

CHILDREN'S WARDS – REQUIREMENTS VS. REALITY: A COMPARATIVE FRAMEWORK FOR ASSESING SPATIAL QUALITY

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ABSTRACT: This paper introduces a comparative framework for evaluating spatial qualities in pediatric hospitals, with a focus on the best practice currently available. Modern healthcare design emphasizes adaptability and patient-centered care, pediatric wards can often be planned using a generalized ward design, especially in smaller local hospitals, which are often ill-suited to be transformed into a ward for children with specific needs. This study defines a set of expected criteria for flexible pediatric hospital design, such as room adaptability, support for family presence – and compares them with situations currently found in Czech hospitals. Using spatial analysis tools and each wards layout, the method assesses key parameters and compares them to the best practice currently known. The findings reveal significant gaps and various shortcomings of the wards, particularly due to the high occupancy in smaller hospital's pediatric units, where little flexibility and accommodations for family can be made. The study shows usefulness of a structured comparison method for identifying design and special shortcomings and can be used for informing future planning. It offers a tool that can be used as a basis for discussion about the actuality of the current guidelines for children wards reconstructions and new builds.

KEYWORDS: hospitals; pediatric wards; children; children's hospitals; inpatient unit planning; family-centred care; spatial flexibility; healthcare; healthcare architecture

INTRODUCTION

The article presents the concept of a comparative framework for evaluating the spatial qualities of pediatric wards that fundamentally shape the experience of hospitalization. Across hospitals in the Czech Republic, pediatric wards are being renovated and rebuilt. However, the resulting layouts often fail to adequately consider all actors—children, their caregivers, and staff—and run up against the lack of a defined minimum spatial requirement for the hospitalization of a child with a caregiver. The mode of pediatric hospitalization predetermines that more space is needed per child than in adult wards. The consequences are improvised accommodation for caregivers, a lack of quiet zones, and limited ability to quickly change the configuration of space according to the patient's age and diagnosis. Under conditions of persistently high occupancy, spaces reach the limits of their capacity and adaptability is lost.

This article responds to the absence of clear spatial standards for admitting a child with a caregiver and to the need to transfer international best practice into the Czech context in a comprehensible, reproducible way. It presents a comparative framework for assessing the spatial flexibility of pediatric wards that connects requirements drawn from literature and practice with verification on selected existing wards.

The evaluation framework is based on the contrast between expected standards and real practice. Its aim is to reveal gaps between expectation and reality, and to identify which environmental properties most influence the quality and usability of the inpatient ward. The hypothesis assumes insufficient flexibility in most facilities, particularly due to spatial constraints and persistently high occupancy in general pediatric wards. The aim is to present a comparative framework based on expected criteria of the modern pediatric environment, which will be generally applicable in local conditions and provide a basis for design decisions in both renovations and new builds.

THEORETICAL BASIS

Currently, the design of pediatric inpatient wards in the international context is shifting from a purely functional, illness-oriented model toward a holistic and

responsive environment that supports clinical care as well as the individual needs of the child and family. This shift is grounded in the principles of family-centered care (FCC) (Kuo et al. 2012) [1], derived from patient-centered care, and in evidence-based design (EBD) (Lenton & Ehrich 2015) [2]—design based on evidence and the use of technologies enabling individualized bedside care.

Abroad, single- to double-bed rooms with full caregiver accommodation directly in the room (rooming-in) prevail (Sunder et al. 2020) [3]. Layouts are typically zoned into a clinical part, a patient-bed area, and a family area, with sufficient space for relaxation, privacy, and spending time together. Fundamental spatial features that demonstrably improve the experience of hospitalization include the presence of daylight (Shepley et al. 2012) [4], acoustic comfort, visual contact with greenery (Ulrich 1984) [5], and opportunities for personalization (displaying personal items) (Verschoren et al. 2015) [6]. In many countries, play therapists already work with children and prepare them and their families for procedures they will face in hospital, which reduces anxiety and stress for the child and family (Matějček 2001) [7]. In the Czech Republic, this practice faces a shortage of staff and suitable spaces. The contribution of the proposed framework lies in its operationalization into an evaluation framework and in spatial, computer-assisted verification directly on the floor plans of specific facilities. We test the framework on selected Czech pediatric wards of various types (regional and university), which makes it possible to compare the expected standard with the results actually achieved in different operational and building contexts.

