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Examining the Relationship Between Therapeutic Architectural Features and Wellbeing Indicators Among Paediatric Patients in Selected Hospitals in Kaduna State

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The hospital environment plays a crucial role in patient wellbeing, particularly among children who are more sensitive to environmental conditions than adults. Beyond medical treatment, architectural features of healthcare facilities have been shown to influence patient comfort, stress levels, and recovery outcomes. This study examined the relationship between therapeutic architectural features and wellbeing outcomes among paediatric patients in four selected hospitals in Kaduna State, Nigeria. The study was guided by specific objectives to assess the presence of therapeutic architectural features and to determine their relationship with paediatric patient wellbeing. A quantitative survey research design was adopted, involving a sample of 422 respondents, comprising paediatric patients, caregivers, and healthcare professionals. Data were collected using structured questionnaires and an architectural observation checklist, and analysed using descriptive statistics and inferential techniques, including Pearson correlation analyses. The findings revealed that all six identified therapeutic architectural features—natural lighting, ventilation and airflow, noise control, spatial organisation and bed arrangement, interior finishes and colour, and access to nature—were positively associated with paediatric wellbeing outcomes. Most of these relationships were statistically significant at $p < 0.01$. Natural lighting and ventilation exhibited the strongest relationships with patient comfort ($r = 0.82$ and 0.78), stress reduction ($r = 0.70$ and 0.74), and perceived recovery ($r = 0.75$ and 0.71). Noise control and access to nature also demonstrated strong associations with stress reduction, while spatial organisation and interior finishes showed moderate but meaningful correlations across all wellbeing indicators. The study demonstrate that therapeutic architectural features are critical determinants of paediatric patient wellbeing and should be treated as integral components of hospital design. Prioritising natural lighting, ventilation, and noise control, alongside flexible spatial layouts and child-friendly interior environments, can significantly enhance comfort, reduce stress, and improve recovery outcomes. The study further underscores the need for regular environmental audits, post-occupancy evaluations, and the systematic integration of evidence-based design principles to improve the quality of paediatric healthcare delivery, particularly in resource constrained settings.

Keywords: Evidence-Based Design (EBD), Healing Environments, Hospital Design, Paediatric Wellbeing, Therapeutic Architecture

Introduction

Healthcare environments are increasingly recognised as active determinants of patient health outcomes rather than passive settings for clinical intervention. Within the framework of evidence-based design (EBD), the built environment is conceptualised as a system of interacting physical, sensory, and spatial conditions that influence psychological wellbeing, emotional stability, and physiological recovery (Joseph & Rashid, 2019; Sadler *et al*., 2021). This paradigm shifts attention from purely clinical determinants of health to the broader role of environmental design in shaping healing processes, emphasising that healthcare outcomes are partially mediated by architectural conditions.

Empirical evidence consistently demonstrates that specific environmental attributes—including lighting quality, ventilation and indoor air quality, acoustic control, spatial organisation, interior finishes, and access to nature—are significantly associated with improved patient outcomes such as reduced stress, enhanced comfort, improved sleep quality, and faster recovery trajectories (Feng *et al*., 2024; Zheng *et al*., 2024). These relationships are not incidental but are explained through measurable physiological and psychological mechanisms, including circadian rhythm regulation, sensory load reduction, thermal comfort optimisation, and cognitive stress modulation (Lawson & Phiri, 2022; WHO, 2023).

The relevance of therapeutic environments becomes more pronounced in paediatric healthcare settings, where children exhibit heightened vulnerability to environmental stressors due to developmental, cognitive, and emotional factors. Hospitalisation often introduces unfamiliar stimuli, loss of routine, and reduced autonomy, which can result in anxiety, fear, and behavioural distress (Lambert *et al*., 2014; Delvecchio

et al., 2019). These stress responses are not only psychological but may also influence physiological recovery and treatment compliance, making environmental quality a critical adjunct to clinical care. Accordingly, paediatric wards require design strategies that actively support emotional security, sensory comfort, and restorative experiences (Shepley & Pasha, 2020; Qi *et al*., 2021).

