

Assessing the Physical Environment of Emergency Departments

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Abstract

Background: Emergency Department (ED) is considered to be the heart of a hospital. Based on many studies, a well-organized physical environment can enhance efficacy.

Objectives: In this study, we aimed to investigate the influence of physical environment in EDs on efficacy.

Materials and Methods: This analytical cross-sectional study was conducted via the faculty members of the ED and residents of Shahid Beheshti University of Medical Sciences in Tehran, Iran. Data were collected using a predefined questionnaire. Descriptive statistics and ANOVA were used to analyze the data.

Results: Sixty-two participants, including 21 females and 41 males, completed the questionnaires. The mean age of the participants was 37 years (SD: 8.42). The mean work experience was 8 years (SD: 4.52) and all the studied variables varied within a range of 3.3 - 4.2. Time indices had the highest mean among variables followed by capacity, work space, treatment units, critical care units and, triage indices, respectively.

Conclusions: In general, time indices including length of patient stay in the ED and space capacity, emphasizing the need to address these shortcomings.

Keywords: Hospital Design and Construction, Environment Design, Accident and Emergency Department, Physical Challenges

1. Background

Emergency Departments (ED) play a critical role in responding to medical emergencies. The ED is considered to be the heart of a hospital (1-6).

Physical environment of an ED has a significant effect on performance. According to many studies, a well-organized physical environment enhances the efficacy and improves the speed and precision in providing services (1, 2, 7-10). However, according to many studies physical environment of EDs requires more attention than other departments. In a research by Ebrahimi et al. ED has been introduced as the most challenging physical environments among the Iranian therapeutic units (11). Recently, Iran's Ministry of Health has given EDs the first priority for revision and allocated a considerable budget to this issue.

Despite the significance of this issue, ED design has been rarely studied as an independent issue (12-14).

2. Objectives

The present study aimed to investigate the efficacy of the physical environment of the ED. Findings of this study can provide useful information for designers, managers and other professionals in revision of the physical environment in the ED.

3. Materials and Methods

The present study was an analytical cross-sectional study. The study population consisted of the emergency medicine specialists. Emergency medicine specialists have a leading role in EDs. Data were collected using a predefined questionnaire. Respondents were the faculty members of Shahid Beheshti University of medical sciences and residents of this field. The medical buildings had life-spans between 4 and 45 years and their facilities they have been described as medium to well-equipped. The average attendance time of the participants of this study in EDs was 4 days per week and 8 hours per day.

The questionnaire consisted of two general parts, including personal information of the participants and questions investigating the the physical environment of the ED. The personal information section included information about age, academic degree (being a faculty member or resident), gender, workplace, and work experiences. This questionnaire consisted of eight general sections: 1) time indices, 2) capacity, 3) patient safety, 4) user satisfaction, 5) quality and arrangement of spaces, 6) functional efficiency, 7) accountability during crises, and 8) evaluation of the specific spaces in the EDs. Each section consisted of subgroups conceptually related to the subject of that

part. The questionnaire included 59 questions with 5-item Likert scale (i.e., ranging from very undesirable = 5 points, no problem at all = 1 point and I have no idea = 0). The questionnaire was validated using the expert judgment method. Two experts in this field reviewed the content of the questionnaire, and after necessary modifications, its validity was confirmed. The test-retest method was used to determine the reliability of the questionnaire. ICC score was calculated to be 0.82. Data were analyzed using SPSS version 18 (SPSS, Inc., Chicago, Illinois, USA). Cronbach's alpha was 0.84. To compare the mean scores of the questions, ANOVA was used. Moreover, descriptive statistics were used to describe the frequency and mean scores.

4. Results

Sixty-two participants including 21 females and 41 males completed the questionnaires. Mean age of the participants was 37 years (SD: 8.42). The mean of work experience was 8 years (SD: 4.52). Among the participants, 16 cases were faculty members and 46 cases were residents of emergency medicine.

The average score of each participant in 8 investigated variables were individually indicated in Table 1. Means of all the studied variables varied from 3.3 - 4.2.

In this table, time metrics had the highest mean among the other variables. After that, capacity metrics had the next high average score (mean scores: 4.14, 4.05). Accountability to crises had the lowest average score (mean score: 3.38).

Statistically, after conducting the ANOVA test among the variables, a significant difference was seen (F: P value < 0.05). When the Tukey test was performed among the time and capacity metrics, no significant difference was observed. However, there was a significant difference between these two variables and other variables. On the

other hand, no significant difference was seen among the variables of satisfaction, functional efficiency, safety, arrangement of spaces and accountability in crises.

