



Reducing Preoperative Anxiety through a Combination of Virtual Reality and Benson Relaxation: A Quasi-Experimental Study

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ABSTRACT

Background: Anxiety before surgery is common and may disturb physiological stability and recovery. Because sedative drugs can cause side effects, safe non-pharmacological strategies are needed. Virtual Reality provides immersive distraction, while Benson relaxation promotes a calming response through controlled breathing. **Purpose:** To determine whether combining Virtual Reality and Benson relaxation reduces anxiety in patients awaiting elective surgery. **Methods:** The research followed a quasi-experimental design with pre- and post-intervention assessments and a comparison group without random allocation. A total of 44 patients were recruited using purposive sampling. Of these, 22 received a combined Virtual Reality and Benson relaxation session, while the remaining 22 underwent standard preoperative care. Participants' anxiety was measured prior to the intervention and again afterward using the Amsterdam Preoperative Anxiety and Information Scale (APAIS). **Results:** Anxiety decreased more in the intervention group. Posttest scores averaged 14.18 ± 4.594 versus 17.91 ± 4.587 in controls, with a mean difference of -3.727 (95% CI: -6.521 to -0.934 ; $p = 0.010$). **Conclusion:** The combined intervention was more effective than standard care in lowering preoperative anxiety. **Implications for Nursing:** Nurses may apply this approach to improve emotional comfort and readiness for surgery.

Keywords: Benson Relaxation, Preoperative Anxiety, Nursing intervention, Virtual reality.

What does this paper add?

1. The findings indicate that integrating Virtual Reality with Benson relaxation provides greater anxiety reduction before surgery compared to routine preoperative care.
2. The study provides evidence for a practical, non-pharmacological approach that integrates distraction and physiological relaxation.
3. The findings support nurses in applying technology-based mind-body interventions in routine preoperative care.

Introduction

Preoperative anxiety remains a frequent psychological concern among surgical patients, often triggered by fear of anesthesia, pain, postoperative complications, or uncertainty about surgical outcomes. Elevated anxiety can cause physiological instability, such as tachycardia, hypertension, and increased oxygen consumption, which may affect anesthetic induction and postoperative recovery (Eberhart et al., 2020; Gao et al., 2023).

While pharmacological agents, such as benzodiazepines, are commonly used to manage anxiety,

they carry potential side effects, including sedation, dependency, and respiratory depression. Consequently, nursing science increasingly emphasizes non-pharmacological interventions that promote psychological comfort and patient autonomy (Tola et al., 2021).

Virtual Reality (VR) has gained recognition as an immersive intervention capable of diverting patients' attention from stimuli that trigger anxiety. Recent studies have shown VR to reduce anxiety in preoperative, dental, and oncologic contexts by enhancing relaxation and emotional regulation (Chiu et al., 2023; Gao et al., 2023). Meanwhile, Benson relaxation, based on repetitive affirmations and slow breathing, elicits a parasympathetic response that lowers stress hormones and stabilizes vital signs (Ebraheim & Ibrahim, 2022).

Although both methods independently demonstrate efficacy in reducing anxiety, limited research has explored their combined application as a synergistic nursing intervention for preoperative patients. Integrating VR distraction with Benson relaxation may enhance relaxation depth and patient engagement by simultaneously activating sensory and cognitive calming mechanisms (Rochmawati et al., 2021; Torné-Ruiz et al., 2023).

The purpose of this study was to investigate whether integrating Virtual Reality with Benson relaxation could reduce pre-surgical anxiety, while also contributing to the development of evidence-based and patient-centered perioperative nursing care.

Methods

Study Design and Setting

The investigation adopted a quasi-experimental approach incorporating pre- and post-intervention assessments with a comparison group. The study was carried out in the surgical units of a tertiary care hospital in Semarang, Indonesia, involving patients scheduled for elective procedures. Reporting of the study followed the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) checklist to ensure clarity and completeness in describing nonrandomized interventions.

Participants

Patients were recruited during the preoperative admission period. Participants were eligible if they were 18 years of age or older, scheduled for elective surgery, able to communicate clearly, clinically stable, and

willing to provide written informed consent.

