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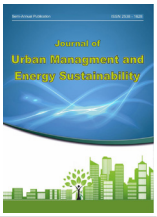

CASE STUDY RESEARCH PAPER

The effects of environmental, social, and functional components on healthcare spaces and their prioritization

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ABSTRACT

There is growing interest in using natural elements in healthcare environments to provide therapeutic benefits. However, it is not yet well understood how patients, their families, friends, and staff who spend time in these spaces utilize them and whether the intended benefits are experienced. This research evaluates visitor feedback regarding the incorporation of natural elements in Asgariyeh Hospital in Isfahan to gain insights into end-user experiences compared to existing literature on green spaces in medical settings and natural environments. The study method is descriptive and analytical, conducted through a survey with a questionnaire. To categorize the factors, the questionnaire questions were divided into three components: environmental, social, and functional. Questions were asked from patients and hospital staff as the target statistical population, alongside interviews with individuals. The results revealed the strongest relationship between the social factor and the environmental factor, followed by the significant correlation between the functional and environmental factors. Several themes related to reasons for access to the hospital's green space and the benefits of natural elements were identified, including the advantages perceived by visitors, features of the calming aspects of nature, and their focus. Ultimately, it was found that the green spaces of Asgariyeh Hospital in Isfahan provide visitors with emotional tranquility through scenic appreciation, leisure opportunities, immersion in nature, restorative experiences, and outdoor air access. Visitor feedback indicates that the primary goal of therapeutic landscape design has been largely successful, providing insights into specific aspects of natural element utilization that are vital for enhancing visitor benefits.

Running Title: The effects of environmental, social, and functional components on healthcare spaces and their prioritization

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INTRODUCTION

Healthcare centers, which are considered significant places aimed at treating patients and improving public health, are of interest from an architectural perspective. Therefore, in most cases, only the quality of treatment at these centers is discussed and examined, and unfortunately, the physical form of the building is evaluated in terms of hygiene, absence of pollution, and functional and physical connections of existing spaces. The satisfaction of users (patients and staff) with the space, perceptual, visual aspects, and their impact on patient behavior are of little importance. However, based on the definition by the World Health Organization, health is a multidimensional concept that, besides the physical aspect, includes psychological and social dimensions. It should be noted that different aspects of health or illness influence each other and are affected by one another. In this study, elements of nature plants, water, and light are considered as independent variables. The built environment of healthcare spaces is considered as the dependent variable. According to Proshansky, the built environment is as much a social phenomenon as it is physical, and built and social environments coordinate with each other. Environmental psychology, as a controlling variable in this research, is a branch of psychology and a subset of behavioral sciences that studies human behavior and its relationship with the surrounding physical environment. This field bridges behavioral sciences and architecture, with architects aiming to analyze the human-environment relationship and apply this knowledge in architectural design.

Research Background

According to Schultz, in primitive societies, the smallest environmental details were known and meaningful, despite creating a complex spatial structure. In contrast, in modern society, attention has shifted towards quantity and goal orientation rather than environmental perception (Schultz, 2003). The formation of a place is a social process rooted in social interactions and activities within it. Therefore, since meanings, components, and activities are embodied in physical space and created through human understanding, understanding how groups construct these identities is important (Relph, 1976). On the other hand, places also play a very effective role in enhancing social dependencies in urban societies. However, Kantar believed that spatial perception varies among individuals, making personal aspects of spatial perception highly significant (Canter, 1977). Relph and Kantar demonstrate two different approaches to the concept of place. Relph, with a phenomenological perspective within human geography, focuses on specific aspects of the concept of place, especially its meaning, whereas Kantar, with a psychological outlook, adopts a positivist view of place (Canter, 1976, Relph, 1997, Canter, 1988). The important point is that both derive from a common fundamental principle: providing a model to define place, in which the elements constituting a place are explained (Groat, 1995; Sime, 1986).

