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Explaining the Patient Satisfaction Model of Hospital Architecture with Patient-Centered Approach (Case Study: Imam Khomeini (RA), Bahman and Gandhi Hospitals in Tehran)

Aida Sadeghi[1], Azadeh Shahcheraghi [2]✉, Khosro Daneshjoo [3], Seyed Behshid Hosseini[4]

1. Department of Architecture, SR.C., Islamic Azad University, Tehran, Iran. E-mail: aida.sadeghi3593@iau.ac.ir
2. Corresponding author, Department of Architecture, SR.C., Islamic Azad University, Tehran, Iran. E-mail: shahcheraghi@iau.ac.ir
3. Department of Architecture, Faculty of Arts, Tarbiat Modares University, Tehran, Iran. E-mail: khdaneshjoo@modares.ac.ir
4. Department of Architecture, Faculty of Architecture and Urban Planning, Iran University of Art, Tehran, Iran. E-mail: behshid_hosseini@art.ac.ir

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ABSTRACT

In today's world, patient satisfaction is recognized as one of the key indicators of the quality of healthcare services. Hospital architecture, with a patient-centered approach, can have a significant impact on increasing patient satisfaction, reducing stress, and improving the treatment process. Paying attention to the patient instead of the treatment process has introduced an approach to hospital design called the "patient-oriented" approach.

This study aims to explain a model for improving patient satisfaction with hospital architecture, based on patient-centered principles, which is in line with analytical-descriptive research based on field observation, library studies, and data collection through questionnaires from 224 patients hospitalized in Imam Khomeini (RA), Bahman and Gandhi hospitals, which are analyzed to provide a suitable solution for design. Data analysis is by regression and correlation method. The software used is ASPECT and SPSS26.

According to the calculated averages, Gandhi Hospital has the best performance and Imam Khomeini (RA) Hospital has the worst performance, and Bahman Hospital is ranked second. The study of these three hospitals showed that hospitals that have incorporated patient-centered principles in their design have a significant impact on reducing stress, increasing positive interactions between patients, medical staff, and the environment, and increasing patient satisfaction. The model proposed in this study can be used as a practical solution for hospital designers and managers to improve patient experience and enhance the quality of healthcare services.

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Introduction

The patient is the main focus of the hospital and all services provided are tailored to their needs. Patient satisfaction is an indicator of the proper implementation of these services. Attention to patient satisfaction as an approach has been around since the 1950s (Teschke, 1991). Patient satisfaction is a concept that is of great importance in the field of medical care and is increasingly being considered. Policymakers in this field should focus on several key components to increase patient satisfaction (Garcia and Martinez, 2021: 102). Patient satisfaction is one of the basic criteria in measuring the quality of medical care. Today, health systems are increasingly emphasizing the issue of patient satisfaction. In the last decade, there has been widespread attention to the issue of patient satisfaction in the NHS, such that this concept is one of the main pillars of the organization's policies. In the context of NHS programs, quality is not limited to clinical assessments but also includes the patient experience. Reduced patient satisfaction may lead to poor cooperation in the treatment process, which can lead to waste of resources and reduced quality of treatment outcomes (Kim and Choi, 2023: 46). Therefore, taking into account the rational demands of patients is the ultimate goal of all forms of medical care and should be considered as an indicator for measuring treatment outcomes. The complexity of the relationship between patient satisfaction and the quality of health services is influenced by factors such as patient characteristics, physician performance and hospital facilities (Smith, Johnson, and Williams, 2022: 794). Patients' expectations of the services they receive have a significant impact on their satisfaction, and any mismatch between the patient's expectation level and the quality of services received can lead to a decrease in satisfaction (Harris et al, 2002: 1277). Also, satisfaction levels can vary among different social and cultural groups, as well as individuals of different ages, genders, and types of healthcare services (Martin, 2000). Currently, designing healthcare centers with the aim of improving clinical outcomes, reducing psychological stress for patients and staff, reducing medical errors, increasing the level of satisfaction of patients, families, and healthcare staff, and also controlling high healthcare costs, are among the key goals in building hospitals of the future (Sadeghi et al., 2014: 34).

Research Background

In this article, appropriate keywords were first selected according to the research objective and documented based on thematic titles. This article points out that poor design of medical environments can negatively affect the health and psychology of users (Hojjat and Ibn Shahidi, 2011: 59). In other articles, reference has been made to the study of “Patient Rights in the History of Iranian and Islamic Hospitals from the Beginning to the 8th Century AH” (Kaviani, 2010). In his studies, Malkin has referred to healing architecture for creating well-being in hospitals (Malkin, 2002). Dr. Ulrich is a researcher who has conducted academic research on the impact of interior design on the health of individuals in medical environments. Studies conducted by him in

