EFFECTS OF PHYSICAL ENVIRONMENT ON PATIENT WELL-BEING: CASE STUDY IN DOKUZ EYLÜL UNIVERSITY HOSPITAL

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ABSTRACT

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Master's Program in Design Studies

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The aim of this research is to find out the influence of healthcare building design and its influence on bedded patients' recovery rate. This study examines the satisfaction levels of users and their relationship with their psychology, well-being, and recovery rate of patients. The satisfaction levels are inspected within indoor quality subtopics and the four aspects of environmental psychology. Dokuz Eylül University Hospital was chosen as a case study. A survey was conducted among the bedded patients to find out their satisfaction levels in this healthcare facility. It was found out that the

interior design of a healthcare facility affects the patients' well-being, psychology, and recovery rate. It is believed that patients may be more likely to visit a hospital where they feel healed. It is also believed that, according to the results of this study, healthcare facility design must be considered in many aspects, and the process of design must be conducted with design specialists and researchers together.

Keywords: user satisfaction, environmental psychology, hospital design, healthcare facility satisfaction, well-being

ÖZET

FİZİKSEL ÇEVRENİN HASTANIN İYİ OLMA HALİ ÜZERİNDEKİ ETKİLERİ: DOKUZ EYLÜL ÜNİVERSİTE HASTANESİ VAKA ÇALIŞMASI

Ertoy, Damla

Tasarım Çalışmaları Yüksek Lisans Programı

Tez Danışmanı: Dr. Öğr. Üyesi Didem Kan Kılıç

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Bu çalışma, sağlık tesisleri tasarımının yatılı hastaların iyileşme hızına etkisini bulmayı hedeflemektedir. Araştırmada kullanıcıların memnuniyet düzeyleri ve kullanıcı memnuniyetinin onların psikolojisiyle, sağlıklarıyla ve iyileşme hızıyla olan ilişkileri incelenmiştir. Memnuniyet düzeyleri iç mekân kalitesi alt başlıkları altında ve çevresel psikolojinin dört temel bileşeni içerisinde incelenmiştir. Bu çalışmada, örnek çalışma olarak Dokuz Eylül Üniversitesi Hastanesi seçilmiştir. Yatılı hastalar arasında onların memnuniyet düzeyini ölçmek adına bir anket yürütülmüştür.

Çalışmanın sonucunda bir sağlık tesisinin iç mekân tasarımının hastaların sağlığına, psikolojisine ve iyileşme hızına etkisi olduğu tespit edilmiştir. Hastaların iyileştiklerini hissettikleri hastaneleri tercih etmelerinin daha olası olduğu düşünülmektedir. Ayrıca, bu çalışmanın sonuçlarına göre, sağlık yapısı tasarımı birçok yönden ele alınmalı ve tasarım süreci uzman tasarımcılar ve araştırmacılar tarafından birlikte yürütülmelidir.

Anahtar kelimeler: kullanıcı memnuniyeti, çevresel psikoloji, hastane tasarımı, sağlık yapısı memnuniyeti, refah

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CHAPTER 1: INTRODUCTION

People live their lives within an environment; whether indoor and outdoor, they shape their behaviors according to their recent environment experience.

Some of the physical environmental features, such as indoor quality and physical environment, detailed in Chapter 2 may show their benefits or harms hours, days, or years later. As examples of the physical environment and indoor quality, air pollution may cause lung diseases, some of which are instantly noticeable, such as damp air and moldy materials. These toxic assets may damage more than human senses. It is known that they threaten human life and well-being in the long term (Mendell et al., 2011). When a person is exposed to an environment that feels troublesome, their well-being may be affected physically and mentally. Adverse exposures may lead to a negative experience, thus negative behavior. Thinking about a healthcare environment with these negative, harmful exposures may be scary, as people visit these buildings for health and well-being.

WHO (1948) defined health as:

"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

However, it is thought that people seek a cure primarily for their physical pain that they could not find in their local family doctor (Fry, 1959). The unseen part of hospital visitations and well-being is that people tend to get stressed inside these healthcare buildings (Kopec, 2006). Two things may cause this anxiety: the stress of their physical problems and their results, and a phenomenon called "white coat syndrome", which can be explained as the occurrence of hypertension in a clinical setting (Pioli et al., 2018). Therefore, it is possible to manipulate the hospital anxiety with some changes in the healthcare environment. Bringing natural elements indoors, such as natural light, natural ventilation, and wooden materials, may manipulate users' morale. Noise reduction may also be decreased, and the allocation of the facilities may be helpful to reduce anxiety. Nevertheless, psychology is only one side of well-being, which is the mental part of it.

1.1. Problem Definition

Healthcare facilities, especially hospitals, are visited every day to seek a cure for their illnesses, and they are admitted for both ambulatory and inpatient treatments due to their treatment process. Outpatients may ignore the environment when there is not any dense stimulant. However, bedded patients may tend to care about the environment more, as their stay is longer than few hours. Even though they do not focus on it, environmental quality parameters may still affect their well-being. Therefore, the main research question of this research is "How do physical environment and indoor space quality of hospital rooms affect the user's recovery?". The influences of indoor space quality on the users' recovery can be measured by the amount of daylight and artificial light, natural ventilation; acoustics and noise control in the space; and the outside view. In addition, the effects of the physical environment on the user's recovery can be measured by the preferences of color and material selection of a hospital room and the plan layout of a space.

Another research question of this study is "How does environmental stress affect the users' well-being?" The user's well-being can be measured by crowding, personal space, privacy, and territoriality issues.

The parameters do not apply only to the patients but also to the healthcare staff and their efficiency. When human needs are not met, it is typical to observe low efficiency and patient care, thus a decrease in patient well-being. Therefore, we try to understand the relationship between the medical staff's work performance and the patient's well-being.

• We believe that the treatment and healing process will speed up when indoor quality is improved, in terms of daylight and artificial light, natural ventilation; acoustics and noise control in the space; and the outside view.

• Patients who are bedded in a hospital room that gets adequate sunlight to recover faster than patients who are bedded in a room without sunlight.

• Healthcare buildings and patient rooms should be designed according to environmental psychology and its notions, which are "Privacy", "Territoriality", "Personal Space", and "Crowding". These notions are important in bedded rooms.

When they are adapted to the design of healthcare buildings, stress levels will diminish, and recovery progress will accelerate.

• The design of the healthcare building affects the staff's mood and efficiency. The staff suffers from not only occupational stress but also environmental stress. When a healthcare building is designed according to indoor space quality parameters, environmental stress levels will decrease. This may also cause occupational stress levels to drop off.

• There is a relationship between medical staff's work performance and the duration of patient recovery. As work performance is affected by indoor space quality, a well-designed healthcare building and hospital rooms will enhance the work performance of the staff; thus, the recovery time will speed up.

The significance of this study is to understand the effects of interior design and indoor quality on the healing process and recovery time. Hospital management, architects and interior designers, and other design disciplines may take advantage of this research for designing a healthcare facility.

1.2. Research Questions of the Study

1. How does indoor environmental quality of hospital rooms affect the user's recovery?
    1.1. What is the importance of daylight in hospital rooms in terms of healing?
    1.2. What is the importance of artificial light in hospital rooms in terms of healing?
    1.3. What is the importance of natural ventilation in hospital rooms in terms of healing?
    1.4. What is the importance of acoustics and noise control in hospital rooms in terms of healing?
    1.5. What is the importance of outside view in hospital rooms in terms of healing?
    1.6. What is the importance of color and material selection in hospital rooms in terms of healing?
    1.7. What is the importance of the plan layout of healthcare buildings in terms of healing?

2. How does environmental stress affect the user's well-being?
    2.1. What is the role of privacy in user's well-being?
    2.2. What is the role of crowding space in user's well-being?
    2.3. What is the role of personal space in users' well-being?
    2.4. What is the role of territoriality in users' well-being?

1.3. Methodology of the Study

İzmir Dokuz Eylül University Hospital Orthopedics department was chosen as a case study of this research. This department was chosen because these patients were able to experience the physical environment and their assets. They were able to understand how this environment affects their psychology, as they were able to look after themselves and use their five senses.

As a case study, the chosen healthcare facility is a university hospital, so it has been challenging in this Covid-19 pandemic era. However, the necessary permits from the institutions were enabled. The necessary permits from the Deputy Secretary-General and Hospital Chief Manager were obtained. It was not desired to put bedded patients and the researcher at risk during the data collection process. Thus, the Department of Orthopedics was chosen, the least risky department in Dokuz Eylül University Hospital. Another reason for selecting this department is that the bedded patients in this department are able to answer the questionnaire by themselves. The size of the sample was 20 participants. The selection criteria were:

- being a bedded patient,
- able to take care of themselves,
- not to have any problems with their sense organs.

After obtaining the necessary permissions, departments were visited, and elections were made according to the necessary criteria by the researcher and the Deputy Secretary-General and Hospital Chief Manager. The Deputy Secretary-General and Hospital Chief Manager had given the required information to the head nurse of the selected department. The head nurse of the department contacted the selected participants at first. Later, the researcher contacted them on the appointed day. The consent for participation was obtained from the participants. Therefore, the

researcher had prepared the consent form that included explanations about the aim of the study, how the data would be used, and its purpose.

The study was conducted using a survey for data collection. The survey designed for this study was prepared for bedded patients to understand how physical space and indoor quality affect the patients' healing.

While designing the survey, the criteria focused on were the amount of daylight and artificial light, outside view, thermal comfort, environmental noise and acoustics, color and material preferences in a hospital room, and the plan layout of a space. The questionnaire also includes questions on environmental stressors, focusing on privacy, crowding, personal space, and territoriality. Later, the data were analyzed by using SPSS.

1.4. Structure of the Study

This thesis is composed of six chapters.

Chapter 1 is the Introduction chapter which dwells on the purpose, research question and hypotheses, and the methodology of the thesis. After the mentioned purpose and methodology of the study, and the research question and hypotheses in the Introduction chapter.

Chapter 2 covers the role of the physical environment and indoor quality of rooms in healthcare facilities in terms of user satisfaction and patient well-being.

Chapter 3 gives insight into the literature on the role of four social aspects of environmental psychology on user satisfaction: privacy, personal space, territoriality, and crowding. This literature review seeks to identify what is known about the impact of the physical environment in those areas and examines the benefits of the physical environment and indoor quality on the recovery of the patients.

Chapter 4 summarizes the history of hospital design from the world and Turkey.

Chapter 5 states the research methodology, which will find answers to the research question and recommend the future facilities, research directions, and design suggestions for improving patients' recovery in hospitals. The research methodology is elaborated, including observation, questionnaire, and analysis. It

discusses the statistical analysis of the relationships between hospital room physical environment elements and the recovery of the patients depending on the four aspects of environmental psychology, namely privacy, personal space, territoriality, and crowding. It summarizes the statistical analysis of the results from the data collected in the research.

Chapter 6 derives conclusions from the analysis. The research is summarized, and future research directions are suggested.

CHAPTER 2: THE ROLE OF INDOOR ENVIRONMENTAL QUALITY ON USERS' SATISFACTION AND WELL-BEING

Buildings are built as a shelter to provide protection from negative environmental settings. However, human beings started to spend most of their time indoors, rather than using the interior spaces only as a shelter (Evans, 2003). As interior spaces became the essential environment of human beings, researchers started to study interior environmental quality (IEQ), people's comfort, wellness, and activities indoors (Nimlyat, 2018).

2.1. Indoor Environmental Quality

IEQ is a study that concerns human life indoors that includes factors such as air quality, lighting, thermal comfort, acoustics, and other related factors. Improving environmental quality is also improves the quality of life of the users (Mujeebu, 2019).

Even though indoor and outdoor environmental qualities are different from each other, it is not possible to think about the quality of interior space without outdoor environmental characteristics. To improve indoor air quality (IAQ), which is only one sub-domain of IEQ, opening windows to let the air in is often recommended (Toyinbo, 2019). Some studies show the differences between natural and artificial lighting and ventilation, which are detailed in the following sections.

If the IAQ is not provided, some biological factors will hinder the quality of the environment and quality of life as well. These biological factors include bacteria that may turn into mold. These are considered biological pollutants, and if the IAQ is not sufficient, the pollution keeps growing. Exposing man constantly to this pollution may cause health deterioration, which hinders well-being (Toyinbo, 2019).

The concerns of indoor air quality and environmental quality are increased since the beginning of the Covid-19 pandemic. Modern life has brought people indoors for almost a century, but Covid-19 locked us in. According to a study, the Italian population spent nearly 60% of their lives indoors before Covid-19, and the lockdown increased this percentage up to 100% (D'Alessandro et al., 2020). It is known that urban residences have already caused an increase in depression, and it is

more critical now to care about environmental quality to reduce stress and depression indoors (Engemann et al., 2019). To measure indoor quality, we should understand the role of daylight, artificial light, and outside view for the users. Therefore, the section below gives detailed information about these subjects.

2.1.1. Lighting

Light, which is one of the basic needs for human beings, is known that may affect human behavior in terms of physical, physiological, and psychological. Good quality lighting is a property of indoor environmental quality, which balances human needs, environmental and economic issues, and design. It not only ensures visual performance, but it also plays a role in safety and well-being (Bellia et al., 2011). It is known that inadequate lighting or, the opposite, high levels of lighting may interfere with circadian rhythm and human rhythms. This interference may cause low performance, safety issues, and health problems. Thus, the quality of lighting matters not only aesthetic tastes but also health and wellness (Daurat et al., 1993). Positive awareness, bringing natural elements in, and connecting culture and people should stimulate people in healing environments (Altimier, 2004).

2.1.1.1. Daylight

Reinhart and Selkowitz (2006) said that:

"Daylight is an architectural tool that influences users' perception and behavior".

Most people prefer daylight rather than using artificial lighting. In-office settings, people tend to stay in offices that have windows. Especially in offices, it may create a connection between the user and the outside world; thus, the work efficiency improves. When daylight is not enough in a work environment, artificial light comes along. However, daylight is not cut off; they are combined (Altman and Wohlwill, 1976).

It is pointed out that daylight exposure in inpatient rooms in healthcare buildings reduces the symptoms such as pain, aching, and depression. It is believed that daylight exposure increases the levels of serotonin, which blocks physical and psychological distress (Ulrich, 2006). In some studies, it is observed that the surgical

patients who had a window and sunlight in their rooms were discharged sooner than the patients who also had a window, but their views were instead soaked in shadows (Ulrich, 1984).

Especially in healthcare environments, it is crucial to design considering the building orientation for natural light. However, when designers try to include the natural light indoors, they must consider the level of brightness and glare. To adjust the level of brightness of interior space, interior designers must be aware of the surface materials that will block high levels of glaring but still invite a good proportion of sunlight. Most healthcare environments and facilities prefer to use surfaces that are easier to clean, but they should know that the risk of glare is higher when the surface is glossier (Kopec, 2006).

According to a study, hospitalized older adults who were not exposed to enough sunlight suffered from depression, as the insufficiency of light changed their brain chemistry and circadian rhythms (Sumaya et al., 2001). This study also pointed out that when those patients were brought to bright light treatment for five days, thirty minutes per day, their depression score was decreased. In another study that focused on dementia patients, inadequate levels of natural light caused behavior changes in those patients (La Garce, 2002).

Figure 1. Liv Hospital Ankara. (Source: Zoom, 2012)

In Figure 1, a photo of Liv Hospital, located in Ankara, was shown as an example of a well-illuminated patient room and good use of daylight.

As much as daylight, artificial light plays a role in user satisfaction. The following section will explain the studies and research about artificial light and its influence on users.

2.1.1.2. Artificial Light

As artificial light was introduced at first, it started to disrupt the natural light and its patterns. Variable types of artificial lighting (such as street, domestic, architectural, security and vehicle) are causing pollution, even though they were designed for people to enhance their views at night-time (Gaston, Visser and Hölker, 2015).

