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Research Paper

Environmental Factors Affecting Mother in the Maternity Ward
(Case Study: Four Hospitals in Golestan Province)

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Abstract

Designing the maternity ward of hospitals is crucial due to the special conditions of mothers before, during, and after birth. Numerous environmental factors affect mothers, and it calls for an evidence-based design of these spaces. Although many investigations have drawn their attention to the issue, there is a paucity of research in terms of the significance of the birth environment factors. Therefore, the specific question of the research is that to what extent each of these factors is significant? In order to answer this question, the researchers devised a questionnaire based on which the most prominent variables could be ascertained. The questionnaire contained four main domains, including fear cascade, facilities, aesthetics and support, and the researchers distributed them among mothers in four hospitals in Golestan province, Iran. Six influential spaces affecting mothers, including communication space, hospitalization room, nursing station, neonatal room, operation room and external space, were investigated in this regard. Using the descriptive-analytical method and SPSS software, the research hypotheses were tested, and the Friedman test was employed to rank the domains and their variables. The findings demonstrated the significance of the aesthetic domain and such variables as the nursing station, natural light in corridors, and view to the doctor room. The study offered fresh insights into the design of a peaceful maternity ward.

Keywords: *Women, Birth environment, Maternity ward, Environmental factors.*

1. INTRODUCTION

The birth environment can both support and hinder birth [1]. The birth process is considered part of the natural life of women, affecting them and their families. In the birth environment, the hospital plays a significant role not just regarding healthcare issues, but also considering the environmental factors affecting the psychological aspects of mothers. Previous research suggests that the psychological conditions of mothers directly influence their physical conditions during birth [2-3]. In comparison to others who refer to the hospital, the mother has special conditions, since, in addition to the pain and stress resulting from her own conditions, she is also under psychological pressure for the birth of her child. Therefore, given the mentioned points, proper design of the birth environment and its optimization seems to be essential. In this regard, the investigation of environmental factors affecting the mother and her concerns is the first step for identifying the environmental elements and proper design of this environment [1,3-4]. Paying attention to the physical environment of birth, identifying the environmental factors, and presenting design solutions based on the wants of mothers and midwives are among the most important research that has been conducted in this regard [5-7]. As the most comprehensive research conducted for measuring birth, BUDSET (*Birthing Unit Design Spatial Evaluation Tool*) can be mentioned. It is an instrument developed by researchers at Sydney University of Technology to evaluate the effectiveness of the birth environment [8]. In the present research, by categorizing the environmental factors through a questionnaire in the form of four BUDSET domains, the birth environment of the research samples has been investigated. Moreover, design elements affecting the mother in the birth

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environment in developing countries such as Iran, where little attention has been paid to the quality of hospital spaces, will help further research in this issue by extracting these elements and their importance.

In this research, the psychological effects of the environment on women in the hospital have been examined with the aim of mitigating stress and improving the psychological conditions of mothers in the birth process (i.e., before, during, and after birth). This research aims to identify mothers' needs about the physical environment of birth and to discover the criteria affecting it. Six spaces that can affect the mother with which the mothers have the maximum relation were identified in the initial investigation of selected hospitals. Therefore, this research has six main hypotheses, including the effectiveness of environmental factors of six spaces of the maternity ward (communication space, hospitalization room, nursing station, neonatal room, operation room, and external space). After testing the hypotheses, this research examines the effectiveness of the domains and factors. In this regard, the two main following questions are propounded: "what factors of the birth environment affect mothers?" and "what is the extent of importance of these factors affecting the mothers?"

Accordingly, in the first part of the paper, the relevant literature is reviewed which consists of two sections: the first is the birth environment, which itself consists of two parts, one research based on BUDSET and the other studies as non-BUDSET. The second section is related to the expectations of mothers of the birth environment. In the research method, first, the research instrument, as well as the data collection method, is analyzed using the questionnaire. Then, the gathered data are analyzed, and eventually, based on data analysis, the results of the research are presented in the discussion and conclusion section.