A substantial body of healthcare design literature identifies therapeutic architectural features as key determinants of patient wellbeing. Natural lighting has been widely associated with improved circadian regulation, mood enhancement, and reduced length of hospital stay, while adequate ventilation contributes to indoor air quality, thermal comfort, and infection risk reduction (Feng *et al*., 2024; WHO, 2023). Similarly, noise control is critical in reducing sleep disturbance and psychological stress in clinical environments, particularly in inpatient wards where continuous exposure to high sound levels is common (Busch-Vishniac & Ryherd, 2019). Spatial organisation and bed arrangement influence privacy, mobility, and interaction patterns, while interior finishes and colour schemes affect emotional perception and psychological comfort. Additionally, access to nature—either visual or physical—has been strongly linked to stress recovery and psychological restoration through biophilic mechanisms (Hartig *et al*., 2014; Kellert *et al*., 2020).

Despite this growing evidence base, the translation of evidence-based design principles into healthcare infrastructure remains uneven globally, particularly in low- and middle-income countries. In many developing contexts, including Nigeria, hospital design is often constrained by limited funding, infrastructural deficits, and prioritisation of functional capacity over environmental quality (Akinluyi *et al*., 2020; Isa *et al*., 2024; Oyakhire *et al*., 2020). As a result, paediatric wards frequently exhibit suboptimal environmental conditions such as inadequate lighting, poor ventilation, excessive noise levels, overcrowding, and limited integration of restorative natural elements. These conditions have been associated with increased stress levels, reduced comfort, and compromised patient experience (Allegranzi *et al*., 2018; WHO, 2022; Busch-Vishniac & Ryherd, 2019).

However, while existing studies in Nigeria have explored healthcare infrastructure challenges and service delivery constraints, they have largely focused on system-level performance indicators rather than the specific role of therapeutic architectural features in shaping paediatric wellbeing outcomes (Akinluyi *et al*., 2020; Isa *et al*., 2024). Moreover, where environmental factors are examined, they are often studied in isolation rather than as an integrated system of interacting design variables. This fragmented approach limits a comprehensive understanding of how multiple architectural features collectively influence patient wellbeing in real-world healthcare settings.

Furthermore, there remains limited context-specific empirical evidence linking therapeutic architectural features directly to measurable wellbeing outcomes among paediatric patients in Nigerian hospitals. This creates a significant knowledge gap in understanding how global evidence-based design principles translate into resource-constrained healthcare environments with distinct climatic, infrastructural, and operational challenges.

This study is grounded in Supportive Design Theory and Biophilic Design Theory, which provide a robust conceptual framework for explaining the relationship between built environments and health outcomes. Supportive Design Theory posits that healthcare environments reduce stress by enhancing perceived control, promoting social support, and providing positive distractions that mitigate psychological distress (Ulrich, 1991; Ulrich *et al*., 2008). Biophilic Design Theory complements this by emphasising the restorative effects of human–nature interactions through environmental features such as daylight, ventilation, and visual access to greenery (Kellert *et al*., 2020; Tekin *et al*., 2023). Together, these frameworks justify the selection of therapeutic architectural features examined in this study.

Against this background, this study investigates the relationship between six therapeutic architectural features—natural lighting, ventilation and indoor airflow, noise control, spatial organisation and bed arrangement, interior finishes and colour, and access to nature and paediatric patient wellbeing outcomes, namely comfort, stress reduction, and perceived recovery, in selected hospitals in Kaduna State, Nigeria. A quantitative survey design is employed to generate empirical evidence on the strength and direction of these relationships.

By providing context specific empirical evidence, this study contributes to the advancement of evidence-based healthcare design literature in resource constrained settings. It offers practical insights for architects, healthcare planners, and policymakers seeking to improve paediatric hospital environments through targeted design interventions that enhance comfort, reduce stress, and support recovery outcomes.

