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Integrating Child-Friendly Elements in the Design of a Pediatric Hospital, Keffi Nigeria

Arc. Williams A. Idakwoji, Ph.D[1], Augustine Omachonu Otalike[2] & Arc. Joseph Audu [3]

Department of Architecture, Faculty of Architecture, Bingham University Karu, Nasarawa State.
[1]idakwoji.williams@binghamuni.edu.ng
[2]Augustineotalike@gmail.com

ABSTRACT

This research examines the use of child-centric design concepts in the architecture of a proposed pediatric healthcare center in Keffi, Nasarawa State, Nigeria. The research employs a qualitative, exploratory methodology that integrates literature review, case studies, and site analysis, acknowledging the distinct physiological and psychological requirements of children. Three global best practices were analyzed to ascertain critical measures that improve pediatric well-being, family involvement, and sustainability. Research indicates that attributes including therapeutic play areas, biophilic components, intuitive navigation, and family-centric places diminish anxiety, enhance resilience, and elevate recovery results. The findings guided the design of the proposed Keffi facility, emphasizing climate responsive and cost-effective measures such as passive cooling, natural ventilation, rainwater collecting, and the utilization of local materials. Cultural significance is integrated through inspired designs, vivid colors, and flexible layouts to accommodate varied patient requirements. The research emphasizes that sustainable, child-friendly healthcare settings may be realized in resource-constrained countries by tailoring global best practices to local circumstances. Such settings enhance pediatric patient outcomes, elevate caregiver satisfaction, and optimize healthcare staff performance, improving overall care quality. The proposed institution intends to establish a standard for future pediatric healthcare design in analogous environments, illustrating that architecture may significantly enhance comfort, dignity, and emotional security in conjunction with superior medical treatment.

Keywords: *Child-friendly design, Paediatric, Architecture, Evidence-based design, Biophilic healthcare, Sustainable.*

INTRODUCTION

The primary objective of any healthcare institution globally has consistently been to address the health requirements of patients. To get an optimal level of health, clients must feel at ease while seeking medical assistance at healthcare institutions (Hamdan et al., 2016). A substantial body of studies has established a correlation between the features of the hospital constructed environment and patient well-being (Gaminiesfahani et al., 2020; Marquardt et al., 2014). Healthcare institutions have endeavored to mitigate patient concern by enhancing the environment's cleanliness, comfort, and accessibility. Optimally built healthcare facilities can facilitate recovery and diminish inpatient durations. Healthcare settings must adapt to the evolving healthcare system, requiring the continuous integration of the newest insights on the influence of particular design solutions on health outcomes (Brambilla et al., 2019). The standards of healthcare settings encompass architectural design elements, environmental characteristics, air quality, noise levels, thermal convenience, confidentiality, natural illumination, views of nature, safety and security, and accessibility to natural surroundings. The parameters of the pediatric hospital setting encompass the establishment of child-friendly settings, therapeutic play, familial support, and artwork for constructive diversion (Babbu & Haque, 2023). In a pediatric hospital setting, positive distraction is recognized as a crucial resource for patients and their parents or caregivers. Positive distraction has demonstrated efficacy in alleviating

patient anxiety, reducing the frequency of adverse behaviors before therapy, improving communication within the patient-clinician interaction, and facilitating pre-surgical preparations (Biddiss et al., 2019).

Pediatric healthcare facilities are dynamic environments where technology, patients, families, and staff interact within a constantly evolving care landscape (Elf et al., 2020). For children, these settings can induce anxiety and stress, potentially leaving lasting psychological effects. Hospitalization often detaches children from their familiar surroundings, causing distress due to the unfamiliarity, discomfort, and loss of autonomy they experience (Babbu & Haque, 2023). Given their unique physiological and psychological needs, children require healthcare environments that are carefully designed with their developmental stage in mind. Pediatric healthcare has thus become a focus of multidisciplinary concern, drawing attention from healthcare providers, designers, policymakers, and families alike (Zheng et al., 2024). Evidence-based, childcentered design, featuring playful elements, virtual reality tools, and therapeutic environments, can significantly improve treatment adherence and emotional well-being (McLaughlan et al., 2019). Ultimately, the distinct ways in which children perceive and interact with their surroundings necessitate hospital designs that foster comfort, learning, and emotional resilience (Ibrahim Momtaz & Shaban, 2018). Literature reviews indicate a burgeoning body of evidence supporting the notion that environmental modifications, such as integrating visual art into hospital environments and creating home-like settings where patients can engage with their toys, significantly influence both patient experience and health outcomes. Child-friendly healthcare is characterized by optimal medical services delivered by healthcare professionals collaborating to alleviate fear, worry, and suffering in children and their families (Hamdan et al., 2016). In the light of the above, this study examines and propose a comprehensive design scheme for a Child-friendly Paediatric Healthcare Center in Keffi, Nasarawa State, Nigeria. The study expects that the incorporation of child-friendly aspects will position the facility as a benchmark for future pediatric institutions in analogous environments.

