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**The effect of color of medical buildings in reducing stress and length of treatment
(Case study: Kowsar Hospital, Shiraz)**

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Abstract

A patient is someone who has mental or physical discomfort or both. A hospital is a place where a patient goes for diagnosis and treatment. Therefore, the graphic effect of the hospital environment on the patient is very important. Color is one of the influential components in hospital graphics. Color therapy is an old art. In the past, people in India and China had temples instead of hospitals where patients were treated with color therapy. In this study, first, the study of color and stress and the different effects of color on humans as important variables and components of the environmental graphics of medical buildings, then by determining the patient's condition and needs, the factors affecting the choice of color and effects are investigated. It reduces stress and the length of treatment of the patient. The present study is a correlational research and in terms of the purpose of finding the relationship between the effect of color of therapeutic buildings and stress and the length of treatment of the patient, is a practical research. The research method, survey method and data collection tool is a combination of standard questionnaire for measuring stress (dass-21) and color questionnaire prepared by the author. The validity of the questionnaire was confirmed by Cronbach's alpha with a value of 0.897. The questionnaire was analyzed with SPSS 26 software.

Keywords: Color in the design of therapeutic building, color and stress, color and length of patient treatment, color therapy.

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1-INTRODUCTION

Art therapy is one of the treatment methods that has been used for a long time. Art therapy contributes to healing in a number of ways. First, the aesthetic quality of works of art can improve the patient's mood, vitality, self-esteem, and personal awareness, and second, research has shown that physiological factors such as heart rate are involved when people are deeply involved in activities they enjoy. Heart, blood pressure and breathing slow down. Today, the architecture of medical centers is changing from mere functionalism to creating a healing environment. The healing environment in medical centers means creating an atmosphere that has positive effects on the treatment of the disease (Ulrich et al., 2004: 30). Hospitals, as a place of treatment for patients, must play a decisive role in physically relieving patients' pain and calming their companions. This will not be possible except in the shadow of the beauty and beauty of hospitals and the influence of colors on the feelings and emotions of patients. In Islamic color therapy, it is believed that many diseases can be treated using color. Interior architects also use them in interior and exterior design of hospitals and other medical centers in order to make colors effective on hospitalized patients (Dargahi and Rajabnejad, 1393: 21).

In residential designs, applying personal tastes about colors is not a case, but in public places such as restaurants, companies, hospitals, etc., applying tastes about colors is not right. (Karimi, 1385: 41) Most people still They do not know for sure to what extent they are psychologically and physically affected by the power of colors and light. Colors are so closely related to all factors and details of our lives that it should be said that colors are like steps that connect the physical and spiritual existence of human beings with other details and phenomena of the universe (Luscher, 1373: 19). The aim of this study was to investigate the relationship between the effect of color on the interior design of the hospital and reduce stress and length of treatment. Applying the research results will play an important role in designing therapeutic environments as much as possible and thus reducing stress and accelerating the treatment process of patients. The main hypothesis of this study is the existence of a significant relationship between the desired color and reducing stress and the recovery time of patients. Any color stimuli received by the human eye, in addition to emotional and psychological reactions, also include physical reactions. To answer these hypotheses, the following questions are considered: What role does the desired color play in reducing stress and the length of treatment for patients? What are soothing and stress-relieving colors? The research method, survey method and data collection tool is a combination of standard questionnaire for measuring stress (dass-21) and color questionnaire prepared by the author.