2. REVIEW OF RELATED LITERATURE

The design of internal spaces in buildings with healthcare purposes has always been challenging for architects and interior designers and other researchers in this area. The special psychological conditions of mothers and their companions, as well as the improvement of peace, security, and mitigation of their anxiety levels alongside the special function and standards of the design of such spaces, are issues that have been under extensive examination to be enhanced. The experimental research performed in this area can be segregated into two main approaches. The first group involves investigating the environmental factors affecting mothers according to midwives, gynecologists, and designers. The literature about evaluating environmental factors affecting the birth process covers different dimensions [6-7, 9-12]. The second group deals with research investigating the needs and wants of mothers during the birth process about the environment or space [2-3, 7, 12-18]. The objective of this group is to identify the expectations of mothers about the environment as the main pillar of birth; therefore, the present research belongs to the second group.

There is extensive evidence suggesting that the physical environment influences the improvement of pain, infection, medical errors, stress, and the welfare of patients and staff [19]. Also, many factors affect the experiences of women about birth, yet the physical environment is one of the essential factors which less attention has been paid to it [3]. Various researchers are trying to determine the factors affecting mothers with regard to the birth environment. The variables of use of green space [2,19], color and natural light [2,14,20], noise [2,6,14,19], ventilation and temperature [2,6,21], a sense of domesticity [1,5,22], easy access to the toilets and bathroom [2, 23-24], and privacy [2,14,19] are among the most crucial variables. Here, first, the research regarding the birth environment in this field is reviewed. Then, the studies that stated the needs and wants of mothers as the main issue of their research about the birth environment are reviewed.

2.1. Birth environment

The design and use of space are among the important characteristics of healthcare facilities. However, mostly the focus is on useful spaces and minimization of formal emotions of the maternity ward towards the development of a sense of domesticity [5]. Research has shown that the physical environment of the birth supports a sense of security and satisfaction during birth [2]. In this regard, physical environments should be designed such that they have a powerful effect on women [13]. Here, the research in this area is reviewed in two major groups: BUDSET and non-BUDSET studies.

2.1.1. BUDSET-Based studies

A group of researchers consisting of architects, midwives, and other researchers at Sydney University of Technology developed an instrument to evaluate the design of the birth environment. This instrument examines the environmental items affecting women in the maternity ward [8]. BUDSET has been developed during a two-year period by this group. This instrument can help in determining what environmental aspects of the birth environment may affect the physical issues and procedure of birth. In the qualitative investigation of this instrument [8], the general factors affecting the design of the birth environment have been categorized into four key domains, including fear, facilities, aesthetics, and support, each of which is constituted of 2-8 indicators. The characteristics of the fear domain include a sense of domesticity, privacy, controlling noise, and universal precautions. Regarding facilities, it includes some factors such as physical support, birth tub, bath facilities, etc. Regarding aesthetics, it includes light, color, texture, interior environment, and femininity and finally regarding support; it includes access to drinks and food for women, the site of residence, and leisure break for the companions and maternity care providers. When using this instrument to investigate the environment, each indicator has been assigned one score, where the total score is eventually calculated, considering the presence or absence of each characteristic. In a

preliminary investigation of BUDSET, this instrument was tested and its content validity was examined. The results showed that this instrument could measure effectively to optimality of the birth environment [25].

In another research Jenkinson et al evaluated the birth environment across several hospitals in Queensland by considering BUDSET categorized factors. The items of privacy, bed, access to water bathtub, quick access toilets, light, windows, noise, decoration, the ability to move around the space, access to nature, easy accesses, personal items, support of the companion and family, and culture were introduced as the key elements in the design of the birth environment which were investigated further. The aim of such research was a general focus on developing spaces in which women feel secure during the birth process [2]. Harte, an Australian researcher who used BUDSET as well as video investigation in his thesis, studied the physical environment of birth and specifically the role of birth supporters. His results showed that the physical environment of the maternity ward does not respond to the needs. Also, he found out that designing the birth environment for supporting companions of birth causes improvement in the conditions of birth and mothers. Design recommendations included spaces with privacy, availability of support areas, adequate space, positive distractors, easy access to food and drinks as well as toilets, customizability, and adjusting the space [26]. Harte and his colleagues proposed the design of the birth unit by developing an interdisciplinary approach, including midwifery, architecture, design, and public health, when using exploratory video ethnographic in another research. This approach is the most effective method to understand the complexities and interactions of design, behaviors, communications, and experiences. It is a powerful method for data collection and analysis, which can mitigate complexity in the field of the birth environment [23].