Wender, Kleeis, and Karston (2009), in their research, sought to find the meaning of home for people who are separated from their place of residence due to work conditions. They define three parameters for the meaning of home: "physical," "functional," and "social." The physical dimension addresses the formal and spatial aspects of the home, the functional dimension concerns activities and uses that occur within the space and give it meaning, and finally, the social dimension includes relationships and interactions with others inside and outside the home environment (Marjolijn Van der Klis & Lia Karston, 2009). Healthcare centers are the primary units providing medical services, and according to the definition provided by the Ministry of Health, Treatment, and Medical Education, healthcare centers are units with at least 15 beds or necessary medical equipment and services, including at least two internal and surgical departments with a team of specialized doctors (Health Treatment and Medical Education, 2019).

Extensive research in the United States has shown that good design, green spaces, and sunlight at appropriate angles can accelerate recovery and increase happiness for patients (Alirezaei, 2010). Similarly, a study by McAndrew suggests that facing natural environments as a green experience reduces psychological stress, evokes positive emotions and moods, and can speed up recovery from illness (McAndrew, 2013). Based on the theories of DeLone and Arneill (2003), healthcare environments and their effects on patients have a broad literature and scope, attracting many managers and experts in fields such as architecture, consulting, and psychology. In the current era, considering architectural examples, the design of healthcare facilities as a treatment machine within medical environments has garnered attention, rather than environmental design aimed at health promotion. Many researchers, like Lumpert (1996), believe that sensitive design can enhance recovery processes and significantly influence patients' mental and physical health, especially under the impact of healthcare architecture. Environmental health research largely focuses on the role of the hospital environment in patients' experiences during treatment. A significant part of this experience is related to the quality of care received. However, the concept of care quality remains vague. Crowner (1990) believed that healthcare quality has two types: actual or true quality, and perceived quality. True quality refers to the service quality in the treatment environment, while perceived quality results from the presence of the individual and their experience of the environment they are in, such as a warm, homely space. It may be preferable to prioritize perceived quality over actual quality because, according to research, a high level of perceptual (perceived) quality often overshadow the deficiencies in the services provided in the treatment sector and appear acceptable. Over a century ago, Florence Nightingale emphasized that a proper environment plays a vital role in patient recovery. Today, healthcare environment designers and building managers work hard to create suitable environments for their patients (Devlin and Arneill, 2003; Joseph and Rashed, 2007).

Overall, the design of healthcare centers should reflect the demographics of the population they serve. A rural healthcare facility should not resemble an urban one, as it may be unfamiliar to users. All design plans must be based on a genuine assessment of the quality of construction phases and equipment of healthcare centers. The details of the facility's planning should be carefully studied. Factors such as the age of users, average height, and the type of medical care provided are crucial. A modern healthcare center should utilize the latest technology but must not neglect the psychological needs of patients (Neshavad, 1987). As demonstrated by Raga (1997) in his research, if functional and perceptual categorizations of needs are not satisfactory, individuals will not have a desirable interaction with the treatment process (also see Baskaya and Yildir-Akalin, 2007). Research on environmental stress and environmental health shows that stress can be effectively reduced by increasing harmony and interaction between an individual and their surrounding environment (Topf, 2000). This is what Topf refers to as individual environment adaptation. Studies indicate that individuals with higher social relationships enjoy better health and more peace compared to those who are more isolated. Strong social connections facilitate recovery and relief from illness. Therefore, there is a strong tendency in healthcare environments toward longer visiting hours, chat groups, and attractive waiting areas. It is advisable to design green spaces near patient rooms and hospital entrance waiting areas where small groups can gather. Open spaces with movable tables and chairs for families or staff to congregate should also be considered. Altman considers the opposite of social participation to be social withdrawal, which involves reluctance to socialize and cooperate, behavioral deviance, and indifference to communal areas.

He attributes these effects to the fast pace of life and the lack of appropriate communal spaces and places (Altman, 2007).