Research Methodology

This study adopted a quantitative survey research design to examine the relationship between therapeutic architectural features and paediatric patient wellbeing in selected hospitals in Kaduna State, Nigeria. The quantitative approach was adopted to enable the collection of measurable data and the application of statistical techniques to determine relationships between environmental variables and wellbeing outcomes

(Creswell & Creswell, 2021; Saunders *et al*., 2023). The study examined six therapeutic architectural features which are natural lighting, ventilation and indoor airflow, noise control, spatial organisation and bed arrangement, interior finishes and colour, and access to nature and external views as independent variables, and three wellbeing indicators, comfort, stress reduction, and perceived recovery as dependent variables.

The study was conducted in Kaduna State, north-western Nigeria, a major healthcare hub with a network of tertiary and secondary hospitals providing paediatric inpatient services. The target population comprised hospital based paediatric care users, including paediatric patients, caregivers, and healthcare professionals. This population definition reflects healthcare research practice, where participants are selected based on their direct interaction with the care environment (Adebayo *et al*., 2021; World Health Organization [WHO], 2021). The region's tropical continental climate has implications for indoor environmental quality, particularly in relation to lighting, ventilation, and thermal comfort (NiMet, 2023; WHO, 2023).

A multistage sampling technique was adopted. In the first stage, four public hospitals with functional paediatric inpatient wards were purposively selected based on clearly defined criteria, including the availability of paediatric inpatient services, high patient volume, variation in infrastructural development, and differences in architectural and environmental design conditions. This selection ensured that the study captured a range of therapeutic environmental qualities across facilities with differing levels of resources and spatial configurations, thereby enabling meaningful comparison of paediatric ward environments within the study context. In the second stage, proportional allocation was applied to distribute the sample size across the selected hospitals based on ward capacity and average patient load, ensuring representation relative to actual usage patterns. Within each hospital, respondents were drawn from three categories paediatric patients, caregivers, and healthcare professionals to ensure comprehensive representation of key stakeholders directly interacting with the ward environment.

The sample size was determined using the Cochran (1977) formula for large populations:

$$n_0 = \frac{Z^2 p(1-p)}{e^2}$$

Based on a 95% confidence level (Z = 1.96), p = 0.5, and margin of error e = 0.05, a minimum sample size of 384 was obtained. To account for non-response, the sample size was increased by 10%, resulting in a total of 422 respondents. Of these, 387 valid responses were retrieved and analysed, yielding a response rate of 91.7%, consistent with the dataset presented in Table 1. The final sample distribution comprised paediatric patients (55.7%), healthcare professionals (27.3%), and caregivers (17.0%), ensuring alignment with the socio-demographic characteristics reported in the results.

Data were collected using two instruments. A structured questionnaire based on a five-point Likert scale was used to assess respondents' perceptions of environmental quality and wellbeing outcomes. The questionnaire measured comfort, stress reduction, and perceived recovery, consistent with the variables analysed in Table 3. The instrument was adapted from established evidence-based healthcare design studies (Lawson & Phiri, 2022) and subjected to content validation by three experts, comprising two academics in architectural design and one specialist in healthcare design, who assessed the relevance, clarity, and adequacy of the questionnaire items to ensure alignment with the study objectives. Reliability testing was subsequently conducted through a pilot study. Reliability testing using Cronbach's alpha yielded coefficients of 0.78 (comfort**),** 0.82 (stress reduction), and 0.75 (perceived recovery), indicating acceptable internal consistency.

An architectural observation checklist was used to assess the presence and adequacy of therapeutic features across the selected hospitals. Each feature was rated using a four-point ordinal scale, and aggregated scores were computed to produce the overall therapeutic feature scores and percentage ratings reported in Table 2. This ensured direct consistency between observational data collection and the comparative results presented across hospitals.