According to the participants' opinion in this study, all the time indices had an average score higher than 3.92. Length of stay in ED had the highest mean among time indices. (4.35 ± 0.86).

Regarding capacity indices, discordance of the admission capacity with the number of patients referring to the ED had the highest average among the questions concerning this issue (the mean score: 4.41 ± 0.82). More than 90 percent of the participants believed that capacity of the ED was disproportionate to the referring patient.

Treatment specific spaces responses are shown in Table 2. Treatment units, critical care units and afterwards, and triage unit had the highest average scores, respectively. In the ANOVA test, there was a significant difference between the treatment units. (F: 3.05, P = 0.01) Tukey analysis, revealed that there was a significant difference between treatment units and service spaces (P = 0.04).

Among the content analysis of open-ended questions, the following points can be mentioned:

- The ED is a highly stressful work environment.
- Inefficient resting space exists for the emergency staff.
- Inefficiency in effective tracking and monitoring of patients and lack of modern technologies
- Disorganization of patients' families in ED
- Shortage of open spaces to maintain performance during emergency conditions
- Inflexibility of physical environment to adjust to the modern diagnostic medical equipment
- Problems creating fast track and triage unit
- Dysfunctional connection of the ED to laboratory, imaging, CCU, and surgery units
- Lack ergonomics in work spaces

Table 1. Investigation of the Efficacy of the Physical Environment of the Emergency Department

| Different Factors Related to the Physical Environment in ED | Weighted Score ^a | SD | No. of Answers |
|---|-----------------------------|------|----------------|
| Time (metrics) indices | | | |
| Length of stay | 4.35 | 0.86 | 62 |
| Length of time for admission | 3.92 | 1.05 | 62 |
| Length of time from admission to decision-making | 4.05 | 1.10 | 61 |
| Length of time from decision-making to treatment or discharge | 4.23 | 0.98 | 62 |
| Mean of time parameters | 4.14 | NA | NA |
| Capacity (metrics) indices | | | |
| Discordance of admission capacity with the number of patients | 4.41 | 0.82 | 61 |
| Discordance of facilities in emergency department with the number of patients | 4.02 | 0.96 | 60 |
| Discordance of the patients and therapeutic potential of the ED | 3.85 | 1.15 | 62 |
| Unbalanced allocation of spaces to emergency units | 3.92 | 1.04 | 62 |
| Means of capacity parameters | 4.05 | NA | NA |
| Patients and staff's safety | | | |
| Hospital infections | 3.68 | 1.04 | 61 |
| Medical errors | 3.46 | 1.03 | 62 |

| | | | |
|---|------|------|----|
| Physical injuries (falls and etc.) | 3.02 | 1.1 | 62 |
| Physical convenience of patients and medical staff | 4.03 | 0.94 | 61 |
| Violence against the medical staff | 3.12 | 1.03 | 60 |
| Appropriate nurses' control over patients | 3.72 | 1.06 | 61 |
| Means of safety | 3.50 | NA | NA |
| Users' Satisfaction | | | |
| Noises | 3.78 | 1.01 | 61 |
| Way finding | 3.48 | 1.08 | 62 |
| Physical privacy | 4.08 | 0.94 | 62 |
| Confidentiality of patient's information | 3.46 | 1.12 | 62 |
| Accountability to cultural needs | 3.42 | 1.07 | 61 |
| Environment cleanliness | 4.09 | 0.85 | 62 |
| Accountability to different age and illness ranges | 3.65 | 1.02 | 60 |
| Accountability to medical staff's needs | 3.72 | 1.02 | 61 |
| Accountability to the patient's entourage | 3.96 | 1.04 | 62 |
| Mean of Satisfaction | 3.73 | NA | NA |
| Quality and arrangement of spaces | | | |
| Long travel distance | 3.92 | 1.04 | 62 |
| Efficient proximity of spaces | 3.13 | 1.08 | 62 |
| Beauty and appropriateness of interior design for each space | 3.04 | 1.09 | 61 |
| Fitness of spaces to users' needs | 4.09 | 0.85 | 60 |
| Mean of quality and arrangement of physical environment | 3.54 | NA | NA |
| Functional efficiency | | | |
| Compatibility and positive effect of physical environment on the speed and precision of performance and process | 3.46 | 1.11 | 60 |
| Use of human resources and equipment | 4.03 | 0.76 | 62 |
| Use of communications, information and media (information technology) | 3.64 | 0.98 | 62 |
| Mean of functional efficiency | 3.71 | NA | NA |
| Accountability during incidents and crises | | | |
| Strength of hospital building | 3.75 | 0.98 | 61 |
| Flexibility of the physical environment for responding in critical conditions | 3.38 | 1.03 | 60 |
| Existence of appropriate critical axis for connection of the ED to other special units | 3.02 | 1.11 | 62 |
| Mean of accountability during incidents and crises | 3.38 | NA | NA |

