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HEALING ENVIRONMENTS FOR CHILDREN: AN ENVIRONMENTAL ASSESSMENT OF THE PEDIATRIC WARD AT ALLIED HOSPITAL, FAISALABAD CITY

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Abstract
The improved physical environment effects have proven to be positive and healing processes for the wellbeing of patients, visitors and health service providers. The research focused on Pediatric Ward of Allied Hospital Faisalabad as compared to other wards. In-hand study is highly qualitative in the sense, as it focused on peculiar indicators and identified those symbols which influence critical parameters to ascertain physical conducive environment for young children. The rationale for opting environmental assessment of pediatric ward was to furnish a study for improvement in existing facilities relating to environmental degradation taking care of national/international standards. The research identified the impacts of physical resources available to the healing process applied to hospitalized children, including their families as guardians. The preliminary studies were carried out with an interesting argument that was faced and discovered, that how numerous factors currently contribute to the healthcare environment? The primary and secondary data was collected through multiple activities i.e. site visits, interviews, questionnaires, one-to-one meetings, focused group discussions, personal observations, photographs and documentation. The results displayed that over-crowding in ward, excessive patients on single bed, unhygienic conditions, unequal space distribution, thermal discomfort and un-user friendly facilities caused severe ill-effects on children, families and the ward staff. Consequently, efforts were made to establish proper guidelines for spaces layout, general facilities and various environmental variables for the pediatric ward.

INTRODUCTION

The pediatric inhabitants are likely to be more sensitive to environment than adults. It gives impression that importance of the physical setting of the pediatric wards (P.W) would very much improve to making a curative environment, an environment created to help the recovery procedure (Abbas & Ghazali, 2011). To optimize performance of a system building, it is essential to analyze the environmental impacts, standardize other sources having similar impact, and calculate the total performance of different environmental factors to select the most preferable option (Mukhtar et al., 2024). The comprehensive evaluation is requirement to measure the environmental functionality in a specific design(Levin, 1997). This is essential as healthy environments have a deep impact on patients,

assistant patients and workers, with optimistic design/plan contributing to better physical and psychological position in addition to efficiency (Mackrill, Marshall, Payne, Dimitrokali, & Cain, 2017). "Healing environment" can be explained taken physical and non-physical environment that is generated to help the recovery procedure of patients and enhance functionality of the staff. In contrast to curative, remedial is a better spiritual and psychological idea of health for improvement (Ahmed et al., 2024). Perception is also psychological, hence healing and the physical environment may be associated to each other (Abbas & Ghazali, 2010).Appraisal of the physical design of health center services from the patients and their attendant's point of view, is the process to recognize their preferences, experiences and anticipation(Samah, Ibrahim, Othman, & Wahab, 2012).Different environmental features will also be used to uncover the key mechanism of a health care environment concerned in the children's comfort and care from their viewpoint (Bishop, 2012).

Faisalabad is ranked as the third most populous city of Pakistan andis the second largest in the north-east of Punjab province. In the census of 2017, population of Faisalabad District is 7.87 million out of which about 51% live in the City. In Total population males are 4.03 million, females are 3.83 million and Shemale/Transgender are 541. Average annual growth rate of Faisalabad is 1.97 from year 1998 to 2017. Allied Hospital (AHF) is the biggest hospital of Faisalabad District and is situated on the Jail Road. Allied Hospital also serves as a teaching hospital and is associated with Punjab Medical College. There are 1,385numbers of beds in different wards of the hospital. The pediatric department of the hospital works day and night (24 hours) and receives patients from urban and rural areas. In pediatric ward total number of bed for patients are 84. The rationale for opting the environmental assessment of pediatric ward at Allied Hospital Faisalabad was to furnish a study for improving existing facilities and environmental up-gradation keeping in view national and international standards up to the satisfaction level of patients. Consequently, to establish proper guidelines for general facilities and various environmental variables of the pediatric ward like lighting, thermal comfort, and acoustics.

Pediatric Ward of Allied Hospital Faisalabad has been considered with the logic that pediatric inhabitants are often more sensitive to environment than adults. The deteriorating environment and overcrowding in the Pediatric ward calls for an investigation into the environmental quality. It was observed that due to high influx of patients, the best possible performance delivery of services has been at stake. The same was the case with other Wards as well, however, in current study only pediatric ward was considered for its high impact on young children at various treatment stages. The study focused on the assessment of deteriorating condition of physical environmental factors i.e. lighting, thermal comfort and space lay-out of existing Pediatric Ward. This research supports the concept of quality of healing environment and user satisfaction. Following major research objectives were set forth:

1. To study the space layout in relation to user needs of Pediatric Ward of Allied Hospital Faisalabad.
2. To ascertain the specialized facilities available at Pediatric Ward of Allied Hospital Faisalabad.
3. To assess the environmental aspects and ambient environment of Pediatric Ward Allied Hospital, Faisalabad.

Research helped to understand about best practices to improve the Pediatric Ward attractive for the children, attendants, staff and other user point of view. Conducive environment will play a significant role in children's psychological and physical well-being. The study further helped to identify possible mitigation measures to control the ambient environment and facilitations for children patients and staff.

REVIEW OF LITERATURE

The physical environment is the setting that helps to build a curative environment and includes an enabling environment, general security and proper treatment. The basic elements of the enabling environment include adequate temperature, exterior view, and arrangements of furniture, breathing space of privacy, lighting and works of art. With regard to external observation, patients who are open to the elements of nature would diminish stress, facilitate the revival of the disease and get better their moods

(Shah et al., 2023). For instance, patients kept in windowed wards help patients determine the time of day and the outdoor climate and also improve patient, family pleasure and overall significance of care (Phiri, 2004).Natural lighting has an effect on the psychological effects for patients and staff. It provides a daylight impact on the psychology of patients and physical illnesses to improve the disease more quickly (Phiri, 2003). In the interim, artificial lighting also plays a role in improving and growing health efficiency and well-being by producing a relaxed environment and a helpful distraction in the health-care setting, and increasing efficiency of staff (Dutro, 2007). The planner of the pediatric healthcare must believe that the design of the facilities, such as safety, security and ergonomics, are organized to convince the pleasure of the user (Ghazali & Abbas, 2012).

