Ontology Space International Journal
ISSN: 2345-6450
OISSN: 2423-7299
Journal homepage: soij.qiau.ac.ir
Autumn 2025, Vol. 14, Issue 4, No. 55, Pages:65-78

Integrating evidence-based design to model patient satisfaction in hospital environments: Insights from Tehran's Imam Khomeini (RA), Bahman, and Gandhi hospitals [a]

Aida Sadeghi [a], Azadeh Shahcheraghi [a,*], Khosro Daneshjoo [b], Seyed Behshid Hosseini [c]

[a] *Department of Architecture, SR.C., Islamic Azad University, Tehran, Iran.*

[b] *Department of Architecture, Faculty of Arts, Tarbiat Modares University, Tehran, Iran.*

[c] *Department of Architecture, Faculty of Architecture and Urban Planning, Iran University of Art, Tehran, Iran*.

Received: 03 April 2025.- Accepted: 07 September 2025
Doi:10.71879/soij.2025.1203126

Abstract

In contemporary healthcare, patient satisfaction is acknowledged as a critical indicator of service quality. Hospital architecture, when guided by patient-centered principles, can substantially enhance satisfaction, alleviate stress, and improve treatment outcomes. The patient-oriented approach shifts the focus from purely clinical processes to the holistic experience of the patient, emphasizing spatial, psychological, and environmental factors. Evidence-Based Design (EBD) further reinforces this approach by employing systematic, data-driven analyses to assess how architectural and interior design features impact patient experience and well-being. This study aims to develop a practical model for enhancing patient satisfaction through hospital architecture grounded in patient-centered principles. The research employs a descriptive-analytical methodology, combining field observations, literature review, and empirical data collection through structured questionnaires administered to 224 hospitalized patients in Imam Khomeini (RA), Bahman, and Gandhi Hospitals. Data analysis was conducted using regression and correlation techniques within the ASPECT framework and SPSS26 software, enabling the identification of relationships between specific environmental features and patient satisfaction levels.Results indicate that Gandhi Hospital, which implemented patient-centered design features most extensively, achieved the highest satisfaction score (mean: 3.901), followed by Bahman Hospital (mean: 3.539), while Imam Khomeini (RA) Hospital recorded the lowest score (mean: 2.779). Regression analyses highlighted that factors such as access to natural light, spatial legibility, noise control, and privacy exerted the strongest positive influence on patient satisfaction. Based on these findings, a model integrating high-impact architectural and interior design elements was proposed to optimize patient experience and overall hospital performance.The study demonstrates that a systematic, evidence-based approach to hospital design not only reduces patient stress and enhances satisfaction but also provides actionable guidance for architects, designers, and healthcare managers. By linking environmental factors with measurable outcomes, this model offers a structured framework for improving healthcare quality and advancing patient-centered architectural strategies.

Keywords: Hospital architecture, Evidence-Based Design, patient satisfaction, Imam Khomeini Hospital, Bahman and Gandhi

1. Introduction

Within hospital settings, the patient represents the primary focal point, and all healthcare services are strategically adapted to address their specific needs. Patient satisfaction functions as a critical metric for assessing the effectiveness of these services, and its formal recognition as a healthcare priority dates back to the 1950s (Teschke, 1991). As a multidimensional construct of growing relevance in healthcare systems, patient satisfaction has increasingly attracted scholarly and policy attention. To strengthen this outcome, policymakers are advised to concentrate on several essential determinants (Garcia & Martinez, 2021:102).

As one of the principal benchmarks for evaluating the quality of healthcare delivery, patient satisfaction has gained notable prominence in recent years. The National Health Service (NHS) has, over the past decade, embedded this concept as a core element of its policy framework, emphasizing that quality encompasses not only clinical performance but also the experiential dimension of care. A decline in satisfaction can undermine patient engagement in treatment, resulting in inefficient resource utilization and compromised clinical results (Kim & Choi, J. 2023:46). Consequently, fulfilling the valid expectations of patients is a fundamental goal across all healthcare systems and a recognized indicator for assessing treatment success.

The dynamic association between patient satisfaction and service quality is mediated by factors such as individual patient attributes, provider competence, and the adequacy of hospital infrastructure (Smith et al., 2022:794). Patients' perceived expectations regarding care quality exert substantial influence on their satisfaction; any disparity between these expectations and the actual service quality can adversely affect satisfaction levels (Harris et al., 2002:1277). Moreover, satisfaction outcomes may vary across socio-cultural backgrounds, demographic groups, and different categories of

* Corresponding Author Email: Shahcheraghi@iau.ac.ir

The current article is derived from the Ph.D. thesis by the first author entitled "A conceptual m odel for improving the architectural quality of evidence-based general hospital (EBD) with an emphasis on patient satisfaction.", guided by the second and third authors, and consulted by the fourth author in the Islamic Azad University Science and Research Branch is in progress.

healthcare services (Martin, 2000).Modern healthcare facility design increasingly seeks to optimize clinical outcomes, mitigate psychosocial strain for both patients and staff, minimize medical errors, elevate satisfaction among patients, families, and personnel, and manage rising healthcare expenditures. Collectively, these objectives form the guiding principles for innovative hospital design aimed at meeting the demands of future healthcare delivery (Sadeghi et al., 1403:34).

Evidence-based research methods were founded in 1965 worldwide. These research methods were introduced to the architecture of hospitals in Britain in 1970. Few studies have been done on EBD since 1980. A health-based design center was founded in 1992 then more and better studies have been done on EBD since then. Huge research EBD projects began in 2000 to improve patients' outcomes and continued until 2004. Findings of around 1000 methods were analyzed up to 2008, and valuable results were obtained. These results indicated that we can improve patients' outcomes and safety by implementing some interventions (Labibzadeh & Sadeghi, 2021: 2).

EBD approach in medical centers is an important and growing movement towards the creation of a safe environment for taking care of patients. Compared to evidence-based medicine (EBM), EBD is a relatively new study field but numerous academic studies have established the foundations of this emerging major in the previous decade (Rashid, 2020).

As a modern approach to medical center design, EBD emphasizes the importance of using valid data to examine its effect on the design process. In therapeutic architecture, this approach is known as "an attempt to improve the well-being of patients and staff, the treatment process of patient, safety, and stress reduction." EBD is a relatively new research field that has adopted its terminology and ideas from various scopes, including environmental psychology, architecture, behavioral economics, and neurology (Tahouri & Sadeghi, 2021: 2).

EBD is defined as "the process of deciding on planning, designing, and constructing medical centers based on the valid evidence to achieve the best possible outcomes."EBD is influenced by the EBM. These two contexts are overlapped. This attitude provides design advice based on the causal relationships between characteristics of the designed medical environment and desired outcomes. Identification and application of psychological components and criteria in the interior design, including proper light and color, adaptable spaces, natural elements, and vegetation are effective in enhancing the quality of medical centers and designing a safer environment with more peace and less stress, which improves the medical performance (Hamzeloo & Sonboli, 2021: 1).

In hospitals, the primary focus is the patient, and all services are tailored to meet their needs. Patient satisfaction is a key measure of healthcare quality and treatment success, influenced by factors such as patient characteristics, staff competence, and the quality of hospital environments.

Modern hospital design aims to improve clinical outcomes, reduce stress for patients and staff, minimize medical errors, and enhance satisfaction for patients, families, and personnel. Evidence-Based Design (EBD) uses valid data to optimize healthcare environments, incorporating principles like natural light, color, adaptable spaces, and greenery to promote well-being, safety, and treatment effectiveness. Historical and contemporary research shows that well-designed hospitals improve both physical and psychological health, patient experience, and recovery, while patient-centered care models further enhance satisfaction and outcomes.

