




# Understanding the interplay of light, color, and interior design in healthcare spaces

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## Abstract

Healthcare facilities have evolved from strictly functional to therapeutic places, integrating spiritual and psychological components of health. Design issues must be given specific attention to establish a therapeutic atmosphere that promotes successful therapy and stress alleviation. Color and light have a tremendous influence on the human mind and body, according to extensive studies, making them critical aspects of healthcare facility design. This study's approach is to contribute to the construction of more effective therapeutic settings by investigating the effects of color and light on human wellness and providing design alternatives. So, it tries to provide a complete design paradigm that combines the strategic use of color and light in healthcare facility interior design. Because healthcare institutions play an important role in improving general well-being, this approach can help to create more effective healing settings. To provide the theoretical framework and collect data, this study uses a combination of library studies and descriptive research. The research initially investigates the notion of color and light, then explains their impact on physical and mental health disorders, as well as their use in therapeutic settings. The study concludes with the creation of a conceptual model and recommended design solutions for healthcare facilities.

*Keywords:* color, healing, healthcare spaces, interior design, light

## 1. Introduction

Hospitals, clinics, and health centers serve to treat patients and improve the health of the community. Therefore, the spatial and functional characteristics of health facilities as permanently accessible spaces need to be considered in their design. In most cases, such centers have been assessed from a functional point of view or in terms of health and pollution. However, factors such as user satisfaction, perception and visual aspects and their impact on patient behavior also need to be considered. The lack of attention to interior design, especially in therapeutic spaces, is striking for several reasons. Interior design plays a crucial role in the process of treatment and recovery of patients in health centers. The results show that healthcare environments influence people's physical and mental health, the treatment process and patients' recovery (Agom et al. 2022; Bernhardt et al. 2021; Elf et al. 2020; Huisman et al. 2012); Evidence on the healing role of hospitals also shows that environmental factors improve patient and staff performance through clinical practices (Lukasik et al. 2022; Brambilla et al. 2020; Konstantzos, 2020; Fadda, 2019; Laursen et al. 2014; Lipkin, 2012). light and color are considered environmental features that have been shown to have a positive impact on the health of hospital patients (Kakitsuba, 2020; Leccese et al. 2017; Kakitsuba, 2015; Hassan et al. 2020; Boubekri, 2014; Rikard, 2006). Studies have shown that the proper use of color in hospitals and healthcare environments promotes mental concentration and enhances feelings of relaxation. For instance, Lindahl et al. (2020) concluded that light and color in

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the physical care environment are perceived as psychologically supportive from the users' perspective. García-Rosales et al. (2018) emphasized the significant role of factors such as light and color in promoting well-being, establishing the visual relationship between outdoor and indoor spaces, orientation, and comfort in movements within hospitals, and rest for users. Mehrotra et al. (2015) have shown that in a multifunctional environment inhabited by a variety of people, such as the treatment rooms of a hospital, the design of the lighting system plays an important role in the comfort of patients, the critical visual requirements of hospital staff, and the comfort and visual needs of visitors.

In general, light plays a very important role in human visual activities and reduces depression, decreases fatigue, and improves alertness. Color and light have a natural power and effect that can affect the soul and spirit of man. One of the most important aspects of creating a healing environment through architecture is the proper use of light and color. In this respect, the hospital is an architectural phenomenon in which color and light can be used as two factors influencing patients. It is expected that appropriate hospital interior design will help patients recover quickly and provide a better sense of space for patients and hospital staff. The present study aims to provide a conceptual framework for the interior design of hospitals and healing environments by reviewing previous research and carefully examining the properties of light and color and their effects on users and the perception of architectural space. In this respect, the study attempts to answer the following questions:

1. From what aspects can the biological effects of color and light be investigated in terms of accelerating patient recovery and their use in the interior design of healthcare environments?
2. What solutions can be offered using color and light for the interior design of healthcare facilities?

## 2. Research Methods

Current research is qualitative and application oriented. So, in accordance with the purposes of the study, to explain the interplay of light, color, and interior design in designing healthcare spaces, the descriptive-analytical research method was used. In this regard, three steps were taken. To delineate the theoretical framework of the study, the first step was to review the studies and theories (desk review) on the significance and impact of light and color in architectural design, especially in the interior design of healthcare spaces. Secondly, the results obtained were categorized based on the physical and spiritual properties of light and color. Then, using descriptive and analytical methods and evaluating the effects of these properties on users, architectural design approaches were proposed. In this step, Using the Delphi technique, an open-ended questionnaire was created based on the components derived from the literature review, and the author asked the appropriate questions in the form of an interview with three separate groups of experts (Table 1). The first group consisted of five architects and seven interior designers from design firms. The second group consisted of four doctors (intensivist: N=1, cardiologist: N=1, general practitioner: N=1, pediatrician: N=1) and four nurses from public and private institutions. The third group consisted of four psychologists, who are scientists concerned with the psychological effects of the environment on humans.

