International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

The Relationship between Physical Environment, Air Quality and Noise to Patient Comfort Levels in the Standard Inpatient Class (KRIS) of RS X Kudus

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Abstract

This study is motivated by the importance of the physical environment of the hospital in supporting patient comfort and recovery, especially in the Standard Inpatient Classroom which has a high occupancy rate. This study aims to analyze the relationship between the physical environment, air quality, and noise on the level of patient comfort. The study used a quantitative approach with a cross-sectional design. The population was all inpatients of KRIS Hospital X Kudus in 2025 totaling 11,480 patients, with a sample of 99 respondents selected through purposive sampling. The research instrument was a Likert scale questionnaire that had been tested for validity and reliability, while data analysis used univariate and bivariate tests with Chi-Square. The results showed that the physical environment (p = 0.018), air quality (p <0.001), and noise (p = 0.001) had a significant relationship with the level of patient comfort, where air quality was the most dominant factor. The conclusion of this study is that improving the quality of the physical environment in an integrated manner, especially ventilation management and noise control, is very important to improve patient comfort and support the healing process in the inpatient room.

Keywords:Air Quality, Hospital Environment, Inpatient Care, Noise, Patient Comfort

INTRODUCTION

In the post-pandemic era of globalization, the healthcare sector is undergoing significant transformation driven by advances in science and technology, thereby improving the quality of services both qualitatively and quantitatively (Farid & Rahmawati,

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2025). Globally, the World Health Organization (WHO) emphasizes the importance of holistic patient-centered care, encompassing physical, psychological, and environmental aspects to support optimal recovery (WHO, 2020, cited in Agusta et al., 2024). At the national level, Indonesia continues to strengthen healthcare development through regulations such as Law Number 44 of 2009 concerning Hospitals and Minister of Health Regulation Number 129 of 2008 concerning Minimum Service Standards, which target safe and comfortable service quality (Farid et al., 2021). Recent trends show an increase in the Public Satisfaction Index (PSI) in public hospitals, reflecting the scientific relevance of this topic in healthcare management and its practical implications for public policy.

Narrowing the context to regional hospitals (RSUD) in Indonesia, such as RS X Kudus, reveals the dynamics of fluctuating inpatient service utilization, from 22,207 patients in 2015 to 19,574 in 2017, influenced by environmental comfort factors (Faridah et al., 2021). This historical data aligns with the achievement of the IKM of 78.42%, which is categorized as good, although ongoing evaluation of nursing and communication services is still needed (Farid et al., 2021). Field phenomena in standard class inpatient rooms (KRIS) show challenges such as high occupancy rates and dynamic activity, which have the potential to disrupt patient comfort due to variations in temperature, lighting, and noise (Agusta et al., 2024). This emphasizes the urgency of managing the physical environment to support overall service quality.

Previous research has explored the influence of the physical environment on patient satisfaction, finding that servicescape features such as lighting and room design significantly influence perceived comfort (NKAT Dewi & Arini, 2019, cited in Wachidyantari & Setiawardani, 2022). Similar studies have shown that good air quality and ventilation reduce the risk of indoor pollution, which is more harmful than outdoor pollution according to the WHO (Tiaraningrum et al., 2022; Purwaningrum, 2024). Meanwhile, noise has been identified as a major stressor that disrupts sleep and recovery, as per the standards of Minister of Health Regulation No. 7 of 2019 (Singkam, 2020).

However, research findings show inconsistencies; for example, NKAT Dewi and Arini (2019) found a significant influence of the physical environment and services on satisfaction, but did not specifically identify air quality or noise. Sode Ali et al. (2024) confirmed the role of healthscape on inpatient satisfaction, while Manurung et al. (2024) highlighted general environmental stressors without detailing variables such as internal noise. Muttaqin and Jj's (2021) study was limited to external traffic noise, while Siwi et al.'s (2017) focused on outpatient care, neglecting the high-density context of KRIS (Farid, 2022).