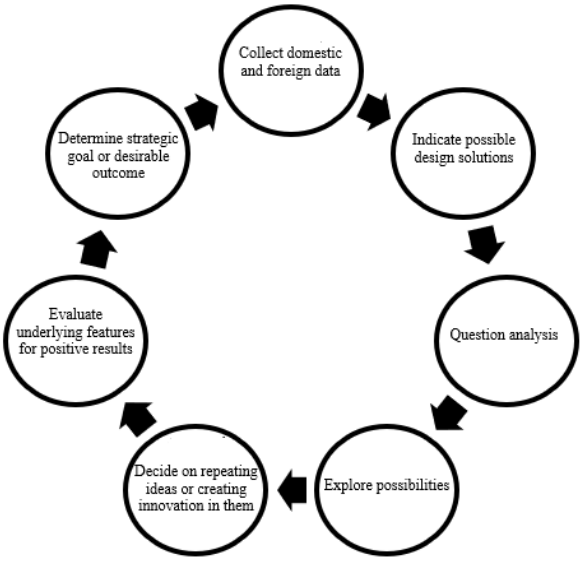

Fig. 1. EBD process cycle
(Source: 2009: 9)

2. Research Background

In accordance with the research objectives, a set of relevant keywords was systematically identified and arranged within thematic categories. The literature indicates that deficiencies in healthcare facility design can adversely influence both the physical health and psychological state of users (Hojjat & Ibn Shahidi, 2011:59). Historical analyses have also addressed topics such as "Patient Rights in the History of Iranian and Islamic Hospitals from the Beginning to the 8th Century AH" (Kaviani, 2010). Within the scope of healing architecture, Malkin (2002) emphasizes the contribution of design strategies to enhancing patient well-being in hospital settings(Malkin, 2002).

Dr. Ulrich is recognized as a leading scholar in exploring how interior design in medical environments affects health outcomes. His landmark research in 1984 demonstrated that exposure to natural scenery can yield positive effects for postoperative patients, accelerating their recovery process (Ulrich, 1984). Subsequent investigations by Ulrich and colleagues (1993) identified environmental stressors such as excessive lighting and noise as significant contributors to heightened stress, eliciting physiological responses that include muscle tension, elevated heart rate, and increased blood pressure

(Ulrich, 1993). Dalke et al. (2006) also examined how the integration of color and light within hospital design influences patient experiences (Dalke et al., 2006).

More recent studies expand this perspective. Adibhesami et al. (2021) explored optimal architectural approaches for pediatric hospitals (Adibhesami et al., 2021), while Hosseini et al. (1401) investigated how the physical environment of medical centers shapes both the mental and physical health of patients (Hosseini et al., 1401). Their findings highlight the value of incorporating aesthetic considerations into healthcare design as a determinant of psychological comfort and overall well-being. Similarly, Evans (1999) analyzed stressful environmental conditions and their implications for treatment outcomes (Evans, 1999).

Research in patient-centered care, family-centered care, and the Planetree model has also demonstrated meaningful effects on patient outcomes and satisfaction. McCormick et al. (1998), in a randomized controlled trial, reported that patients in hospital units designed according to the Planetree model expressed higher satisfaction with the physical environment and nursing care(McCormick et al., 1998). In another contribution, Frampton and Guastello (2008), through "Making Patient-Centered Care More Visible: A Planetree Perspective," emphasized the role of patient-centered care principles and the Planetree framework in improving patient experience (Frampton, & Guastello, 2008). Furthermore, Kaplan et al. (2013), in "Is the Planetree Patient-Centered Approach to Care Profitable?: A Cost-Benefit Analysis," found that applying this model can result in both cost savings and enhancements in workplace environments. Finally, Anderson (2024), a physician and architect, presented evidence from Boston University showing that hospital architectural design can significantly shape patient treatment processes and accelerate recovery(Anderson, 2024).

In summary, existing research highlights the significant impact of hospital design on patient health, psychological well-being, and satisfaction. While substantial evidence supports the benefits of environmental interventions—such as natural light, color, noise reduction, and patient-centered care models—there remain gaps regarding the combined effects of multiple design strategies, long-term outcomes, and context-specific considerations.

This study aims to address these gaps by integrating multiple evidence-based design interventions, and assessing their effects on both patient outcomes. By doing so, the research contributes novel insights into designing healthcare environments that are not only clinically effective but also psychologically supportive, culturally sensitive, and operationally efficient.

3. Theoretical Framework Patient-Centered Care

For decades, the salience of familial engagement within the continuum of hospital-based care was largely underappreciated. Beginning in the late 1970s, however, innovative paradigms such as patient-centered care, the Planetree framework, family-centered care, and collaborative therapeutics—emerged in response to the psychosocial imperatives of patients seeking the emotional reassurance and advocacy of loved ones during clinical interventions. In 2007, the Society of Critical Care Medicine, the preeminent international body in the discipline of intensive care, issued a formal position statement endorsing the extension of visiting privileges and the systematic integration of family presence in critical care units (Smith, 2007).

While initially met with professional reticence from segments of the healthcare workforce, family-centered care schemas have progressively achieved epistemic legitimacy within clinical practice. Accumulating empirical evidence has reinforced their multidimensional value, with practitioners acknowledging their capacity to enhance therapeutic efficacy, psychosocial resilience, and patient satisfaction (Rogers, 2012). Under this model, the patient and their familial network are conceptualized as co-constitutive agents in the treatment trajectory, exercising shared authority in decision-making processes. The entrenchment of this philosophy within advanced healthcare systems has been a catalyst for re-envisioning spatial and operational paradigms in hospital architecture (Hamilton, 2008).

In contemporary discourse, the architectural programming of hospitals is undergoing a pronounced reorientation toward human-centered and salutogenic design principles. In leading European contexts, spatial planning now transcends the narrow remit of technical and biomedical functionality, privileging environmental configurations that attenuate anxiety, counteract affective dysregulation, and promote holistic recovery. Accordingly, numerous legacy healthcare infrastructures have been subjected to retrofitting and adaptive reuse to cultivate atmospheres of intimacy, comfort, and psychological safety. Within this evolution, traditional multi-bed inpatient wards are increasingly supplanted by private, high-amenity single-occupancy suites, aligning the built environment with the therapeutic ethos of patient-centered care. Within this framework, key evidence-informed recommendations include the following:

1. Expanding the provision of health services to patients
2. Streamlining administrative processes and providing medical documentation
3. Creating healing environments in health centers
4. Upgrading staff skills and giving them decision-making power (Alalouch & Aspinall, 2007)

In a study conducted by the Booz Allen Hamilton Institute, preliminary results proved that patient-centered care improved service delivery, increased patient and staff

satisfaction, reduced surgical costs, and increased physician effectiveness (Teschke, 1991).

1. **World Health Organization (WHO):** Patient-centered care means respecting the patient's opinion about the treatment system and strengthening his self-confidence
2. **The International Association of Patients (IAPO)** states 5 principles of patient-centered care: respect, choice and strengthening self-confidence, patient participation in treatment policy, access, support, and information.
3. **The Institute for Improving Patient-Centered Care** defines patient-centered care as: taking into account cultural beliefs, personal interests and values, family situation, social circumstances and lifestyle of the patient

The Institute for Patient-Centered Design articulates eleven core principles aligned with the overarching objectives of patient-centered care. These include: respecting patient privacy; fostering effective communication; providing personal space while cultivating trust; enabling active participation of patients and families in the care process; empowering patients in decision-making; enhancing safety and security; ensuring accessibility of facilities; creating environments that are comfortable and restorative; supporting therapeutic processes; advancing staff-related goals; and identifying design opportunities that address unmet needs of both patients and staff through collaborative engagement between architects, interior designers, and medical equipment planners (Horsburgh, 1995).

