LETTER TO THE EDITOR

Key Points to Design an Orthopedic Specialty Hospital; Implementation of Green Building Standards to Optimize Performance of Orthopedic Units

Dear Editor

It is well-known that environments can impact a person's health by inducing feelings of happiness or distress and conveying information about one's identity, self-esteem, and security.[1,2]

Orthopedic Specialty hospitals (OSHs) provide a larger surgical volume while improving operative time and length of stay of patients, compared with general hospitals with less adverse outcomes than general hospitals. Over the past decade, there has been an exponential trend toward specialty hospitals, with increasing interest from both patients and healthcare providers.[3-5]

Green building standards ultimately aimed to minimize the overall negative impact on global environments and enhance indoor environment quality.[6,7] The applicability of the following indicators from the most common green building guidelines has been assessed in the design of an orthopedic specialty hospital[Table-1].

Table1. Indicators of healthy buildings according to most common green building guidelines

Green Building Guidelines	IEQ items					Ergonomic designing	Site selection	Climate-responsive designing	Access to public transportation	Ease of access for patients with ambulation disabilities
	Air quality	Thermal comfort	Acoustics Performance	Visual comfort	Natural lighting					
LEED[1]	*	*	*	*	*	*	*	-	*	*
BREEAM [2]	*	*	*	*	*	*	*	-	*	*
Green MARK	*	*	*	*	*		*	*	*	-
EEWH[3]	*	*	*	*	*	*	*	*	*	*
Green Star	*	*	*	*	*		*	-	*	-
KGBC [4]	*	*	*	*	*			-	-	

[1] Leadership in Energy and Environmental Design, [2] Building Research Establishment Environmental Assessment Methodology, [3] Ecology, energy saving, waste reduction and health, [4] Korea Green Building Council

Indoor environment quality (IEQ) items:

The impact of IEQ on patient's satisfaction is a measure of psychological response and physical complaints.[8]

1. Access to natural Light:

Consider placing windows strategically and using skylights to maximize the entry of natural light is a key in designing hospitals.

2. Thermal Comfort:

Maintaining appropriate temperature and humidity levels can indirectly contribute to musculoskeletal health.[6]

3. Acoustic Performance:

By minimizing excessive noise levels and implementing

Corresponding Author: Hamed Kamelnia, Faculty of Architecture & Urban Planning, Ferdowsi University of Mashhad, Mashhad, Iran

Email: kamelnia@um.ac.ir

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sound-absorbing materials, the guidelines aim to create quieter environments that may help reduce stress and promote overall comfort.

4. Indoor air quality (IAQ):

There is a clear connection between exposure to indoor air pollutants and the occurrence of asthma, allergies, bronchitis, and chronic obstructive pulmonary disease.

The indoor environment design:

Settings of hospital facilities should prioritize the emotional and physical needs of patients, their families, and the staff. [7]

Ergonomic Considerations:

Among the six guidelines provided, three specifically address ergonomic principles related to the design of workspaces, seating, and furniture. These principles promote good posture and reduce musculoskeletal risks.

Site selection and surrounding land:

Designing accessible and well-designed outdoor areas that offer patients and staff opportunities for relaxation, connection with nature, and therapeutic experiences. [6]

Climate-responsive designing:

Applying climate-conscious principles and strategies to optimize energy efficiency, indoor air quality, thermal comfort, and sustainability in healthcare facilities.

Access to public transportation:

Considering public transportation in hospital design is crucial to provide convenient and accessible transportation options for patients, visitors, and staff.

Ease of access for patients with ambulation disabilities:

This is achieved through adherence to accessibility standards, implementing barrier-free design, ensuring accessible entrances, and prioritizing wheelchair accessibility.

Extracted general architectural considerations that apply to OSHs:

1. Well-designed and Efficient Layout:

Minimizing the distance between different areas such as patient rooms, nursing stations, examination rooms, and support spaces is a critical point. This helps streamline workflow and improves efficiency.[5]

2. Adjustable Features:

Installing railings in corridors at different heights benefits both adults and children, ensuring their safety and convenience while navigating the hospital.

3. Patient Flow Optimization:

Designing dedicated paths for patients, staff, and equipment can help prevent congestion and maintain privacy.

4. Dedicated Imaging and X-ray Areas:

Incorporate dedicated spaces for imaging and X-ray equipment, easy access for patients and staff.

