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An exploration of biophilic architecture as a means of enhancing wellbeing in Maternity Hospital Design

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Abstract
Health is a fundamental right, and healthcare environments play a crucial role in promoting both physical and psychological recovery. Maternity hospitals, which care for women during pregnancy and childbirth, require thoughtfully designed spaces that go beyond clinical functionality to provide comfort and support for both mothers and infants. Recent studies have shown the profound effects of hospital environments on patient outcomes, with natural elements contributing to reduced stress, improved mood, and faster recovery. Biophilic design a concept that integrates nature into built environments has been identified as a key strategy for creating healing spaces in healthcare settings. This paper explores the extent to which Biophilic design features are applied in existing maternity hospitals in Nigeria, with a particular focus on Kano. By examining the cultural and environmental factors influencing design choices. Data was collected through qualitative methods, including case studies and an empirical survey of existing facilities. The research identifies gaps in the current design of maternity hospitals in Kano and offers recommendations for integrating Biophilic elements. The study emphasizes the need for maternity hospitals to provide environments that connect patients with nature, promoting emotional and mental health alongside physical healing. This will contribute to the growing body of knowledge on the human-nature connection in healthcare design, proposing a holistic approach that aligns with global best practices for patient-centered healthcare environments. Findings from the study demonstrate the importance of creating naturalistic spaces within maternity hospitals to enhance both patient and staff experiences. The research concludes that Biophilic design is essential in redefining healthcare settings to promote healing, reduce anxiety, and support overall well-being. It recommends that healthcare architects and designers adopt Biophilic principles to ensure that hospital environments not only meet clinical needs but also foster a deeper connection with nature, ultimately improving health outcomes.

Keywords: Biophilic, maternity, landscape, comfort, nature, environment, healthcare, hospital

Introduction

The overall well-being and shaping of patient experiences are determined by the nature of our healthcare environments. This reflects the design of maternity hospitals which is very important in the sense that expectant mothers and new born are very sensitive to physical and physiological stressors. According to Chaudhury & Banerjee, (2020) [8]. traditional approaches to design of hospitals often give priorities to functionality and to an extent efficiency, yet recent studies highlight the need for spaces that reduce stress, foster emotional comfort and have cultural relevance

Biophilic architecture is an approach to design, which emphasizes importance of maintaining connection with natural world through the built environment (Kellert, 2005; Verganti *et al*., 2021). It blends its principles with a deeper thoughtful connection to nature and human wellbeing. However, in order to assist architects and developers in the practical application of biophilic design, Kellert (2005) broke it down into two dimensions: Organic Dimension of Biophilic Design which includes the shapes and forms which are found in the building environment that directly, indirectly, or symbolically reflect the inherent human affinity for nature. Organic dimension means designing with forms, shapes, and materials that mimic natural features and processes.

In addressing psychological and cultural healing, this design moves beyond aesthetics by integrating natural elements, sensory experiences and symbolic connections to life cycles. In the context of this paper, maternity settings in kano, the approach will not only enhance physical comfort, but will also support emotional resilience and a sense of dignity during child birth and recovery (Chaudhury & Banerjee, 2020) [8].

A limited number of studies with regards to maternity healthcare facilities have focused on oncology environments and the psychosocial effects of the hospital in women and children patients (Borrescio-Higa & Valdés, 2022) [5]. Furthermore, these facilities in kano and its environs are faced with a lot of challenges related to climatic conditions, cultural expectations, and energy efficiency. The claim for biophilic architecture becomes important.

