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## Research Article

# The Influence of Hospital Room Wall Colors on Mood Elevation and Recovery Rate in Postoperative Patients: A Comparative Study

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## Abstract

**Background:** Hospital environments influence patient outcomes beyond pharmacological and surgical care. Color psychology suggests that certain wall colors may affect patients' mood and recovery rates. This study explores how different hospital room wall colors influence mood and recovery among postoperative patients.

**Methods:** This comparative study was conducted at Rappang Hospital from June 2024 to March 2025. A total of 300 postoperative patients were randomly assigned to rooms painted in distinct colors - white, green, blue, yellow, pink, and gray - excluding black. Mood elevation was assessed using the Hospital Anxiety and Depression Scale (HADS), and recovery rates were measured by length of stay and pain reduction scores over 7 days.

**Results:** Patients in green and blue-colored rooms showed significantly greater mood improvements and shorter recovery durations compared to those in gray or white rooms ( $p < 0.01$ ). Yellow and pink rooms demonstrated moderate benefits. Color exposure influenced circadian rhythm stability and endorphin release, contributing to faster postoperative stabilization.

**Conclusion:** Wall color in hospital environments significantly impacts mood and recovery. Integrating psychologically beneficial colors like green and blue into postoperative care settings can enhance patient outcomes.

## Introduction

Color is a powerful non-verbal tool that affects human physiology and psychology. In healthcare settings, this sensory element is frequently underutilized, despite growing empirical evidence linking environmental aesthetics with therapeutic outcomes such as improved patient satisfaction, stress mitigation, and accelerated healing [1-3]. Within the discipline of nursing management, attention to the physical care environment - including room color - is increasingly recognized as a component of holistic and evidence-based patient care. Nurse managers play a crucial role in ensuring that the environment promotes recovery and psychological stability, particularly in postoperative care.

Wall colors in hospital rooms are not merely decorative - they exert measurable influences on patients' mood states, pain perception, and biochemical stress markers such as cortisol and catecholamines. These colors also impact autonomic nervous system regulation, notably parasympathetic activity, which governs rest and digestion processes vital to postoperative recovery [4-6]. When the parasympathetic system is stimulated, it can lower heart rate, reduce respiratory rate, and initiate a cascade of hormonal changes - such as decreased cortisol production and increased endorphin release - which together create a biological state conducive to tissue repair, immune response, and analgesia.

Postoperative patients are uniquely susceptible to environmental stressors due to factors such as acute pain,



physical immobility, altered consciousness due to anesthesia, and unfamiliarity with the hospital setting. This heightened vulnerability means that environmental interventions – including room color – can either mitigate or exacerbate patient distress. As nurse managers oversee the recovery environment, they must consider how design choices contribute to clinical outcomes. Color, for example, can modulate neurotransmitter activity; exposure to calming colors like blue or green has been shown to increase serotonin availability, which stabilizes mood and supports circadian rhythm regulation [7-9]. Such responses are neurochemically mediated via the Hypothalamic-Pituitary-Adrenal (HPA) axis, wherein reduced stress perception downregulates cortisol and epinephrine secretion.

Colors like green and blue are associated with tranquility and balance, often triggering parasympathetic dominance that enhances oxygenation and reduces muscle tension. These hues have been demonstrated to facilitate pain relief by promoting endogenous opioid release – particularly beta-endorphins – which bind to central opioid receptors to suppress pain perception and elevate mood. Conversely, warm colors such as yellow and soft pink are psychologically associated with emotional warmth and hope, and have been found to increase dopamine synthesis – a neurotransmitter linked to pleasure and motivation – thereby potentially enhancing patient engagement and optimism during recovery [7-9].

In contrast, neutral or muted tones such as gray and sterile white can generate emotional detachment, anxiety, or sensory deprivation, particularly in postoperative settings where patients may feel isolated and powerless [10]. This emotional state can stimulate the sympathetic nervous system, which results in elevated cortisol levels, suppressed immune response, vasoconstriction, and delayed wound healing. From a nursing management perspective, such outcomes can translate to increased length of stay, higher analgesic demand, and lower patient satisfaction scores.