**Table 1** The statistical population of study.

Participant	N	Gender		Education
		Women	Men	
Architect	5	3	2	Ph.D.
Interior Designer	7	4	3	5 Masters & 2 Ph.D.
intensivist	1	-	1	Doctorate
cardiologist	1	-	1	Doctorate
general practitioner	1	1	-	Doctorate
pediatrician	1	1	-	Doctorate
Nurse	4	2	2	Bachelor
Psychologist	4	2	2	Ph.D.

Generally, several steps were done to check the validity and reliability of the data. One was to examine the studies conducted by previous researchers to code the data and the conceptual model of the research is the result of examining and analyzing the results obtained from their studies. It is worth noting that the selection of participants is one of the most important components of Delphi technique. This is because the basis of this method will be the expert opinions of the participants. There is no clear rule for a sufficient number of samples, and their number varies depending on the situation. Often, the number of participants is less than fifty, and more than fifteen to twenty is sufficient (Hasson & Keeney, 2011). For this purpose, the results were shared with twenty-four experts in related fields. In this way, the researcher could be sure that the results obtained from the theoretical basis would be confirmed by the experts. At the last step, after the systematic collection of data, the conceptual framework of the study was presented in the form of a comprehensive model, and it was proposed to use light and color aspects in the interior design of therapeutic spaces.

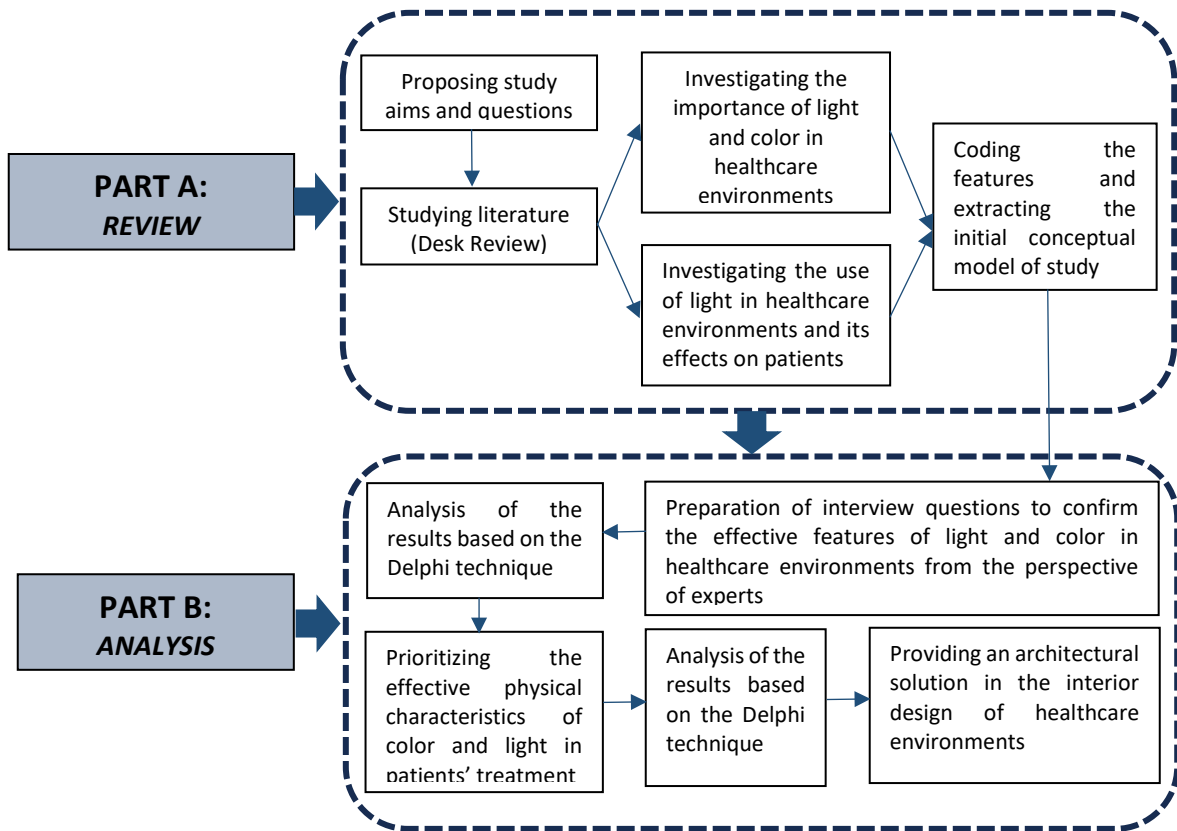


Diagram 1 Research's conducting process (Author).