Enhancing wellbeing in maternity hospital design in kano through exploring the potentials of biophilic architecture is required. It will examine how natural forms, materials, spatial organization can create therapeutic environments that meet human needs and medical requirements

Literature Review

Biophilic Architecture and Wellbeing in Hospital

Biophilic design is a design philosophy that encourages the use of natural systems and processes in the design of built environment (Panagopoulos *et al*., 2020) [22]. Nigeria is the most populous African Nation and has the maternal mortality rate of 280 to 1150 per 100,000 live births (Mohammed *et al*., 2022) [16]. This research intends to explore and hence adopt suitable Biophilic design principles in the design of a befitting Maternity hospital in Kano. The

concept of biophilic design, which integrates natural elements into living spaces, can be applied to create serene postpartum spaces in maternity clinics, which offers comprehensive care for mothers and infants, including specialized prenatal care and postpartum facilities with private rooms to facilitate bonding between the new family units(Kellert, 2005; Verganti *et al*., 2021).

. Therefore, incorporating biophilic elements such as natural light, indoor plants, and nature-inspired artwork in maternity clinics can potentially contribute to creating serene and healing environments for new mothers (Ryan *et al*., 2014; White *et al*., 2020) [7, 27].

Natural Light: Incorporating large windows, skylights, and clerestory windows to bring in natural light and reduce the need for artificial lighting.

Green Walls and Roofs: Incorporating living walls and roofs to bring in a natural element and improve air quality.

Water Features: This includes fountain, ponds, to create a calming and soothing environment.

Nature-Inspired Artwork: Useof nature-inspired artwork and graphics to bring in a natural element and create a calming environment.

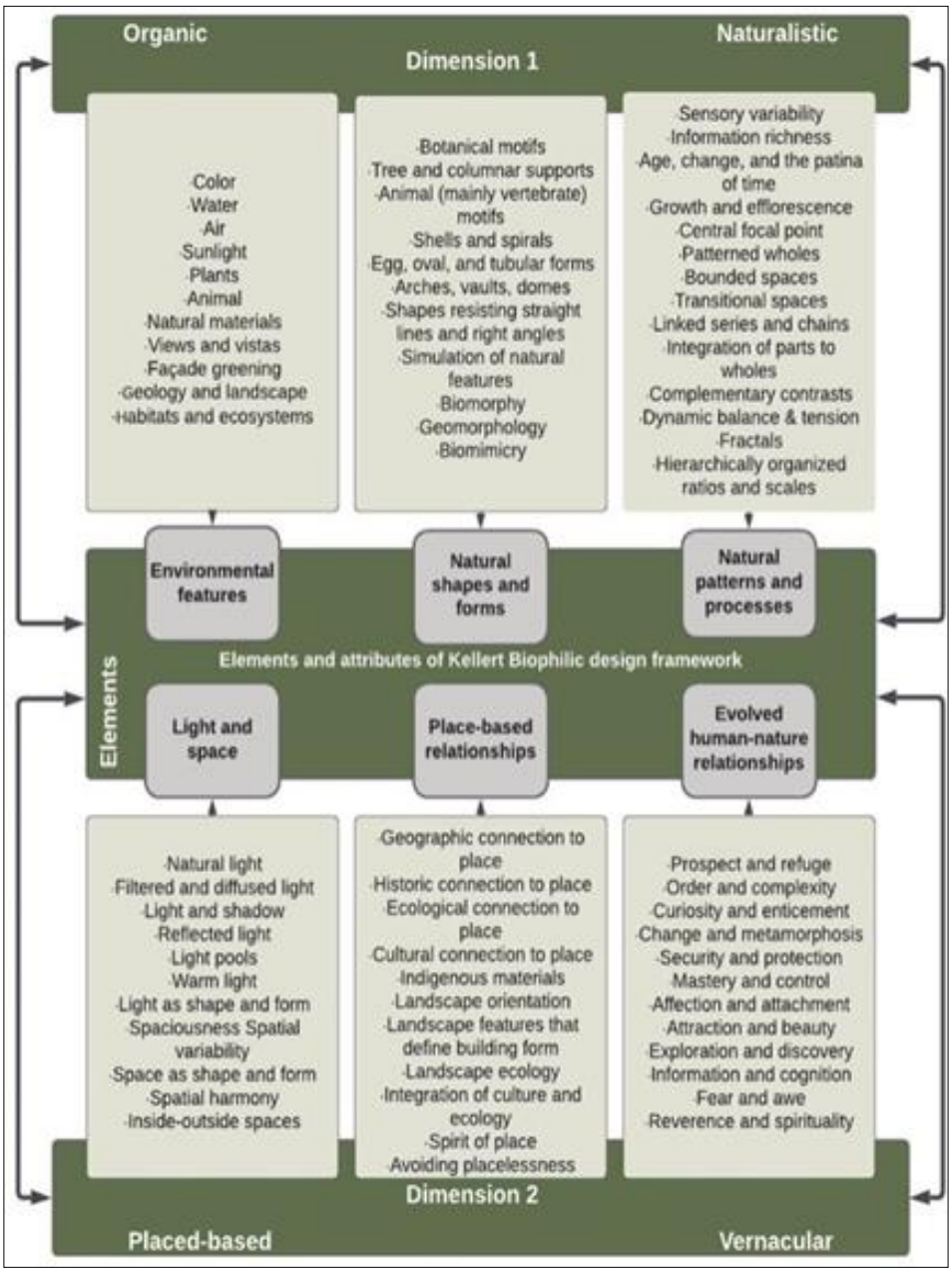
Plants and Greenery: Green elements that make up soft landscapes in patient rooms and public areas.