1984 showed that nature has positive effects on patients undergoing surgery and accelerates their recovery process (Ulrich, 1984). Also, his and his colleagues' studies in 1993 showed that environmental factors such as light and noise increase stress in individuals and have physiological effects on the body, causing muscle tension, increased heart rate, and blood pressure (Ulrich, Outi, and Eltinge, 1993). Dalke and his colleagues in 2004 examined color and light in hospital design and its effect on patients (Dalke et al., 2006). Adibhessami and colleagues studied children's hospitals and the appropriate design of children's hospitals. (Adibhesami et al., 2021) Hosseini and his colleagues studied the effect of the physical environment of medical centers on the physical and mental health of patients in a study and provided solutions by considering aesthetic principles and approaches in the design of medical spaces as a factor affecting the psyche and health of individuals (Hosseini et al., 2014). Evans has studied and evaluated stressful environmental factors that affect treatment outcomes. (Evans, 1999) In the field of patient-centered, family-centered care, and the planetary model, numerous studies have been conducted to examine the effect of these approaches on treatment outcomes and patient satisfaction. In 1998, McCormick, Fleming, and Joffe, in an article titled "A Randomized Trial of a Patient-Centered Hospital Unit," showed that patients in units based on the planetary model were more satisfied with the hospital environment and nursing care (McCormick, Fleming, and Joffe, 1998). Frampton and Guastello, in their article titled “Making Patient-Centered Care More Visible: A Planetary Perspective,” examined the importance of patient-centered care and the role of the Planetary model in improving patient experience (Frampton, and Guastello, 2008). Kaplan, Bushell, and Brigham, in 2013 article titled “Is the Planetary Patient-Centered Approach to Care Profitable? A Cost-Benefit Analysis,” showed that implementing the Planetary model can lead to cost reductions and improved work environments (McCormick, Fleming, and Joffe, 1998). A study at Boston University by Dr. Anderson, a physician and architect, showed that the architectural design of hospitals can have a significant impact on patient treatment and recovery (Anderson, 2024).

Theoretical Foundations

Patient-centered care

For a long time, the importance of family involvement in the hospital treatment process was ignored. Since the late 1970s, approaches such as patient-centered care, the planetary model, family-centered care, and collaborative therapy have been introduced to meet the social needs of patients who desire the presence of their loved ones in the treatment process. In 2007, the Society of Critical Care Medicine (the largest international organization in the field of critical care) proposed increasing visiting hours and family presence in critical care units (Smith, 2007).

Despite the concerns of medical staff, family-centered care models have gradually become more popular and medical professionals have recognized the benefits of this method for patients (Rogers, 2012). In this style of care, the patient and his family members are recognized as essential elements of the treatment process and are involved in treatment decisions. This approach has gradually become established in the design of healthcare centers in leading countries and has led to fundamental changes in hospital architecture (Hamilton, 2008). Currently, there is an increasing trend towards human-centeredness in hospital design. In European countries, instead of focusing solely on technical and medical aspects, architects are trying to create a space that will remove patients from anxiety-provoking and depressive situations. Therefore, old healthcare centers have revised their design to provide a more intimate and comfortable environment for patients. In this regard, communal inpatient rooms have given way to luxurious single-person suites. Key recommendations in the patient-centered treatment model 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 and 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 offers 11 principles for design in line with the goals of patient-centered care: respecting privacy, creating communication, personal space while building trust, allowing patient and family participation in the care process, creating patient decision-making power, improving safety and security, providing accessible facilities, creating a comfortable and relaxing environment, supporting treatment, supporting staff goals, identifying design opportunities that meet unmet needs of patients and staff, collaborating with the interior design team and interior design equipment in the architect (Horsburgh, 1995).

Patient-centered care center design and its effects

- **Stress reduction:** Treatment environments have a direct impact on patients' sensory perceptions and play a fundamental role in facilitating the recovery process in stressful situations. Optimal hospital design can reduce psychological stress for patients and their families (Mardami et al., 2013).
- **Cost reduction:** Some researchers believe that designing hospitals based on healing principles reduces medical costs. Studies have shown that reduced length of stay, optimization of nurses' time, reduced use of strong medications, and reduced turnover of medical staff are among the consequences of this design (Coile, 2008).
- **Length of patient stay:** Patients who are admitted to private rooms with natural light, family-friendly space, and a favorable view experience an average reduction in length of stay from 9.5 days to 4.5 days (Gallan and Lanning, 2010).
- **Improved patient safety and infection control:** Studies have shown that prolonged hospitalization and intrahospital transfers increase the risk of infection (Tornieporth, et al., 1996). Patient isolation is a commonly recommended preventive measure that reduces infection and is achieved by placing patients in single-bed rooms with dedicated ventilation (Branswell, 2008).
- **Patient satisfaction:** Based on surveys and assessments conducted with patients based on their opinions about private rooms and length of stay in the hospital, patients in private rooms and with their families next door were more satisfied with the hospital environment and their nurses' room (Gotlieb, 2002: 51).