Patients were not included if they had visual or hearing limitations that prevented the use of a VR device, had a diagnosed psychiatric disorder, were under the influence of sedative medication before baseline assessment, or required urgent medical intervention.

Group Allocation

Participants were allocated to the intervention or control group without the use of random assignment. Allocation was carried out consecutively according to admission order to minimize disruption to clinical workflow. Randomization was not implemented due to practical constraints in the surgical schedule and ward organization. A total of 44 participants were included, with 22 patients in each group.

Sample Size

The number of participants required for the study was determined through a power analysis comparing two independent group means, using a 0.05 significance threshold and 80% statistical power. Assuming a moderate to large effect size, a minimum of 20 individuals per group was considered sufficient. To account for potential attrition, the final sample included 22 participants in each group.

Intervention Procedure

The intervention was delivered once during the preoperative period, approximately one to two hours before surgery.

Patients in the intervention group first received a 10-minute Virtual Reality session using a head-mounted device displaying calming natural scenery accompanied by soft background audio. The content was standardized for all participants.

Immediately afterward, a 10-minute Benson relaxation session was conducted. Patients were guided by a trained nurse to sit comfortably, close their eyes, breathe slowly and regularly, and silently repeat a calming word during exhalation. The total duration of the combined intervention was about 20 minutes.

The control group received routine preoperative nursing care, including standard preparation and information, without additional relaxation therapy.

Measurements

Preoperative anxiety was assessed using the

Amsterdam Preoperative Anxiety and Information Scale (APAIS) developed by (Moerman et al., 1996). This instrument consists of six items that explore concerns related to anesthesia, the surgical procedure, and the need for information. Each item is rated on a five-point Likert scale ranging from 1 (not at all) to 5 (extremely), producing total scores between 6 and 30, with higher scores indicating greater anxiety. The APAIS was administered prior to the intervention and again immediately afterward to determine changes in anxiety levels in both groups. The scale has been extensively applied in perioperative settings and has demonstrated satisfactory validity and reliability.

Data Collection and Ethical Considerations and Analysis

Data collection took place in the surgical units while patients were in the preoperative phase. Eligible participants were approached, provided with an explanation of the study objectives and procedures, and asked to sign a written informed consent form before participation. Baseline anxiety was measured using the APAIS before the intervention was delivered. Following the intervention, anxiety was reassessed using the same instrument to determine changes in scores between pretest and posttest in both groups.

Ethical clearance for the study was obtained from the Research Ethics Committee of the Faculty of Nursing, Universitas Islam Sultan Agung, Semarang (Approval

No. 172/A.1-KEPK/FIK-SA/II/202). Participation was entirely voluntary, and individuals were informed that they could discontinue at any stage without penalty. All personal information was handled confidentially throughout the study.

The collected data was processed and analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistical methods were applied to present participant characteristics and anxiety levels. Within-group differences before and after the intervention were examined using paired t-tests, while independent t-tests were conducted to compare post-intervention scores between groups. A p-value below 0.05 was interpreted as indicating statistical significance.

Because data was collected anonymously and no identifying information was recorded, individual responses could not be withdrawn after the data had been entered into the statistical database.

Results

The study included 44 patients scheduled for surgery, with 22 assigned to the intervention group and 22 to the control group. The majority of participants were adults aged 19-59 years (93.2%), and most were female (70.5%). More than a half of the respondents had completed senior high school (59.1%), and an approximately equal proportion had undergone previous surgical procedures (50%). Overall, the demographic profiles of both groups were comparable (Table 1).