RESEARCH BACKGROUND

Definition of stress

Stress can be defined as a person's mental, physical, emotional, and behavioral responses to any perceived internal or environmental threat or pressure. Long-term or high stresses affect different aspects of our lives. (Boroumand, 2003: 211) Lack of boredom, headache, change in stress rhythm or nervous tension in psychology means pressure and force and any stimulus that causes stress in humans is called a stressor or stress factor. The tension created in the body and the reaction of the body is called stress. In other words, any factor that causes tension in the body and soul and loss of balance is stressful. When the body is under stress, heart reactions, physical fatigue, anger and aggression, insomnia, chest tightness, indigestion, heartburn, sweating, dry mouth, anorexia, body heat or cold, sadness, tremors, cravings Smoking, loss of concentration, dizziness, shortness of breath, frequent urination, memory loss, scattered body aches, sighing, loneliness, confusion, inflammation, and flushing are some of the physical causes of stress. Many factors cause stress. For example, illness, late arrival at work, traffic, etc., but the most important factor in our attitude is the way we look at the events and happenings that happen around us (Sohrabi, 2003: 179). By using the interior architecture of

medical spaces and paying attention to physical factors such as color, lighting, privacy, etc., based on the aesthetic and functional principles of architecture, it is possible to create suitable and necessary spaces without paying attention to the presence and absence of patients. I have a cure or a disease; Reduce and take steps to promote the health of people, which is the most important goal of healing environments (Motalebi et al., 2015: 44)

Color definition

The first step in carefully examining an issue is to provide a comprehensive definition of it. Color in Dehkhoda Dictionary is a light effect that gives the appearance of objects of different representations; That is, the special effect that arises in the eye from the reflection of light rays on objects. Color is the part of visual perception that, by observing with one eye (and without moving it), can distinguish a single spot from its structure from an adjacent spot. (Groter, translated by Pakzad, 391: 1393). Color is a reflection of light that comes in different forms. Paint is any semi-liquid or gum-like compound that, when applied, forms a thin layer to cover a solid. Colors come in light. Sunlight is colorless, and the rainbow indicates that all colors are present in white light. Light comes from the sun and hits objects, and from the object to the eye and then to the brain. Color is a visible reflection that is caused by the passage or propagation or reflection of color combinations by objects (Ostvar, 1391 :1). The color is human life, the colorless world seems to us as dead. Colors are the children of light and light is their mother. Colors, forces are radiant energies that affect us positively or negatively, whether we like it or not. Colors express mental and emotional worries and discomforts, states that we do not dare to express to others. Color can be in a collection as a mirror that shows its characteristics with its messages (Arabian, 23 : 1387) color is not one of the transverse factors but the intrinsic elements of the work of art and in a word in the most accurate interpretation, color is one of the elements of the emergence of meaning in the work (Bolkhari, 1394: 1394).

The psychological effect of color on humans

Increasing use of colors has created a great change in the field of color psychology (Ostvar, 1391: 18) Color is a powerful factor that can evoke or soothe, create a feeling of warmth or cold, annoying or pleasant (Ibid. The study of the effect of colors on the body has been a topic that has always been raised throughout history. The Assyrians, Babylonians, and Egyptians all used some form of color and light in healing (Clark and Demarco, 2001: 95-103). Psychologists have studied the effect of color on people and described their condition. They consider the harmony of colors to be more related to human emotions. In the effect environment, cold colors (with a deep, light and light state) that are usually used lightly, and warm colors (not deep and used in a dark and heavy state) also show themselves well. (Sate, 1994: 54) Colors generally affect emotions, physical condition, mood and even everyday conversations and cause us to feel warm and sincere and passionate emotions or vice versa, cold and accompanied by depression and Let's get bored. (Writer, 105: 1393).

Psychological effect of color on the patient

Color can have a great impact on people's perception and response to the environment and has a direct impact on improving the environmental qualities of patients, staff and families and the rate of patients' recovery. Colors are forces that affect humans and create a feeling of comfort or discomfort, activity or stillness. Proper use of paint in hospitals can heal patients (Karimi, 41: 2008). The colors of the environment are influential in human beings and cause change and transformation within them, so that this effect is sometimes so intense that it controls all human affairs. Colors not only affect human beings but also lead to the progress or stagnation of a society (Akbarzadeh, 1996: 56).

