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SCHOOL OF BUILT ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

**SUPPORTIVE PEDIATRIC HEALTHCARE FACILITIES FOR CHILDREN WITH
ATTENTION-DEFICIT HYPERACTIVITY DISORDER**

BY

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DECLARATION

I, OBUA ANGELLA OBUA, declare that this research report entitled Supportive Pediatric Healthcare Facilities for Children with Attention Deficit Hyperactivity Disorder (ADHD) is my original work. I confirm that I have not submitted it to any other institution for any award or qualification. I appropriately acknowledged and referenced all sources used in this study in accordance with academic standards.

I further declare that any work not my own is clearly indicated and cited.

Signature:

Date:

11/2/2026

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Date:

12/02/2026

DEDICATION

I dedicate this research to all children living with Attention-Deficit Hyperactivity Disorder (ADHD) whose everyday experience inspired this study, and to their caregivers and healthcare professionals who work tirelessly to provide support, care, and hope within the pediatric healthcare environment.

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ABSTRACT

This research investigates how architectural design can create supportive pediatric outpatient healthcare environments that enhance interaction and well-being among children diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD), their caregivers, and pediatric staff at Mulago National Referral Hospital in Kampala, Uganda.

Children with ADHD are sensitive to environmental stimuli such as noise, light, congestion, and clutter, which significantly affect their behavior, attention, and emotional regulation. Despite this, many healthcare environments, especially in developing countries, focus on functionality rather than the psychological and sensory needs of pediatric patients.

This study adopted the qualitative research approach using an observational checklist and semi-structured interviews to assess both environmental and architectural factors within the pediatric outpatient facility. Three major themes emerged during thematic analysis of the collected data: sensory regulation and environmental comfort, spatial quality and organization, and supportive and inclusive design approaches.

The results revealed that the current design of the facility exposes children to sensory overload, spatial congestion, and a lack of child-centered and inclusive design features. In contrast, much literature indicates that controlled lighting, acoustic insulation, biophilic elements, spatial zoning, and therapeutic play environments significantly improve children's behavioral outcomes, emotional outcomes, and overall experience.

It concludes that architecture plays a significant role in supporting the emotional, cognitive, and social well-being of children with ADHD and recommends the integration of sensory-sensitive, flexible and inclusive design interventions in pediatric outpatient facilities, specifically in low-resource healthcare settings.

Keywords: Attention-Deficit Hyperactivity Disorder, Pediatric Healthcare, Architecture, Sensory regulation, Inclusive design, Supportive environment.

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1.0 CHAPTER ONE

1.1 INTRODUCTION

1.11 Background

Pediatric health research has concentrated on neonatal care (Kyasimire et al, 2024), infectious diseases (Mpimbaza et al, 2020), and surgery (Alberti & Kisa, 2024), both internationally and locally. It has addressed disease management and service delivery. Much literature in architecture highlights the importance of evidence-based design and supportive environments in reducing stress and fostering holistic well-being among pediatric patients; however, these studies have focused on the general population rather than specific neurodevelopmental conditions.

Recently, interest in healing environments has grown worldwide. A healing environment (both tangible and intangible) supports an individual's overall recovery process (Ghazali & Abbas, 2012). Evidence-based design is a theoretical framework for understanding and developing healing environments. It reduces patient stress by increasing control, providing distraction, and promoting social interaction, which ultimately leads to better treatment outcomes in healthcare settings (DuBose, MacAllister, Hadi and Sakallaris, 2018).

Pediatric health defines a child as an individual between birth and puberty, encompassing adolescent medicine, which extends up to 21 years of age (Strouse, Trout and Offiah, 2022). A research study demonstrates that the context influences the child's occupation, as they are contextually situated and flexible in nature (Njelesani, Sedgwick, Davis and Polatajko, 2010).

Attention-Deficit Hyperactivity Disorder is a neurodevelopmental disorder in children that sometimes persists into adulthood. It represents a lack of focus, lack of self-control, and excessive activity - children with ADHD experience psychological and social disparities at home, school, and in the community. ADHD is prevalent at 5-7% internationally (Salari et al, 2023), 7.47% in Africa (Ayano, Yohannes and Abraha, 2020), and 10-11% in Uganda (Wamulugwa et al, 2017), which means that the proportion of children affected is high, thereby increasing the demand for pediatric health services in Uganda. Children with ADHD respond strongly to their environmental experiences (positive or negative) compared to children who are not at risk of ADHD.

In Uganda, pediatric healthcare units experience financial and infrastructural challenges, which pose a threat to the well-being of pediatric patients. Research indicates the significance of healing

environments, yet there is a research gap in the study of healing environments in pediatric outpatient healthcare settings for children with ADHD. This research aims to assess the General Pediatric Outpatient Unit in Mulago National Referral Hospital environment and determine the effect on children aged 5-12 years diagnosed with ADHD.

1.12 Problem statement

Pediatric patients with ADHD are prone to interacting with environmental influences that determine behavior. Therefore, understanding the healing effects of architecture on children with ADHD is necessary to inform the design of outpatient health care facilities for holistic well-being.

1.13 General Objective

To evaluate the Paediatric healthcare outpatient facility environment and determine the effects on children with Attention-Deficit Hyperactivity Disorder.