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This limitation creates a clear research gap: there has been no integrated study that simultaneously examines the physical environment, air quality, and noise on patient comfort in the KRIS room of RS X Kudus, especially with an empirical approach at high occupancy (Kolcaba, 1994, cited in S. Dewi & Rustam, 2024). The problem statement of this research is: to what extent do these three factors relate to the level of patient comfort in the Standard Inpatient Class (KRIS) of RS X Kudus, considering that the Minister of Health's standards have not been fully realized in the field?

This study aims to analyze the relationship between the physical environment, air quality, and noise on patient comfort at KRIS Hospital X Kudus, with specific objectives for each variable. The urgency lies in the positive IKM trend that requires empirical support for quality optimization, while its novelty is the simultaneous integration of three factors in the KRIS context—which has not been previously explored—thus providing theoretical contributions to servicescape theory (Bitner, 1992, cited in Wachidyantari & Setiawardani, 2022) and practical recommendations for ventilation management and noise control for hospital management (Farid, 2022; Efri et al., 2025).

RESEARCH METHODS

This quantitative study uses an associative approach, aiming to examine the relationship between independent variables, namely the physical environment (X1), air quality (X2), and noise (X3), and the dependent variable, namely patient comfort level (Y) in the Standard Inpatient Class (KRIS) at X Kudus Hospital. The quantitative approach was chosen because it allows objective numerical measurements and generalization of results through inferential statistical analysis, as recommended for studies of variable relationships in the health context (Creswell & Creswell, 2023). The study design is cross-sectional, where data is collected over a single time period to capture contemporary patient perceptions, in line with standard practices in hospital service management (Sugiyono, 2021). The study location focused on X Kudus Hospital, as a major referral hospital with a high KRIS occupancy rate, making it representative for analyzing the dynamics of the physical environment (Farid et al., 2021).

The study population included all inpatients at KRIS Hospital X Kudus throughout 2025, totaling 11,480 people based on Medical Record data, selected because it was relevant to the issue of environmental comfort due to overcrowding (Sugiyono, 2021). The sample was drawn using the Slovin formula with a 5 percent error rate, resulting in , rounded to 99 people to ensure representativeness (Emzir, 2021). A purposive sampling technique was applied with inclusion criteria: patients admitted for at least 48 hours,

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conscious enough to complete the questionnaire (or accompanied by family), and willing to participate; while exclusion criteria included critical patients or incomplete data (Sudaryono, 2022). This approach ensures the sample accurately represents the population, avoiding selection bias in observational health studies (Creswell & Creswell, 2023).$n = \frac{11.480}{1+11.480(0,1)} n = \frac{11.480}{1+114,8} n = \frac{11.480}{115,8} n = 99,13$

The main instrument is a Likert-based questionnaire with a 1–5 scale (1=strongly disagree to 5=strongly agree), which measures the following variables operationally: comfort (Y) through indicators of cleanliness, room temperature, and safety (adapted by Septianingrum & Martini, 2023, based on Kolcaba, 1994 via S. Dewi & Rustam, 2024); physical environment (X1) via service environment, air quality, noise, movement space, and cleanliness (adapted by Ranayudha, 2020 from Sedarmayanti, 2021 and Bitner, 1992 via Wachidyantari & Setiawardani, 2022); air quality (X2) via circulation, temperature-humidity, and cleanliness (adapted by Sumikoon, 2019); and noise (X3) via psychological, communication, and physiological disturbances (adapted by Kholik & Krishna, 2012 via Singkam, 2020). Data collection was conducted both in-person and online via Google Forms with the assistance of hospital staff, ensuring efficiency and accessibility for respondents (Sugiyono, 2021). Instrument validity was tested using Pearson correlation (calculated r > table r or p < 0.05), while reliability was assessed using Cronbach's Alpha (> 0.70), following standard procedures for ordinal observation scales (Emzir, 2021; Machali, 2021).

The research procedure followed sequential stages: preparation (instrument development and ethics), data collection (questionnaire distribution over 1–2 months), processing (data cleaning and instrument testing), and analysis and interpretation. Univariate analysis described the frequency distribution and percentage of each variable for respondent characteristics and environmental conditions; bivariate analysis used the Chi-Square test for inter-variable relationships (p < 0.05 significant), adjusted for a categorical scale (good/bad) (Sudaryono, 2022). All analyses were conducted using SPSS version 26 software, ensuring statistical robustness in an associative design (Creswell & Creswell, 2023). This procedure aligns with health research ethics, including informed consent and data confidentiality, to support the validity of the results and practical contributions to KRIS management (Farid, 2022).

