Architectural solutions of contemporary pediatric hospitals – a study of selected projects

DSc. PhD. Eng. Arch.
NATALIA PRZESMYCKA, ASSOC. PROFESSOR
Lublin University of Technology
Faculty of Civil Engineering and Architecture
ORCID: 0000-0002-1755-2448

MSc. Eng. Arch.
RAFAŁ STROJNY
Lublin University of Technology
Faculty of Civil Engineering and Architecture
ORCID: 0000-0002-2451-9152

The article presents the results of research on contemporary trends in the design of pediatric hospitals. The aim of the research was to determine directions both in the sphere of architectural, functionality and spatial solutions, as well as the arrangement of the areas of nursing and public areas, recognized as distinguishing features in relation to specialized hospitals of other profiles.

Introduction

Medicine is one of the most dynamically developing fields of science. Healthcare facilities, which are the base for the performance of therapeutic procedures and treatment process should follow its development. The increasing share of advanced technologies and growing sanitary, hygienic and functional requirements cause that architects designing new hospital facilities reach for unconventional solutions, often based on theoretical (EBD Evidence-based design) and practical assumptions [1] and introducing eco-friendly and energy-saving solutions [2].

State of research

The influence of the interior space of hospital facilities on the process of treatment and convalescence is the subject of research in many scientific spheres [3, 4]. Researchers pay attention to various aspects and properties of interior design of hospital wards and public spaces [5, 6], as well as special solutions such as greenery [7], color, temperature and acoustics [8]. These studies are related to the increasingly popular holistic approach to the treatment process and are of interest not only to architects and physicians but also to scientists from other fields such as philosophy and sociology [9, 10].

The influence of architectural solutions is most visible in the aspect of stress reduction A factor having a direct impact on human health and the course of treatment processes [11, 12, 13]. The authors also stress the importance of the presence of family members in the treatment process, which in the case of pediatric hospitals is particularly important [14, 15].

With regard to the methodology of designing paediatric hospitals as specialised health care facilities, in recent years we can observe the use of research-based methods (EBD) as well as the participatory model [16, 17, 18]. Simultaneously with the guidelines and design guides [19, 20] studies are published questioning the dominating role of 1-person hospital rooms in paediatric wards [21].

Methodology

The study covered ten paediatric hospitals from selected European countries. The criteria for the selection of facilities for the study was the time of their establishment (after 2010 or under construction)[1], the function of the facility and the application of original architectural solutions, based on the current state of knowledge in the field of health care facility design.

Fig. 1. Comparison of the entrance area of several of the examined hospitals (from left: children's hospital BørneRiget, Copenhagen, by 3XN, Sheffield Children's Hospital, Avanti Architects, Phot. Simon Kennedy, Alder Hey Children's Hospital, BDP Architects, Phot. David Barbour. Illustrations by the curtesy of owner

Fig. 2. Comparison of selected bed wards in the studied hospitals (from left: Sheffield Children's Hospital, Avanti Architects, Phot. Jill Tate, Princess Máxima Centre for Child Oncology, Liag Architects, Phot. Ronald Tilleman, Alder Hey Children's Hospital, BDP Architects, Phot. David Barbour. Illustrations by the curtesy of owner

In each of the analyzed cases, these buildings are also characterized by a number of ecological and energy-saving solutions. The analysis included patient areas, bed rooms, solutions applied in them, general areas, the entrance area to the facility, links between individual areas, the natural environment and the dominant materials used inside. The research materials were obtained from publications, websites of individual hospitals, design studios and directly from designers. The size of the studied objects ranges from 8,000 to 60,000 m^2 of floor area, approx. 38.000 m^2 on average, which is an important information about the scale of modern investments.

The results

Entrance area

In each of the analyzed objects attention is drawn to a specially designed representative entrance area. Although it is not the most important part of the structure from the therapeutic point of view, it is the part that will make the first impression on a small patient. For children, the stay in the hospital is a stressful situation, which makes it important for them to feel a sense of peace entering the hospital. Due to the fact that most of the discussed buildings are of considerable size, a high entrance area was used, usually spanning the whole height of the building or at least several storeys. It is the core of the whole concept. Often there are winter gardens or other green accents. The monumentality of these areas is mitigated by good natural light combined with natural materials. The dominant material in these spaces is wood, which creates a friendly and calm atmosphere. Some implement subtle subdued colorful accents to bring the space to life. A study on the experiences of children with atriums in the hospital showed that the vast majority of patients positively receive the tall entrance areas. Accents in the form of sculptures, works of art combined with good lighting and warm materials reduce the monumentality of the hall to human scale [18].

Spacious lobbies also serve for better orientation in the building and allow for a general understanding of the functional layout. They also provide a sense of comfort, relaxation and safety [5]. An interesting solution was used in Queen Silvia's Children's Hospital (Gothenburg, Sweden) in the form of fancy works of art, which aim to reduce the fear of small patients before staying in the hospital. At Sheffield Children's Hospital (UK), the inside of the entrance area is dominated by a large play tube that is available from each ward, providing a neutral space for patients to play and above all places them at the heart of the whole establishment. Special architectural solutions in the entrance areas provide a good first impression for small patients, reducing anxiety and providing a friendly atmosphere.

