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# SATISFACTION OF HEALTHCARE STAFF WITH THE QUALITY OF WORKING AND RESTING AREAS: HEALTHCARE INTERIORS IN THE CITY OF İZMİR, TURKEY

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**Abstract**

While many studies have focused on Patient Centered Design in healthcare facility interiors, few have looked at Staff Centered Design. However, the quality of healthcare interiors is important for improving staff job satisfaction and performance. The main aim of this paper is to analyze the role of interior design parameters, such as color, materials, lighting, and acoustics, in terms of the physical and psychological needs of doctors and nurses in their healthcare working and resting areas. Within this framework, three hospitals in İzmir, Turkey, were selected as the case study. The methodology includes four instrumental components: literature review, on-site observations, structured questionnaires, and semi-structured interviews. The results of this study have the potential to fill a significant gap in addressing hospital interiors in İzmir in terms of creating greater awareness of design to improve users' physical and mental health, and to allow them to work in healthy, happy, safe, and comfortable environments.

## 1. INTRODUCTION

It can be said that there are many studies focusing on the relation between interior environments of healthcare facilities and their users. While some of the studies deal with more subjective issues like energy use, plan layout, acoustic control [1; 2; 3; 4], others focus on more objective ones such as psychological and sociological aspects [5; 6; 7; 8; 9; 10]. Studies focusing on the psychology of the users states the importance of "stress" on the user. Ulrich (1991) argues that healthcare interiors have a functional emphasis on facilities, which could be stressful to their users –patients, visitors, and staff. Hospital and healthcare environments affect both patients' healing process and hospital staff's abilities [11; 12; 13 as cited in 14]. However, although there are many studies revealing the relation between stress and the interior of healthcare environments, just few of them deal with healthcare staff, in other words staff-centered design has not received much attention in healthcare research. This indicates that only minor attention has been given to staff experiences and staff-specific design factors [15]; but staff experience cannot be regarded as subordinate to the experience of patients.

The value of well-designed staff break areas and restorative effects of breaks are also mentioned in healthcare literature [16]. For this purpose, this study investigates the working and resting areas of doctors and nurses, as more important area that they have to be in during their working hours.
In order to foster satisfaction of the doctors and nurses with reducing their stress, the current study proposes color, material, lighting (for visual comfort) and acoustics (for audial comfort) as key parameters. Color

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and lighting can determine peoples' perceptions and responses in the environment, they are also powerful elements for coding and wayfinding in healthcare interiors [17]. Similarly, the use of an appropriate materials in a space would enhance the perceptual quality of this space. Besides, a proper materials used in surfaces or furniture would assist as a noise control element in space [18]. Visual comfort could be considered the most prior factor in healthcare interiors yet healthcare staff assess sound as the third after lighting, coloring and interior/exterior landscaping [19]. According to a research, phones ringing and conversation noise are evaluated as one of the main obstacles in intensive care units by 46% of respondents [20]. Especially noise sourced from machines and other sound distracts destroy concentration and increases exhaustion of staff [21].

These parameters –color, material, lighting and acoustics– were examined in regard to their level of satisfaction perceived by the doctors and nurses through the observations, interviews and questionnaires at the three case-study hospitals in the city of İzmir, Turkey. Considering the widespread impact of the study, it is considered to be more feasible to investigate local cases to share the results with local healthcare institutions, specifically the Public Hospitals Association, and contribute to their development. Thus, by investigating the level of satisfaction of these factors by the view of staff as users of healthcare spaces, this study aims to propose new implications for further designs in terms of the parameters within its scope.

### 1.1.Literature Review

In the interior design of healthcare facilities, much importance has been given recently to designing pleasant spaces that promote the well-being and satisfaction of their users. According to the Interior Design Manual "design solutions should improve the quality of life and productivity as well as protect the health, safety and welfare of the veterans, visitors and staff" [22]. That is, the main object of interior design focuses on the user so all the spatial parameters must fulfil the needs of users and make them satisfied. The term "user centered design" emerged for this purpose, albeit in a different scientific field in the University of California San Diego in 1980s, aiming to develop the efficiency of outputs by participating the user into the design process.

In accordance with user centered design; it is seen that while there has been much research into patient centered design [23; 24; 25] but not staff centered design. Among the few ones focusing on staff satisfaction, Ulrich (2006) states that good design of a physical environment in healthcare facility fosters better clinical outcomes and reduces stress in staff. Likewise, healthcare environments with more hospitality designs increase staff satisfaction [27]. These environments increase not only their satisfaction, also increase their wellbeing and productivity [28]. Similarly, designing healthcare interiors in a supportive way for staff would promote wellness and reduce the stress of healthcare workers [29, as cited in 30].

#### 1.1.1. Color

Color is one of the most important interior design elements that affects human psychology, productivity, and motivation. Especially for healthcare environments, color plays a crucial role for staff who are under stress during long working hours. As color "involves a very complex interaction between light, eyes, and brain" [31; 32, p.11], humans' psychological and physiological responses are extensively affected by color. Experiments have shown that many psychological and behavioral outcomes, such as temperature, coldness, activity, passivity, lightness, stimuli, rest, joy, and sadness vary according to type, value, and saturation of colors [33].

Marcella Graham [as cited in 34, p.9], an environmental design consultant, believes that the human response to color falls within six categories including physiological, within the eye, cognitive, mood, impressionistic, and associative [35]. Colors have emotional associations: "Brighter colors are associated with positive feelings like being happy, cheerful, or hopeful whereas darker colors recall negative feelings, such as being bored, sad or withdrawn" [32, p.13].

Effects of color on emotional responses to the environment [36]; relationship between color and human response [37]; positive effects of combining cool and warm colors on human minds and their contribution to comfortable atmosphere and settings were also studied [38].

Ghamari & Amor (2016) mention color issue in terms of staff morale and productivity [39]. Referring to the Ulrich et al. (2008) and Dalke et al. (2006), they state that numerous staff decisions in well-designed working environment can aid recruitment and retention of staff in addition to improving morale [13; 17]. Appropriate lighting and color design can positively affect the concentration, productivity and morale of staff [17]. Thus, "the psychological wellbeing of healthcare staff is also affected by color, hue, and saturation, which provide character to a hospital interior and are essential for the quality of its indoor atmosphere" [11; 40 as cited in 14, p.83].