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DISCUSSION

Respondent Characteristics

Table 1. Distribution of Respondent Characteristics in X Hospital Kudus

Variables	Category	f	%
Gender	Man	43	43.4
	Woman	56	56.6
	Total	99	100.0
Age	< 20 years	12	12.1
	20–40 years	63	63.6
	> 40 years	24	24.2
	Total	99	100.0
Education	Elementary School (SD)	31	31.3
	Junior High School (SMP)	33	33.3
	Senior High School (SMA)	24	24.2
	Bachelor	11	11.1
	Total	99	100.0
Length of Treatment	< 3 days	26	26.3
	3–5 days	45	45.5
	> 5 days	28	28.3
	Total	99	100.0

Source: Researcher data processing, 2026

The majority of respondents at X Hospital in Kudus were women (56 people, 56.6%), which is related to their role in patient care. Most were aged 20–40 years (63 people, 63.6%), which is the productive age with optimal adaptation. The education level was dominated by junior high school (33 people, 33.3%) and elementary school (31 people, 31.3%). The length of stay was mostly 3–5 days (45 people, 45.5%), reflecting the need for adequate recovery.

Construct Validity Test

Table 2. Results of Construct Validity Test

No	r Table	Comfort (X1)	Physical Environment (X2)	Air Quality (X3)	Noise (Y)	Information
1	0.444	0.952	0.855	0.905	0.764	Valid
2	0.444	0.780	0.805	0.876	0.733	Valid
3	0.444	0.696	0.794	0.905	0.891	Valid
4	0.444	0.952	0.776	0.812	0.671	Valid

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5	0.444	0.952	0.889	0.850	0.737	Valid
6	0.444	0.846	0.900	0.892	0.929	Valid
7	0.444	0.789	0.823	0.874	0.958	Valid
8	0.444	0.952	0.889	0.868	0.764	Valid
9	0.444	0.920	0.882	0.861	0.891	Valid
10	0.444	0.696	0.785	—	—	Valid
11	0.444	0.952	0.784	—	—	Valid
12	0.444	0.920	0.893	—	—	Valid

Source: Researcher data processing results, 2025

Based on the results of the validity test with 20 respondents, the r table value was 0.444. The analysis results showed that all statement items in the Physical Environment variable (X_1), Air Quality (X_2), Noise (X_3), and Patient Comfort Level (Y) have a calculated r value greater than the table r and a significance value of $p < 0.05$. Thus, it can be concluded that all questions in this research questionnaire are valid and able to measure each of the variables studied accurately. Therefore, all questionnaire items are suitable for use as data collection instruments in this study.

Internal Consistency Test

Table 3. Test Results Internal Consistency

No	Variables	Number of Items	Cronbach's Alpha	Criteria	Information
1	Physical Environment (X_1)	12	0.970	≥ 0.70	Consistent
2	Air Quality (X_2)	12	0.958	≥ 0.70	Consistent
3	Noise (X_3)	9	0.957	≥ 0.70	Consistent
4	Comfort Level (Y)	9	0.938	≥ 0.70	Consistent

Source: Researcher data processing results, 2025

Based on the results of the reliability test using Cronbach's Alpha, all research variables showed a Cronbach's Alpha value greater than 0.70. This indicates that the questionnaire instrument for the Physical Environment variable (X_1), Air Quality (X_2),

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Noise (X_3), and Patient Comfort Level (Y) were declared reliable and suitable for use as data collection tools in this study.

Univariate Analysis

Table 4. Distribution of Respondents' Comfort Levels in X Hospital Kudus

Category	Amount (f)	Percentage (%)
Good	56	56.6
Bad	43	43.4
Total	99	100.0

Based on the table above, the distribution of respondents' comfort levels at X Hospital in Kudus shows that the majority of respondents had a good level of comfort, namely 56 people (56.6%). Meanwhile, respondents with a poor level of comfort numbered 43 people (43.4%). These results indicate that more than half of the respondents felt good comfort during their treatment at the hospital. However, there was still a fairly large proportion of respondents with a poor level of comfort, which indicates that there are aspects of the environment or services that need further attention and improvement to improve overall patient comfort.