Data analysis was conducted using SPSS version 26. Descriptive statistics, including frequencies, percentages, and mean scores, were used to summarise socio-demographic characteristics (Table 1) and therapeutic architectural feature distributions (Table 2). Inferential analysis was performed using Pearson correlation, which was applied to examine the relationships between therapeutic architectural features and paediatric wellbeing indicators, as presented in Table 3. Additional correlation analysis was conducted at the hospital level to generate the results reported in Table 4, where Pearson's correlation coefficients were used to assess the strength of relationships within each facility. Statistical significance was evaluated at $p < 0.01$, consistent with the thresholds reported in the results section.

Ethical approval was obtained from the Institutional Review Board (HREC Reference Number: BDTH/HREC/Oct/2024/351/VOL.2). Informed consent was obtained from all participants and caregivers prior to data collection. Participation was voluntary, and confidentiality and anonymity were maintained throughout the study in accordance with established ethical standards (WHO, 2021).

Results and Discussion

Socio-demographic characteristics

A total of 387 valid responses were analysed, representing a response rate of 91.7%. Respondents were drawn from four hospitals, with representation reflecting their relative size and patient load. Paediatric patients constituted the majority of respondents, followed by healthcare professionals and caregivers, ensuring that all key user groups within the paediatric ward environment were adequately represented. The patient sample showed a balanced distribution across gender and age groups, while healthcare professionals were predominantly nurses with varied years of experience. This distribution provides a reliable basis for assessing both user perception and environmental conditions within the selected hospitals as presented in Table 1.

Table 1: Socio-Demographic Characteristics of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Hospital (N = 422)	Barau Dikko Teaching Hospital	138	32.7
	Yusuf Dantsoho Memorial Hospital	103	24.4
	Sir Patrick Yakowa General Hospital	95	22.5
	Gambo Sawaba General Hospital	86	20.4
	Total	**422**	**100.0**
Participant Category (N = 422)	Paediatric Patients	235	55.7
	Healthcare Professionals	115	27.3
	Caregivers	72	17.0
	Total	**422**	**100.0**
Gender (Patients Only) (N = 235)	Male	108	46.0
	Female	127	54.0
	Total	**235**	**100.0**
Age Group (Patients Only) (N = 235)	1–5 years	77	32.8
	6–10 years	84	35.7
	11–15 years	74	31.5
	Total	**235**	**100.0**
Healthcare Professionals (N = 115)	Doctors	44	38.3
	Nurses	71	61.7
	Total	**115**	**100.0**
Years of Experience (N = 115)	1–5 years	38	33.0
	6–10 years	41	35.7
	Above 10 years	36	31.3
	Total	**115**	**100.0**
Caregiver Relationship (N = 72)	Parent	70	97.2
	Guardian	2	2.8
	Total	**72**	**100.0**

Note: Percentages are based on valid responses within each category.

Therapeutic architectural features

The assessment of therapeutic architectural features revealed notable variation across the hospitals (Table 2). Barau Dikko Teaching Hospital demonstrated the highest level of compliance with therapeutic design principles, indicating a well-integrated healing environment. In contrast, Gambo Sawaba General Hospital recorded substantially lower scores, reflecting gaps in the provision of key environmental features. Across all facilities, natural lighting and ventilation were consistently better implemented, whereas noise control and spatial organisation showed greater inconsistency, particularly in lower performing hospitals. These differences highlight uneven integration of therapeutic design strategies within paediatric wards.

Table 2: Overall Therapeutic Architectural Feature Summary by Hospital

Therapeutic Feature	No. of Items	Max Score (4-point)	Barau Dikko Teaching Hospital (Total / M)	Yusuf Dantsoho Memorial Hospital (Total / M)	Sir Patrick Yakowa General Hospital (Total / M)	Gambo Sawaba General Hospital (Total / M)
Natural Lighting	7	28	28 / 4.00	23 / 3.29	22 / 3.14	18 / 2.57
Ventilation & Indoor Airflow	5	20	20 / 4.00	15 / 3.00	13 / 2.60	12 / 2.40
Colour & Interior Finishes	6	24	24 / 4.00	18 / 3.00	16 / 2.67	13 / 2.17
Noise Control Measures	5	20	19 / 3.80	14 / 2.80	10 / 2.00	9 / 1.80
Spatial Organisation & Bed Arrangement	4	16	16 / 4.00	12 / 3.00	10 / 2.50	8 / 2.00
Access to Nature & External Views	4	16	16 / 4.00	14 / 3.50	10 / 2.50	9 / 2.25
Total Score	31	124	123	96	81	69
Overall Mean Score	—	4.00	**3.97**	**3.10**	**2.61**	**2.23**
Overall Percentage (%)	—	100	99.2	77.4	65.3	55.6