Patient Satisfaction Model with a Patient-Centered Approach

The explanation of the patient satisfaction model of hospital architecture with a patient-centered approach requires the consideration of multiple criteria that include various functional, environmental, human, and technical aspects of hospital architecture. These criteria are divided into three general categories: **architectural features, interior design features, and psychological and social features**, and two general categories of **internal and external factors** that can be implemented by collecting scientific evidence and practical experiences to achieve higher quality in the design of public hospitals.

These models show that achieving patient satisfaction depends on various factors, from the basic rights of the patient to the principles of environmental design that help reduce stress and increase the feeling of safety and comfort. This model offers a multifaceted approach to hospital design in which the physical and psychological needs of patients are considered, as well as professional and environmental standards. The sources of patient satisfaction used in this model include the **Patient Rights Charter, the eight ASPECT sections, and the EBD principles**.

- **Patient Rights Charter:** This section includes the basic rights of the patient such as the right to know, respect, confidentiality, receiving proper care, and the right to object. Paying attention to these rights in the design and management of the hospital environment makes the patient feel safe and respected, which in turn helps to create a positive experience for him. This section is of great importance because respecting the

patient's rights will have a great impact on his satisfaction with hospital services (Mossadegh Rad, and Isna Ashari, 2004).

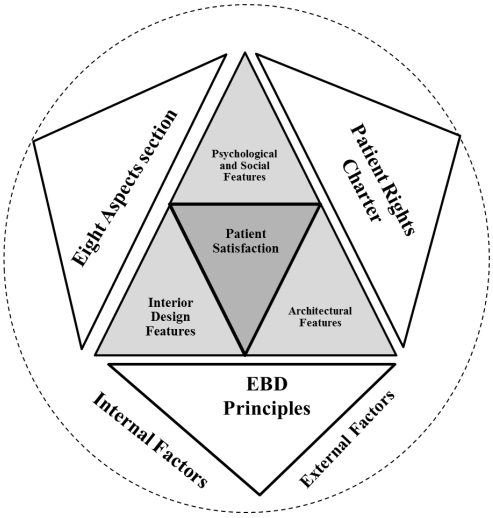

Figure 1. Patient satisfaction model 1

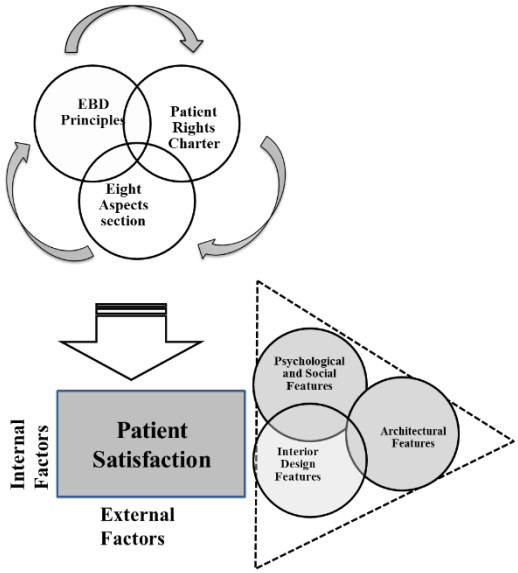

Figure 2. Patient satisfaction model 2

- **Eight ASPECT sections:** This section includes elements of hospital design and planning that have a direct impact on the patient's feelings and experiences. Important sections such as privacy and participation, appropriate visibility, access to nature, comfort and control, appropriate interior design, and sections related to staff are in this category. These features are essential for creating a relaxing and pleasant environment that is psychologically healing (NHS, 2007).
- **Evidence-Based Design (EBD):** Evidence-based design, as a new approach to hospital design, focuses on the importance of using reliable data to influence the design process. This approach to hospital design is defined as "an effort to improve the lives of patients and their families, reduce stress, improve the process of disease treatment, and ensure patient safety and security" (Cama, 2009). Evidence-based design has become a necessity in modern hospitals. This approach not only helps improve the experience and satisfaction of patients, but also has become an economic strategy for hospitals by improving efficiency and reducing costs (McCullough, 2016).

The Patient Satisfaction Model based on the patient-centered approach is a comprehensive and practical tool for analyzing and improving the patient experience in the hospital environment. Combining architectural design principles, psychosocial considerations, and Hospital internal features can lead to improved quality of healthcare services and increased patient satisfaction.

Patient satisfaction factors (first dimension)

Patient satisfaction with the hospital environment is one of the most important criteria for measuring the quality of medical services and care environments. This satisfaction is influenced

by a set of internal and external factors. Internal factors are related to the patient's individual characteristics and personal experience, while external factors are related to the characteristics of the physical and cultural environment. Dividing these factors into specific categories can help to better understand the impact of each on patient satisfaction (Maguire et al., 2013).