1.14 Objectives

1. To explore architectural and environmental factors within paediatric outpatient healthcare facilities that influence the experience of children diagnosed with ADHD.
2. To assess the current spatial, functional and environmental condition of the paediatric outpatient healthcare facilities.
3. To examine how the paediatric outpatient healthcare facilities affects the interaction between children with ADHD, caregivers, and staff.

1.15 Research Questions

1. What architectural and environmental factors within paediatric outpatient healthcare facilities influence the experience of children diagnosed with ADHD?
2. What is the current spatial, functional and environmental condition of the paediatric outpatient healthcare facilities?
3. How can architecture create supportive paediatric healthcare facilities that enhances interaction and well-being among children with ADHD, caregivers, and staff?

1.16 Justification

There exists a predominant use of generic hospital design for paediatric units in Uganda, which focuses on treating illness with little consideration of the patients' psychological and emotional well-being. International evidence shows the significance of evidence-based design to promote the holistic well-being of children. However, research that studies how supportive environments can be adapted for children with ADHD in low-resource paediatric outpatient healthcare setting in Uganda is lacking. Therefore, this research addresses the research gap by exploring how architecture can create supportive environments specific to the needs of children with ADHD in Uganda.

1.17 Significance

This research adds to the already existing literature focused on children's healthcare from an architectural perspective through supportive environments, which are specific to the needs of children with ADHD in low-resource settings, to support and promote holistic well-being. It also provides context-sensitive and evidence-based design guidelines that enhance decision-making in the design and rehabilitation of childcare health facilities.

2.0 CHAPTER TWO

2.1 LITERATURE REVIEW

This chapter reviews existing literature to the design of supportive pediatric healthcare facilities with a focus on children with Attention-Hyper Activity Disorder. It examines theoretical frameworks and contextual research that explores relationship between healthcare environments, child development, stress regulation, and user experience. With a focus on Evidence-Based Design, Supportive Environment Design, and Attention Restoration Theory to establish how the built environment influences emotional, cognitive, and behavioral outcomes in children. The role of caregivers and healthcare staff in enhancing well-being of children with ADHD.

Design of pediatric healthcare facilities has undergone a significant shift over the last years. In one developmental study (Kipps & Erdman, 2025), this is due to the influence of societal change, medical advances, and current emphasis on the developmental needs of children. As compared to adult healthcare environments, pediatric facilities must respond to children's heightened sensitivity to unfamiliar settings, limited coping mechanisms, and reliance on caregivers for emotional regulation. Therefore, the pediatric healthcare setting is not merely a clinical environment but a complex social and psychological setting. It presents unique challenges for children who are required to navigate unfamiliar spaces, interact with medical staff, and undergo examination with limited timeframe.

During outpatient visits, adjusting to a new environment is vital to children with ADHD (Babbu & Haque, 2023). This experience is associated with stress and anxiety that negatively affect cooperation, communication, and clinical outcomes. The outpatient facilities lack opportunities for adaptation, making environmental design a key factor in mitigating stress. According to Ulrich, Berry, Quan and Pasha (2010), healthcare and the built environment are inherently interconnected in their influence on patients' healthcare outcomes. Design elements like spatial layout, access to nature, lighting, color, artwork, acoustics, and visual complexity significantly affects children's emotional and cognitive responses (Babbu & Haque, 2021). These design elements enhance comfort, reduce fear, and foster positive healthcare experiences which are necessary to improve their health service experience during outpatient visits, while poorly designed environments may exacerbate anxiety, confusion, and behavioral challenges.

Healthcare environments promote wellness if the design fosters a sense of control with respect to physical surroundings, access to social support, and access to positive distractions in physical surroundings (Ulrich, 1991). In a recent study report, indoor and outdoor environments that allow self-regulation in children with ADHD reduce overstimulation and behavioural challenges, which have clear implications for the health outcomes for children with ADHD (Finnigan, 2024). Nevertheless, much of the literature evidence is from high-resource settings, leading to a research gap in how such approaches could be applied in pediatric healthcare facilities in low-resource settings, which experience financial and infrastructural constraints.

2.11 Evidence-Based Design

Evidence-Based Design is a design concept applied to advance the practice of developing healthcare facilities using reliable evidence to improve the patient health outcomes, safety, and overall well-being (Babbar, 2024). It integrates scientific evidence, user needs, and design expertise to create healthcare environments that support healing and efficiency. Evidence-based Design shifts the focus from only treating illnesses to holistic care that considers the emotional, psychological and developmental needs to enhance the overall well-being and development of children in the healthcare setting (Kipps & Erdman, 2025).

Evidence-based design identifies environmental factors that influence patient experience. It outlines key components such as acoustic environment that minimize noise and introduce pleasant sounds, visual environments that provide natural light and positive distraction, and effective wayfinding systems that support cognitive comprehension and reduce frustration. Patient room design, including privacy and sleep quality and the provision of family support spaces that encourage social interaction is also emphasized (Ulrich et al, 2010), to enhance the holistic well-being of patients reduce waste of resources and enhance sustainability.

