
Evidence-Based Design: A Sustainable Approach for Planning and Designing Pediatric Healthcare Environments

Abdul Halim Babbu*

Department of Architecture, Jamia Millia Islamia, New Delhi, India

*Corresponding author: ahbabbu@gmail.com

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ABSTRACT

Designing pediatric healthcare facilities requires a thorough understanding of the unique needs of children, which differ from those of adults in terms of physical, emotional, and developmental requirements. Addressing these needs ensures that pediatric patients receive specialised care for their well-being and recovery. Little evidence is available regarding the design variables of pediatric healthcare facilities. Evidence-based design (EBD) has emerged as a sustainable approach that integrates research, empirical evidence, and best practices into the healthcare design process. This paper identifies the design variables of pediatric healthcare facilities impacting the outcomes of patients, families, and staff and develops a conceptual framework for the pediatric healthcare-built environment. A literature review was conducted to identify the design variables of pediatric healthcare environments and the opinion of experts was gathered to finalise the design variables. A conceptual framework for pediatric 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.

1.0 INTRODUCTION

An increasing body of research shows that a meticulously designed healthcare-built environment can positively impact the health outcomes of its users. Evidence-based design approaches have been shown to have an impact on the overall experience, healing, and patient well-being (Carr et al., 2011; Ferris, 2013; McLaughlan & Pert, 2018; Peditto et al., 2020). The term "evidence-based design" (EBD) was coined to advance the practice of developing healthcare facilities using reliable evidence (Wang et al., 2014). EBD is usually understood to refer to the application of evidence during built environment design to improve the health outcomes of building users (Ulrich et al., 2008). Efficiency, cost, and clinical functioning were frequently prioritised in hospital designs in the past (Ulrich et al., 2004), and the designs were based on a standard set of sources of data. The way healthcare is provided has changed considerably over time as a result of improvements in medical knowledge, and technology. The ongoing development of healthcare delivery attempts to address new problems and offer high-quality, easily accessible care to various groups. The emphasis gradually changed to a focus on creating healing environments, often known as environments that are "psychologically supportive" (Al-Bqour et al., 2022). The idea of "healing environments" proposes that the physical environment of healthcare settings can make a difference in how quickly the patient recovers from or adapts to specific acute and chronic conditions (Ulrich et al., 2010). As a result, the concerns and challenges facing designers today are becoming more complex.

Architectural elements, interior design features, and ambient features were identified as the three relevant dimensions of the physical environment (A. Babbu et al., 2023; Kotzer et al., 2011). The spatial layout of a hospital, the size of the rooms, and the placement of the windows are examples of architectural aspects that are comparatively permanent (A. H. Babbu & Haque, 2021). The term "interior design features" refers to less durable components including furniture, colours, and artwork. Lighting, noise level, smells, and temperature are examples of ambient features (Kol et al., 2015; Kotzer et al., 2011).

Although EBD has significantly improved healthcare environments, there is still a dearth of research devoted exclusively to pediatric patients. Despite the significance of developing child-friendly and healing environments for young patients, the body of research in this field is less substantial than in adult populations. EBD principles can be used effectively to develop sustainable pediatric healthcare-built environments supporting environmentally responsible practices that benefit patients, families, and staff (Peavey & Vander Wyst, 2017; Quan et al., 2017). Designing healthcare environments that promote the well-being, comfort, and healing of pediatric patients necessitates specific research initiatives that consider their unique requirements and developmental stages. This paper attempts to establish the therapeutic goals of pediatric patients, addresses their specific needs, and proposes a framework for pediatric healthcare facilities while considering the unique requirements of pediatric patients.

2.0 METHODOLOGY

The databases Scopus, PubMed, and Web of Science (WoS) were used to find research publications in peer-reviewed journals from 2000 to 2020. The keyword searches were carried out to discover relevant studies relating to pediatric patient, family, and staff outcomes. The keyword also includes pediatric built environment aspects such as hospitals, hospital units, and healthcare facilities. The search includes any study that referred to the physical environment of pediatric/adolescent healthcare buildings in the title or abstract. Other relevant studies were also obtained from the reference lists of the cited papers. Research that assists in establishing the association between the built environment of pediatric healthcare facilities and key therapeutic goals has been discovered.