Internal factors

- **Cognitive factors:** Cognitive factors are related to the patient's mental and psychological processes, such as the patient's understanding of medical information, ability to make decisions, and processing information related to the disease and treatment (Stewart et al., 2000).
- **Perceptual factors:** These factors are related to the patient's experience of the physical and psychological environment of the hospital. The patient's perception of interior design, lighting, noise levels, and even social interactions can influence their experience (Commission, 2013).
- **Biological factors:** Biological factors include the patient's physical condition, pain level, and body response to environmental conditions. Patients who are not in good physical condition or who experience a lot of pain are usually less satisfied with treatment environments that do not adequately meet their physiological needs (Kumar, Rahman, and Saha, 2016).
- **Physical factors:** Physical factors include the physical characteristics of the patient's body, such as the ability to move and interact with the environment. The design of the hospital environment should be such that patients with physical limitations can easily use the spaces and equipment (Carayon et al., 2006).

External factors

- **Chemical factors:** These factors are related to the quality of the hospital's air environment, the level of pollution, and the chemicals present in the environment. Clean air quality, proper ventilation, and the use of non-toxic materials in hospital construction can have a positive impact on patient health and satisfaction (Olds and Clarke, 2010).
- **Spatial-temporal factors:** Spatial factors include the layout of spaces, easy access to different parts of the hospital, and sufficient space for patients and their companions. On the other hand, temporal factors include the length of wait times for medical services and proper scheduling management in providing services (Ulrich, Outi, and Eltinge, 1993).
- **Symbolic factors:** Symbolic factors are related to the cultural, spiritual, and social influences of the hospital environment. Environmental symbols and signs such as the use of colors, wall art, and cultural symbols in hospital design can enhance a sense of belonging and comfort for patients (Dalke et al., 2006).
- **Physical factors:** Physical factors include the overall design of the hospital, the quality of materials used in construction, lighting, and environmental acoustics. Bright environments, with low noise levels, and the use of durable and aesthetic materials in design can have a significant impact on patient satisfaction (Kumar, Rahman, and Saha, 2016).

Factors of Satisfaction with Medical Center Environments

(Second Dimension) Healing Environment Factors

Architectural Features

Architectural features are one of the dimensions of environmental satisfaction sources. Architectural features are defined as relatively constant aspects of the hospital and the overall layout of the space.

- **Shape and Form:** The geometry and form of the hospital entrance are the first things that patients perceive when entering the hospital space, and if the geometry of the entrance has an attractive form, the first successful step has been taken towards designing an acceptable environment for patients (Baskaya, Wilson, and Ozcan, 2004). According to research conducted by Zimring and his colleagues in a hospital before and after renovation on the role of the size of inpatient rooms in the treatment process and environmental satisfaction, it was found that patients in smaller rooms with fewer people showed better outcomes, higher social relationships, and more environmental control (Joseph and Zimring, 2022).
- **Appropriate layout of uses:** In relation to architectural features, one of the important categories is the appropriate layout of departments and internal connections between them. It is due to the appropriate layout of departments that the spaces of a medical center are placed together in an efficient manner and a proper spatial connection is created between them (Ministry of Health, 2013).
- **Readability:** Readability in design, as the first condition in the architecture of a building, expresses its specific structure and direction. Due to illness, patients are unable to receive and analyze environmental information, and as a result, environmental stress overcomes them (Mollerup, 2009).
- **Connection to nature:** Green space in medical centers is one of the most fundamental design factors. In recent decades, a space called the healing garden has been designed and built in some hospitals (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:** Today, there is a strong tendency to design hospitals with single-bed rooms. Designing hospitals with single-bed rooms has many benefits, including improved sleep, increased patient satisfaction, privacy (Mardami et al. 2013: 8), reduced hospital infections and physical injuries, reduced medical errors, increased communication between medical staff and patients and their companions, and improved patient safety (Sadeghi et al., 2014: 30).

Interior design features

The second category of sources of environmental satisfaction is interior design features. Interior design features are defined as semi-fixed features of the hospital environment that cause patient satisfaction or dissatisfaction.

- **Light:** In the past, the issue of light in space was viewed only as a factor for illumination, while today, by engineering light in space with the aim of increasing environmental quality, significant effects can be created on the space and users (Boyce, Hunter, and Howlett, 2013). Natural light reduces patient depression, reduces bipolar disorders and seasonal depression, improves sleep and reduces treatment duration (Joseph, 2006), relieves pain and reduces excitement. On the other hand, insufficient attention to providing lighting and optimal lighting regulations leads to factors such as reduced job efficiency and effectiveness, increased medical errors and unexpected accidents, difficulty in visual adaptation, premature fatigue and eye damage (Hosseini et al., 2022: 30).
- **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). In psychology, color is full of extraordinary power that affects humans through the five senses. Colors, has various effect on soul and body of human. In the color dimension and psychology of color, the meaning of color therapy, is the use of colors in various ways used to improve health. Colors generally effect on the physical state of the mood, that is, it affects the warm, sensational feelings, or vice versa, cold with depression. Color can heal the human soul and bring joy. With the aid of colors can create harmony between the body and soul (Dorriy and Shool, 2020: 25).
- **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 cruelest 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 and Bandarabad, 2015: 403). Music has an immediate physiological effect by affecting the central nervous system of the body (Kemper and 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 and 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 and 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 and 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, Outi, and Eltinge, 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 and Zimring, 2021). According to the definition of the American Artistic Association, art therapy is the treatment of mental disturbances