LITERATURE REVIEW

The patient experience is a fundamental aspect to consider while delivering quality care in a child friendly healthcare institution. Emerging technology have facilitated the fulfillment of the psychological requirements of patients in pediatric hospitals. The objective of establishing a kid friendly atmosphere is to mitigate, if not eliminate, the distress endured by a child and to engage him or her throughout the caregiving process. The Child-friendly Healthcare Initiative (CFHI) emphasizes critical standards, including the reduction of pediatric hospitalizations, the provision of excellent, child-driven healthcare, the establishment of child-friendly surroundings, the delivery of emergency care, the promotion of equity, the acknowledgment of children's rights, the alleviation of pain, the protection of vulnerable children, and the support of play, learning, nutrition, decision-making, as well as the monitoring and enhancement of overall health (Huang et al., 2025). The constructed environment of pediatric healthcare facilities significantly influences the emotional, psychological, and physical welfare of children and their families. Contemporary research progressively highlights that hospital architecture is not a passive setting for medical procedures but a significant factor influencing patient outcomes and recovery pathways. A study by (Ogunnaike et al., 2025) emphasized that when meticulously constructed, pediatric surroundings may reduce stress, improve coping mechanisms, and cultivate a feeling of safety and emotional control for both young patients and their caregivers. Emotional distress in hospitalized children arises not only from illness or medical procedures but is also profoundly affected by environmental stressors, including noise, unfamiliar lighting, lack of privacy, disorientation in navigation, and a deficiency of sensory stimuli appropriate for the child's developmental stage.

Iacono et al., (2023) asserted that emotional experiences in pediatric radiology departments are closely linked to the quality of space and atmosphere. Children engaged in routine yet engaging surroundings, where play areas coexist with clinical efficiency, demonstrate decreased fear during diagnostic procedures. Gibson et al. (2021) illustrate that play interventions integrated into the

architectural framework, rather than appended as accessories, produce substantial psychological advantages. This encompasses reduced heart rates, expedited acclimatization to hospital protocols, and enhanced communication between pediatric patients and healthcare professionals.

Nonetheless, spatial limitations, financial restraints, and stringent hospital rules frequently obstruct the execution of such initiatives, highlighting a continual disparity between theoretical frameworks and actual results. Mehra, Franck, and Hodgson (2024) discovered that family-centered care models flourish in environments that facilitate proximity, privacy, and engagement in care routines. Likewise, the research by Grandjean et al. (2024) highlights that pediatric and neonatal intensive care units are enhanced by spatial configurations that enable families to engage actively in caring, therefore fortifying emotional connections and alleviating feelings of helplessness during hospitalization. These findings align with the conclusions of Nilsson et al. (2021), who observe that user happiness and perceived health outcomes are significantly connected with factors such as noise buffering, spatial legibility, indoor air quality, and the provision of child-scaled furniture.