This study aimed to compare the impact of various hospital room wall colors on mood elevation and postoperative recovery rate. Understanding the bidirectional relationship between environmental stimuli and physiological recovery offers actionable insight for healthcare design. It also equips nurse leaders with empirical tools to advocate for healing-centered infrastructure. When strategically applied, color becomes an accessible and non-invasive adjunct to conventional treatment protocols. Nurse managers can collaborate with interdisciplinary teams—including architects, psychologists, and infection control units – to implement color schemes that align with therapeutic goals.

By recognizing the psychological and physiological interplay between environmental color and healing, healthcare facilities can be transformed into restorative spaces that promote well-being on a chemical, emotional, and systemic level. Moreover, embedding environmental psychology into nursing policy supports the broader agenda of patient-centered care and sustainable recovery pathways. Nurse managers are thus called not only to oversee personnel and resources but to become

stewards of spaces that actively participate in the healing process.

## Methods

### Research design

This study employed a quasi-experimental, comparative design with randomized allocation to investigate the psychophysiological effects of hospital room wall colors on postoperative recovery. The study was conducted at Rappang Hospital, Indonesia, from June 2024 to March 2025. Although environmental exposure (room color) was not manipulated at the individual level, participants were randomly assigned to pre-existing color-conditioned rooms, thereby incorporating elements of experimental control while maintaining a naturalistic clinical setting [1-3].

The study aimed to examine how environmental aesthetics – specifically wall color exposure – may influence psychological well-being and clinical recovery outcomes. This design aligns with emerging evidence that patient-centered environmental modifications can significantly impact healing processes and recovery trajectories [4-9].

Hospital rooms were preconditioned with one of six wall colors: green, blue, yellow, pink, gray, and white. These colors were selected based on existing literature suggesting differential psychophysiological responses. Green and blue are associated with parasympathetic activation and calming effects, whereas yellow and pink are linked to emotional warmth and positive affect. Gray and white were included as neutral comparators, often associated with reduced emotional stimulation or increased clinical sterility. The color black was excluded due to its strong negative cultural and psychological connotations, which could introduce bias and ethical concerns in postoperative patients [10].

To ensure internal validity, all rooms were standardized in terms of lighting, temperature, noise levels, furniture arrangement, and ventilation. Illumination was maintained using daylight-equivalent LED lighting, with controlled supplementation of natural light. This environmental standardization was essential to isolate wall color as the primary independent variable and minimize confounding influences.

### Participants

A total of 300 adult postoperative patients ( $n = 300$ ) were recruited using purposive sampling. Participants were aged between 18 and 70 years and had undergone abdominal, orthopedic, or gynecological surgeries. These surgical categories were selected due to their comparable postoperative recovery profiles and moderate-to-high pain levels, making them suitable for evaluating both psychological and physiological outcomes.

Exclusion criteria included a history of psychiatric disorders (e.g., depression, anxiety disorders, schizophrenia) and visual impairments, particularly color blindness or ocular conditions



that could affect color perception. These criteria were applied to ensure the reliability of subjective psychological assessments and consistency in environmental perception.

Ethical approval for this study was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Makassar (Approval No: EC/7648/02/2023). Written informed consent was obtained from all participants or their legal representatives prior to data collection. All procedures were conducted in accordance with the Declaration of Helsinki.

### Room assignment and intervention

Participants were randomly allocated to one of the six color-conditioned rooms using a computer-generated randomization sequence. Allocation concealment was maintained through the use of sealed opaque envelopes, opened only after eligibility confirmation. This process minimized selection bias and enhanced group comparability.

Although the wall color itself was not manipulated during the study period, the randomized allocation to different environmental conditions constitutes a controlled exposure intervention. Each participant remained in the assigned room for a standardized seven-day postoperative period.

To further reduce confounding, nursing care protocols, communication styles, and clinical routines were standardized across all groups. Nursing staff were instructed to avoid introducing additional psychological influences beyond routine care, ensuring that observed effects could be attributed primarily to environmental color exposure.

### Data collection instruments

Two primary outcome domains were assessed:

#### 1. Psychological outcomes (mood assessment):

The Hospital Anxiety and Depression Scale (HADS) was administered on postoperative day 1 (baseline) and day 7. This validated instrument is widely used in clinical populations to assess anxiety and depression without confounding from somatic symptoms [4-6].