As the population rises in big cities, it is hard to provide a sufficient level of brightness in buildings in the daytime only with natural light. There are many reasons for the need for artificial light at daytime, some of which are weather and sky conditions, and other hinders that were not foreseen in the design process of that building (such as other buildings there were built after, and they block the sunlight) (Maitreya, 1977).

Some studies focused on indoor and outdoor artificial light and its health effects such as cardiovascular diseases, metabolic disorders, immune system irregularities, and increased risk of carcinogenesis after prolonged exposure. Being exposed to light for extended periods may cause melatonin (a hormone that regulates the cycle of alertness and sleep) levels to alter. This alteration could cause various physiological effects (Navara and Nelson, 2007). Low-level incandescent bulbs used at night suppress melatonin levels up to 50% (Schulmeister et al., 2004; Navara and Nelson, 2007). This kind of disruption in melatonin production causes adverse effects on the immune system, endocrinal systems, and hormones (Prendergast and Zucker, 2002). It is important to understand these health impacts caused by artificial light exposure at night through pollution of light (Navara and Nelson, 2007).

Navara and Nelson (2007) also state that the employees who work in shifts are exposed to high levels of artificial light and light pollution. It is highly likely to disrupt their behavioral rhythms and psychology by shifting their circadian rhythms.

Shift workers are exposed to abnormal levels of intense light when it is biologically the time reserved for rest and sleep (Navara and Nelson, 2007).

Another study focused on the psychological mood shifts caused by light and colors in a work environment. Employees experienced the worst mood when the environment was too dark. Although, when the environment was too bright, their mood was also in decline. The mood was the best when the light levels were "just right" (Küller et al., 2006).

The selection of fixtures or bulbs for lighting in hospitals is usually poorly and inefficiently made. When the lighting fixtures are not appropriately set, it may cause too much glare in some locations, and in other areas, it may become darker than intended. Linear fluorescent lights are highly used in the hallways of healthcare facilities, which causes inevitable glare when combined with shiny surfaces (Shumaker and Reizenstein, 1982).

Visual indoor quality items are not only limited to lighting but also the outside view from an indoor space influences user satisfaction in terms of indoor quality.

2.1.2. Outside View

Human beings started to shelter themselves to be protected from the dangers of the environment. In the prehistoric era, humankind used natural environments as shelters, such as caves and trees, which were also used as shelters by other living species. As they started to invent tools, humankind began to build a place to live that presents more than just sheltering; a place to cook, eat, sleep, and raise their children. This act of sheltering caused the act of structuring and building. After centuries and the industrial revolution, buildings and structures were massively built, which resulted in urbanization. Massive urbanization act, unfortunately, caused some destruction in natural living spaces and prohibited the interaction between human and natural environment. In the 21st century, humankind started to seek a solution to invite natural environments to the existing buildings without threatening the original structure. Today, when architects design a building, they aim for a shelter that does not harm the natural environment and builds environmentally conscious structures. However, they must consider the relationship between the natural environment and humans, as well as the natural environment and architecture (Aşkın, 2019).

Research that focuses on underground workspaces found out that windows are essentially important for the people who always work indoors. Furthermore, the absence of windows creates the desire for outside view and daylight. Room spaciousness and perception of a pleasant room are highly influenced by the windows (Nagy, 1998; Radikovic et al., 2005).

Outside view and nature view is effective for reducing recovery time and psychological discomfort, and it enhances job satisfaction and staff efficiency. Large windows, which are located low, may reduce the psychological disturbances, such as paranoia and delirium by improving sensory abilities. Shared spaces, such as the cafeteria and waiting lounge, can be designed with laminated glass, which will connect the user to the outside visually, and the shared space will not evoke the feeling of being trapped between walls. Natural elements can also be considered as a positive distraction, which is able to distract a patient from their pain and illness, and this positive distraction will have an effect of stress decrease, thus shorter recovery time (Karlin and Zeiss, 2006).

Indoor quality and its effects on the user cannot be defined with only visual assets, as user satisfaction, in general, is not limited to sight. The sense of feeling and hearing also affects user satisfaction. In the next section, thermal comfort and some features of it within will be reviewed.

2.1.3. Thermal Comfort

In modern society, people live a big part of their lives indoors, which is increased with the Covid-19 pandemic outbreak. Ventilation of an interior space has become the major priority; however, artificial ventilation is not recommended as it might spread the coronavirus faster. Even though natural ventilation is not preferred when living in a crowded urban neighborhood, it is now more dangerous to let the virus stay in rather than not let the air pollution in (D'Alessandro, 2020).

It is known that heat transfer changes when temperature differences occur. If the environment is cold, the human body loses its heat too and gets colder, resulting in shivering; when the environment is hot, the human body tries to release excess heat through sweating. Both examples lead to the discomfort of man (Çengel, 2015).

Thermal comfort does not only affect people and their comfort, but also it affects the sustainability of energy and resources. Space conditioning itself uses 44% of building energy (Raish, 2003).

Contrary to common belief, the air temperature itself is not the only indicator of thermal comfort. To evaluate thermal comfort, environmental and personal factors must be considered as well. Environmental factors are listed as air temperature, radiant heat, velocity, and humidity. Personal factors are metabolic heat and thermal resistance of clothing (Olesen, 1982). As the personal factors are included, thermal comfort level differs for every individual. The human body generates heat and dissipates at a rate, but when the heat loss or heat gain is higher than this rate, it causes discomfort. The produced heat must be equivalent to heat loss (Raish, 2003).

Figure 2 below shows the factors of heat loss and thermal comfort in humans.

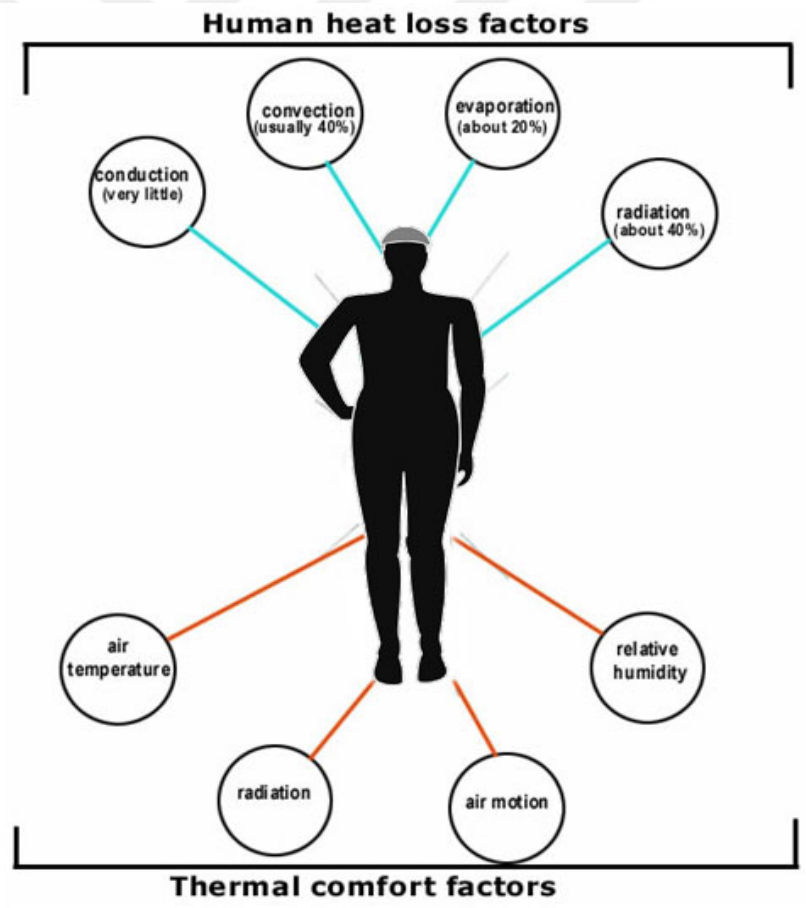


Figure 2. Factors of human heat loss and thermal comfort. (Source: Altaintegra, no date)

Parsons (2002) defines air temperature as:

"... the temperature of the air surrounding the human body which is representative of that aspect of the surroundings which determines heat flow between the human body and the air".

Temperature can be measured with a thermometer. Today, the most known temperature scales are Celsius, Fahrenheit, and Kelvin. Commonly used thermometers have dry bulbs, so they cannot measure the moisture of air; thus, air temperature is also called "dry-bulb temperature" (Legg, 2017).

The mean radiant heat (MRT) is defined in ISO 7726 (1998) as the uniform temperature of an imaginary surrounding in which in the actual non-uniform surrounding, the radiant heat transfer from the human body is even to the radiant heat transfer (Butera, 2018).

The difference between MRT and air temperature is that air temperature is the average air temperature in an enclosure. At the same time, MRT measures net radiant heat gain and loss within an enclosure, and MRT is not reliant on on-air temperature (Walikewitz, 2015).

MRT affects thermal comfort more than air temperature. As an example, a cold wind blowing from the window into the house, where it is warm, may disrupt a person's comfort. The air temperature is stable, but that slight breeze affects the person directly. MRT is considered a critical parameter, as it affects thermal comfort both indoors and outdoors (Butera, 2018).

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines humidity as the water content in the air (Hamehkasi, 2016). The effects of relative and absolute humidity may change with ventilation, climate, season, and the type of the building (Nguyen et al., 2014).

It is known that the level of humidity is one of the main features of indoor environmental quality, which also affects thermal comfort and health. High levels of humidity are unsafe, and low levels of humidity affect human health negatively (Hamehkasi, 2016). According to a research that focused on office environments, the most common symptoms of low humidity level are dry eyes and upper airway irritation, which are also known as sensory symptoms (Wolkoff, 2018). On the other

hand, high humidity creates a productive environment for biological health agents, such as fungi and mold, which are threatening health and well-being in the long term (Baughman and Edward, 1996). In the short term, high humidity with the help of high heat triggers airway obstruction for asthma patients (Strauss et al., 1978).

The subject of human thermal comfort is neglected when it comes to healthcare facility design, as it is more important to prevent bacterial growth in a healing environment. The most crucial factor here is to provide clean air circulation and minimize the risks of contamination while designing the artificial ventilation system of the facility (Khodakarami and Nasrollahi, 2012).

The patients who are getting treated in a healthcare facility prefer a warmer space rather than a neutral environment. Feeling too much cold may cause disturbances and discomfort, which may cause aggravated pain, muscular and joint tension, restlessness, and overall low patient satisfaction, and a delayed healing process (Khodakarami and Nasrollahi, 2012).

2.1.4. Environmental Noise and Acoustics

Sound is defined in physics as a vibrating molecule movement, also known as an oscillation in atmospheric pressure within a material that is in any phase (liquid, gas, or solid). This movement produces sound waves, which is the variation pattern of sound over time. (Talty, 1988). The subfactors of sound are studied widely in the acoustics branch of physics. Architectural acoustics study the relationship between the produced sound and listeners in a space. Some phenomena must be considered to acquire good acoustic design in an interior space; absorption, reflection, refraction, and diffusion (Dökmeci Yörükoğlu, 2016).

Noise is defined in Cambridge Dictionary as:

"a sound or sounds, especially when it is unwanted, unpleasant, or loud".

It is known that it causes physiological and psychological effects as an environmental stressor, and it affects well-being. Noise causes the same reaction on the human body as stress does (Choiniere, 2010). Some hormonal changes are seen both in noisy environments and stressful situations, such as the increase of endocrine (Cunha, 2015), which will hinder patient well-being.

According to Tiesler et al., (2015), noise is not only the sound pressure level which is only the measurement by decibels, but also it is the cognitive process and perception of acoustics. Even though the SPL is the same, two different sounds may cause people to react differently. In this case, it would be a mistake to label only SPL as a noise stressor. (Tiesler et al., 2015). However, it is accepted that high levels of sound pressure cause disturbance, even deafness, in extreme conditions. World Health Organization recommends that the average noise levels should not be higher than 35 dBA in treatment rooms (such as intensive care units) of healthcare facilities, and in wardrooms, the noise level should not be more immerse than 30 dBA (Berglund, 1999; Hsu, 2012).

Environmental noise causes disturbance among almost thirty-five percent of the EU citizens, and a quarter of the population suffers from sleep destitution and disturbances for the same reason (WHO, 2011; Urban and Maca, 2013).

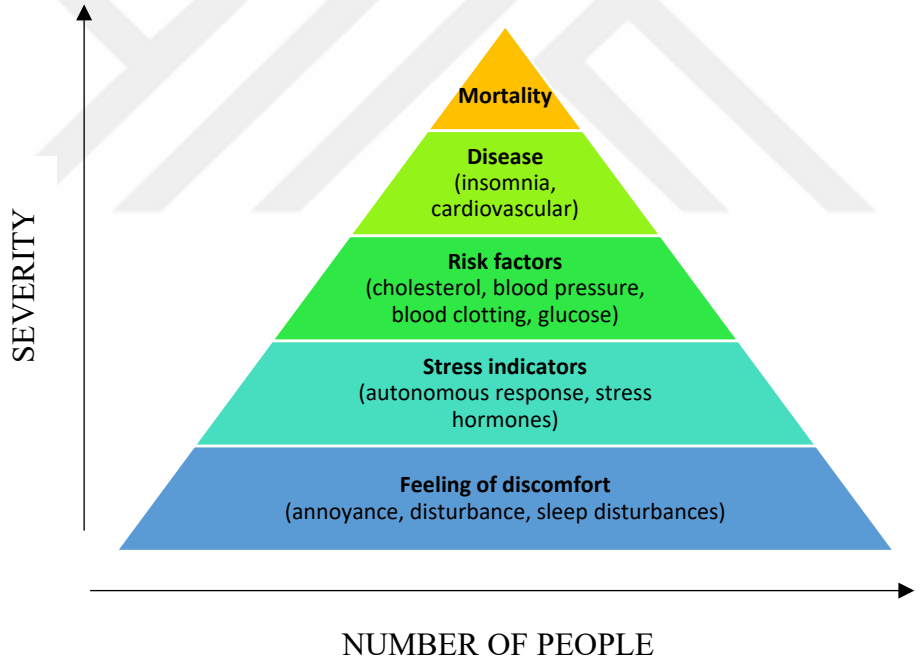


Figure 3. WHO Pyramid of health effects of noise. (Source: Noise and Health, 2014)

The sound environment, also called soundscape, is defined as a perceived and understood sound environment by an individual or group. It is causally related to the experience of the environment; therefore, the noise annoyance is also a problem of the soundscape. When the room acoustics is improved, the soundscape shall be

enhanced. However, the soundscape is not only focusing on noise control but also focuses on bringing desirable sounds such as natural elements (Miller, 2013). It is known that natural elements improve the well-being of human beings, as humans are also a part of nature (Maller, 2002).

Watts et al (2016) describe tranquil spaces as natural environments that artificial sounds do not dominate the space. There are studies that show tranquil environments have a positive impact on patient recovery rates and decreased stress and pain (Watts et al., 2016; Ulrich, 1984, Ulrich et al., 1991; Grahn and Stigsdotter, 2003; Hunter et al., 2010).

When people are not healthy and suffering from an illness, any kind of unwanted noise disturbs their well-being and healing. If the unwanted noise levels are increased, it may cause more health problems such as sleeping disorders, increased pain perception, and anxiety, which may lengthen the recovery rate of the person (Chaudhury, Mahmood and Valente, 2005).

Physical surroundings influence human health in part through psychological and physiological repair (Berto, 2014), which is dependent on the capacity of both individuals and places to support diverse health outcomes (Stokols, 2003; Berto, 2014; Mishra et al., 2020). A study states that nature is one of the strongest restorative assets in an environment, even if it is not the only asset. Nature is healing, and it is essential to access nature indoors, even though it is not a big area, such as the seaside or the forest (Kaplan, 1992).