Table 3. Distribution of Respondents' Answers regarding Comfort Level (Y)

No	Statement	1	2	3	4	5
1	I feel comfortable because the room is clean	0%	0%	16.2%	64.6%	19.2%
2	A clean environment makes me calmer	2.0%	0%	24.2%	52.5%	21.2%
3	Cleanliness of the room supports my recovery process	1.0%	0%	21.2%	63.6%	14.1%
4	The room temperature supports my comfort	1.0%	0%	22.2%	55.6%	21.2%
5	I feel the temperature of the treatment room is stable	3.0%	0%	21.2%	55.6%	20.2%

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6	Room temperature does not interfere with my activities	1.0%	0%	24.2%	53.5%	21.2%
7	I feel safe in this treatment room	1.0%	0%	17.2%	59.6%	22.2%
8	The security facilities in the treatment room are adequate.	0%	0%	17.2%	61.6%	21.2%
9	The ward environment makes me feel protected.	1.0%	0%	17.2%	64.6%	17.2%

Based on the questionnaire on the comfort level in the standard inpatient room at X Hospital Kudus, the majority of respondents agreed (64.6% in P1, 52.5% in P2, 63.6% in P3) or strongly agreed (19.2%–21.2%) regarding the cleanliness of the room that supports calm and recovery. In addition, respondents were satisfied with the stable and non-disturbing room temperature (55.6% agreed in P4–P5, 53.5% in P6; strongly agreed 20.2%–21.2%). Regarding the security aspect, most agreed (59.6% in P7, 61.6% in P8, 64.6% in P9) that the facilities were adequate and made them feel protected (strongly agree 17.2%–22.2%). Overall, respondents showed a high level of satisfaction with the cleanliness, temperature, and security of the room.

Table 4. Distribution of Respondents' Perceptions of the Physical Environment in X Hospital Kudus

Category	Amount (f)	Percentage (%)
Good	57	57.6
Bad	42	42.4
Total	99	100.0

Based on the table above, the distribution of respondents' perceptions of the physical environment at X Hospital in Kudus shows that the majority of respondents rated the physical environment as good, namely 57 people (57.6%). Meanwhile, respondents who rated the physical environment as poor were 42 people (42.4%). These results indicate that more than half of the respondents have a positive perception of the physical environmental conditions of the treatment room, such as cleanliness, lighting, spatial layout, and other supporting facilities. However, there is still a fairly large proportion of respondents who rate the physical environment as less than good, so this is an indication

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of the need to improve the quality of the hospital's physical environment to support patient comfort during treatment.

Table 5. Distribution of Respondents' Answers regarding Physical Environment Variables (X_1)

No	Statement	1	2	3	4	5
1	The treatment room has a layout that facilitates patient activities.	0%	0%	18.2%	65.7%	16.2%
2	The treatment room feels comfortable for resting.	0%	0%	22.2%	55.6%	22.2%
3	The treatment room environment supports the patient's recovery process.	2.0%	0%	22.2%	54.5%	21.2%
4	The air in the treatment room feels fresh and not stuffy.	2.0%	2.0%	18.2%	56.6%	23.2%
5	Air circulation in the room feels good	0%	0%	18.2%	64.6%	17.2%
6	The temperature of the treatment room feels comfortable	0%	0%	7.1%	70.7%	22.2%
7	The noise level in the treatment room does not disturb rest.	0%	0%	14.1%	67.7%	18.2%
8	Conversations or activities around you are not too noisy.	0%	0%	17.2%	65.7%	17.2%
9	The condition of the treatment room is quite calm and conducive	0%	0%	18.2%	61.6%	20.2%
10	The treatment room is always in clean condition	0%	0%	7.1%	68.7%	24.2%
11	The equipment and facilities in the treatment room look well maintained.	1.0%	0%	16.2%	56.6%	26.3%
12	The floor and room environment are kept clean	2.0%	0%	21.2%	54.5%	22.2%

Based on the distribution of respondents' answers regarding the Physical Environment variable (X_1) in the standard inpatient room at X Kudus Hospital, the majority stated they agreed (54.5%–70.7%) or strongly agree (16.2%–26.3%) on all questions, including layout that facilitates activities (65.7% agree, P1), comfort of rest (55.6%, P2),

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E-ISSN : 2964-0865
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recovery support (54.5%, P3), fresh air (56.6%–64.6%, P4–P5), comfortable temperature (70.7%, P6), low noise (61.6%–67.7%, P7–P9), and cleanliness and maintenance of facilities (54.5%–68.7%, P10–P12). Overall, respondents were satisfied with the physical environment conditions that were conducive to patient recovery.