Impacts of Patient-Centered Care-Oriented Hospital Design

• **Stress mitigation** – Therapeutic environments exert a direct influence on patients' sensory perceptions and play a pivotal role in facilitating recovery under stressful conditions. Evidence indicates that optimal hospital design can significantly alleviate psychological stress for both patients and their families (Mardami et al., 2013).

• **Cost containment** – Empirical findings suggest that hospitals designed in accordance with healing principles yield measurable cost reductions. Documented benefits include decreased average length of stay, optimized nursing workflows, reduced reliance on high-intensity medications, and lower staff turnover rates (Coile, 2008).

• **Length of stay reduction** – Patients accommodated in private rooms with access to natural daylight, family-friendly spatial arrangements, and favorable external views exhibit a marked decrease in hospitalization duration—from an average of 9.5 days to 4.5 days (Gallan & Lanning, 2010).

• **Enhanced patient safety and infection control** – Prolonged hospitalization and frequent intra-hospital transfers are associated with elevated infection risk (Tornieporth et al., 1996). A widely endorsed preventive measure is single-occupancy room placement with dedicated ventilation systems, which facilitates patient isolation and mitigates nosocomial infection rates (Branswell, 2008).

• **Patient satisfaction** – Survey-based evidence demonstrates that patients accommodated in private rooms, particularly when situated near family members, report higher satisfaction levels with both the hospital environment and nursing care quality (Gotlieb, 2002:51).

Model for Patient Satisfaction within a Patient-Centered Architectural Framework

The conceptualization of a patient satisfaction model in hospital architecture—anchored in patient-centered principles—necessitates a multi-criteria framework encompassing functional, environmental, human, and technical dimensions of healthcare design. These determinants can be classified into three primary domains: (1) architectural attributes, (2) interior design characteristics, and (3) psychosocial and cultural considerations. Moreover, these factors operate within the broader categories of internal and external influences. The operationalization of this model requires the systematic integration of empirical evidence and practitioner expertise to elevate the quality standards in the design of public healthcare facilities.

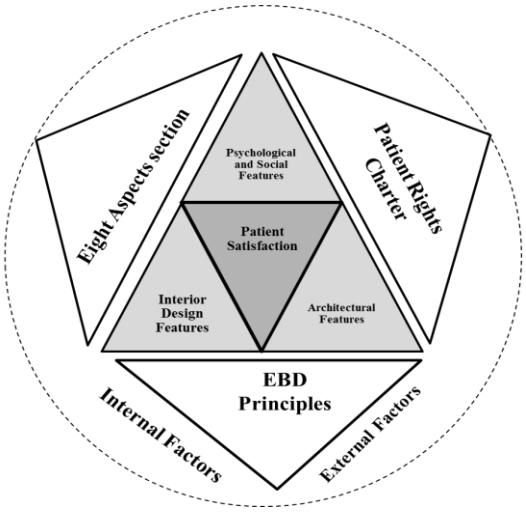

Fig. 2. patient satisfaction model 1

Patient Satisfaction Models in Hospital Design

Patient satisfaction is influenced by multiple determinants, ranging from fundamental patient rights to evidence-informed environmental design strategies. These strategies mitigate stress and enhance perceptions of safety and comfort. The model provides a multidimensional framework, integrating patients' physical and psychological needs with professional and environmental standards. Key sources of patient satisfaction include the Patient Rights Charter, the eight ASPECT domains, and Evidence-Based Design (EBD) principles.

Patient Rights Charter: This component specifies essential patient entitlements, including rights to

information, dignity, confidentiality, competent care, and voicing objections. Integrating these rights into hospital design and management fosters security and respect, enhancing overall patient experience. Respecting patient rights significantly impacts satisfaction with hospital services (Mossadegh Rad & Isna Ashari, 2004).

Eight ASPECT Domains: These domains encompass critical elements of hospital design and operational planning, directly influencing patient perceptions and experiences. Key areas include privacy and engagement, visual accessibility, integration with nature, comfort and environmental control, interior aesthetics, and staff-related factors. Collectively, these domains create a restorative and psychologically supportive environment (NHS, 2007).

Evidence-Based Design (EBD) Principles: EBD is a contemporary approach to hospital architecture that relies on empirical evidence to guide design decisions. It aims to optimize patient and family well-being, reduce stress, improve treatment outcomes, and ensure safety (Cama, 2009). EBD is essential in modern hospitals, improving patient satisfaction and functioning as a cost-effective strategy by enhancing efficiency and reducing operational costs (McCullough, 2016).

The Patient Satisfaction Model, grounded in a patient-centered approach, provides a practical framework for evaluating and improving patient experiences. Integrating architectural principles, psychosocial considerations, and internal hospital features can substantially enhance healthcare quality and patient satisfaction.

Patient Satisfaction Factors (First Dimension)

Patient satisfaction with the hospital environment is a key indicator of healthcare quality. Satisfaction is shaped by intrinsic and extrinsic factors. Intrinsic factors relate to patients' characteristics and personal experiences, whereas extrinsic factors pertain to the physical and sociocultural environment. Categorizing these determinants clarifies their impact on satisfaction (Maguire et al., 2013).

Internal Factors

Cognitive Factors: Mental processes, including understanding medical information, decision-making, and processing disease- and treatment-related data (Stewart et al., 2000).

Perceptual Factors: Patients' experience of the hospital's physical and psychosocial environment. Interior design, lighting, acoustics, and social interactions strongly influence perception and satisfaction (Commission, 2013).

Biological Factors: Physiological status, pain levels, and responses to environmental stimuli. Patients in poor health or experiencing high pain report lower satisfaction in environments that inadequately meet physiological needs (Kumar et al., 2016).

Physical Factors: Patients' bodily capabilities, including mobility and interaction with spaces. Hospital design must ensure accessibility for patients with physical limitations (Carayon et al., 2006).

External Factors

Chemical Factors: Air quality, pollutants, and exposure to chemical agents. Clean air, proper ventilation, and non-toxic materials positively influence health outcomes and satisfaction (Olds & Clarke, 2010).

Spatial-Temporal Factors: Spatial aspects include layout, accessibility, and sufficient space for patients and companions. Temporal aspects include wait times and service delivery efficiency (Ulrich et al., 1993).

Symbolic Factors: Cultural, spiritual, and social cues in the environment. Colors, artwork, and culturally relevant symbols enhance patients' sense of belonging and comfort (Dalke et al., 2006).

Physical Factors: Architectural quality, material selection, lighting, and acoustics. Well-lit, acoustically optimized, and aesthetically refined spaces constructed with durable materials enhance patient satisfaction (Kumar et al., 2016).

Factors of Satisfaction with Medical Center Environments (Second Dimension) – Healing Environment Factors

Architectural Features

Architectural characteristics represent a foundational dimension influencing environmental satisfaction. These features encompass relatively stable attributes of healthcare facilities, including the overall spatial organization and architectural configuration.

• **Shape and Form:** The geometric articulation and volumetric composition of hospital entrances serve as the primary perceptual interface for patients. An entrance with an aesthetically appealing form facilitates a positive initial cognitive-emotional response, establishing a favorable environmental perception (Baskaya et al., 2004). Evidence from Joseph and Zimring (2022) indicates that smaller inpatient rooms with fewer occupants enhance patient outcomes, social engagement, and perceived environmental control. (Joseph & Zimring, 2022).