In general, healing environments are measured as a place to cure the mind, body and soul, a place wherever admiration and self-esteem are intertwined in everything, a place where life and death, disease, and remedial they define the moment and the building backs them up (Shah et al., 2023b). While there is a debate about an accurate definition of healing environments, numerous essential components of a healing environment have been obviously recognized: quality of air, thermal comfort, acoustic control, privacy, light, nature views and access to community support (Shah et al., 2023b). The exclusion of environmental stress, which is poor air quality, acoustic, glare, safety/security of staff and patients, and the removal of stress stay behind the top of any definition of a curative environment, but an environment of curative is more than a safe building. It is one that holds patients, attendant and staff/worker, While they support them during the time they are in the building (McCullough, 2010).

The health profile of Pakistan is still not very encouraging. The overall reduction in infant and child mortality has been slow in the country (Bhatti et al., 2024). The awareness of nutritional needs, the pre and postnatal care of mothers is also weak. The poor people of the country have very little knowledge about illness and diseases and, on the other hand, face great difficulties in receiving high-cost private treatment, as they have very few assets (Bhatti et al., 2023). World Health Organization (WHO) define, health in its broadest sense is "a state of complete physical, mental and social wellbeing and not simply the absence of disease or illness." Therefore, the government and the private sector must pay close attention to improve the overall quality of health facilities for all masses. The Ministry of Regulation and Coordination of National Health Services is accountable for the health structure of Pakistan. The Ministry of Health was developed to the provinces under Amendment 18. In addition to the federal health department, each of the four provinces of Pakistan has its respective health and secretariat departments, headed by the health minister. The respective ministries are responsible for controlling, managing, administering medical service issues, and also framing and enforcing health policies as circulated by the federal health departments (Nishtar et al., 2013). The Environmental Policy of Punjab 2015 provides a general framework to address the environmental problems facing the Punjab, in particular the pollution of freshwater bodies, air pollution, loss of biodiversity, desertification, water extraction, deforestation, natural disasters and climate change. It also gives instructions to address cross-cutting issues, underlying causes of environmental degradation to meet national and international obligations. The theme of the Environmental Policy of Punjab 2015 is sustainable development in the sense of improving human well-being. Make the right distinctions between different environments in terms of setting environmental noise standards, for example. rural versus urban Medical and educational establishments compared to other areas, nighttime noise level versus daytime standards for residential areas, areas near roads, railroads, airport infrastructure and protected areas, etc.(Muhammad et al., 2017).

Health is a condition of whole mental, social and physical comfort and not simply the absence of sickness or illness. Health care facilities (HCF) are found wherever patients with medical conditions come to treatment, which is offered by health specialists and other medical professionals. In current years, we observe a growing notice in the role of technology and the built environment as part of the inclusive treatment of patients. Discussions about the significance of the built environment for the health and care of the patient and the provision

and support of medical care extend at least until 400 BC(Huisman, Morales, Van Hoof, & Kort, 2012).
Thermal comfort is a significant feature to provide an adequate inside climate, particularly in healthcare centers. For patients, the thermal environments can induce physiological stress, in addition to stress linked to the illness, subsequent surgery or injury to the patient. This stress can even impose conditions that threaten life. In this study the thermal comfort of the patients in caring facilities is studied (Shajahan, Culp, & Williamson, 2018). Appropriate lighting is essential in a healthcare environment where the lives of people are in the hands of trained eye professionals (Bhatti et al., 2025). The eyes need to see, and the eyes need adequate light to see well. Although there are two forms of lighting, artificial or natural, natural light has no benefit over artificial lighting for the delivery of visual tasks. But some studies have shown that natural light offers patients and caregivers important health benefits, physical and mental, which are consistent with a general economic benefit for the facilities (McCullough, 2010). Noise usually defined as unnecessary sound. The noise travels in waves form that produces a level of acoustic pressure that is calculated in decibels (dB), with zero dB that corresponds approximately to the human hearing input and 120 to 140 dB that corresponds to the pain threshold (Bhatti et al., 2025). Ambient noise is usually measured in A-weighted decibels (dBA). A dBA is a dB corrected for the variation in the frequency response of the typical human ear at a common noise level. In general, the A-weighting of the ambient sound consists in evaluating all the frequencies of the sound, frequencies that in the average frequency range (Yang et al., 2025). According to the WHO recommendation that the continuous noise in the hospital room be 35 dB and in the night peaks in the room does not exceed 40 dB(Khaiwal et al., 2016). The environment of use of space has an impact on the people who use it. In the modern era, design for healthcare settings has commenced to comprise aesthetic improvements in an effort to decrease stress and nervousness, amplify patient fulfillment and encourage health and care (BENNEWORTH, 2009). In the room / ward, the relationship between environment and behavior is influential and widespread: the preventive visit strategy is often attributed to the lack of space for families(Schweitzer et al., 2004).Space is an important factor when communicating in any institutional configuration. Communication can save lives in a healthcare environment. Technological progress is also important when designing the physical space. However, it has many characteristics that can facilitate organization, communication, interaction, subdivisions, simplification and multitasking.(Ahmad, Price, & Demian, 2014).