The literature on the main causes of fatigue of healthcare staff and consequences of this as well as patient and facility outcomes show that a need for improving staff areas are crucial. Improved breakroom design plays an important role in improving staffs' job satisfaction and performance [41]. These researchers analyzed the impact of design attributes on staff members. Although, they found very limited evidence on this issue, they revealed that staff members' health, job performance and desire to remain in the profession have been positively affected. For reducing nursing staff turnover, staff break areas should allow for private relaxation and reflection [42].

These emotional and psychological factors affecting the wellbeing of healthcare staff should therefore be considered in the application of color in staff areas of the hospital.

### 1.1.2. Materials

The first issue in the choice of material is appropriateness for the hospital setting in terms of safety, ease in cleaning and maintenance, and different user types and abilities. If these criteria are met, other components regarding the perceptual quality of the space can also be satisfied [43]. Apart from chemical, physical, and mechanical properties, materials also have visual effects with varying properties from material to material, such as size, color and texture. With these features, materials create visual perceptual effects in the space such as width, depth, and brightness, and tactile ones such as cold, hot, soft and hard [44]. In addition to variations in ceiling height, texture, and color, different types of materials, such as plaster, mosaic tile, stucco, and glass, graphics, as well as acoustical tiles in the ceiling, can provide users with interesting and visually appealing interior atmospheres [45; 46 as cited in 8].

The characteristics of materials for healthcare interiors are ranked as in the following order: aesthetics, durability, ease of maintenance, client preference, initial cost, maintenance cost, infection control, ease of installation, and life-cycle cost [47 as cited in 14, p.83].

All finishes and coverings in a hospital should tolerate treatment for bacterial and fungal agents, because a hospital is vulnerable to spread of infections caused by the presence of sick patients [48]. The most important characteristics of finished materials in acute care units, for example, are robustness, solidness, and durability because the risk of routine and accidental impacts is too important [49; 50; 11; 51 as cited in 14]. Healthcare staff experience difficulties in moving or transporting patients and equipment due to slippery floors [52 as cited in 53, p.106].

High-performing and sound-absorbing interior surfaces benefit patients as well as hospital staff [13 as cited in 14]. Studies on noise impacts on healthcare workers generally deal with noise interference with communication and noise as a distraction. Cognitive performance and concentration, stress and fatigue issues are also studied [54]. This noise problem is important for hospitals as different loud sources were doubled with sound-reflecting materials [55].

In healthcare flooring there are a number of considerations including environmental issues, infection control, air quality, patient and worker safety, comfort and aesthetics. Apart from PVC which has associations with asthma; the release of highly toxic dioxins and reproductive toxicants, alternatives for

flooring materials include rubber, polyolefin, and linoleum flooring. Another flooring choice is bamboo which is being used in sustainable projects. Other options which are naturally antibacterial and anti-microbial, provide cushioned comfort and easy to maintain and environmentally friendly are rubber and resilient textile sheet flooring [56].

Reason (1990, 2000) identifies that fatigue is a contributing factor to human error and it has a negative impact on healthcare staff's alertness, mood and psychomotor and cognitive performance, which may also impact patient safety [57; 58]. Within the literature about the relationship with healthcare worker fatigue and flooring, some researchers found that flooring serves as a contributing factor of fatigue [59; 60; 61].
Harris (2015) studied three flooring materials, terrazzo, rubber and carpet tile in terms of sound absorption, comfort, light reflectance, employee perceptions and preferences and patient satisfaction. He mentions that causes of healthcare worker injury include pushing and pulling equipment, patient handling, slippery flooring surfaces and standing or walking on a hard surface for many hours at a time. A resilient or soft flooring solution reduces fatigue. In his study, workers found cleanliness as an important factor both for appearance and for concerns about infection prevention. Participants defined terrazzo floors and carpet tiles as being kept clean. The defined rubber flooring as showing a lot of dirt and scuff marks and looking dull and unfinished. Cleanliness, comfort, noise and aesthetics are criteria for perceptions about flooring. Choosing flooring that affects measurable change in sound levels which increases patient and employee satisfaction benefits the patient and hospital organization [62].

For the health and safety of patients and employees, the selection of wall finishes during design and renovation phases is crucial. Properly selecting wall finishes that are functional, cost-effective and easy to maintain is crucial for healthcare facilities because of the septic conditions in hospitals. Wall coverings can affect several measures of quality: the relative humidity (RH) of a room [63], indoor air quality (IAQ) [64] and the transmission of harmful bacteria [65].

Wall finish materials vary from natural products such as wall coverings, mosaics, tiles, porcelain, natural stone, terrazzo, linoleum, rubber and wood to synthetic materials such as vinyl [14;Ü 66]. Although paint is durable and needs low maintenance, the use of appropriate type of paint for wall finishes of hospitals and medical facilities is very crucial [67 as cited in 14]. Plastic-laminated, fire-retardant plywood fiberglass composite substrate and vinyl, respectively, are aesthetically appealing and easy to maintain [50 as cited in 14; 68] and it offers a variety of colors, textures and patterns [49 as cited in 14]. Although vinyl materials are preferred in hospitals because of their durability and ability to control infection [69], plastics and polyvinyl chlorides (PVCs) are unhealthy and have an adverse environmental impact [70; 13].
In a similar study, Lavy & Dixit (2012) analyzed the literature on wall finishes in three healthcare units: surgery, emergency and inpatient units. They found that cleanliness is of utmost concern for surgery, emergency and inpatient units [14].

### 1.1.3. Lighting

Lighting is a multidimensional interior parameter for healthcare interiors with important psychological effects on users apart from its appropriateness or adequacy for physical use. Pati et al. (2008) claim that inadequate lighting is one of the important stress factors along with poor acoustics, uncomfortable temperatures, and inappropriate ergonomic design [71 as cited in 72]. Yılmaz (2005) proposes many solutions with light for decreasing the stress of children patients in hospitals [8]. As stated by several research, controlling circadian rhythm with appropriate intermittent bright light enhance adaptation to night shift work among healthcare staff [73; 74; 75; 76; 77; 13].

Not just with its amount, light is assessed by its parameters like color, temperature, control etc. Accordingly, providing high color rendering index lighting source and providing full-spectrum artificial light could reduce the stress of healthcare staff [8; 79; 80; 46; 81].