• **Appropriate layout of uses:** Functional adjacency and optimal spatial arrangement of hospital departments are essential for operational efficiency and cohesive patient flow. An intelligently organized layout ensures spatial continuity and effective interdepartmental connectivity (Ministry of Health, 2013).

• **legibility:** Spatial legibility, a fundamental principle in architectural design, clarifies structural organization and directional cues. For patients with cognitive or physical impairments, legible environments mitigate stress and cognitive overload (Mollerup, 2009).

• **Connection to nature:** Integration of biophilic elements, including therapeutic gardens, has demonstrated substantial psychological and physiological benefits, such as stress reduction, alleviation of depressive symptoms, and pain mitigation (Shahcheraghi and Bandarabadi, 2015: 404). Creating green space in hospitals has benefits such as reducing

patient stress, reducing depression and pain (Ulrich, 1984: 420).

• **Decentralization:** Single-occupancy rooms are increasingly prioritized in modern hospital design, providing advantages such as enhanced sleep quality, privacy, infection control, reduction in medical errors, improved patient-staff interactions, and overall safety (Mardami et al., 2013; Sadeghi et al., 2014).

Interior design features

Interior design constitutes semi-fixed environmental attributes that significantly influence patient satisfaction and well-being.

• **Light:** Beyond illumination, lighting design functions as a therapeutic intervention, optimizing visual comfort and psychological health. Exposure to natural and engineered light improves mood, regulates circadian rhythms, accelerates recovery, alleviates pain, and enhances patient outcomes, while inadequate lighting compromises safety and staff performance (Boyce et al., 2013; Benedett et al., 2001; Joseph, 2006; Hosseini et al., 1401).

•**Color:** Color plays a fundamental role in improving the quality of the environment, orientation, information acquisition and navigation. From an aesthetic perspective, color is able to provide pleasant and attractive conditions for patients, visitors and employees (Dalke et al., 2006: 3). Color psychology means the impact of the environment on the mind and mental states of people through the coloring in the space and causes us to achieve warm, sincere and passionate feelings or, conversely, cold and accompanied by depression and boredom (Shahcheraghi and Bandarabad, 2015: 309).

•**Sound:** Florence Nightingale first raised this issue in her book "Nursing Tips": Sound that causes discomfort is harmful to the patient. Excessive noise is the most cruel form of neglect (Nigtingale, 1969: 47). Hospital noise levels are often high, usually between 65-85 decibels, and cause a lot of discomfort among patients and a sense of stress among staff (Shahcheraghi & Bandarabad, 2015: 403). Music has an immediate physiological effect by affecting the central nervous system of the body (Kemper & Danhauer, 2005).

• **Air, ventilation and aroma:** The effect of air on human behavior and psychology is significant and important, and psychologists believe that air pollution is effective in causing depression, aggression, drowsiness and mental disorders (Shahcheraghy & Bandarabad, 2015: 332). Air exchange and ventilation are essential to provide the necessary oxygen, preventing air stagnation that creates a suitable environment for the spread of infection (Ulrich & Zimring, 2021). Scents can both cause stress and may be relaxing and effective in treatment. (Malkin, 1992: 19)

• **Positive distraction:** Positive distraction is anything that can distract a person and create a positive emotional response and happiness in them (Pati & Nanda, 2020). The right choice of relaxing artwork in the treatment space can reduce patients' anxiety (Kaiser, 2007: 8). In this way, the patient's recovery process is increased by instilling peace from the environment. (Ulrich, 1993: 7) Failure to pay attention to the correct use of entertainment in environmental design causes positive entertainment to have the opposite effect and increase environmental stress and act as negative entertainment (Ulrich & Zimring, 2021).

• **Aesthetic:** Aesthetically optimized environments strengthen patient satisfaction, reduce stress, and enhance overall perception of care quality, reinforcing the therapeutic efficacy of healthcare spaces (McCullough, 2016; Boyce et al., 2013).

• **Textiles, materials, and furniture:** Selection of materials, furnishings, and textiles influences comfort, cognitive focus, and restorative potential for all users, improving environmental experience and functionality (Moeller, 2005).

• **Navigation:** Efficient wayfinding is critical for patients experiencing cognitive, emotional, or physical exhaustion, as complex layouts can exacerbate stress and disorientation (Mollerup, 2009).

• **Home-like atmosphere:** Incorporating domestic or hospitality-inspired design elements enhances patient experience, mitigates stress, and elevates staff satisfaction, emphasizing psychological comfort alongside clinical performance (Ulrich & Zimring, 2021).

Social and psychological characteristics

This dimension encompasses interpersonal and psychosocial determinants of patient satisfaction and environmental perception.

•**Sense of control:** Perceived autonomy and environmental control are essential for mitigating anxiety and enhancing overall satisfaction; lack of control correlates with heightened stress and discomfort (Marberry, 2007: 143).

• **Privacy:** Each person's privacy is the sense that each person has about their independence and social value (Heidari et al., 2011, 645). Respecting patient privacy while facilitating selective social interaction optimizes therapeutic outcomes and personal dignity (Boyce et al., 2013).

• **Social communication:** Effective interpersonal interactions with medical staff, incorporating verbal and non-verbal cues, foster trust, comprehension, and patient engagement (Ittelson et al., 1970; Alvarsson et al., 2010).

• **Psychological comfort:** Psychological well-being derives from adequate disease knowledge, social support, patient-clinician rapport, and spiritual considerations (Siegrist, 2003).

• **Facilities:** Advanced, ergonomically designed medical facilities enhance patient safety, reduce infection risk, and improve service quality, contributing to overall satisfaction (Ulrich & Zimring, 2021).

• **Staff:** Competent and empathetic healthcare personnel interactions improve treatment outcomes and significantly increase patient satisfaction (Sadeghi et al., 1403).

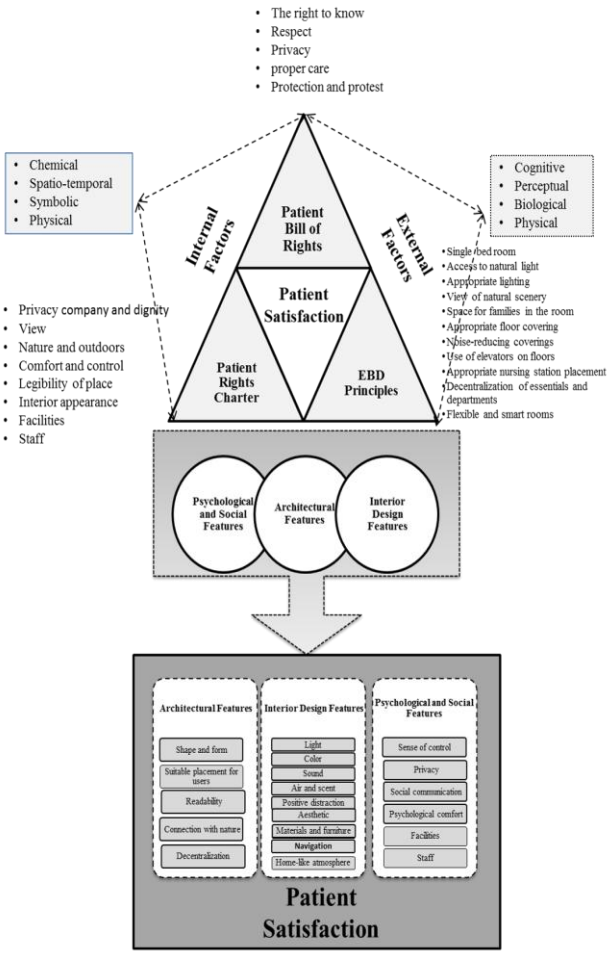

Fig. 3. patient satisfaction model 2

4. Research Methodology

The present study employs a descriptive-analytical framework, combining systematic field observations, comprehensive literature review, and a case study approach. Empirical data were obtained through structured questionnaires distributed among hospitalized patients at Imam Khomeini (RA), Bahman, and Gandhi Hospitals in Tehran. By critically assessing the operational strengths and deficiencies of these facilities and applying rigorous data analysis, the research develops evidence-based design strategies and solutions. Quantitative examination was conducted utilizing regression and correlation analyses, firmly anchored in the theoretical underpinnings of the study.