through artistic intermediaries, which through this method of treatment of the atmosphere can reveal it and help the therapist to evaluate what he has presented. Art therapy has various components such as painting therapy, therapeutic show and therapeutic music (Aminjafari, and Bagherilori, 2019: 58).

- **Aesthetic:** Beauty as a physical matter has always been discussed and debated in various designs, and most interior and exterior designers seek to create a unique space from a different environment (Mirhadi, Dehbashi Sharif, and Diba, 2024: 63), Aesthetic is one of the strongest quality components of a healing environment, and its benefits include increasing user satisfaction, reducing stress, patients, and patient companions. Paying attention to the interior architectural components of healthcare centers with an aesthetic approach and creating a healing space improves the quality of healthcare spaces (McCullough, 2016). Beauty in healthcare centers is closely related to creating a healing space, and its benefits include reducing stress and increasing satisfaction for employees, patients, and their companions (Boyce, Hunter, and Howlett, 2013). The aim of aesthetics is explaining the nature of beauty and modality of our perception and our preference of it and analyzing its levels. Before the audience face a type of variety of art, he has some generalities in his mind, that itself give rises to some presumptions and it is in the first look to the oeuvre that his feeling will be developed and one reacts to it and the texture of beauty is hidden in that reaction (Lotfi Mehr et al., 2020: 8).
- **Textiles, materials, and furniture:** The correct use of materials has a great impact on the quality of spaces from the perspective of employees (easier concentration and fewer distractions), patients (easier to fall asleep), and visitors (more organized environment) (Moeller, 2005).
- **Navigation:** In most cases, patients who visit healthcare centers have depleted their emotional, physical, and cognitive resources due to illness, stress, and fatigue. In such situations, navigation is more difficult, and being in a complex and confusing environment is very annoying and stressful (Mollerup, 2009).
- **Home-like atmosphere:** Designing hospitals in a way that provides a home-like or hotel-like environment is effective in improving the patient experience, reducing stress, and increasing staff satisfaction. This approach emphasizes creating relaxing environments rather than focusing on medical performance. This design not only increases the satisfaction of patients, but also their companions (Ulrich and Zimring, 2021).

Social and psychological characteristics

The last category of sources of satisfaction are social and psychological characteristics. Social characteristics are characteristics related to social relationships and psychological dimensions of patients.

- **Sense of control:** Lack of a sense of control is one of the most important factors affecting the increase in individual anxiety, and control over the environment is one of the factors affecting the feeling of satisfaction with the environment. Many studies indicate that the lack of a sense of control in the environment has harmful results such as anxiety, discomfort, and worry (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). A type of design that both

considers the patient's privacy and encourages social interactions is more effective in terms of improving the disease (Boyce, Hunter, and Howlett, 2013).

- **Social communication:** An important issue that has received much attention in the design of medical centers is the extent to which different designs affect people's social interactions (Ittelson, Proshansky, and Rivlin, 1970). A type of social communication is the patient's relationship with the doctor and nurse. A person who is sick is stressed and may not understand what the doctor and nurse are saying. Therefore, facial and body movements and their attitude are extremely effective in gaining the trust of the patient and his family (Alvarsson et al., 2010).
- **Psychological comfort:** Psychological comfort is referred to as people's judgments about their own situation. Having sufficient knowledge about the disease, social support, close contact between the patient and the doctor, and spiritual aspects are all related to high psychological comfort (Siegrist, 2003). Sense of place is a factor that transforms a space into a place with special sensory and behavioral characteristics for certain people. The sense of place, in addition to causing a feeling of comfort in an environment, supports the cultural concepts desired by the people, the social and cultural relations of the society in a specific place and causes people to remember past experiences and achieve identity (Mehraban, Ghodsi, and Mahmoodi, 2023: 32).
- **Facilities:** The design of hospital facilities plays a significant role in improving the quality of medical services and patient satisfaction. Patient safety and comfort are among the main priorities in hospital design. Designing spaces that minimize infection transmission, as well as the availability of modern and ergonomic equipment for patients and healthcare personnel, increases safety and quality of services (Ulrich and Zimring, 2021).
- **Staff:** Appropriate communication between healthcare center staff and patients not only helps improve treatment outcomes, but also increases patient satisfaction (Sadeghi et al., 2024: 32).