Table 6. Distribution of Respondents' Air Quality Perceptions in X Hospital Kudus

Category	Amount (f)	Percentage (%)
Good	58	58.6
Bad	41	41.4
Total	99	100.0

Based on the table above, the distribution of respondents' perceptions of air quality at X Hospital in Kudus shows that the majority of respondents rated the air quality as good, namely 58 people (58.6%). Meanwhile, 41 respondents (41.4%) rated the air quality as poor.

Table 7. Distribution of Respondents' Answers regarding Air Quality (X_2)

No	Statement	1	2	3	4	5
1	Indoor air flows well	0%	0%	19.2%	59.6%	21.2%
2	I don't feel stuffy because the air flow is sufficient.	1.0%	0%	22.2%	59.6%	17.2%
3	Room ventilation works well	0%	0%	22.2%	57.6%	20.2%
4	The room temperature feels stable and not too hot/cold	2.0%	0%	22.2%	65.7%	10.1%
5	The humidity of the room feels comfortable	2.0%	0%	25.3%	52.5%	20.2%
6	The room temperature supports my comfort during treatment.	0%	0%	18.2%	65.7%	16.2%
7	The room air does not have a strong smell	0%	0%	13.1%	64.6%	22.2%
8	There is no disturbing dust in the room	0%	0%	26.3%	54.5%	19.2%
9	The air in the room feels clean	0%	0%	13.1%	68.7%	18.2%
10	The air quality in the room feels good	0%	0%	21.2%	58.6%	20.2%
11	The air in the room supports my health condition.	0%	0%	18.2%	56.6%	25.3%

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12	The air quality in the room makes me feel comfortable.	1.0%	0%	17.2%	59.6%	22.2%

Based on the distribution of respondents' answers to the Air Quality variable (X_2) in the standard inpatient classroom of X Kudus Hospital, the majority of respondents gave positive assessments on all indicators. Most respondents agreed to strongly agree that the air flow was good, ventilation was functioning optimally, the temperature and humidity of the room felt stable and comfortable, the air did not have a strong odor, there was minimal dust, and it felt clean. In addition, respondents also assessed that the air quality of the room supported comfort and health conditions during treatment.

Table 8. Distribution of Respondents' Noise Perception in X Hospital Kudus

Category	Amount (f)	Percentage (%)
Good	55	55.6
Bad	44	44.4
Total	99	100.0

Based on the table above, the distribution of respondents' perceptions of noise at X Hospital in Kudus shows that the majority of respondents rated the noise level as good, namely 55 people (55.6%). Meanwhile, respondents who rated the noise level as poor were 44 people (44.4%). These results indicate that more than half of the respondents felt that the noise level in the treatment room was quite controlled and did not significantly disrupt patient comfort during treatment. However, the proportion of respondents who rated the noise level as poor was still quite large, indicating the presence of sound sources that could potentially disturb patient peace, such as visitor activity, staff traffic, or sounds from the hospital's surrounding environment. Therefore, noise control efforts are needed to create a more conducive treatment room atmosphere and support the patient's recovery process.