Table 1. Characteristics of respondents (n = 44)

Characteristics	Intervention (n = 22)	Control (n = 22)	Total (n = 44)
Age			
Adolescents (10-18 years)	1 (4.5%)	0 (0%)	1 (2.3%)
Adults (19-59 years)	21 (95.5%)	20 (90.9%)	41 (93.2%)
Elderly (>60 years)	0 (0%)	2 (9.1%)	2 (4.5%)
Gender			
Male	4 (18.2%)	9 (40.9%)	13 (29.5%)
Female	18 (81.8%)	13 (59.1%)	31 (70.5%)
Education			
Elementary School	2 (9.1%)	2 (9.1%)	4 (9.1%)
Junior High School	1 (4.5%)	2 (9.1%)	3 (6.8%)
Senior High School	14 (63.6%)	12 (54.5%)	26 (59.1%)
University	5 (22.7%)	6 (27.3%)	11 (25.0%)
Surgical Experience			
Yes	11 (50.0%)	11 (50.0%)	22 (50.0%)
No	11 (50.0%)	11 (50.0%)	22 (50.0%)

Before the intervention, both groups exhibited

similar anxiety levels based on APAIS scores. After the

intervention, a marked reduction was observed in the intervention group. The mean pretest and posttest

scores, along with their mean differences, are presented in Table 2.

Table 2. Mean anxiety scores before and after the intervention

Group	Mean Pre-test $\pm$ SD	Mean Post-test $\pm$ SD	Mean Difference	p-value
Intervention	20.18 $\pm$ 3.924	14.18 $\pm$ 4.594	6.00	0.000
Control	19.00 $\pm$ 5.201	17.91 $\pm$ 4.587	1.09	0.003

Analysis using an independent t-test indicated a significant difference in post-intervention anxiety scores between the intervention and control groups ($p = 0.010$).

The combination of Virtual Reality and Benson relaxation significantly reduced preoperative anxiety compared to standard care (Table 3).

Table 3. Effectiveness of virtual reality and Benson relaxation combination on preoperative anxiety

Group	n	Mean $\pm$ SD	Mean Difference	95% CI (Lower-Upper)	p-value
Intervention	22	14.18 $\pm$ 4.594	-3.727	-6.521 - -0.934	0.010
Control	22	17.91 $\pm$ 4.587			

The results demonstrated a greater decrease in mean anxiety scores among participants who received the combined Virtual Reality and Benson relaxation intervention compared with those receiving standard preoperative care. This indicates that the multimodal non-pharmacological approach was effective in reducing preoperative anxiety and could be implemented as part of routine nursing practice for surgical patients.

Discussion

The results of this study demonstrated that the combination of Virtual Reality and Benson relaxation effectively reduced preoperative anxiety among surgical patients. The statistically significant difference observed between the intervention and control groups suggests that a multimodal approach integrating sensory distraction and relaxation response is more effective than standard preoperative nursing care alone.

The decrease in anxiety scores aligns with previous research indicating that Virtual Reality (VR) is an effective non-pharmacological intervention for reducing perioperative stress by diverting patients' attention from anxiety-inducing stimuli and fostering a sense of calmness (Awed et al., 2025; Parsons et al., 2022). Similarly, Benson relaxation activates the parasympathetic nervous system, reducing physiological arousal including elevations in heart rate and breathing rate, which are common in preoperative anxiety (Abdalrahim, 2023; Ahmadiania et al., 2025).

Studies by Razavinasab et al. (2025) and Golchoubi et al. (2024) also confirmed that relaxation-based interventions significantly reduce preoperative anxiety and improve emotional stability before surgery. The integration of VR and Benson relaxation, therefore, offers dual benefits: immersive distraction through visual and auditory stimuli, and internal relaxation through controlled breathing and positive affirmation.

The findings further support the role of nurses in implementing mind-body interventions as part of holistic perioperative care. As highlighted by Maghalian et al. (2024) and López-Rodrigo et al. (2025), nurses play a crucial role in identifying anxiety symptoms early and providing evidence-based non-pharmacological care to enhance surgical readiness.

While pharmacological methods remain effective, they carry potential side effects and are not always suitable for all patients. Non-pharmacological interventions, such as those in this study, can be easily implemented, are cost-effective, and have no adverse outcomes. This makes them ideal adjuncts to standard nursing practice, particularly in decreasing preoperative anxiety levels while increasing patient satisfaction (Alhusamiah et al., 2024; Nouri et al., 2025).

The findings add to existing evidence suggesting that the integration of digital technologies and behavioral strategies can improve outcomes for patients undergoing surgery. Future studies may explore different durations, frequencies, or types of VR content to optimize effectiveness across various surgical populations.