These principles are relevant for children who benefit from environments that are predictable and encouraging without being overwhelmed. However, much of evidence-based design originates from high resource settings where financial capacity and technological infrastructure significantly differ from those in low-resource settings. This presents a limitation in directly applying evidence-based design strategies in pediatric healthcare facilities in Uganda, which experience spatial constraints, overcrowding, and limited funding. Therefore, there is need to adapt evidence-based

design principles in ways that are contextually appropriate, culturally responsive, and economically feasible.

2.12 Supportive Environment Design

The theory of Supportive Environment Design developed by Ulrich (1991, 2000) states that the environment has the potential to affect patients' health outcomes linked to stress either positively or negatively depending on their design characteristics. In order to support patients' well-being, the theory identifies three (3) environmental attributes that influence reduction of stress. A sense of control, social support, and positive distraction. A study by Andrade & Devlin (2015) also confirms that the supportive environment design theory of perceptions of control, social support, and positive distraction, when applied in healthcare facilities, reduces patients' stress. These attributes are relevant to in pediatric healthcare facility where stress significantly affects children's emotional regulation and behavior.

Humans have a strong need for control over their environment. Sense of control refers to an individual's perceived ability to influence their surrounding and experience. In a healthcare facility, lack of control is a major contributor to stress. (Ulrich, 1991) argues that environments that allow users to understand, predict, and navigate spaces easily reduces anxiety for children with ADHD. Architectural features such as clear circulation paths, visible destinations, familiar spatial sequencing, and opportunities for choice can enhance perceived control and reduce distress (Ulrich, 2000).

Social support is the emotional support and tangible assistance that a person receives from others. (Ulrich, 2000) highlights that frequent and meaningful contact with family members and caregivers helps buffer stress and improve well-being. Individuals with high social support experience less stress compared to those with low social support. Pediatric healthcare facilities whose spatial arrangement allows caregivers to remain close to children during waiting, consultation, and examination processes foster reassurance and emotional stability. Therefore family-centered design approaches that provide comfortable waiting areas, visual connections and shared spaces enhance caregiver involvement and improve patient experience.

Positive distraction is a phenomenon in environmental-social situations with the capacity to promote restoration from stress, for instance, music, art, comedy, nature, and pet animals (Ulrich, 2000). In environmental psychology, research states that children are sensitive to sensory input

due to their cognitive and emotional development. For children with ADHD, this sensitivity is heightened. Exposure to unpredictable environments can exacerbate symptoms of hyperactivity, impulsivity and inattention. However, environments that balance stimulation through calming colors, controlled acoustics, and organized spatial layouts support emotional regulation and focus (Ulrich, 1991). This body of literature demonstrates the importance of supportive environments in healthcare settings, where facility design provides moderate well-regulated stimulations. This reduces stress while maintaining engagement, contributing to positive behavioral outcomes, and healthcare experiences. It presents an opportunity to evaluate its adaptation in outpatient pediatric healthcare facilities for children with ADHD in Uganda.

2.13 Attention Restoration Theory (ART)

Attention Restoration Theory (ART) demonstrates that natural environments have the capacity to restore cognitive functioning and reduce mental stress, fatigue, and enhance mental clarity in patients. Nature has an aesthetic advantage, which provides an opportunity for individuals to distance themselves from daily life pressures and actively engage with stimuli as it encourages involuntary attention while allowing voluntary attention capacities to recover and restore (Alhsainat & Günce, 2024). Access to natural elements such as gardens, courtyards, daylight and views of greenery reduce anxiety and improve patient satisfaction. Individuals benefit from a change, which helps them to escape everyday stress, experience expansive spaces and contexts, engage in activities that align with their inherent motivation, and experience stimulation that is softly fascinating (Ohly et al, 2016). (Basu, Duvall and Kaplan, 2018) says that natural environments are ideal places to restore attention capacity. It can moderately hold one's attention while leaving sufficient headspace for reflection. Natural environments are beneficial to children with ADHD as exposure to outdoor spaces and natural elements improves attention, reduces impulsivity and enhances self-regulation.

While ADHD is not curable, its symptoms can be managed through pharmacological and psychotherapeutic interventions. Research in pediatric healthcare has shown that children with ADHD are influenced by both individual and environmental factors (Hood & Baumann, 2024). (Babbar & Haque, 2021) says appropriate and creative use of healthcare facility spaces, as well as provision of child-friendly spaces with child-specific features, can improve the well-being and satisfaction of patients. It emphasizes the need to create unstructured, flexible, and contemporary

environments in pediatric healthcare facilities. (Finnigan, 2024), points out that noise pollution, navigating environments, and overstimulating environments amplify ADHD symptoms. Exposure to natural environment settings and the incorporation of sensory refuges for self-regulation are associated with improved attention.

Caregivers and staff are active producers of experiences, as children heavily rely on them in a healthcare setting (Shepley & Pasha, 2017). Environments that enable caregivers and staff to use structured, predictable, and calm routines help them manage behavior more effectively during visits, thus improving examination interactions between children with ADHD, caregivers, and staff within pediatric healthcare settings. Family-centered design approaches improve caregiver satisfaction that improves provision of support to patients (Yu, Wong, Gignac, Walker and Ross, 2023). Staff efficiency depends on environmental design feature such as well-organized circulation, clear sightlines, and accessible workstations, which improve their ability to support children (Ulrich et al, 2008). Therefore, the built environment mediates the interaction among children with ADHD, caregivers, and pediatric healthcare staff. Design strategies that facilitate communication, visibility and calm interactions contribute to improve therapy experiences and well-being.