MATERIALS AND METHODS

Methodology

The research method in this thesis is descriptive-analytical, based on the research problem, and is applied in terms of usage, with the results directly applicable to the formation of the physical environment of treatment spaces. In terms of objective, it is relational because it examines the relationship between two phenomena: natural elements and the enhancement of the quality of treatment environments. In this context, natural elements, considered as independent variables in the research, include plants, water, and light. For plants, the study considers trees and shrubs (evergreen and deciduous, short and tall, with and without fruit), ornamental and non-ornamental flowers, and grass. Water is examined in still form (fountains and ponds) and flowing form (fountains, streams, and rills). Light refers to sunlight (direct and indirect), with measurements of plants and water based on their scale, which is nominal and ordinal according to the square meter occupied on the horizontal and vertical surfaces, respectively. Light is measured by a nominal and ordinal scale of the passing level on the external facade of the building. The treatment spaces involved in this study include the pediatric hospital section, selecting hospitalized patients to eliminate confounding and interfering variables. The chosen patients have full consciousness, are free from psychological issues, and stay more than three days; this measurement scale is nominal. In this research, the descriptive-analytical method serves as the foundation and framework for conducting the study and enhancing understanding. Additionally, domestic and international experiences and library studies and related specialized texts will be reviewed. In the data collection phase, the research tool is a questionnaire. Following the analysis, the effects of natural elements on the formation of treatment centers will be systematized through comparative methods.

Table 1: Frequency distribution of responses, mean and standard deviation of performance factor indicators

Item	Frequency of responses					Total abundance	Average	Standard deviation
	Very Little (1)	Little (2)	To some extent (3)	Many (4)	Very much (5)			
Air temperature conditions - indoor space suitable for children	7	49	140	167	21	384	3.38	0.843
Green elements – interior	8	63	176	125	12	384	3.18	0.816
Plant diversity - therapeutic area	13	60	157	134	20	384	3.23	0.894
Natural materials - interior	14	69	140	134	27	384	3.24	0.950
The lighting condition of the hall's interior space	24	59	134	132	35	384	3.25	1.026
Daylight conditions - Therapeutic green area	12	28	94	174	76	384	3.71	0.967
Night light status - therapeutic green area	19	55	88	177	45	384	3.45	1.034
Sound condition – interior	14	42	132	158	38	384	3.43	0.939
Sound status - Green Therapy Area	15	77	188	92	12	384	2.89	0.850
The state of desirable odors	26	80	193	72	13	384	2.91	0.892

DISCUSSION AND FINDINGS

To enhance the accuracy level and reduce potential errors that may occur in manual calculations, SPSS statistical software has been used for data analysis, which possesses high capabilities in data interpretation and analysis. For descriptive statistics, the data related to respondent distribution of demographic features and other desired characteristics in the questionnaire are presented. This section also includes frequency distribution tables of responses, means, standard deviations of the questionnaire data, and statistical charts for description. In the inferential statistics section, the method used to test research hypotheses is the one-sample t-test. Additionally, the Friedman ranking test has been employed to rank the dimensions, components, and factors influencing the research. The statistical data analysis in this study was performed using SPSS software version 25. This section aims to present all statistical operations conducted on the questionnaire in a structured manner. First, descriptive statistics are discussed, followed by the results of statistical tests (inferential statistics). Of the total 384 people in the research unit, 227 (59%) were men and 157 (41%) were women.

Descriptive study of research variables

Based on the data presented in Table 1, the frequency distribution of the performance factor items is observable. The highest average score pertains to the item "Natural light condition - therapeutic green space," with a mean of 3.71. The lowest average score among these items relates to the item "Sound condition - therapeutic green space," with a mean of 2.89. The greatest standard deviation, at 1.034, is associated with the item "Night lighting condition - therapeutic green space," indicating that there was disagreement among respondents regarding its importance. The smallest standard deviation, at

Table 2: Frequency distribution of responses, mean and standard deviation of environmental factor indicators