Conclusion

The results indicate that integrating Virtual Reality with Benson relaxation effectively reduced preoperative anxiety among surgical patients. The intervention produced a significantly greater decrease in anxiety levels compared to standard preoperative care. Integrating sensory distraction through Virtual Reality with the relaxation response from Benson's technique provides a simple, safe, and evidence-based non-pharmacological approach that enhances patient comfort and emotional readiness before surgery.

Nurses are encouraged to apply this combined intervention as part of preoperative nursing care to help patients manage anxiety and improve their overall surgical experience. Hospitals and nursing educators should consider incorporating Virtual Reality-based relaxation techniques into clinical guidelines and nursing curricula to promote holistic, patient-centered care. Further studies are recommended to further explore, such as long-term effects, impact on social life, cost-effectiveness, and the applicability of this intervention across different surgical settings and patient populations.

Implications for Nursing

The findings highlight the important role of nurses in managing preoperative anxiety through non-pharmacological interventions. Integrating Virtual Reality with Benson relaxation into preoperative care offers a practical, safe, and affordable strategy. This approach can support patients' emotional preparedness for surgery and promote holistic nursing care.

REFERENCES

- Abdalrahim, A. (2023). Enhancing empathy in nursing education: A feasibility and usability study of virtual reality-based training for dementia care. *Jordan Journal of Nursing Research*, 2(4), 1-9. <https://doi.org/10.14525/JJNR.v2i4.04>
- Ahmadinia, A., Babamohamadi, H., Ghods, A.A., Ghorbani, R., Ameri, M., & Asgari, M.R. (2025). Comparison of Jacobson's and Benson's relaxation techniques on pre-angiography anxiety: A randomized clinical trial. *Journal of Nursing and Midwifery Sciences*, 12(3). <https://doi.org/10.5812/jnms-161209>
- Alhusamiah, B., Aldiqs, M., & Zeilani, R.S. (2024). Application of Roy adaptation model: Using artificial intelligence-driven immersive virtual reality as a novel technology for cancer pain management among patients with advanced breast cancer. *Jordan Journal of Nursing Research*, 3(4). <https://doi.org/10.14525/JJNR.v3i4.03>
- Awed, H., Mahmoud, F.Z., Essawi, R.I., & Khalil, A.K. (2025). Effect of virtual reality versus effleurage massage on shoulder pain, anxiety, and satisfaction of women undergoing gynecological laparoscopic operation. *Assiut Scientific Nursing Journal*, 13(50). <https://doi.org/10.21608/asnj.2025.357543.2008>
- Chiu, P.L., Li, H., Yap, K. Y.-L., Lam, K.C., Yip, P.R., & Wong, C.L. (2023). Virtual reality-based intervention

Limitations

Certain limitations need to be considered when interpreting the findings of this study. The modest sample size and recruitment from a single hospital may restrict the degree to which these results can be applied to different clinical environments or patient populations. Second, the quasi-experimental design without full randomization may have introduced selection bias. Third, anxiety was measured using a self-report instrument, which may be influenced by individual perception and response bias. In addition, the study evaluated only short-term effects immediately after the intervention, so the long-term impact of the combined therapy on postoperative outcomes remains unclear. Future studies with larger participant groups, randomized controlled designs, and extended follow-up periods are recommended to strengthen the evidence base.

Conflict of Interests

The authors confirm that no financial or personal relationships influenced the conduct of this research.

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Author Contributions

Study Design: **FJ, SS**. Data Collection: **FJ**. Data Analysis: **FJ, SS, DCR**. Study Supervision: **SS, DCR, RW**. Manuscript Writing: **DCR**. Critical Revision for Important Intellectual Content: **SS, DCR, RW**.