### 3. Theoretical Framework

#### 3.1. The importance of light in healthcare environments

Light is one of the most important and significant environmental factors. Research has shown that light influences hormonal rhythms, the balance of metabolism and the control of bodily functions (Barati and Barati, 2005). The psychological and behavioral system of man has evolved over time, and all these changes have been influenced by sunlight, to which the light-sensitive and light-regulated organs have adapted (Chen et al. 2022; Tomassoni et al. 2015; So & Leung, 2011). In this context, light therapy (heliotherapy) involves exposure to daylight or specific wavelengths of light, using lasers, light emitting diodes, fluorescent lamps, dichronic lamps or very bright lamps, full spectrum light, controlled by various devices. As a rule, the light is prescribed for a certain period of time and at a certain time of day. On the other hand, daylighting is a process that goes

beyond creating suitable conditions for seeing objects. This process has special emotional qualities that can affect people's mood. In the healthcare centers the presence of light in any room is necessary, and this important factor creates motivation for the recovery of patients (Rahmanian & Mahmoudi, 2020). Hospitals have many negative effects on the recovery process of patients who are hospitalized for long periods of time. For this reason, the hospital environment should be designed for patients so that they suffer less from tension and anxiety and their mental and physical needs can be easily met. Research has shown that when designing rooms, incorporating light at a standard angle, and using wide windows accelerates recovery and increases patient and staff relaxation. Just as a house is warmed and enlivened by light, a hospital space should, as far as possible, evoke the same feeling in patients. Daylight in the hospital not only meets the biological needs, vitamin D, regulates sleep and rest, but also enlivens the hospital environment, and patients are less afraid of the hospital environment with appropriate lighting (Veitch & McColl, 2001).



Figure 1 Examples of using light in healthcare environments ([www.renadesign.com](http://www.renadesign.com)).

### 3.2. The use of light in healthcare environments and its effects on patients

The hospital's lighting system includes the provision of general lighting for all departments, including examination, injection, specialty care, and patient rooms. For this reason, the optimal visual requirements for patients and even for physicians and staff should be considered in the lighting design of the various hospital spaces. The fundamental goal of any health care system is to create the appropriate environment to restore patients to health. These systems include hospitals, special care centers for the mentally ill, surgery centers, clinics, and medical clinics. A comfortable view must be provided for patients and their companions, doctors and other hospital staff, and uniformity of light sources and lighting is also important (Parsons, 2000). Natural light is optimally supplied in health centers at different times of the year and, in addition to energy efficiency, has a significant impact on strengthening circadian rhythms and the healing process. Architects can promote healing and inner peace by using natural lighting effects. To create favorable conditions in the hospital, one should take advantage of the various properties of daylight. Sunlight not only has positive effects on the soul and spirit but is also considered a sign of hope and recovery for patients who have been in the hospital for a long time. In addition, there is the disinfecting effect of sunlight, especially in environments polluted by people. On the other hand, without natural light, the rooms look too gloomy and heavy. Sunlight is an abundant source of natural light and illuminates architectural forms. Even if the sunlight is intense, the quality of light directly or indirectly affects the patient. The energy of the sunlight entering space hits the surfaces inside the space and creates light and shadow, animating the space and separating the shapes inside the space. Since the intensity and direction of sunlight is almost known, its visual effect on the surface, shapes and space of the room can be controlled and predicted by the size, location, and direction of the windows (Dianat et al. 2013; Alzubaidi & Soori, 2012).

The dimensions of a window play a role in determining the amount of light in a room. The size of the wall or ceiling opening depends not only on the light, but also on other factors such as the materials, the wall or ceiling structure, the need to create a private space, ventilation, the degree of seclusion and the effect of the openings to the outside. Thus, in determining the amount of light in a room, the position and direction of a window are more important than its dimensions. The direction of an opening can be determined to receive direct sunlight at a particular time of day. The harmful effects of direct sunlight, such as excessive heat gain, can be controlled by installing a canopy or creating shade from tree foliage or nearby buildings. The direction of an opening can be adjusted to face away from direct sunlight and instead take advantage of indirect light from the surrounding area, as its light remains constant even on cloudy days and attenuates the intensity of direct sunlight. Adjusting the amount of light in the space also has a significant effect. It can also be mentioned that the use of floor-to-ceiling windows, which direct natural light inside, and proper lighting at night lead to tranquility and a sense of belonging in the space. It is true that light is one of the most important things in designing a therapeutic space, but it will not have a positive effect if it is not controlled appropriately (Rahmanian & Mahmoudi, 2020; Thuesen et al. 2011).

### *3.3. The importance of color in healthcare environments*

The role of color in people's lives has always been so great that it has never been considered an unknown and foreign word. In some ancient cultures, including the Egyptians, Chinese and Greeks, color was used for treatment. Colorists believe that the imbalance in the body indicates the lack of one or more colors, which can be compensated by using the desired colors. Goldstein believes that color has a direct influence on behavior and all organisms in the human body. Color can affect a person's soul and spirit. According to psychologists, people who strengthen their sense of color have better control over their emotions and can create better harmony between body and mind (Malkin, 2002). The proper use of colors in medical centers not only lifts the mood and creates a cheerful atmosphere but can also be effective in the treatment of various diseases through the effect on the body and soul of patients. Research shows that colors directly influence human behavior. For example, the color scheme of walls, clothing and fabrics in treatment rooms affects how patients respond to treatment. Hospital architects and interior designers believe that the use of appropriate methods in design makes patients feel safe and confident, which is crucial in accelerating the improvement of their physical and mental condition (McGee & Park, 2020; Süber & Olguntürk, 2018; Yang & Zhang, 2012). The effect of color in the hospital environment is so important that it can even reduce the fear of illness and the duration of treatment in patients.