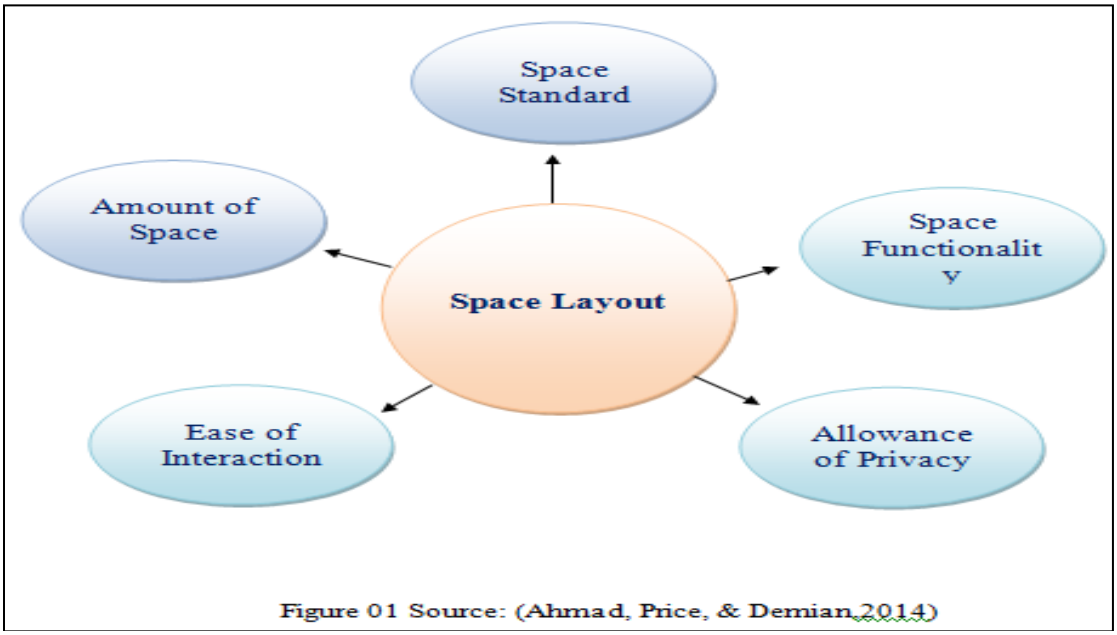

Figure 01 Source: (Ahmad, Price, & Demian,2014)

According to Carolyn E. Francis, "well-designed" and planned spaces originated to sustain collaboration and creation as opposed to disordered behaviors and reduce the problems of health regulation. These spaces were tested to be very important, elegant and more efficient to improve the child's health situation(Talpur et al., 2016). Children could call those spaces and feel happier when they were in that environment. This means that architects must design/plan useful spaces to make easy child care and the value of space. For children to understand the exterior and interior spaces of a health center as their own and ignore the painful health process they suffer (Ahsan et al., 2023). The designers and architects must imagine these factors every time they design these spaces.(Sawyerr, 2010). The national reference manual on planning and infrastructure standards provides general guidelines on general facilities, architectural parameters and environmental assessment of hospitals. The architectural standard parameters suggested that 100-250 beds should be built on plot size of 8400-9700 m2including all medical facilities and residential area of hospital. The space requirement for children ward is 18.5 m^2 per bed. The current standards adopted in Pakistan are much lower than international standards. The gazette of Pakistan is published by the Ministry of Regulations and Services recommends that the space required per bed for the Medical and Dental Institute is 250 square feet or 23.24 m^2 per bed. The size of each area of the patient's bed should not be less than 23.5 m^2 in regulate to meet the necessary requirements.

Space is a key attribute of all types of buildings. The design / plan and use of the medical care space is significant because the environment varies rapidly due to the population that grows and ages (changing demographics); Advances and developments in medical devices and treatments (changing technology); flexible roads of care; and modern systems of health care delivery (SHAIKH et al., 2019). The spaces must be wide enough so that patients can move freely, whether in beds, wheelchairs or stretcher. The flow path to change patients from one area to another must be accessible and free at all times(Carpman & Grant, 2016).

The capacity of a child's ward is calculated in conditions of operational beds. The number of operational beds, a decision of management, is used to decide the budget of available human resources. This is also true through a ratio of staff per prepared bed(de Bruin, Bekker, Van Zanten, & Koole, 2010). Staff performance and patient care are grouped into the categories "organizational" and "safety and well-being". Workers competence and patient wellbeing are two of the key factors in combining the flexibility of space and the standardization of space. The corridors for patient access and apparatus must have a least width of 2.44 meters. Passageway in areas that are not normally used for beds, stretchers and equipment can be reduced in breadth to 1.83 meters. A suitable area will be offered for public, activity, furniture, equipment and public services (Carpman & Grant, 2016). Insideof the ward standardized spaces, dimension, shape, design, dimension of windows and direction ,doors position, openings sites, toilets place, amount of treatment, required space for workforce to use their checkup apparatus and provide health care facilities in a specified time(Ahmad et al., 2014). A health center and other health services should see an adequate level of sound and sufficient visual isolation to obtain the acoustic and privacy needs in the selected areas, which allows the realization of behavior without obstacles.(Carpman & Grant, 2016).

The literature described the best possible ways to address the environmental assessment specially in terms of Thermal Comfort, Lighting and Acoustics measure to address the issues in technical ways. The literature further expresses a variance of standards particularly for an allowance in sizes, privacy, location and other factors of children wards and rooms for easy and smooth functional processes. And it also reveals, provisions to be provided in/around the Pediatric ward in order to address basic requirements for children patients and the attendants such as furniture, waiting area, cafeteria, toilets, pharmacy etc.

RESEARCH METHODOLOGY

The methodology outlines the major indicators for each step of study needs to be oriented. Evaluation of a physical built environment with precise determined and spatial needs, the study of the prevailing built Pediatric ward through documents and observation become required. The study

involved a significant perception of the built structure, facilities, its existing situation and space layout with its main emphasis towards its approaching reasonable practice for the resolution it's up gradation for more functional.

Table 01 Summary of Study Methods and Aspect in Focus

Study Methodology	Environmental Aspects in Focus	
• Observational	• Ambient Environment	• Thermal • Acoustics • Lighting
• Questionnaire	• Space Layout	• Space Standard • Amount of Space • Space Functionality
• Interview	• User Need's	• Drinking Water • Waiting Are • Toilet • Access to Cafeteria • Pharmacy
• Environmental gadget • Photographs		

Source: (Redshaw & Scrase, 2004)

The study population consisted of patients / assistants and entire staff of Allied Hospital Faisalabad. The population consists mainly of the city of nearby people and allied areas. It also includes people from the urban and nearby suburban areas. Convenience and purposive sampling was adopted. Selected sample composed mainly of two groups. Group one was composed mainly of patients and their assistants, while the second group, which was at the service of the Department of Pediatrics, that is, doctors, nurses, paramedical personnel, administrative personnel and other health giver persons. The number of participants in this group ranged from 8 to 10 according to the staff of the pediatric ward. The existing capacity to accommodate indoor patients is 84 beds, according to the data provided by the Head of the Department of Pediatrics of the Allied Hospital. The study consisted of sampling techniques. Thirty patients admitted to children's ward and staff members of the children.