A panel of 15 experts was selected from different fields, such as paediatricians, nurses working in pediatric facilities, healthcare architects, and professors in architectural institutions. Semi-structured interviews with the selected experts were done to finalise the therapeutic goals and get their opinions on design variables. Semi-structured interviews were employed because they enable a thorough examination of participants while granting the freedom to delve deeper for specific insights. On each goal, the experts were asked "What are your suggestions to achieve this goal?" and Would you like to add any other design variables for this goal? New design variables emerged. Sometimes the experts mentioned a criterion in a previous goal, so they did not mention it again. The interviews were manually transcribed. Following transcription, the interviews were arranged according to goals, all the expert comments were gathered sequentially, and the data was coded. All

the coding and analysis was done manually. This method boosts the possibility of building pediatric healthcare environments that prioritise the physical, emotional, and psychological well-being of young patients by merging their combined skills, new ideas, and interdisciplinary viewpoints.

In addition to this, seven case studies were also done in the National Capital Region (NCR) of India to know how these therapeutic goals are achieved in real-world settings. The case studies were conducted in three different settings: standalone pediatric hospitals (n=1); pediatric super-speciality with teaching institute (n=2); and super-speciality hospitals with pediatric department (n=4). In the case study surveys, the staff were asked "How do you achieve this goal" instead of "What are your suggestions to achieve this goal." Interviews of the case studies were transcribed manually. Design variables were finalised based on literature study, experts' opinion, and case studies.

3.0 RESULTS

A thorough abstract assessment paired with specific exclusion criteria yielded 48 journal papers. The exclusion criteria were: (a) articles that do not provide access to the complete document and (b) articles that are not pertinent to this paper's theme. Eight therapeutic goals were identified through the included literature: child-friendly environment; nature and outdoors; privacy; positive distraction; therapeutic play, family and peer support, safety, and security; and comfort. Table 1 shows the included literature against their identified therapeutic goals. The definition of each goal is listed in Table 2.

Table 1. Literature and therapeutic goals.

Literature (Author, Year)	Therapeutic Goals	Child-friendly environment	Nature and outdoors	Privacy	Positive distraction	Therapeutic Play	Family and peer support	Safety and Security	Comfort
(Adams et al., 2010)		*		*	*	*		*	*
(Akinluyi et al., 2019)		*		*			*		
(Alzoubi & Al-Rqaibat, 2015)		*	*		*	*			
(Avila-Aguero et al., 2004)					*	*		*	
(Biddiss et al., 2013)		*			*	*			*
(Biddiss et al., 2019)		*			*	*			*
(Birch et al., 2007)		*	*	*			*		*
(Bishop, 2012)		*			*	*	*		*
(Burns-Nader & Hernandez-Reif, 2016)			*	*	*	*		*	
(Chau et al., 2006)			*			*	*	*	
(Clark et al., 2019)		*			*	*	*	*	
(Clift et al., 2007)		*		*			*	*	
(Coad & Coad, 2008)		*			*	*		*	*
(Corsano et al., 2015)		*		*			*		*
(Curtis & Northcott, 2017)				*			*		
(Eisen et al., 2008)			*		*	*	*		
(Franck, 2017)				*			*		*
(Ghazali et al., 2013)			*	*			*	*	
(Gibson & Nelson, 2009)		*					*		*
(Hamdan et al., 2016)		*			*	*			*
(Hutton, 2005)				*			*		
(Park, 2009)					*	*	*		
(Jiang, 2020)		*	*			*	*		
(Kol et al., 2015)				*					*
(Koller & McLaren, 2014)		*			*				*