Color can have a major impact on how people perceive and respond to the environment and can also improve the quality of the environment for patients, staff, and families, as well as patient recovery rates. Research has shown that color, like light, can improve recovery rates by 10% (Rahmanian & Mahmoudi, 2020). The use of colors in the operating room and patient preparation room for surgery is very important, and the recovery room should give the patient a sense of confidence and hope. The use of colors in the hallways and at the entrance of the hospital makes the space legible and heart-warming and gives the staff and patients a sense of freshness and vitality. The use of color in hospital interior design can help customers find their way around. Researchers have found that the tension caused by losing your way leads to increased blood pressure, headaches, and increased pressure from tension. Colors should be chosen so that signs are legible. And color design should consider people who suffer from color blindness. The chosen color should not overshadow the visual environment, and on the other hand, the contrast on the panels is very important. The presence of contrasts between colors does not simply mean the contrast between them, but rather the study of the relationships and comparison between them (Rismanchi et al. 2021).



Figure 2 Examples of using color in healthcare environments (www.renadesign.com).

### 3.4. The use of color in healthcare environments and its effects on patients

When designing a color for a hospital, it is very important to consider all patterns and types of color sources. One of the most important elements of a healing environment is colors, so each color has a certain effect on a person's body, psyche and social state depending on its properties. Positive results for patients are achieved when natural light, natural elements and cheerful colors are considered in the design of hospital rooms and various departments (Dalke et al. 2004). The patient's environment should provide a sense of security of medical care along with physical and emotional relaxation. Achieving this balance is not an easy goal, as the variety of color schemes depends on the length of stay and the nature of the illness. Patient groups have special needs, and the quality of colors provides a better environment for them. For example, red color increases heart rate, blood pressure and respiratory rate. Therefore, it is not recommended to use this color in the delivery room (Kulivand & Kazemi, 2012), and the color gray is also not appropriate in the pediatric and maternity ward, where people expect a cheerful environment. Soft and bright red and yellow colors are more associated with childhood, and it is better to use these colors in the pediatric department (Malkin, 2002).

Mentally ill people have a special emotional experience. Spaces surrounded by certain dense colors are threatening for people with mental problems. Colors should cause these spaces to be perceived bright and open as much as possible (Dalke et al., 2004). The use of dense colors increases the incidence of schizophrenia. The sight of orange and red colors is unbearable for this group of patients. It should also be noted that excessive use of green and blue colors, which are known for their calming effect, can cause depression in this case (Rahmanian & Mahmoudi, 2020). Although designing with neutral and soft colors can be demotivating for patients who are hospitalized for long periods of time, using these colors for environments that require peace and quiet reduces stress. Soft green, gray and walnut colors are suitable for patient rooms. The color contrast between the floor and the walls and other surfaces makes the environment more suitable for people with visual problems (Birren, 2005). The influence of the properties and effects of some key colors on the human mind and spirit is discussed as follows:

- **Red:** The red color symbolizes life. In psychology, the red color stands for self-confidence. For this reason, this color is used in the treatment of anxiety. This color intensifies emotions and creates excitement and strength. It is the most suitable color for the treatment of anemia and blood diseases and can be used in the treatment of bronchitis, rheumatism, and tuberculosis. Also, this color can be useful in the treatment of colds and infections of the lungs (Muadi, 2000).

- **Blue:** Blue is the color of relaxation and helps relieve symptoms of insomnia and reduce nervous agitation. The blue color symbolizes the fight against infectious diseases and is used to solve problems caused by sore throat, measles, mumps, inflammation, cramps, and headaches. The blue

color calms the nervous system and drives away obsession. People suffering from insomnia are recommended to stay in environments where the blue color is used more often. It is worth mentioning that excessive use of blue color causes depression and fatigue (Rismanchi et al. 2021).

- **Yellow:** Psychologists recommend yellow to treat depression. The yellow color awakens in people a spirit of vitality and strengthens the will to live. Energetic and nervous people should not be exposed to this color too much. Yellow helps with constipation, boosts self-confidence, stimulates digestion, and improves thinking (Rahmanian & Mahmoudi, 2020).

- **Green:** Green represents peace and hope. This color is considered the best color for stress disorders and mental disorders, it has a calming effect and drives away fatigue and increases tolerance. The green color leads to a feeling of friendship, hope, peace, and faith. This color has a positive effect on thinking and creativity. Green promotes digestion and maintains inner peace and is also useful for people suffering from insomnia.