The effect of different colors on humans

Red is a very powerful energizer and stimulant and relieves some skin diseases. Increases heart rate and blood pressure. Orange stimulates the nervous system and causes clarity and clarity of mind and stimulates appetite and memory. Increases the flow of oxygen to the brain. Green is a color that calms people, reduces pain and creates a feeling of security. Blue creates a feeling of calm, comfort, and relief in human beings. The color blue lowers the heart rate, lowers the body temperature and increases the vital activities of the cells. Yellow activates the motor nerves and produces energy in the muscles and strongly strengthens the human mind. Leonardo da Vinci believed that purple could increase human thinking power by up to 10 times. White has an entertaining, depressing and spiritual effect. (Ostovar, 19-31: 1391) Brown color indicates the existence of a special emotion towards the human body. Brown transmits depressive autumn colors. Brown sometimes creates a sense of sadness and isolation. Gray is neither anxious, nor calming, nor exciting, nor mental, nor objective, nor internal, nor external (Arabian, 1387: 77) Purple has a sense of rest and drowsiness. Lowers body temperature, reduces pain in the body, and increases venous activity (Mahlabani, 2014: 65). White is used for regeneration and repair, regulates chronobiological rhythm, and increases serotonin secretion. . Adjusting sleep, creating a balance between the physical and hormonal systems are other effects of this color (Noorabadi, 1385: 63). Activities turn around and are slow and sluggish, conquering and affecting (Ostvar, 1391: 30).

Table 1: The effect of different colors on humans

Color type	Impact on humans
Red	Very powerful energizer and stimulant and soothes some skin diseases
Orange	Stimulates the nervous system and causes clarity and clarity of mind and stimulates appetite
Green	It is a color that soothes people, reduces pain and creates a feeling of security.
Blue	It creates a feeling of calm, comfort, and relief in human beings. Blue color lowers heart rate, lowers body temperature and increases vital cell activity
Yellow	It activates the motor nerves and produces energy in the muscles and strongly strengthens the human mind. Increase the power of human thinking up to 10 times
Brown	Indicates the existence of a special emotion towards the human body. Brown transmits depressive autumn colors. Brown sometimes creates a sense of sadness and isolation
Gray	It is not anxious, it is not calming and it is not exciting, it is not mental and it is not objective, it is not internal or external
Purple	Feels rested and sleepy. Lowers body temperature, reduces pain in the body and increases venous activity
White	Used for regeneration and repair, regulates chronobiological rhythm and increases serotonin secretion. Adjusting sleep, balancing the physical and hormonal systems are other effects of this color
Black	It is a sedentary, quiet, static and non-stimulating color, and while not causing any kind of mental and physical stimulation, it reduces other activities and results in slowness and slowness. It is conquering and affecting