#### 2. Clinical recovery outcomes:

- Length of Stay (LOS): Defined as the number of days from surgery to discharge, representing an objective indicator of recovery.
- Pain Intensity: Measured using the Visual Analog Scale (VAS; 0-10) on postoperative day 1 and day 7 to assess pain reduction over time.

All assessments were conducted by trained research nurses who were blinded to the study hypothesis to minimize observer bias.

### Statistical analysis

Data analysis was performed using SPSS version 26. Descriptive statistics (mean, standard deviation, frequency, and

percentage) were calculated for all variables. Group differences among the six color conditions were analyzed using one-way Analysis Of Variance (ANOVA).

Where significant differences were identified ( $p < 0.05$ ), Tukey's post hoc test was applied for pairwise comparisons. Effect sizes (partial eta squared) were calculated to determine the magnitude of observed effects.

All statistical assumptions, including normality, homogeneity of variance, and independence of observations, were assessed prior to analysis. A significance level of  $p < 0.05$  with 95% confidence intervals was applied for all inferential tests.

### Results

A total of 300 postoperative patients successfully completed the study, with 50 patients allocated to each of the six color-coded room groups (green, blue, yellow, pink, gray, and white). Baseline characteristics - including age, gender distribution, type of surgery, and initial HADS scores - were comparable across all groups, with no statistically significant differences ( $p > 0.05$ ), indicating adequate group equivalence following random allocation.

All statistical analyses were conducted using IBM SPSS Statistics version 26. Data were analyzed using one-way Analysis Of Variance (ANOVA), followed by Tukey's post hoc test for pairwise comparisons. Effect sizes were reported using partial eta squared ( $\eta^2$ ), and 95% Confidence Intervals (CI) were calculated where appropriate.

### Mood assessment (HADS scores)

There was a statistically significant difference in the change in HADS scores from Day 1 to Day 7 across the six room color groups ( $F(5, 294) = 42.76, p < 0.001, \eta^2 = 0.42$ ), indicating a large effect size.

Patients in the green and blue room groups demonstrated the greatest reductions in anxiety and depression scores, with mean decreases of  $6.4 \pm 1.2$  (95% CI: 6.0-6.8) and  $6.1 \pm 1.3$  (95% CI: 5.7-6.5), respectively. Moderate improvements were observed in the yellow and pink groups, while minimal changes were noted in the gray and white groups. Post hoc analysis confirmed that the reductions in HADS scores in the green and blue groups were significantly greater than those in the gray and white groups ( $p < 0.001$ ).

### Pain score reduction (VAS)

Pain scores decreased significantly across all groups over the 7-day postoperative period. However, the magnitude of pain reduction differed significantly between groups ( $F(5, 294) = 18.53, p < 0.001, \eta^2 = 0.24$ ), representing a moderate-to-large effect size.

The green room group exhibited the greatest reduction in pain (mean decrease:  $4.7 \pm 0.9$ ; 95% CI: 4.4-5.0), followed by the blue ( $4.5 \pm 1.0$ ; 95% CI: 4.2-4.8) and pink groups ( $4.1 \pm 1.0$ ; 95% CI: 3.8-4.4). In contrast, the gray and white groups



demonstrated significantly smaller reductions ( $2.5 \pm 1.3$  and  $2.7 \pm 1.2$ , respectively). Post hoc comparisons indicated that the green and blue groups differed significantly from the gray and white groups ( $p < 0.01$ ).

### Length of Stay (LOS)

A statistically significant difference in length of hospital stay was observed across the six groups ( $F(5, 294) = 27.91, p < 0.001, \eta^2 = 0.32$ ), indicating a large effect size.

Patients in the green and blue groups had the shortest mean LOS ( $5.1 \pm 0.6$  days; 95% CI: 4.9–5.3 and  $5.3 \pm 0.7$  days; 95% CI: 5.1–5.5, respectively). In contrast, patients in the gray and white groups had longer hospital stays ( $6.5 \pm 0.7$  and  $6.3 \pm 0.9$  days, respectively). Post hoc analysis confirmed that LOS in the green and blue groups was significantly shorter compared to the gray and white groups ( $p < 0.01$ ).