- **Orange:** Orange is also called anti-fatigue color. It is one of the colors that make people happy and is recommended by psychologists for the treatment of depression. This promotes social feelings. Orange preserves energy increases appetite, helps absorb calcium, supports healing and maintains the body health. The orange color strengthens the function of the lungs, spleen and pancreas and is recommended for the treatment of asthma and bronchitis and for cleansing the intestines. On the other hand, irradiating the overworked muscles of the body with orange light increases the blood pressure in this area and gives new energy to these muscles so that they can return to their natural state and the body eliminates the order of muscle pain (Rismanchi et al. 2021).

- **Purple:** The purple color awakens emotions. It is useful to relieve addiction and migraine symptoms and improves the function of the nervous, lymphatic, and cardiovascular systems and maintains potassium balance. Purple is considered the color of spirituality, dignity, and honor. From a spiritual point of view, it is very effective in reducing hatred and anger. Of course, excessive use of this color causes depression, longing, and spiritual discomfort (Rahmanian & Mahmoudi, 2020).

- **Neutral:** Neutral colors and colors combined with gray are known to have a relaxing and anxiety-relieving effect. Therefore, these colors should not be overused in hospitals, as they reduce visual stimulation and make the environment boring, which can lead to depression. Neutral colors are appropriate for short-term stays, but for long-term stays, using these types of colors will cause patients to become bored. Neutral colors are not used for patients with Alzheimer’s disease because they cause anxiety and confusion in patients (Muadi, 2000). The following diagram presents an overview of the main concepts mentioned in the research theory framework section:

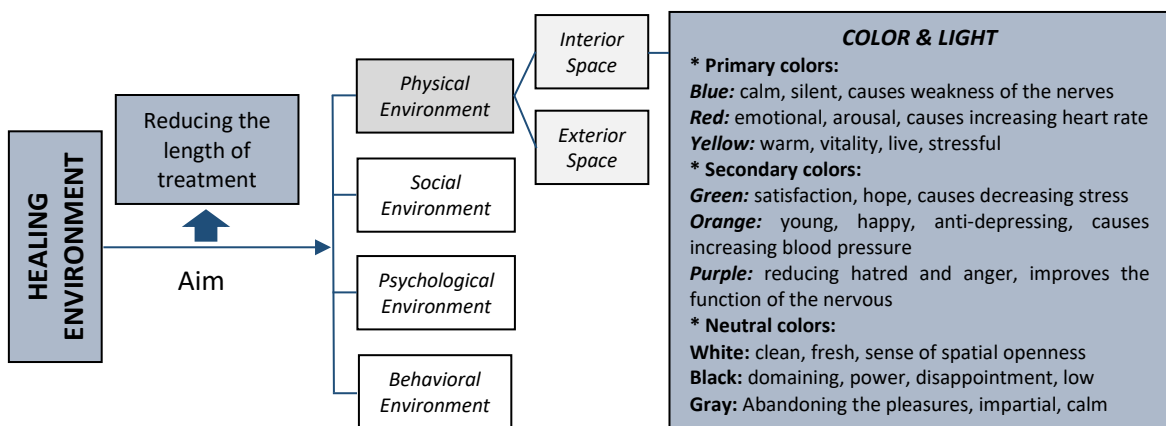


Diagram 2 Research’s conducting process (Author).

#### 4. Results and Discussion

The general aim of the research was to study the effect of the quality components of light and color in the interior spaces of healthcare environments. Since the patient’s stay in the hospital can be associated with a lot of anxiety, a suitable interior design that uses the effect of elements such as light and color can create a friendly, calm, stress-free and healing environment for patients. Now that the positive and negative effects of light on the human body and spirit have been studied, we can point out the sensitivity of this subject and the effect of light on the health of the patient’s body and soul. However, it should be mentioned that the intensity of light in open and closed environments of the hospital, and the use of natural and artificial light should be controlled so that it does not have side effects on patients. By categorizing the cases studied in terms of the effects of light on the user and the architectural space, the following table attempts to provide a design approach for strengthening the interior design of healthcare environments:

