

Exploring Healing Design Elements for Patient Room Design: Preferences of Adolescent Patients from Surgical Units

Eun Young Kim¹

¹Interior Architecture and Design Program, University of Tennessee at Chattanooga, Tennessee, USA

Correspondence: Eun Young Kim, Interior Architecture and Design Program, University of Tennessee Chattanooga, Chattanooga, Tennessee, USA. Tel: 1-423-425-5458. E-mail: eun-y-kim@utc.edu

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Abstract

Although the substantial influence of hospital environments on well-being has been widely recognized, research on the same topic for adolescent patients is limited. This study examined adolescent patients' preferences in hospital room designs to identify design elements that can potentially promote the healing process. Eight computer-simulated patient room images were developed through the combinations of three design elements: trim style (straight vs. arch), ceiling and floor details (plain vs. decorated), and window view (nature vs. city). Adolescent patients evaluated the images of patient room images using seven preference evaluation words on a Likert scale. Adolescent patients did not differ in preference for either straight or arch trim styles ($p > 0.05$). Also, the different ceiling and floor details, such as plain vs. decorated, did not differ in the responses ($p > 0.05$). However, the study results indicated that more adolescent patients strongly prefer the nature view than the city view ($p < 0.01$), with higher peaceful, comfortable, pleasant, private, and enjoyable perceptions. Therefore, the window view was the most significant among the examined design elements, directing the value of relaxation and connection beyond the hospital environment. The results imply that 3D simulation of the patient room images adopting design elements can quantify adolescent patients' perceptions of room design in conjunction with the Likert scale. Based on the results of this study, adolescent patient rooms should be designed and developed considering natural stimulation aspects in connection with the outside environment.

Keywords: adolescent patient, patient room, preference, nature view, healing

1. Introduction

Depending on patients' characteristics and medical conditions, patients experience different degrees of stress while staying in a hospital. Research has evidenced that physical stimuli in hospital environments can influence patients' healing processes and health outcomes (Ghazali & Abbas, 2012; Ulrich, Zimring, Quan, Joseph, et al., 2004; Ulrich, 1984). Information about adolescent inpatients' feelings about hospital environments is insufficient. Adolescence is characterized by dramatic physical and emotional changes from childhood into individual maturity. The cognitive centers at this age are also in flux (Ramowski et al., 2007). Well-designed healthcare environments can support a patient's healing processes through physical and psychological benefits. Prior studies evidenced a meaningful relationship between physical healthcare environments and improved well-being (Ulrich, 1984; Karlin & Zeiss, 2006; Ampt & Maxwell, 2008; Salonen et al., 2013; Bukh et al., 2015). The importance of healthcare environments for adolescents should not be overlooked because of the transient nature of adolescence (Ullan et al., 2011). With an increasing number of adolescents with chronic health issues, healthcare professionals are confronting challenges in managing the complexity of adolescent health concerns (Sawyer et al., 2007).

Chronic pain occurring in adolescence may develop into more significant depressive symptoms and lower self-esteem than in other age groups (Varni, 1996). Adolescents also responded more sensitively to hospitalized environments where privacy was not sufficiently provided (Britto et al., 2010; Hutton, 2002). Adolescents' subclinical social anxiety also garnered attention as a potential health issue, and some studies acknowledged particular emotional fluctuations influenced by surroundings (Hutton, 2002; Valkenburg, 2006). Adolescent patients isolated from their peers experienced more significant anxiety than non-patient adolescents (Van Zalk & Van Zalk, 2015). However, empirical research findings are inadequate to support the necessity of hospital room planning for enhancing adolescent patients' psychological well-being. Some research evidenced that adolescents' preferences in hospital settings with interior colors and decoration (Tivorsak et al., 2004) have significant value in

terms of an emotional boost for healing. The transient nature of the adolescent development stage explains the distinct adolescent population's preferences from adults and pediatrics. According to research results (Blumberg & Devlin, 2006), adolescent patients preferred hospital hallway and lobby designs with bright colors reflecting childhood but disliked decoration with emblems directly related to childhood. However, the research focused on the indoor design aspects of common areas, and the results could not be extended to the design of private spaces. Application of evidence-based hospital design plans for adolescents should consider their unique physical and mental status to enhance healing and psychological well-being (Craik & Feimer, 1991; Hartig & Staats, 2006). Since preference is a complex feeling based on experience, background, and knowledge, the analysis of the preferences should consider the environment and stimulus level (Imamoglu, 2000; Stamps & Mystery, 2004).

Although major national health institutes such as the U.S. Department of Health and Human Services and the American Academy of Pediatrics slightly differ in the age definition of the adolescent stage, for this study, adolescent participants ranged in age from 14 to 18. Holistic restoration of patients is the goal of healthcare providing facilities. Therefore, this study was designed to estimate how the design elements influence potential restoration of adolescent patients at hospital room environment by adopting computer-simulated room images containing interior design elements and Likert scale based perception keywords.