Technological advances and developments in medicine enable a model of care delivered directly at the bedside, termed “vertical patient care,” in which staff can care for the patient at a single bed across all levels of hospitalization (from intensive through intermediate to standard care), without moving the patient from one room to another. This led to the concept of the “acuity-adaptable” room (Hendrich et al. 2004) [8]. The architectural solution must interlink building and operational strategies.

In pediatric wards, flexibility and age-appropriate environments are crucial (Clensy 2022) [9]. Rooms and the overall configuration of the ward must respond to and

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encompass the differing needs of all age groups, from toddlers to nearly adults. In practice this should mean the possibility of using flexible furniture and enabling simple reconfiguration of the room without building work, while also providing adequate equipment across the ward for caregivers of younger hospitalized children.

The presence of a caregiver is a declared right of the child (EACH 2006) [10]. In practice, however, some wards lack the spatial and operational preconditions—for a full caregiver stay one needs a bed for the caregiver, storage capacity, caregiver facilities outside the room, and ward rooms for private discussion of the child's health status (Ehrich et al. 2017) [11]. This creates a discrepancy between expectation and reality.

As a conceptual basis for the methodology we use the work of W. Sunder et al. (The Patient Room, 2020), which describes qualitative-typological evaluation of double rooms based on floor-plan arrangements and key structural elements with the aim of estimating their user qualities. The method combines expert interviews, operational observation, and more, synthesizing these into six categories (Sunder et al. 2020) [3]. The framework therefore does not offer a universal ideal room; it serves to compare typologies and understand operational links to user quality. The proposed methodology builds on international trends that connect environmental properties with the subjective quality of stay of the child and caregiver and then translates them into criteria verifiable on the layout of specific wards (Lambert et al. 2013) [12]. This theoretical foundation underpins the comparison of best practice with the situation in Czech hospitals.

From these trends it follows why we evaluate exactly seven categories—flexibility, multifunctionality, intelligibility, privacy and zoning, child adaptation, indoor environment, and family involvement (Verschoren et al. 2015) [6]. Each corresponds to repeatedly described determinants of the quality of the child's and family's stay in the literature and together they cover both clinical needs and psychosocial aspects of the stay.

METHODOLOGY

The aim of the methodological procedure is to translate the requirements of family-centered care into observable and measurable criteria and to verify these by comparison with existing pediatric inpatient wards. The study is a comparative mixed-methods design (Lucas 2016) [13] and is based on the principle of "expectation vs. reality," in which we verify the fulfillment of criteria in concrete realizations. The sample consists of selected pediatric inpatient wards with different capacities and building-operational configurations. The analysis includes layout documentation and semi-structured interviews with staff, capturing the current operational state of the wards. The research

has elements of post-occupancy evaluation (Groat & Wang 2013) [14], but is not a full application of the POE method. Cases include smaller general hospitals and university facilities to observe the roles not only of design but also of occupancy and structural module. The starting point is a synthesis of international guidelines and cross-disciplinary studies, from which a set of evaluation criteria is derived that reflect the key needs of the child, family, and operations. The selected criteria are: spatial flexibility (ability to adapt quickly without building work), multifunctionality (one place serving clinical and non-clinical functions), spatial intelligibility (wayfinding, readability of flows, intuitiveness), privacy and zoning (acoustic and visual protection, zoning of rooms and ward spaces), adaptation to children (scale, ergonomics, safety, age appropriateness), indoor environment (daylight, acoustics, temperature, window views), family involvement (accommodation for caregivers, spaces for caregivers). In parallel, three types of empirical inputs are collected—status of the bed stock (layout and technical documentation), semi-structured interviews, and statistical information—which serve to iteratively refine the evaluated criteria.

Each criterion is operationalized into quantitative and qualitative indicators. Quantitative indicators include m² per patient, the proportion of rooms with their own bathroom facilities, and the presence and size of support spaces (Sunder et al. 2020) [3].