2.1.5. Colors and Materials

As well as lighting, color affects how people respond and perceive the environment (Birren, 1978). Color and lighting additionally affect the recovery rate of patients by improving their overall experience of hospitals and life quality (Mahnke, 1947). Not only color empowers the sense of wayfinding and navigation, but also it bolsters the well-being of patients and staff. Improving the visual environment boosts both the patients' and staff's morale, thus increasing productivity (Dalke, 2006).

It is essential to consider the emotional and psychological factors that may alter the sense of well-being. The essential concern is to create a welcoming and friendly

environment for staff, patients, and their visitors and companions. Subtle use of color in any environment may help controlling glare, brightness and it also may help to welcome the daylight in (Dalke, 2006).

The notion of color usually evokes an aesthetically qualified application that highlights the visual quality of spaces. However, colors have a psychological and physiological impact on human beings when they are looked at directly. Primarily the psychological tendencies, anxiety, and fears must be averted to cure an illness. The effect of colors' attention-drawing is able to relieve the patient's psychology; therefore, it helps the healing process. Today, "color therapy" methods are directly applied in therapies. Currently, there is not enough data in the healthcare industry and treatment; however, studies prove the effect of colors not only in psychological illnesses but also in the healing of physical illnesses. Even if there is no application of color therapy, the use of colors in an interior space has psychotherapeutic impacts, and color choices are efficient in creating a healthy environment (Güller, 2007).

According to a study directed by Porter and Mikellides (1976), cold colors (blue-green group) have soothing and sedative effects, and those may be used to relieve manic-aggressive states of patients. As warm colors (red-yellow group) have exhilarant and stimulating effects, they are beneficial to cheer up depressive and suicidal patients (Porter and Mikellides, 1976).

It is pointed out that, to comprehend the emotional meaning which humankind relates with colors, it is essential to figure out the importance of colors which signal in nature. It is argued that the color red is used to stimulate emotions, but that may affect a person positively or negatively. It may remind of sexual attractiveness or a poisonous but edible berry (Humphrey, 1976; Best, 2017).

In a study, participants claimed that they worked in their best performance when the use of color was bright and various (Küller et al., 2006). However, some studies point out that it is not entirely desirable to use strong and bright colors (Küller and Mikellides, 1993; Kwallek et al., 1996). It is pointed out that moderate use of color in an environment enhances the mood of staff (Küller et al., 2006).

Figure 4 below shows an example of moderate color use in the Pediatric Emergency Department of Providence Sacred Heart Medical Center. The aim is to

soothe the patients, which are children here, with the help of the cold colors. Floral shapes also invite some nature into the room.

Figure 4. Providence Sacred Heart Medical Center - Pediatric Emergency (Source: Archdaily, no date.)

2.1.6. Plan Layout

Hospital buildings are considered the most complex type of buildings. Every hospital building must have functional units and services that are widely ranged within. These services and units may be listed as the department of diagnostics, clinical laboratories, emergency wards, imaging and radiology departments, surgery wards, and functions of hospitality, which are food service and cleaning, and essentially bedded patient care, also known as bed-related functions. Hospitals must comprise communication, mechanical and electrical systems requiring expertise and knowledge specialized for that branch. Besides these functions, the designer must consider the building from several points of view; healthcare staff, patients, service staff, and suppliers. All these requirements are requisite for a good hospital design (Carr, 2017).

In healthcare buildings, stoas and courtyards were common. Diseases and their spread surged after continental battles between Europe and America in the 1850s; thus, government officials devised new plan layouts to prevent disease transmission (Aydın, 2009). The columns were converted into walls and closed hallways, the patients were subdivided based on their diseases, and these spaces were connected to the main hallway through various layouts, which is known as the "Pavilion Plan Layout" (Diren, 2018). In Figure 5, the plan layout of Royal Herbert Hospital is presented. The Herbert Hospital, which was named after Sidney Herbert, became a model for dozens of civilian and military hospitals.

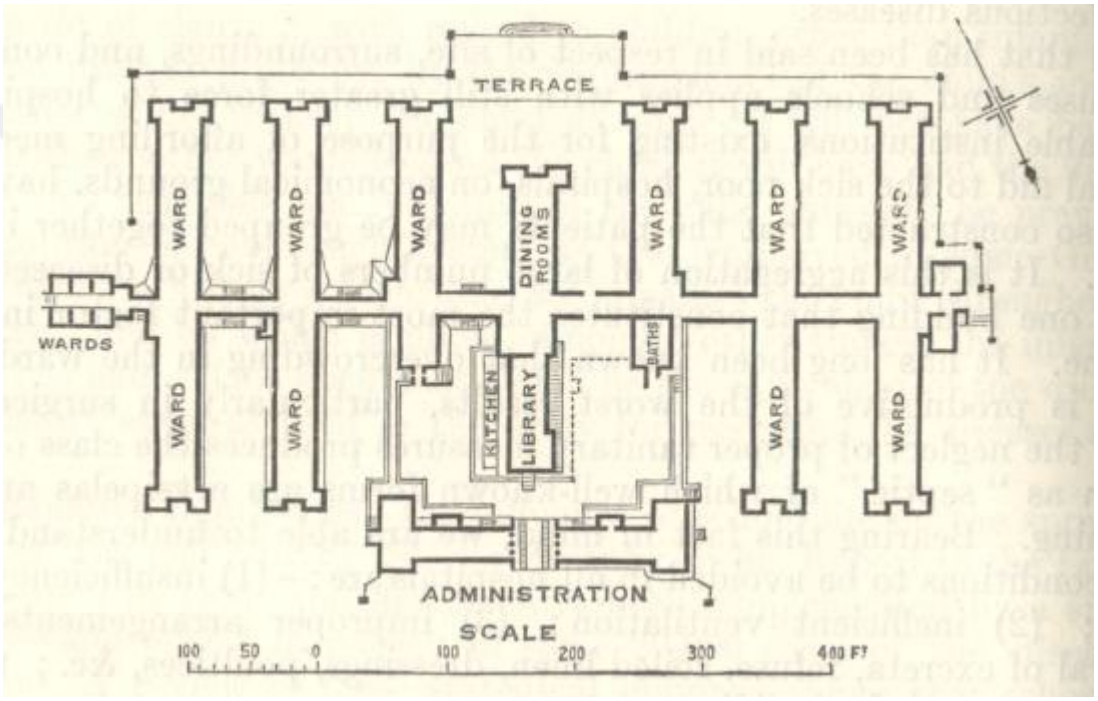


Figure 5. Plan Layout of the Royal Herbert Hospital. (Source: Asylum Projects, 2013)

Medical equipment increased in parallel with new technologies, increasing in both variety and number. Furthermore, the importance of sterilization, heating expenses related to exterior wall size, and staff circulation path have all changed, resulting in a change in the architectural plan as well. The plan layout shifted from pavilion to monoblock, including vertical circulation such as elevators. Monoblock plan layouts were first founded in America, then applied in Europe. The plan layouts were developed as T-type, H-type, and Y-type in the 20th century (Aydın, 2009; Diren, 2018).

CHAPTER 3: THE ROLE OF 4 ASPECTS OF ENVIRONMENTAL PSYCHOLOGY ON USERS' SATISFACTION

People tend to view their surroundings in two ways; subjective observation, which is shaped by their desires and personal preferences, or objective observation, which is neutral. If the environment is personal, such as home, it is viewed personally and shaped for their desires. However, if the environment has no interest for that person, such as an acquaintance's home, only the objective view manifests itself. This interest is determined by the viewer's emotion and conceptualization of that environment (Kopec, 2006).

Regardless of the type of observation, the environment is experienced through senses (smelling, touching, tasting, hearing, and seeing), and this experience has the effect of both physical and psychological, which also affects well-being (Cooper, 2014).

Stress usually causes psychosomatic symptoms that affect the well-being of a patient. Psychosomatic symptoms are known as clinical symptoms felt by the patient, but there is no underlying sickness. The most known symptoms are abdominal pain, headache, chest pain, and difficulty breathing. In theory, these symptoms are caused because of stress (Brill et al., 2001). These psychosomatic symptoms may interfere with the diagnosis of an actual illness, thus affecting the process of healing.

It is known that patients experience stress when they are in a healthcare facility, not only because of their sickness but also because the design of healthcare facilities is so inadequate. These poorly designed facilities have these common characteristics: noise, low privacy, and interference with social support. There are lighter expressions of stress than psychosomatic symptoms, which also affect the healing process and well-being. These expressions are psychological, physiological, and behavioral. Psychologically, stress causes anxiety and depression by sensing the feeling of helplessness. Physiologically, high blood pressure and increased stress hormones are also caused by stress. If the stress levels are not lowered, it is inevitable to experience a dysfunctional immune system. Behaviorally, social withdrawal increased alcohol usage, verbal dispute, and sleeplessness caused by

stress affect well-being. Thus, it is important to design better healthcare facilities in order to reduce the stress levels of patients so that they can heal faster and better (Ulrich, 1992).

Ulrich (1991) also states that people tend to control the environment they live in. When people cannot control their surroundings and events that stress the person, it is manifested as negative health outcomes.

The most important objectives of healthcare environments are to diagnose, cure and inform patients about their health. Architectural design and related disciplines study to contribute to these purposes and increase the performance of healthcare buildings. It is crucial to prioritize the functionality of spaces and prioritize the precautions to boost the morale of the users, which are patients, patient relatives, and staff (Karamustafa, 2012).

The characteristics of space have an influence on user reaction and their experiences of the environment. According to workspace research conducted by Oldham and Rotchford (1983), crowded workspaces and offices may disrupt efficiency by hindering the concentration of employees. In some cases, it is inevitable to ignore or avoid contact with others. As the employees have no personal space, their behavior changes negatively, causing stress, discomfort, and inefficiency between coworkers and supervisors (Oldham and Rotchford, 1983).

All the living species need a place that they feel the possession of that place. Animals tend to mark their spots by urine or other bodily fluids, and humans today tend to build walls and fences, and even borders (Kopec, 2006). This need for territoriality rises from the need to control actions and interactions by asserting dominance and taking control of that territory (Sack, 1983). Edward Soja (1971) finds that territoriality has an impact on the social behavior and social activities of humans, which is quite similar to owning private property in modern life (Raffestin, 2012).

3.1. Privacy

Privacy can be described as the process of boundary regulation when a person wants to isolate themselves from other people (Davis and Palladino, 1997). Altman (1975) described privacy as controlling the access of others to the person, their

environment, and their groups selectively (Kopec, 2006). Pedersen (1996) also points out that privacy is not excluding oneself from others and their environment but controlling the interaction with others. Westin (1967) presents four aspects of privacy, which are anonymity, solitude, intimacy, and reserve.

Anonymity can be described as hiding the true identity of self but not avoiding interaction with others (Westin, 1967). In the past decades, this behavior was exhibited by famous people and celebrities; however, today, anonymity is mainly seen on the internet, when the person has thousands of "followers" in any social media account, for protecting their personal information (Zhang and Kizilcec, 2014).

Solitude is the act of isolating oneself from physical invasion. The difference between privacy and solitude is; privacy is a selective act, but solitude might not always be selective (Westin, 1967).

Intimacy is defined as group privacy with emotional interaction. Its difference with solitude is, intimacy is interrupted by visual and auditory disturbances, and intimacy requires more than one person, but solitude is only the physical invasion of a person and the isolation of only one person (Westin, 1967).

Reserve presents itself as psychological and emotional barriers between the person and others. People who keep their distance from others emotionally intend to protect their feelings and thoughts from the public (Westin, 1967).

A study shows that getting treatment in a single room in a healthcare facility gives the patients privacy and the ability to control their environment, but they feel lonely by being only with themselves as their social interaction is reduced. Solitude may result negatively on well-being and health in the long term and reveals as depression, cognitive decline, and other disabilities (Anåker et al., 2018). This situation may be averted by designing a shared space for patients to socialize. Nonetheless, if the patient is in critical condition, where they are not allowed to leave their room or physically interact with anybody, visitation should be allowed by setting a safe distance between the companion or the visitor and the patient.

3.2. Crowding

Crowding is usually confused with population density in space. It is certain that there is a link between them, but what makes them different from each other is that

density is objective and quantitative; it can be calculated using a mathematical formula. However, crowding is highly personal and subjective as it is a psychological construct. Some spaces, even though they are full of people, may not cause the feeling of crowding for some people; however, for others, it may feel crowded even if the population in that space is not dense (Kopec, 2006).

Crowding usually presents itself as stress when the density of the population is higher when the man feels the loss of control in their surroundings and cannot act consciously to perform their goals. Crowding experience may differ from one person to another, depends on the level of perception of having control in their environment (Kopec, 2006).

One of the most common experiences of crowding is the traffic in rush hours. If the person is driving their own car, they will feel stuck and having no control in this situation, even though they are alone in their cars (Kopec, 2006). Another rush hour experience is when people use public transportation. Even if the vehicle is not crowded, and there are seats available in the middle of between two other passengers, people do not prefer to sit in the middle seat because of the feeling of crowding (Evans and Wener, 2007).

Crowding in healthcare facilities is primarily experienced in emergency departments and outpatient treatment departments due to density. The density of population is usually caused by managerial or governmental decisions. In the United States, first care providers cannot acquire every medical supply; therefore, they cannot be helpful all the time; thus, patients prefer to go to an emergency department of any hospital (Barish et al., 2012). When patients are required to go to a clinic in Turkey, they have to make an appointment through Central Physician Appointment System, also known as MHRS (Merkezi Hekim Randevu Sistemi). This system allows patients to choose their medical attendants and healthcare facility (Öztaş, 2016). Despite its advantages, it causes serious density in hospitals because the system allows making an appointment every ten minutes. Studies point out that ten minutes is actually the minimum time requirement for patient care. However, not all illnesses and treatments are the same, and physicians may need more time to diagnose the patient after getting the patient's history (Yardım and Eser, 2017). When

given insufficient time for the patient is expanded, it causes queues and crowdedness in hospital halls, which may trigger the feeling of crowding.

3.3. Personal Space

Kopec (2006) describes personal space as:

"... an oval-shaped bubble that surrounds each of us as we move through the world around us".

This bubble may expand or shrink depending on the experience of the surrounding. It is also a subjective and interpersonal phenomenon, and it emerges with interaction (Kopec, 2006).

There are four interpersonal distance zones defined by Edward T. Hall:

- Intimate zones (0 cm - 45 cm) allow two or more people who have strong emotional bonds, such as family, close friends, and significant others.
- Personal zones (45 cm - 120 cm) welcomes casual friends and other close social contacts, such as coworkers, members of an organization or a group, and friendly acquaintances.
- Social zones (120 cm – 365 cm) are for regular acquaintances such as friends of friends and coworkers who work in the same company but in a different department. They know each other by names and faces, but they do not share a conversation except for common non-personal purposes.
- Public zones (365 cm – 762 cm) are the distance that people keep between strangers in the same space. When this distance is violated, by getting closer than 365 centimeters, the person may feel discomfort due to the feeling of crowding and may feel the invasion of their personal space. Public zones can be exemplified as two strangers waiting for a bus or getting in a queue. (Hall, 1966)

These zones are also visualized and shown in Figure 5.

The invasion of personal space has been decreased after COVID-19. Even though the term "social distancing" was already known as a public health tool, its importance has risen with the pandemic (Mohler et al., 2020).