Source: Authors, 2020

Literature review

Sadeghi et al. (2014) in a study entitled The role of color in the hospital in accelerating the healing process of the disease concluded that colors affect physical and mental patients. Dargahi et al. (2013) in an article entitled "Review of the phenomenon of color therapy with emphasis on hospital environments" concluded that color therapy is related to different areas, including the relationship between color therapy and the nature of different cultures. Its effect on eliminating or reducing physical, mental, and psychological disorders, the effect of color therapy on work environments and industrial psychology, creativity and especially its application in medical and hospital areas. Gorji Mahlabani et al. In a study that the effect of color in the design of hospital wards concluded that the correct use of colors in different wards of the medical center, including the hospital ward is a very important factor in the process of recovery of patients. By creating a suitable and pleasant environment by using colors, the designer directly and indirectly affects the mental and physical condition of the patient and changes the speed of his recovery process. The ancient Iranians used a kind of color therapy based on light radiation (Gorji Mehlabani, 1392: 64). Historical research shows that in ancient China, physicians used a red substance to treat certain skin conditions. The ancient Greeks used a purple ribbon to treat patients and thought it was a magic color, but the exact beginning of research into this was in the mid-twentieth century. In 1949, Goldstein conducted experiments on the effect of color on human body function and published his observations. His experiments were performed on people with Parkinson's disease, and the results showed that red is effective in increasing the severity of the disease, while green has a therapeutic function. In 1957, Gerard discovered through several detailed experiments that red was a nerve stimulant and blue was the opposite. In 1974, Jacob and Hostemir discovered that the colors red, yellow, green, and blue stimulated the nerves, respectively. During experiments, Frank Gebert found that red is stimulant and green and blue are soothing. In the 1990s, Freeling found in experiments that red raises blood pressure and heart rate, and green creates relative calm. Frank Monk achieved similar results in freeling in 1994 (Bakhtiari Fard, 1388: 86). In ancient India, the Ayurveda people believed that shining different colors on the body's energy center caused emotions or life in a person. Today, color therapy is used in the same area to solve physical and mental problems. In the late 17th century, the modern method of using paint for healing became known, which coincided with the decomposition by Isaac Newton. Finally in 1878 Dr. Edwin D. Babbitt realized that paint could be used to heal wounds. (Noorabadi, 62: 1385). The Egyptians were the first civilization to do research on color therapy. They built colored corridors in their temples, such as Karnak and Tabas, in which they discovered the effect of color on people in healing and healing (Edge, 2003: 10). In the history of medicine, color is the oldest medicine. Dye has been used to heal patients (Coclivo, 71-83: 1999).

research method

The research is currently a correlational analysis and for some reason, it is an applied research. The statistical population of the study is the medicine of two hospitals in Shiraz, one with favorable color conditions in design and other unfavorable color conditions in hospital design, age group 22 to 67 years. This research was conducted in May 2016. The research method, survey method and data collection tool is a combination of standard questionnaire for measuring stress (DASS-21) and color questionnaire prepared by the author. Each of the subscales of depression, anxiety and stress consists of 7 questions, the final score of each of which is obtained through the sum of the corresponding flood scores (Table 2). Each question is scored from zero (does not apply to me at all) to 3 (absolutely applies to me). Then, two samples from each group were randomly selected with a total of about 34 patients and questionnaires were distributed among them. After collecting the questionnaires by removing incomplete questionnaires, 15 questionnaires from each group were analyzed. 26spss software

was used for data analysis and processing. The test method and the research hypotheses are Pearson and Spearman correlations. The questionnaire was prepared in several stages, its validity and reliability were calculated. The reliability of the questionnaire was confirmed by calculating Cronbach's alpha.

Table 2. Intensity of each subscale

Intensity	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Low	10-13	8-9	15-18
Medium	14-20	10-14	19-25
Intense	21-27	15-19	26-33
Very Intense	+28	+20	+33

Source: Authors, 1399

Introducing the research area

Shiraz is one of the metropolises of Iran and the capital of Fars province in the south of the country. The population of Shiraz in 2016 was 1565572, which is 1869001 people including the population living in the suburbs. Shiraz is the fifth largest and most populous city in Iran and the most populous city in the south of the country (Statistics Center of Iran website, 2019). The statistical population of the study is the patients of two hospitals in Shiraz, one with favorable color conditions in design and the other with unfavorable color conditions in hospital design, with an average age of 22 to 67 years. This research was conducted in May 2016. Kowsar Hospital has favorable graphic conditions and Faghihi Hospital has relatively unfavorable graphic conditions (authors). Kowsar Hospital of Shiraz, affiliated to the Charity Foundation of the Fars Heart Foundation, has started its activities in 2005 on a 30,000 square meter land in one of the greenest areas of Shiraz, with the help of benevolent philanthropists. This hospital has 300 The hospital bed offers 18 operating and angiography rooms and the most advanced and equipped diagnostic and therapeutic equipment for its specialized and sub-specialized services. Kowsar Hospital, with the cooperation of over 1000 of the best medical, support and administrative staff and more than 250 of the best and most skilled physicians in various fields, has been able to obtain a first degree of national accreditation since its establishment. Iran to provide its safe and quality services at very reasonable prices to its patients and clients from all over Iran¹. In 1286 AH, the late Haidar Ali Khan Az al-Muluk built a hospital in the current location of the hospital and half of the income from the income of one The village in Dorud region dedicated women to treating its poor patients. In 1322, a well-equipped hospital was built in this place by the then municipality².