Table 9. Distribution of Respondents' Answers regarding Noise (X_3)

No	Statement	1	2	3	4	5
1	The sounds in the ward did not bother me emotionally.	0%	0%	17.2%	69.7%	13.1%

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2	I feel calm even though there is activity around me.	1.0%	0%	10.1%	56.6%	32.3%
3	There is no sound that stresses me out	0%	0%	17.2%	66.7%	16.2%
4	There is no disturbing noise when communicating.	0%	0%	10.1%	62.6%	27.3%
5	I can hear the conversation clearly	0%	0%	10.1%	68.7%	21.2%
6	The atmosphere is calm enough to talk with the nurse/family.	0%	0%	18.2%	61.6%	20.2%
7	Noise doesn't make it difficult for me to sleep	1.0%	0%	14.1%	63.6%	21.2%
8	Noise does not affect my physical condition	0%	0%	12.1%	73.7%	14.1%
9	I don't feel tired or dizzy from the noise.	1.0%	0%	14.1%	65.7%	19.2%

Based on the distribution of respondents' answers regarding the Noise variable (X_3) in the standard inpatient room at X Kudus Hospital, the majority stated that they agreed (56.6%–73.7%) or strongly agree (13.1%–32.3%) on all questions, including sound does not disturb emotionally (69.7% agree, P1), remains calm despite activity (56.6%, P2), does not cause stress (66.7%, P3), clear communication without noise (62.6%–68.7%, P4–P5), a quiet atmosphere for talking (61.6%, P6), and does not interfere with sleep or physical condition (63.6%–73.7%, P7–P9). Overall, respondents assessed that noise was controlled and supported patient comfort.

Bivariate Analysis

1. **The Relationship Between Physical Environment and Patient Comfort Level**

Table 10. Relationship between the Physical Environment and the Level of Patient Comfort in the Standard Inpatient Class at X Kudus Hospital

Physical Environment	Comfort Level		Total	p-value
	Good	Bad		
Good	38 (66.7%)	19 (33.3%)	57 (100%)	0.018
Bad	18 (42.9%)	24 (57.1%)	42 (100%)	
Total	56 (56.6%)	43 (43.4%)	99 (100%)	

Based on the table above, the relationship between the physical environment and the level of patient comfort in the standard inpatient class of X Kudus Hospital shows that

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of the patients who were in a good physical environment, most felt comfortable, namely 38 people (66.7%), while those who felt uncomfortable were 19 people (33.3%). Meanwhile, in patients who were in a bad physical environment, most felt uncomfortable, namely 24 people (57.1%), and those who felt comfortable were 18 people (42.9%). The results of the statistical test using the Chi-Square test obtained a p-value = 0.018, which indicates that there is a statistically significant relationship between the physical environment and the level of patient comfort in class III of X Kudus Hospital.

2. **The Relationship Between Air Quality and Patient Comfort Levels**

Table 11. Relationship between Air Quality and Patient Comfort Level in the Standard Inpatient Class of X Kudus Hospital

Air Quality	Comfort Level		Total	p-value
	Good	Bad		
Good	42 (72.4%)	16 (27.6%)	58 (100%)	<0.001
Bad	14 (34.1%)	27 (65.9%)	41 (100%)	
Total	56 (56.6%)	43 (43.4%)	99 (100%)	

Based on Table 11, the relationship between air quality and the level of patient comfort in the standard inpatient class of X Kudus Hospital shows that of the patients who were in an environment with good air quality, most felt comfortable, namely 42 people (72.4%), while those who felt uncomfortable were 16 people (27.6%). Meanwhile, in patients who were in an environment with poor air quality, most felt uncomfortable, namely 27 people (65.9%), and those who felt comfortable were 14 people (34.1%). The results of the statistical test using the Chi-Square test obtained a p-value <0.001, which indicates that there is a statistically significant relationship between air quality and the level of patient comfort in class III of X Kudus Hospital.

3. **The Relationship Between Noise and Patient Comfort Levels**

Table 12. Relationship between Noise and Patient Comfort Level in the Standard Inpatient Class of X Kudus Hospital

Noise	Comfort Level		Total	p-value
	Good	Bad		
Good	39 (70.9%)	16 (29.1%)	55 (100%)	0.001

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Bad	17 (38.6%)	27 (61.4%)	44 (100%)	
Total	56 (56.6%)	43 (43.4%)	99 (100%)	

Based on Table 11, the relationship between noise and the level of patient comfort in the standard inpatient class of X Kudus Hospital shows that of the patients who were in an environment with good noise, most felt comfortable, namely 39 people (70.9%), while those who felt uncomfortable were 16 people (29.1%). Meanwhile, in patients who were in an environment with bad noise, most felt uncomfortable, namely 27 people (61.4%), and those who felt comfortable were 17 people (38.6%). The results of the statistical test using the Chi-Square test obtained a p-value = 0.001, which indicates that there is a statistically significant relationship between noise and the level of patient comfort in the standard inpatient class of X Kudus Hospital.