DATA COLLECTION & ANALYSIS

A matrix was developed in the form (Table 02) showing the number of times the research areawas visited together with the time, date, hours of stay and activities carried-out.

Table 02 Matrix indicating performed activities in the AHF hospital

Sr.#	Date	Timing	Motive of Visit
1	02-07-2018	11am-2pm	Permission process to start the documentation, meeting with MS and Senior Registrar of PW.
2	04-07-2018	3pm-6pm	Ward measurements, photographs, data collection after obtaining the permission of the doctor on duty.
3	07-07-2018	2pm-6pm	Ward measurements, photographs, data collection after obtaining the permission of the doctor on duty, etc.
4	11-07-2018	3pm-6pm	Functional processes of the department observed.
5	20-07-2018	3pm-6pm	Functional processes of the department observed and discussed.
6	28-07-2018	1100-1500	Discussion and update to Senior registrar on the work done, the

Sr.#	Date	Timing	Motive of Visit
			data collection from doctors, staff and patients.
7	30-07-2018	1100-1500	Collection of data from the health provider.(Doctor and Para-Medical Staff)
8	06-08-2018	1pm-7pm	Problems of the pediatric ward were identified and documented, Discussion with the senior Doctor and the Doctor on duty, anticipated responses and that could serve as a probable solution.
9	11-08-2018	0900-1100	Observed data, discussed with the head of the pediatric ward on intervention of design and extension of the building
10	13-08-2018	2pm-7pm	Information collected from patients and attendees.
11	14-08-2018	2pm-6pm	Information collected from patients and attendees.
12	15-08-2018	2pm-7pm	Information collected from patients and attendees.
13	17-08-2018	1pm-8pm	Ward functionalities observed, discussed the data collected with the doctor on duty and the data collected from the Doctor and related medical personnel.

Source: Developed by Researcher

Thermal Comfort

The city of Faisalabad is located in the arid zone and notable extreme temperature variation in summer and winter seasons. Therefore, use of mechanical device heaters in winter, fans and air conditioners and in summer seems to be desirable to achieve thermal comfort different from tree planting. To understand thermal comfort level, readings are taken during the investigation period using the temperature and humidity data recorder and are presented in Table 03 clearly shows that, due to use of mechanical heating and cooling devices, the temperature in ICU, CCU and in ward is satisfactory according to local climatic conditions, but slightly higher than 18 degrees C to 24 degrees Celsius throughout the investigation period meeting criteria of the Facility Guide Line Institute USA for thermal comfort.

The view point of selected sample of children (patients) and staff/worker is almost the same as mentioned in Table 04 In general, selected sample of patients and staff seems to be satisfied with the thermal comfort arrangements in summer having only small variation in vision. During investigation period, general complaints are reported in winter and summer on thermal comfort due to the shortage of natural gas in the country and in summer due to the shortage of fuel to operate the generators as alternative provisions for energy supply.

Table No 03 Thermal Comfort (Gadget data)

Thermal Comfort Comparison at Various Locations of Pediatric Ward with Facility Guide Line Institute USA Standard

Observed Values of Temperature (Mean)		Neonatology ward		General Pediatric Ward	Corridors	FGI2010 USA Standard
		ICU	CCU			
01-07-2018 to 31-07-2018	1st Week	26.5	26	29	30	Reliable cooling and heating 18 to 24 C shall be provided on a 24 hour per
	2nd Week	25	24.4	28.4	29.4	
	3rd Week	23.5	23.10	27	28.25	
	4th week	21.6	22.8	26.20	27.20	
01-08-2018 to 17-08-18	1st Week	19.3	19.5	23.5	25.65	

	2nd Week	20.10	20.6	21.8	22.8	
	3rd Week	21.40	22.90	25.90	27	

(Value observed on July to August 2018 Timing 2pm-7pm

Figure: 02 Thermal Comfort Arrangements

Table 04 Thermal Comfort Observational data

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Thermal Comfort in Summer	48%	56%

Perception of thermal comfort of patients in pediatric wards of health centers is obtained by questioning and comparing the results with the International Standard. This research approach can be continued for a larger number of patients and for other wards to provide a prerequisite decision go/no go for the application of standard methods for determining thermal comfort in wards.

Acoustics Comfort

Noise level in several places of the pediatric ward is taken using a sound level meter as indicated in Table 05. It seems that the building of pediatric wards is subject to a problem of greater intensity of noise in almost all areas of building. Main reason being, it's adjacent to the main corridor (varanda) and leads to another left and right side of ward where, truss passage of patient and patient's assistant is high throughout the day.

Noise level in the ICU, CCU and in general pediatric ward is 55.4dBA, 55. dBA and 64.8dBA, respectively, higher compared to the FGI standards. Upper limit 45dBA is not acceptable for hospital sites. Noise level in the rooms is 63.6 dBA, which are also 11 above the upper limits, as described in the FGI Standards. While the noise level in corridors and waiting areas is 74.80dBA and 75.4dBA, respectively, higher than upper limit 50dBA.

Questionnaire survey both patients and staff reported a notable dissatisfaction with the problem of noise in rooms as shown in Table 06. It is observed that the noise complaints in the emergency bay are maximum since this area is in front of the main entrance of the PW. Observation is, noise problems are due to folding steel doors and frequent arrival of visitors and patients feel discomfort due to admitted patients.