**Table 2** The properties and effects of the light on physical and mental states and provision of a design approach.

Properties	Physically		Spiritually	
	Advantage	Disadvantage	Advantage	Disadvantage
<ul style="list-style-type: none"> <li>* Melatonin secretion</li> <li>* Body rhythm regulation</li> <li>* Increased activity</li> <li>* Appetite</li> <li>* Positive feeling to the environment</li> </ul>	<ul style="list-style-type: none"> <li>*Vitamin D supply</li> <li>* Pain relief</li> <li>*Rickets</li> <li>*Germicide</li> <li>* Blood pressure regulation</li> <li>*Pulse adjustment</li> <li>*Pain control</li> <li>*Hair growth</li> <li>*Improvement of blood circulation</li> <li>*Improvement of sinus disorder</li> </ul>	<ul style="list-style-type: none"> <li>*Fatigue</li> <li>*Irritations &amp; sensitivities</li> <li>*Eye fatigue</li> <li>*Insomnia</li> <li>*cardiovascular diseases</li> <li>*Stomach, intestinal disorders</li> <li>*Wrinkling of the skin</li> <li>*Malignant skin tumor</li> </ul>	<ul style="list-style-type: none"> <li>*Invigorating</li> <li>*Exciting</li> <li>*Create hope</li> <li>*Positive Energy</li> <li>*Life giving</li> <li>*Increase job efficiency</li> <li>*Reduction of hospitalization time and pain</li> <li>*Increasing the positive feeling to the hospital environment</li> </ul>	<ul style="list-style-type: none"> <li>*Loneliness</li> <li>*Worry</li> <li>*Depression</li> <li>*Lack of motivation</li> <li>*Emergence of emotional and social problems</li> <li>*Confused</li> </ul>
<b>Design Approach</b>	<ul style="list-style-type: none"> <li>*The use of wide and large windows in the design to create bright interior spaces, transfer a lot of natural light inside to provide relaxation and thermal comfort, and as a result improve the patients</li> <li>*The possibility of outdoor lighting through the design of the terrace or open space</li> <li>*Light intensity control through the installation of awnings and the use of glass equipped with sensors</li> <li>*Creating transparency and visual clarity in the environment through the design of transparent walls and wide corridors</li> <li>*Designing natural and artificial lighting for different hospital spaces according to optimal vision needs for patients and even doctors and staff</li> <li>*Creating light and shadow designs to separate the shapes inside the space and create dynamics by balancing the light intensity by considering the size, location, and direction of the windows.</li> <li>*Using intelligent artificial lighting system</li> <li>*Using trees to control light intensity</li> <li>*Not using fluorescent lights to reduce the patient's fear and anxiety</li> </ul>			

What is understood from reviewing the studies conducted on color and investigating its impacts on people’s sense of well-being is that in a healthcare environment the factor of color design is of vital importance in creating a pleasant, ambient environment. Color can have an impact on patients’ perceptions and responses to the hospital environment and it also affects patient recovery rates, improving the quality and overall experience of patients, staff, and visitors. In addition, reviewing studies on the use of color in healthcare environments showed that there are some demonstrable, replicable, behavioral, and perceptual effects from color that justified their use in certain ways for design. Although using various colors can have an unbelievable effect on appearance, the spatial perception of a hospital, and boost morale and raise interest, color must be observed or investigated in context to avoid generalizations about color perception and mood affects. Negligent, careless or no use of color design can have an impact on users’ perception and sense of space and well-being. Hence, by categorizing the cases studied in terms of the effects of color on the patients and the architectural space, the following table propose a design approach for strengthening the appropriate use of colors in interior design of healthcare environments:



