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Users' Perceptions of the Physical Environment Design Factors in Ethiopian Hospitals

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Abstract

Background*: The physical environment in which an individual lives or receives treatment significantly impacts human health and well-being. Research shows that it is essential to consider users' opinions while designing the physical environment of hospitals. Using an evidence-based methodology, the current study examines how users (N = 384) perceive the physical environment at two large Ethiopian hospitals: St. Paul's Hospital Millennium Medical College (SPHMMC) and Nekemte Comprehensive Specialised Hospital (NCSH). Based on a literature review, we examined how all users—that is, hospital staff, patients, and families—perceived the design factors in the two hospitals.*

Methods: *A questionnaire survey was performed to find out how users felt about the design items that were collected from different sources and to rate their significance. The duration of the data collection* was *from August 7-18/2022, and September19-30/2022, in NCSH and SPHMMC, respectively. Principal component analysis (PCA) was used to decrease the 23 scale items intended for users' self-report perception from several sources in the literature to 21 items. The statistical analysis was performed using IBM SPSS Statistics version 27. After that, the items' descriptive statistics, including means, frequencies, percentages, and standard indicates that it is crucial to consider users' opinions when deviations (SD), were computed.*

Results: *Among the 21 design elements evaluated by 384 hospital patients, cleanliness and hygiene (mean = 4.68) were the most significant environmental features, followed by daylight availability (mean = 4.57) and family-friendly space (mean = 4.43). One of the least significant design elements was the existence of coordinated art objects (mean=3.09).*

Conclusion: *The discovery of the 21 design factors in this study supports the use of evidence-based design (EBD) to establish a healing environment for all users, including staff, patients, and their families. All the 21 design variables that were taken from the literature has got mean scores higher than 3.0 out of 5.0, indicating that people would rather take them into account when designing a hospital. However, extrapolating these results and attempting to use them as support for other institutions in different regions may require evidence-based decisions due to different factors.*

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INTRODUCTION

According to research, it is essential to take users' opinions into account while designing the physical environment of healthcare facilities. It can facilitate the healing process for patients and make the work of caretakers easier. It has been found that human health and well-being are significantly impacted by the physical surroundings in which an individual lives or receives treatment. Patients should be able to spend most of their hospital stay in a welcoming environment, according to the general consensus (2,4,5,16). The perspectives and input of the users (staff, patients, and families) about the physical environment include what they think is important and what improves their healthcare experience. According to Elf, M. et al. (10,12,16), such a source of information is essential for problem analysis and developing an effective action plan for hospitals' quality improvement.

Hospital physical environment design should incorporate factors like safety, ergonomics, color, artwork, adequate lighting, a good view, sufficient furniture, and an inviting environment to enhance a patient's health and well-being. Studies have shown that adapting healthcare design to users' psychological requirements can enhance medical outcomes by fostering healing and reducing hospital stays (7,9,11).

Additionally, studies have demonstrated that Evidence Base Design (EBD) is based on the technical know-how and needs of designers as well as the information currently available on what is best for users. Literature also suggests that it is simpler to monitor how users are reacting to different design concepts if there were a practical and relevant self-report measure on hospital environmental quality perception. According to Shen, X. et al. (1,6,13), in addition to putting research-based solutions into practice, it is important to assess the views of the patients in the targeted hospital care unit.

Numerous physiological, psychological, and physical factors obscure the effects of the physical environment in the corpus of existing information, claim R.S. Ulrich et al. Prior to being utilized in the decision-making process, these variables need to be transformed into design indications or variables. R. S. Ulrich et al. (14,15,16) state that these translations are not always straightforward and may lose their semantics and utility. Based on the aforementioned idea, environmental psychologist R.S. Ulrich, who conducts a number of empirical scientific studies on the impact of healthcare facilities on patient medical outcomes, ensured that without considering the users' own perceptions, researchers could not fully identify the effects of the physical environment on users.

There is currently no enough study data on hospital users' opinions of the physical environment design features. Researchers have not fully examined the range and kind of features that users consider essential to their health and well-being. How these factors are viewed in connection to hospital physical environment design and how they could be more successfully incorporated into the design process, however, have received little consideration.

To bridge this gap, the current study used an evidence-based methodology to examine how users perceive the physical environment in two sizable Ethiopian hospitals, St. Paul’s Hospital Millennium Medical College (SPHMMC) and Nekemte Comprehensive Specialized Hospital

(NCSH). We examined how all users—that is, hospital staff, patients, and families—perceived the design components in the two hospitals based on a review of the literature.