Bed wards

The second most important area in a paediatric hospital is the bed ward. In modern facilities of this type, design solutions are used to ensure, as far as possible, a homely atmosphere, the intimate character of the interior, and to reduce the sense of hospital institutionality. Modern forms of such buildings are shaped in a way that provides each room with a unique view through its windows. They usually open towards green areas or parks. The important role of greenery in this type of facilities is based on scientific research which proves the positive impact of greenery on health [3]. Therefore, the newest paediatric hospitals are integrated with green areas. Access to greenery is often possible directly inside the building as well as from many places outside. It is becoming popular to use smaller wards that shorten the way between individual zones. This also provides a smaller scale of zones with a more homely character. Green terraces or winter gardens are often situated at the end of ward's maintenance sections. Another form of greenery is the winter garden in the central zone of the building, which is also the entrance zone. Natural lighting plays an important role as well as short corridors. They are designed in such a way as to avoid the impression of a being long and dark. Usually within the wards, single-corridor systems are used to maintain a friendly scale of space for children. Such design is in line with the expectations of small patients, who, according to research, expect bright, warm and cheerful surroundings in the hospital space [16].

Another aspect is fun, which is considered to be part of the rehabilitation process. Therefore, a number of different play spaces are used in the wards, general areas, inside and outside the building. They are often combined with greenery. An innovative solution was used in Julian Children's Hospital (The Hague, Netherlands). Based on research that has proven to reduce pain and stress in children through a distracting environment [6]. In order to help the patients regain balance faster, designers created five leading characters which through interactive animations and moving projections are accompanying small patients on their hospital journey. They appear mainly in elevators, in the corridors of the operating theatre, and in the treatment rooms. In Queen Silvia's Children's Hospital (Gothenburg, Sweden), a library at the therapeutic areas and a school were designed to make the hospital's space more common.

The green and play areas are a valuable addition to the bed ward areas, a healing space that should provide a pleasant and family atmosphere. For this purpose, spaces for parents have been provided in all of the discussed facilities. Usually they are solved as an extra bed, but there are examples of how the ward space can be organized with the parents' rooms included. This design of the bed ward was used in the Princess Máxima Centre for Child Oncology (Utrecht, Netherlands). It designed single bedrooms connected to the parents' room. They can be combined or shared as required.

In modern paediatric facilities, excess of bright colors and decorations of wards in the form of cartoon images is avoided. This is a fundamental change in relation to predominant design trends of the second half of the 20th century, when such decorations were often the only differentiating factor of the interior design and even the whole architecture of the hospital facility. The dominant material in most

[1] Buildings selected for discussion, consecutive number corresponds to the object from table 1: hospital name, location/year of construction. 1 – Copenhagen Children's Hospital (Copenhagen, Denmark/ ~2024), 2 – Queen Silvia's Children's Hospital (Göteborg, Sweden /2020), 3 – New Children's Hospital (Helsinki, Finland/2018), 4 - Hôpital Necker Enfants Malades (Paris, France/2018), 5- Princess Máxima Centre for Child Oncology (Utrecht, Netherlands /2018), 6 – Sheffield Children's Hospital (Sheffield, UK/ 2018), 7 – Juliana Children's Hospital (Hague, Netherlands /2015), 8 – Alder Hey Children's Hospital (Liverpool, UK/2015), 9 – Parma Children's Hospital Pietro Barilla (Parma, Italy / 2013), Princess Elisabeth Children's Hospital (Ghent, Belgium /2011).

Table 1. Comparison of selected elements shaping the architecture of the discussed pediatric hospitals

Number / Source	Scale of the architecture Size of the hospital / floor area of the hospital [m^2] (number of beds)	Characteristics of common areas	Characteristics of wards
1 [22]	9 storeys, loose arrangement, 1 corridor arrangement / 58.000 (900)	Entrance area: 9 storeys, predominantly wood, play areas, good natural lighting	Large windows overlooking the greenery and panorama of the city, short, wide corridors ending in a winter garden with a play area
2 [23]	8 storeys. compact arrangement, 2-corridor system / 35.000 (112)	Entrance area: 8 storey with conservatory, predominantly wood, good natural lighting	Large windows overlooking the atrium and the surrounding area, wide corridors connected to the winter garden and play area
3 [24]	140 8 storeys, compact arrangement, 2-corridor system / 48,000 (140)	Entrance area: 2 storeys, colorful accents, large glazing, good natural lighting	Large windows overlooking the area, external blinds, single rooms with space for parents
4 [25]	8 storeys, compact arrangement, 1 and 2 corridor system / 60,000 (404)	Entrance area: 2 storeys with a trained roof, predominantly steel, good natural lighting	Large windows with greenery elements overlooking the city panorama, single rooms with space for parents
5 [26]	4-5 storeys, compact arrangement, 1 corridor system / 45,000 (112)	Entrance area: 2 storeys, dominant share of wood, colorful accents, green courtyards with play areas, good natural lighting	Single rooms connected to the parents' room and a balcony overlooking green courtyards or green surroundings, wide and short corridors
6 [27] [28]	3 storeys, compact arrangement, 1 corridor system / 8,000 (72)	Entrance area: 3 storeys with a central play tube and colorful accents, good natural lighting	Large windows with blinds overlooking the city panorama, corridors ended with an atrium and a play tube
7 [29]	4 storeys, compact arrangement, 1 corridor system / 34,500 (210)	Entrance area: 4 storeys with play space, interactive animations and moving projections on the walls	Large windows overlooking the greenery and surroundings, single rooms with space for parents, corridors integrated with atrium
8 [30] [31]	5 storeys, loose arrangement, 1 corridor arrangement / 60,000 (270)	Entrance area: 5 storeys, predominantly wood, good natural lighting	Wide corridors finished with green play terraces, rooms overlooking the park
9 [32]	4 storeys, compact arrangement, 2 corridor system / 14,000 (99)	Entrance area: 1 storey, dominated by steel and glass, wooden and colorful accents	Single rooms with space for parents, large windows overlooking the green atrium or the surrounding area
10 [33]	6 storeys, compact arrangement, 1 corridor system / 16,000 (78)	Entrance area: 2 storeys, wooden accents	Single rooms, large windows overlooking the area, wide and short corridors