Halim (2024) advocates for an evidence-based design methodology that emphasizes post occupancy assessment and participatory design; nevertheless, these frameworks are not consistently implemented in practical applications. The concept of evidence-based design (EBD) has been thoroughly documented as a therapeutic environment in healthcare. EBD is a methodology based on utilizing scientific knowledge to inform architectural and interior design choices in healthcare environments. This approach establishes a basis for comprehending the significance of including environmental elements that facilitate healing (Alhsainat & Günçe, 2024). The shift towards Evidence-Based Design (EBD) in healthcare originated with the observation that patients with a view of trees experienced shorter postoperative durations, used fewer analgesics, and expressed more favorable perceptions of their results in medical records compared to those who faced a brick wall (Malenbaum et al., 2008). Arafat and Atreya (2024) warn against the ageist compartmentalization of design ideas, observing that principles from geriatric care, such as tactile navigation and mood-responsive lighting, may also provide therapeutic advantages in pediatric settings. The problem is to create a universal design language that addresses the emotional, physical, and cognitive diversity in pediatric populations while adhering to stringent clinical requirements. (Mackrill et al., 2014) noted that improving healthcare services and settings by positive design significantly impacts the physical and mental well-being of patients and staff. The enhancements have encompassed many non-pharmacological strategies to alleviate stress-related pain and reduce the time of hospitalization (Tagharrobi et al., 2016). The establishment of therapeutic and healing gardens (HG) as non-pharmacological interventions has shown effective in improving general well-being and mitigating pain, restlessness, and discomfort in patients within healthcare settings (Gillis & Gatersleben, 2015).

A substantial body of data indicates that the physical environment of healthcare institutions, including layout, materials, equipment, and furnishings, significantly influences the facilitation or prevention of disease transmission (Alhsainat & Günçe, 2024). (Babbu, 2024) conducted a study that identified the design variables of paediatric healthcare facilities impacting the outcomes of patients, families, and staff and develops a conceptual framework for the paediatric healthcarebuilt environment. A literature review was conducted to identify the design variables of paediatric healthcare environments and the opinion of experts was gathered to finalize the design variables. A conceptual framework for paediatric healthcare environments was developed consisting of 96 design variables under eight therapeutic goals namely: child-friendly environment; nature and outdoors; privacy; positive distraction; therapeutic play; peer and family support; safety and security; and comfort that have the potential to impact the outcomes of patient, families, and staff. Incorporating these variables into the design would contribute to improved patient outcomes.

Alhsainat (2018) did a study to explore the role of the interior space in creating, not only a therapeutic hospital environment for children but also an environment that provides their feelings and support their wellbeing, as much as possible. This based on the principle of reducing patient stress by understanding children's experience in the hospital environment, also to investigate the role of the physical environment in the patient's feelings and well-being. This study is vital as it explains what the

child healthcare environment should constitute to support them. To develop the healing environment in a paediatric setting, this research starts with an extensive literature review about desirable interior space elements in paediatric setting, children's needs, indoor healing environment and the design requirements in paediatric settings. Following with an analysis for queen Rania hospital for children, using interviews, observations, and questionnaire conducted with patients, parents, and doctors to complement what was found in the literature. The data found in the case study were used to conceptualize more richly a holistic healing environment for children in paediatric settings and improve a future development recommendation for Queen Rania Hospital for children in Jordan. Therefore, the significance of this study is to organize design guidelines in a paediatric hospital setting, by coming up with influence factors for design and research practices in the paediatric healthcare environment.

Dwiputri and Swasty (2019) did a research tittle 'Colour Coding and Thematic Environmental Graphic Design in Hermina Children's Hospital.' The research problem was to create an Environmental Graphic Design (EGD) for a children's hospital that is communicative, attractive, and educative and to investigate the role of colour coding in the design. A case study was conducted at Hermina Hospital Depok, which consisted of literature study, observation, interviews, and questionnaires. Colour coding was used as a strategy to differentiate areas and to provide an understanding of the layout of the hospital complex. The purpose of this study was to design an effective EGD for a hospital as a means of information and communication to the visitors, especially children. Another aim was to apply colour coding to a complex area.

Emusa (2023) conducted a study that investigates the impact of a child-friendly hospital-built environment on paediatric patients' satisfaction at Federal Medical Centre Keffi. While previous research has highlighted the significance of service quality and physical environment in enhancing positive healthcare experiences, empirical studies specifically examining the influence of childfriendly hospital-built environments on paediatric patients' satisfaction in Nigerian healthcare settings are lacking. Using a survey-based cross-sectional research design, data was collected through structured questionnaires focusing on paediatric patients' perception of the hospital's childfriendly features and overall experience. The study findings reveal a significant association between the child-friendly hospital environment and paediatric patients' satisfaction. It emphasizes the need for healthcare providers to consider and prioritize child-friendly elements in their built environments to enhance the overall healthcare experience for paediatric patients.