**Table 3** The properties and effects of the color on physical and mental states and provision of a design approach.

Color	Effect	Physically		Spiritually	
	Properties	Advantage	Disadvantage	Advantage	Disadvantage
<b>Red</b>	<ul style="list-style-type: none"> <li>*Increasing blood pressure</li> <li>*Increasing heart rate</li> <li>*Energy producer</li> <li>*Irritating</li> </ul>	<ul style="list-style-type: none"> <li>*Anemia</li> <li>*Gripe</li> <li>*Infection</li> <li>*Sterility</li> <li>*Bronchitis</li> <li>*Rheumatism</li> </ul>	<ul style="list-style-type: none"> <li>*High blood pressure</li> <li>*Nervous mood</li> <li>*High fever</li> <li>*Obesity</li> </ul>	<ul style="list-style-type: none"> <li>*Overcome fear</li> <li>*Depression treatment</li> <li>*Increase life expectancy &amp; self-confidence</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous system disorders</li> <li>*Psychological problems</li> </ul>
<b>Blue</b>	<ul style="list-style-type: none"> <li>*Decreasing blood pressure</li> <li>*Balancing heart rate</li> <li>*Peaceful</li> <li>*Calmness</li> <li>*Cooling</li> </ul>	<ul style="list-style-type: none"> <li>*Reduction of nervous excitement</li> <li>*Increase the strength of the body's defenses</li> <li>*Asthma treatment</li> <li>*Smallpox &amp; thyroid treatment</li> </ul>	<ul style="list-style-type: none"> <li>*Not good for grip</li> <li>*Not good for digestive system</li> <li>*Eye pain</li> </ul>	<ul style="list-style-type: none"> <li>*Peace</li> <li>*Calmness</li> <li>*Healing</li> <li>*Honesty</li> <li>*Stress buster</li> </ul>	<ul style="list-style-type: none"> <li>*Not good for anxiety</li> <li>*Feeling cold</li> </ul>
<b>Yellow</b>	<ul style="list-style-type: none"> <li>*Create a spirit of vitality</li> <li>*Concentration enhancer</li> <li>*Stimulation nervous and muscles</li> </ul>	<ul style="list-style-type: none"> <li>*Paralyzed</li> <li>*Rheumatism and arthritis</li> <li>*Sluggish liver</li> <li>*Pancreas and stomach and constipation</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous mood</li> <li>*Obesity</li> <li>*Hyperthyroidism and eyes</li> </ul>	<ul style="list-style-type: none"> <li>*Depression</li> <li>*Boredom</li> <li>*Lack of concentration</li> </ul>	<ul style="list-style-type: none"> <li>*Mental disorders</li> <li>*Tendency to isolationism</li> </ul>
<b>Green</b>	<ul style="list-style-type: none"> <li>*Alive, hope, faith</li> <li>*Promising</li> <li>*Sedative</li> <li>*Increasing tolerability</li> <li>*Feelings of friendship</li> </ul>	<ul style="list-style-type: none"> <li>*Infection</li> <li>*Insomnia</li> <li>*The pain</li> <li>*Body weakness</li> <li>*Heart problems</li> <li>*Restores muscle cells &amp; bones</li> </ul>	<ul style="list-style-type: none"> <li>*Blood pressure</li> <li>*Breathing down</li> <li>*Low heart rate</li> <li>*Malignant glands</li> </ul>	<ul style="list-style-type: none"> <li>*Stress and mental disorders</li> <li>*Fatigue and low endurance</li> </ul>	<ul style="list-style-type: none"> <li>*Depression</li> </ul>
<b>Orange</b>	<ul style="list-style-type: none"> <li>*Increasing blood pressure &amp; heart rate</li> <li>*Antispasmodic</li> <li>*Stimulating and energizing</li> <li>*Appetizer</li> </ul>	<ul style="list-style-type: none"> <li>*Kidney stones &amp; gall bladder</li> <li>*Gripe</li> <li>*Bronchitis</li> <li>*Malignant glands constipation</li> <li>*Lung disease</li> </ul>	<ul style="list-style-type: none"> <li>*High blood pressure</li> <li>*Imbalance and disharmony in the nervous system</li> </ul>	<ul style="list-style-type: none"> <li>*Depression</li> <li>*Boredom</li> <li>*Isolation</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous system</li> <li>*Tension</li> <li>*Stress</li> <li>*Insomnia</li> </ul>
<b>Purple</b>	<ul style="list-style-type: none"> <li>*Heart calmer</li> <li>*Blood purifier</li> <li>*Sadness</li> <li>*Elimination of toxins</li> </ul>	<ul style="list-style-type: none"> <li>*Spleen and bladder *Diseases</li> <li>*Rickets</li> <li>*Back pain</li> <li>*Sciatica</li> <li>*Epilepsy</li> <li>*Pneumonia and weak immune system</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous system disorder</li> </ul>	<ul style="list-style-type: none"> <li>*Mental disorders such as schizophrenia and insanity</li> <li>*Hate</li> <li>*Anger</li> <li>*Fear</li> </ul>	<ul style="list-style-type: none"> <li>*Depression</li> <li>*Sadness</li> </ul>
<b>Neutral</b>	<ul style="list-style-type: none"> <li>*Calming eyes &amp; nerves</li> <li>*Low visual stimulation-boring</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous tense</li> <li>*High blood pressure</li> </ul>	<ul style="list-style-type: none"> <li>*Nervous system disorder</li> </ul>	<ul style="list-style-type: none"> <li>*Tension</li> <li>*Psychopathy</li> <li>*Stress</li> </ul>	<ul style="list-style-type: none"> <li>*Boredom</li> <li>*Depression</li> </ul>
<b>Design Approach</b>		<p>*Neutral palettes with soft natural tones work best for patient rooms and can have a hand in calming patients and their family members faced with the stress of having an ill loved one, according to the study. Avoid using palettes with strongly contrasting colors in these spaces, as they are known to cause strain for occupants.</p> <p>*Brightly lit rooms with stronger color palettes can help staff's needing a quick break to stay fresh and lively. Darker, subtler break rooms with softer lighting are preferred by many workers looking to rest for longer periods of time.</p> <p>*Red is believed to be energizing and encourage alertness: It's recommended for patients with dementia, who need brain stimulus. It's great for memory care services in senior homes.</p> <p>*Blue, green, and purple, especially in cool muted hues, can be very calming. They're great for hospital rooms, wards, waiting areas, and wellness centers like spas.</p>			

## 5. Conclusion

The results of the research show that, depending on the needs of the patients in the healthcare environments, it is necessary to transform the hospital environment into a cheerful and relaxing environment, with the appropriate colors and light and beautification factors suitable for that space. Besides lighting and visibility, the light factor is one of the most effective environmental factors for the quality of treatment and the working environment. Natural light, or daylight, has a psychological effect on patients. Daylight has a positive effect on the healing process of psychological and physical diseases and accelerates it. Light has a direct influence on the activity of the inner parts of the brain. Rooms without natural light appear oppressive and heavy. Therefore,

lighting conditions should be considered more carefully when designing patient rooms in therapeutic environments. For example, the use of natural light, the creation of openings and windows, and the use of artificial light improve spatial perception, color recognition, reduce fatigue, elevate mood, and accelerate the patient's recovery process. The use of bright, appealing, warm colors and the design of rooms with a variety of colors provide a sense of cleanliness and openness, creating a pleasant environment and a better understanding of the space.