4.1 Statistical population

The number of people in the statistical population is 891 The statistical population in this study is the patients hospitalized in 3 levels of the hospital classification system, namely Imam Khomeini Hospital, Bahman Hospital, and Gandhi Hospital in Tehran, as follows. These 3 hospitals are considered successful in terms of architecture, service provision, and patient satisfaction.

- **Level 1: 100-bed city hospital** (case study: Gandhi Hospital(
- **Level 2: 200-bed regional hospital** (case study: Bahman Hospital(
- **Level 3: 591-bed national hospital** (Imam Khomeini Hospital)

4.2 Sample Volume

The Cochran formula was used to determine the sample size in this study. The number of samples using the Cochran formula is **224** people. The proportional allocation of the sample shares is as follows:

- **Imam Khomeini Hospital (RA):** 149 people
- **Bahman Hospital:** 50 people
- **Gandhi Hospital:** 25 people

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{d^2} - 1\right)}$$

n = Sample size
N = Statistical population size
z = Acceptable confidence interval standard error percentage
q = Proportion of the population lacking a certain attribute
q (1-p) = Proportion of the population lacking a certain attribute
d = Desired degree of confidence or probable accuracy
According to the above formula, if we want to have a sample size with a population gap of 0.5. The value of z is usually 1.96. The confidence interval in this formula is 95%, the population size is 891 people, and the error rate is 0.05, and in the most conservative case, the number of questionnaires is 224.

4.3 Research Tools

The tool used in this study is the ASPECT software questionnaire, and graphs and descriptive statistics were extracted from it using SPSS26 software.

4.4 Data analysis method

In this study, a face-to-face survey was administered to 239 randomly selected male and female hospitalized patients, aged 16 to 85 years, to assess their level of satisfaction with the hospital environment. Responses were systematically recorded and analyzed using ASPECT software. The evaluation employed a Likert-type scale ranging from 0 to 6, where: 6 = Strongly agree, 5 = Agree, 4 = Moderately agree, 3 = Moderately disagree, 2 = Disagree, 1 = Strongly disagree, and 0 = No response.
The questionnaire data were subsequently categorized according to the dimensions of the healing environment, allowing for extraction of factor-specific results. All

processed data were then imported into SPSS26 software for statistical analysis, which facilitated the generation of quantitative metrics and graphical representations of patient satisfaction levels.

5. Results and Discussion

Table 2 presents the mean scores of the eight ASPECT dimensions for patients in Imam Khomeini (RA), Bahman, and Gandhi Hospitals. Imam Khomeini (RA) had an overall mean of 2.779, below the theoretical average, indicating low satisfaction, with comfort (3.913) and staff (3.703) relatively higher, while privacy and participation (2.111), interior design (1.803), and other dimensions remained below average.

Table. 2
Statistical indicators of patient satisfaction in ASPECT sections

Factors	Imqm khomeini(RA)	Bahman	Gandhi
C1: Privacy, company and dignity	2/111	3/072	4/088
C2: Views	2/464	4/272	3/840
C3: Nature and outdoors	2/868	3/920	3/453
C4: Comfort and control	2/715	3/036	3/680
C5: Legibility of place	3/913	3/787	4/040
C6: Interior appearance	1/803	3/230	4/165
C7: Facilities	2/473	3/322	3/880
C8: Staff	3/703	3/767	4/060
ASPECT overall score hospitals	2/779	3/539	3/901

Bahman Hospital scored 3.539 overall, above the theoretical average, reflecting moderate to high satisfaction. Visibility (4.27) was the highest-rated dimension, and all other factors exceeded the theoretical mean, with no scores below it.

Gandhi Hospital achieved the highest overall mean of 3.901. Privacy and participation (4.088), space readability (4.040), interior design (4.165), and staff (4.060) scored above 4, and all remaining dimensions were also above the theoretical average, indicating consistently high patient satisfaction.

Table .3
Statistical indicators of patient satisfaction of hospitals by factors of the healing environment

Category	Factors Of The Healing Environment	Imqm khomeini	Bahman	Gandhi
Architectural features	Shape and form	4/752	4/470	4/660
	Suitable deployment of uses	3/060	3/260	4/320
	Routing	3/201	2/860	2/800
	Connection with nature	2/773	4/124	3/800
	Decentralization	1/362	2/330	4/180
	Total score of architectural features	**3/030**	**3/409**	**3/952**
Interior design features	light	4/262	4/360	4/080
	Color	1/711	3/740	4/280
	Sound	2/103	2/720	3/600
	Temperature, air and adore	2/104	2/460	2/860
	Positive Distraction	1/309	3/240	4/320
	Beauty	1/349	2/180	3/400
	Arrangement	1/966	3/760	4/0400
	Textiles, materials and furniture	2/073	3/260	3/300
	Legibility	3/856	2/830	3/900
	Home-like space	2/125	3/027	4/373
	Total score of interior design features	**2/277**	**2/277**	**3/815**
Mental and social features	Sense of control	3/084	3/020	4/380
	Privacy	2/371	3/227	4/120
	Social communication	2/490	3/870	3/960
	Psychological comfort	1/825	3/870	3/940
	Facilities and safety	2/427	3/166	4/000
	Staff	3/618	3/823	4/080
	Total score of Mental and social features	**3/636**	**3/496**	**4/080**
The score of components of the healing environment of hospitals		**2/648**	**3/317**	**3/949**

6. Patient Satisfaction Analysis

Table 2 presents the mean scores of the eight ASPECT dimensions for patients in Imam Khomeini (RA), Bahman, and Gandhi Hospitals.

Imam Khomeini (RA): Overall mean = 2.779, below the theoretical average, indicating low satisfaction. Comfort (3.913) and staff (3.703) scored relatively higher, while privacy and participation (2.111), view (2.464), access to nature (2.868), comfort and control (2.715), interior design (1.803), and facilities (2.473) remained below average.

Bahman Hospital: Overall mean = 3.539, above the theoretical average, reflecting moderate to high satisfaction. Visibility (4.27) was the highest-rated dimension. Privacy and participation (3.072), access to nature (3.920), comfort and control (3.036), space readability (3.787), interior design (3.230), facilities (2.322), and staff (3.767) all exceeded the theoretical mean, with no dimension below it.

Gandhi Hospital: Overall mean = 3.901, the highest among the three hospitals, indicating high satisfaction. Privacy and participation (4.088), space readability (4.040), interior design (4.165), and staff (4.060) scored above 4, while all other dimensions also exceeded the theoretical mean.