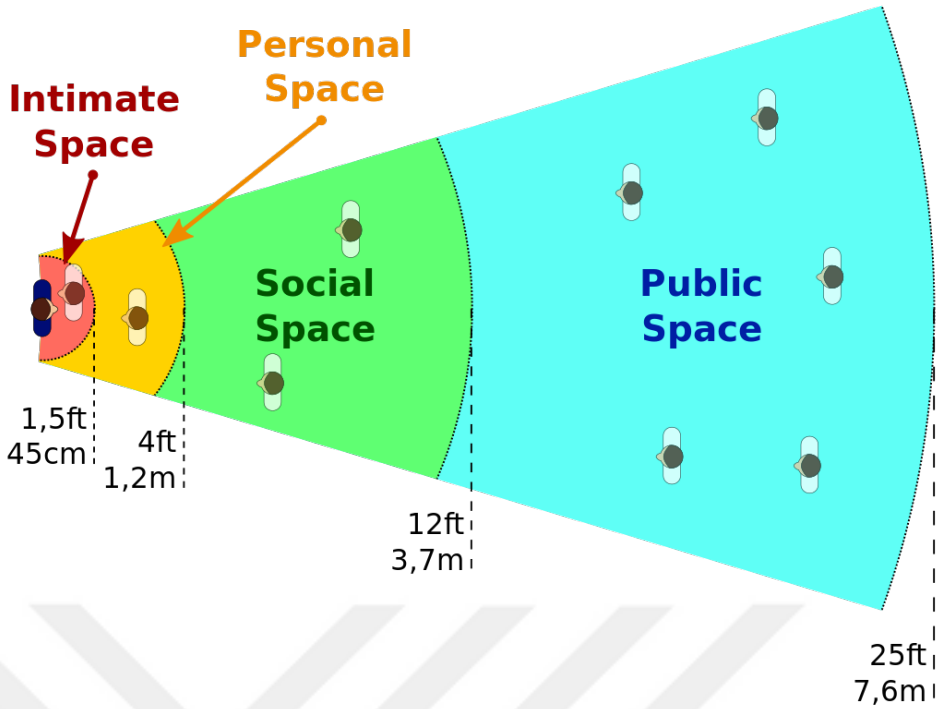


Figure 6. Personal Spaces in Proxemics (Source: Wikimedia, 2014)

Personal space and territory invasion are experienced in healthcare facilities more than in a family environment. Nurses or physicians may need to examine the patient by touching, and in some cases, the patient might be naked, which is mostly discomforting and embarrassing, and it may evoke the feeling of being exposed and vulnerable. (Sawada et al., 1998; Marin, Gasparino and Puggina, 2018). Since physical examination has become a natural routine for healthcare staff, they might forget to ask before touching or knock the door before they come into the patient's room. This kind of intrusion may cause more anxiety and discomfort, thus reducing the recovery rate and well-being (Allekian, 1974).

3.4. Territoriality

Silva (2011) defines territory as an area that people claim as theirs, and territoriality is the instinct of defending that territory from others. Territoriality is not a unique characteristic of mankind; it is also seen in the animal kingdom. It can also be defined as personalizing an area or a space that reflects the identity of the user with their possessions and their understanding of defending their own physical space, or as Kopec (2006) says, "being on our own turf". When a man is in their own

territory, they feel more safe, dominant, and able to control any other intruder (Kopec, 2006).

According to Lyman and Scott (1967), there are four types of territories, which are public, home, interactional territories, and body territories. Public territories are open to everyone, people have the freedom of access, but they do not have the freedom of behavior. Home territories, even though the name has the word "home", are public areas where users have relative freedom of behavior. Clubhouses and bars are some examples of home territories. Interactional territories are the areas where social gatherings take place. They are fragile and mobile; they do not require wall structures; social interaction defines the boundary of this kind of territory. The last of them are body territories, which are the most private type of territories. It defines the surrounding of a human body and the space the body takes; the immediate surrounding. As tattoos and scars are involved in body territories, the needle used by a physician, too, is involved in this kind of territory (Lyman and Scott, 1967).

On the other hand, Kopec (2006) divides territories into three, which are primary, secondary, and public territories. Primary territories are highly personal spaces that usually belong to a person or people, such as an individual's own home. Secondary territories are not as significant and private as home but still have importance. Public territories are the public spaces where people need to control their behavior (Kopec, 2006).

Hayter (1981) highlighted the importance of autonomy function for territoriality. Autonomy is defined in Cambridge Dictionary as:

"the ability to make your own decisions without being controlled by anyone else".

When one is in their own territory, they may feel more independent to ask questions, reject any action that crosses them; however, when they come out of their territory, the person feels weaker and submissive. The anxiety in healthcare facilities emerges for the same reasons; they need the treatment, but the idea of being touched without asking may be overwhelming. On the other hand, as people tend to feel submissive and meek out of their territory, they refrain from asking questions or refusing anything. This situation may cause the retardation of treatment and patient care; thus, it affects well-being and health (Hayter, 1981).

A patient's territory, when getting treatment in a healthcare facility, can be invaded in three ways: invasion by looking, invasion by touching the patient's owning and possessions without any permission, and invasion with objects both in a patient's room and on the patient's body (Silva, 2011).

CHAPTER 4: THE FEATURES OF HEALTHCARE FACILITY DESIGNS

There are common characteristics of healthcare facilities, which are essential, regardless of the building's size or location.

- Cost-effective solutions and efficiency,
- Flexibility,
- Providing a therapeutic environment,
- Sanitation,
- Accessibility,
- Circulation,
- Security and safety,
- Sustainability (Carr, 2017).

Efficiency can be provided by minimizing the distances between departments; however, it must be reminded that minimizing in a healthcare facility does not mean allocating the different types of wards or departments intertwined. There must be spaces between them, but those spaces must not be redundantly allocated. It is best to group similar functional spaces that have the exact system requirements. Outpatient clinics and polyclinics may be located on the entrance floor close to the entrance door for direct access, which will increase efficiency and improve wayfinding and circulation for outpatients. They will not wander around and circulate between floors and back corridors of the facility. The back corridors of healthcare facilities may be used for logistics and suppliers, which will not hinder staff efficiency and patient care (Carr, 2017).

Flexibility and modularity in hospital buildings and healthcare facilities came into prominence after the COVID-19 pandemic breakout. After the pandemic, most of the hospitals and healthcare facilities had to convert and isolate some wards into COVID-19 wards, and they needed to increase their resources for these wards. Some of the COVID-19 patients had to be treated in intensive care units, or they needed surgeries, but they could not leave the pandemic wards to hinder the spread of the virus. The ability to converting wards is a characteristic of modularity and flexibility

in healthcare facilities, and its importance is recognized more after this breakout (Jaarsma et al., 2020).

Patients, whether bedded or not, tend to experience stress, confusion, and fear in healthcare facilities, and this may come in the way of well-being and healing. Especially interior designers must work on creating therapeutic environments to hinder the experience of discomfort and stress. The feeling of not having control in a space is also a trigger for stress, and healthcare facilities are considered the least controllable building type. Even when the slightest opportunity to control something will decrease stress in patients, such as setting the room temperature or even the channel on the television, in some cases, it is helpful to bring some small items from home, which will awake the feeling of belonging and territoriality of the patient, as long as it does not interfere with sanitation and cleanliness of the environment. Bringing natural elements into the room has the effect of calming people, such as daylight or the view of the natural outdoor environment. Even the pictures of a natural environment may help to ease the pain. (Ulrich, 1992; Carr, 2017).

Inpatients must be protected from any infections, as they are already struggling with their own disease. The finishing materials must be durable, sterile, easy to clean, and appropriate for each space to maintain sanitation and cleanliness of healthcare facilities. Housekeeping services in healthcare facilities must function regularly, preferably multiple times a day (Carr, 2017).

Accessibility is important and viable for any kind of environment; however, it is more crucial in healthcare facilities, as there will be more handicapped or disabled people inside getting treatments. The corridors and other circulation areas must be wide enough for two wheelchairs to pass effortlessly, and the floor surface must be as flat as possible. Unnecessary steps hinder the mobility of wheelchair users, and building ramps will cause the loss of space (Carr, 2017).

Circulation must be controlled within any healthcare facility. Severely ill patients who may not have an immune system at the moment should not encounter any other patient that may spread any infection around them. Especially outpatients, who may not be diagnosed yet, are considered as threats to other patients. Outpatient routes must be clearly defined, and their destinations (clinics, polyclinics, etc.) should be easy to find. Defining the routes applies to visitors, too, except their

destinations are not clinics but patient rooms; however, their routes should not intercept other service routes. Service routes must be located differently than patient and visitor routes. Their circulation may be solved in back corridors, such as the outflow of wastes, trashes, and other used supply containers; clean supplies, food may also be solved differently. These routes should not interfere with the health service areas, such as nurse stations, clinical laboratories, and radiology departments. One of the essential circulation planning is the morgue and cadaver transfers. Patients and visitors should not see those to maintain their psychological health (Carr, 2017).

As a current example, COVID-19 patients must not encounter only the patients but also other people, and they must be isolated and quarantined. The quarantined ward should not be located in a highly circulated area (Paletta et al., 2020).

Safety and security in healthcare facilities must be provided and executed delicately, not only for the patients but also for healthcare staff. Violence in healthcare facilities is seen everywhere in the world, mostly performed by patient relatives. Designing the healthcare building safer and increasing security staff and measurements is not enough, but it is a step to protect the staff from violence (Brophy et al., 2017; Fujita et al., 2011; Carmi-Iluz et al., 2005). Safety and security are not only required for preventing violation but also are needed for the protection of hospital assets, including drugs and sharp tools. Healthcare facilities are vulnerable, as securing them constantly would make patients feel more stressed, but an optimal solution is needed without dispute (Carr, 2017).

Sustainable buildings are widely discussed in today's world, and as the most complex building type, hospitals should follow sustainability criteria. As healthcare facilities comprise many functions, the use of energy and water is high, so is the outflow of waste and trash. It is crucial to design a healthcare building accordingly, both for protecting the natural resources and the users of the facility, staff, or patient (Carr, 2017).

4.1. History of Healthcare Facilities

In Ancient Greek, chronic patients would visit temples to be healed (Sternberg, 2009; Berberoğlu, 2010). Historians claim that these temples are the first healthcare buildings in history. They were built away from the town center to avoid noise and pollution, and they were near the water resources and with a sea view (Miller and Swensson, 2002; Berberoğlu, 2010).

One of the earliest healthcare centers, Temple of Asklepion, provided service for visitors, not only for worshipping their gods but also, they provided service for patient healthcare since the year 400 BC. Other than religious and healthcare reasons, the Temple of Asklepion was also used for theatres, musical recitals, and other ceremonies; however, these events are believed to have an effect on patient well-being (Menekay, 2009). Today, its ruins are located in Bergama (Izmir / Turkey), where it is remembered as the city that death cannot walk in, the city that death wills never open (Berberoğlu, 2010).

The people had found out eventually that nature affects the way of healing and well-being, so they let the natural elements in. The water flows, natural lighting, and other natural elements were always welcome. These buildings are remarkably similar to today's spa and wellness buildings (Berberoğlu, 2010).

4.1.1. History of Healthcare Facilities in Europe

The use of stoas and courtyards were common in healthcare facilities. After continental wars between Europe and America in the 1850s, diseases and spread was increased; so, the government officials worked on other plan layouts to avoid transmissions of diseases (Aydın, 2009). The columns were transformed into walls and created closed hallways, the patients were grouped by their diseases, and these spaces were connected to the main hallway by different arrangements, which is called "Pavilion Plan Layout" (Diren, 2018). In Figure 7, Sedgwick Hospital’s pavilion-type plan was displayed.

In the Pavilion plan type, patient beds are located in a hallway, placed perpendicular to the windows. The air circulation is secured by opening the opposing windows (Aydın, 2009; Terzioğlu, 1964).

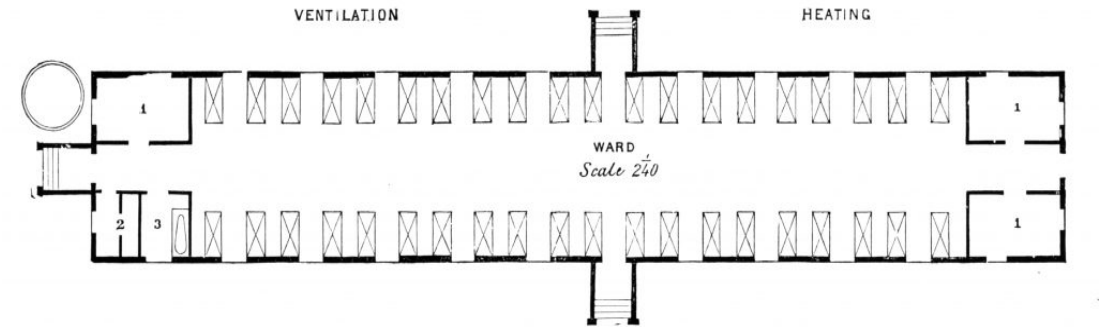


Figure 7. Sedgwick Hospital, Greenville, LA (Source: National Museum of Civil War Medicine, 2019)

After technological developments, medical equipment was also developed and increased by variety and number. Also, the importance of sterilization, heating expenses due to outer wall size, and staff circulation path is changed; thus caused a change in the architectural layout too. The plan layout changed from pavilion to monoblock, which includes the use of vertical circulation such as elevators. Monoblock plan layouts were first founded in America, then applied in Europe. The plan layouts were developed as T-type, H-type, and Y-type in the 20th century (Aydın, 2009; Diren, 2018).

4.1.2. History of Healthcare Facilities in Turkey

In the era of Seljuk and Ottoman, healthcare buildings that provide health services and education of medicine were built by the foundations that were also founded by top government officials. These buildings were called "darush-shifa" and "shifa-hane" (Cantay, 1992).

The most common healthcare facility was "darush-shifa", which can be translated as "the house of healing" (Devellioğlu, 1978). These buildings were open to the public, and they provided healthcare for everyone; Muslim or non-Muslim, women, men, children, soldiers, civilians did not matter. Not only were they visited for bedded treatments, but also there were polyclinical services twice a week (Altıntaş, 2012). In Islamic accommodation buildings such as inns and caravansaries, there was a top accommodation limit of three days, but darush-shifas had no such limit so that patients and others who did not have a place to stay could accommodate in these buildings (Shefer, 2003).

Darush-shifas had a distinct architectural layout. Vaulted or domed central halls, which are called "iwan", and the use of stoas in courtyards were seen in all

darush-shifas, and they were located in social complexes, which also included other spaces such as mosques, schools, and Turkish baths (Altıntaş, 2012).

Darush-shifas primarily provided service for orphans, outcasts, and others who could not provide patient care at home, as people usually took care of their patients at home in the Ottoman era (Altıntaş, 2012; Songur and Saygın, 2014). Today, patients should be treated and healed in hospitals. Darush-shifas were founded and built for the necessity of welfare and social solidarity according to their religious beliefs, which is Islam. They provided service for a long time as a charity, but as the society changed, so did darush-shifas, and they were replaced with modern hospitals (Songur and Saygın, 2014).

Figure 8. Darus-shifa of Kayseri (Source: Rehbername, 2020)

In the 19th century, darush-shifas still existed, but the newly constructed healthcare facilities were designed according to pavilion plan layout. One of the first pavilions planned healthcare facilities in Turkey is called "Bezm-i Alem Gureba-i Müslimin Hospital", which is also the first healthcare facility that is called "hospital", and its construction is started in 1845 (Aydın, 2009). Today, it is known as “Bezmialem Foundation University Hospital,” a medical school that started on October 25, 2010 (Bezmialem Hospital History, 2021).

The architectural changes and technological developments in healthcare facilities throughout the world have also affected the Turkish healthcare facility architecture as the population and urbanism have proliferated (Diren, 2018).

CHAPTER 5: METHODOLOGY

This chapter of the study presents the methodology used in this research to explain how the research proceeded.

As a case study, Dokuz Eylül University Hospital was chosen to conduct this research. The reason to choose this healthcare facility is that it is a university hospital in İzmir, it has a large capacity for many patients in different departments, and it is one of the earliest hospitals that was built in İzmir. The findings and the results of the conducted survey are presented and discussed in this chapter, and design suggestions according to the conducted survey will be exemplified.