(Kotzer et al., 2011)		*				*	*	
(Lambert et al., 2014)	*		*			*	*	
(Lee et al., 2012)								*
(Lim et al., 2019)				*	*			
(Mulhall et al., 2004)	*					*		
(Nanda et al., 2009)				*	*			
(Nourmusavi Nasab et al., 2020)				*	*	*	*	*
(Pasha & Shepley, 2013)		*			*			*
(Pasha, 2013)		*		*		*	*	
(Pati & Nanda, 2011)				*	*			
(Pearson et al., 2019)	*			*				*
(Peditto et al., 2020)		*				*		
(Pelander et al., 2007)				*		*		
(Pelander et al., 2009)	*							*
(Reeve et al., 2017)		*			*			
(Robinson & Green, 2015)				*				*
(Runeson et al., 2002)							*	
(Sherman et al., 2005)		*					*	
(Tivorsak et al., 2004)	*		*	*				
(Water et al., 2017)			*	*	*			
(Whitehouse et al., 2001)		*			*			
(Wolitzky et al., 2005)				*	*			
(Woo & Lin, 2016)	*	*				*	*	*

(*) indicates the therapeutic goals found in the respective literature.

Table 2. Definition of therapeutic goals. Compiled by author based on literature review.

Therapeutic goal	Definition
Provide child-friendly environments	Features of the surrounding environment that promote participation, protection of children and access to quality social services.
Provide access to nature and outdoors	Environmental characteristics provide opportunities to interact with nature and outside views through windows.
Provide privacy	Environmental characteristics that provide physical privacy, informational privacy, and decisional privacy.
Provide strategies for a positive distraction	A pediatric healthcare environment features that stimulate happy emotions and keep fascination without tiring or stressing the pediatric patients, consequently preventing worrying thoughts.
Provide opportunities for therapeutic play	The term "therapeutic play" refers to a range of interventions that are used to improve the health and well-being of children while they are playing. Play activities are structured according to the child's age and developmental stage, depending upon the child's health condition.
Provide family and peer support	Environmental features of pediatric healthcare facilities that assist families and parents in caring for their children's health, development, and well-being. It aids the family in learning and putting into practice techniques to encourage their child's positive behaviour.
Provide safety and security	Features in pediatric healthcare that support keeping patients secure and healthy while they are in the hospital. Environmental qualities that maximize patient and family safety and security in terms of patient fall danger, infection risk, theft risk, and fire safety.
Provide Comfort	Environmental features lessen the pain of children when they are hospitalized. Additionally, it gives patients and their families the most comfort possible by offering appropriately designed areas for relaxing and taking a break, appropriate furnishings, noise control, lighting control, temperature management, etc.

4.0 DISCUSSION

Figure 1 displays the conceptual framework suggested for the EBD domain in the pediatric healthcare-built environment. Design variables for the constructed environment are presented on the left side of the framework. The participant outcome factors that may affect these outcomes are presented in the middle section. On the right side are organisational result variables that may affect any of the outcomes in the framework. The relationships between the variables are shown by the lines and arrows. Figure 1 shows, that everyone who uses the healthcare system, including patients, families, doctors, nurses, and other employees, is strongly impacted by the pediatric-built environment. Pediatric healthcare results are influenced by a variety of factors, including organisational culture, clinical abilities, service process design, and facility design. The following description provides a summary of each therapeutic goal based on the outcomes of the patient, family, and staff.