The qualitative part evaluates the existence and quality of the family zone, the degree of privacy, the possibilities for adapting the equipment, and the clarity of wayfinding. Everything is graphically verified using CAD, modeling on the layout the placement of different types of beds, caregiver equipment, ward zoning, and checking the ergonomics of the entire operation. Adaptability is assessed using predefined hospitalization scenarios that cover different age groups and their needs, as well as specific spatial and equipment requirements. The selected scenarios are 0–2, 2–6, 6–10 years (always with a caregiver), 10–15 and 15+ (without a caregiver), and psychiatric hospitalization. For each scenario it is assessed whether it allows a comfortable stay for most of the tested scenarios. In CAD we systematically verify passages, access to bathroom facilities, sight lines, and collisions when a caregiver bed is added. Evaluation is conducted on a three-point scale with a brief note. We convert verbal levels into points and triangulate indicator – category – scenario – ward. To ensure reliability we use a unified definition of indicators and control readings in problematic cases.

Evaluation is conducted on a three-point scale adapted to the individual categories; for comparison we convert verbal levels into equivalent points and supplement each evaluation with a brief comment on the main constraint or advantage. The output is a fulfill-

	Haviřov	Kladno	MNUL	Ustí nad Orlicí	FN Motol
Patient allocation	diag	x	age	age	age + diag
Beds per unit (patients)	13	24	18	16	21
Patient age range	0-18	0-18	6-18	6-18	6-18
Caregiver beds	13	12	4	8	2
Parental amenities	x	✓	✓	x	21
Playroom	✓	✓	✓	✓	✓
Dining hall	✓	x	o	x	x
Room size	3-4L	1-4L	2L	2L	1-2L
Bathroom in standard room	x	x	o	o **	o **
Patient-room area per child	11,15 m ²	15,7 m ²	11,7 m ²	15 m ²	11,9 m ²
Patient-room area incl. Bathrooms	145 m ²	379 m ²	212 m ²	241 m ²	251 m ²
Support area per child	1,46	3,56	4,89	9,50	3,43
Total support area	19 m ²	85,4 m ² *	88 m ²	152 m ²	72 m ²
Parent support area	x	13,8 m ²	31,1 m ²	x	21 m ²
Child support area	51 m ²	66,8 m ²	33,3 m ²	27 m ²	15,4 m ²

* separate wing with storage ** one bath per 4bed unit

Tab. 1.: Overview of the examined wards and basic data, author (Source: author's own processing, data collection)

Kritérium	Definition	Indicators	Rating - scale	
Spatial flexibility	Ability to change spaces over time and adapt to needs	Modular layouts, sliding partitions, shared zones	low	Multiple spaces designed for alternate use or transformation
			mid	Some rooms adaptable but inconsistently
			high	Layout fixed, almost no modifiable spaces
Multifunctionality	Use of one space in multiple ways	Transformable or overlapping zones	present	Clear, diverse use possibilities
			limited	Some spaces allow, mainly passively
			absent	Spaces are single-purpose only
Spatial clarity	Clear and comprehensible, easily readable for all involved	Landmarks, wayfinding system, hierarchy and logical spatial sequence	high	Wayfinding is intuitive, with clear signage and spatial zones
			mid	Partly hierarchical arrangement, some areas confusing
			low	Unclear orientation, users become disoriented
Privacy and zoning	Separation of public/non-public, exam/rest/play areas, noisy/quiet – comfort	Clear layout, acoustic comfort, transition zones, clear zoning	clear	Distinct zones, clear transitions
			partial	Zones partially overlap, zoning not always respected
			unclear	No evident division of zones
Adaptation to children	Decor, play elements, adaptation/personalization of space	Play elements, colours, design, space for play therapy	high	Well-designed spaces with interactive elements and room for play therapy
			mid	Some interactive elements used, child-adapted design
			low	Minimal adaptation to children, only hints
Environment	Daylight, ventilation, user-controllable indoor environment (lighting, temperature...)	Windows, ward orientation, quality of artificial lighting	pleasant	Well controllable, views to greenery, diverse lighting options
			neutral	View into hospital grounds, partly controllable, adequate lighting
			unpleasant	View into technical areas, no control possible, only basic lighting
Family involvement	Provision of facilities for caregiver and family	Quality of sleep arrangement, day room, family education, play therapy	good	Family spaces integrated in design, room for play therapy
			partial	Some family spaces (e.g., mothers' room), adequate space
			minimal	No dedicated family spaces