5.1. Case Study

Faculty of Medicine in Dokuz Eylül University was established on March 1, 1978; however, it was connected to Ege University back then. In 1985, the old buildings of Ege University Faculty of Pharmacology were repurposed into Dokuz Eylül University Hospital temporarily, with a bed capacity of 325 patients, after the new law regulations in 1982. Today the hospital has more facilities, with a new clinic building which involves Fertility Center, Organ Transplant Center, Department of Radiology, and the Department of Emergency. Now, the hospital can welcome 925 inpatients (Atmaca, 2013).

The process of data collection has been done with a survey study among the bedded patients. The data collection has taken place in Dokuz Eylül University Hospital Orthopedics Department, and it is collected on-site by the researcher. According to the survey study, statistical analysis and a calculation are made, and design suggestions are made to lead future interior designers and architects to design a healing healthcare facility.

Figure 9. Photo of Dokuz Eylül University Hospital. (Source: Google Maps, 2021)

5.1.1. Participants

The participants of the study were the bedded patients in the Orthopedics Department of Dokuz Eylül University Hospital. There were 20 participants in total. The age range of the participants differs between 19 and 44. The average age is calculated as 30. Participants are selected from this department as they do not have a severe or fatal illness.

Gender was not a criterion to be a participant in this research. The size of the sample was 20 patients. The selection criteria were:

- being a bedded patient,
- able to take care of themselves,
- not to have any problems with their sense organs.

After obtaining the necessary permissions, departments were visited, and elections were made according to the necessary criteria by the researcher and the Deputy Secretary-General and Hospital Chief Manager as well. The Deputy Secretary-General and Hospital Chief Manager had given the necessary information to the head nurse of the selected department. The head nurse of the department contacted the selected participants at first. Later, the researcher contacted them on the appointed day. The consent for participation was obtained from the participants. Therefore, the researcher had prepared the consent form that included explanations about the aim of the study, how the data would be used, and its purpose.

5.1.2. Questionnaire

The questionnaires were filled by the participants who are getting treatment in Dokuz Eylül University Hospital Orthopedics Department. This research aims to determine users' satisfaction with the indoor quality and four environmental psychology subtopics: privacy, crowding, personal space, and territoriality.

The first part of the questionnaire includes questions for collecting general information from the user, such as patients' age, bed placement (whether it is by the wall or by the window, to understand their relationship with daylight and outside view), the reason of their choice to get treated in this hospital, how long they were staying, and how many patients stay in the same room. The second part of the questionnaire is made using a five item-scale. Participants are led to mark the answers according to their satisfaction levels. The scale is formed as:

1: Strongly disagree
2: Disagree
3: I do not know
4: Agree
5: Strongly agree

The third part of the questionnaire, which is only one question, asks the patient which hospital room design is designed well according to their taste. Figure 10 displays the pages of the conducted questionnaire.

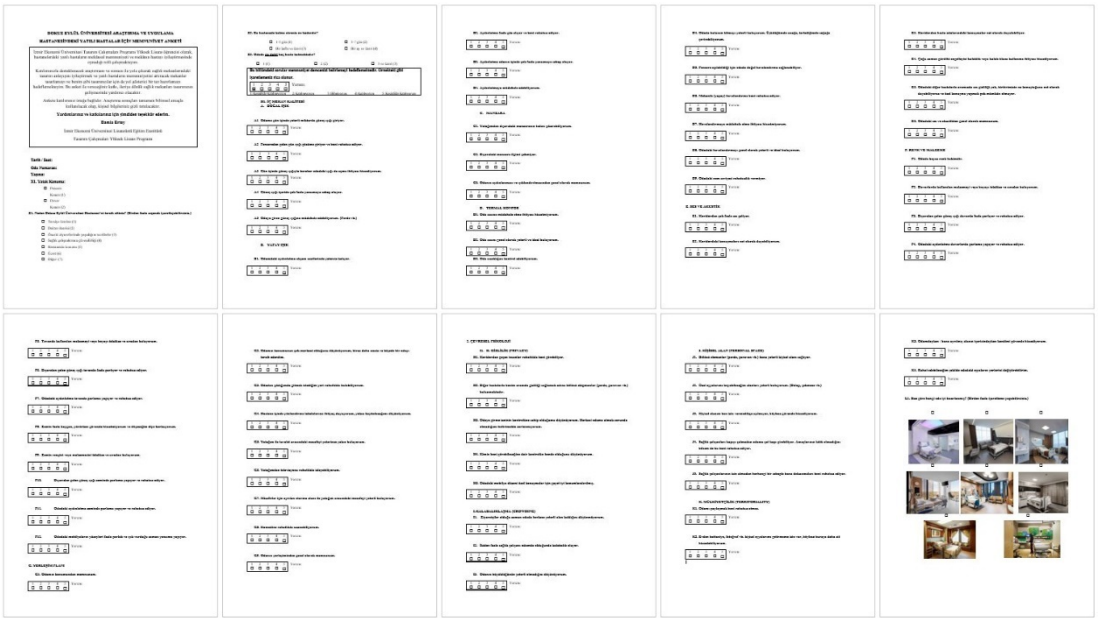


Figure 10. Thumbnail of the pages of conducted questionnaire.

5.2. Results

In this section of Chapter 5, the descriptive and statistical analysis of the conducted survey is described. The distribution of data is analyzed by frequency, percentage, average, standard deviations, and statistics are discussed in accord with the hypothesis of this study.

5.2.1. Descriptive Analysis

The distribution of control variables and percentages of the study are analyzed together, and later the score means are shown. Table 1 shows the distribution of control variables of the study. When the variable of "Bed placement", 60% of the participants (12 patients) claimed that they are accommodated by the window, and 40% of the participants (8 patients) are located near the wall. The variable of "reason to choose this healthcare facility" shows that 20% of the patients preferred this hospital by recommendation, 25% of the patients came for the recommendation of medical doctors, 10% of them came in this hospital because they had an experience of this hospital, 25% of them preferred here because they are trusting the healthcare staff, and lastly, 20% of the participants chose this facility because of its location. 40% of participants have been staying in this hospital for one to three days, 20% of participants have been staying in this hospital for three to seven days, 35% of participants have been staying in this hospital for a week, and 5% of participants have been staying in this hospital for a month. Six of the participants are staying alone in their hospital rooms (30%), and twelve patients are sharing the room with another patient (60%), and two patients share the room with two or more patients (10%).

Table 1. Distribution of Control Variables of the Study

		Frequency	Percentage
Bed placement	By the window	12	60
	By the wall	8	40
Reason to choose this healthcare facility	Recommendation	4	20
	Doctor's advice	5	25
	Past experiences	2	10
	Credibility of the healthcare staff	5	25
	Location of the hospital	4	20

Table 1 Continued. Distribution of Control Variables of the Study

Duration of stay	1-3 Days	8	40
	3-7 Days	4	20
	One week and more	7	35
	One month and more	1	5
Patients in the same room	1 patient	6	30
	2 patients	12	60
	3 or more patients	2	10
Total		20	100

Table 2 shows the satisfaction score of the participants. It is found out that patients have above average satisfaction with this healthcare facility.

Table 2. Satisfaction Scores

	Avg.±SD	**Low-High**
Daylight	17,2±3,7	13-25
Artificial Light	13,3±3,6	8-20
Outside View	10,9±2,3	7-15
Thermal Comfort	30,8±7,1	19-45
Noise and Acoustics	19,8±5,2	8-29
Color and Materials	36,7±11,4	17-60
Plan Layout	30,8±5,3	21-41
Privacy	18,2±3,8	12-25
Crowding	8,8±3,2	3-15
Personal Space	16,3±4,3	10-25
Territoriality	15,4±3,6	7-20

5.2.2. Reliability and Normality Analysis

In this section, the Cronbach's Alpha analysis results show the statistical credibility of the conducted survey. The satisfaction scale subjected to testing within Cronbach's Alpha analysis has been tested by every article. The scores over 0.70 show that the statistical results are credible, and it increases as it comes closer to the results of Cronbach's Alpha analysis of the satisfaction scale, which includes 65 articles, which is presented in Table 3. It is found out that the parameter of Cronbach's Alpha has a high parameter of 0.948. This parameter shows that the satisfaction scale and findings are highly credible, and there is no obstacle to use this scale in statistical analysis.

Table 3. Analysis of Credibility of the Satisfaction Scale

	Cronbach's Alpha	Number of Articles
Satisfaction Scale	.948	65

Table 4 below presents the results of the Shapiro-Wilk test, which is used for analyzing the normality of the study. Findings point out that, within all the subscales, p>0,05 condition is reached. Thus, the data were distributed normally, and it is decided to use the parametric tests on hypothesis tests.

Table 4. Shapiro-Wilk Normality Test

Shapiro-Wilk	Statistics	p
Daylight	0,831	0,277
Artificial Light	0,927	0,135
Outside View	0,949	0,357
Thermal Comfort	0,95	0,369
Environmental Noise and Acoustics	0,945	0,294
Color and Materials	0,900	0,061
Plan Layout	0,941	0,255
Privacy	0,935	0,190
Crowding	0,921	0,102
Personal Space	0,874	0,114
Territoriality	0,936	0,205

5.2.3. Hypothesis Tests

In this section, the hypotheses that were built as research motives are tested by parametric test methods. Independent Sample T-Test, One-Way ANOVA Test, and Pearson Correlation tests were utilized.

Table 5 below shows the results of Independent Sample T-Test results to detect the statistically important differences between the "Bed Placement" and satisfaction scale variables. The findings here point out that, between "Bed Placement" and "Artificial Light" satisfaction, there is a significant difference statistically, and this difference shows that the participants who were placed by the window (17,92±4,25) were more satisfied with the artificial light than the participants who were placed by the wall (11,13±1,25).

Table 5. Bed Placement and Research Scales Average Differences

		X	SD	t	p
Daylight	By the Window	17,92	4,25	1,062	0,302
	By the Wall	16,13	2,59		
Artificial Light	By the Window	14,75	4,05	**2,437**	**0,025**
	By the Wall	11,13	1,25		
Outside View	By the Window	11,42	2,71	1,116	0,279
	By the Wall	10,25	1,39		
Thermal Comfort	By the Window	32,75	7,75	1,537	0,142
	By the Wall	27,88	5,46		
Environmental Noise and Acoustics	By the Window	20,42	6,22	0,581	0,569
	By the Wall	19	3,59		
Color and Material	By the Window	40	13,5	1,615	0,124
	By the Wall	31,88	5,08		
Plan Layout	By the Window	32,42	5,38	1,667	0,113
	By the Wall	28,5	4,75		
Privacy	By the Window	18,58	4,58	0,539	0,596
	By the Wall	17,63	2,45		
Crowding	By the Window	9,17	3,95	0,616	0,645
	By the Wall	8,25	1,67		
Personal Space	By the Window	16,75	5,51	0,491	0,629
	By the Wall	15,75	1,83		
Territoriality	By the Window	15,17	3,93	-0,452	0,657
	By the Wall	15,88	2,47		

Table 6 below presents the One-Way ANOVA test results to determine the statistically important average differences between the variable of "The Reason to Choose This Healthcare Facility" and satisfaction. The findings of this test show that there are no statistically significant average differences between these two parameters (p>0,05).

Table 6. Average Differences Between the Variables of "The Reason to Choose This Healthcare Facility" and Satisfaction Scale

		X	Ss	F	p
Daylight	Recommendation	14,75	0,50	1,228	0,341
	Doctor's advice	17,60	5,27		
	Past experiences	21,00	4,24		
	Credibility of the healthcare staff	18,20	4,09		
	Location of the hospital	16,00	0,00		
Artificial Light	Recommendation	14,75	4,50	0,851	0,515
	Doctor's advice	12,00	2,00		
	Past experiences	16,50	4,95		
	Credibility of the healthcare staff	13,40	4,22		
	Location of the hospital	11,75	3,40		
Outside View	Recommendation	11,75	2,36	0,282	0,885
	Doctor's advice	10,40	1,82		
	Past experiences	12,00	2,83		
	Credibility of the healthcare staff	10,60	2,70		
	Location of the hospital	10,75	2,99		
Thermal Comfort	Recommendation	28,00	9,20	0,611	0,661
	Doctor's advice	31,40	7,13		
	Past experiences	37,50	10,61		
	Credibility of the healthcare staff	29,20	7,26		
	Location of the hospital	31,50	4,65		
Environmental Noise and Acoustics	Recommendation	21,25	5,25	1,466	0,262
	Doctor's advice	16,40	6,07		
	Past experiences	26,00	2,83		
	Credibility of the healthcare staff	20,40	5,03		
	Location of the hospital	19,00	3,56		
Color and Materials	Recommendation	38,50	13,67	0,811	0,538
	Doctor's advice	29,40	8,26		
	Past experiences	44,50	16,26		
	Credibility of the healthcare staff	37,00	13,23		
	Location of the hospital	40,00	9,31		

Table 6 Continued. Average Differences Between the Variables of "The Reason to Choose This Healthcare Facility" and Satisfaction Scale

Plan Layout	Recommendation	32,75	6,24	1,023	0,427
	Doctor's advice	29,8	4,97		
	Past experiences	36	4,24		
	Credibility of the healthcare staff	31	6,44		
	Location of the hospital	27,5	3,32		
Privacy	Recommendation	18,75	4,35	2,512	0,086
	Doctor's advice	17,8	3,11		
	Past experiences	22,5	3,54		
	Credibility of the healthcare staff	19,6	3,51		
	Location of the hospital	14,25	1,71		
Crowding	Recommendation	9,5	3,79	0,977	0,453
	Doctor's advice	6,8	2,17		
	Past experiences	10,5	4,95		
	Credibility of the healthcare staff	10,2	3,11		
	Location of the hospital	8	3,16		
Personal Space	Recommendation	17,5	6,14	0,835	0,524
	Doctor's advice	13,8	2,28		
	Past experiences	19,5	7,78		
	Credibility of the healthcare staff	17,4	4,93		
	Location of the hospital	15,5	1,29		
Territoriality	Recommendation	15,75	3,5	2,014	0,144
	Doctor's advice	17,2	2,95		
	Past experiences	16,5	0,71		
	Credibility of the healthcare staff	12,2	3,11		
	Location of the hospital	16,5	3,11		

Table 7 below presents the One-Way ANOVA test results to determine the statistically significant average differences between the "Duration of Stay" and satisfaction scale variables. Results point out that not only between "Duration of Stay" and "Daylight Satisfaction" is there a statistically significant average difference, but also the "Environmental Noise and Acoustics Satisfaction" scale has a significant difference. The observation of these scales shows that the participants who stayed in the hospital for one week or more have the lowest satisfaction levels.

The participants who stayed in the hospital for three to seven days have the highest satisfaction levels.

Table 7. Average Differences Between the Variables of "Duration of Stay" and Satisfaction Scale

		X	Ss	F	p
Daylight	1-3 Day(s)	17,75	3,58	**3,648**	**0,035**
	3-7 Days	18,25	4,19		
	One Week or More	14,86	1,46		
	One Month or More	25,00	.		
Artificial Light	1-3 Day(s)	14,13	4,45	1,669	0,214
	3-7 Days	15,25	3,59		
	One Week or More	11,00	1,63		
	One Month or More	15,00	.		
Outside View	1-3 Day(s)	12,13	2,36	1,477	0,258
	3-7 Days	10,75	2,50		
	One Week or More	9,71	1,89		
	One Month or More	11,00	.		
Thermal Comfort	1-3 Day(s)	31,63	6,70	1,353	0,293
	3-7 Days	30,50	10,21		
	One Week or More	28,29	5,12		
	One Month or More	43,00	.		
Environmental Noise and Acoustics					
	1-3 Day(s)	22,25	4,80	4,878	0,014
	3-7 Days	22,35	4,65		
	One Week or More	17,43	2,82		
	One Month or More	8,00	.		
Color and Materials	1-3 Day(s)	40,75	13,23	1,514	0,249
	3-7 Days	37,50	12,45		
	One Week or More	34,57	6,58		
	One Month or More	17,00	.		
Plan Layout	1-3 Day(s)	32,75	5,39	1,158	0,356
	3-7 Days	32,00	6,63		
	One Week or More	27,86	4,41		
	One Month or More	32,00	.		
Privacy	1-3 Day(s)	18,63	4,24	1,969	0,161
	3-7 Days	21,00	2,94		
	One Week or More	15,86	2,91		
	One Month or More	20,00	.		
Crowding	1-3 Day(s)	9,88	3,44	0,889	0,468
	3-7 Days	9,50	3,32		
	One Week or More	7,29	2,93		
	One Month or More	8,00	.		

