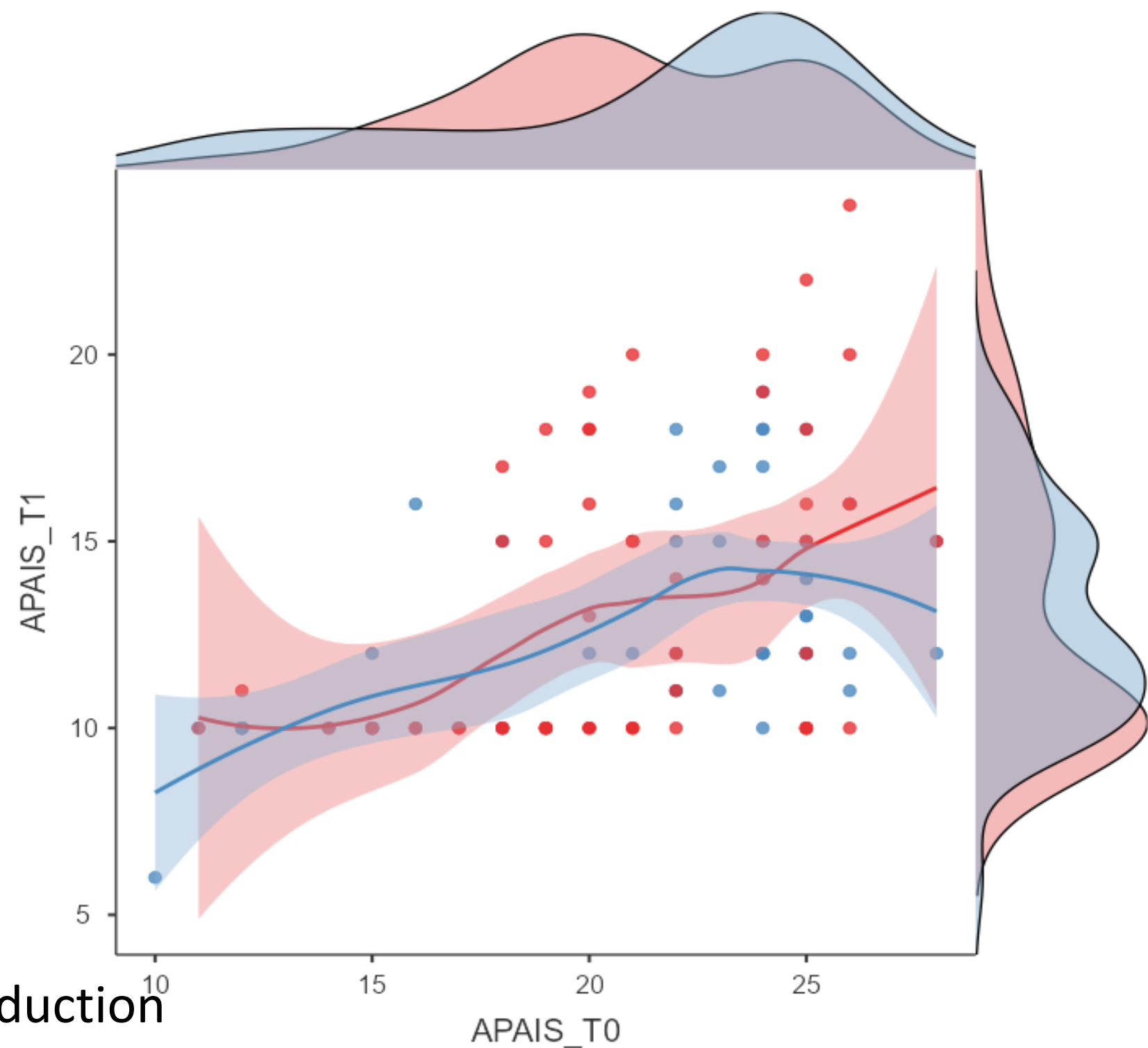


FIGURE: APAIS Scatter + Density Plot
Overlapping distributions. Parallel anxiety reduction

Table key between-group differences

Outcome	NSI – VR (Mean Difference)	95% CI	p-value	Interpretation
APAIS (T ₁)	+0.19	−0.98 to 1.36	0.75	✓ Non-inferior
VAS-Stress (T ₁)	+6.35	1.97 to 10.73	0.005	★ NSI superior
VAS-Preparedness	+0.95	−1.12 to 3.03	0.36	Equivalent
Heart Rate (T ₁)	−1.92	−6.53 to 2.68	0.41	Equivalent
Systolic BP (T ₁)	−2.30	−6.34 to 1.74	0.26	Equivalent
Simulator Sickness	+818.6	766.9 to 870.3	<0.001	★ VR much worse
VAS-Pain (T ₃)	+0.32	−3.03 to 3.67	0.85	Equivalent
Satisfaction (T ₃)	+1.11	−0.09 to 2.31	0.07	Equivalent

DISCUSSION/ CONCLUSIONS

- Anxiety reduction with both NSI and VR aligns with prior evidence supporting immersive or auditory distraction in surgical patients.^{2,3}
- Unlike VR studies reporting frequent cybersickness, NSI showed **markedly superior tolerability**, indicating greater feasibility for routine perioperative use.
- Stress reduction was significantly higher with NSI, suggesting auditory immersion may be equally or more effective than visual-immersive VR for modulating sympathetic arousal.
- Comparable hemodynamic improvements support NSI as an effective non-pharmacological calming strategy.
- Lack of a usual-care control group limits estimation of benefits over standard practice.

CONCLUSION

- NSI is non-inferior to VR** for reducing preoperative anxiety.
- NSI offers superior stress reduction and dramatically fewer adverse effects.**
- Highly scalable, low-cost, and ideal for resource-limited perioperative settings.**

Limitations

Single centre; participants unblinded. No usual-care control group. Outcomes self-reported.

CLINICAL IMPLICATIONS

- Works with **any smartphone + headphone** combination.
- No licensing, training, or technical support needed.
- Suitable for high-volume OR complexes and short-stay surgeries.
- Can be implemented instantly as a **psychological prehabilitation tool**.

REFERENCES

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