METHODOLOGY

Study area

Nasarawa State, created on 1 October 1996, is located in the north-central geopolitical zone of Nigeria with Lafia as its capital. Covering an area of approximately 27,117 km², it shares boundaries with Kaduna State to the north, Plateau State to the east, Benue State to the south, Kogi State to the west, the Federal Capital Territory (Abuja) to the northwest, and Taraba State to the southeast. The state had an estimated population of about 2.93 million in 2022, up from 1.83 million in the 2006 census, and ranks 28th in population among Nigeria's 36 states. Nasarawa is ethnically and linguistically diverse, with major languages including Eggon, Alago, and Gwandara, alongside Hausa, Tiv, Fulfulde, and Mada, and various ethnic groups such as Afo, Agatu, Arum, Bassange, Gade, Jukun, Kanuri, and Yoruba. It experiences a tropical wet and dry climate, with the rainy season occurring from April to October and the dry season from November to March, and average annual temperatures ranging between 26°C and 34°C. The economy is predominantly agricultural, producing crops like yam, maize, millet, and rice, complemented by livestock farming, artisanal mining, and exploitation of solid minerals such as barite, limestone, and salt.

Map of Nigeria showing Nasarawa State

Study Design

The research design adopted a qualitative and exploratory approach, focusing on understanding the spatial, functional, and aesthetic needs of child friendly paediatric healthcare facilities. The study integrates theoretical research with practical design exploration, combining literature review, case studies, and site analysis to inform the architectural design process. The exploratory nature of the research facilitates the discovery of innovative solutions tailored to the unique needs of the target population. The exploratory approach will involve case studies of existing pediatric centers considered to have included child friendly designs. The findings of from the exploratory study was examined to establish child friendly pediatric healthcare design standards. The said standard was comparatively analyzed against the proposed design for pediatric hospital for Keffi, Nasarawa State.

RESULTS AND DISCUSSION

Findings from Literature

Great Ormond Street Hospital (GOSH), London, UK

GOSH is a benchmark for integrating playful and therapeutic spaces within a historic urban context. It employs interactive installations, art therapy, rooftop gardens, and playful wayfinding to reduce patient anxiety. Sustainable features such as rainwater harvesting and green roofs demonstrate an effective blend of environmental responsibility with high-quality healthcare. However, the complexity and cost of retrofitting heritage structures present challenges for scalability in resource-limited settings (Figure 1).

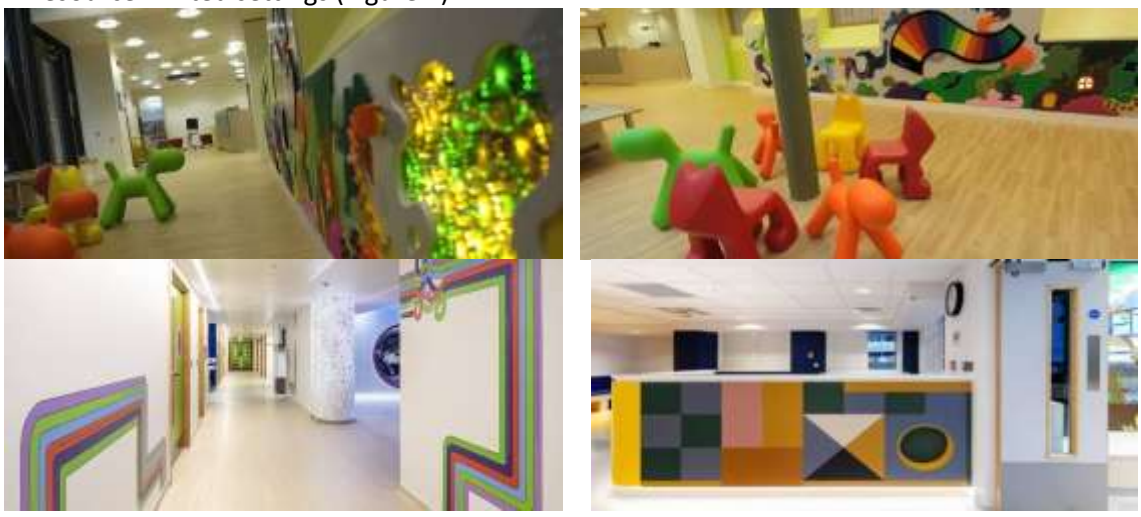

Figure 1: Showing the picture of Great Ormond Street Hospital (GOSH), London, UK.