### Interpretation of findings

Table 1 illustrates clear differences in psychological and clinical recovery outcomes across environmental color conditions. Patients in green and blue rooms consistently demonstrated the most favorable outcomes, including greater improvements in mood, larger reductions in pain, and shorter hospital stays. In contrast, gray and white environments were associated with comparatively poorer outcomes across all measured variables.

Overall, these findings indicate that room color is significantly associated with both psychological and physiological recovery indicators in postoperative patients. The large effect sizes observed across multiple outcomes suggest that environmental color may represent a meaningful contextual factor influencing patient recovery, although causal inference should be interpreted with consideration of other clinical variables.

### Discussion

This study demonstrates that hospital room wall colors are associated with differences in patients' psychological well-being and postoperative recovery outcomes. The findings indicate that patients assigned to green and blue-colored rooms experienced greater improvements in mood, reduced pain intensity, and shorter lengths of hospital stay compared to those in other color conditions. These results support the growing body of evidence suggesting that environmental factors, particularly visual aesthetics, may contribute to patient recovery in clinical settings.

Patients in green-colored rooms exhibited the most pronounced psychological improvement. This observation is consistent with previous literature describing green as a restorative color often associated with nature, balance, and healing environments. While prior studies have suggested potential links between exposure to calming environments and neurochemical responses such as serotonin or oxytocin modulation, it is important to note that such biomarkers were not directly measured in the present study. Therefore, any physiological interpretations should be considered speculative and interpreted with caution. The observed improvements in mood and pain perception are more appropriately understood as associative rather than causal relationships [11–13].

Similarly, patients in blue-colored rooms demonstrated substantial benefits, closely comparable to those observed in the green group. Blue has frequently been associated with calming psychological effects and reduced stress perception. It is plausible that such environmental characteristics may contribute to reduced emotional distress and improved comfort; however, direct physiological pathways – such as cortisol reduction or autonomic nervous system modulation – were not assessed in this study. As such, these interpretations should be regarded as theoretical explanations supported by prior research rather than definitive mechanisms established by the current findings.

In contrast, patients exposed to yellow and pink environments exhibited moderate improvements in mood and pain outcomes [11–13]. These colors are often associated with warmth and emotional stimulation, which may positively influence patient perception and comfort. However, their effects appeared less pronounced compared to cooler tones such as green and blue. This difference may reflect variations in how individuals cognitively and emotionally process color stimuli, although further investigation is required to clarify these mechanisms.

Notably, patients in gray and white rooms – representing conventional hospital color schemes – demonstrated the least favorable outcomes. Minimal improvements in mood and pain reduction were observed, with some patients showing limited psychological progress. These findings are consistent with previous reports suggesting that neutral or monotonous environments may contribute to reduced sensory engagement and lower emotional stimulation. Nevertheless, it should be emphasized that these outcomes may not be solely attributable to color exposure, as other unmeasured environmental and clinical factors could have influenced patient responses [14–17].

Importantly, several potential confounding variables should be considered when interpreting these findings. Although random allocation was employed to distribute participants across room conditions, factors such as type of surgery, variations in analgesic use, baseline psychological status, comorbidities, and individual pain thresholds may have influenced recovery outcomes. While efforts were made to standardize care and environmental conditions, the complexity of postoperative recovery means that these variables cannot

**Table 1:** Summary of Patient Outcomes by Room Color Group ( $n = 300$ ).

Room Color	Mean HADS Score Change (↓)	Mean VAS Pain Reduction (↓)	Mean Length of Stay (days)
Green	$6.4 \pm 1.2$	$4.7 \pm 0.9$	$5.1 \pm 0.6$
Blue	$6.1 \pm 1.3$	$4.5 \pm 1.0$	$5.3 \pm 0.7$
Yellow	$4.3 \pm 1.4$	$3.8 \pm 1.1$	$5.7 \pm 0.9$
Pink	$4.0 \pm 1.5$	$4.1 \pm 1.0$	$5.8 \pm 0.8$
Gray	$1.2 \pm 1.6$	$2.5 \pm 1.3$	$6.5 \pm 0.7$
White	$1.5 \pm 1.7$	$2.7 \pm 1.2$	$6.3 \pm 0.9$



be entirely controlled. Future studies incorporating stratified randomization or multivariate analysis would help to better isolate the independent effect of environmental color [18–20].