Natural and artificial light have different effects on human health and comfort. Natural light, in particular, is preferable over artificial light in healthcare interiors. A study reveals that if any staff exposure more than three hours of natural light during his/her work hours have much more job satisfaction and less stress

compared with the staff exposure less daylight [13 as cited in 82]. In furtherance, a great number of study show that daylight or bright artificial light have positive effect on reducing depression and improving mood [13]. Also, the control of natural lighting level can be critical to maintain a pleasing atmosphere in healthcare interiors. Using windows without any control element like curtains or blinds could cause 'black holes' in the walls and the view out would be inappropriate [17]. Moreover loosely woven and bright colors of textile blinds could be insufficient in preventing over sunlight.

When natural lighting could not be adequate, artificial lighting should be designed appropriately in order to satisfy the users of space. Especially, dimming light for comfort and focusing powerful light on medical treatments are fundamental requirements in doctor examination rooms. For resting areas, the overriding aim is to be relaxing. Therefore, the light level should be lower than in working areas, with diffused, dim, and flexible task lighting elements alongside ambient lighting fixtures. It is also known that, in designing lighting plan of a space, large and diffused light reduces contrast and gives homogeneity to the space. Similarly, in order to reduce reflection, the lighting scheme must be constituted from the lighting elements with low glare, task lighting luminance [84]. Especially at night in nurse work stations, luminance level should be arranged according to allow visual adaptation [18].

#### 1.1.4. Acoustics

Besides visual and tactile design features in healthcare interiors, acoustic comfort is critical for users to have spatial satisfaction as well. Situations that provide optimum noise levels and appropriate acoustic conditions, whether the users are active or passive, provide audial comfort.

It is known that not keeping noise within acceptable levels and failing to provide comfortable acoustic conditions causes psychological and physical disorders. According to research, users feel comfortable if they can control noise levels and adapt it to their needs [85 as cited in 86]. Likewise, Waye et al. (2010) list three consequences of noise in hospitals, namely auditory fatigue, mental fatigue, and tension [as cited in 3]. Noise also makes perceived work demand more than real, causes loss of control, and decrease communication quality [13 as cited in 88]. Furthermore, staff feel stressful under high sound levels in their environments [89; 90]. Especially, it is reported that stress sourced from noise associated with emotional exhaustion and burnout in nurses [13; 91].

There are many types of noise in healthcare interiors. Especially, the noise coming from outside of the room is one of the main noise sources in healthcare facilities. For preventing this noise, sound leakage and privacy lack through the ceiling should be prevented with hard-wall partitions which extend to the ceiling [13; 92; 93]. Also, creating private spaces for discussion near by the waiting areas could help speech privacy in these spaces [13; 94]. The geometry and the size of space are the other crucial parameters in acoustic comfort. According to a research, the acoustics of long corridors (e.g. service floors, polyclinic floors etc.) having many branches, become more complicated [95]. But, if considering noise and room acoustics, the most important parameters are sound pressure level and reverberation time. For having a proper acoustical comfort in a healthcare interior, providing sound-absorbent ceilings and other parameters that shorten Reverberation Time and reduce noise propagation, should be the prior strategy [96].

## 2. MATERIAL and METHOD

### 2.1. Methodology

The methodology of the study included four instrumental components: literature review, on-site observations, structured questionnaires, and semi-structured interviews. Three hospitals in the city of İzmir, Turkey were selected as the case study: Hospital 1, Hospital 2 and Hospital 3 (Figure 1). The first selection criterion was hospital type. According to the literature, hospitals can be categorized according to their scale, type of disease treated, and healthcare function. Normal scale hospitals were selected, with from 150 to 600 beds; the selected disease type was General Hospitals; and district hospitals were selected in terms of healthcare function. The second selection criterion was to decide the city and the region. District 1, District

2 and District 3 are three districts that were all within the metropolitan boundaries and that were all within the South Public Hospitals Association. The third criterion was the ownership status, with two options: state or privately owned hospitals. Considering the widespread impact of the study, it was considered more useful to study state hospitals since their physical environments are created under budgets that are more limited. The fourth selection criterion was selecting recently constructed hospitals, meaning less than 10 years old.


Figure 2.1. Selected hospitals, exterior views: a. Hospital 1; b. Hospital 2; c. Hospital 2 (Authors' archive, 2017)

On-site walkthrough observations at the hospitals included two basic components: taking notes on a notepad, and photographing using the researchers' digital cameras. Each of the three hospitals was visited by all the researchers twice to identify the main positive and negative aspects of each hospital's interior design elements.

Questionnaires and interviews, were efficient tools to understand healthcare professionals' opinions and perspectives on the predetermined design parameters of this study. Questionnaires were considered an effective instrument to obtain users' opinions quickly and in large quantities while helping users express their opinions without revealing their identities. Two types of respondents were targeted: doctors and nurses. The number of respondent doctors and nurses was calculated based on total numbers in each hospital (Table 1). Stratified simple random sampling was used, with each hospital considered as one for each layer. In determining the number of questionnaires to administer to doctors and nurses, sample size was calculated from the total number of doctors and nurses in each hospital (Figure 2). Respondents were selected randomly to participate. Questionnaire items were designed to ask whether the following four interior design elements met the physical and psychological requirements of doctors and nurses in their working and resting areas: color, materials, lighting, and acoustics. Some items used a 5-point Likert scale ranging from 1 to 5 while other items presented adjective couples, such as warm-cold, spacious-not spacious, calming-stressing, etc., from which respondents could choose more than one option.

To assess the intelligibility and clarity of the items and a pilot questionnaire was administered to one doctor and nurse from each hospital. Based on the pilot study, Cronbach's (reliability of scales) test was employed to test the reliability of the dependent variables. The resulting Cronbach alpha coefficient of reliability ranges from 0 to 1 in providing this overall assessment of a measure's reliability. If all of the items have high covariance, then the Cronbach alpha coefficient will approach 1 as the number of items in the scale approaches infinity. In other words, the higher the coefficient, the more the items have shared covariance and probably measure the same underlying concept. The Cronbach alpha coefficient for the set of items including the dependent variables was 0.82. These items may, therefore, be considered highly reliable.

After the reliability analysis, amended final questionnaire was produced with improved content validity and the adjective couples were converted to a Likert scale by scoring 1 to those connoting satisfaction and 0 to those connoting dissatisfaction for the analysis.