Tab. 2.: Proposed evaluation framework including criteria, author (Source: author's own processing)

ment matrix and corresponding visualizations that clearly show the gaps between expectation and reality. Cases are purposefully selected to represent both smaller regional hospitals and university facilities.

The method does not replace long-term post-occupancy evaluations, and results may be temporarily influenced by high occupancy or the quality of documentation. Its strength, however, is transparency, repeatability, and straightforward application in the early phases of planning renovations and new builds.

RESULTS

Applying the evaluation framework to selected pediatric inpatient wards revealed a gap between expectation and reality.

In most cases the wards are not very flexible and caregiver accommodation is often improvised. Three systemic variables are key—area, current occupancy, and the structural system—which most constrain the flexibility of individual rooms. CAD verification repeatedly confirmed that simply adding a full caregiver bed blocks service passages, complicates access to bathroom facilities, and dissolves the family zone into the clinical area. Without spatial reserve, the ward's intelligibility and operational flows are lost. Flexibility draws on low levels of occupancy. Wards with low occupancy or larger area per bed therefore achieve the best results. In wards where rooms are small and occupancy is persistently high, adaptability is reduced to a minimum.

The examples show that Havířov benefits from lower

	Havířov	Kladno	MNUL	Ústí nad Orlicí	FN Motol
Spatial flexibility	mid	low	low	mid	low
Multifunctionality	absent	absent	limited	limited	limited
Spatial clarity	mid	mid	low	high	mid
Privacy and zoning	unclear	partial	unclear	partial	clear
Adaptation to children	low	mid	mid	high	mid
Environment	neutral	neutral	neutral	pleasant	neutral
Family involvement	minimal	partial	partial	partial	partial

Tab. 3.: Heatmap of assessments of selected wards (Source: author's own processing)

occupancy and the deliberate non-use of full capacity, which enables operational changes in room occupancy and combinations, and the rooms appear flexible. This characteristic would not be present at full occupancy. A disadvantage in Havířov, however, is the under-dimensioned facilities for both staff and caregivers and the lack of in-room bathroom facilities.

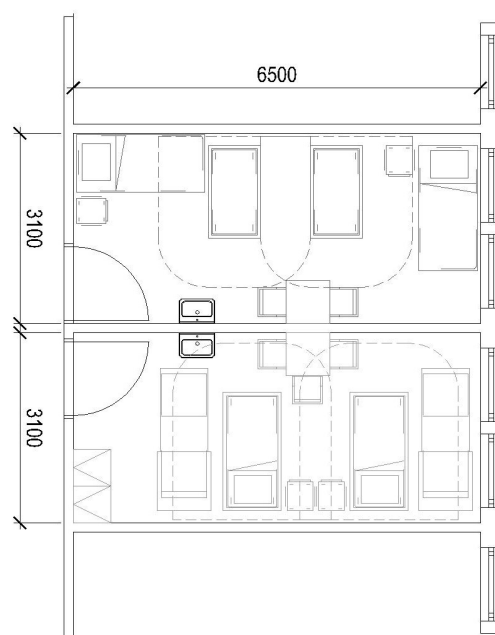


Fig. 1.: Room options in Havířov under lower occupancy, author (Source: Hospital Havířov, 2024)

Kladno Hospital is a ward with fixed division of individual rooms, which are pre-assigned by children's age. In practice, this means that if the hospital needed to admit more children from one group, the spatial setup would be limiting.



Fig. 2.: Typology of rooms at Kladno Hospital, author (Source: DOME archive, 2023)

Ústí nad Orlicí Hospital, as an example of a cellular typology (two rooms with shared bathroom), is characterized by good nurse overview, clear zoning, and ample space for children, but facilities for caregivers are limited. Two caregivers are accommodated per cell, so at full occupancy it is not always possible to house caregivers comfortably directly in the room.