In Uganda, much literature points out that pediatric outpatient healthcare facilities operate in crowded, minimally resourced spaces, which amplify symptoms in children with ADHD and influence service delivery to patients (Namazzi et al, 2022). Such environments amplify stress and behavioral challenges in children, particularly those with neurodevelopmental conditions such as ADHD. Limited spatial organization, high noise levels, and lack of child-specific design features negatively affect both patient experience and service delivery. Despite these challenges, there exists a need for context-appropriate design solutions that enhance holistic well-being with the existing constraints. Research suggests that adaptable, low-cost, and culturally responsive design interventions improve healthcare experiences without requiring extensive financial investment (Namazzi et al, 2022). However, there remains a significant gap in the literature addressing the design of pediatric outpatient facilities specifically for children with ADHD in Uganda. It provides an opportunity for research to explore context-sensitive architectural strategies that promote emotional regulation, cognitive stimulation and holistic well-being at the facilities

3.0 CHAPTER THREE

3.1 METHODOLOGY

The methodology states the framework adopted for this research. It explains the research design, approach, study area, population, sampling strategy, data collection methods, data analysis procedures, quality control measures, and ethical considerations. The methodology was selected to ensure an in-depth understanding of how the built environment influences the experiences of children diagnosed with Attention-Deficit Hyperactivity Disorder within the pediatric outpatient healthcare setting, as well as how caregivers and healthcare staff perceive and interact with the environments at the facilities.

3.11 Research design

This research adopted the qualitative exploratory research design. The exploratory nature of the design was appropriate due to the limited existing research on ADHD supportive pediatric outpatient healthcare environments in Uganda. This allowed for the in-depth examination of environmental conditions, spatial experiences, and human interaction within the healthcare setting. A qualitative design was chosen as the research sought an understanding of how children diagnosed with ADHD experience the healthcare spaces. It focused on describing and interpreting experiences, perceptions, and behavior of children, caregivers, and pediatric healthcare staff within the outpatient environment. This research design enabled the exploration of contextual realities, spatial qualities and environmental factors that influence the emotional regulation, attention and behavior in children with ADHD.

3.12 Research Approach

The qualitative research approach was employed, which is suitable for capturing subjective experiences, perceptions, and meanings associated with the pediatric healthcare built environment. It ensured that the research explored the relationship between the architectural environment and human behavior in the healthcare context for children with ADHD. It facilitated the exploration of environmental influences on children with ADHD; understanding caregivers' perceptions of how space affects children's behavior and comfort, and examining pediatric healthcare staff experiences and how the physical environment supports service delivery. The approach supported the identification of architectural opportunities for creating supportive pediatric outpatient healthcare environment for children with ADHD.

3.13 Geographical Area

The study was conducted at the General Pediatric Outpatient Unit in Mulago National Referral Hospital in Kampala, Uganda. Mulago hospital is the largest public health facility in the country and serves as a national referral center for pediatric healthcare services. The selected facility reflects a typical high-demand public healthcare environment characterized by high patient volumes, limited resources and diverse user needs. The facility was considered appropriate for the study because it represents the realities of the public pediatric outpatient facilities in Uganda. Children with ADHD receive care at the is unit making it a relevant context for exploring environmental influences on behavior, stress, and experience.

Therefore, findings from this facility have strong practical relevance that can inform context-appropriate design strategies for ADHD supportive pediatric healthcare environments in Uganda and similar low-resource settings.

3.14 Study Population

This research focused on children aged 6-12 years diagnosed with ADHD attending the pediatric outpatient unit, caregivers (parents and guardians) who accompany the children during outpatient visits, and healthcare staff who directly interact with children with ADHD. The selected age group was appropriate because children within this range are developmentally capable of expressing behavioral responses to environmental stimuli, while still being able to interact and rely on caregivers at the outpatient unit.

The caregivers and pediatric healthcare staff were included to ensure a holistic understanding of the pediatric outpatient environment from the perspective of key stakeholders directly interacting with children with ADHD and the spaces at the healthcare setting, capturing both user experience and service delivery.

3.15 Sampling Strategy

This research used the qualitative non-probability-sampling strategy. Purposive sampling strategy was selected since it allowed for intentional identification of participants (caregivers and pediatric healthcare staff) based on direct involvement with children diagnosed with ADHD and their ability to provide relevant information about the pediatric outpatient environment. Caregivers were selected based on their role in accompanying children with ADHD during visits. Healthcare staff were elected based on their involvement in pediatric outpatient care.

Purposive sampling ensured that participants were knowledgeable about the healthcare environment and capable of understanding how spatial conditions influenced behavior, interaction, and care process.

3.16 Methods and Tools of Data Collection

Data collection methods used were semi-structured interviews, which were conducted with caregivers and pediatric healthcare staff. It allowed participants to describe their experiences, perceptions, and observations regarding how the built environment affects children with ADHD. It involved open-ended questions, which enabled flexibility and encouraged participants to elaborate more on conditions of the environmental and physical environment at the facility.