**Table 2.1. Population and sample size for the questionnaire, broken down by staff role and hospital**

| Hospital | Doctor Number (Total) | Doctor Number (Sample Population) | Nurse Number (Total) | Nurse Number (Sample Population) |
|---|---|---|---|---|
| Hospital 1 | 47 | 12 | 120 | 32 |
| Hospital 2 | 25 | 7 | 42 | 11 |
| Hospital 3 | 76 | 21 | 137 | 37 |
| TOTAL | 148 | 40 | 299 | 80 |

$$n = \frac{NZ^2 * .25}{[d^2 * (N-1)] + [Z^2 * .25]}$$

Where n = sample size required
N = total population size (known or estimated)
d = precision level (usually .05 or .10)
Z = number of standard deviation units of the sampling distribution corresponding to the desired confidence level

Figure 2.2. Sample size formulation (Prepared by the authors)

### 2.2. Statistical analysis

SPSS version 22.0 (SPSS, Inc., Chicago, Illinois) was used for all statistical analyses. A two-tailed p value of $<0.05$ was considered statistically significant. The descriptive features for each group are found as the mean, median and frequency (%). The quantitative data were tested for normality using the Kolmogorov-Smirnov test. When the data fit a normal distribution, continuous variables were compared using Student t test and categorical variables were compared using Fisher exact test. Otherwise, Mann-Whitney U test was used. Chi Square test was used to identify statistically significant differences between the means of the subgroups. All of these statistical methods are used by hypothesis testing.

Since the color choice and artificial light use in hospitals are similar, the responses received for these parameters were evaluated in one pool. But the use of acoustic and natural lighting changes in each hospital; therefore the responses were evaluated separately.

For the interviews, purposive sampling was used in accordance with a qualitative approach [97]. The sample was divided into three groups to gain information about different aspects of the hospitals' interior design quality. Two doctors, two nurses and the chief doctor or deputy chief doctor from each hospital were interviewed. The interview method involved identification of the participants, explanation of the project and obtaining informed consent through signed agreements, identification of pilot interview questions, giving interviewees the questions before the pilot interview, conducting pre-interviews with one person from each group, revising the questions according to the pilot interview results, delivering the pre-interview questions and copyright forms to the interviewees [98], and conducting the final interviews. The interviews had three stages: opening the interview (re-introduction of the study and objectives), questioning and guidance [97], deciphering the interviews. Interview data analysis followed two steps: manual thematic analysis and frequent/repeating themes analysis, using NVivo as the qualitative data analysis software. This enabled the most frequently used words to be detected in order to determine the focus of each design parameter.

## 3. FINDINGS AND RESULTS

### 3.1. Color

As similar color schemes are used in each hospital's indoor environment, responses are evaluated in one pool. The doctors and nurses were asked whether they were satisfied or not with colors of the working and resting spaces. User satisfaction was measured by responses for the following positive adjectival descriptions: warm, spacious, big, wide, hygienic, light, and regular according to hypothesis tests. The opinions of the doctors and nurses about the colors were also measured from responses for the following positive descriptions: cheerful, spacious, relaxing, energetic, motivating, and relaxing. The statistical tests showed that they were satisfied with color in both their working ($p=0.00$) and resting areas ($p=0.00$; Figures 3-6). The doctors and nurses were also asked whether they satisfied with color selection in their working and resting spaces. The statistical tests showed that they were satisfied with color selection in both their working ($p=0.044$) and resting areas ($p=0.044$; Figures 3-6).

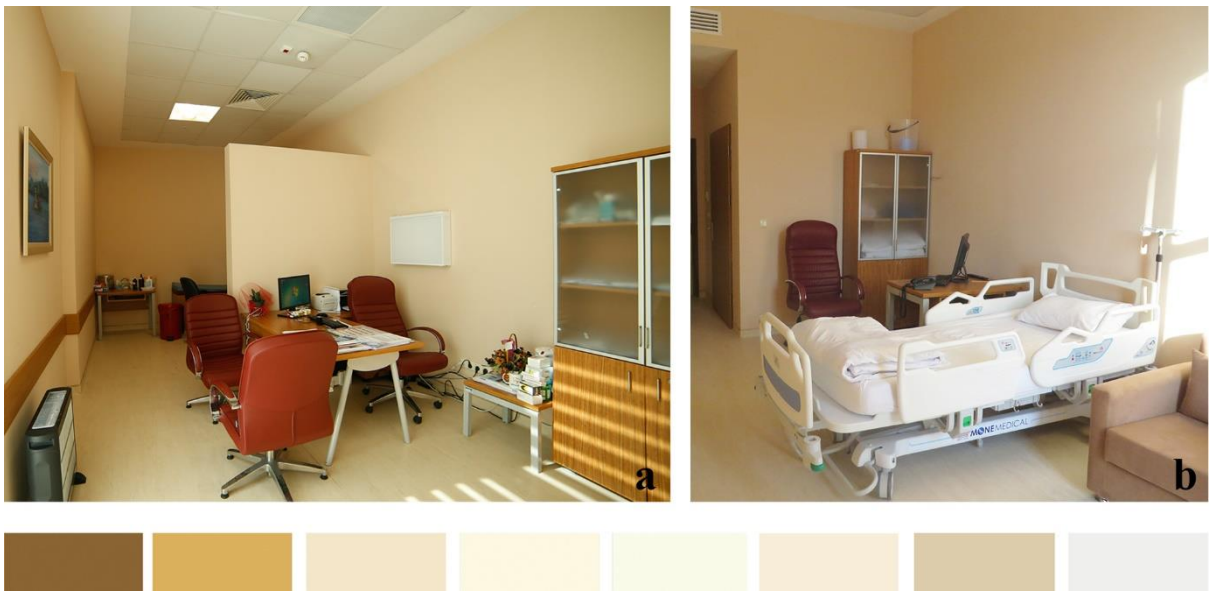


Figure 3.1. Hospital 2: a. Colors of doctor's examination room; b. Colors of doctor's resting room (Authors' archive, 2017)