Each therapeutic architectural feature was assessed using multiple indicators rated on a four-point scale (1 = Feature absent or ineffective, 2 = Feature minimally present or limited, 3 = Feature adequately present and functional, 4 = Feature fully implemented and highly supportive). The values presented in Table 2 represent aggregated scores across these indicators for each feature within each hospital. Natural lighting had a maximum possible score of 28, indicating that it was assessed using seven indicators (7 × 4 = 28). This aggregation approach allows for a more comprehensive evaluation of each feature beyond a single item measure.

Correlation between architectural features and wellbeing

The relationship between therapeutic architectural features and paediatric wellbeing indicators is summarised in Table 3. All six features exhibited positive and statistically significant associations with comfort, stress reduction, and perceived recovery. However, rather than treating all variables equally, clear patterns emerged in terms of their relative influence.

Natural lighting and ventilation were the most influential features, showing strong and consistent relationships across all wellbeing indicators. These findings suggest that environmental conditions that directly affect physiological comfort, such as adequate daylight and airflow, play a primary role in enhancing patient experience and recovery. The stronger associations observed for natural lighting and ventilation with paediatric wellbeing outcomes can be more meaningfully interpreted within the contextual realities of hospital environments in Kaduna State with resource constrained settings. Many paediatric wards are characterised by inconsistent electricity supply, limited mechanical ventilation systems, and inadequate environmental control systems. As a result, natural lighting and passive ventilation become not only design preferences but primary determinants of indoor environmental quality. These conditions also explain why improvements in daylight access and airflow demonstrate stronger statistical relationships with comfort, stress reduction, and perceived recovery compared to other architectural features. Noise control and access to nature also demonstrated strong associations, particularly with stress reduction, indicating their importance in creating a calming and restorative environment. From a climatic perspective, Kaduna State's tropical continental climate, characterised by high daytime temperatures and marked seasonal variation, further amplifies the importance of ventilation and daylighting in regulating indoor thermal comfort.

In comparison, spatial organisation and interior finishes showed moderate but meaningful relationships with wellbeing outcomes. While these features contribute to comfort and emotional support, their influence appears to be more complementary than primary. This distinction suggests that while all therapeutic features

are important, some have a more direct and measurable impact on patient wellbeing than others.

Table 3: Descriptive Statistics and Pearson Correlation between Therapeutic Architectural Features and Paediatric Wellbeing

Architectural Feature	M (SD)	Comfort (r)	Stress Reduction (r)	Perceived Recovery (r)
Natural Lighting	4.32 (0.58)	0.82**	0.70**	0.75**
Ventilation & Indoor Airflow	4.18 (0.62)	0.78**	0.74**	0.71**
Noise Control	3.96 (0.69)	0.69**	0.71**	0.68**
Spatial Organisation & Bed Arrangement	3.85 (0.64)	0.65**	0.63**	0.62**
Interior Finishes & Colour	3.72 (0.71)	0.58**	0.55**	0.57**
Access to Nature & External Views	3.89 (0.66)	0.61**	0.69**	0.64**

Notes: r = Pearson correlation coefficient; **SD** = Standard deviation; **p < 0.01**, ** denotes statistically significant correlation

Natural lighting showed the strongest association with comfort ($r = 0.82$, $p < 0.01$) and perceived recovery ($r = 0.75$, $p < 0.01$), while ventilation also exhibited strong correlations across all indicators ($r = 0.71–0.78$, $p < 0.01$). Noise control and access to nature were particularly associated with stress reduction, whereas spatial organisation and interior finishes showed moderate but significant relationships.