Table 7 Continued. Average Differences Between the Variables of "Duration of Stay" and Satisfaction Scale

Personal Space	1-3 Day(s)	17,13	5,36	0,389	0,762
	3-7 Days	17,50	5,80		
	One Week or More	15,00	2,45		
	One Month or More	15,00	.		
Territoriality	1-3 Day(s)	13,75	3,69	2,355	0,112
	3-7 Days	14,75	2,22		
	One Week or More	17,14	2,54		
	One Month or More	20,00	.		

Table 8 below presents the One-Way ANOVA test results to determine the statistically significant average differences between the variable of "Patients in the Same Room" and the satisfaction scale. Results point out that there are statistically significant average differences between "Patients in the Same Room" and Thermal Comfort, Personal Space, and Territoriality scales. These results show that the participants (patients) who stayed alone in the room have the highest satisfaction rate.

Table 8. Average Differences Between the Variables of "Patients in the Same Room" and Satisfaction Scale

		X	Ss	F	p
Daylight	1	19,67	5,57	3,185	0,067
	2	15,67	1,56		
	3 and more	19,00	2,83		
Artificial Light	1	15,67	4,80	2,179	0,144
	2	12,50	2,78		
	3 and more	11,00	1,41		
Outside View	1	12,67	2,42	3,057	0,073
	2	10,08	1,98		
	3 and more	11,00	1,41		
Thermal Comfort	1	39,50	4,64	**16,522**	**0,000**
	2	27,00	4,41		
	3 and more	27,50	3,54		
Environmental Noise and Acoustics	1	21,83	8,47	0,766	0,483
	2	18,67	3,31		
	3 and more	21,00	1,41		

Table 8 Continued. Average Differences Between the Variables of "Patients in the Same Room" and Satisfaction Scale

Color and Materials	1	44,83	17,03	2,696	0,096
	2	34,00	6,38		
	3 and more	29,00	1,41		
Plan Layout	1	33,33	8,12	0,905	0,423
	2	29,75	3,70		
	3 and more	30,00	4,24		
Privacy	1	20,67	5,16	1,984	0,168
	2	17,08	2,81		
	3 and more	17,50	2,12		
Crowding	1	11,00	4,10	2,512	0,111
	2	7,67	2,31		
	3 and more	9,00	2,83		
Personal Space	1	20,50	4,97	**5,839**	**0,012**
	2	14,58	2,87		
	3 and more	14,50	0,71		
Territoriality	1	18,33	2,07	**4,322**	**0,032**
	2	14,17	3,27		
	3 and more	14,50	2,12		

On the next page, the Pearson Correlation Test results are presented. This test was conducted to find out the relationship between satisfaction scales.

Table 9. Correlation Analysis Between Satisfaction Scales

		Daylight	Artificial Light	Outside View	Thermal Comfort	Env. Noise and Acoustics	Color and Materials	Plan Layout	Privacy	Crowding	Personal Space	Territoriality
Daylight	r	1	0,391	0,352	,627**	0,129	0,179	,542*	,595**	0,402	0,395	0,051
Artificial Light	r		1	,620**	,552*	,545*	,550*	,623**	,674**	,513*	,593**	0,262
Outside View	r			1	,602**	,664**	,676**	,640**	0,444	0,405	,519*	0,268
Thermal Comfort	r				1	0,332	,540*	,501*	,450*	,516*	,506*	0,339
Env. Noise and Acoustics	r					1	,834**	,520*	0,387	,589**	,557*	0,073
Color and Materials	r						1	,571**	0,388	,638**	,670**	0,067
Plan Layout	r							1	,798**	0,440	0,428	0,016
Privacy	r								1	,549*	,645**	0,091
Crowding	r									1	,825**	0,028
Personal Space	r										1	0,265
Territoriality	r											1

*=p>0,05
**=p<0,01

5.2.4. Findings Regarding Users' Satisfaction and Physical Environment of Space

Finding 1: There were significant relationships between Daylight Satisfaction scale and Thermal Comfort (r=0.627, p<0,01), Plan Layout (r=0,542; p<0,05), and Privacy (r=0,595; p<0,01), and these relationships between scales are statistically significant, and indirect proportioned to each other; meaning, when one of these scales are increased, others increase too, and when one of them are decreased, other scales have decreased values too.

Daylight was explained as an architectural tool that affects user behavior and their perception (Reinhart and Selkowitz, 2006). As patients' behavior changes with daylight, their satisfaction level also changes overall. Ulrich (2006) pointed out that daylight in inpatient rooms reduces the symptoms such as pain, aching, and depression. He also points out that daylight improves the levels of serotonin, which is helpful to block physical and psychological pain. Daylight, as a pain-reliever, has influences on patients' behavior and satisfaction. According to this finding, as the patients are happy with the daylight, they are also satisfied with other features of indoor quality.

Finding 2: There were significant relationships between Artificial Light Satisfaction scale and Outside View (r=0.620, p<0,01), Thermal Comfort (r=0,552; p<0,05), Environmental Noise and Acoustics (r=0,545; p<0,05), Colors and Materials (r=0,550; p<0,05), Plan Layout (r=0,623; p<0,01), Privacy (r=0,674; p<0,01), Crowding (r=0,513; p<0,05), and Personal Space (r=0,539; p<0,01). These relationships between scales are statistically highly significant, and in direct proportioned to each other; meaning, when one of these scales are increased, others increase too, and when one of them are decreased, other scales have decreased values too.

When artificial lights were found at first, it was thought that it is disrupting the natural light and its patterns. It is said that they are causing pollution as they enhance mankind's vision at nighttime (Gaston, Visser, and Hölker, 2015). However, when it is correctly used, the results are satisfactory. In this finding, it is found out that when patients are happy with the artificial light, they are also happy with a lot of indoor quality features and the aspects of environmental psychology.

The patients who were satisfied with artificial light were also satisfied with the outside view. It can be said that, as they can enjoy the outside view from their room, their room also gets sufficient amounts of daylight. A combination of daylight and artificial light when needed may result in good outcomes, as found in this finding.

Artificial lights in the patient rooms were efficiently designed and placed so that patients did not suffer from glare, reflection, and blinding effects of the lights from the finishing materials of furniture, floors, walls, and ceilings

The relationship between artificial light satisfaction and the aspects of environmental psychology was surprising, as, in a multi-patient room, it is hard to maintain visual comfort, which might affect the personal space needs and privacy needs of a patient.

Finding 3: There were significant relationships between Outside View Satisfaction scale and Thermal Comfort (r=,0,602; p<0,01), Environmental Noise and Acoustics (r=0,664; p<0,01), Colors and Materials (r=0,676; p<0,01), Plan Layout (r=0,640; p<0,01), and Personal Space (r=0,519; p<0,05). These relationships between scales are statistically highly significant and indirectly proportioned to each other, meaning, when one of these scales is increased, others increase too, and when one of them is decreased, other scales have decreased values.

As Karlin and Zeiss (2006) said that natural elements could also be considered as a positive distraction, which is able to distract a patient from their pain and illness. It is possible that this positive distraction caused the satisfaction of other features of indoor quality. As an example, the patients were ignoring the noise in the hospital when they were enjoying the outside view. Also, the view of sunny weather may invoke a feeling of warmth in patients, which influences their satisfaction with thermal comfort.

This finding also points out that the patients who were outside view were also satisfied with the plan layout, which suggests that their location of the room is well placed and has a satisfactory outside view.

Finding 4: There were significant relationships between Thermal Comfort Satisfaction scale and Colors and Materials (r=0,540; p<0,05), Plan Layout (r=0,501; p<0,05), Privacy (r=0,450; p<0,05), Crowding (r=0,516; p<0,05) and Personal Space

(r=0,506; p<0,05). These relationships between scales are statistically highly significant and indirectly proportioned to each other, meaning, when one of these scales is increased, others increase too, and when one of them is decreased, other scales have decreased values.

Thermal comfort is a tricky subject in healthcare facility design, as human thermal comfort is considered less important than maintaining hygiene and preventing bacterial growth and the spread of any disease. The same study suggests that patients are expecting a warmer environment (Khodakarami and Nasrollahi, 2012). Warm environments, except the dry-bulb temperature, can be maintained from lighting, outside view, finishing materials selection, and the social environment. This may also be called positive distractions, but this finding supports that when patients are satisfied with material finishing and colors, and the plan layout, they are also satisfied with thermal comfort. Also, these patients are satisfied with three of the four aspects of environmental psychology, which are privacy, crowding, and personal space.

Finding 5: There was a highly significant relationship between Environmental Noise and Acoustics Satisfaction scale and Colors and Materials (r=0,834; p<0,01). Also, there were significant correlations between Environmental Noise and Acoustics Satisfaction scale and Plan Layout (r=0,520; p<0,05), Crowding (r=0,589; p<0,01), and Personal Space (r=0,557; p<0,01). These relationships between scales are statistically significant and indirectly proportioned to each other, meaning, when one of these scales is increased, others increase too, and when one of them is decreased, other scales have decreased values.

The statistically highly relationship between environmental noise and acoustics and colors and materials shows that the finishing materials are chosen and applied considering the acoustics of the space. There wasn't any designed soundscape, such as letting natural sounds inside, but still, preventing high pitched noises with high levels in a healthcare facility is challenging, and it was maintained in Dokuz Eylül University Hospital.

This finding also shows that plan layout satisfaction also affects the satisfaction of environmental noise and acoustics. Patients are overall satisfied with the location of their room and low sound permeability, and this shows that patients did not feel

their personal space was invaded and the sounds did not awake the feeling of crowding.

Finding 6: There were significant relationships between Colors and Materials Satisfaction scale and Plan Layout (r=,571; p<0,01), Crowding (r=0,638; p<0,01) and Personal Space (r=0,670; p<0,01). These relationships between scales are statistically highly significant and indirectly proportioned to each other, meaning, when one of these scales is increased, others increase too, and when one of them is decreased, other scales have decreased values.

It is found out that the finishing materials and colors of interior elements, such as walls, floors, and ceilings, and the furniture are handled well in this facility. Patients are overall satisfied, and they do not feel crowded or feel like their personal space was invaded. Küller et al., (2006) presented in their study that moderate color use enhances the mood of the staff. The use of color in this facility was also moderate; patients did not feel the design of their rooms is dull or boring, which enhanced their satisfaction levels.

As Dalke (2006) pointed out in their research, color has an impact on how individuals react to and interpret their surroundings, just like lighting does. Patients' recovery rates are also influenced by color and illumination, which improves their overall hospital experience and life quality. Color not only improves navigation and wayfinding but also boosts the well-being of patients and staff. It's critical to think about the emotional and psychological aspects that can affect one's perception of wellbeing. The most important mission is to make the environment welcoming and friendly for staff, patients, and their visitors and companions. In any environment, the use of color in a subtle way can assist reduce glare, brightness and welcome daylight in. In this case study, participants who were satisfied with the colors and materials of this facility did not experience any problems with wayfinding and dissatisfaction with the plan layout of this facility. Also, the participants did not complain about lighting when they were satisfied with the materials and colors.

Finding 7: There was only one highly significant relationship between the Plan Layout Satisfaction scale and Privacy (r=0,798). This relationship between two scales is statistically highly significant and directly proportional to each other,

meaning, when one scale value is increased, the other value increases too, and when one scale value is decreased, the other scale has decreased value.

Patients were asked if they can find the place they want to go without having the need to ask the staff and the distances between objects in their rooms. It is found out that being able to reach objects in the room or finding their way in the hospital without needing help provides some privacy for the patient.

5.2.5. Findings Regarding Users' Satisfaction and 4 Aspects of Environmental Psychology

Finding 1: There was one highly significant relationship between the Privacy Satisfaction scale and Personal Space ($r=0,645$, $p<0,01$) and one moderately significant relationship between the Privacy Satisfaction scale and Crowding ($r=0,549$; $p<0,01$). These relationships between scales are statistically significant and indirectly proportioned to each other, meaning, when one of these scales is increased, others increase too, and when one of them is decreased, other scales have decreased values.

Privacy and personal space often go hand in hand; the satisfaction levels are also found out that they have a highly significant relationship. The sense of crowding usually disrupts privacy, especially in healthcare facilities; the invasion of privacy is quite common.

Marin, Gasparino, and Puggina (2018) found out in their study that in healthcare facilities, personal space and territory invasion are more common than in a family setting. Nurses or physicians may need to touch the patient, and in some situations, the patient may be naked, which is generally uncomfortable and embarrassing and can make the patient feel exposed and vulnerable. Since physical examinations have become ingrained in medical professionals' routines, they may neglect to ask before touching or knock on the door before entering the patient's room. This type of intrusion may increase anxiety and discomfort, lowering recovery rates and negatively impacting overall well-being (Allekian, 1974). In this case study, the participants did not feel invaded most of the time, and thus they did not feel anxious or uncomfortable, and their recovery rate was higher.

Finding 2: There was only one highly significant relationship between the Crowding Satisfaction scale and Personal Space (0,825; p<0,01). This relationship between two scales is statistically highly significant and directly proportional to each other, meaning, when one scale value is increased, the other value increases too, and when one scale value is decreased, the other scale has decreased value.

Kopec (2006) points out that crowding is a relative, personal, and significantly subjective construct. Especially the invasion of privacy may certainly awake the feeling of crowding. He also points out that when the population density is excessive, crowding causes stress because the person feels out of control of their environment and is unable to act consciously to achieve his goals. The sense of crowding may range from one individual to another, depending on their notion of control over their surroundings. In this case study, participants did not feel crowded in their rooms, even though they are sharing them with other patients. The furniture and bed placements between patients were also helpful, as their interpersonal zones were not invaded, they did not feel crowding.

5.3. Discussion

Patients who were satisfied with any of the indoor quality assets, which are lighting, outside view, thermal comfort, and acoustics, were also satisfied with other indoor quality assets and the four aspects of environmental psychology, namely, privacy, crowding, personal space, and territoriality. Environmental psychology and indoor quality satisfaction are inseparable topics of interior design, and they should always be considered in the process of design. Especially in healthcare buildings, improvement of patient psychology with the help of indoor quality and interior design results in a better recovery rate and wellbeing of the patients, which means the patients may be discharged sooner than expected.

One of the most promising factors of indoor quality was lighting, both daylight and artificial light. Daylight affects the user behavior, and their behavior change affects their satisfaction level of indoor quality overall. Daylight is also a helpful architectural tool in healthcare facilities, which can reduce pain and ache in patients. The fact that daylight also has the influence of regulating hormone, vitamin, and serotonin levels, it is able to block physical and psychological aching. It is a natural pain reliever that has the power of influencing the behavior and satisfaction of the

users. As shown in Finding 1, patients who were satisfied with the daylight were also satisfied with thermal comfort, plan layout, and privacy.