Natural Materials: Use of natural materials, such as wood and stone in the design and construction of the hospitalOutdoor spaces, such as gardens and terraces, where patients and families can connect with nature.

Nature Views: Provide views of nature from patient rooms and public areas to create a calming and soothing environment.

Biophilic Colors: Use of colors inspired by nature, such as blues and greens, to create a calming and soothing environment.

Natural Ventilation: Incorporate natural ventilation strategies to reduce the need for mechanical systems and improve indoor air quality.



Source: Aadapted from (Kellert 2008)

Fig 1: Dimensions, elements and attributes of Kellert Biophilic design framework

Source: Author's work (2024)

Fig 2

Biophilic design in tropical environments significantly enhances human health and well-being by fostering a deep, sensory-based connection with nature through architectural elements. As illustrated in Table 1, Figure 2 the design approach prioritises natural systems and processes to improve comfort, psychological restoration, and sustainability in the built environment (Kellert, 2018; Ryan *et al*., 2014) [7, 12]. One of the core dimensions is prospect, which refers to unobstructed views of the landscape, horizons, and skies key visual elements that are abundant in tropical regions. These expansive visual connections help reduce stress, mental health and promote cognitive restoration (Browning *et al*, 2014) [7].

Table 1: Elements of Biophilic Design that enhance occupant well-being by integrating nature into built spaces

Sn	Key Dimension	Qualities/ Attributes
1	Prospect (ability to see into the distance)	Brightness in the field of view (windows, bright walls); Ability to get to a distant point for a better view; Horizon/sky imagery (sun, mountains, clouds); Strategic viewing conditions; View corridors
2	Refuge (sense of enclosure or shelter)	Canopy effect (lowered ceilings, screening, branchlike forms overhead)
3	Water (indoors or inside views)	Glimmer or reflective surface (suggests clean water); Moving water (also suggests clean, aerated water); Symbolic forms of water
4	Biodiversity	Varied vegetation indoors and out (large trees, plants, flowers); Windows designed and placed to incorporate natural views; Outdoor natural areas with rich vegetation and animals
5	Sensory variability	Changes and variability in environmental colour, temperature, air movement, textures, and light over time and spaces; Natural rhythms and processes (natural ventilation and lighting)
6	Bio mimicry	Designs derived from nature; Use of natural patterns, forms, and textures; Fractal characteristics (self-similarity at different levels of scale with random variation in key features rather than exact repetition)
7	Sense of playfulness	Incorporation of decor, natural materials, artefacts, objects, and spaces whose primary purpose is to delight, surprise, and amuse
8	Enticement	Discovered complexity, Information richness that encourages exploration; Curvilinear surfaces that gradually open information to view