GOSH is renowned for pioneering child-centered healthcare design. It incorporates interactive installations, art therapy spaces, rooftop gardens, and playful wayfinding that significantly reduce stress and anxiety in paediatric patients (Connellan *et al.,* 2021). The hospital's large, glazed panels maximize daylight, reinforcing Akinbami's (2024) findings on the benefits of natural light in promoting recovery. GOSH also implements rainwater harvesting and green roofs, illustrating how environmental sustainability can coexist with high-quality healthcare delivery (Babbu, 2024). Challenges include balancing historic preservation with modern retrofitting requirements, offering valuable lessons for integrating innovation in constrained contexts.

Children's Hospital of Pittsburgh, USA

This LEED-certified hospital demonstrates a strong synergy between green architecture and childcentered care. Features include healing gardens, bright interiors, low-emission materials, and highefficiency systems. The emphasis on interactive play areas and art aligns with evidence-based design principles. However, the high cost of maintenance for extensive green infrastructure poses challenges for replication in contexts with limited funding (Figure 2).

Figure 2: Showing Picture of Children's Hospital of Pittsburgh, USA.

This hospital integrates LEED-certified sustainable design with healing gardens, interactive installations, bright interiors, and artwork designed for children. It features high-efficiency HVAC systems, low-emission materials, and stormwater management systems. This LEED-certified facility blends green architecture with paediatric care. Low-emission materials, green roofs, and healing gardens create a supportive environment that balances sustainability with therapeutic goals (Fung, 2021). The inclusion of interactive play areas and art installations aligns with Anderson's (2024) emphasis on imagination and symbolic play in paediatric well-being. The hospital's success underscores the value of evidence-based design but also highlights the high costs of maintaining such advanced infrastructure (Chow et al., 2024).

Royal Children's Hospital (RCH), Melbourne, Australia

The Royal Children's Hospital (RCH) features extensive biophilic design, including public gardens, natural ventilation, and views of a wildlife sanctuary visible from wards. It includes interactive digital art, dedicated family areas, and community-integrated spaces. Sustainability initiatives include cogeneration, greywater recycling, and high-performance glazing (Figure 3).

Figure 3: Showing child-friendly hospital of Royal Children's Hospital (RCH), Melbourne, Australia.

RCH demonstrates how architecture can simultaneously address medical excellence and holistic well-being. The child-friendly elements improve emotional health, while passive design reduces energy consumption. The project underscores the value of integrating therapeutic landscapes in urban hospital settings. The RCH exemplifies biophilic and community-driven healthcare architecture. It features extensive gardens, interactive technology, public art, and wildlife views that create a therapeutic landscape (Araújo *et al.,* 2019). Its passive design, cogeneration plant, and water recycling reflect Abdulkareem's (2023) advocacy for sustainability in child-friendly environments. The design supports multi-sensory engagement, reinforcing Gültekin's (2023) findings that biophilic elements lower paediatric stress and foster faster recovery. The scale and cost of these interventions, however, pose replicability challenges for low-resource settings.

TABLE 1: Comparative Analysis of Architectural, Sustainable, and Therapeutic Design Features in Leading Pediatric Hospitals.

Feature	Great Ormond Street Hospital, London (UK)	Royal Children's Hospital, Melbourne (Australia)	Children's Hospital of Pittsburgh, USA
Architectural Focus	Child-centered design with art therapy spaces, interactive installations, rooftop gardens, and playful wayfinding.	Biophilic design incorporating wildlife views, public gardens, interactive art, and community-integrated spaces.	LEED-certified sustainable design integrating healing gardens, interactive installations, and vibrant interiors.
Sustainability	Rainwater harvesting, green roofs, and daylight maximization.	Cogeneration plant, greywater recycling, high-performance glazing.	High-efficiency HVAC, low-emission materials, green roofs, stormwater management.