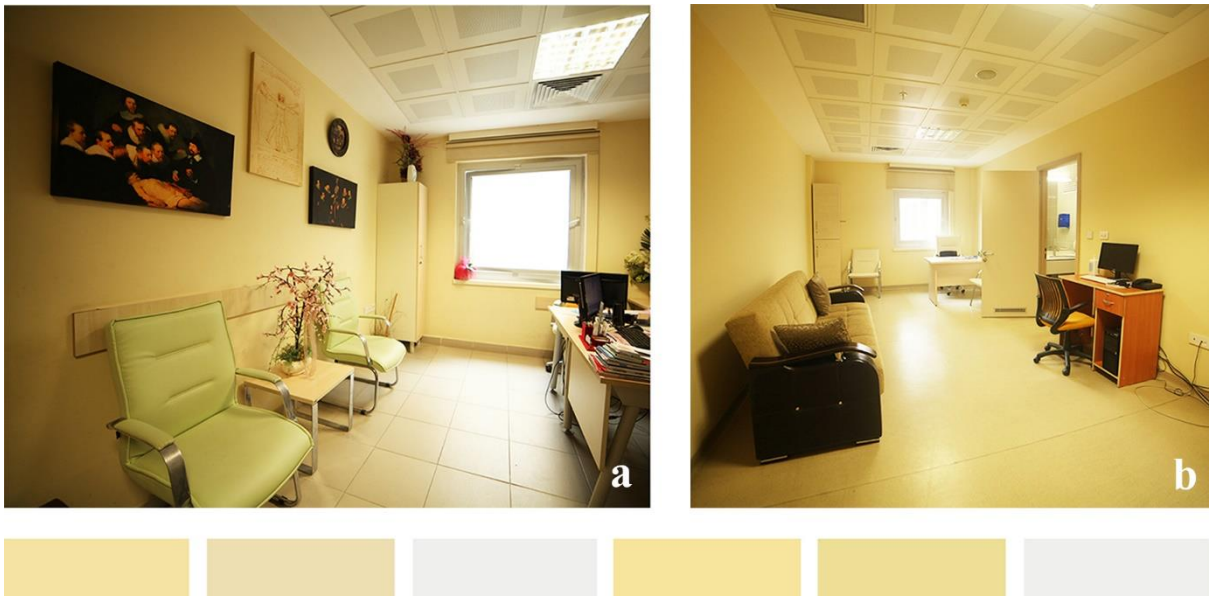


Figure 3.2. Hospital 3: a. Colors of doctor's examination room; b. Colors of doctor's resting room (Authors' archive, 2017)

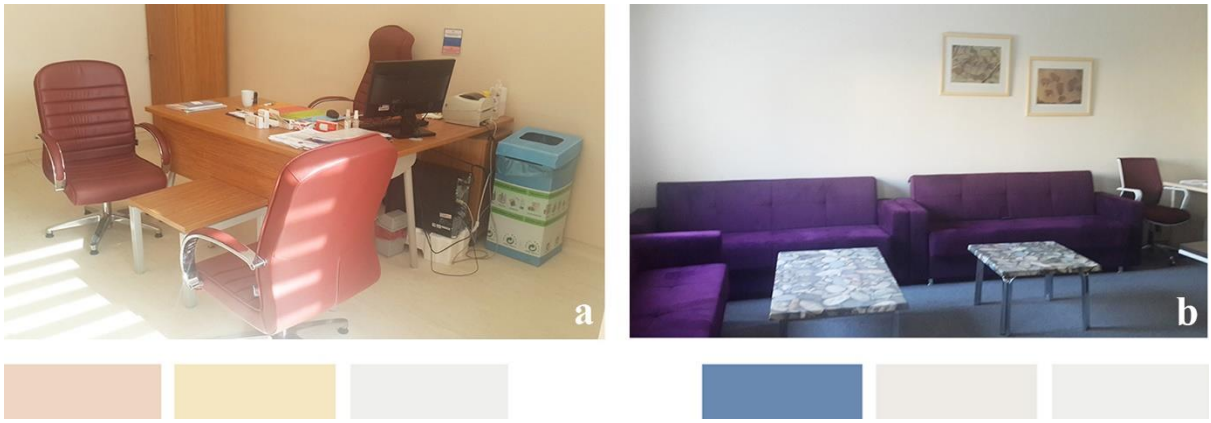


Figure 3.3. Hospital 1: a. Colors of doctor's examination room; b. Colors of doctor's resting room (Authors' archive, 2017)

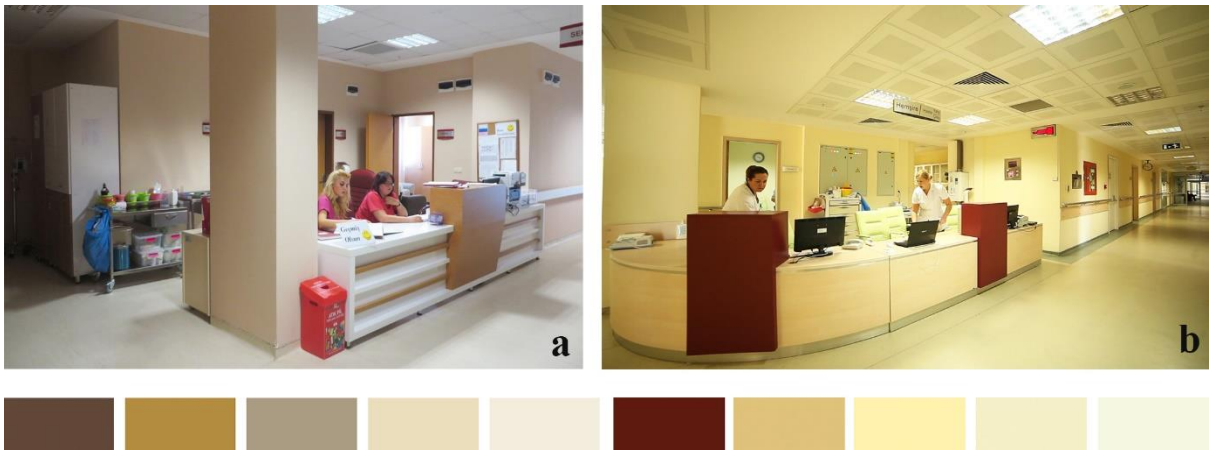


Figure 3.4. a. Colors of nurse station, Hospital 2; b. Colors of nurse station, Hospital 3 (Authors' archive, 2017)

The interview results confirmed that both doctors and nurses were mostly satisfied with the colors in their working and resting areas. While doctors mostly preferred light and relaxing colors in both areas, nurses preferred vivid colors in their working environment to keep themselves energetic and lively whereas they preferred the same color tones as the doctors indicated for their resting areas. Some of the nurses prefer light colors to be happy and to have spacious and warm environment in their working spaces. Others prefer relaxing colors in their resting areas but more spectacular colors in their working areas. Doctors mostly prefer light colors in their working and resting areas.