Role of Biophilia in Healing Process

Various researches under the umbrella of Biophilia have found the relevance of surrounding natural environment to human wellbeing, health and productivity. Chaudhury (2020) & Banerjee, (2020) [8] summarized the findings of such studies as follows; Firstly, contact with nature has been found to enhance healing and recovery from illness and major surgical procedures, including direct contact (e.g. natural lighting, vegetation) as well as representational and symbolic depiction of nature Secondly Proximity to open spaces, presence of vegetation has been correlated to with enhanced coping and adaptation to new environment also reduces number of health and social problems and lastly using of materials that mimic nature. Furthermore,according to Chaudhury & Banerjee (2020) [8] hospital settings with natural lighting, natural ventilation and other environmental features result in improved worker's performance, lower stress and greater motivation to the patients. So also, the human brain responds functionally to sensory patterns and cues emanating from the natural environment. These findings are a reflection of the key dimensions of biophilic design as illustrated in Fig. 2

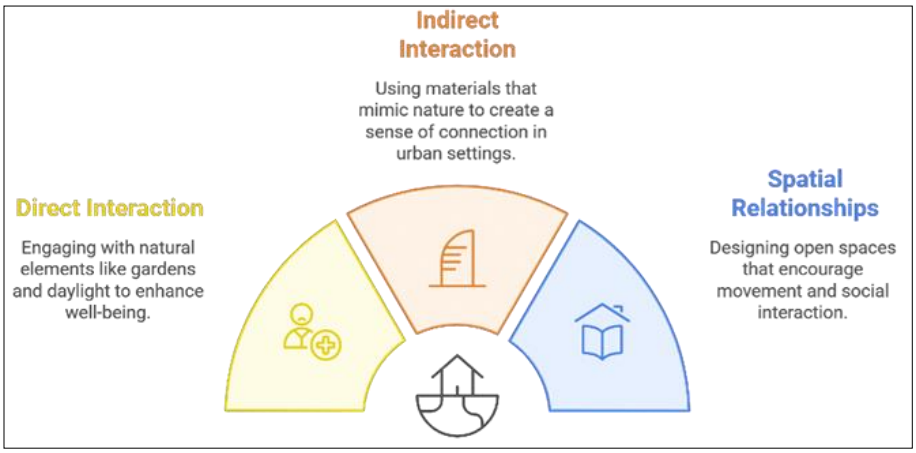
Methodology

This study is grounded in a qualitative, exploratory research paradigm that aligns with the interpretivist tradition, suitable for understanding complex, context-dependent phenomena such as biophilic design in hospital architecture. The research design employed a flexible, emergent strategy, allowing data collection and analysis to evolve iteratively. This approach is widely endorsed in exploratory studies where the goal is to uncover meanings, patterns, and relationships rather than to test specific hypotheses (Creswell &Poth, 2018) [9]. Case study methodology was used as the primary strategy, as it enables in-depth exploration of contemporary issues within their real-life contexts (Yin, 2018) [28].

The study focused on multiple case studies selected purposively to reflect diversity in geography and climate while sharing ecological and architectural themes. The primary case study was drawn from the North-west geopolitical zone of Nigeria to enrich cross-cultural understanding and contrast biophilic design strategies.

Data collection utilised mixed qualitative techniques, including field photography for architectural documentation, hand sketches for spatial mapping, field notes for recording

observed biophilic variables, and participant observation to capture users' experiential interactions. Semi-structured interviews with patients and caregivers further enriched the findings, a method validated in environmental behaviour research (Groat& Wang, 2013) [29]. Variables for assessment included building orientation impact, material expression, integration with natural surroundings, and use of natural patterns, consistent with established frameworks for evaluating biophilic architecture (Kellert, 2018) [12]. This adaptive, multi-method approach ensured a robust, context-sensitive analysis of biophilic design practices across diverse environmental and cultural settings.