METHODS

Study Design

A descriptive research design is employed to meet the research objectives and offer a more thorough analysis. A quantitative study was conducted using a questionnaire survey to find out how people perceived the design items that were selected from different sources and to rate their significance. The duration of the data collection was from August 7-18/2022, and September19-30/2022, in Nekemte Comprehensive Specialized Hospital and St. Paulos Hospital Millennium Medical College, respectively.

Sampling

In-and-out patients, their families, and medical staff from both hospitals—physicians, nurses, technicians, and administrative/managerial staff—are all participants in the study. Participants in this survey were required to be at least eighteen. The respondents were randomly selected from each ward or department, and both sexes were given equal chances as much as possible. The sample size was determined by adding up all respondents in each department or ward.

Together, these two hospitals contain 3829 medical professionals, administrative personnel and 958 beds. Based on projected sample size tables with a 95% confidence level and a 5% degree of accuracy/margin of error, the sample size for the aforementioned population was 357. However, due to concerns that some surveys might not be returned or might be incomplete due to the stressful and hectic environment of hospitals, the researcher chose 400 respondents to collect sufficient, reliable information.

Development of the Questionnaire

A thorough literature review served as the foundation for the questionnaire's formulation. The design factors taken from the literature review were used in its development. There were twenty-one items in the final questionnaire structure. To create healing environments in hospitals, the respondents were asked to rank specific design components according to their significance.

Various sources in the literature are used to create the questionnaire intended for users' self-report perceptions. To prevent confusion and repetition of replies, some of the hospital environment measuring scales' contents taken from the literature were combined for the current study due to their overlapping meanings. However, the objects used in earlier similar investigations were supplemented with some additional things. To improve the questionnaire's content validity and incorporate several crucial items that are thought to help. The newly included items were intended to improve the questionnaire's content validity and incorporate some significant items that support a healing environment.

On a five-point Likert scale, with 1 denoting not important, 2 least important, 3 neither important nor unimportant, 4 important, and 5 most important, respondents were asked to rate how important they thought an item was to fostering a healing environment. A higher score indicated a higher level of perception. The questionnaire asked about demographics including age, gender, dwelling location, and degree of education. To ensure that the respondents, particularly the patients and their

families, could easily comprehend the questionnaire and clearly identify their preferences of the physical environments, its contents were first developed in English and then translated into the local languages, Amharic and Afan-Oromo. However, the workers at both hospitals completed the initial English-language questionnaire because they are professionals.

Data collection

The quantitative data was obtained using a self-report questionnaire. A self-report questionnaire is used to gather information regarding people's perceptions of the physical healing environment in each hospital. To strengthen the validity of the surveys, the corresponding author translated the contextual meaning into the local language throughout the survey because the respondents were unable to understand the original meaning and architectural context of the questionnaire items. 384 (96%) of the 400 issued questionnaires were completed. while 4% were excluded because they were not complete.

Data analysis

The statistical analysis was performed using IBM SPSS Statistics version 27. Percentages and frequencies were computed to do a descriptive analysis of the demographic data. After that, the items' descriptive statistics, including means, frequencies, percentages, and standard deviations (SD), were computed. Utilizing Cronbach's alpha, the reliability test was conducted. Since the study involved comparing the perspectives of groups of respondents, the reliability test had to be conducted to assess the correlation between items.

The Kaiser–Meyer–Olkin (KMO) test for sample adequacy measuring 0.801 and Bartlett's test showing a significant correlation between items (Chi-square = 2210.684; $p < 0.001$) served as the foundation for the factor solution. The literature suggests that for a scale to be considered sufficiently reliable for use with responder groups, it must satisfy the Cronbach's coefficient alpha (α) $\geq$ 0.70 requirement (19,20). According to the literature, a coefficient of (α) ≥ 0.70 is regarded as acceptable, $0.70 < \alpha \leq 0.80$ as good, and $\alpha > 0.80$ as very good (19,20).

Therefore, in the current investigation, the value of 0.801 is very good. However, research indicates that in order to help address the study concerns, a multi-item scale questionnaire can be reduced to more manageable scales. Principal Components Analysis (PCA) was computed to identify the variables and components that were most closely connected. To assist in identifying the linked variables that needed to be extracted, the principal component analysis (PCA) findings were subjected to Varimax rotation. These findings suggest that the items on the questionnaire were suitable for factor analysis.