### 3.2. Materials

To determine the perceptual effects created by materials, the questionnaire asked doctors and nurses how they were affected by their spatial perceptions of the floor materials used in hospital working and resting areas. The definitional pairs used for measuring satisfaction were hot-cold, spacious-boring, small-large, narrow-wide, hygienic-unhygienic, light-dark, and regular-irregular. For interpreting their responses, positive adjectives were warm, spacious, large, spacious, hygienic, light, and regular. The statistical tests showed that they were satisfied with the floor materials in both their working areas ($p=0.00$) and resting areas ($p=0.00$; Figure 7). The statistical tests showed that both doctors and nurses were not satisfied with the floor material in both their working areas ($p=0.269$) and resting areas ($p=0.908$; Figure 7; Tables 2-4). The statistical tests showed that they satisfied with the wall materials in their working areas ($p=0.029$) but not in their resting areas ($p=0.078$; Figure 8). The statistical tests showed that both doctors and nurses satisfied with the ceiling material in both their working areas ($p=0.01$) and resting areas ($p=0.05$; Figure 9).


Figure 3.5. a. Floor material (ceramic tile) in doctor's examination room, Hospital 3; b. Floor material (ceramic tile) in doctor's resting room, Hospital 1 (Authors' archive, 2017)


Figure 3.6. Hospital 1: a. Wall material (paint) in nursing station; b. Wall material (paint) in nurse's resting room (Authors' archive, 2017)


Figure 3.7. a. Ceiling material (aluminium + gypsium) in nurse's resting room, Hospital 3; b. Ceiling material (rockwool + gypsium) in a doctor's examination room, Hospital 2 (Authors' archive, 2017)

**Table 3.1. Tire State Hospital interior materials, broken down by material function and staff role**

| Material | Wall | Floor | Ceiling |
|---|---|---|---|
| Doctor's examination room | Paint | Ceramic tile | Aluminum+gypsum |
| Doctor's resting room | Paint | Vinyl | Aluminum+gypsum |
| Nurse's working area | Paint | Vinyl | Aluminum+gypsum |
| Nurse's resting room | Paint | Vinyl | Aluminum+gypsum |

**Table 3.2. Çeşme State Hospital interior materials, broken down by material function and staff role**

| Material | Wall | Floor | Ceiling |
|---|---|---|---|
| Doctor's examination room | Paint | Vinyl | Rockwool+gypsum |
| Doctor's resting room | Paint | Vinyl | Rockwool+gypsum |
| Nurse's working area | Paint | Vinyl | Rockwool+gypsum |
| Nurse's resting room | Paint | Vinyl | Rockwool+gypsum |

**Table 3.3.. Urla State Hospital interior materials, broken down by material function and staff role**

| Material | Wall | Floor | Ceiling |
|---|---|---|---|
| Doctor's examination room | Paint | Ceramic tile | Aluminum+gypsum |
| Doctor's resting room | Paint | Carpet/Ceramic tile | Aluminum+gypsum |
| Nurse's working area | Paint | Vinyl | Aluminum+gypsum |
| Nurse's resting room | Paint | Ceramic tile | Aluminum+gypsum |

According to the interview data, the most crucial issue in the hospitals in terms of material is hygiene. Interviewees stated that materials must be detergent-resistant and easy to clean, and not show dirt. The most important points that interviewees mentioned about materials in their working and resting areas were the type of materials; specifically comfort ease of cleaning in terms of hygiene, sound absorbance, sustainability, and durability.

### 3.3. Lighting

In the questionnaire, doctors and nurses were asked whether they were satisfied with the natural and artificial lighting in the two spaces. Due to the same type of artificial light use, artificial light conditions of the 3 hospitals were assessed with together. The statistical tests showed that they were satisfied with the artificial lighting conditions in both their working areas (p=0.00) and resting areas (p=0.01). Because of differences in the natural lighting conditions, each hospital was evaluated separately according to functions and users. The statistical tests showed that doctors in Hospital 3 were dissatisfied with the natural lighting conditions in both their working areas (p=0.880; Figure 4a) and resting areas (p=0.237; Figure 4b). In contrast, the same hospital's nurses were satisfied with the level of natural lighting in both in their working (p=0.001; Figure 6b) and resting areas (p=0.000; Figure 9a). In Hospital 1, doctors were dissatisfied with the level of natural lighting in both their working (p=0.030; Figure 5a) and resting areas (p=0.569; Figure 5b). Likewise, nurses were dissatisfied for both their working (p=0.18; Figure 8a) and resting areas (p=0.564; Figure 8b). In Hospital 2, the statistical tests showed that doctors were dissatisfied with the natural lighting conditions in both their working areas (p=0.442; Figure 3a) and resting areas (p=1.000; Figure 3b) whereas nurses were satisfied for both their working areas (p=0.001; Figure 6a) and resting areas (p=0.000; Figure 10).

Figure 3.8. Natural light in nurses' resting room, Hospital 2 (Authors' archive, 2017)

The hospitals investigated in this were generally artificially illuminated with fluorescent lighting (Figures 3-4; 6-10) recessed in suspended ceilings. During the interviews, doctors said that they prefer powerful, flexible and varied lighting types in their working areas but low light levels in their resting areas. Some doctors mentioned adding extra lighting fixtures to their resting rooms. In particular, those doctors whose rooms had no access to natural light complained about fluorescent lighting.

Besides the type of lighting, controlling light is a crucial matter for healthcare staff. The statistical tests showed that while doctors in Hospital 3 found the control of natural lighting inadequate in both their working ($p=0.086$) and resting areas ($p=0.029>\propto=0.05$), nurses found it adequate in both ($p=0.006$ and $p=0.000$, respectively). Similarly, doctors in Hospital 1 were dissatisfied with the control of natural light in both their working ($p=0.604$) and resting areas ($p=0.280$), as were nurses ($p=0.110$ and $p=0.869$, respectively). In Hospital 2, doctors found the control of natural lighting inadequate in both their working ($p=0.826$) and resting areas ($p=0.826$) whereas nurses found it adequate in both areas ($p=0.005$ and $p=0.005$, respectively). In addition to natural lighting, also control of artificial lighting was also evaluated in the questionnaire. The statistical tests showed that both doctors and nurses working in these hospitals found control of artificial lighting inadequate in both their working and resting areas ($p=0.009$).