Observation was used to examine how children with ADHD interacted with the physical environment during outpatient visits. It focused on behavioral responses to the environmental factors such as noise levels, spatial congestion, circulation patterns, and availability of calming spaces. It provided first hand insight into real-time interactions between children, caregivers, staff, and built environment. Photographic documentation and sketches were used to capture the physical features that influenced user experience. It enabled visual documentation and aided in translating observed conditions into architectural design implications. Document reviews involved reviewing relevant documents to understand existing standards of the pediatric healthcare environments in Uganda. It helped to identify gaps in policy intentions and actual spatial conditions on the ground.

3.17 Quality Control of Data

To ensure the credibility and trustworthiness of findings, quality control measures were implemented. Data triangulation was achieved by using multiple data sources and methods, including interviews, observation, visual documentation, and document reviews. This approach provided a more comprehensive understanding of the research problems and reduced risk of bias.

Clear documentation of the data collection process and analysis procedures enhanced dependability and transparency. Consistency in observation focus and interview questioning ensured that the findings were examined through cross-referencing multiple data sources to strengthen validity.

3.18 Data Analysis

Data was analyzed thematically. This process involved systematically reviewing of interview transcripts, observation notes, and visual data to identify recurring patterns and themes related to the built environment and user experience. The developed key themes were interpreted in relation to the theoretical frameworks i.e. evidence-based design, supportive environment design, and attention restoration theory. Comparative analysis between qualitative themes and descriptive data enhanced the formulation of conclusions and ensured consistency across findings.

3.19 Ethical considerations

Ethical considerations were prioritized throughout the research process to safeguard the well-being and rights to all participants. Participants were informed of the purpose of the study, their role in research, and the voluntary nature of their participation. Informed consent was obtained prior to data collection. Participants were informed of their right to withdraw from the study at any stage without penalty. Anonymity and confidentiality were upheld by ensuring that personal identities were excluded from research records and reports. Data were handled responsibly and reported accurately to maintain integrity and transparency. Special care was taken to minimize potential harm, given the involvement of children; ensuring ethical standards were maintained throughout the research process.

4.0 CHAPTER FOUR

4.1 FINDINGS

This section presents data findings from a qualitative study conducted at the general outpatient pediatric unit at Mulago National Referral Hospital. It is located in the northern part of Kampala on Mulago Hill. The findings are from semi-structured interviews with caregivers and pediatric healthcare staff and observation of children with ADHD within the outpatient environment. The research evaluates the environmental and architectural factors that influence the experience of children with ADHD, the current spatial, functional, and environmental conditions of the unit, and how architecture can create supportive pediatric healthcare facilities that enhance interaction and well-being among children with ADHD, their caregivers, and staff.

Through thematic analysis of the data, the findings are organized under three major themes: sensory regulation and environmental comfort, spatial quality and organization, and supportive and inclusive design approach. These themes indicate the recurring patterns in participant responses and observed behavior thereby highlighting the relationship between the built environment, healthcare experiences, and outcomes.

The findings reveal that architectural and environmental factors influence the emotional and behavioral experiences of children with ADHD, which in turn affects interaction among children, their caregivers, and pediatric staff. This shows a gap in implementing global design theories and best practices in pediatric healthcare facilities in Uganda. To address the gaps, architectural responses that not only prioritize function but also sensory stimulation, inclusivity, emotional and cognitive support is fundamental

4.11 Sensory Regulation and Environmental Comfort

This is the ability of the built environment to support emotional stability, attention, behavioral regulation and minimize sensory overload in children with ADHD. Sensory overload is the major environmental factor influencing the experience of children with ADHD in the facility, which experiences noise and overcrowding. Persistent background noise was observed in waiting areas and corridors of the facility, whose source is conversations, movement, operational activities and children. All this creates an acoustically hostile environment, which affects the children with ADHD. A pediatric staff member said, “Noise interferes with attention and concentration in the waiting area,” and a caregiver similarly said, “My child is always distracted and cannot settle

down.” Due to the noise intensity; children displayed restlessness, pacing, and difficulty settling down. In the consultation rooms, noise intrusion was also observed due to open doors and windows, which reduced privacy and increased distraction during examination sessions.

The visual environment was found to be overstimulating and inadequate in supporting emotional regulation due to lack of child-friendly elements. Walls of the facility are bare and finished in neutral color tones with minimal visual cues, artwork, and child-oriented elements. While neutral color palettes may provide a clean outlook and reduce visual clutter, the absence of age-appropriate and engaging visual elements can contribute to a sterile and unwelcoming environment. Observations showed children seeking stimulation through movement rather than visual engagement, indicating unmet sensory needs. Both pediatric staff members and caregivers reported that it is difficult to redirect the children’s attention during long waiting periods.

Ventilation at the facility depends on open windows and doors, which allows for adequate air circulation. However, this allowed for external noise and movement related distractions to penetrate the interior spaces like the consultation rooms. This fact compromised the sensory comfort of children with ADHD and reduced effectiveness of interactions at the facility.