Abbreviation: ED, emergency department; NA, not available.

^aScore 5 represents a basic challenge and very undesirable situation; and score 1 represents a quite desirable situation.

Table 2. Investigation of Efficacy of Physical Environment in EDs

| Emergency Department Spaces | Weighted Score ^a | SD | No. of Answers |
|--|-----------------------------|------|----------------|
| Parking | 3.02 | 1.22 | 59 |
| Waiting spaces | 3.62 | 1.08 | 62 |
| Triage | 3.76 | 1.08 | 62 |
| Fast track | 3.12 | 1.17 | 62 |
| Critical care spaces and recovery room | 3.78 | 1.01 | 60 |
| Intervention room and outpatient surgery | 3.23 | 1.14 | 61 |
| Treatment units | 3.92 | 0.98 | 62 |
| Staff spaces | 3.68 | 1.07 | 61 |
| Service spaces | 3.04 | 1.21 | 60 |

^aScore 5 represents a basic challenge and very undesirable situation; and score 1 represents a quite desirable situation.

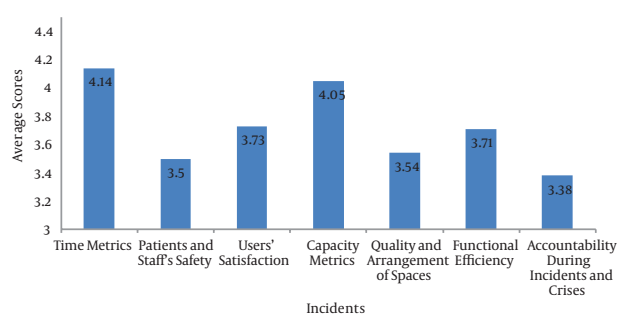


Figure 1. Average Scores of Study Variables

5. Discussion

Our results indicate that all sections relating to physical environment were problematic. All variables were placed in a range between intermediate challenges to very undesirable situation. Time and capacity metrics had significant differences in comparison to other variables. Time metrics including subgroups of length of stay, length of waiting for admission, length of admission to decision-making and the length of decision making to discharge were among the most important functional issues of the ED. According to a guideline dealing with the clinical governance of the country's ED, this length of time should not be more than 6 hours (15).

However, according to the viewpoint of specialists who are in close contact with patients, length of stay in the ED is not desirable. Abundant studies have emphasized the importance of time metrics in the ED (16-22).

Capacity metrics, which have been identified as second challenges of EDs included the following subgroups: Discordance of admission capacity with the number of referring people, discordance of facilities with medical needs of the patients, incompatibility of patients with the medical potential of the ED and unbalanced allocation of spaces to each unit of the ED. In a study by Bernstein et al (2009), it has been emphasized that crowding in the ED has a significant effect on the clinical outcomes of patients (23). Hence, providing a solution to address capacity may improve clinical outcomes (8, 18).

In many studies, it has been emphasized that improving capacity metrics may result in improvement of time metrics (5, 9, 22). By reviewing the literature concerning the solutions for time and capacity metrics, the following points can be mentioned (18, 20, 22, 24-33):

- Replacement of traditional nurse-based triage with team triage model including physicians has shown that physicians could discharge a high number of patients without admission.

- Implementation of low flow/high flow strategy when the ED is overcrowded, some of patients may receive treatment in the initial care area.

- Implementation of segmented tracking system in the ED like fast track conditions improve capacity metrics.

- Designing an internal waiting room allows patients to be treated while awaiting the results of primary diagnostic tests.

Footnotes

Authors' Contribution:Hassan Goodarzi and Kasra Hassanpour: planning, coordination, data collection, analysis, and writing of the manuscript. Hassan Goodarzi and Hamidreza Javadzadeh: supervision and guidance in all stages.

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