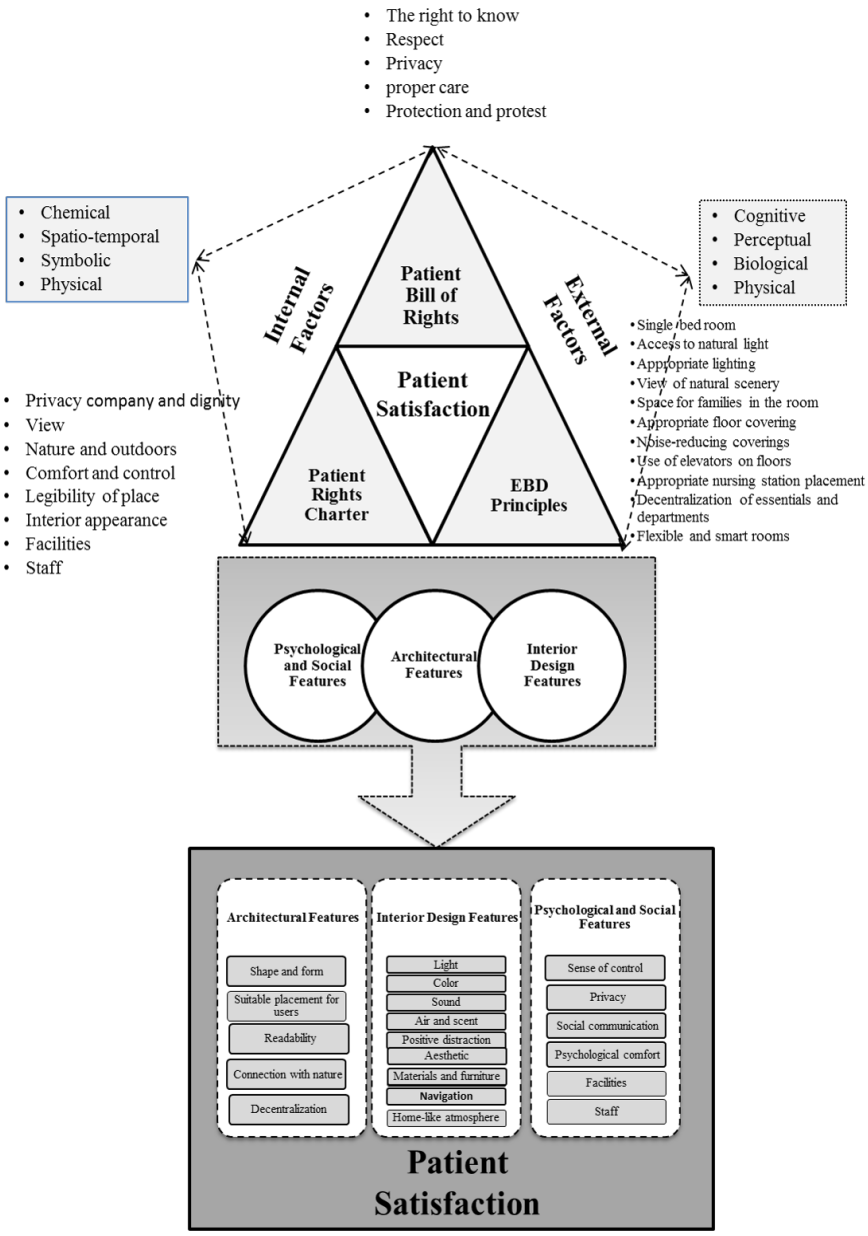

Figure 3. Patient satisfaction model 3

Research Methodology

This research is descriptive-analytical research based on field observations, library studies, and a case study in the form of data collection through questionnaires from hospitalized patients in Imam Khomeini (RA), Bahman, and Gandhi Hospitals in Tehran. By examining their strengths

and weaknesses and analyzing the data, an appropriate design idea and solution have been presented. Data analysis and analysis is based on the regression and correlation methods around the theoretical foundations of the research in question.

Statistical Population

The statistical population is 891individuals. 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)

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, 224 questionnaires are used.

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.

Data analysis method

In this study, a face-to-face survey was conducted on 239 randomly selected male and female hospitalized patients aged 15 to 80 years on the "level of satisfaction with the hospital". The answers to the questions were entered into the ASPECT software. The weighting of the answers to the questions was on a Likert scale ranging from 0 to 6. The answers to the questions were divided into the following categories: 6 = Strongly agree, 5 = Agree, 4 = Somewhat agree, 3 = Somewhat disagree, 2 = Disagree, 1 = Strongly disagree, 0 = No answer

The questionnaire was again categorized based on the factors of the healing environment and other results were extracted from it. Finally, the results obtained were entered into the SPSS26 software and the following numbers and graphs were obtained.

Table 1. Statistical indicators of patient satisfaction in Imam Khomeini (RA), Bahman, Gandhi hospitals, into eight ASPECT sections.