Item	Frequency of responses					Total abundance	Average	Standard deviation
	Very Little (1)	Little (2)	To some extent (3)	Many (4)	Very much (5)			
Connection and access to nature	18	78	128	134	26	384	3.19	0.989
Security situation - Green area	23	68	141	108	44	384	3.21	1.055
Child-friendly readability - green area	8	31	110	157	78	384	3.69	0.953
Relaxation, stress reduction, suitable for children – green space	25	45	130	145	39	384	3.33	1.026
Improving social interactions - green space	18	32	120	159	55	384	3.52	0.993
Sensory stimulation - green space	14	50	128	156	36	384	3.39	0.952
Diversity of space - green area	14	63	124	147	36	384	3.33	0.979
Beauty Perception - Green Space	33	94	162	73	22	384	3.02	0.999
Privacy, seclusion – green space	16	74	143	123	28	384	3.19	0.968
There is a fountain in the pond - a green area	11	46	134	160	33	384	3.41	0.910
Children's play equipment - green area	6	21	99	175	83	384	3.80	0.892
Walking trails – green areas	8	23	119	188	46	384	3.63	0.849
Garbage collection system	5	36	75	205	63	384	3.74	0.887
Surface water collection system	21	58	149	131	25	384	3.21	0.964

0.816, corresponds to the item "Green elements - internal," suggesting that respondents had the least disagreement about this item.

Based on the data available in Table 2, the frequency distribution of environmental factor items is observable. The highest average score pertains to the item "Appropriate readability for children - green space," with a mean of 3.69. The lowest average score among these items relates to the item "Privacy, solitude - green space," with a mean of 3.19. The greatest standard deviation, at 1.055, is associated with the item "Safety condition - green space," indicating that there was disagreement among respondents regarding its importance. The smallest standard deviation, at 0.849, corresponds to the item "Walking paths - green space," suggesting that respondents had the least disagreement about this item.

Based on the data presented in Table 3, the frequency distribution of social factor items is observable. The highest average score pertains to the item "Designing spaces to facilitate conversations and social interactions in the courtyard," with a mean of 3.54. The lowest average score among these items relates to the item "Designing and creating waiting spaces for social interaction," with a mean of 3.05. The greatest standard deviation, at 0.913, is associated with the item "Designing and creating waiting spaces for social interaction," indicating there was disagreement among respondents about its importance. The smallest standard deviation, at 0.790, corresponds to the item "Having a building and site identity (presence of specific elements related to the boundary and their preservation and reinforcement)," suggesting that respondents had the least disagreement about this item.

RESULTS AND CONCLUSION

Inferential statistics

After describing the variables and responses obtained from the statistical population, this section examines the hypotheses proposed and the statistical test used in the research, so that by analyzing the findings, we can examine the validity and invalidity of the hypotheses from a statistical perspective.

One-sample t-test

After entering the questionnaire data by converting the five-option Likert scale to a pseudo-interval scale by assigning values from 1 to 5 (1: very little, 2: little, 3: somewhat, 4: a lot, and 5: very much), we use the population mean test (t-test) to test the research hypotheses. This test is used for quantitative variables and in some cases is used to detect the effect or lack of effect of a variable(s) in the situation under study. For example, we use this test to examine the effect or

Table 3: distribution of responses, means, and standard deviations of social factor indicators

Item	Frequency of responses					Total abundance	Average	Standard deviation
	Very Little (1)	Little (2)	To some extent (3)	Many (4)	Very much (5)			
Designing spaces for conversations and social interaction on campus	6	28	139	173	38	384	3.54	0.829
Designing and creating a pause space for people to socialize	20	71	184	89	20	384	3.05	0.913
Having an identity for the building and its surroundings (the presence of specific elements related to the area and their preservation and reinforcement)	3	45	174	140	22	384	3.35	0.790
Possibility of holding medical meetings and group therapeutic activities on site	8	57	190	112	17	384	3.19	0.816

lack of effect of all research variables on a given phenomenon, so that if the mean of each variable is greater than a certain limit, that variable is considered effective in the phenomenon in question. (Momani, 2012, 68) Therefore, to test the research hypotheses, the population mean statistical hypothesis test, or in other words, the one-sample t-test, has been used, which actually tests the difference between the mean of the sample under study and a given value.