2. Methods

2.1 Development of Patient Room Images

The combinations of the three elements: trim styles (straight vs. arch) \times ceiling and floor details (plain vs. decorated) \times window views (nature vs. city), were implemented in the patient room images (Table 1).

Table 1. Combinations of three design elements applied to the computer-simulated room images

Design Element			Room Image No.
Trim Styles	Ceiling & Floor	Window View	
Straight trims with green and neutral colors	Plain	Nature	1
		City	2
	Decorated	Nature	3
		City	4
Arch trims with yellow and bright blue colors	Plain	Nature	5
		City	6
	Decorated	Nature	7
		City	8

The patient room designs and image constructions were developed according to the general guidelines of FGI 2014 Guidelines (FGI, 2014). A total of eight room images were generated according to Table 1 using 3D modeling, and rendering software, Google Sketchup, and Podium 2.4. Figure 1 presents the room images # 1 and 5 showing contrasts between the trim styles, ceiling and floor details, and window views.



Figure 1. Computer-simulated room images developed by combining the three design elements such as trim styles \times ceiling and floor details \times window views). *Note:* Contrasts of styles for trim (straight with neutral color tone vs. arch with bright color tone), ceiling and floor (plain vs. decorated), and window view (nature vs. city) were applied to the eight room designs. Figures present only room # 1 and 5 to show the contrasts

2.2 Preference Evaluation Instrument

The evaluation instrument for the eight computer-simulated room images was developed along with Likert scale preference evaluations to quantify the responses to each room image. The adolescent inpatients evaluated each room image on a 5-point Likert scale from 1 (least likely) to 5 (most likely) for seven evaluation words: Peaceful, Comfortable, Pleasant, Roomy, Controllable, Private, and Enjoyable (Table 2). The evaluation words referred to Kasmar (1970) for the adolescents' environmental perceptions.

Table 2. Evaluation words and five-point Likert scale used for the room image evaluation.

Evaluation Word				
Peaceful, Comfortable, Pleasant, Roomy, Controllable, Private, Enjoyable				
Likert Scale				
1 (Least likely)	2	3	4	5 (Most likely)

2.3 Participants and Survey Procedure

This study was approved by the University of Louisville Institutional Review Board of Research Office. The participants were recruited at the surgical department in the Children's Hospital in Louisville, Kentucky, USA. The Norton Healthcare Research Office reviewed the researcher liability before the participant recruitment at the surgical department. After the deliberations of the study details, adolescent patients that signed the prepared consent form along with their guardians were included in the survey. The participating inpatients scored the room images presented by digital screen based on the perception keywords using the five-level Likert scale. A total of 47 adolescent patients completed the survey, ranging from 14 to 18 years old while waiting for their operations. The physical conditions of the participating patients varied depending on the types of surgical operations, therefore, the data collections were conducted only with the patient who were able to sit and communicate with the researcher regarding the survey.

2.4 Statistical Analysis of Data

Descriptive statistics and a Chi-square analysis were conducted with the subjects' demographic data to examine underlying discrepancies. First, the room design preference data were rearranged by the three design elements in a univariate model; then, the dataset was analyzed by ordinal logistic regression analysis of proc logistic of SAS (2010), considering the discrete nature of the five-point Likert scale. Finally, the three-room design elements (trim style, interior detail, and window view) were considered independent variables, and the responses for the seven evaluation words were regarded as dependent variables.

3. Results

3.1 Subject Demographics

The adolescent patients did not show significant differences in gender distribution. The percentage of female subjects was slightly higher than males, with females comprising 57.4% of the patient group. The probability of the chi-square test was not significant ($p = 0.36$). The age distribution ranged from 14 to 18 years old, with a slightly higher proportion of 16 to 17-year-old subjects, but the frequency of the age group was also insignificant ($p = 0.26$).

3.2 The Effect of Design Element on Preference

Table 3 presents the significance of the design element's effects on the subjects' responses to each evaluation word. Trim style and interior detail did not affect the adolescent patients' responses to the evaluation words ($p > 0.05$). However, the window view was significant in most responses to the evaluation words except for 'roomy' and 'controllable.'

Table 3. *P*-value of the design element effects on adolescent patients' responses for seven evaluation words

Design Elements	Evaluation Words						
	Peaceful	Comfortable	Pleasant	Roomy	Controllable	Private	Enjoyable
Trim style	0.84	0.41	0.66	0.61	0.24	0.25	0.09
Ceiling & floor detail	0.19	0.14	0.25	0.94	0.78	0.06	0.92
Window view	< 0.0001	< 0.0001	< 0.001	0.17	0.35	< 0.0001	0.01

Table 4 presents the distributions of adolescent patients' responses to the window view element since the impacts of the other two design elements (trim style and interior detail) were not significant on the seven evaluation words. Also, percentages of the responses for the two evaluation words 'roomy' and 'controllable' were not provided in the table due to their insignificance in the window view element. More than 70% of the responses were presented in approval of the window view design element for the five evaluation words, while below 20% were distributed in disapproval.