Factors	Imam 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

The average indices related to the eight ASPECT sections in patients hospitalized in Imam Khomeini (RA), Bahman, and Gandhi hospitals are shown in Table 1. In Imam Khomeini (RA), the total average was calculated to be 2.779, which, since this index was lower than the theoretical average, indicates poor satisfaction with the eight factors of this hospital. The data also indicate that the average of the comfort factors (3.913) and staff (3.703) had a relatively higher average than the average, which means relative satisfaction of the patients. However, the average level of patient satisfaction in the factors of 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) was lower than the average, which indicates a lower level of satisfaction in these factors.

In Bahman Hospital, we observe that the total average is calculated as 3.539, which is higher than the theoretical average, indicating a relatively high satisfaction with the eight factors of the hospital. The information also indicates that the average of the visibility factor is 4.27, which indicates a high satisfaction of patients with the aforementioned factors in this hospital. The average of the areas of 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) have a relatively higher average than the theoretical average, which indicates that the aforementioned factors in this hospital are approved by the hospitalized patients and have been able to attract their relative satisfaction. It is worth noting that patients hospitalized at Bahman Hospital did not give answers below the theoretical average in any of the eight ASPECT components, which does not indicate dissatisfaction with the aforementioned factors.

Finally, considering the average of patients hospitalized in Gandhi Hospital, it is observed that the total average is 3.901, because this index is higher than the theoretical average, indicating a relatively high satisfaction with the eight factors of Gandhi Hospital. Also, the average of the factors of privacy and participation (4.088), space readability (4.040), interior design (4.165) and staff (4.060) had an average of at least 4 out of the total score, that is, 6, which indicates a higher satisfaction with the mentioned factors in this hospital. The level of patient satisfaction in other factors had an average relatively higher than the average, which means the relative satisfaction of hospitalized patients with the mentioned components. An important point in Gandhi Hospital is that the average of patient responses in none of the eight ASPECT components is lower than the theoretical average.

Table 2. Statistical indicators of patient satisfaction in Imam Khomeini (RA), Bahman, Gandhi hospitals by components of the healing environment.

Category	Factors of the Healing Environment	Imam 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**

The average of the components of the healing environment of Imam Khomeini (RA), Bahman, and Gandhi hospitals is shown in Table 2. 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.

Hypothesis Test

In the current research, the variables of the healing components, which include architectural features, interior design features, and psychological and social features, are known as independent variables, and the design of the treatment center is known as dependent. Before testing the hypotheses, the presuppositions of structural equations, including normality (Kolmogorov–Smirnov test), non-collinearity of independent variables (variance inflation factor test (VIF)) and independence of observations (Durbin-Watson test) were examined. It is assumed that all the mentioned assumptions have been confirmed. According to Figure 4, it can be seen that interior design features with a score of 0.346 had the greatest impact on the design of the medical center, psychological and social features with a score of 0.339 had the second highest impact, and finally architectural features with a score of 0.087 had the least impact. It should be noted that the specific cultural and social factors of each society have a profound impact on the perception and experience of patients from medical environments. In Iran, given the unique cultural and social structure, these factors play a special role in the design of hospitals and medical spaces.

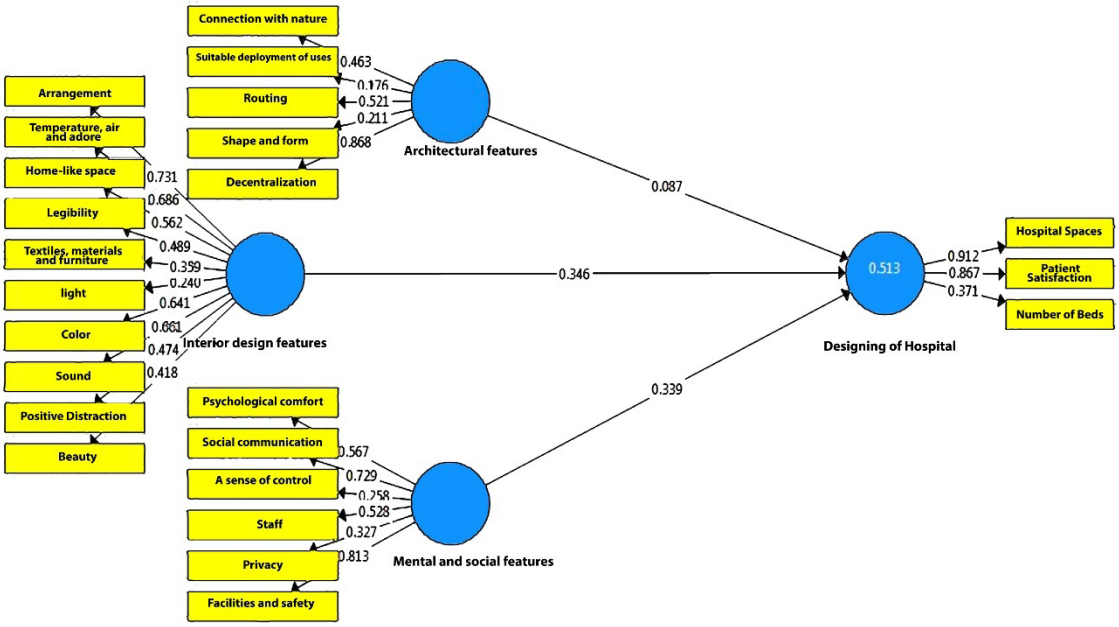

Figure 4. Standardized path coefficients of the conceptual model of patient satisfaction.