Artificial light could be problematic when designed poorly and not parallel with furniture and finishing materials. However, when it is designed considering all the factors such as glaring and reflecting, the results are highly satisfactory. In this study, it is found out that the patients who were satisfied with artificial light were also satisfied with a lot of indoor quality assets and three of the environmental psychology aspects. They were also happy with the outside view, thermal comfort, environmental noise and acoustics, colors and materials, plan layout, privacy, crowding, and personal space. The satisfaction correlation between indoor quality assets was expected; however, the relationship between artificial light and the aspects of environmental psychology was surprising, as it is hard to maintain visual comfort in multi-patient rooms, and it could result in personal space and privacy invasion of a patient.

Outside view findings show that the patients who were satisfied with the outside view were also satisfied with thermal comfort, acoustics, colors and materials, plan layout, and personal space. It is believed that as the outside view can be considered as a positive distraction (Karlin and Zeiss, 2006), the patients might be distracted from the bad sides of their healing process, and that resulted in overall satisfaction.

Patients who were able to experience outside view were placed in the beds by the windows. Other patients whose beds were placed by the wall might not be satisfied with their privacy, personal space, and crowding, as the visitors of other patients located by the window or the healthcare staff have to pass through their designated space. It is believed that this result may show the relationship between outside view satisfaction and environmental psychology aspects satisfaction and why they are directly proportional.

The satisfaction of thermal comfort of patients is generally tricky in healthcare facilities, as the air-bulb temperature should not be so warm that bacterial growth and disease spread would not increase. It is believed that designing warm environments, with the help of moderate color use, may result in thermal comfort as well. As

finding 4 suggests, those who were satisfied with thermal comfort were also satisfied with colors and materials, which is supporting this idea.

Patients who were satisfied with thermal comfort, besides colors and materials, were also satisfied with plan layout, privacy, crowding, and personal space.

The relationship between environmental noise and acoustics, and colors and materials, which was discovered and explained in Finding 5, reveals that the finishing materials are chosen and applied considering the acoustical needs of the facility. Although there was no specifically intended soundscape, such as allowing natural sounds inside, suppressing high-pitched noises at high levels in a healthcare facility is difficult, and it was maintained in Dokuz Eylül University Hospital. Additionally, there are relationships between acoustical satisfaction and plan layout, crowding, and personal space. This finding shows us that noises from other sources do not affect the patient's auditory personal space, and it does not cause crowding. It is believed that the satisfaction of plan layout is also caused by these results.

The patients who were satisfied with the colors and materials of the surfaces and furniture were also satisfied with the plan layout, crowding, and personal space. This finding shows similar results with the finding of environmental noise and acoustics. The color use in the facility was moderate and subtle, so it did not feel either crowding or boring; thus, their satisfaction levels of indoor quality assets are increased in direct proportion.

Plan layout satisfaction was only correlated with privacy satisfaction. This finding shows us that the furniture placements and room locations are designed well, and they did not cause any trouble for patients.

It was found out that almost all the indoor quality assets were related and satisfactory in parallel with each other. When the satisfaction levels increase in only one asset, the others participate in this increase as well and resulting in overall satisfaction. Patients who were most satisfied with the indoor quality and environmental psychology were healing faster.

In the aspects of environmental psychology, only the scale of territorial satisfaction did not show satisfactory results in this study. It is believed that the concept of territoriality might be unusual for the participants of the study.

Patients who were satisfied with privacy were also satisfied with two other aspects of the environmental psychology aspects, namely, personal space and crowding. The relationship between privacy and personal space was higher than crowding, which was an expected result.

Individuals' perceptions of crowding may differ depending on their sense of control over their environment. Participants in this case study did not feel crowded in their rooms, despite sharing them with other patients. The arrangement of furniture and beds between patients was also beneficial, as their personal space was not violated, and they did not feel crowded.

5.4. Design Suggestion

In Figure 11, the design of a hospital room was suggested according to the minimum dimensions defined by the Ministry of Health of Turkey. In two patient rooms, both of the beds can be placed by the window to benefit the daylight and outside view equally. However, the windows should be bigger as much as possible to get most of the daylight and outside view, as the patients stay in bed for most of their time in the hospital.

The TV can be placed on the exterior wall of the restroom. Between beds, a separator or a curtain can be placed, which will maintain privacy between patients. It will still be possible to watch TV together when the divider is closed, and both of the patients can still benefit from the daylight and outside view at the same time.

As the patient beds are placed closer to the window and further from the hallway, the noise control between the circulation area and the patients will be maintained, which will result in acoustical satisfaction. Also, thermal comfort can be maintained better when both of the patients are placed by the window. The ventilation and air conditioner can be placed, considering both the airflow leaking from the windows and the patients together.

The colors should be decided according to the department of the rooms. Colors affect psychology directly, and they may cause unwanted results. As Porter and Mikellides (1976) suggested, cold colors and warm colors have different effects, such as sedative and soothing, and stimulating. Suicidal patients may require more

dynamic colors, which are mostly warm colors; however, patients who suffer from physical pain may require soothing colors, which are the blue-green group colors.

Finishing materials of surfaces and furniture should be decided according to most of the indoor quality assets. They should not cause glare and blinding by reflection; they should not disrupt thermal comfort (such as materials like leather may cause sweat); they should not reflect or transmit sounds directly. On the selection of materials, it is important to pick the most convenient materials in terms of cleaning and hygiene. Healthcare facilities encapsulate many types of bacteria, germs, and diseases, and patients must be protected from other types of diseases during their healing process.

As the divider is closed, there will be less feeling of crowding between patients. The visitors will not entirely disrupt the other patient's privacy when they are visiting their patient. Better design can be maintained if the door could be centered, but it is not possible with considering the wheelchair movement in the room, especially in the restroom.

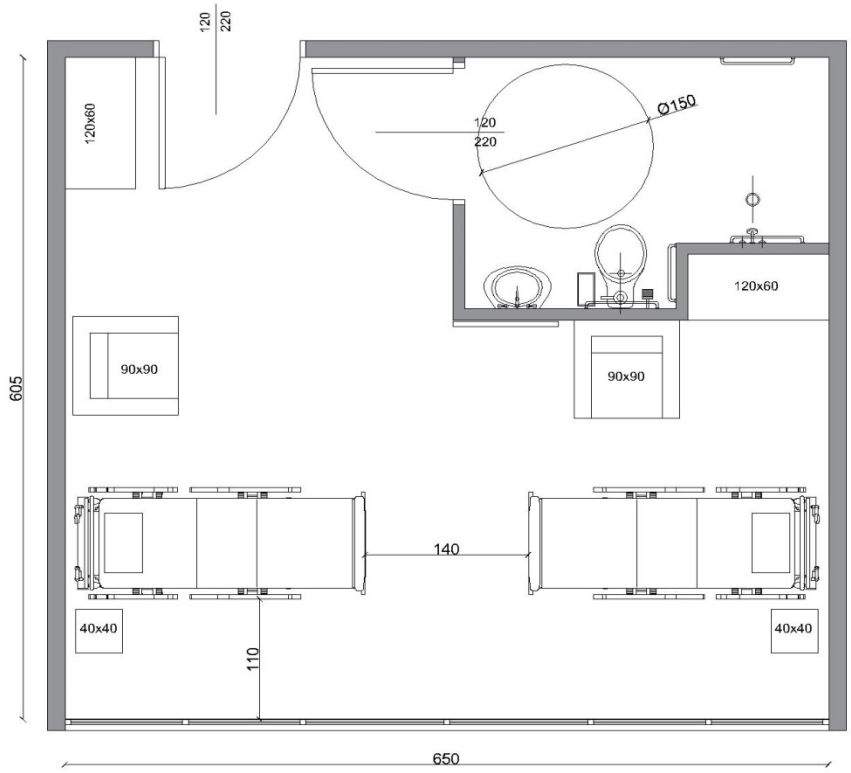
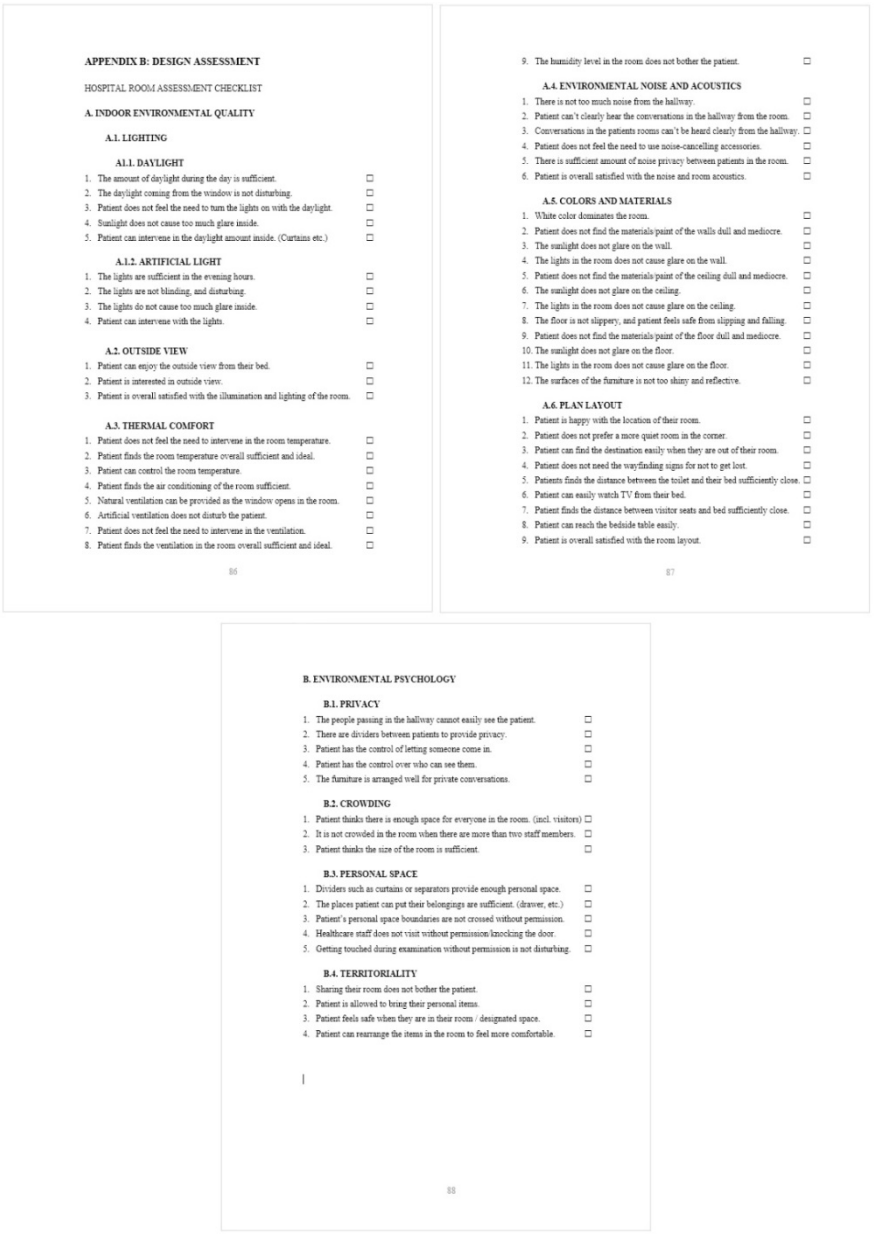


Figure 11. Design suggestion for patient rooms for daylight benefit. Drawn by the author.

Placing patient beds face to face may also result in better socializing between patients. In the traditional two-bedded patient rooms, the beds are placed side by side, which will require turning around to socialize. Considering the health problems of patients, not all of them would be capable of turning their heads or bodies.

An assessment for hospital room design is suggested regarding to the conducted questionnaire to assess the existing hospital room and its affects on patients. The assessment is designed as a checklist; any checked article shows that the patient is satisfied on that article.



APPENDIX B: DESIGN ASSESSMENT

HOSPITAL ROOM ASSESSMENT CHECKLIST

A. INDOOR ENVIRONMENTAL QUALITY

A.1. LIGHTING

A1.1. DAYLIGHT

1. The amount of daylight during the day is sufficient. ☐
2. The daylight coming from the window is not disturbing. ☐
3. Patient does not feel the need to turn the lights on with the daylight. ☐
4. Sunlight does not cause too much glare inside. ☐
5. Patient can intervene in the daylight amount inside. (Curtains etc.) ☐

A.1.2. ARTIFICIAL LIGHT

1. The lights are sufficient in the evening hours. ☐
2. The lights are not blinding, and disturbing. ☐
3. The lights do not cause too much glare inside. ☐
4. Patient can intervene with the lights. ☐

A.2. OUTSIDE VIEW

1. Patient can enjoy the outside view from their bed. ☐
2. Patient is interested in outside view. ☐
3. Patient is overall satisfied with the illumination and lighting of the room. ☐

A.3. THERMAL COMFORT

1. Patient does not feel the need to intervene in the room temperature. ☐
2. Patient finds the room temperature overall sufficient and ideal. ☐
3. Patient can control the room temperature. ☐
4. Patient finds the air conditioning of the room sufficient. ☐
5. Natural ventilation can be provided as the window opens in the room. ☐
6. Artificial ventilation does not disturb the patient. ☐
7. Patient does not feel the need to intervene in the ventilation. ☐
8. Patient finds the ventilation in the room overall sufficient and ideal. ☐

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9. The humidity level in the room does not bother the patient. ☐

A.4. ENVIRONMENTAL NOISE AND ACOUSTICS

1. There is not too much noise from the hallway. ☐
2. Patient can't clearly hear the conversations in the hallway from the room. ☐
3. Conversations in the patients rooms can't be heard clearly from the hallway. ☐
4. Patient does not feel the need to use noise-cancelling accessories. ☐
5. There is sufficient amount of noise privacy between patients in the room. ☐
6. Patient is overall satisfied with the noise and room acoustics. ☐

A.5. COLORS AND MATERIALS

1. White color dominates the room. ☐
2. Patient does not find the materials/paint of the walls dull and mediocre. ☐
3. The sunlight does not glare on the wall. ☐
4. The lights in the room does not cause glare on the wall. ☐
5. Patient does not find the materials/paint of the ceiling dull and mediocre. ☐
6. The sunlight does not glare on the ceiling. ☐
7. The lights in the room does not cause glare on the ceiling. ☐
8. The floor is not slippery, and patient feels safe from slipping and falling. ☐
9. Patient does not find the materials/paint of the floor dull and mediocre. ☐
10. The sunlight does not glare on the floor. ☐
11. The lights in the room does not cause glare on the floor. ☐
12. The surfaces of the furniture is not too shiny and reflective. ☐

A.6. PLAN LAYOUT

1. Patient is happy with the location of their room. ☐
2. Patient does not prefer a more quiet room in the corner. ☐
3. Patient can find the destination easily when they are out of their room. ☐
4. Patient does not need the wayfinding signs for not to get lost. ☐
5. Patients finds the distance between the toilet and their bed sufficiently close. ☐
6. Patient can easily watch TV from their bed. ☐
7. Patient finds the distance between visitor seats and bed sufficiently close. ☐
8. Patient can reach the bedside table easily. ☐
9. Patient is overall satisfied with the room layout. ☐

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B. ENVIRONMENTAL PSYCHOLOGY

B.1. PRIVACY

1. The people passing in the hallway cannot easily see the patient. ☐
2. There are dividers between patients to provide privacy. ☐
3. Patient has the control of letting someone come in. ☐
4. Patient has the control over who can see them. ☐
5. The furniture is arranged well for private conversations. ☐

B.2. CROWDING

1. Patient thinks there is enough space for everyone in the room. (incl. visitors) ☐
2. It is not crowded in the room when there are more than two staff members. ☐
3. Patient thinks the size of the room is sufficient. ☐

B.3. PERSONAL SPACE

1. Dividers such as curtains or separators provide enough personal space. ☐
2. The places patient can put their belongings are sufficient. (drawer, etc.) ☐
3. Patient's personal space boundaries are not crossed without permission. ☐
4. Healthcare staff does not visit without permission/knocking the door. ☐
5. Getting touched during examination without permission is not disturbing. ☐

B.4. TERRITORIALITY

1. Sharing their room does not bother the patient. ☐
2. Patient is allowed to bring their personal items. ☐
3. Patient feels safe when they are in their room / designated space. ☐
4. Patient can rearrange the items in the room to feel more comfortable. ☐

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Figure 12. A Layout of Hospital Design Room Assesment

CHAPTER 6: CONCLUSION

This chapter comprises the conclusion part of the thesis. It also discusses the future research recommendations for the researchers and gives a set of design guidelines for the hospital rooms for the designers and the limitations that could not be controlled during the data collection.