¹ (<http://www.kowsar-hospital.ir>)

² (<https://faghihi.sums.ac.ir/>)

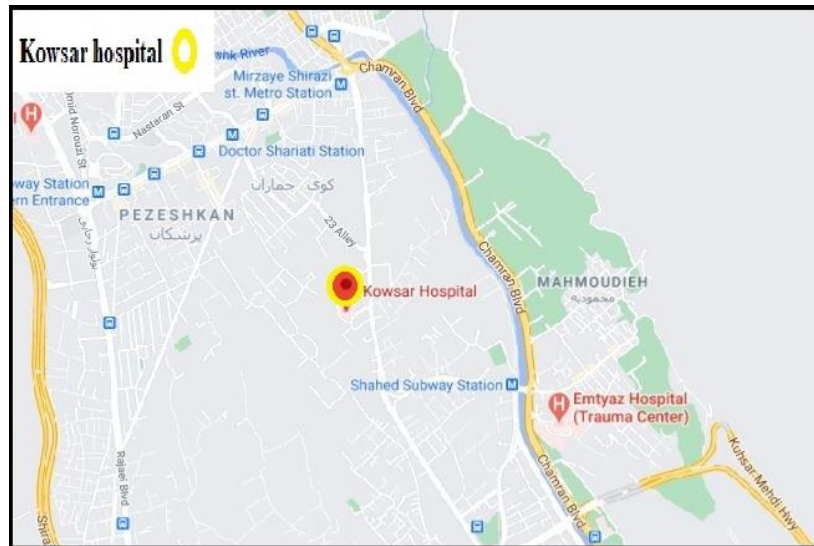


Figure 1. Kowsar Hospital area, Source: Google Earth, 1399

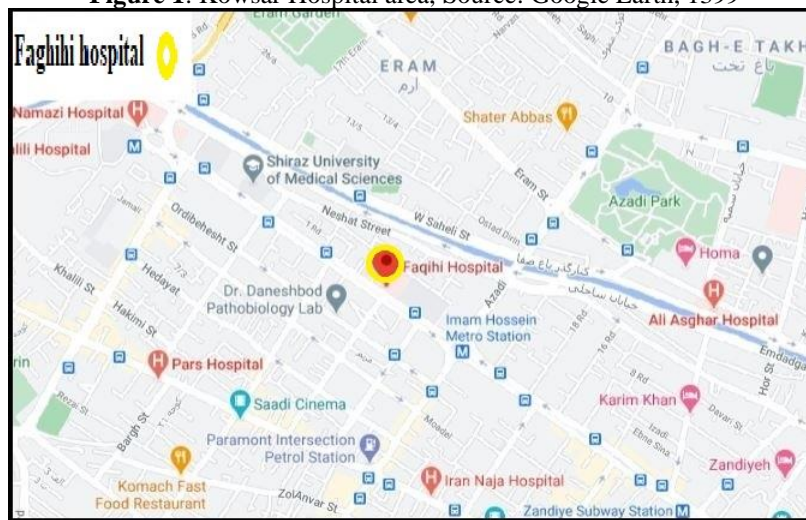


Figure 2: Area of Faghihi Hospital, Source: Google Earth, 1399



Figure 3: Kowsar Hospital Building, Source: Kowsar Hospital website, 1399



Figure 4: Faghihi Hospital Building, Source: Faghihi Hospital website, 1399

Discussion and findings

The information obtained in the relevant tables shows the effect of color in reducing stress and length of hospital stay in this study. In this paper, the color of the independent variable, stress and length of hospitalization of the dependent variables are identified. In addition, the controlled variables of age, income and disease type are not unaffected by the final results. Cronbach's alpha showed that the internal stability of the scale was 0.85 for stress and 0.897 for the whole scale, which indicates the reliability of the questionnaire. According to the researchers, when Cronbach's alpha is 0.7 or higher, the questionnaire has acceptable reliability and as a result, the questions have an internal correlation (Table 3).