The average of the components of the healing environment of Imam Khomeini(RA), Bahman, and Gandhi hospitals are shown in Table 1. The data indicate that the total average, the average of the interior architectural features, and the average of the psychological and social features in Imam Khomeini (RA) hospitals are equal to 2.648, 2.277, and 2.636, respectively. Since the theoretical average is 3 and the aforementioned numbers are less than the average, it is concluded that patients are dissatisfied with the quality of the overall space of Imam Khomeini (RA) Hospital and have close to average satisfaction only in architectural features.

In the indices of the components of the healing environment of Bahman Hospital, it is observed that the dimensions of architectural features, interior design features, and psychological and social features are higher than the average, indicating relative satisfaction with the aforementioned factors.

In Gandhi Hospital, the average of the components of the healing environment indicates that the aforementioned numbers are very high, close to average, indicating relative satisfaction of the patients in these dimensions. On the other hand, the average psychological and social characteristics of Gandhi Hospital were above average, indicating high patient satisfaction with this factor.

Patient satisfaction and perceptions of the healing environment vary significantly across the three hospitals. Gandhi Hospital demonstrates the highest overall satisfaction, followed by Bahman Hospital, while Imam Khomeini (RA) shows notable deficiencies, particularly in privacy, interior design, and access to nature. These findings highlight the importance of integrating architectural, environmental, and psychosocial considerations in hospital design to enhance patient experience and well-being.

7. Hypothesis Test

In this study, the healing environment components—including architectural features, interior design features, and psychological and social features—were treated as independent variables, while the design of the medical center was considered the dependent variable. Prior to hypothesis testing, structural equation assumptions were verified, including normality (Kolmogorov–Smirnov test), absence of multicollinearity (variance inflation factor, VIF), and independence of observations (Durbin–Watson test), all of which were satisfied. As shown in Figure 4, interior design features exhibited the greatest influence on medical center design ($\beta = 0.346$), followed by psychological and social features ($\beta = 0.339$), while architectural features had the least impact ($\beta = 0.087$). These results underscore that patients' perceptions and experiences are significantly shaped by the cultural and social context; in Iran, such factors play a pivotal role in the design of hospitals and healthcare environments.

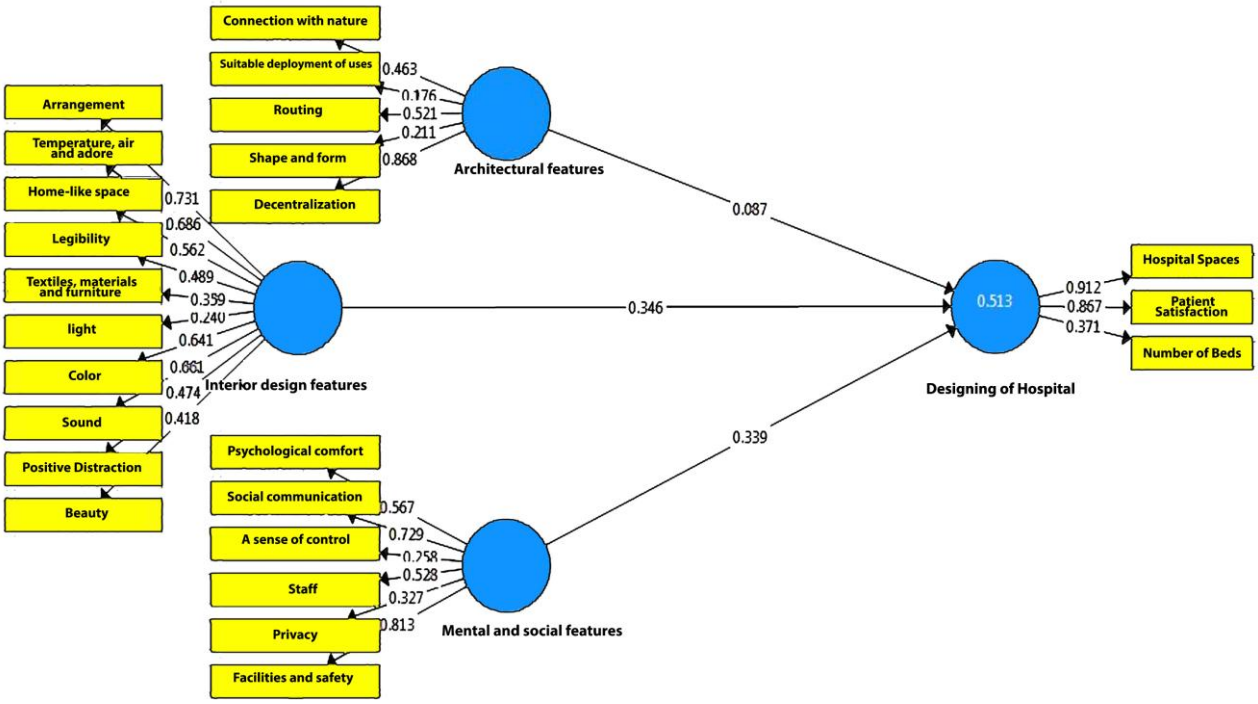

Fig. 4. Standardized path coefficients of the conceptual model of patient satisfaction

8. Comparing Hospital Performance

The appropriate statistical method for comparing the average performance of the aforementioned hospitals is the analysis of variance (ANOVA) test, which is effective for comparing the averages of more than two populations. Hypothesis: There is a difference between the average performance of the components of the healing environment of hospitalized patients in Imam Khomeini (RA), Gandhi, and Bahman hospitals. The analysis of variance test was used to test the above hypothesis Table 3 shows the information related to the comparison of the average performance of the three hospitals in the dimension of the components of the patient's healing environment. It is observed that the significance level is calculated to be 0.000, and since the aforementioned number is less than 0.01, it can be concluded that with 99% confidence there is a significant difference between the average performance of the components of the healing environment of patients hospitalized in Imam Khomeini (RA), Gandhi and Bahman hospitals, and therefore the hypothesis is accepted. According to the calculated averages, Gandhi Hospital had the best performance and Imam Khomeini (RA) Hospital had the worst performance. On the other hand, Bahman Hospital was ranked second.

Table. 4
Standardized path coefficients of the conceptual model of patient satisfaction

Source of variation	sum of squares	Degrees of freedom	Mean Squares	Fisher's statistic	Significance level sig
Between hospitals	50/325	3	16/775	55/50	0/0000
Within hospitals	94/574	258	0/332		
Total	144/903	288			

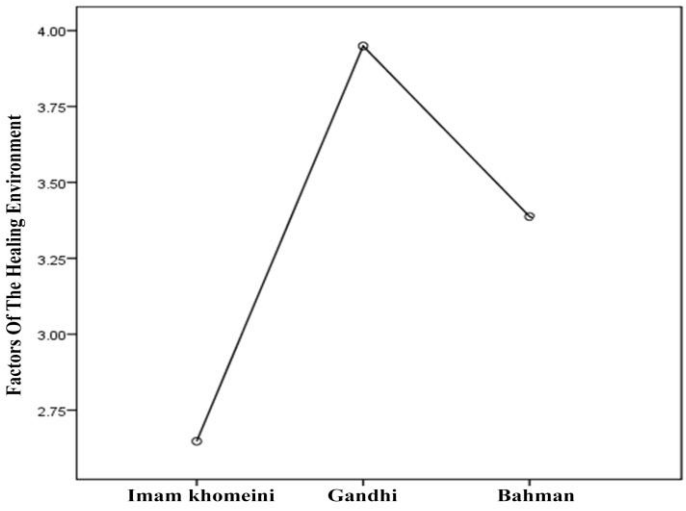

Fig. 5. Comparing the performance of healing environment components in three hospitals

9. Conclusion

The findings indicate that patient satisfaction is highest in Gandhi Hospital, followed by Bahman Hospital, and lowest in Imam Khomeini (RA) Hospital. A primary determinant of this variation is the architectural and interior design of the hospitals. Gandhi Hospital, with its structured and principled architecture, provides a calm and therapeutic environment, enhancing the overall patient experience. In comparison, Bahman Hospital possesses adequate architectural design, but it does not contribute to patient comfort and convenience to the same extent as Gandhi Hospital. Nevertheless, its structural and spatial quality is superior to that of Imam Khomeini (RA), explaining the higher satisfaction levels of patients there. In Imam Khomeini (RA) Hospital, the older and less efficient design may lead to patient dissatisfaction with the facilities and spatial environment. These differences in architectural and interior design clearly influence patients' experiences and indicate that these hospitals have not fully implemented optimal healing environment standards, directly impacting both patient and staff satisfaction.