4.1. Child-Friendly Environment

To ascertain what makes an environment child-friendly, the parameters of a child-friendly environment have been explored in a variety of ways (A. Babbu et al., 2023; Coad et al., 2008; Hamdan et al., 2016). Creating an atmosphere that is suited to the requirements and comfort of children, their families, and the medical staff who care for them is a key component of designing a pediatric facility at a human scale (Adams et al., 2010; Gibson et al., 2009). When designing pediatric healthcare facilities, colour and texture should be used with care (Corsano et al., 2015; Ghazali et al., 2013). Young patients feel comfortable and curious in a setting with vibrant colours and tactile surfaces (Lambert et al., 2014). To make children feel more at ease, personal toys, video games, and other items from home should be permitted and even encouraged (Avila-Aguero et al., 2004). Providing decentralised activity areas for different age groups with a linkage through visual connections makes the environment child-friendly. Clearly marked drop-off areas increase convenience and safety for pediatric patients and their families. It offers quick patient transfers, less traffic, and less anxiety during arrivals and departures. Medical gas equipment that is hidden helps create a calmer environment for young patients, which promotes healing (Tivorsak et al., 2004). To conceal medical gas outlets, designers may use recessed panels, ornamental screens, artistic coatings, or themed patterns (A. H. Babbu & Haque, 2023). The risk of accidents and injuries to pediatric patients is decreased by eliminating sharp edges from the design. It improves security, reduces the possibility of cuts or bruising, and gives patients, families, and staff more piece of mind. The design aspect may include soft furnishings, usage of non-toxic materials, rounded or padded corners, and child-friendly furniture (Pelander & Leino-Kilpi, 2010).

Experts' views on child-friendly environments: Child-friendly environments are less intimidating and more comforting which can help reduce anxiety and fear, and promote faster recovery in pediatric patients. Children are more likely to cooperate with medical procedures and treatments. Child-friendly environments provide a sense of emotional support to families and encourage them to be actively involved in their child care. When families see their children happy and engaged in the hospital environment, it can alleviate their stress. A child-friendly environment can make it easier for physicians to examine and treat children as children may be more cooperative in these settings.

4.2. Nature & Outdoors

The promotion of garden use depends on several elements, including garden visibility, accessibility, and the availability of child-sized equipment (Pasha et al., 2013). When children and adolescents are exposed to nature and gardens, their emotions can be improved, discomforts can be relieved, and healing can occur (Woo et al., 2016). Placing bright brochures in locations with high traffic can increase the garden's visibility (Whitehouse et al., 2001). The views outside the window can also improve patient happiness (Birch et al., 2007). A garden that has more child-friendly amenities, like play areas, sculptures, and child-sized furniture, encourages more movement and a longer stay in the garden (Pasha et al., 2013). Some of the criteria for constructing a hospital garden include walking paths, the sound of running water, and areas for socialising (Sherman et al., 2005). Lack of seating, foliage, and shading discourages children, families and staff from visiting hospital gardens (Pasha, 2013). A comprehensive approach to healthcare design that prioritises both physical and psychological well-being corresponds with the possibility for pediatric patients to see the ground from their rooms. Such design features can considerably enhance young patients' overall experience and recuperation.