Items were added to the factors if they had high loadings (≥ 0.40) and if they only had one loading on a single factor. The variables in the PCA results agreed well with those in previous comparable studies. Two of the initial 23 questionnaire items were eliminated during the PCA procedure. The remaining 21 categories were retained and further broken down into six condensed factors: aesthetics, Safety, wayfinding & facilities, accessibility & hygiene, sensory and views &spatial.

Table 1: Summary of the six factors and their rotated component matrix

Items from the questionnaire	Components					
	Factor 1 Aesthetics	Factor 2 Safety	Factor 3 Way finding & Facilities	Factor 4 Accessibility & hygiene	Factor 5 Sensory	Factor 6 Views &spatial
Pleasant colour scheme	.747	-	-	-	-	
Presence of coordinated art objects	.749	-	-	-	-	
Building aesthetics	.735	-	-	-	-	
Measures to prevent patient falls	-	.664	-	-	-	
Entertainment facilities	-	.687	-	-	-	
Thermal comfort	-	.786	-	-	-	
Provision of adequate Space and facilities for patient families	-	-	.607	-	-	
Availability of social spaces and social facilities	-	-	.730	-	-	
way finding	-	-	.519	-	-	
cleanliness and personal hygiene	-	-	-	.662	-	
Access for disabled persons	-	-	-	.565	-	
Proximity to services and facilities delivery points	-	-	-	.638	-	
Accessibility of toilet and bath	-	-		.541	-	
Noise control	-	-	-	-	.630	
Adequate illumination	-	-	-	-	.676	
Natural ventilation	-	-	-	-	.701	
Availability of daylight	-	-	-	-	.791	
Views of nature						.776
Interior design	-	-	-	-	-	.661
Orientation	-	-	-	-	-	.716
Spatial design	-	-	-	-		.614
Cronbach's alpha coefficient (.828)	.849	.820	.778	.775	.718	.802
Percentage of explained Variance (62.7 %.)	22.4%	10.2%	8.4%	10.6%	11.3%	12.8%

RESULTS

Respondents' characteristics

The features of the respondents' living areas and demographics are included. Of the 384 hospital users who inquired about it, 47.1% were women and 52.9% were men. Over 46% of the responders, or the majority, were in the 25–35 age range. Ages 18 to 24 comprise the second largest age range, or 30%. Only. 0.5% of the respondents were older than 65, and 4.8% of the respondents were between 50 and 65. Approximately one-fifth of the respondents were between the ages of 35 and 50. Every status of educational level is involved in terms of their earned degree. The majority of them (54%) are qualified to hold a first degree or higher, such as a bachelor's, master's, or doctoral degree; their respective percentages are 44%, 5.6%, and 3.6%. Conversely, fewer than half (46.8%) of the respondents meet the requirements to be classified as non-degree holders, such as those with a TVTE diploma or a high school diploma. In terms of the respondents' precise areas of residence, over half of them—55.6%—live in core urban areas, followed by suburban areas of cities (26.4%) and rural areas (18%) (Fig 1).