Source: Adapted from (Zulnoorain K. et. al 2025)

Fig 3: Key dimensions of biophilic design

Case study 1

The objective of the case study is to explore the ways in which biophilic design patterns has been integrated in the design and construction of the selected hospitals, so as to see how these patterns were used as a psychological therapeutic tool to meet the psychosocial needs of the patients and the staff of the hospital.

Hospital: Aminu Kano Teaching Hospital (A.K.T.H) along Zaria road, Kano.

Building Type: Maternity Ward

Fig 1

Fig 2

Fig 3

Fig 4

Source: Author's field work (2024)

Fig 1,2,3,4: Illustration supporting the evaluation of Biophilic Architecture variables

Table 2: Biophilic strategies compliance table

Sno	Variables	Indicators	compliance		
			yes	no	partial
1	Natural light	Presence of windows	✓		
2	Green walls and Roofs	Vertical greenery/green roof		✓	
3	Water Features	Fountains/ponds		✓	
4	Nature Inspired Art-work	Murals inspired by natural forms		✓	
5	Plants and greenery	Indoor/ outdoor plants			✓
6	Natural materials	Use of wood, stone, clay		✓	
7	Natural views	Unobstructed sights to natural views			✓
8	Biophilic colours	Use of earth tone colours			✓
9	Natural Ventilation	Cross ventilation enhancers		✓	

Case study 2 Building Type: Maternity Hospital

Sabo BakinZuwoMaternity Hospital Kano.

Fig 5

Fig 6

Fig 7

Fig 8

Source: Author's field work (2024)

Figures 5, 6, 7, 8: Illustration supporting the evaluation of Biophilic Architecture variables

Table 3: Biophilic strategies compliance table

Sno	Variables	Indicators	compliance		
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6	Natural materials	Use of wood, stone, clay		✓	
7	Natural views	Unobstructed sights to natural views		✓	
8	Biophilic colours	Use of earth tone colours			✓
9	Natural Ventilation	Cross ventilation enhancers			✓

Deductions

The studies reveal limited compliance to biophilic architecture principles since only natural light were adequately incorporated to support visibility and user comfort. However, key strategies as seen in the table are absent indicating a significant gap. Some of the approaches are partially integrated to provide some connection to nature but are not consistent across the wards. Overall, findings

suggest minimal biophilic strategies demonstrating missed opportunities to create a conducive environment that could enhance wellbeing in maternity care.

Implications and Future Directions

The implications for stakeholders are manifold. Despite the incorporation of natural lighting, findings indicate partial or absent of other biophilic strategies which has some implications as appraised in the Table 4.

Table 4

sno	Implication	Clarification
1	Well-being and Healing environment	Biophilic environments provide conducive situations like psychological comfort etc but due to absence of elements like water features, natural ventilation, the wards may not be comfortable for patients.
2	Healthcare Architecture	The priotization of functionality and efficiency over all-inclusive well-being in hospital designs highlights a gap in current hospital design approaches.
3	Cultural and climatic considerations	The biophilic design principles should be adapted to reflect the culture and climatic conditions of the context in which they are applied.

Conclusion

The study examined the application of biophilic architecture strategies in Maternity Hospitals and Maternity wards of hospitals in Kano, Nigeria, but findings reveal limited compliance with natural lighting been the only variable fully integrated. Some strong features green walls, water elements, natural materials, natural ventilation were absent, while others like natural views, biophilic colours were partially employed.

Despite the ward benefits from daylighting, the building falls short of nature-connected environment which has implications for maternal well-being.

Health care facilities design by Architects should aim at the integration of biophilic strategies most especially in hot dry climates like Kano.

Also, emphasis should be layed on context specific adaptations to balance cultural identity and environmental sustainability. By doing so maternity hospital can evolve into healing environments.

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