Design Variables in Pediatric Healthcare-Built Environment				
<p>Child-friendly environments</p> <ul style="list-style-type: none"> • Proper size and detailing of the building • Facility design at the human scale • Skyline of the facility related to the surrounding environment • Building should interest in terms of colour & texture • Avoid long corridors • Do not pass the corridor through the children's activity area • Short-term parking for parents • Link activity areas through visual connections • Parking for differently abled • Proper drop-off zone • Hide medical gases from view • Non-slippery floors with minimum joints • Avoid sharp-edged objects <p>Nature and Outdoors</p> <ul style="list-style-type: none"> • Proper visibility of hospital gardens • Play features and child-sized furniture in gardens • Socialization spaces in gardens • Shading in a hospital garden • Proper seating in the hospital garden • Daylighting • Operable windows • Optimal indoor daylighting • Window, where patient & family spend time • Opportunities to see the ground • Interesting outside views through the window 	<p>Privacy</p> <ul style="list-style-type: none"> • Single-bedded versus multi-bedded patient room • Visibility of patient from outside through window • Acoustical barriers between patient rooms and corridors • Recess or entryway to avoid visibility of patient from the corridor • Segregation of patient & family zone • Patients' choice of visual privacy • Spaces for private conversations • Semi-outdoor or outdoor spaces for patients • Decentralization of public areas <p>Positive distraction</p> <ul style="list-style-type: none"> • Display of drawings • Display of artwork with realistic scenes • Use of brightly coloured items • Use of images containing water, beach/underwater environment • Use of music & television • Use of nature sound • Use of virtual/augmented reality • Installation of murals • Installation of virtual ponds/aquariums • Shared hand-free toys • Use of interactive media 	<p>Therapeutic Play</p> <ul style="list-style-type: none"> • Building design should promote play • Creation of distinct play zones • Age-associated landscaping • Play opportunities for differently abled children • Avoid placing held toys in waiting areas • Adequate number of activity areas • Visual connection between outdoor & indoor activity • Adequate natural light in play areas • Family and Peer support • Room layout should promote family engagement • Comfortable chairs/recliners for the family • Easy & movable chairs in shared patient rooms • Engagement of families in activity without disturbing patient • Family's ability to see and hear TV without disturbing the patient • Lighting should not disturb the patient • Design should support communication with children • Age-associated activity for interaction • Barrier-free environment for mingling with peers • Space for families and friends to interact • Avoid unfamiliar sights, odours, and sound 	<p>Safety and Security</p> <ul style="list-style-type: none"> • Patient room doors distant from the stair • Security system to prevent child abduction • Single versus multiple entries into the shared patient room • Facilities for the prevention of newborn kidnapping • Location of nursing station near infant care area • Patient bed sink in locked position • Coeff. of friction in choosing flooring materials • Suitable lighting to prevent patient fall • Minimum flooring joints • Visibility of patient rooms from the nursing station • A clear path through the room to the bathroom • Low window standing with support • Grab bars in washrooms • Hand washing facilities at strategic locations • Surfaces and finishes easy to clean • Avoid water splashing from washbasins • Fire compartmentalization • Fire hoods in the kitchen • Fire drills at regular intervals • Enforce "No smoking facility" 	<p>Comfort</p> <ul style="list-style-type: none"> • Segregate baby wards from older children • Adequate storage for personal items • Visually attractive patient room • Noise reduction strategies in patient rooms • Easy-to-use furniture in patient rooms • Nature views from windows • Artwork in the patient's line of sight • Design seating lockers considering the scale of the child • Patient's ability to control natural light • Patient's ability to control artificial light • Sound absorbing materials • Patient's ability to open/close windows • TV/Wi-Fi in patient rooms • Controlling of music by child