Table 3. Reliability Statistics

Cronbach's alpha	Cronbach's standard alpha	Number (questions)
0.897	0.897	21

Source: Authors, 1399

Table 4. **. Correlation is significant at the level of 0.01
Spearman correlation between color in hospital design and stress

		Color in hospital design	Stress
Spearman correlation	Color in hospital design	The correlation coefficient	1
		Significant level	.
		Number	30
	Stress	The correlation coefficient	**0.766
		Significant level	0.000
		Number	30

Source: Authors, 1399

Table 5. **. Correlation is significant at the level of 0.01
Spearman correlation between color in hospital design and Duration of hospitalization

			Color in hospital design	Duration of hospitalization
Spearman correlation	Color in hospital design	The correlation coefficient	1.0	**0.709
		Significant level	.	0.000
		Number	30	30
	Duration of hospitalization	The correlation coefficient	**0.709	1.0
		Significant level	0.000	.
		Number	30	30

Source: Authors, 1399

Table 6 ** Correlation is significant at the level of 0.01
Pearson correlation between color in hospital design and stress

		Color in hospital design	Stress
Color in hospital design	Pearson correlation	1	**0.750
	Significant level		0.000
	Number	30	30
Stress	Pearson correlation	**0.750	1
	Significant level	0.000	
	Number	30	30

Source: Authors, 1399

Table 7. **. Correlation is significant at the level of 0.01
Pearson correlation between color in hospital design and Duration of hospitalization

		Color in hospital design	Duration of hospitalization
Color in hospital design	Pearson correlation	1	**0.569
	Significant level		0.001
	Number	30	30
Duration of hospitalization	Pearson correlation	**0.569	1
	Significant level	0.001	
	Number	30	30

Source: Authors, 1399

The purpose of this study was to investigate the effect of color on reducing stress in patients in the hospital. The results show a correlation between stress and duration of hospitalization with color status with Spearman correlation coefficients of 0.766 and 0.709 and Pearson 0.750 and 0.569 at a significant level of 0.01, respectively, whose correlation coefficients are in Tables 4, 5, 6 and 7 is clearly visible. The aim of this study was to investigate the effect of optimal color on reducing stress and length of hospital stay. The results show that in terms of stress in the hospital with favorable color conditions, 53.3% of patients have normal, 26.7% mild stress,



13.3% moderate stress, 6.7% severe stress and 0% very severe stress. More patients with moderate hospital discomfort have moderate, severe, and very severe stress (Table 8).

Table 8. Hospital agreement table with optimal color design * Hospital with undesirable color design and stress

		Normal	Low	Medium	Intense	Very Intense	Total
desirable conditions	Number	8	4	2	1	0	15
		%53.3	%26.7	%13.3	%6.7	%0.0	%100
Undesirable conditions	Number	4	3	3	3	1	14
		%28.6	%21.4	%21.4	%21.4	%7.1	%100
Total	Number	12	7	5	4	1	29
		%41.4	%24.1	%17.2	%13.8	%3.4	%100

Source: Authors, 1399

The results show that the duration of hospitalization with favorable color conditions is less than the duration of hospitalization with unfavorable color conditions. (Table 9).