5. Well-Designed Examination Rooms:

Create examination rooms that are spacious, well-lit, and properly equipped with essential orthopedic examination tools, adjustable examination tables, wall-mounted monitors, and easy access to storage for medical supplies.[6]

6. Rehabilitation and Therapy Spaces:

Equipped with appropriate exercise equipment, therapy tables, and other necessary tools.

7. Supportive Flooring:

Good flooring materials offer better traction and prevent from slips and falls. Slip-resistant flooring can be beneficial in orthopedic units.

8. Task Lighting:

Should be bright, focused, and adjustable to meet specific lighting needs during procedures and examinations.[7]

9. Ambient Lighting:

Soft, diffused lighting can help reduce anxiety and promote relaxation.

10. Thoughtful Storage Solutions:

Incorporate ample storage space for medical supplies, equipment, and patient records. Use smart storage solutions like shelves, cabinets, and modular systems.

11. Privacy Enhancements:

Design features that enhance patient privacy, such as soundproof walls, curtains, or screens between patient beds.

12. Patient-Friendly Amenities:

Patient-friendly amenities such as comfortable seating in waiting areas, restrooms with grab bars, accessible sinks, and toilets at appropriate heights, Wi-Fi connectivity, charging stations. [Figure 1a, b, c].

13. Infection Control Measures:

Antimicrobial surfaces, handwashing stations, and separate areas for cleaning and disinfection of medical equipment to maintain a clean and safe environment.[8]

14. Avoid uneven surfaces:

Patients with orthopedic issues, such as those using crutches, walkers, or wheelchairs, may find it challenging to navigate uneven surfaces. Additionally, walking or standing on uneven surfaces can place additional stress on joints of the lower extremity, which can lead to discomfort, pain, and potentially delayed healing.

15. Elevators:

Elevators should be spacious, with wide doors to accommodate stretchers, wheelchairs, and medical equipment. Double doors or side-opening doors can provide wider openings.[8]

16. Casting rooms:

Incorporate ramps, wide doorways, and accessible bathroom facilities to accommodate individuals using wheelchairs or other mobility aids with a combination of natural light and artificial lighting to minimize shadows. A durable and easily cleanable flooring material, such as vinyl or linoleum is recommended.[7]

17. Telemedicine and Virtual Consultations:

Explore the use of telemedicine and virtual consultations

where appropriate to minimize in-person visits and reduce the risk of exposure for patients and healthcare providers.

18. Operating Rooms:

Operating rooms are the heart of orthopedic specialty hospitals. Utilization of new technologies has increased exponentially over the past decades in orthopedic surgeries. Advanced fluoroscopic and navigation equipment, in addition to recently popular robotic arms need more spaces to ensure maintaining of the sterilization during surgeries.

Figure 1a (Left). Considering different workstation height in design (D/Dock. VUmc Cancer Center. Available at: https://www.ddock.com/cases/vumc-cancer-center-amsterdam/. Accessed June 09, 2023.)
Figure 1b. Designing a unique and appealing color stair for kids can be a fun and creative project
Figure 1c. Designing space for Sport Therapy (HKS. Scottish rite for Children. Available at: https://www.hksinc.com/what-we-do/case-studies/texas-scottish-rite-hospital-for-children-north-campus/. Accessed June 12, 2023.)

Outdoor design:

1. Accessible Pathways:

Ensure that pathways throughout the outdoor areas are wide, smooth, and wheelchair accessible. Use materials that are easy to navigate, such as concrete or paving stones, and incorporate ramps or gradual slopes where needed.

2. Outdoor Exercise Areas:

Areas with exercise equipment specifically designed for orthopedic patients, such as low-impact cardio machines, stretching stations, and resistance training tools.

Implementing green building guidelines in the design of specialized hospitals, such as orthopedic hospitals, can contribute to their improved efficiency.[8] it is a multi-faceted endeavor. Every aspect should be considered to ensure a truly sustainable and patient-centered design.[9,10]

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Neda Mirzaei PhD [1]
Hamed Kamelnia PhD [2]
Seyed Gholamreza Islami PhD [3]
Saeid Kamyabi PhD [4]
Seyedeh Negar Assadi MD [5]

1 Department of Architecture, Semnan Branch, Islamic Azad University, Semnan, Iran

2 Faculty of Architecture & Urban Planning, Ferdowsi University of Mashhad, Mashhad, Iran

3 Faculty of Architecture, College of Fine Arts, University of Tehran, Tehran, Iran

4 Energy and Sustainable Development Research Center, Semnan Branch, Islamic Azad University, Semnan, Iran

5 Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

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