Color and light also have a great influence on human life and can be effective in bringing balance to various parts of the body and in curing many physical and mental problems of patients. Therefore, it is necessary to provide the opportunity for adequate daylight to enter these enclosed spaces to improve the biological quality and increase the level of health. The evaluation of the case studies shows the importance of light and its undeniable role in speeding up the recovery of patients. Moreover, the results indicate that the use of colors and the consideration of aesthetic and environmental aspects can be very effective in improving patients. Therefore, the results of the current study can be used as a generalizable conceptual framework for hospital and health center design. Based on this model, part of the general framework of interior design can be explained in terms of the use of light and color factors in a healing environment. On this basis, and to address the second question of study, three physical, perceptual, and social aspects can be considered (Diagram 3). The design of light and color can have a significant impact on these components, ultimately leading to patient recovery and improved staff efficiency. Such a model can be considered a suitable approach for the study and interior design of healthcare environments:

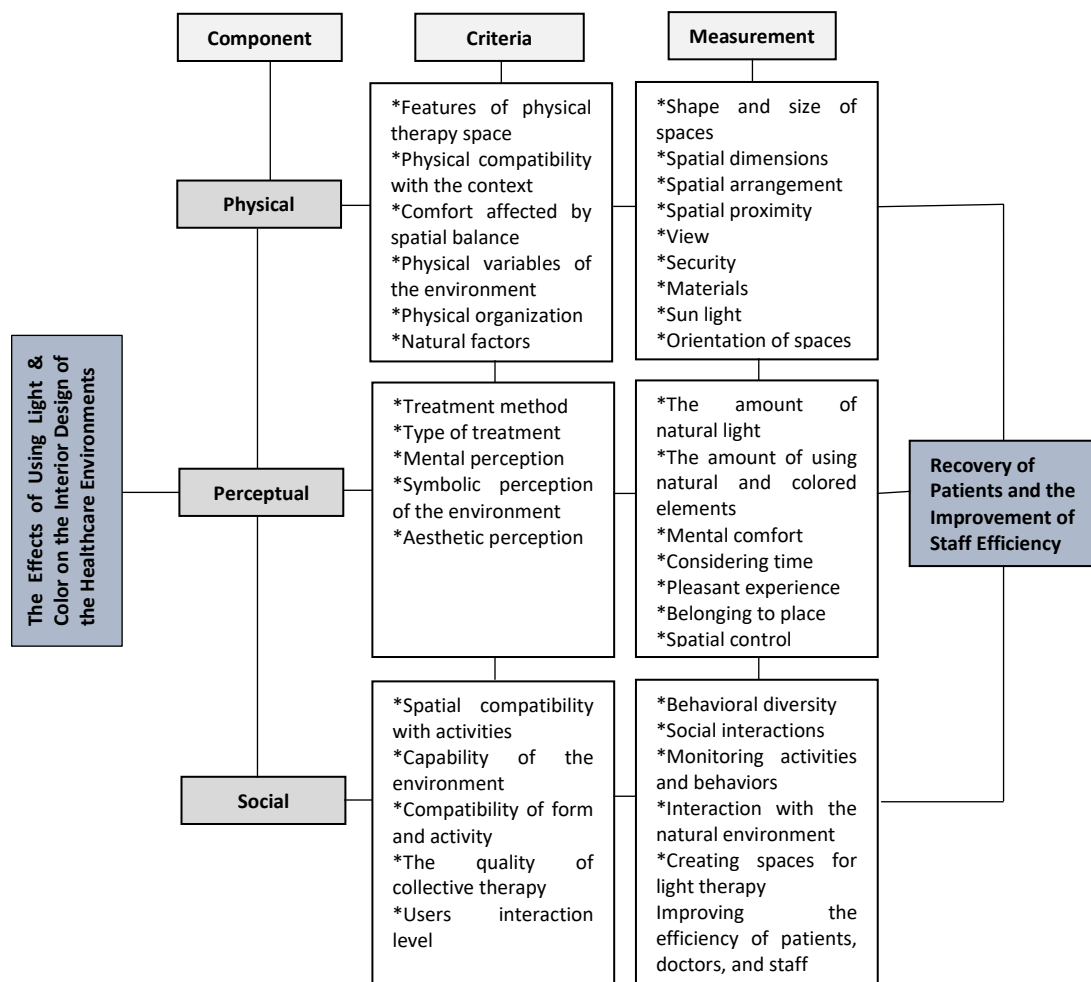


Diagram 3 A conceptual model, representing the effects of using light and color on interior design components.

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## **Resume**

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