According to the interview results, most participants with negative feelings about the level or ability to control natural lighting complained about the orientation of their working area or the surface that the light comes from. While doctors mostly prefer warm white colors in both their working and resting areas, nurses prefer cold white light in their working areas for establishing vascular access. Doctors working in rooms without natural lighting are dissatisfied with their working conditions because of various problems, such as lack of ventilation and being constrained to use fluorescent lighting. They also complained that the furniture layout prevented them from accessing daylight in their working areas.

### 3.4. Acoustics

The three hospitals that the study investigated arrange their polyclinic waiting areas differently. While Hospital 3 has separate waiting areas for each of its clinics, Hospitals 1 and 2 use common waiting areas for all clinics so patients coming because of different diseases wait in the same area before their examinations in these two hospitals. Given these layout differences, responses to the question asking whether doctors and nurses are disturbed by noise coming from outside their working and resting areas are analyzed separately for each hospital. Whereas doctors in Hospital 3 were disturbed by outside noise affecting both their working ($p=0.021$) and resting areas ($p=0.043$), nurses were not disturbed in either

working (p=0.000) or resting areas (p=0.000). While doctors in both Hospital 1 and 2 were disturbed by outside noise affecting their working areas (p=0.08), they were not disturbed by outside noise in their resting area (p=0.004). Similarly, nurses in Hospitals 1 and 2 were disturbed by outside noise in their working areas (p=0.006) but not their resting areas (p=0.004).
In the interviews, doctors and nurses listed the sources of noise coming from outside. Some doctors' working rooms had been converted from rooms with different functions, such as restrooms or corridors, due to unexpected needs since the design stage, which allows voices to be heard between these improvised rooms. The other complaints about noise concerned the vertical and horizontal partitions between spaces, and ventilation ducts and outlets, which were among the most distracting ways that voices transmit between rooms.
Participants also indicated that a generally annoying source of noise is originated from patients and their relatives. In particular, interviewees from Hospitals 1 and 2 complained about noise from adapted rooms (such as a waiting area for a child clinic or another examination room). In contrast, interviewees from Hospital 3 did not complain about noise from waiting areas because the plan layout of the waiting areas. Instead, they were disturbed by noises like phone rings, nurse pagers for patients, and air machines.

## 4. DISCUSSION

### 4.1. Color

According to the data gathered from the literature, questionnaires and the interviews, color provides character to the working and resting areas of doctors and nurses. It is also essential for the quality of indoor atmosphere, with a significant impact on the mood, behavior, and psychological well-being of healthcare staff. Moreover, a conducive and positive environment supported with appropriate colors can create feelings of satisfaction and hope among hospital staff [14, p.83]. Most of the staff in this study indicated that color is an important factor in their motivation and mostly preferred light colors that created a spacious environment. Nurses stated that they prefer vivid colors in their resting areas although they are generally satisfied with the existing colors of both their working and resting areas, which have light tones of yellow, gray, and pink. This agrees with the literature, in classifying colors as cool and warm [17].

In parallel with research that identifies color as one of the most essential factors for the quality of indoor atmosphere and the psychological wellbeing of healthcare staff, the NVivo results show that in all three hospitals, doctors and nurses used words related to color most while the second-ranked words in the color part of the interview were light and spaciousness. In conclusion, the primary objective of color design "is to achieve a friendly and welcoming atmosphere with variety and interest" [17, p.346] for hospital staff working and resting areas.

### 4.2. Materials

Interior surfaces, such as wall finishes, floor coverings, and ceiling finishes, generally affect the quality of the interior atmosphere. In this study, both the survey and interview results indicated that interior surfaces have a significant role in the participants' perception of space.

Hospital staff were mostly satisfied with their working and resting spaces in terms of the floor coverings. They generally defined these spaces as warm, large, spacious, hygienic, light, and regular. On the other hand, both the survey and interview results supported previous research that, although ceramic tiles provide a washable surface, the grouted joints can create maintenance problems and "have a tendency to absorb liquids and odors" [83, p.254], which can lead to hygiene concerns. One of the interviewees indicated that the most important issue for them was that the floor materials did not cause infection while another highlighted the role of flooring as a design element that affects user safety, indicating that slippery floors are very dangerous and suggesting PVC materials instead. The interview and questionnaire results confirmed that healthcare staff were satisfied with the existing PVC floor covering because it is easy to clean, resistant, and comfortable.

The NVivo results showed that doctors and nurses in all three hospitals used the words wall and floor more often than ceiling. This result indicates that ceilings has less effect or impact on healthcare staff compared to walls and floors.

Another finding from the survey and interviews is that, while hospital staff were satisfied with the wall surfaces of the working areas, they were not satisfied with the resting rooms' wall coverings. To correct this, instead of using only a single paint color, materials like plastic laminated, fire-retardant plywood that are more durable, and fiberglass composite substrate and vinyl, which are aesthetic and need less maintenance, could be used [50 as cited in 14]. In both the survey and interviews, participants highlighted the issues about the characteristics of surface materials, such as preferring anti-slip, hygienic, dirt-resistant, durable, and noise-absorbing ones.

The survey and interview results agreed with the literature that ceiling coverings must be easily cleanable and painted with antibacterial paint. According to the NVivo results, ceiling was the twenty-second most common word used, indicating that both doctors and nurses were not annoyed with the ceiling materials of their working and resting areas.

### 4.3. Lighting

According to the literature, the questionnaire and interview data, doctors and nurses prefer powerful lighting source in medical treatment rooms with the support of dimmed lighting alternatives, such as controllable task lighting or ambient lighting. For their resting areas, however, they prefer dimmed, soft, and low light levels. In parallel with the literature, the interviews indicated that doctors are not satisfied with cold white fluorescent lighting in their working areas because it is bright and cannot be dimmed. As emphasized in this study, natural light has a crucial effect on staff physiology and psychology. The interviews revealed that doctors felt uncomfortable or isolated from the outside if they had no chance to get natural light in their working areas because of the location, size or proportions of the room, its orientation to the sun, or window size. The NVivo results revealed that both doctors and nurses used the word natural more than artificial, which indicates that they find natural light more important than artificial light.