Table 05 Noise Level (Gadget Data)
Comparison of Noise Level at Various Locations of Hospital Building

Noise Level at Various Locations in Pediatric Ward	Sound Level Meter Reading in dBA	Facility Guide Line Institute USA Standard Mini-Maxi Limit for Noise (dBA)
Neonatology ward		
i) ICU ii) CCU	54.80 55.10	35-45
Genera Pediatric Ward	64.10	35-45
Corridor	75.40	40-50
Waiting area	74.80	40-50

(Value observed on Dated11-08-2018.... Timing1pm-6pm)

Table 06 Noise Level Observed in Pediatric Ward

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Noise Level	15%	22%

Lighting
Adequate lighting was measured with a Luxmeter, as per Facility Guide Line Institute Standards (2010), and minimum standard for ambient light levels were measured at 1.5 feet above the floor in a horizontal plane. Pediatric ward includes neonatology, ICU, CCU, general pediatric ward, main entrance to the ward, waiting area, nursing station of the toilet block and circulation areas as mentioned in chapter 2.
The Lux Meter readings observed at the various locations are in the range of 85 to 269 lux as shown in 07 showing conditions are not satisfactory. It was also observed that I.C.U and C.C.U have a better lighting arrangement compared to other areas of the room. More than 50% of patients and staff are reported to be satisfied of adequate lighting. Data and results in Table 08 with severe deficiencies in artificial lighting reported by patient's/staff members in toilets attached to ward/corridors. Inadequate lighting installations, due to lack of artificial lighting devices observed by patients/staff.
Daylight coming through the window, orientation of window wall of the pediatric ward exists at northand south side.The northern facing wall receives the least amount of solar light during the year. The possibility of it directly affecting is small, as it may only be affected during the summer.

Lux Data Collection Sheet: For each location number on lighting layout, wrote the corresponding lux reading in data collection sheet. Calculated Lux reading mean for comparison with Guide Line Institute Standards (2010)

Table 07Lux Meter Data Collection Sheet

Description	Location	Lux Reading	Lux Reading (Mean)
Neonatology ward	1	268.10	269.80
	2	271.10	
	3	269.8	
	4	270.20	
General Pediatric Ward	1	252.25	251.70
	2	251.60	
	3	252.40	

Description	Location	Lux Reading	Lux Reading (Mean)
	4	250.55	
Main Entrance of Ward	1	160.0	161.50
	2	161.60	
	3	162.5	
	4	161.80	
Waiting area	1	205.10	205.50
	2	205.50	
	3	206.10	
	4	205.15	
Nursing Station	1	248.40	248.50
	2	249.70	
	3	248.00	
	4	247.90	
Circulation Area	1	240.20	241.05
	2	241.50	
	3	241.10	
	4	241.40	
Toilet Block	1	80.5	80.45
	2	80.20	
	3	81.00	
	4	80.10	

Source: Developed by Researcher

Using grid measuring methods of readings of lux bmeters took at intervals of one meter in the working plane of PW of AHF. When the illumination is uniform: marked a grid of 3 x 3 meters (i.e. 9 measurement points), otherwise measured, at each point of 1-meter grid in a representative area. In a narrow space (for example, hallway) measured center down at one meter intervals. Where many spaces have the same design, measure 2 or 3 rooms (it is not necessary to measure them all).

Table 08 Lighting Adequacy

Comparison of Light Level at Various Locations of Pediatric Ward with Facility Guide Line Institute USA Standard (2010)

Various Locations in Pediatric Ward	Digital Lux Meter Readings (mean) (Lux)	FGI Standard USA 2010 (Lux)
Neonatology ward	269.80	300 (Task Lighting 1000)
Genera Pediatric Ward	251.70	300(Task Lighting 500)
Main Entrance of Ward	161.50	300 Lux
Waiting area	205.50	300 Lux
Toilet Block	80.20	300 Lux
Nursing Station	248.00	300 Lux
Circulation Area	241.10	300 Lux

(Value observed on Dated: 13-8-2018...Timing 2pm-7pm)

Figure 03 Lighting Arrangements in Ward

Table 09 Lighting Adequacy Observational

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Lighting Level	15%	22%

Study observed that how light affected the visual comfort of the patient, while complete information was collected during the entire investigation period. The assortment of patients for the interview was based on the variant of the types of different bays and the location of the bed with respect to the source of the light. The visual comfort questionnaire for illumination was based on the statement that the patients in the pediatric ward with a serious sickness or is not an emergency condition. The purpose of questionnaire was to understand the patient's response to natural, artificial and environmental light in various places in the room. 25 Number of patients / assistant was carried out to investigation the matter. The patient's reply was marked as yes or no, satisfactory or unsatisfactory.

Space Layout

The construction of the pediatric ward is 1,124.39 m^2 with an accommodation capacity of 84 beds for hospitalized patients, clear space available for 6.20 m^2 in the pediatric ward being insufficient and below are national and international standard 20.5m^2 per bed. The Space allowances for the one bed room and the four-bed room according to the plan of spaces in HBN V1.0 4s

Table 09 Area Analysis for single and four-beds ward

i) Area Description for Single Bed	Recommended Allowance (m^2)
For Single Bed room clear space	16.0 m^2
Support Area for Family and Clinical work station	3.0 m^2
WC/ Shower &En-suit	4.5 m^2
Total Area for Single Bed Room	23.5 m^2
ii) Area Description for Four Bed	**Recommended Allowance (m^2)**
For 4 Bed room clear space	58.0 m^2

Support Area for Family and Clinical work station	3.0 m^2
En-suite help Shower & Wash	4.5 m^2
En-suite help WC/Wash	4.5 m^2
Total Area for 4 Bed Room	70.0 m^2

Source: V1.0 – HBN 4s standard

Necessary space around the bed for a series of practical activities can be carried-out in one bedroom; Table 4.6 shows that current space allocation for one bed room of 23.5 m^2 gives enough space to covers bed space of 3600 mm wide and 3700 mm deep. It's established, most of the activities are performed on bed sides and can be accommodated inside the size of 3600 mm width and 3700 mm depth. This signifies free space around the bed and does not contain space for storage space, preparation and work surfaces. By applying the 3600 mm x 3700 mm clearance to the four-bed room, there could be a big impact on affordability.

Table 09 illustrates how the space around the requirements of the bed potentially increases the dimension of a room with 4 beds by more than 20.5 m^2.