Hypothesis test:

H0: The mean of the responses does not differ significantly from the theoretical mean. (3=μ)

H1: The mean of the responses differs significantly from the theoretical mean. (3≠μ)

Given that all the questions in the questionnaire were designed directly, the mean obtained in the range of one to three means low and very low, and in the range of more than three means high and very high. For this purpose, we define the H0 and H1 hypotheses for all hypotheses and then use the t-test to test and analyze the hypotheses. In the following, the results of the population mean test in the studied individuals are discussed.

Assessing the current state of functional, environmental and social factors

Now, considering the output of this test (Tables 4, 5, 6), we will analyze its results. The first column from the right shows the functional, environmental, and social factors, respectively. The second column displays the t-statistic. The third column presents the degree of freedom for the functional factor. The fourth column shows significance. Given that the significance level for the functional, environmental, and social factors is less than 5 percent, it can be concluded that the average of these factors has a significant difference with the number 3. The last two columns show the lower and upper limits of the 95% confidence interval for the average of these variables. Given that the upper and lower limits for these variables are positive, the average of

Table 4: Results of the t-test to measure the current status of the performance factor

Factor	t-test statistic	Degree of freedom	Significance level (two domains)	95% confidence interval of the mean difference		Result
				Lower limit	Upper limit	
Functional	7.329	383	0.000	0.177	0.307	Approved

Table 5: Results of the t-test to measure the current status of the environmental factor

Factor	t-test statistic	Degree of freedom	Significance level (two domains)	95% confidence interval of the mean difference		Result
				Lower limit	Upper limit	
Environmental	10.167	383	0.000	0.315	0.466	Approved

Table 6: Results of the t-test to measure the current status of the social factor

Factor	t-test statistic	Degree of freedom	Significance level (two domains)	95% confidence interval of the mean difference		Result
				Lower limit	Upper limit	
Social	9.771	383	0.000	0.225	0.339	Approved

this variable is greater than 3. As a result, considering the upper and lower limits of the last row of this output, it can be concluded that the functional, environmental, and social factors are in a favorable situation.

Friedman test

In this study, the Friedman test was used to prioritize variables. The Friedman test is used to prioritize and rank variables based on the greatest impact on the dependent variable. This test, named after its inventor, the famous economist Milton Friedman, is actually used to compare several groups in terms of their average rankings. We used this test in this study to prioritize the research factors.

The null hypothesis and the first hypothesis in this test are as follows:

H0: The average rankings are the same

H1: At least two rankings have different averages.

Prioritizing research factors

The result of the Friedman test includes two outputs. The first output (Table 7) is the number of data points for each factor, the value of the chi-square statistic, the degree of freedom, and the significance level, respectively. Since the significance level is less than 5 percent, the null hypothesis is rejected and the claim that the ranks of these dimensions are the same is not accepted.

Table 7: Review of Friedman test indicators

Sample size	Degree of freedom	Chi-square statistic	Significance level
384	5	288.994	0.000

The second output (Table 8) is descriptive statistics showing the average ratings of each factor.

Table 8: Friedman test results based on research factors

variable	Average rank	Rank
Functional	3.01	3
Environmental	3.63	1
Social	3.02	2

Table 9: Results of Friedman test based on performance factor components

Variable	Average rank	Rank
Air temperature conditions - indoor space suitable for children	7.70	4
Green elements – interior	6.68	8
Plant diversity - therapeutic area	6.93	6
Natural materials - interior	6.91	7
The lighting condition of the hall's interior space	6.42	9
Daylight conditions - green therapeutic area	7.10	5
Night light status - therapeutic green area	9.18	1
Sound condition – interior	8.11	2
Sound status - Green Therapy Area	7.76	3
The state of desirable odors	5.96	10

Therefore, based on the averages presented in Table 4-9, at a 95% confidence level, the "lighting condition in the therapeutic green space at night" is the most important component, and the "desired odors condition" is the least important factor affecting the functional factor.