These findings show the inadequate sensory regulation within the outpatient facility that heightens inattention, hyperactivity, and emotional dysregulation among children with ADHD. This in turn negatively affects caregiver management and staff engagement.

4.12 Spatial Quality and Organization

This is the scale, arrangement, zoning and connectivity of spaces within the facility for functional segregation, supervision, sense of spatial clarity (predictability) and safety for children with ADHD. Overcrowding is a significant spatial challenge at the outpatient facility. Observations revealed high patient volumes during peak hours, which leads to congestion in waiting areas and circulation corridors. Caregivers mentioned that, “The waiting area is usually congested,” which makes it difficult to manage their children behavior in crowded spaces. The limited space for movement restricts opportunities for children to release excess energy in a controlled manner, increasing restlessness. The absence of calming areas further contributes to behavioral unrest.

Lack of spatial zoning due to limited separation of quiet and active spaces within the facility. The waiting, circulation, and consultation activities occur in proximity leading to noise spill over and

spatial confusion. This absence of functional segregation makes it difficult for children with ADHD to understand the purpose of the different spaces increasing anxiety, restlessness, and reduced predictability. This creates challenges for children with ADHD who benefit from structured and legible environments. It was observed that children frequently moved between spaces without clear transitions, leading to increased caregiver stress and staff interruptions.

The current spatial layout provided moderate visibility through open doorways and shared spaces allowing for caregivers and staff to supervise children. This strategy however, compromises privacy and acoustic control during consultations. Healthcare staff noted that children have a limited opportunity to prepare emotionally and mentally for consultations due to lack of gradual transitions between spaces

4.13 Supportive and Inclusive Design Approach

Supportive and inclusive design refers to the ability of the built environment to accommodate user needs, especially those of children with ADHD that facilitates interaction among children, caregivers, and staff. The facility's-built environment prioritizes efficiency and functionality rather than psychological and emotional comfort. Furniture is predominantly adult-scaled, limiting children's comfort, independence, and sense of control. Children were observed sitting weirdly and moving frequently due to discomfort. Lack of child-scaled furniture reduced opportunity for self-regulation and increased dependency on caregivers for physical support.

The lack of dedicated caregiver and staff spaces limited the opportunity for rest, privacy, and emotional regulation. Caregivers and staff reported experiencing physical fatigue and emotional stress during outpatient visits. Staff workspaces are functional but lacked environmental features that support calm interaction such as visual separation and acoustic buffering. It affected staff efficiency and quality of interactions be among children, caregivers, and staff. However, the facility made effort towards physical accessibility although it lacked flexibility to accommodate neurodiversity needs. The facility lacks sensory refuges and quiet zones that allowed children to self-regulate, encourage participation, exploration, and positive distraction. This limits the overall supportive capacity of the facility towards children with ADHD.

The findings reveal that the pediatric outpatient unit at Mulago National Referral Hospital lacks key architectural and environmental features necessary to support children with ADHD. Sensory overload due to noise and congestion, poor spatial organization and limited inclusive design

considerations are challenges faced at the facility, which negatively influence children's emotional regulation and behavior. It also increases caregiver stress and interferes with interactions. This indicates the need for context-sensitive architectural strategies that integrate sensory regulation, spatial clarity, and inclusive design to create supportive pediatric outpatient environments for children with ADHD.

5.0 CHAPTER FIVE

5.1 DISCUSSION

The discussion examines findings of how sensory regulation, spatial quality, and inclusive design within the pediatric outpatient unit relates to the theoretical frameworks of evidence-based design, supportive environment design, and attention restoration theory.

5.11 Sensory Regulation and Environmental Comfort.

The findings revealed that sensory overload affects the emotional and behavioral stability of children with ADHD. This is in alignment with the literature that emphasizes the importance of controlled sensory stimulation in environments designed for children with ADHD. Ulrich (1991, 2000) on supportive environments design theory identifies sensory comfort as an important factor in stress reduction. Similarly, Kalantri (2025) emphasizes that environments designed with controlled sensory stimulations using sensory-friendly architectural factors such as controlled lighting and acoustics, color balance, ventilation, textures, and contact surfaces enhance children's sensory processing and well-being. These promote calmness, focus, emotional, and behavioral stability in children with ADHD.

The pediatric outpatient facility demonstrates limited application of these principles. It employs a neutral dual-color palette that supports cleanliness and visual simplicity, which fails to provide adequate positive sensory engagement for children with ADHD. (Rashed & Howeid, 2014) says architectural geometry influences energy flow and psychological comfort by harmonizing shapes and orientation using form, motion, and color. The lack of child-friendly visual elements observed at the unit suggests prioritization of clinical neutrality at the expense of emotional and cognitive stimulation. Noise at the facility from the waiting areas and corridors emerged as a dominant sensory stressor, which aligns with Finnigan (2024) that auditory overstimulation exacerbates inattention and hyperactivity in children with ADHD. The noise from waiting areas easily travels into the consultation rooms due to the hard surface of the walls and furniture. Although functional and easy to maintain, they are highly reflective to sound waves and intensify acoustic discomfort. (Babbu, 2024) suggests that soft textures and warm surfaces are important for sensory grounding and emotional reassurance. The absence of these elements results in restlessness and inattention during clinical visits.