This study demonstrates that hospital architecture functions as more than a physical factor; it is a critical variable in enhancing patient-centered experiences and improving healthcare outcomes. Patient satisfaction emerges as a key indicator of hospital effectiveness. Hospitals that prioritize architectural and environmental factors not only excel in healthcare delivery but also actively address the physical and psychological needs of patients. This comprehensive approach fosters patient trust and contributes to the overall health and well-being of the community.

The proposed model integrates principles of evidence-based design, human-centered design, and contemporary health-focused architecture, providing a framework for architects, interior designers, hospital administrators, and healthcare policymakers. Optimizing the hospital's physical environment can reduce patients' cognitive load, enhance psychological safety, increase staff productivity, minimize occupational fatigue, and improve system-wide efficiency. From a forward-looking perspective, this research emphasizes the transition from traditional hospital design to modern, smart, and patient-centered paradigms. It positions hospitals not merely as treatment facilities but as environments that accelerate recovery and elevate the quality of care through health-focused architectural strategies.

Suggested Strategies

- Implementation of Health Information Management Systems (HIS)
- Design of human-centered healthcare environments
- Enhancement of patient participation in healthcare decision-making
- Continuous assessment and monitoring of healthcare quality
- Integration of advanced technologies in service delivery
- Incorporation of patient and family feedback
- Development of evidence-based standard guidelines
- Ensuring equity in access to healthcare services

Recommendations for Future Research

- Examination of cultural and social factors affecting patient satisfaction
- Analysis of the impact of emerging technologies on patient experience
- Evaluation of patient participation in healthcare decision-making
- Development of multidimensional models to assess patient satisfaction
- Investigation of satisfaction among specific patient populations

References

Adibhesami,M.Sadeghi,A. oormohammadifar,N. Sahebi,S. (2021), The Impact of Hospital Atmosphere on the Reducing Stress of Pediatric: A Case Study in

Tehran, Iran, Environmental Design Research Association, https://jhttps://edra.confex.com

Alalouch, C., & Aspinall, P. (2007), Spatial attributes of hospital multi-bed wards and preferences for privacy, Facilities, 25(9/10), 345-362. DOI:10.1108/02632770710772450

Alvarsson, J., Wiens, S., & Nilsson, M. E. (2010), Stress recovery during exposure to nature sound and environmental noise, International Journal of Environmental Research and Public Health, 7(3), 1036–.6401. doi: 10.3390/ijerph7031036

Anderson, D. C. (2024), The impact of hospital design on patient recovery, Boston University Research Articles. https://www.bu.edu/articles/2024/impact-of-hospital-design-on-patient-recovery

Arjmand, M. & Khani, S. (2013). Role of privacy on the architecture of a persian house, Quarterly. pp. 27-38.

Baskaya, A., Wilson, C., & Ozcan, Y. (2004), Wayfinding in a unfamiliar environment, different spatial settings of two polyclinics. Environment and Behavior, 36(6),839-867.

Boyce, P., Hunter, C., & Howlett, O. (2013), The benefits of daylight through windows. Troy, NY: Rensselaer Polytechnic Institute.

Branswell, H. (2008) Sinks responsible for deadly hospital infection, The Globe and Mail, L4.

Braun, V. & Clarke, V. (2006)' Using thematic analysis in psychology', Qualitative Research in Psychology Journal, 3 (2), 77-101.

Cama, R. (2009), Evidence- Based Healthcare design, John Wiley and Sons, Inc. Hoboken, New Jersey.

Carayon, P., Schoofs Hundt, A., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Flatley Brennan, P. (2006), Work system design for patient safety: The SEIPS model, Quality and Safety in Health Care, 15(Suppl 1), i50-i58. doi: 10.1136/qshc.2005.015842

Coile, R. (2008), Healing environments: Progress toward Evidence-Based Design. Russ Coile's Health Trends, 13(11), 8-12.

Commission FH. (2013),Future hospital، caring for medical patients.

Dalke, H., Littlefair, P.J., Leo, D. L., Camgöz, L . (2006): Lighting and color for hospital design. A report on an NHS Estates Funded Research Project, London South Bank University, London, https://www.semanticscholar.org

Evans, G. W. (1999), Measurement of the physical environment as stressor, American Psychological Association. https://psycnet.apa.org/record/1999-02242-009

Frampton, S., & Guastello, S. (2008), Making patient-centered care more visible: The Planetree perspective, Health Environments Research & Design Journal, 2(2), 42-49. DOI: 10.1016/s0738-3991(97)00089-x

Gallant, D., & Lanning, K. (2010), Streamlining patient care processes through flexible room and equipment design, Critical Care Nursing Quarterly, 24(3), 59-76. DOI: 10.1097/00002727-200111000-00006

Garcia, M., & Martinez, A. (2021), The role of hospital design in patient satisfaction: Evidence from recent studies, Journal of Environmental Psychology, 75, 101-110.

Gotlieb, J. (2002), Understanding the effects of nurses on the process by which patients develop hospital satisfaction, Holistic Nursing Practice, 17(1), 49-60. DOI:10.1097/00004650-200210000-00010

Guenther, R., & Vittori, G. (2020), Sustainable healthcare architecture (2nd ed.), Wiley.

Hamilton, D. K. (2008), Evidence is found in many domains, HERD 1(3) Pp. 5-6.DOI: 10.1177/193758670800100302

Harris, P. B., McBride, G., Ross, C., & Curtis, L. (2002), A place to heal: Environmental sources of satisfaction among hospital patients, Journal of Applied Social Psychology, 32(6), 1276-1299. doi.org/10.1111/j.1559-1816.2002.tb01436.x

Heydari, Mohammad Reza; Anousheh, Monireh; Azad Aramaki, Taghi; Mohammadi, Isa. (2011), The process of maintaining patient privacy, a data-based theory. Shahid Sadoughi Yazd Journal of Medical Sciences and Health Services, Volume 19, Issue 5. https://www.sid.ir/fa/journal/ViewPaper.aspx?id=146643.(in Persian)

Hojat, Isa; Ibn Shahidi, Marjan Al-Sadat. (2011), Redefining the hospital space in children's hospitals based on the assessment and analysis of children's needs with the approach of reducing fear of the environment, Beautiful Arts Publication, No. 48.(in Persian)

Horsburgh, Robert, C. Jr. (1995), Healing by design, The New England Journal of Medicine, 333 , 735-740.