of the examined objects is wood with colorful accents (or high quality wood-like materials). Most of the rooms are single with space for parents and a bathroom accessible from the room. Such solutions provide privacy, greater intra-family support, ensure better sleeping comfort and alleviate patient anxiety [12]. Multi-bed rooms are rare and are designed mainly for the youngest children. Nevertheless, they also provide space for parents. Studies indicate that the presence of the family, greenery, play areas and a large amount of natural light reduce the sense of anxiety in children [14, 17].

The interior decoration and colours of children's rooms are designed in a universal way, adapted to every age and gender of patients. Usually these are delicate colorful elements with a dominant share of wood. The rooms provide exceptional views of the greenery through large windows and appropriate location of the wards. The architects also use a number of solutions to protect against excessive sunshine such as inside or outside blinds, shutters and other proprietary solutions. The rooms, apart from a spacious bathroom, are equipped with the necessary furniture for children and their parents.

The research results are presented in the Table 1.

A noticeable trend that appears more and more often in the solutions for paediatric hospital design is the ecological approach and future functioning of the facility. Most of the facilities built in the last few years use ecological materials with low carbon footprint, solar, wind and geothermal energy. It is also important to collect and use rainwater, which is associated with green areas increasingly common in this type of facilities. In addition to green technologies, passive solutions and intelligent installations are used to improve the operation of the entire facility. Thanks to such implementations, these buildings are often granted environmental certificates (e.g. LEED, BREEAM). The main leading feature of modern paediatric hospitals is the important role of greenery and the role of play space as an integral part of treatment.

Conclusions

As a result of the analysis of the selected buildings, the following conclusions can be made:

1) The comfort and tranquility of children are the main starting points in the design of modern pediatric hospitals.
2) In architectural solutions of entrance and common areas the aim is to achieve the effect of spaciousness and legibility of layout.
3) In architectural solutions of nursing sections the emphasis is placed on the maximum reduction of corridor length and intimate arrangement of patients' rooms.
4) The therapeutic role of greenery inside the facilities, in the immediate surroundings and in the distant view links, providing an attractive view out the window is appreciated.

Comfort and peace of mind for children are the main starting points for the design of modern paediatric hospitals. The large scale of these buildings is offset by the application of architectural solutions and interior design allowing for the maximum use of daylight, obtaining the effect of spaciousness, openness and friendliness. At the same time, solutions are applied within individual wards to create an atmosphere of peace, coziness and intimacy. The bedrooms are arranged in a way that makes it possible for parents to stay with their children, which is of great therapeutic importance. Stress reduction is addressed through implementing both the architectural and urban planning solutions. The hospitals are usually located in green areas or have attractive views, and architecturally both external and internal spaces are designed specifically with stress reduction in mind.

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Abstract: The article presents the results of research on contemporary trends in the design of paediatric hospitals. The aim of the research was to determine directions both in the sphere of architectural, functionality and spatial solutions, as well as the arrangement of the areas of nursing and public areas, recognized as distinguishing features in relation to specialized hospitals of other profiles.
Keywords: paediatric hospital, architecture of health care facilities, paediatric ward

Streszczenie: ROZWIĄZANIA ARCHITEKTONICZNE WSPÓŁCZESNYCH SZPITALI PEDIATRYCZNYCH – STUDIUM WYBRANYCH REALIZACJI. Artykuł przedstawia wyniki badań dotyczących współczesnych tendencji w zakresie projektowania szpitali pediatrycznych. Celem badań było określenie kierunków zarówno w sferze rozwiązań architektonicznych, funkcjonalno-przestrzennych, jak i aranżacji stref obszarów pielęgnacyjnych oraz ogólnodostępnych uznanych za wyróżniki w stosunku do szpitali specjalistycznych o innych profilach.
Słowa kluczowe: szpital pediatryczny, architektura obiektów służby zdrowia, oddział dziecięcy