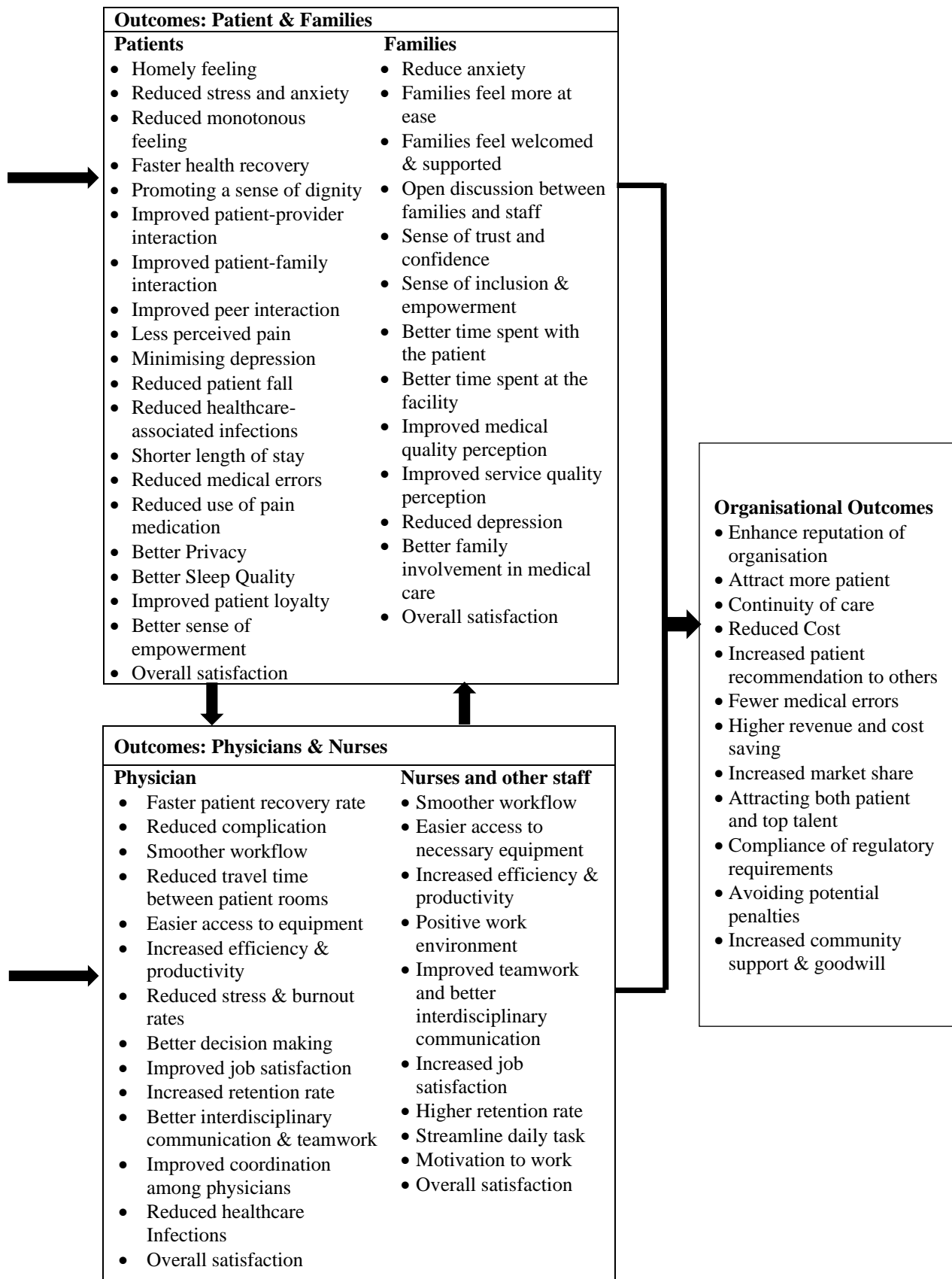


Figure 1. Evidence-based framework for pediatric healthcare environment. Developed by the author based on studies of Ulrich et al., (2010).

Expert's views on nature & outdoors: Access to nature and the outdoors reduces stress, and anxiety in pediatric patients. Exposure to natural light and fresh air aid in the recovery process and promote better sleep. Nature and the outdoors provide families with a respite from stress and help them recharge and better support their child's healthcare journey. Access to the outdoors boost the mood and job satisfaction of healthcare providers and stimulate creativity and problem-solving skills among paediatrician and staff. It leads to increased job satisfaction and a more positive workplace culture.

4.3. Privacy

Privacy during hospitalisation can lessen anxiety; nevertheless, insufficient seclusion can induce stress in youngsters (Akinluyi et al., 2019). While patients want privacy, staff members must also visit them to ensure their safety and well-being (Lu et al., 2016). The space design, position of the toilet, location of the patient's bed, and interactions with other design components may all have an impact on the patient's privacy (Curtis et al., 2017; Hutton, 2005). To avoid exposure of the patient's bedhead from the corridor/public spaces, provide a tiny entryway, an inward toilet, or a recess in the patient room doorway. Movable screens may be preferred over curtains for personal care in shared rooms (Marquardt et al., 2014).

Expert's views on privacy: Privacy provides patients with a sense of security and emotional support. Knowing that their personal information and medical discussions are confidential can reduce anxiety. Privacy respects the dignity of patients, especially adolescents and older children. It allows families and caregivers to have private and meaningful conversations with healthcare providers. Respecting patient privacy is a fundamental aspect of medical professionalism. Consistently holding privacy builds trust between staff and patients.