All examined relationships are positive and statistically significant, indicating that improvements in therapeutic architectural features are associated with increased comfort, reduced stress, and enhanced perceived recovery among paediatric patients. The strength of the correlations ($r = 0.55–0.82$) suggests moderate to very strong relationships, with natural lighting and ventilation showing the highest levels of significance and influence.

At the hospital level, facilities with higher overall therapeutic feature scores consistently demonstrated stronger relationships with wellbeing outcomes (Table 4). This pattern reinforces the overall finding that better designed environments are associated with improved patient experiences. Hospitals with more comprehensive integration of therapeutic features not only performed better in environmental assessments but also showed stronger links to comfort, reduced stress, and perceived recovery. Pearson and result was consistent, confirming the robustness of the relationships.

Table 4: Pearson's Correlation between Therapeutic Architectural Features and Paediatric Patient Wellbeing by Hospital

Hospital	Architectural Mean (IV)	Wellbeing Mean (DV)	r	p
Barau Dikko Teaching Hospital	3.97	3.85	0.81	<0.01
Yusuf Dantsoho Memorial Hospital	3.10	3.42	0.72	<0.01
Sir Patrick Yakowa GH, Kafanchan	2.61	3.10	0.65	<0.01
Gambo Sawaba GH, Zaria	2.23	2.98	0.58	0.05

Overall, the results demonstrated a clear and consistent relationship between the quality of the built environment and paediatric patient wellbeing. The findings emphasise that therapeutic architectural features are not isolated design elements but interrelated components that collectively shape the healing environment. Differences observed across hospitals further highlight the need for a more systematic and standardised approach to integrating evidence-based design principles in paediatric healthcare settings.

Discussion

The findings of this study strongly reinforce the role of therapeutic architectural features as key determinants of paediatric patient wellbeing. The results show that natural lighting and ventilation and indoor airflow are

the most influential features, demonstrating the strongest and most consistent relationships across comfort, stress reduction, and perceived recovery.

The prominence of natural lighting in this study aligns with previous research, which identifies daylight as a critical factor in enhancing patient comfort, reducing stress, and accelerating recovery processes (Boubekri *et al*., 2020). Adequate exposure to natural light supports circadian rhythm regulation and creates a psychologically reassuring environment, which is particularly important for paediatric patients (Figueiro *et al*., 2017; Boubekri *et al*., 2020). From a theoretical standpoint, this finding is consistent with Supportive Design Theory, which explains that environments that reduce physiological strain and enhance environmental predictability contribute to reduced stress responses in healthcare settings.

Similarly, ventilation and indoor airflow exhibited strong correlations across all wellbeing indicators, confirming their importance in maintaining thermal comfort and indoor air quality. These findings support existing evidence that improved ventilation contributes to healthier indoor environments and enhances patient outcomes (Allen *et al*., 2018; World Health Organization [WHO], 2023). Within Supportive Design Theory, adequate airflow can be interpreted as a mechanism of environmental control that reduces discomfort and supports perceived recovery by minimising physiological stressors.

Noise control emerged as a significant factor in stress reduction and perceived recovery, consistent with prior studies demonstrating that excessive hospital noise can increase anxiety, disrupt sleep, and negatively affect recovery (Busch-Vishniac & Ryherd, 2019; Lawson & Phiri, 2022). The strong association observed in this study highlights the importance of acoustic design in paediatric wards and aligns with the stress-reduction pathway of Supportive Design Theory, where minimisation of environmental irritants enhances psychological stability and rest.

Access to nature and external views also showed strong relationships with stress reduction, supporting biophilic design principles that emphasize the restorative effects of natural elements in healthcare environments (Ulrich, 1984; Liddicoat & Krasny, 2021). This suggests that even visual connections to nature can significantly enhance patient wellbeing by promoting attention restoration and emotional recovery, as explained by Biophilic Design Theory.