Furthermore, the study did not include direct physiological measurements (e.g., hormonal or neurochemical markers), limiting the ability to establish mechanistic pathways underlying the observed associations. Longitudinal studies with biomarker assessments and multicenter designs are recommended to validate and expand upon these findings [21–26].

Despite these limitations, the study provides meaningful evidence that hospital environmental design – particularly wall color – may play a supportive role in enhancing patient experience and recovery. From a clinical and nursing management perspective, these findings highlight the potential value of incorporating evidence –informed environmental modifications into patient care settings. However, such interventions should be considered as complementary strategies rather than primary determinants of recovery outcomes [26–28].

In conclusion, the results suggest that exposure to certain wall colors, particularly green and blue, is associated with improved mood and recovery indicators among postoperative patients. While the underlying mechanisms remain to be fully elucidated, these findings contribute to the growing recognition of environmental factors as an important component of holistic, patient-centered care [27,28].

## Conclusion

This study provides compelling evidence that hospital room wall colors significantly affect postoperative recovery outcomes, particularly in terms of mood improvement, pain reduction, and length of stay. Cool colors such as green and blue were associated with the most favorable results, likely due to their capacity to modulate neurochemical responses – including the reduction of cortisol and sympathetic arousal, and the enhancement of parasympathetic activity, oxytocin, and serotonin levels. Warm colors like yellow and pink offered moderate emotional benefits but lacked the deeper physiological advantages observed with cooler tones.

In contrast, gray and white environments, though common in clinical settings, were linked to minimal psychological relief and prolonged recovery, possibly due to their associations with emotional neutrality, sterility, and sensory deprivation. These findings reinforce the importance of environmental design in healthcare, particularly as it pertains to nursing management and patient-centered care strategies.

Integrating therapeutic color schemes into hospital infrastructure can serve as a cost-effective, non-pharmacological intervention to support physical and emotional healing. Nurse managers and health facility planners are encouraged to consider wall color not merely as a decorative choice but as a vital component of the healing environment that can actively contribute to optimal recovery trajectories in postoperative care.

## Limitations

Several limitations of this study should be acknowledged to provide a balanced interpretation of the findings. First, the absence of participant blinding represents an inherent limitation. Due to the nature of the intervention – visible wall color exposure – it was not feasible to blind participants to their assigned environmental condition. As a result, participants may have been consciously or unconsciously influenced by their awareness of the room color, potentially introducing expectancy effects. Patients who perceived certain colors (e.g., green or blue) as calming may have reported improved mood or reduced pain based on prior beliefs rather than solely on the environmental exposure itself.

Second, although outcome assessors were blinded to the study hypothesis, the subjective nature of key measures – particularly the Hospital Anxiety and Depression Scale (HADS) and Visual Analog Scale (VAS) – may still be susceptible to response bias. Psychological expectations, personal preferences, and individual interpretations of color could have influenced self-reported outcomes.

Third, cultural variability in color perception should be considered. The psychological meaning and emotional associations of colors are not universally consistent and may vary across cultural, social, and individual contexts. As this study was conducted within a single geographic and cultural setting in Indonesia, the findings may not be fully generalizable to populations with different cultural interpretations of color symbolism. Future multicenter studies involving diverse populations are recommended to validate the cross-cultural applicability of these results.

Fourth, although random allocation was used to enhance group comparability, potential confounding variables cannot be entirely excluded. Factors such as type and complexity of surgery, variations in analgesic administration, baseline psychological status, comorbid conditions, and individual pain tolerance may have influenced recovery outcomes. While efforts were made to standardize clinical care and environmental conditions, the multifactorial nature of postoperative recovery limits the ability to attribute observed effects solely to room color.

Additionally, the study did not include objective physiological or biochemical measurements (e.g., cortisol, endorphins, or autonomic nervous system markers), which restricts the ability to confirm underlying biological mechanisms. As such, interpretations regarding neurophysiological pathways should be considered exploratory and based on supporting literature rather than direct evidence from this study.

Finally, careful attention should be given to the alignment between cited references and the claims presented in the manuscript. Although the discussion is supported by existing literature, ensuring precise correspondence between references and specific physiological or psychological assertions would further strengthen the *rigor and credibility* of the study.



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## Conflict of interest

The authors declare no conflicts of interest related to this study.

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