Hosseini, Seyed Behshid, Aida Sadeghi, and Armin Piriai. (2012), Access to the criteria of a healing hospital environment with a patient-centered approach. Arman Shahr Journal of Architecture and Urban Planning 15(39), 45-62 DOI:10.22034/AAUD.2022.69545.1034.(in Persian)

Ittelson, W. H., Proshansky, H.M., & Rivlin, L.G. (1970): A study of bedroom use on two psychiatric wards, Hospital and Community Psychiatry, 21. 25-28. DOI: 10.1176/ps.21.6.177

Jones, W. (1995),Acute care design: Emerging trends, In S. Marberry (Ed.), Innovations in healthcare design , (pp. 12-21), New York: John Wiley and Sons.

Joseph, A. (2006): The impact of light on outcomes in healthcare settings. Issue Paper #2. Concord, CA: The Center for Health Design.

Joseph, A., & Zimring, C. (2022), The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity. Journal of Healthcare Design, 45(1)-3-17

Kaiser, C. P. (2007), Careful fine art selection simulate patient healing: Serene nature views. rather than abstract art or no art, helps heart patients recover faster, Diagnostic Imaging, 2007(1) Pp. 7-8.

Kaplan, G. S., Bushell, S. S., & Brigham, T. J. (2013), Is the Planetree patient-centered care approach financially sustainable? A cost-benefit analysis. The Permanente Journal, 17(3), 20-24. DOI: 10.1016/s0738-3991(97)00089-x

Kaviani Pooya, Hamid. (2010), The First Hospitals and Medical Centers in Pre-Islamic Iran, Iranian Journal of Ethics and Medical History, 3(3), 13-23. SID. https://sid.ir/paper/451092/fa.(in Persian)

Kemper, K. J. and Danhauer, S. C. (2005), Music as therapy, South Medical Journal, 98(3) Pp. 282-8. DOI: 10.1097/01.SMJ.0000154773.11986.39

Kim, H., & Choi, J. (2023), The impact of hospital environment on patient satisfaction: A systematic review, Journal of Healthcare Management, 68(1), 45-58.

Kumar, S. Rahman, H., Saha, S. K. (2016), Infection control in healthcare facilities: Current issues and challenges, Indian Journal of Medical Research, 143(4), 439-450.

Maguire R, kreit B, Smith S., (2013), Hamamoto B, Hendricks D. future of thehospitals: public summary report united state, institude for future; 305(6322): 650-854 doi: 10.7861/futurehosp.14.013

Malkin, J. (1992), Hospital Interior Architecture: Creating Healing Environments for Special Patient Population. NewYork: John Wiley.

Malkin, Jain,. (2002), Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment, and Procedure; 3 rd. ed.; John Wiley and Sons Inc. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119174813

Mandeli, Kh. (2019)' Public space and the challenge of urban transformation in cities of emerging economies: Jeddah case study' Cities Journal, 95.

Mardami, Karim; Hashemnejad, Hashem; Hassanpour, Bahman; Bagheri, Malihe. (2013), Evidence-Based Design for Medical Centers. Tehran: Asr Kankash. .(in Persian)

Martin, C. (2000), Putting patients first: Integrating hospital design and care. Lancet, 356 (9228), 518. DOI: 10.1016/S0140-6736(05)74196-9

McCormick, K., Fleming, E., & Joffe, S. (1998), A randomized trial of a patient-centered hospital unit, Journal of Nursing Care Quality, 13(1), 32-40. DOI: 10.1016/s0738-3991(97)00089-x

MCullough, C. S. (2016), Evidence-Based Design for Healthcare Facilities, Indianapolis, IN: Sigma Theta Tau International.

Ministry of Health, Medical Education and Medical Education, Deputy for Management and Resources Development, Office of Physical Resources Management and Development Projects Executor. (2013), Safe Hospital Planning and Design Standard, General Hospital Standards and Requirements. Volume 10, Tehran: Pendarnik.(in Persian)

Moeller, N. (2005), Sound masking in healthcare environments: Solving noise problems can help promote an environment of healing, Healthcare Design 5(5) 29-35.

Mollerup, P. (2009), Way showing in the hospital, Australasian, Medical Journal, 10(1), 112-114. https://doi.org/10.4066/AMJ.2009.85

Mosaddeq Rad, Ali Mohammad and Isna Ashri, Parto (2004), Doctors and Patients Regarding Patient Rights and Respect for Them in Shahid Beheshti Hospital, Isfahan, https://civilica.com/doc/1726584.(in Persian)

Nigtingale, F. (1969), Notes on nursing: What is it, and what is it not, Dover: New York.

Olds, D. M., & Clarke, S. P. (2010), The effect of work hours on adverse events and errors in health care, Journal of Safety Research, 41(2), 153-162. DOI: 10.1016/j.jsr.2010.02.002

Pati, D., & Nanda, U. (2020), Influence of positive distractions on children in two clinic waiting areas. HERD: Health Environments Research & Design Journal, 4(3):124-40 DOI:10.1177/193758671100400310

Rogers, D. (2012), Weighing up the case for evidence-based design , Cknstruction Research and Innovation, Volume3. Issue2. Pp. 14-17.

Sadeghi, Aida, Shahcheraghi, Azadeh, Daneshjo, Khosrow and Hosseini, Seyed Behshid. (2014), Explaining the three-dimensional model of improving the quality of evidence-based medical centers (EBD) with an emphasis on patient satisfaction (case study: Bahman Hospital), Rahpooye mamari & shahrsazi, 2(3), 23-38. doi: 10.22034/rau.2024.2008955.1056.(in Persian)

Shahcheraghi, Azadeh., Bandarabad, Alireza. (2015), Surrounded by the environment: Environmental psychology in the design of therapeutic spaces, Tehran: University Press.(in Persian)

Siegrist, J., (2003), Subjective well- being: new conceptual and methodological development in health- related social sciences. Department of Medical Sociology, University of Dusseldorf .;1-13. https://doi.org/10.1016/0277-9536(89)90295-5

Smith, J. (2007), Design with nature , Healthcare Design 7(1), pp.37-41.

Smith, J. A., & Hamilton, D. K. (2023), Designing for flexibility in healthcare facilities, In Proceedings of the International Conference on Healthcare Design , pp45-56.

Smith, L. M., Johnson, P. R., & Williams, K. (2022), Environmental factors influencing patient satisfaction in healthcare settings, Health Services Research, 57(3), 789-805.

Stewart, M. A., Brown, J. B., Weston, W. W., McWhinney, I. R., McWilliam, C. L., & Freeman, T. R. (2000), Patient-centered medicine: Transforming the clinical method, CRC Press.

Teschke, D. A. (1991), Nebraska hospital brings services closer to patients-Bishop Clarkson Memorial Hospital-provider Perspective , Health Care Financial Management, 45(10), p.118.

Tornieporth, N. G., Roberts, R. B., Hafner, J. H., & Riley, L. (1996), Risk factors associated with vancomycin-resistant Enterococcus faecium infection or colonization in 145 matched case patients and control patients ,Clinical Infectious Disease, 23, 767-772.

Ulrich Roger S. Outi Lunden, and JL Eltinge, (1993), Effects of exposure to nature and abstract pictures on

patients recovering from heart surgery, Psychophysiology 30 (S1)

Ulrich, R. S., & Zimring, C. (2021), The evidence-based design of healthcare facilities: Current perspectives and future directions. Health Environments Research & Design Journal, 14(2), 10-23. https://doi.org/10.1177/1937586720976275

Ulrich, R.S. (1984), View through a window may influence recovery from surgery, Science, 224, pp. 420-421. https://pubmed.ncbi.nlm.nih.gov/6143402/