- to reduce preoperative anxiety in adults undergoing elective surgery. *JAMA Network Open*, 6(10), e2340588. <https://doi.org/10.1001/jamanetworkopen.2023.40588>
- Eberhart, L., Aust, H., Schuster, M., Sturm, T., Gehling, M., Euteneuer, F., & Rüscher, D. (2020). Preoperative anxiety in adults: A cross-sectional study on specific fears and risk factors. *BMC Psychiatry*, 20(1), 140. <https://doi.org/10.1186/s12888-020-02552-w>
- Ebraheim, M., & Ibrahim, Z. (2022). Effect of Benson relaxation technique on pain, vital signs, sleep quality and anxiety among patients after spinal surgery. *Egyptian Journal of Health Care*, 13(1). <https://doi.org/10.21608/ejhc.2022.326039>
- Gao, Y., Wang, N., & Liu, N. (2023). Effectiveness of virtual reality in reducing preoperative anxiety in adults: A systematic review and meta-analysis. *Journal of Advanced Nursing*, 79(10), 3678-3690. <https://doi.org/10.1111/jan.15743>
- Golchoubi, A., Miri, K., Vagheei, S., Hajiabadi, F., Kahrom, M., & Behnam Vashani, H.R. (2024). Evaluating the impact of Benson's relaxation technique on anxiety and delirium among coronary artery bypass graft surgery patients. *Journal of Cardiothoracic Surgery*, 19(1), 657. <https://doi.org/10.1186/s13019-024-03186-9>
- López-Rodrigo, N., Moll-Bertó, A., Montoro-Pérez, N., Montejano-Lozoya, R., Mármol-López, M.I., & Alós-Maldonado, R. (2025). Nonpharmacological interventions to reduce anxiety in paediatric preoperative settings: An updated umbrella review and meta-analysis. *Journal for Specialists in Pediatric Nursing*, 30(3). <https://doi.org/10.1111/jspn.70009>
- Maghalian, M., Mohammad-Alizadeh-Charandabi, S., Ranjbar, M., Alamdary, F.A., & Mirghafourvand, M. (2024). Informational video on preoperative anxiety and postoperative satisfaction prior to elective cesarean delivery: A systematic review and meta-analysis. *BMC Psychology*, 12(1), 6. <https://doi.org/10.1186/s40359-023-01499-3>
- Moerman, N., van Dam, F.S.A.M., Muller, M.J., & Oosting, H. (1996). The Amsterdam Preoperative Anxiety and Information Scale (APAIS). *Anesthesia & Analgesia*, 82(3), 445-451. <https://doi.org/10.1097/0000539-199603000-00002>
- Nouri, S., Hanifi, N., & Ramezani-Badr, F. (2025). The effect of combined rhythmic breathing and aromatherapy on pain intensity and anxiety in patients with unstable angina. *Contemporary Clinical Trials Communications*, 48, 101575. <https://doi.org/10.1016/j.conctc.2025.101575>
- Parsons, D., Gardner, P., Parry, S., & Smart, S. (2022). Mindfulness-based approaches for managing stress, anxiety and depression for health students in tertiary education: A scoping review. *Mindfulness*, 13(1), 1-16. <https://doi.org/10.1007/s12671-021-01740-3>
- Razavinasab, S.A., Zeidabadi, B., Sadegh, R., Nosratabadi, I., Abolghaseminejad, P., & Amiri, M.M. (2025). Efficacy of relaxation techniques in reducing preoperative anxiety and fear in general surgery patients: A quasi-experimental study. *Journal of Integrative Nursing*, 7(4), 211-218. https://doi.org/10.4103/jin.jin_81_25
- Rochmawati, D.H., Huda, A.N., Kuncoro, J., & Setyowati, W.E. (2021). Family psychoeducation (FPE) therapy for family anxiety in caring for family members with mental disorders. *Enfermería Clínica*, 31, S165-S169. <https://doi.org/10.1016/j.enfcli.2020.12.015>
- Tola, Y.O., Chowm K.M., & Liang, W. (2021). Effects of non-pharmacological interventions on preoperative anxiety and postoperative pain in patients undergoing breast cancer surgery: A systematic review. *Journal of Clinical Nursing*, 30(23-24), 3369-3384. <https://doi.org/10.1111/jocn.15827>
- Torné-Ruiz, A., Reguant, M., & Roca, J. (2023). Mindfulness for stress and anxiety management in nursing students in a clinical simulation: A quasi-experimental study. *Nurse Education in Practice*, 66, 103533. <https://doi.org/10.1016/j.nepr.2022.103533>