Table 10: Results of Friedman test based on environmental factor components

Variable	Average rank	Rank
Connection and access to nature	9.18	1
Security situation - Green area	8.07	3
Child-friendly readability - green area	7.97	4
Relaxation, stress reduction, suitable for children – green space	5.35	12
Improving social interactions - Green space	3.77	14
Sensory stimulation - Green space	6.47	7
Diversity of space - Green area	5.15	13
Beauty Perception - Green Space	6.24	10
Privacy, seclusion – Green space	6.42	8
There is a fountain in the pond - a Green area	5.62	11
Children's play equipment - Green area	7.12	5
Walking trails – Green areas	6.99	6
Garbage collection system	8.31	2
Surface water collection system	6.29	9

Therefore, according to the averages presented in Table 10, at a 95% confidence level, "connection and access to nature" is the most important component and "improvement of social interactions-green space" is the least important component affecting the environmental factor.

Table 11: Results of Friedman test based on social factor

Variable	Average rank	Rank
Designing spaces for conversations and social interaction on campus	2.88	1
Designing and creating a pause space for people to socialize	2.17	4
Having an identity for the building and its surroundings (the presence of specific elements related to the area and their preservation and reinforcement)	2.59	2
Possibility of holding medical meetings and group therapeutic activities on site	2.36	3

Therefore, according to the averages presented in Table 11, at a 95% confidence level, "designing spaces for conversations and social communication in the area" is the most important component and "designing and creating a pause space for social communication among people" is the least important component affecting the social factor.

Correlation test between research factors

Table 12 examines the correlation between factors (the impact of smart growth indicators on residents' walking rates) using the Pearson correlation test. Correlation is a way of showing how closely two or more variables are linked or related to each other. Probably the most widely used statistical measure of bivariate correlation is the Pearson moment correlation coefficient, commonly called the Pearson correlation. Its abbreviation is r. The Pearson correlation indicates the extent to which there is a linear relationship between the quantitatively measured variables.

Table 12: Pearson correlation matrix between main factors

Factors	Functional	Environmental	Social
Functional	1		
Environmental	0/40	1	
Social	0/33	0/45	1

The results of the Pearson correlation test (12) showed that there is a statistically significant relationship between all factors and all relationships are confirmed at the 95% confidence level ($P<0.05$). The results show that the strongest relationship between the factors is related to the relationship between the social factor and the environmental factor, whose correlation coefficient is 0.45, and after that the strongest correlation is related to the relationship between the functional and environmental factors with a correlation coefficient of 0.40. Al-Asgariyah Hospital, as an urban hospital with significant spatial limitations that restrict therapeutic green spaces, faces these constraints. This early research provides inadvertent evidence of the perceived value attributed to healing gardens, including that they provide accessible spaces within the hospital vicinity for patients, families, and staff—yet they do not evoke the "feeling" or "similarity" of a hospital. Appreciative comments reflect the fresh air, gardens, and scenic views—offering a sense of normalcy, a different perspective, and a break from focusing on the injuries and illnesses patients experience. Specifically, remarks left on benches indicate that exposure to natural outdoor environments, with attractive views, notable seating, as well as play areas and significant green spaces, are welcomed by users. Similar to studies on healing gardens in pediatric hospitals elsewhere, visitors to therapeutic grounds mainly seek a place to sit and relax. However, findings from this study are likely biased by the data collected on benches. Visitor comments mainly refer to the beauty of the green space and scenery, noting it as a peaceful place that offers a sense of "time outside" the hospital. This may highlight the importance of landscape design and the use of specific features and plants to create a sense of solitude, visual serenity, and lushness amidst busy environments. Given the spatial limitations of this urban hospital and considering the technical restrictions on designing and selecting plants for its terraced gardens, this is notewor-

thy. It demonstrates the value that can be created even within relatively small garden spaces that are well-designed and properly placed.

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