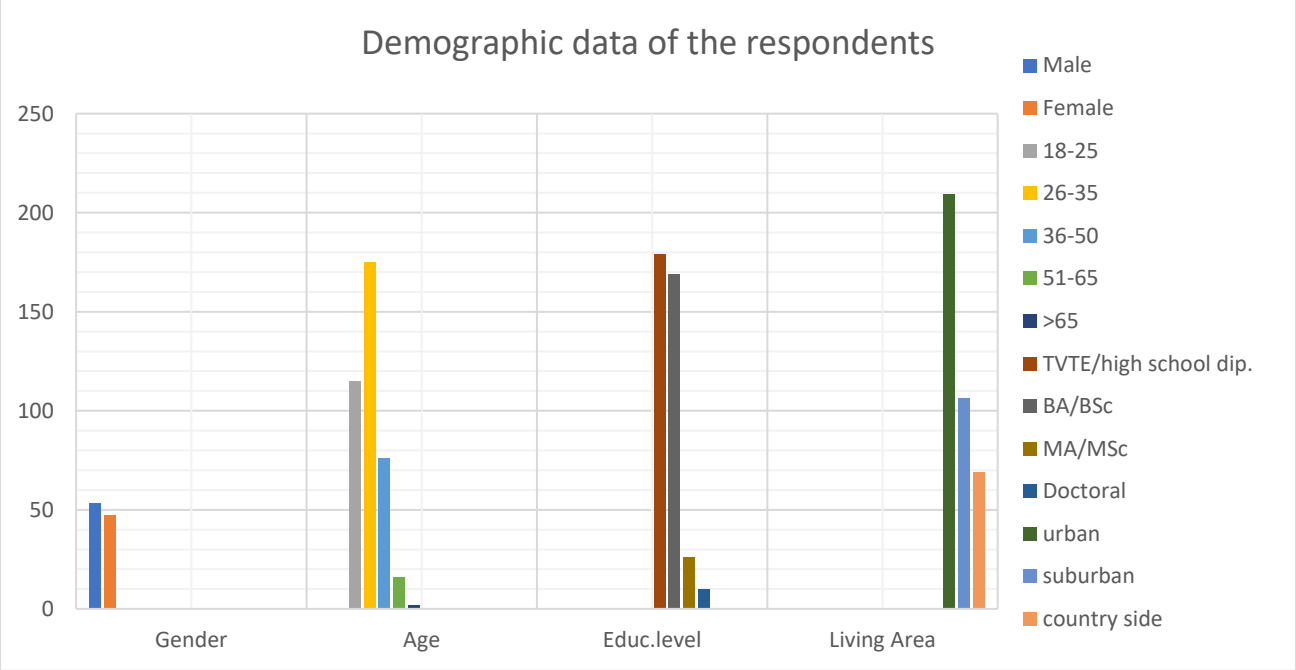

Fig 1. Demographic data of the respondents.

Users' Perceptions of the Design Factors

All users in both hospitals were asked to rate the mean score of each design feature (item) in order to determine whether or not their views of the physical environment are similar. The findings in Table 3 demonstrate that, except one item—cleanliness and hygiene—user evaluations at various hospitals vary significantly. With mean values of 4.58 & SD (0.645) in SPHMMC and 4.64 & SD (0.618) in Nekemte Comprehensive Specialized Hospital, this questionnaire item was the only one that

people placed first (top). The remaining 20 items were ranked differently in the two hospitals that were the subject of the study. For instance, there was a shift in the ranking or rating order; the item "Adequate illumination" was ranked second in Paulos Hospital and seventh in NCSH. For example, "orientation," which was ranked eighth at SPHMMC and sixteenth in the second category at Nekemte Hospital, is another indication of the disparity in users' perspectives. At SPHMMC, the "presence of coordinated art objects" was scored 14th, whereas, at NCSH, it was ranked 21st.

This demonstrates that people's opinions of the environment at various hospitals vary greatly. The mean score for all questionnaire items was between 3.01 and 4.64, which is another significant finding from the users' opinions of each facility. This indicates that the 21 things were assessed as either “most important” or "important" or "neutral" by the hospital users, rather than as "least important" or "not important”. This suggests that users perceived all the items as legitimate and favored (Table 2).

Table 2. Summary of users’ perceptions of the design factors of both hospitals

St. Paul’s Hospital Millennium Medical College			**Nekemte Comprehensive Specialized Hospital**		
Design factors	Mean value	SD	Design factors	Mean value	SD
cleanliness and personal hygiene	4.58	.645	cleanliness and personal hygiene	4.64	
Adequate illumination	4.51	.641	Provision of adequate Space for patient families	4.44	.786
Natural ventilation	4.45	.648	Availability of daylight	4.44	.743
Access for disabled persons	4.41	.800	Natural ventilation	4.29	.662
Noise control	4.33	.645	Availability of social spaces and social facilities	4.27	.753
Availability of daylight	4.27	.925	Noise control	4.25	.764
Provision of adequate space and facilities for patient families	4.25	.939	Adequate illumination	4.24	.673
Orientation	4.20	1.002	Accessibility of the toilet and bath	4.23	.964
Building aesthetics	4.19	.808	Spatial design	4.18	.792
Accessibility of toilet and bath	4.15	.950	Access for disabled persons	4.17	.793
Thermal comfort	4.10	.774	way finding	4.10	.814
Measures to prevent patient falls	4.00	.917	Views of nature	4.01	1.026
Entertainment facilities	3.93	.951	Proximity to services and facilities delivery points	3.92	.860

Presence of coordinated art objects	3.86	1.10	Measures to prevent patient falls	3.85	.951
Proximity to services and facilities, delivery points	3.79	.917	Interior design	3.72	1.150
way finding	3.72	1.10	Orientation	3.71	.961
Availability of social spaces and social facilities	3.69	1.05	Building aesthetics	3.52	1.145
Spatial design	3.11	1.220	Thermal comfort	3.43	.963
Interior design	3.02	1.231	Entertainment facilities	3.39	1.187
Views of nature	3.01	1.213	Pleasant colour scheme	3.29	1.090
Pleasant colour scheme	3.01	1.242	Presence of coordinated art objects	3.09	1.168