4.4. Positive Distraction

The connection between artwork in pediatric healthcare settings and health promotion and patient well-being is supported by a growing body of literature. Children who are in hospitals may find great psychological and emotional comfort in their artwork and drawings (Bishop, 2012; Clark et al., 2019; Koller et al., 2014; Water et al., 2017). Children are drawn to colourful objects and imaginative décor, but adolescents prefer art that depicts realistic scenes (Eisen et al., 2008; Nanda et al., 2009; Park, 2009; Tivorsak et al., 2004). Children benefit from positive distraction, which has been shown to significantly reduce patient stress (Biddiss et al., 2019; Pati et al., 2011). Children who are in hospitals may feel better when they are exposed to art and realistic scenes (Bishop, 2012; Clark et al., 2019). Pediatric patients' favourable health outcomes are physiologically influenced by the installation of murals, virtual ponds, and aquariums (Lim et al., 2019; Pearson et al., 2019; Wolitzky et al., 2005).

Expert's views on positive distraction: Positive distractions such as interactive games, videos, or music help alleviate anxiety and fear in pediatric patients. When pediatric patients are distracted, they are more likely to cooperate with treatment plans, take medicines, and participate in therapies. Distraction helps families process complex medical information and treatment options more effectively, leading to more informed decisions. Healthcare facilities that are known for their distraction-focused approach enjoy a strong reputation in the community.

4.5. Therapeutic Play

Play is a crucial part of childhood since it gives children important developmental advantages and enables parents to interact with them on their own level (Ginsburg, 2007). The physical, social, and cognitive growth of a child depends on play. According to Silva (2016), therapeutic play is a type of play therapy in which the child follows a set of rules and has predetermined objectives. Aquariums and interactive media offer play alternatives for children with special needs, whereas shared, handheld play options increase the risk of infection (Biddiss et al., 2019). Atriums, waiting areas, hospital gardens, and other public areas should be thoughtfully planned to include activities for self-directed play (Biddiss et al., 2013; Jiang, 2020). According to their age and developmental stage, younger children and teenagers prefer specific play areas (Reeve et al., 2017). Numerous research have examined the psychological and emotional support that families provide to pediatric patients, and it has been noted that the family plays a key part in the care process (Clift et al., 2007). To effectively engage patients and their families in the patient room, places must be made available (Kotzer et al.,

2011). When children are in age-appropriate activity spaces, they have greater possibilities to do activities like play with toys, utilise a computer, and interact with peers (Birch et al., 2007; Nourmusavi Nasab et al., 2020).

Expert's views on therapeutic play: Engaging in play activities reduces stress and anxiety, making healthcare experiences less intimidating. Therapeutic play teaches children valuable coping mechanisms that they can use not only during their hospital stay but also in their everyday lives. Therapeutic play offers families and caregivers an opportunity to engage with their children in a supportive way, reducing stress. Therapeutic play often involves collaboration among different healthcare team members, fostering a sense of teamwork and shared responsibility for patient care. Pediatric healthcare facilities that value therapeutic play create a supportive and healing environment fostering trust and community engagement.

4.6. Peer and Family Support

In hospital settings, the pediatric patient frequently feels lonely, frightened, bored, worried, and sad since it is a strange world filled with unexpected sights, smells, and sounds. Isolation, harsh treatment, and estrangement from family members are just a few of the social and emotional challenges that children face in hospitals. (Lambert et al., 2014). Having access to friends and family gives youngsters a sense of security and comfort (Pelander et al., 2007). Children of all ages desire the hospital to be a nice place to visit and are concerned about age-associated characteristics of the hospital, want to play and share activity spaces with friends and peers, and desire to have their beds nearby their parents (A. H. Babbu et al., 2023).

Expert's views on peer and family support: Peer support provides emotional comfort and a sense of friendship reducing feelings of isolation. Interacting with peers and receiving encouragement from family members helps pediatric patients develop better coping strategies, making their healthcare journey less daunting. It also motivates pediatric patients to adhere to treatment plans and engage in therapeutic activities. This support enhances emotional well-being, improves communication, and contributes to a more compassionate and collaborative healthcare environment.