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. Comparing the performance of healing environment components in three hospitals using analysis of variance (ANOVA) test.

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			

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.

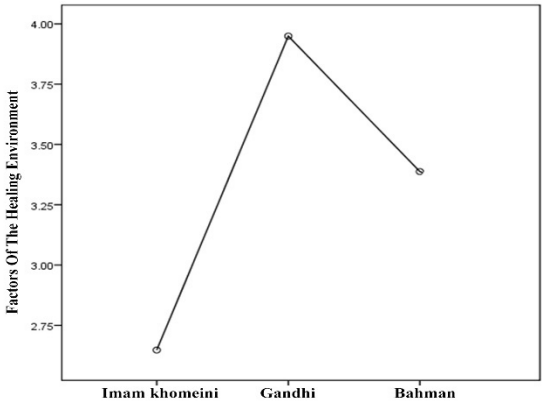

Figure 5. Comparing the performance of healing environment components in three hospitals.

Conclusion

Studies indicate that the satisfaction of patients hospitalized in Gandhi Hospital is higher than in Bahman Hospital, and in Bahman Hospital than in Imam Khomeini Hospital. One of the main reasons for this difference in patient satisfaction is the architecture and interior design of these hospitals. Gandhi Hospital, with its principled architecture, provides a calm and pleasant space for patients, which helps to improve the patient experience. In comparison, Bahman Hospital also has a suitable architecture, but this design does not affect the comfort and convenience of patients as much as Gandhi Hospital. However, the structure and architecture of this hospital are better than Imam Khomeini Hospital, which makes the satisfaction rate of patients hospitalized in Bahman higher than Imam Khomeini. In Imam Khomeini Hospital, the design and architecture are relatively older and less efficient, which may cause patients to feel dissatisfied with the space and facilities. This difference in architecture and interior design has clearly affected the experience of patients hospitalized in these hospitals. And this hospital has not been able to fully implement the standards of the healing environment, and this has directly affected the satisfaction of patients and staff.

The findings of this study showed that hospital architecture, beyond a physical factor, acts as a fundamental variable in enhancing the patient's user-centered experience and improving treatment indicators. Ultimately, patient satisfaction with the hospital is a key factor in its success. Hospitals that pay special attention to these aspects are not only leaders in providing health and medical services, but are also known as centers that care about the physical and psychological needs of their patients. This comprehensive approach, while gaining the trust of patients, also helps to improve the overall health of the community.

The model proposed in this study provides a framework that combines evidence-based design principles and human-centered design and modern approaches to health-centered architecture, which can be used as an implementation strategy for architects, interior designers, hospital managers, and health system policymakers. This model shows that optimizing the physical environment of the hospital not only reduces the cognitive burden of patients and enhances their sense of psychological safety, but also improves the productivity of medical staff, reduces job fatigue, and increases the efficiency of the medical system. From a futures perspective, this research emphasizes the need to transition from traditional design patterns to new paradigms of smart and patient-centered hospitals and shows that a successful hospital is not simply a treatment environment, but also a platform that can accelerate the patient's recovery process and improve the overall quality of medical care by utilizing health-based architecture principles. It is suggested that future research, by examining international examples more extensively, evaluate the impact of this model in hospitals of different scales and provide more operational solutions for its implementation.

Suggested strategies

- Use of health information management systems (HIS)
- Design of human-centered healthcare environments
- Increase patient participation in healthcare decision-making
- Continuous assessment and monitoring of healthcare quality
- Use of new technologies in healthcare provision
- Pay attention to patient and family feedback
- Develop evidence-based standard guidelines
- Ensure equity in access to healthcare services

Suggestions for future research

- Investigate cultural and social factors affecting patient satisfaction
- Analyze the impact of new technologies on improving patient satisfaction
- Assess the impact of patient participation in healthcare decision-making
- Develop multidimensional models to measure patient satisfaction
- Study the satisfaction of specific patients

Author Contributions

All authors contributed equally to the conceptualization of the article and writing of the original and subsequent drafts.

Data Availability Statement

Data available on request from the authors.

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Ethical considerations

The study was approved by the Ethics Committee of the Islamic Azad University, SR.C. The authors avoided data fabrication, falsification, plagiarism, and misconduct.

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Conflict of interest

The authors declare no conflict of interest.

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