DISCUSSION

The Relationship between the Physical Environment and the Level of Patient Comfort in the Standard Inpatient Class of X Kudus Hospital

The Chi-Square test results showed a significant relationship (p=0.018) between the physical environment and patient comfort at X Kudus Hospital, in line with Busari & Henry (2025) who stated that physical aspects such as cleanliness, air, temperature, and noise contribute directly. A total of 57.6% of respondents rated the environment as good, supporting Kolcaba's (1994) Comfort Theory through relief, ease, and transcendence. This finding is supported by Sulastri & Indiani (2020), Pangestika et al. (2025), and Mamboh et al. (2025) with r=0.538 (p=0.001), emphasizing the optimization of facilities for holistic comfort.

The Relationship Between Air Quality and Patient Comfort Levels in the Standard Inpatient Class of X Kudus Hospital

The Chi-Square test yielded p<0.001, indicating a highly significant relationship between air quality and comfort, with 58.6% of respondents rating it as good, according to Tian (2023) and Saad Baqer et al. (2022). Air quality (IAQ) is influenced by ventilation, temperature, and humidity, preventing nosocomial infections according to Ningsih & Assagaf (2022) and Ayu & Posmaningsih (2022). Nightingale's Environmental Theory (1860) and Kolcaba's Comfort Theory, supported by WHO, emphasize fresh air for relief, ease, and transcendence for optimal recovery.

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The Relationship Between Noise and Patient Comfort Levels in the Standard Inpatient Class at X Kudus Hospital

The Chi-Square test showed p=0.001 (p<0.05), confirming a significant relationship between noise and comfort, where 55.6% of respondents rated it as good, in line with Busari & Henry (2022) and Pangestika et al. (2025). Noise from conversations disrupts sleep, stress, and communication, as per Efendi et al. (2020) and Islamy (2024), with a maximum standard of 35 dB during the day/30 dB at night. Kolcaba's Comfort Theory explains that noise control provides relief, ease, and transcendence; noise management suggestions enhance recovery.

Research Limitations

This study has several limitations that need to be considered in interpreting the research results.

1. This research is quantitative in nature so it only shows the relationship between variables without explaining the cause-effect relationship.
2. The research variables and analysis methods used are still limited, so other factors outside the research have the potential to influence the patient's comfort level.
3. Data was obtained from a perception-based questionnaire which is subjective and has the potential to cause bias.
4. The study has not used objective environmental measurements, so the results reflect patient perceptions more.
5. The scope of the research is limited to standard inpatient classrooms with a limited number of respondents and research time, so the generalization of the results is still limited.

CONCLUSION

This study shows that the physical environment, air quality, and noise have a significant relationship with the level of patient comfort in the Standard Inpatient Class (KRIS) of X Kudus Hospital. A good physical environment is proven to increase patient comfort with a higher proportion of comfort in clean, organized, and appropriately temperatured rooms. Air quality is the most dominant factor, indicated by the highest significance value, which confirms the importance of ventilation, temperature, and air cleanliness in supporting patient comfort and recovery. Noise also has a significant effect, where a quieter environment can improve the quality of rest and psychological stability of patients. Overall, these three variables complement each other in forming patient comfort

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holistically, in accordance with the patient-centered care approach and Kolcaba's comfort theory.

However, this study has limitations, including the use of a cross-sectional design that cannot explain causal relationships, and perception-based measurements that are potentially subjective. Furthermore, the study variables are still limited and not supported by objective environmental measurements such as actual noise levels or technical air quality. Therefore, further research is recommended to use a longitudinal or mixed methods design with the addition of other variables such as lighting, room density, and service quality, as well as integrating objective environmental measurements. Practically, the results of this study provide important implications for hospital management to improve patient comfort through optimizing ventilation, noise control, and ergonomic and sustainable physical environmental arrangements to support better quality healthcare services.

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