4.7. Safety and Security

Institutions that provide medical treatment for children must prioritise safety and security. There is mounting evidence that the design of hospitals has an impact on patient safety and security. By serving as a deterrent to harmful situations, hospital design may have an impact on patient safety (Joseph & Rashid, 2007). All patient sites must be visible to nurses, and young patients must be able to see the nurses to feel protected. Hospital design decisions, such as air quality, indoor daylighting (Alzoubi et al., 2015), patient room layouts, and other interior design elements, can have an impact on hospital safety outcomes, such as nosocomial infections, patient falls, and medical errors (Joseph et al., 2007). Negative or positive pressure ventilation, as well as single-bed patient rooms with high efficiency filters, are more effective at stopping the spread of airborne diseases.

Expert's views on safety and security: Safety measures, such as infection control and safe handling of medical equipment, directly contribute to the physical well-being of pediatric patients, reducing the risk of harm during hospitalisation. Safety measures, such as non-slippery floors and childproofed areas, prevent accidents and injuries, ensuring a safer healthcare experience for children. Families and caregivers experience peace of mind when they know their child is in a safe and secure healthcare environment. Families face less stress and anxiety when they are assured that their child is receiving care in a secure environment. Safety and security protocols are fundamental to delivering high-quality healthcare and mitigating the risk of medical errors, and accidents, which can protect the professional reputation of healthcare providers.

4.8. Comfort

It is crucial to prioritise the comfort of the young patients. Hospitals can be frightening and daunting for children, but by putting their physical, emotional, and psychological health first, professionals can make hospitals a more comfortable and healing place for young patients. Faster healing and improved health outcomes are considerably facilitated by a comfortable physical environment. Pelander (2009) emphasised the need to involve the children in the caregiving process. Single-bed patient rooms can significantly lower noise and infection levels while providing comfortable social support (Blumberg & Devlin, 2006).

Expert's views on comfort: A comfortable and stress-free environment can promote faster healing and recovery in pediatric patients. It contributes to emotional well-being, reducing anxiety, fear, and stress during their hospital stay. Comfortable surroundings make children more willing to cooperate with medical procedures, treatment, and examinations. It encourages families to actively participate in their child's care. Comfortable surroundings may lead to more efficient healthcare processes, reducing the risk of adverse events and improving patient outcomes.

5.0 CONCLUSION

EBD is a field that is quickly developing and becoming more rigorous. Based on the expertise and information at their disposal, hospital owners and designers must make crucial decisions regarding how pediatric hospitals will be constructed. There is rising evidence from reliable sources to support the use of design elements to enhance healthcare outcomes. To create adaptable and high-performing pediatric healthcare facilities that will not only enhance operational efficiencies, save costs, and improve patient and staff experiences, more rigorous EBD approaches must be applied. Interdisciplinary teams must work on EBD when creating new pediatric healthcare facilities. Future research should develop models and frameworks in partnership with designers, engineers, and planners to offer real-world assistance for using these methodologies in design practice.

Sustainable buildings, or at least those that have received environmental sustainability certification, are regarded as higher quality, and typically have better economic ratings. In complicated high-performance structures with a considerable environmental impact, such as pediatric hospital buildings, sustainability represents a challenge to tackle as well as a desirable aim to achieve. Incorporating the social, economic, and environmental facets of sustainability, it can be concluded that sustainable development is a crucial precondition for ensuring health. It is crucial to plan healthy spaces that can support and enhance inhabitants' health, wellness, and human aspects.

The ninety-six pediatric healthcare-built environment design variables that are grouped under eight therapeutic goals portray the structure of EBD. The framework demonstrates how different built environment elements are methodically planned and carried out to support the overarching goals of EBD. Consistent patterns of findings reinforce the quality of the evidence supporting the environmental connection. For instance, studies have repeatedly shown that using interactive media and display of artwork improves the outcome of pediatric patients. Additionally, researchers from various countries have reported a strong correlation between therapeutic play and better pediatric patient outcomes. Similarly, several researchers have documented a significant association between single bed patient rooms and reduced infection rate. By incorporating several facets of patient care and well-being into the actual layout of the facility, this framework provides a comprehensive approach to the design of pediatric healthcare facilities.

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