Table 3. Descriptive analysis of the design factors of both hospitals (average)

Design indicators (factors)	Mean	Std. Deviation
Cleanliness and personal hygiene	4.68	.582
Availability of daylight	4.57	1.974
Provision of adequate Space and facilities for patient families	4.43	.830
Accessibility of toilet and bath	4.35	.910
Natural ventilation	4.34	.673
Access for disabled persons	4.29	.809
Noise control	4.28	.725
Spatial design	4.26	.788
Adequate illumination	4.25	.656
Availability of social spaces and social facilities	4.19	.805
way finding	4.16	.819
Views of nature	4.02	1.021
Measures to prevent patient falls	4.02	.908
Proximity to services and facilities, delivery points	3.92	.883
Orientation	3.79	1.017
Interior design	3.73	1.132
Building aesthetics	3.66	1.079
Thermal comfort	3.62	.959
Entertainment facilities	3.57	1.154
Pleasant colour scheme	3.42	1.031
Presence of coordinated art objects	3.09	1.146

DISCUSSION

Studies show that taking into account how users perceive the significance of design elements is a prerequisite for user-centred hospital design and healthcare building operation. Therefore, by identifying these design criteria that all hospital users can grade based on their personal preferences to achieve healing settings, the author thinks that this study provides the basis for future research.

The mean of the respondents' preferences on the 5-point Likert scale is summarized by the descriptive analysis of the design aspects

displayed in Table 3 above. For every design indication, the mean and standard deviations (SD) of the responses are calculated. Based on the users' ratings, the questionnaire items were arranged in descending order. It should be mentioned that all of the design aspects have mean scores higher than 3.01 even though the ranking order indicates user preferences. This suggests that people view each of these factors as crucial to creating a healing atmosphere in hospitals.

Previous studies have rated the preferences of medical professionals and in-patients with regard to users' opinions of hospitals' physical settings. On the one hand, these research concentrated on distinct user groups, such as healthcare providers or inpatients. To the best of the authors' knowledge, no single study has combined the opinions of every user. On the other side, user preferences change as the number of design aspects rises. This indicates that respondents have the opportunity to choose or rank a variety of items according to their preferences. This claim is supported by Mourshed & Zhao (11,17), who offered 16 items for healthcare providers and 19 items for inpatients, respectively. Every other item in this survey received a different rating, except the highest ranked (cleanliness & hygiene) and lowest ranked (entertainment facilities).

On the other hand, we expanded the questionnaire to 21 items (design considerations) and incorporated the opinions of every user in both institutions. Among the 21 design elements evaluated by 384 hospital users (patients, their families, and staff), we discovered that cleanliness and hygiene (mean = 4.68) was the most significant environmental factor, followed by daylight availability (mean = 4.57) and family-friendly space (mean = 4.43). The least important design feature was the presence of coordinated art artifacts (mean=3.09), while the second and third least important factors were pleasant color schemes (mean=3.42) and entertainment facilities (mean=3.57).

With the exception of the different rank order, this conclusion is comparable to the earlier findings. The higher number of questionnaire items (design variables) could be the cause of this discrepancy in rank. Despite appearing as distinct terms in several research, the design considerations that were gleaned from a thorough literature analysis share a common notion. Additionally, the context of the research questions determines which design indicators are used in one study and which are replaced with different items in another. Additionally, our results indicate that the overall rating scores, which range from 3.09 to 4.68, are rather high. Table 3 shows that the majority of the items, or 13 out of 21, had mean scores greater than 4 (meaning they were important), while the remaining 8 items had mean scores greater than 3 (meaning they were neither important nor unimportant). This suggests that all of these design elements should be taken into account when hospital users are being designed.

CONCLUSION

In order to aid in the creation of evidence-based or healing hospital environments, this study looked into how users perceived the physical environmental design elements of hospitals. Determining the impression of users is crucial for evidence-based hospital design. Therefore, the discovery of the 21 design criteria in this study supports the use of evidence-based design to establish a healing environment for all users, including staff, patients, and their

families. It is important to note a few limitations, though. Even though our study's scope was broad, future research should look into variables that could influence how hospital staff members view the physical space.

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