Table 9. Cross table of hospital with desirable and undesirable color conditions * Number of hospitalization days

		1	2	3	4	5	6	Total
desirable conditions	Number	1	3	2	1	0	0	7
		%14.3	%42.9	%28.6	%14.3	%0.0	%0.0	%100
Undesirable conditions	Number	0	1	1	3	1	1	7
		%0.0	%14.3	%14.3	%42.9	%14.3	%14.3	%100
Total	Number	1	4	3	4	1	1	14
		%7.1	%28.6	%21.4	%28.6	%7.1	%7.1	%100

Source: Authors, 1399

Also, from the study of Tables 10, 11 and 12, we find that black, yellow and red colors are stressful, respectively, and green, blue and white colors have an essential role in reducing patients' stress, and white, blue and green colors for the room. Patients are appropriate (Tables 10, 11 and 12).

Table 10. What color is stressful?

		frequency	Percent	Valid Percent	Cumulative Percent
Valid data	Red	4	13.3	13.3	13.3
	Yellow	5	16.7	16.7	30
	Black	21	70	70	100
	Total	30	100	100	

Source: Authors, 1399

Table 11. What color reduces stress?

		frequency	Percent	Valid Percent	Cumulative Percent
Valid data	Blue	9	30	30	30
	Green	14	46.7	46.7	76.7
	White	7	23.3	23.3	100
	Total	30	100	100	

Source: Authors, 1399

Table 12. What color is suitable for the wall of the patient's room?

		frequency	Percent	Valid Percent	Cumulative Percent
Valid data	Blue	7	23.3	23.3	23.3
	Green	1	3.3	3.3	26.7
	White	22	73.3	73.3	100
	Total	30	100	100	

Source: Authors, 1399

And according to Table 13, we conclude that 70% of people consider the percentage of color effect in reducing patient stress to be very high, 26% of them high and another 3.3% moderate. Also, from the study of Table 14, we find that 66.7% of people consider the use of different colors in treatment spaces to increase patients' mood and improve their mental disorders to be very high, 30% of them high and another 3.3% moderate.

Table 13. How effective do you think the color of the patient's room is in reducing the patient's stress?

		frequency	Percent	Valid Percent	Cumulative Percent
Valid data	medium	1	3.3	3.3	3.3
	Much	8	26.7	26.7	30
	Very Much	21	70	70	100
	Total	30	100	100	

Source: Authors, 1399

Table 14. To what extent is the use of different colors in therapeutic spaces effective in increasing the mood and improving the mental disorders of patients?

		frequency	Percent	Valid Percent	Cumulative Percent
Valid data	medium	1	3.3	3.3	3.3
	Much	9	30	30	33.3
	Very Much	20	66.7	66.7	100
	Total	30	100	100	

Source: Authors, 1399

Conclusion

Researchers in previous research have concluded that color therapy is related to various areas, including the relationship between color therapy and the nature of different cultures, its effect on the elimination or reduction of physical, mental, and psychological disorders. He mentioned the effect of color therapy on work environments and industrial psychology, creativity and especially its application in medical and hospital fields. In this research, the following results

were obtained: Color has a fundamental effect on human mental health. In the category of city and architectural spaces, color is an important issue, and one of these spaces is medical spaces and hospitals. Inappropriate and inconsistent colors with the environment, form and space and adjacent colors, have a negative effect on the human psyche and interfere with good communication with them. Proper use of color and form in different parts of the medical center is a very important factor. It is considered in the process of patient recovery. The results of this study show that in environments with undesirable color, the amount of stress and length of treatment is higher than environments with desirable color. In general, it can be said that due to the effect of color in reducing stress and the duration of treatment and their better performance, so the importance of paying attention to the effects that hospital design has on building users is becoming more apparent. Architects have a major role in designing treatment spaces and with the correct design and tailored to the physical and mental needs of patients can improve the level of treatment in society. Therefore, we conclude that the desired colors have a significant effect on reducing the patient's stress and the duration of his treatment. Also, the colors that are suitable in the design of the hospital and have a calming effect are blue, green and white or a combination of them.

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