In contrast, spatial organisation and bed arrangement, as well as interior finishes and colour, demonstrated moderate but statistically significant relationships with wellbeing outcomes. While these features contribute to comfort and emotional support, their relatively lower correlation values indicate that they function as supportive rather than primary therapeutic factors. This is consistent with previous studies that highlight the role of spatial layout in improving privacy and movement (Huisman *et al*., 2012) and the influence of colour on emotional perception rather than direct physiological outcomes (Dalke *et al*., 2006; Andrade & Devlin, 2015). From a theoretical perspective, these features enhance perceived control and cognitive ease but exert indirect rather than primary physiological effects.

Overall, the findings confirm that paediatric wards with higher levels of therapeutic architectural features consistently promote better comfort, reduced stress, and improved perceived recovery, as stated in the abstract. The variation observed across hospitals further emphasises the need for the systematic integration of evidence-based and biophilic design principles in healthcare facilities, particularly in resource-constrained settings where environmental stressors are more pronounced and design interventions can have disproportionately significant effects on patient wellbeing**.**

Conclusion

The results obtained from this study provide an empirical foundation for proving that architectural elements used for therapeutic purposes have a great impact on the psychological well-being of children in hospitals, where all factors tested had a positive correlation with well-being and recovery. This study demonstrated that therapeutic architectural features play a significant and measurable role in influencing paediatric patient wellbeing within hospital environments. The findings show that all six evaluated features—natural lighting, ventilation and indoor airflow, noise control, spatial organisation, interior finishes, and access to nature are positively associated with key wellbeing indicators, including comfort, stress reduction, and perceived recovery. Among these, natural lighting and ventilation emerged as the most influential factors, exhibiting the strongest and most consistent relationships across all outcome variables.

The results further revealed that hospitals with higher overall therapeutic design scores consistently recorded stronger associations with patient wellbeing, reinforcing the importance of a holistic and integrated approach to healthcare design. While spatial organisation and interior finishes demonstrated moderate effects, they remain essential supportive components that enhance the overall healing environment when combined with primary environmental factors. These findings provided strong empirical support for evidence-based design principles in paediatric healthcare facilities, particularly in resource-constrained contexts where targeted design interventions can significantly improve patient experience and recovery outcomes.

It was found that natural light and air ventilation were the two most important variables impacting

psychological wellbeing. Notably, the research results are situated where the hospitals operate in a resource limited healthcare environment in Kaduna State, Nigeria, and where there were clear differences in the quality of infrastructure and environmental design among the chosen hospitals. Differences in the effectiveness of the therapeutic design and the resulting wellbeing effects show that limitations in lighting, ventilation, sound insulation, and space design are still common problems in limited-resource hospitals.

Theoretically, the research contributed to the existing body of knowledge on supportive design and biophilic design theories by offering an empirically tested application of these theories from a developing country setting, which is often neglected in scientific literature. On a more practical level, the outcomes of the research pointed to the necessity for the involvement of healthcare professionals, architectural experts, and relevant decision-makers to regard hospital environments not just as passive buildings but rather as tools that can aid healing processes. Optimizing the amount of natural light by designing the orientation and façades properly, improving ventilation systems to enhance air quality and thermal comfort, as well as incorporating measures for acoustic control, are key aspects in designing hospitals. It is important to note that creating layouts that ensure privacy and movement, as well as interaction between a nurse and the child, employing soothing interior materials, and providing opportunities for children to see greenery are crucial design features.

In spite of the foregoing achievements, however, the study is hampered by a lack of longitudinal methodology which constrains any causative link between building attributes and wellbeing results. The use of subjective perceptions could also skew findings but, in this study, this issue was overcome by incorporating observations alongside self-reports. Additionally, the study was limited to four public hospitals within Kaduna State, which might affect external validity because of variations in infrastructural and climate factors elsewhere.

For future research, longitudinal and mixed methodologies would be useful in uncovering the causal relationships between therapeutic architecture and clinical recovery outcomes as well as in exploring these concepts at various types of health care institutions across other locations and socio-economic settings.

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