According to the interview and questionnaire results, doctors were especially dissatisfied with lighting control in both their working and resting areas, which reduced their sense of belonging and spatial tranquility. In conclusion, for well-designed lighting in healthcare staff working and resting areas, direct or indirect glare and visual noise should be prevented, dark and light adaptation should be homogenized, and control of lighting should be provided by permitting dimmed light [46; 25].

### 4.4. Acoustics

Audial comfort, which has many physical, psychological, and social effects, should also be considered in the working and resting areas of doctors and nurses. The survey and interview results also showed that outside noise disturbed doctors and nurses both physically and psychologically. According to the NVivo results, doctors and nurses in Hospital 3, where the polyclinic waiting areas are separate for each department, used the word noise less in their interviews than did staff in Hospitals 1 and 2. This supports the recommendations in the literature that improved layouts can reduce noise in healthcare interiors. To reduce noise, the relationships between interior spaces should be arranged to minimize crowding.

As Table 5 shows, both doctors and nurses were satisfied with light colors in both their working and resting spaces. The only materials they were not satisfied with were in their resting areas in that they preferred materials that made them feel at home in their resting areas in order to enter rest mode. Medical staff were least satisfied with the state of natural lighting, with doctors being more dissatisfied than nurses. Both doctors and nurses were dissatisfied with their ability to control both artificial and natural lighting. This demonstrates the significance of artificial lighting control in healthcare interiors. Doctors of all three hospitals were dissatisfied with noise control whereas nurses in all three hospitals were satisfied because doctors' spaces – whether separate or not – were adjacent to crowded patients' waiting areas. Thus, overall, doctors and nurses across the three hospitals were dissatisfied with both lighting and acoustics. However,

although it appears that lighting and acoustic design were more problematic, this does not mean that color and material are less important. Rather, the awareness of doctors and nurses about how color and materials affect their working and resting practices in healthcare interiors was less developed or articulated than their awareness of lighting and acoustics. This was demonstrated by their responses in the interviews in which they were able to articulate the significance of color and materials when asked about these issues in depth.

**Table 5. Summary of questionnaire results of interior parameters ("✓" indicates unsatisfaction whereas "X" indicates satisfaction)**

| | | | Doctor | Nurse | Doctor | Nurse |
|---|---|---|---|---|---|---|
| | | | Working | Working | Resting | Resting |
| **COLOR** | | All hospitals | ✓ | ✓ | ✓ | ✓ |
| **MATERIALS** | **FLOOR** | All hospitals | ✓ | ✓ | ✓ | ✓ |
| | **WALL** | All hospitals | ✓ | ✓ | X | X |
| | **CEILING** | All hospitals | ✓ | ✓ | ✓ | ✓ |
| **LIGHTING** | **ARTIFICIAL** | All hospitals | ✓ | ✓ | ✓ | ✓ |
| | **NATURAL** | Tire S. Hospital | X | ✓ | X | ✓ |
| | | Urla S. Hospital | X | X | X | X |
| | | Çeşme S. Hospital | X | ✓ | X | ✓ |
| | **CONTROL OF ARTIFICIAL LIGHTING** | All hospitals | X | X | X | X |
| | **CONTROL OF NATURAL LIGHTING** | Tire S. Hospital | X | ✓ | X | ✓ |
| | | Urla S. Hospital | X | X | X | X |
| | | Çeşme S. Hospital | X | ✓ | X | ✓ |
| **ACOUSTICS** | | Tire S. Hospital | X | ✓ | X | ✓ |
| | | Urla S. Hospital | X | ✓ | ✓ | X |
| | | Çeşme S. Hospital | X | ✓ | ✓ | X |

## 5. CONCLUSION

The analyses of this study have revealed several noteworthy results concerning color, materials, lighting and acoustics. In terms of the "color" component, it can be recommended to employ light colors in working areas of the staff for a spacious environment; vivid colors in resting areas of nurses; brighter colors for positive feelings like being happy, cheerful or hopeful; to combine cool and warm colors to achieve comfortable atmosphere and settings; and not to employ darker colors for avoiding negative feelings such as being bored, sad or withdrawn. In terms of the "material" component, it can be recommended to employ PVC materials for user safety, easy cleanliness, resistance and comfort; easy cleanable and painted with antibacterial paint for ceiling coverings; different types of materials like plastic-laminated, fire-retardant plywood apart from a single paint color in resting rooms; and not to employ ceramic tiles with grouted joints to prevent maintenance and hygiene problems. In terms of the "lighting" component, it can be recommended to use shiny and bright surface areas in restricted sizes to prevent glaring; to arrange furniture so as not to shine; to choose color and texture of blinds correctly; to increase use of natural light; to choose the right light color and intensity and CRI value in artificial lighting; and to use controlled natural light and

adjustable artificial lighting. In terms of the "acoustics" component, it can be recommended use separated waiting areas in polyclinics for minimizing density of patients in each area and shorten corridors length for enhancing acoustic control; to position spaces that are functionally compatible with each other side by side; and to provide horizontal (floor and ceiling materials) and vertical (partition walls) sound insulation between spaces by proper material selection and applications.

Appropriate design and implementation of interior design elements for the working and resting areas of medical staff, specifically colors, floor, wall, and ceiling materials, lighting, and noise control, can create healthy, happy, safe, and comfortable environments that will better satisfy the staff's physical and psychological needs. The design parameters of this study were limited to the interior components color, material, lighting and acoustics. Further studies may include other interior parameters such as plan layout, furniture design, art objects and/or other decorative elements, which also have considerable effects on interior atmosphere.

The results of this study have the potential to fill a significant gap in addressing hospital interiors in terms of creating greater awareness of design to improve users' physical and mental health, and to allow them to work in healthy, happy, safe, and comfortable environments. With the results of this study, it is expected that several stakeholders of healthcare sector –especially in İzmir and in Turkey– including healthcare designers, planners, researchers as wells as administrative actors and policy-makers in the healthcare sector may gain awareness on the importance of designing healthcare staff areas in the hospitals.

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