Figure 04 Existing Plan of Pediatric ward

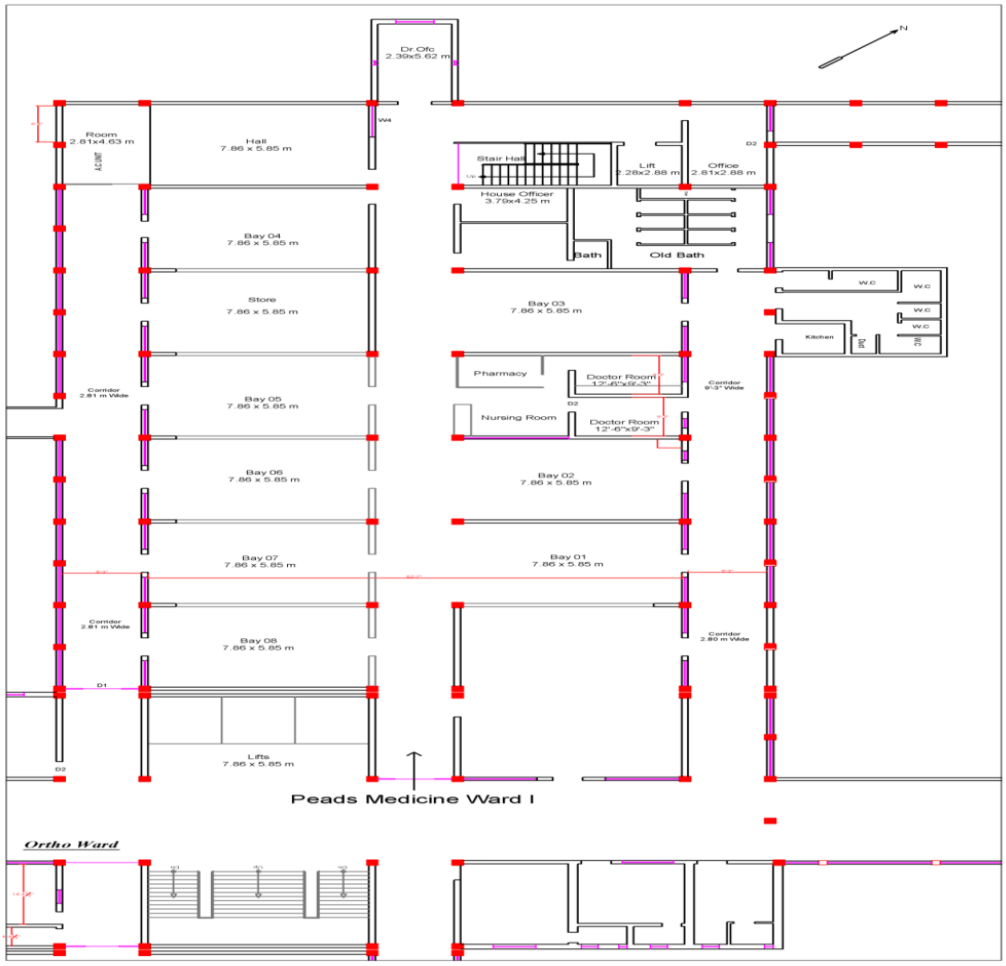

Figure 05 Single Bay 4x4 Bed Existing Plan of Pediatric ward

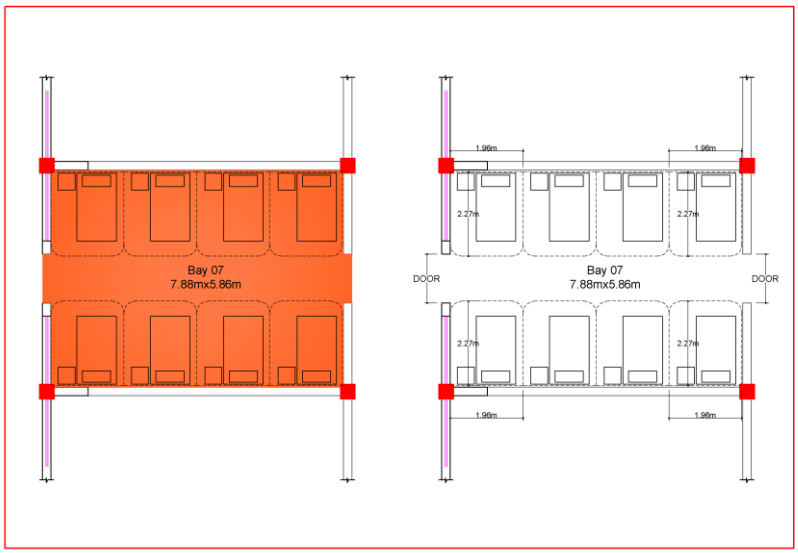

Figure 05 4x4 Bed Bay Existing Setting of Pediatric ward with area of each component

Table 10 Data of Pediatric Ward layout of AHF

Layout Type	Pediatric Ward AHF (Area)	Total number of beds	Current space Per Bed
Area analysis (m2)for Ward			
Total Bed area	521.09	84	6.20
Support area	137.89	84	1.641
Toilet Block area	75.557	84	0.89
Net area	**734.537**	**84**	**8.731**
Circulation(incl. engineering and planning	389.86	84	4.629
Gross area (GIFA)	**1124.397**	**84**	**13.38**

Table 11 Comparison of Area of Pediatric ward/bed area of HBN V.4 Health Standard

Layout Type	Space Allowance HBN-V.4 Health	P.W Current Area (m2)	Area Analysis (m2)	
Area per bed analysis (m2)			**Area Difference**	**Ratio % (m2)**
Bed area per bed	20.50	6.20	<14.3	< @ 69.76%
Support area per bed	6.41	1.641	<4.769	< @74.59%
Dining/sitting area per bed	0.63	0.49	<0.14	< @22.22%
Net area per bed	**27.53**	**8.731**	<18.799	< @71.24%
Circulation per bed	9.45	4.629	<4.821	< @51.02%
Gross area (GIFA) per bed	**36.98**	**13.38**	**<23.62**	**< @ 63.87%**

Comparison of the pediatric ward / bed area with the HBN health standard illustrates that the space available for a 6.20 m^2 per bed in the pediatric ward is insufficient and is below the national and international HBN standard of 20.5m^2 per bed.