The air quality and thermal comfort at the facility are relatively acceptable due to the presence of natural ventilation through windows. However, findings indicate that the waiting area and corridor tend to be hot when the number of people is high. This reflects an alignment with evidence-based design principles (Ulrich et al, 2010), which advocates for environmental comfort and emphasizes the need for design strategies that balance ventilation, acoustics, and thermal control. The facility lacks deliberate sensory zoning (quiet, active, and retreat spaces), which contradict literature that suggests that structured sensory environments that allow children with ADHD to self-regulate is of importance (Kalantri, 2025).

Observations indicate a missed opportunity to support emotional regulation within the outpatient setting as access to nature and biophilic features is minimal at the facility. This finding diverges from the attention restoration theory, which highlights nature's ability to reduce mental fatigue and restore attention (Basu, Duvall and Kaplan, 2018).

While literature emphasizes the importance of sensory regulation through the incorporation of sensory-responsive design to promote calmness, emotional, and behavioral comfort for children with ADHD, the outpatient pediatric unit shows a lack of sensory-sensitive design, indicating a gap in existing global theories and practice, and contextual practice.

5.12 Spatial Quality and Organization

Environments with high spatial clarity and organization help children anticipate and regulate behavior. Spatial zoning supports structured routines and helps reduce impulsivity since each activity has a clear spatial identity (Kalantri, 2025). The findings demonstrate that spatial disorganization, congestion, and inadequate zoning negatively affects children's behavior and caregiver experience, which aligns with literature. Similarly, (Abdallah, 2025) asserts that architecture has the ability to eliminate distractions, extend concentration, promote calmness, and promote attention restoration in a child with ADHD. However, field findings demonstrate that the spatial layout of the facility, which is a linear plan that consists of a central corridor that connects various activity zones places emphasis on functional efficiency at the facility. It reveals insufficient spatial hierarchy, congestion, and inappropriate spatial zoning observed in the waiting area and consultation rooms, which is contrary to what literature consistently shows.

(Kazibwe, 2022) points out space inadequacy, overcrowding, and limited privacy as functional and spatial deficiencies at the facility, which were evident in the study findings. The consultation

rooms are small in scale with adult-sized furniture, which restricts movement and exacerbates restlessness in children with ADHD. This is in contradiction to (Chauhan, Sachdesa, Malhotra and Gupta, 2024; Babbu, 2024), which demonstrates that flexible, scaled and sensory sensitive design supports diverse user needs and prioritizes psychological comfort, visual warmth, and a sense of security thereby enhancing interaction among children, their caregivers, and pediatric staff. The reliance on verbal instructions due to inadequate wayfinding systems indicates spatial confusion. The undefined functional relationship between spaces leads to a compromise in privacy and environmental control. Evidence-based design emphasizes that clear wayfinding reduces cognitive load and anxiety for children with ADHD and caregivers as they navigate unfamiliar environments (Ulrich et al, 2010). The lack of visual cues and environmental signage increases dependency on staff and caregivers, increasing their stress levels.

Visibility and supervision within the facility is moderate since semi-transparent partitions separate the consultation spaces (private spaces), waiting and corridor (public spaces), open doorways, and windows, aligning with (Shepley & Pasha, 2017). However, this openness compromises acoustic privacy and environmental control, creating a tension between supervision and sensory comfort. The absence of transitional spaces between waiting and consultation areas also contradicts supportive environment design theory, which emphasizes gradual spatial transitions for stress reduction (Ulrich, 2000).

Spatial disorganization disrupts the child's sense of orientation and poses as a risk to injury at the facility. The findings highlight the need to incorporate flexible spatial design with an emphasis on child-friendly furniture, positive distraction, play, and nature (biophilic features). It ensures balance and safety with freedom of exploration.

5.13 Supportive and Inclusive Design Approach

Supportive and inclusive design accommodates neurodiversity through sensory zoning, flexible spaces, and adaptable furniture for children engagement. Spaces connected to nature improve relaxation and reduce anxiety (Chauhan et al, 2024; Babbu, 2024). This promotes comfort and engagement as well as attention restoration, emotional, and behavioral balance in children with ADHD. However, findings at the pediatric outpatient facility prioritize efficiency and functionality resulting in a rigid spatial layout that pays minimal attention to sensory and behavioral needs of children with ADHD. It contradicts (Ulrich, 2000; Chauhan et al, 2024; Babbu,

2024) that identifies play as a critical positive distraction that supports cognitive development, emotional regulation, and social interaction. The facility has addressed physical accessibility through ramps and wide doorways, indicating that accessibility is limited to mobility. Literature demonstrates that inclusivity expands beyond physical access to sensory, cognitive, and emotional needs (Babbu, 2024; Babbu & Haque, 2021). The insufficient wayfinding systems at the facility reduces spatial autonomy for both children with ADHD and caregivers.

The facility lacks therapeutic and engagement-oriented features like play zones, nature integration, which significantly reduces the opportunity for restoration and positive interaction. (Basu et al, 2018) notes that environments that provide engagement without overstimulation support emotional balance and cognitive recovery. Therefore, the absence of these features indicates an inclusivity gap in the implementation of guidelines for emotional safety and cognitive engagement at the facility.