Table 4. Percentage of the adolescent patients' Likert scaled responses showing the degree of approval of window view for the evaluation words.

Evaluation words	Window views	Least likely	Less likely	Neutral	Somewhat likely	Most likely
Peaceful	Nature	0.5	6.3	12.5	29.3	51.3
	City	0.8	10.5	18.3	32.9	37.5
Comfortable	Nature	0.0	1.9	8.2	27.5	62.4
	City	0.0	3.0	11.7	33.2	52.1
Pleasant	Nature	0.2	0.7	9.8	26.4	62.9
	City	0.4	1.1	13.4	31.2	54.0
Private	Nature	2.8	8.3	17.9	28.9	42.1
	City	4.6	12.9	23.4	29.0	30.1
Enjoyable	Nature	0.0	1.0	9.4	30.2	59.4
	City	0.0	1.4	12.2	34.5	51.9

There were more positive response percentages on the nature view (average 84%) than the city (average 77%) across the evaluation words. The combined portions of 'somewhat likely' and 'most likely' responses for the 'private' evaluation word were 71.0 and 59.1% on nature and city window views, respectively, which were lower approval compared to those of other evaluation words. The 'private' evaluation word received the highest disapproval responses in the percentages; the sum of 'less likely' and 'least likely' were 11.1 and 17.5% for nature and city views, respectively. The 'most likely' responses for 'enjoyable' demonstrated a 7.5% difference between nature and city window views, which was the least between nature and city views among the evaluated words.

4. Discussion

More than half of the responses to the applied design elements placed between 'somewhat likely' and 'most likely,' indicated overall approval of the hospital room design by the adolescent patients. This study anticipated significant associations of roomy or controllable perceptions with trim styles or design details since visual effects of interior elements on interior spatial perceptions were substantial in the research (Jaglarz, 2011). The impact of interior settings, such as shapes and arrangement of interior features, should influence the interior space perceptions through visual illusions. However, the responses to other design elements for this study's evaluation words were not as significant as the window view element. This result may reflect the asynchrony of this age's physical, psychosocial, and cognitive abilities, as Sanders (2013) reported. Perhaps, the health status also affected the subjects' sensitivity to the delicate changes in the room simulations.

The consistently higher 'most likely' responses on the natural window view setting indicated a higher appreciation of the view than the city view. In addition, after surgery, patients who stayed in a room with a nature scenery

through a window had a shorter hospitalization, less stressful experience, and fewer analgesic doses than patients in a room without a window (Ulrich, 1984). Another study focusing on the effect of the natural environment also demonstrated a more significant recovery than in city settings (Kaplan 1995; Kaplan and Peterson, 1993). This advantage may have been due to the attraction to nature and color, which positively affected the health and well-being (Ulrich et al., 2008; Ulrich et al., 1991; Velarde et al., 2007). Hutton (2005) and Mazuch and Stephen (2005) positively valued large windows in a room, regardless of city or nature view, because the large window interior feature satiated teenagers' desire to connect to the outside beyond the hospital environment. Restoration is a significant part of the holistic healing process for hospital patients. There was empirical evidence for the benefit of the natural environment over the built (Hartig et al., 1991; Kaplan, 1995). Nature's ability to restore stress and attentional fatigue could make people prefer natural environments over built environments. Therefore, preference for nature supports restoration ability. Some empirical findings also evidenced restoration theory related to nature scenes (Adams et al., 2009; Tennessen & Cimprich, 1995; Ulrich et al., 2008).

Although the window view was the design element most influential on positive responses from the adolescent patients, substantial numbers of the subjects also felt less private from the interior aspect. The responses to disapproval for private perception remained at 11.1 and 17.5% on nature and city window view settings, respectively. Those proportions were the highest disapproval responses among the evaluation words. Hutton (2002) emphasized the importance of private space for adolescents, especially in hospitalization. Therefore, window views in a hospital room setting should be carefully considered to balance adolescent patients' confidentiality and other preferences. Meanwhile, the 'enjoyable' and 'pleasant' perceptions demonstrated the slightest difference between the nature and city views, reflecting adolescent patients' choice in some dynamic influence through the city view.

With the defined design elements (straight/arch trim style, plain/decorated interior detail, and nature/city window view) and Likert scale evaluations, this study was able to quantify adolescent patient room design preferences through the separated design element approaches. However, this study also has some limitations in interpreting the design impact on adolescent patients' design choices due to the possible gap in the responses to the concurring impression of color, hue, or other design characters and the verbally defined design elements. In addition, estimating preference even with well-designed survey instruments has been challenging due to the underlying process (Berkyne et al., 1970; Park et al., 2010). Finally, individual body condition would be another compound factor in the survey results.

The motivation for this study was to fill the gap between evidence-based design planning and the findings in literature for hospital room designs, particularly for adolescent patients. The developed hospital room rating, quantifying the room design preference on the applied design elements in this study, differentiated some interior design values through simulated room designs and a survey instrument.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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