Therapeutic Features	Art therapy, family-centered spaces, child-scaled furniture, and daylight-enhanced interiors.	Multi-sensory landscapes, interactive technology, therapeutic views to nature.	Healing gardens, symbolic play areas, child-friendly artwork.
Strengths	Reduced patient anxiety, integration of sustainable and therapeutic design, strong family support areas.	Strong biophilic engagement, community connection, multisensory healing environment.	Demonstrates synergy of sustainability and childcentered care, evidencebased design outcomes.
Weaknesses	High redevelopment costs, retrofitting challenges in historic structures.	High implementation and operational costs, limited replicability in low-resource contexts.	High maintenance costs for extensive sustainable features.

Discussion of findings

The three case studies reveal common themes and unique lessons that inform the design of a homely paediatric healthcare center for Keffi. Central to all examples is the prioritization of the emotional and physical well-being of children through architecture. Elements such as dedicated play spaces, therapeutic gardens, vibrant colors, and natural light help reduce anxiety and contribute to faster recovery. Family-oriented spaces and intuitive wayfinding promote ease of navigation and comfort for caregivers and visitors. Each hospital employs design as a tool not only for healing but also for education, community engagement, and environmental responsibility. Collectively, these cases affirm that integrating homely, child-friendly elements improves paediatric health outcomes and caregiver satisfaction (Anderson, 2024; Connellan et al., 2021).

Key strategies include prioritizing natural light, biophilic design, interactive play, and familyoriented spaces. For Keffi, passive cooling, local materials, and flexible spaces are critical given financial and climatic constraints (Akinbami, 2024; Ekhaese & Ezeora, 2024). Modular designs will accommodate future expansion, and community engagement will ensure cultural relevance and acceptance (Channon, 2023; Chow et al., 2024). The proposed center should focus on lowtech sustainability measures, such as rainwater harvesting, solar shading, and cross-ventilation, which are cost-effective and easy to maintain (Babbu, 2024). A phased construction strategy may also be advisable to manage financial outlays while ensuring consistent service delivery. Findings highlight that homely environments support paediatric resilience, reduce anxiety, and improve recovery rates. Vibrant colours, soft materials, scaled furniture, and sensory engagement help children feel secure (Dawson & Guare, 2018). The role of symbolic play, interactive installations, and imaginative spaces is well established in supporting emotional healing (Anderson, 2024).

Integrating family zones strengthens the caregiver-patient bond and promotes family-centred care (Connellan et al., 2021). Sustainability is achievable alongside child-friendliness, but careful planning is vital. Passive strategies, vernacular materials, and community craftsmanship can deliver sustainable and homely healthcare without over-reliance on costly imported technologies (Babbu, 2024; Ekhaese & Ezeora, 2024). Furthermore, adaptable interiors that accommodate play, learning, and rest help address the diverse needs of paediatric patients across age groups (Akametalu et al.,2023).Evidence also suggests that healthcare staff satisfaction improves in welldesigned, homely environments, enhancing care quality and reducing burnout (Chow et al.,2024). This adds another layer of value to investing in child-centered design. The use of culturally relevant motifs, textures, and art fosters a sense of belonging, making the environment more inclusive and comforting for children and families (Jazemi, 2024).

CONCLUSION

This study examined the integration of child-friendly design principles into the development of a paediatric healthcare facility in Keffi, Nasarawa State, Nigeria. Drawing on lessons from leading international case studies, Great Ormond Street Hospital in London, the Royal Children's Hospital in Melbourne, and the Children's Hospital of Pittsburgh—the research highlighted that environments prioritizing emotional well-being, family involvement, and sustainable design can significantly improve health outcomes for children. Across all cases, features such as therapeutic play areas, biophilic elements, intuitive wayfinding, and family-centered spaces were shown to reduce patient anxiety, foster resilience, and enhance caregiver satisfaction. For the Keffi context, these insights point to the importance of adopting cost-effective, climate-responsive strategies, including passive cooling, natural ventilation, rainwater harvesting, and the use of local materials. By embedding culturally relevant motifs, vibrant colours, and adaptable layouts, the proposed design can create a homely and inclusive environment that aligns with the needs of both children and caregivers. The findings also reaffirm that sustainable and child-friendly healthcare design is achievable in resource-limited settings when global best practices are adapted to local realities. Ultimately, the proposed facility has the potential to serve as a benchmark for paediatric healthcare in similar environments, delivering high-quality medical care while promoting comfort, dignity, and emotional security for young patients and their families.

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