In the scenario analysis, the most critical are 6–10 years with a caregiver, where the child often already needs a large bed, and the hospitalization of more older children with a demand for privacy. In smaller general hospitals, rooms are difficult to enlarge because the building's structure does not allow it. Older build-

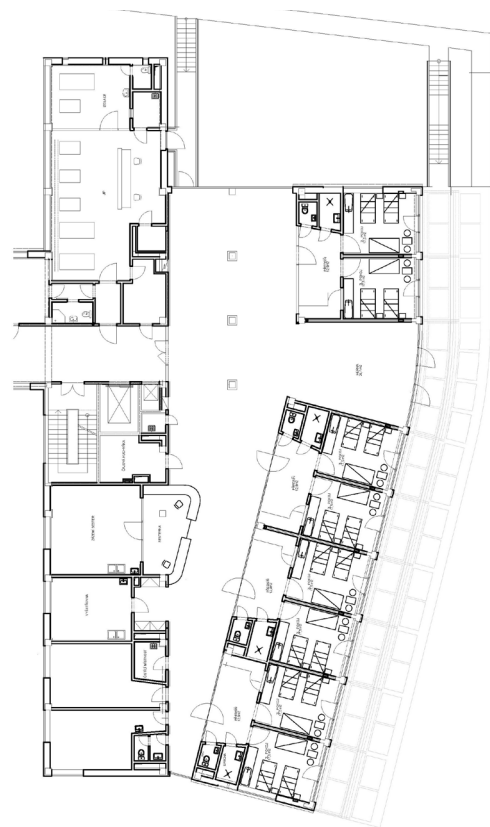


Fig. 3.: Cellular typology at Ústí nad Orlicí Hospital, author (Source: DOME archive, 2023)

ings have a load-bearing system with a smaller module designed for a time when caregivers were hardly allowed on wards and rooms held more patient beds. The unchanging structural system and placement of service cores now limit the possibilities of building alterations for further development—the space cannot be sensibly re-zoned nor can a full caregiver bed be comfortably added. The pressure for maximum capacity then directly translates into a lack of privacy and limited options to change the layout. The hypothesis of insufficient flexibility is therefore confirmed.

CONCLUSION

In the present study we compared a set of expected criteria for a flexible pediatric environment with the current situation at selected facilities in the Czech Republic. Through a combination of spatial analysis and layout review, key parameters were assessed and the main limitations of real wards in relation to the requirements of family-centered care were identified. The results meet expectations—at smaller wards with high occupancy, the scope for adaptation is minimal, caregiver accommodation tends to be improvised, privacy and zoning often fail to reach the required level, and adaptability is difficult without building interventions. In practice, flexibility rests on three variables that reinforce or weaken each other: area per bed, current occupancy, and the building's structural system. Without a combination of more area, lower occupancy, and a more favorable structural logic, both family integration and real spatial adaptation will remain improvisation rather than standard.

The matrix clearly maps the gap between expectation and reality across hospitalization scenarios and makes it possible to decide where a layout adjustment will help and where it is necessary to work with capacity and operational parameters. For renovations and new builds, the implications are clear: work with a minimum area standard and capacity reserve, prefer one to two beds per room with a separate family zone and a full bed for the caregiver, strengthen storage and

consultation facilities, and use flexible furniture and solutions that do not require building interventions. In buildings with a wall-bearing module it makes sense to target smart, simpler interventions with the highest impact, especially in zoning and acoustics.

Further research should validate the framework on a broader sample, supplement it with post-occupancy evaluations and basic economic analysis, so that its conclusions can be systematically embedded in procurement conditions and standards. The study thus confirms that a methodological approach based on spatial analysis and comparison with clearly defined criteria is a suitable tool for informed decision-making about future modifications to pediatric wards. The evaluation framework can be used directly in procurement for renovations and new builds as a checklist of room requirements and a set of scenarios that the design must handle without building interventions. Early use of the framework reduces the risk of later compromises in privacy and family involvement.

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