6.0 CHAPTER SIX

6.1 CONCLUSION AND RECOMMENDATIONS

6.11 Conclusion

The study concludes that sensory overload is a significant factor influencing emotional and behavioral dysregulation among children with ADHD in the outpatient facility at Mulago Regional Referral Hospital. Although findings show that natural ventilation provides acceptable air quality, it permits noise intrusion, compromising sensory comfort in waiting area and consultation room. It also revealed that excessive noise, overcrowding, lack of acoustic control, inadequate sensory zoning, and minimal access to nature and biophilic features heightened restlessness, inattention, and anxiety in children with ADHD during outpatient visits. The absence of deliberate sensory-responsive design features indicates a gap between evidence-based design principles and existing architectural practice. The findings confirm that environments lacking sensory regulation negatively affects children's ability to self-regulate, placing strain on caregivers and healthcare staff during clinical interactions.

Poor spatial organization, overcrowding, and inadequate spatial zoning within the facility negatively affects behavior, supervision, and therapeutic engagement. The linear layout prioritizes functional efficiency though it lacks spatial hierarchy, clear zoning, and transitional spaces. This leads to confusion, noise spillover, limited privacy, and difficulty for children with ADHD to anticipate activities and navigate spaces independently. Small consultation rooms with furniture restricts movement and compromises comfort. Inadequate wayfinding systems leads to cognitive overload and reliance on verbal guidance. Although the presence of moderate visibility supports supervision, acoustic privacy and emotional comfort is compromised. All these spatial limitations heighten anxiety, increase restlessness and inattention, and affect the effectiveness of interaction and care delivery.

There is limited inclusivity at the facility as shown in the findings. While physical accessibility (ramps and wide doorways) support mobility, the facility lacks child-specific furniture, play areas, sensory refuges, family-centered spaces, and staff support spaces necessary for emotional support, security, and engagement. The facility's spatial layout fails to accommodate the needs of children with ADHD necessary to promote positive interaction among children, caregivers, and healthcare staff. The absence of play and interactive spaces reduces opportunity for positive distraction,

emotional and behavioral regulation, and attention restoration. Therefore, the environment is functionally efficient though psychologically unsupportive, which points out a gap in the implementation of inclusive and child-centered design principles within the facility.

Architectural design plays an important role in shaping the experiences of children with ADHD in the pediatric outpatient healthcare facility. The findings confirm that sensory-responsive design, clear spatial organization and inclusive design strategies are essential in supporting emotional regulation, cognitive functioning, and positive interaction. This study therefore, contributes to the limited literature on ADHD-supportive pediatric healthcare design in Uganda and emphasizes the role of architecture as a direct therapeutic agent

6.12 Recommendation

Architects, hospital management in collaboration with the Ministry of Health, and policy makers should implement these recommendations.

The facility should focus on minimizing sensory overload due to excessive noise, overcrowding, lack of acoustic control, inadequate sensory zoning, and minimal access to nature and biophilic features, to support emotional and behavioral regulation in children with ADHD.

- Introduce acoustic zoning by separating noisy and quiet functions using spatial buffers and partitions.
- Install sound-absorbing materials like acoustic ceiling panels, soft wall finishes, and cushioned furniture in waiting areas and consultation room to reduce noise.
- Enhance natural lighting while controlling glare through shaded windows and translucent finishes to ensure visual stimulation and comfort in the waiting area, consultation rooms.
- Improve thermal comfort by supplementing natural ventilation with passive cooling integration where necessary.
- Integrate of biophilic features, such as indoor plants, small courtyards, and garden views to support relaxation and attention restoration.
- Apply muted, calming color palettes and natural textures that provide sensory grounding without overstimulation.

To improve spatial quality and organization, the facility should address overcrowding, disorientation, and inadequate spaces observed in the facility, to reduce congestion, enhance predictability and support supervision and privacy.

- Establish clear functional zones including quiet zones, active zones, and retreat spaces, to support self-regulation.
- Introduce transitional spaces between waiting and consultation areas to allow psychological and emotional preparation for children with ADHD.
- Redesigning consultation rooms to provide adequate space, child-scaled furniture, and improved privacy.
- Implement intuitive wayfinding systems using color coding, symbols, and visual cues suitable for children.
- Reorganize circulation paths to reduce congestion and improve patient flow.

The facility should implement the following to ensure that the pediatric outpatient environment is inclusive and supportive, to enhance engagement, collaboration, and interaction among children, caregivers and staff. It lacks child-specific furniture, play areas, sensory refuges, family-centered spaces, and staff support spaces

- Incorporate dedicated play areas where children can release energy positively while remaining supervised.
- Introduce child-scaled, flexible furniture to enhance comfort, independence, and sense of control.
- Integrate multi-sensory engagement elements like tactile walls, interactive art, and textured surfaces.
- Provide caregiver support spaces with comfortable seating and visual access to children.
- Design staff workspaces that support calm interaction, visibility, and reduced stress.

Further research should investigate cost-effective, low-resource design strategies to support wider implementation of responsive architectural adaptations for ADHD supportive pediatric healthcare facilities in Uganda.

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