Table 12 Space Distribution

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Space standard	10%	15%

Amount of Space

Amount of space in PW gives an impression of being inadequate as reported by patients and staff, but in almost all, wards patients complain about seat benches. The capacity of a children's room is measured in terms of operational beds. In the pediatric ward of AHF, spaces are not wide enough so that patients can move freely, whether they are in beds, stretchers or wheelchairs. It is also observed that pediatric wards face the problem of space extensively. Table data above confirms the point of view of patients and staff about the amount of inadequate space PW ward is depicted in Figure 05

Figure 05 Existing observed condition of the ward

Table 13 Amount of Space

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Amount of Space	10%	15%

Space Functionality

The functionality of the space is shown in Table 13 the work spaces are inadequate in the ward in view of the patients / patient assistant and the staff. The circulation routes to transfer patients from one area to another are not free at all times. The work spaces are not wide enough so that patients can move freely, whether they are in beds, stretchers or wheelchairs. Staff performance and patient care are affected by inadequate space functionality. Staff/worker competence and patient safety/security are two of the key factors in combining spatial flexibility and space standardization.

Figure: 06 Space Functionality in PW of AHF

Table 14 Space Functionality

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Space Functionality	20%	35%

Ease of Interaction

Table 14 Shows pleasure and displeasure of patients / assistants and staff due to ease of interaction of treatment spaces, necessary for staff to use their medical equipment and provide health care services.

Ease of interaction of staff with patients reduces span of stay and reduces physical problem in recovery phase. Poor access around bed in the AHF pediatric ward is traumatic for staff, which has to work, normally under stress, in insufficient space.

Figure 07 Ease of Interaction in P.W

Table 15 Ease of Interaction

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Ease of Interaction	25%	40%

Allowance of Privacy

Privacy in rooms is a serious problem. Table 15 indicates, dissatisfaction rate between patients and staff with respect to privacy arrangements in the rooms is very high. However, visual privacy of patients must be guaranteed in accordance with the recommended standard mentioned. The response of patients regarding the issue of privacy is shown in Table15

This situation is also depicted in Figure 08.

Figure 08 Allowance of Privacy

Table 16 Allowance of Privacy

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Privacy in PW	20%	30%

Table 17 Shows satisfaction level of adjustability of furniture in Pediatric ward, which is often overcrowded yet under-performing space is experience a long overdue reinvention. It is observed that the Pediatric wards are extensively facing the problem of old furniture and their adjustability. Sufficient space is therefore being mandatory for staff to help and to put up moving and treatment Furniture/equipment.

Table 17 Adjustability of furniture

Description	Satisfaction Level by Patient	Satisfaction Level by Staff
Adjustability of furniture	40%	50%

Minimal number and dirty state of toilet are inside pediatric ward, since it's directly correlated to health of patients. Unfortunately, results of data indicates both patients and staff and both un-satisfied with general hygienic condition and general facilities of the washing rooms. It gives an impression that the facilities mentioned above are not properly managed and supervised by the room staff.

Selected sample of patients and staff members reported that the cafeteria building did not exist in or near the pediatric ward. The construction of cafeteria exists within the limit of hospital and is far from the pediatric ward. During group discussions, both patients and staff collectively express their demand for separate construction of the cafeteria in an appropriate location within or adjacent to the pediatric ward building. Waiting area is another essential part of ward before admitting, as patients use the waiting area of hospital, waiting their turn. For the general patient attended, there is no waiting area, except for neonatology. In neonatology there is a separate room for waiting and feeding for the Children/waiting area. Results of pediatric ward survey on the waiting area and seating arrangements clearly indicate the non-existence of seating facilities and waiting area informed by patients and staff, respectively. During group discussions, both patients and staff collectively express their demand for the separate seating building and waiting area at the appropriate location within or adjacent to the pediatric ward building. Pharmacy inside the ward is a more essential part of entire healing process of hospitalized patients. Dispensing room of central pharmacy in pediatric ward improves the services and intervention of the pharmacy room. It is obvious that the waiting time of the patients is zero due to the existence of Pharmacy in pediatric ward of AHF.

RESEARCH FINDINGS

The findings illustrated various effects on children, families and staff/worker from multipurpose viewpoints and aspects; magnitude of physical settings and environmental factors for disordering the health care facilities. The findings of facts indicated that overcrowding in the ward and basic health facilities are the prime one and are not met according to actual needs. Least efforts have been done so far to establish adequate guidelines, especially for the design of the space, to avoid discomfort environmental variables like avoid noise, acoustics issues and providing ambient environment in pediatric ward.

CONCLUSIONS

After concise analysis of AHF data, literature review, extensive discussions with medical staff

and patients/assistant, following conclusions were drawn:

1. Following facilities have totally un-user friendly and in-sufficient to cater their requirements such as availability of drinking water, waiting and seating area, Pharmacy, minimum number and dirty state of the toilet, right place for the feeding of children, privacy, proper cafeteria, hygienic conditions, safety and security, alternative energy supply arrangements and the availability of supervisory personnel and needs up-gradation of ward patients.
2. Pediatric ward faces serious concerns for space distribution, space layout, functionality and flexibility of space and ease of interaction among patient and health staff. Existing space distribution provided is insufficient to meet patient's needs as per national and international standards. Wards should be designed according to patients' needs beside of National and International standard, as currently been over-crowded as HBN health Standards.
3. Environmental factors; Environmental Assessment of pediatric ward for indoor patients were improper on yearly basis analysis. General aspects of environmental assessment include; lighting, ventilation, thermal comfort, acoustics, which mostly depicts in a way negative effects of hospitalization and generally stimulates to healing process. All deficiencies regarding the lighting, ventilation, thermal comfort, and acoustics issues were noted to overcome and later patients' wellbeing solutions.
4. Lighting is low as FGI standards, while Noise level is also quite high as national and internal standards and needs to be addressed.
5. Results, findings and discussions were documented, along with concerns raised by patients / assistants and other child health specialists. On daily basis recorded data, reflects to establish more child health care centers and note influx of recorded patients.