This study is conducted to investigate the effects of the healthcare facility design and environment on bedded patients' satisfaction levels and recovery rate. A questionnaire was conducted on the bedded patients to explore their satisfaction levels within indoor quality, physical environment, and the aspects of environmental psychology. According to the findings of this study, indoor quality satisfaction, physical environment satisfaction, and the four aspects of environmental psychology are related to each other in direct proportion. This means, when indoor quality satisfaction is low, the physical environment is also unsatisfactory, and this affects patients' psychology and recovery rate.

Most of the problems that were encountered were caused by the Covid-19 pandemic outburst during the study. Dokuz Eylül University Hospital was turned into a pandemic clinic and hospital; therefore, the study had become challenging. As Covid-19 precautions, taking photos or videos were not allowed inside, the permissions were delayed multiple times. The case study was planned to involve an observation part, but it was not allowed as it was risky to stay indoors, especially in a pandemic hospital.

The sample group was limited to twenty people, as the case study was limited to only one department of the hospital because of the pandemic. As having the low number sample group, the role of age and gender was not taken into consideration, and the focus was made on satisfaction. This research can be conducted after Covid-19 ends, with a bigger sample group and considering age and gender in the future. After Covid-19 ends, the researchers will possibly be allowed to take photos or record videos by permission, and the permissions should be easier to get.

Another limitation is that the study was conducted only in spring. In the future, the study can be conducted for a longer time frame to include different seasons to find out the role of daylight deeper.

The study may expand with the comparison of two different hospitals. Especially in private hospitals, it is believed that satisfaction level and recovery rate would be higher than Dokuz Eylül University Hospital. Future research may reveal the difference between satisfaction levels of two hospitals, one is private, and the other is a public or university hospital.

The findings of daylight were presenting the most prominent leads on the interior design of the healthcare facility. Patients who were satisfied with the daylight were also satisfied with the outside view, thermal comfort, their privacy needs, and the plan layout. Interior designers should consider placing the beds as closely as possible to the window for patients to enjoy the daylight and the outside view. Especially outside view is considered as positive distractions, it is believed that the need for painkillers may be lowered. On the questionnaire's last question, the most checked designs were always included windows. Therefore, it shows that patients prefer daylight and want to stay in a room with a window. In Figure 11, a room plan was drawn by the researcher, which is suggesting a new plan layout for hospital rooms with two beds for benefitting the most of daylight and outside view. Furthermore, the same plan also suggests some solutions in terms of the four aspects of environmental psychology as well.

The assets of interior design and its effects on behavior and psychology have been widely studied in the open-office environment on user satisfaction and work efficiency. However, interior design within hospital environments and its effects on patients should be researched more. The significance of the environment and its influence on healing and well-being affects not only the patients but also it will reflect on the healthcare staff. It is important to understand how much design impacts well-being and how to improve the design by considering the patient psychology within the walls of a healthcare facility.

The significance of this study is to understand the effects of interior design and indoor quality on the healing process and recovery time. Therefore, this research will benefit the hospital management, architects, and interior designers. Other design disciplines may also take advantage of this research for designing healthcare facilities, such as graphic design and visual communications design, as they play a

major role in designing wayfinding images and artworks that are placed in the hallways and patient rooms.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

SATISFACTION QUESTIONNAIRE FOR BEDDED PATIENTS IN DOKUZ EYLÜL UNIVERSITY HOSPITAL

I study the role of interior space and the Environmental satisfaction of bedded patients in healthcare facilities as the master's student of Design Studies Programme in Izmir University of Economics.

The aim of my study is to improve the understanding of healthcare facility design, to design an environment that will increase the satisfaction of bedded patients, and to lead the designers also design accordingly. With your participation and contribution, this study will help improving forward healthcare facility designs.

The participation of the survey is voluntary. The results of the research will only be used for scientific purposes, and your personal information are confidential.

Thank you in advance for your help and contribution.

Damla Ertoy

Izmir University of Economics Graduate School

Date / Time:

Room Number:

Age:

X1. Bed Placement:

☐ By the window (1)

☐ By the wall (2)

Z1. Why did you choose Dokuz Eylül University Hospital? (You may check off more than one option.)

- ☐ Recommendation (1)
- ☐ Doctor's advice (2)
- ☐ Past experiences (3)
- ☐ Credibility of the healthcare staff (4)
- ☐ Location of the Hospital (5)
- ☐ Fees (6)
- ☐ Other (7)

Z2. How long have you been staying in this hospital?

☐ 1-3 day(s) (1) ☐ 3-7 days (2)

☐ One week or more (3) ☐ One month or more (4)

Z3. How many patients are staying in your room, <u>including yourselves?</u>

☐ 1 (1) ☐ 2 (2) ☐ 3 and above (3)

Questions that are asked in this section aim to define your satisfaction levels. Please mark your answer as shown.

1	2	3	4	5
☒	☐	☐	☐	☐

Comments:

1: I strongly disagree 2: I disagree 3: I do not know 4: I agree 5: I strongly agree

I. INDOOR ENVIRONMENTAL QUALITY

A. DAYLIGHT

A1. The amount of daylight during the day is sufficient.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

A2. The daylight coming from the window hits me directly in my eyes, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

A3. I feel the need to turn the (artificial) lights on with the daylight.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

A4. Sunlight causes too much glare inside.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

A5. I can intervene in the daylight amount inside. (Curtains etc.)

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

B. ARTIFICIAL LIGHT

B1. The lights are insufficient in the evening hours.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

B2. The lights are blinding, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

B3. The lights cause too much glare inside.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

B4.I can intervene with the lights.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

C. OUTSIDE VIEW

C1. I can enjoy the outside view from my bed.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

C2. The outside view does not interest me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

C3. I am overall satisfied with the illumination and lighting of the room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D. THERMAL COMFORT

D1. I do not feel the need to intervene in the room temperature.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D2. I find the room temperature overall sufficient and ideal.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D3. I can control the room temperature.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D4. I find the air conditioning of the room sufficient. I can turn it into warm when I am cold and into cold when I am hot.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D5. Natural ventilation can be provided as the window opens in the room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D6. Artificial ventilation disturbs me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D7. I do not feel the need to intervene in the ventilation.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D8. I find the ventilation in the room overall sufficient and ideal.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

D9. The humidity level in the room does not bother me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E. ENVIRONMENTAL NOISE AND ACOUSTICS

E1. There is too much noise from the hallway.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E2. I can clearly hear the conversations in the hallway from my room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E3. Conversations in the patient rooms can be heard clearly from the hallway.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E4. Most of the time, I feel the need to use noise-canceling headphones or earplugs.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E5. There is no noise privacy between other patients in the room and me. We can clearly hear what others talk about, and it is not possible to have any private conversation.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

E6. I am overall satisfied with the noise and room acoustics.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F. COLORS AND MATERIALS

F1. White color dominates the room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F2. I find the materials and/or paint of the walls dull and mediocre.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F3. The sunlight glares too much on the wall, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F4. The lights in the room are causing glare on the wall, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F5. I find the materials and/or paint of the ceiling dull and mediocre.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F6. The sunlight glares too much on the ceiling, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F7. The lights in the room are causing glare on the ceiling, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F8. The floor is too slippery. I do not feel safe when I walk, and I am afraid I may fall.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F9. I find the materials and/or paint of the floor dull and mediocre.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F10. The sunlight glares too much on the floor, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F11. The lights in the room are causing glare on the floor, and it is disturbing.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

F12. The surfaces of the furniture are too shiny, and they reflect light in the room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G. PLAN LAYOUT

G1. I am happy with the location of my room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G2. I think the location of my room is too central, and I would prefer a more quiet room in the corner.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G3. I can find the place I want to go to easily when I am out of my room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G4. I need to see the wayfinding signs in the hospital; otherwise, I think I will get lost.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G5. I find the distance between the toilet and my bed is sufficiently close.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G6. I can easily watch the TV from my bed.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G7. I find the distance between the seating for visitors and my bed is sufficiently close.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G8. I can reach the bedside table easily.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

G9. I am overall satisfied with the room layout.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

II. ENVIRONMENTAL PSYCHOLOGY

H. PRIVACY

H1. The people passing in the hallway can easily see me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

H2. There are dividers between other patients to provide privacy and me. (Curtains, separator, etc.)

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

H3. I think I have the control of letting someone come in. I do not have any difficulties pointing out that I do not have to let everyone in my room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

H4. I think I have control over who can see me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

H5. The furniture is arranged well for private conversations.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

I. CROWDING

I1. I do not think there is enough space for everyone when there are visitors in the room.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

I2.It is crowded in the room when there is more than two healthcare staff.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

I3.I think the size of the room is not sufficient.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

J. PERSONAL SPACE

J1. Dividers such as curtains or separators provide enough personal space.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

J2. The places I can put my belongings are sufficient. (Wardrobe, drawer, etc.)

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

J3. The boundary of my personal space is not crossed unless I give permission so that I can feel safe.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

J4. Healthcare staff comes in unexpectedly without knocking on the door. Even though I know their intentions are not bad, it still disturbs me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

J5. It disturbs me to be touched by the healthcare staff for any reason without permission.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

K. TERRITORIALITY

K1. Sharing my room does not bother me.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

K2. I am allowed to bring my personal items, such as a blanket, pictures, etc. so that I feel I belong here more.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

K3. I feel safe when I am in my room / in my designated space.

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

K4. I can rearrange the items in the room to make myself more comfortable.

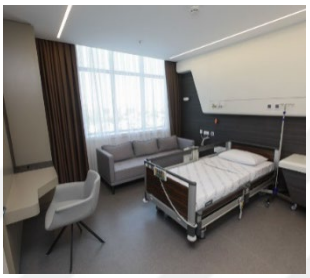
1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

L1.Which room is designed well? (You may check multiple items.)

☐

☐



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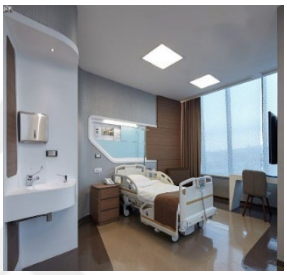

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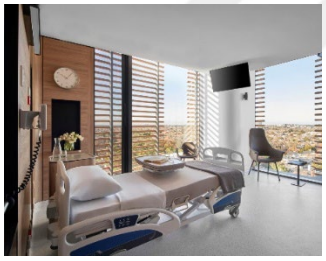

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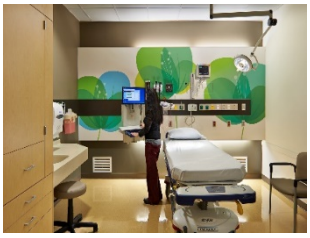

APPENDIX B: DESIGN ASSESSMENT

HOSPITAL ROOM ASSESSMENT CHECKLIST

A. INDOOR ENVIRONMENTAL QUALITY

A.1. LIGHTING

A1.1. DAYLIGHT

1. The amount of daylight during the day is sufficient. ☐
2. The daylight coming from the window is not disturbing. ☐
3. Patient does not feel the need to turn the lights on with the daylight. ☐
4. Sunlight does not cause too much glare inside. ☐
5. Patient can intervene in the daylight amount inside. (Curtains etc.) ☐

A.1.2. ARTIFICIAL LIGHT

1. The lights are sufficient in the evening hours. ☐
2. The lights are not blinding, and disturbing. ☐
3. The lights do not cause too much glare inside. ☐
4. Patient can intervene with the lights. ☐

A.2. OUTSIDE VIEW

1. Patient can enjoy the outside view from their bed. ☐
2. Patient is interested in outside view. ☐
3. Patient is overall satisfied with the illumination and lighting of the room. ☐

A.3. THERMAL COMFORT

1. Patient does not feel the need to intervene in the room temperature. ☐
2. Patient finds the room temperature overall sufficient and ideal. ☐
3. Patient can control the room temperature. ☐
4. Patient finds the air conditioning of the room sufficient. ☐
5. Natural ventilation can be provided as the window opens in the room. ☐
6. Artificial ventilation does not disturb the patient. ☐
7. Patient does not feel the need to intervene in the ventilation. ☐
8. Patient finds the ventilation in the room overall sufficient and ideal. ☐

9. The humidity level in the room does not bother the patient. ☐

A.4. ENVIRONMENTAL NOISE AND ACOUSTICS

1. There is not too much noise from the hallway. ☐
2. Patient can't clearly hear the conversations in the hallway from the room. ☐
3. Conversations in the patients rooms can't be heard clearly from the hallway. ☐
4. Patient does not feel the need to use noise-cancelling accessories. ☐
5. There is sufficient amount of noise privacy between patients in the room. ☐
6. Patient is overall satisfied with the noise and room acoustics. ☐

A.5. COLORS AND MATERIALS

1. White color dominates the room. ☐
2. Patient does not find the materials/paint of the walls dull and mediocre. ☐
3. The sunlight does not glare on the wall. ☐
4. The lights in the room does not cause glare on the wall. ☐
5. Patient does not find the materials/paint of the ceiling dull and mediocre. ☐
6. The sunlight does not glare on the ceiling. ☐
7. The lights in the room does not cause glare on the ceiling. ☐
8. The floor is not slippery, and patient feels safe from slipping and falling. ☐
9. Patient does not find the materials/paint of the floor dull and mediocre. ☐
10. The sunlight does not glare on the floor. ☐
11. The lights in the room does not cause glare on the floor. ☐
12. The surface of the furniture is not too shiny and reflective. ☐

A.6. PLAN LAYOUT

1. Patient is happy with the location of their room. ☐
2. Patient does not prefer a more quiet room in the corner. ☐
3. Patient can find the destination easily when they are out of their room. ☐
4. Patient does not need the wayfinding signs for not to get lost. ☐
5. Patients finds the distance between the toilet and their bed sufficiently close. ☐
6. Patient can easily watch TV from their bed. ☐
7. Patient finds the distance between visitor seats and bed sufficiently close. ☐
8. Patient can reach the bedside table easily. ☐
9. Patient is overall satisfied with the room layout. ☐

B. ENVIRONMENTAL PSYCHOLOGY

B.1. PRIVACY

1. The people passing in the hallway cannot easily see the patient. ☐
2. There are dividers between patients to provide privacy. ☐
3. Patient has the control of letting someone come in. ☐
4. Patient has the control over who can see them. ☐
5. The furniture is arranged well for private conversations. ☐

B.2. CROWDING

1. Patient thinks there is enough space for everyone in the room. (incl. visitors) ☐
2. It is not crowded in the room when there are more than two staff members. ☐
3. Patient thinks the size of the room is sufficient. ☐

B.3. PERSONAL SPACE

1. Dividers such as curtains or separators provide enough personal space. ☐
2. The places patient can put their belongings are sufficient. (drawer, etc.) ☐
3. Patient's personal space boundaries are not crossed without permission. ☐
4. Healthcare staff does not visit without permission/knocking the door. ☐
5. Getting touched during examination without permission is not disturbing. ☐

B.4. TERRITORIALITY

1. Sharing their room does not bother the patient. ☐
2. Patient is allowed to bring their personal items. ☐
3. Patient feels safe when they are in their room / designated space. ☐
4. Patient can rearrange the items in the room to feel more comfortable. ☐