RECOMMENDATIONS

Healing environments contribute to massive well-being for patients, doctors, nurses, health personnel and administrators who works in the building. Healthy work environments contribute really to improving staff performance. Some important recommendations were developed as observed by the researcher and discussed with the users, including patient / assistant, the doctors and other health personnel after the data analysis was completed.

1. Lighting is in-adequate in the pediatric ward, which needs to be ensured according to FGI Standards.
2. Requirements of thermal comforts are also not according to FGI Standards and should be achieved through the proper insulation, provision of radiator heaters, fans and air conditioners in the building.
3. Severe Noise problem needs to be reduced by imposing strict rules and regulations such as restrictions on visitor's/patients attendants and outside noise.
4. Improve existing facilities at pediatric ward through ensuring the availability of quality drinking water, adequate place for mother's seating area and privacy.
5. Proposed extensions of the pediatric ward, cafeteria and general waiting building, though newly constructed health care facilities, but still space distribution per bed must be ensured as per HBN health Standards.
6. Lack of privacy arrangements may also be ensured and further enhanced through additional provision of removable solid partition in the wards.
7. The quality of drinking water needs to be improved and ensured according to WHO drinking water quality Standards.
8. Environmental considerations should be adopted specifically prevailing conditions and according to international Standards.
9. Overall condition of Pediatric ward environment must be upgraded and maintained to ensure safety and wellbeing of patients.
10. Synchronized assessment system about investigating the existing facilities and actual requirements needs to prepare guidelines for improving existing facilities.
11. Well-designed and functional Pediatric Center is a center that spaces are designed according to normal flow pattern of hospital (functional relationship diagram of hospital designs) and, at

same time, those spaces are child friendly to give child sickness has denied him or her.

PROPOSED DESIGN INTERVENTIONS

Patients and staff collectively express their demand for basic facilities that are not met as needed. Minimize patient complaints. The existing facilities can be improved considering the proposals detailed below. The renovation and extensions of the Pediatric ward building to improve existing facilities represent an attractive solution, but it is a challenging task, since it is not economical due to limited resources, so it is necessary to provide important structural modifications. However, serious reported deficiencies should be eliminated.

Severe deficiency of toilet block, provision of seats for patient assistant, potable water and cafeteria building inside the ward building was reported. Taking into account the above, proposed the construction of a new block that includes toilet, waiting area and cafeteria building, selecting an adjoining area of 200 m^2 and a covered area of 500 m^2, next to the AHF pediatric ward. The proposed modifications and the existing distribution plan are highlighted in Figures below. Provide adequate and ample light exposure according to the recommended standard in certain work places, for example pharmacy areas or medications. In addition, access to natural light is vital to reduce spatial disorientation. Decrease occasional complaints from the power source by ensuring a sufficient alternative arrangement of the power generator.

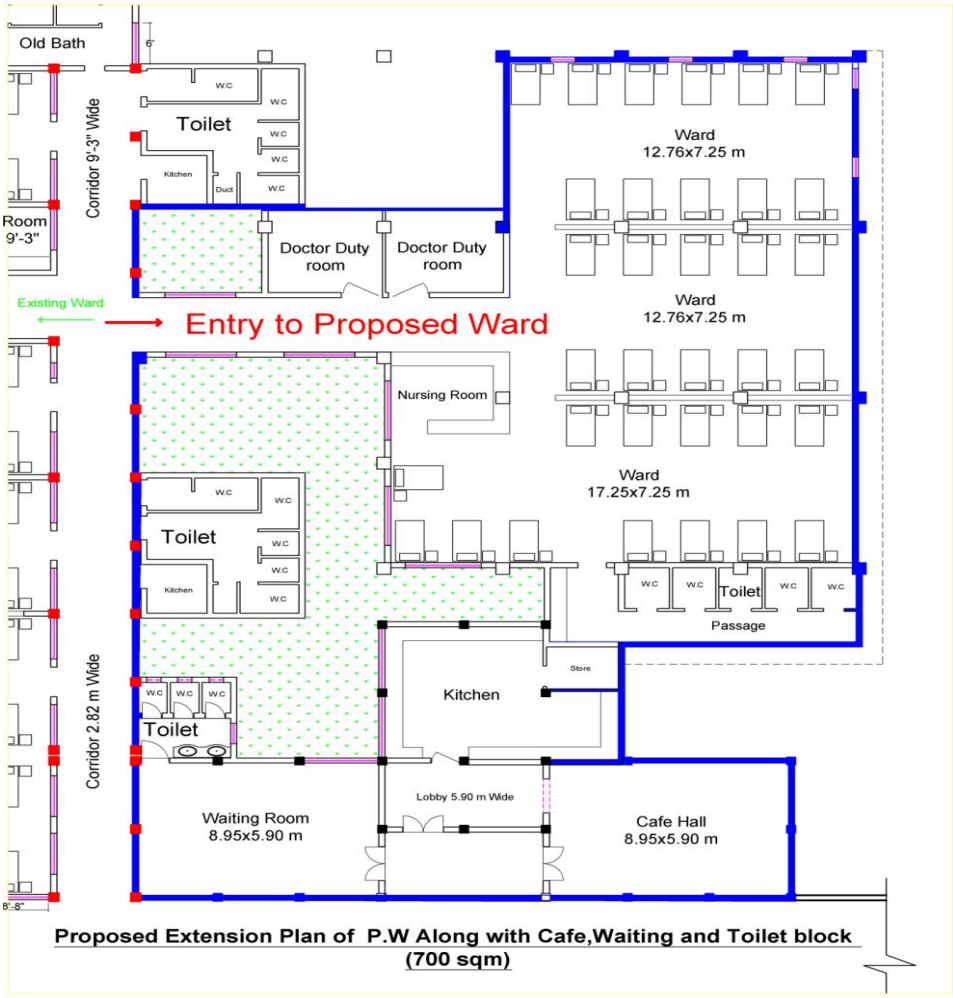

Figure 09 Proposed Extension Plan of Ward, Café, Waiting and Toilet Block.

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