2.1.2. Non-BUDSET-Based studies

By developing suitable conditions, the environment causes the facilitation of the birth process and satisfaction of mothers with birth. For this reason, the researchers of this area have been trying to discover the environmental factors affecting the mothers and properly designed maternity ward to encourage them toward natural birth, to reduce the cesarean delivery, and eventually to mitigate postpartum complications. Using human-centered design (HCD), Howard stated that combining the architecture evidence with that of midwifery, nursing, and medicine improves the care outcomes [14]. Further, Page has considered the sense of peace in mothers to be effective in birth and stated that the physical environment and access to proper facilities enhance vaginal birth over C-section (Caesarean section). Over half of the women investigated in this research considered factors such as temperature control, the proper place for walking, foam pillows, a room similar to the home (sense of domesticity), controlling entrance to and exit from the environment as important [27].

Extensive research has been conducted on the effects of snoezelen room on improving patients in hospitals. It consists of placing the person in a soothing and stimulating environment. These rooms are particularly designed to deliver stimuli to various senses, using lighting effects, color, sounds, music, scents, etc. One example is the research by Jamshidi Manesh et al, who dealt with investigating the effect of snoezelen room on the mother and course of birth in Iran. The findings suggested that distraction in the snoezelen room causes the diminished intensity of pain for the mother, shortened duration of birth, and incidence of episiotomy [28]. In similar research by Hauck et al for investigating the experiences of mothers, they interviewed 16 women who had used snoezelen room at this stage of pain. They found that the factors of distraction, convenience, peace, environmental control, security, and a homelike environment can affect the pain stage. Accordingly, they proposed the usage of this room for birth by mothers [21].

Color and light have always been of interest as key factors in therapeutic spaces. Dalke et al investigated the effectiveness of light and color in 20 hospitals. Their research suggested that the visual design of the hospital environment widely affects the patients, employees, and users, where designing a balanced and attractive environment is crucial [20]. Also, Jenkinson et al studied the interior design and decoration of the birth environment and proposed use of deep in non-flexible colors such as velvet, pink, and green; they also recommended not using light colors [2].

2.2. Mother's Environmental Expectations

Women consider many factors when selecting the birth environment [1]. All women need to feel a sense of security before, during, and after birth; this sense is affected by a variety of factors including the birth environment [8,15, 29-30]. The results of research conducted in this regard showed that for many women, the transference from the home environment to the hospital was stressful [1,24]. Mother-oriented design is based on supporting the pain and postpartum stages as well as the promotion of peace and convenience. In this regard, various variables affecting mothers have been examined [3,7,13,24,31,32].

Symon and his colleagues investigated the design of maternity units and its impact on birth in England. They dealt with examining the environmental perception of mothers and the arrangement of equipment. They stated that mothers' perceptions about the environment, such as aesthetic indicators, are subjective. The mothers who were in large and organized spaces of the maternity ward had greater satisfaction with the care quality and vice versa. Generally, their findings indicated that spatial perception was mostly dependent on the general satisfaction with the facilities and the surrounding environment. In another part of this research, they stated that control and empowerment were critical aspects of the environment, and it is assumed that the ability to control environmental variables helps the physiological course of the birth [5]. Undesirable noise

during birth negatively affects mothers and creates stress for many of them. They further explained that the mothers believe that they should be able to control the environmental variables, including temperature and ventilation — however, midwives opposed to giving such control to mothers [6]. The companions and their effects alongside the mother are undeniable. Designing the birth environment such that it responds to the needs of the companions and supports them is an important point suggested by various studies [32]. In another research, Symon and his colleagues investigated the role of companions and supporting them in the birth environment. Their research suggested that the environment influences the perception and behavior of humans, where the presence of a companion can affect the welfare and peace of mothers. Furthermore, while the main focus is on taking care of the mother, it should be acknowledged that the companion also plays a significant role, as they contribute to facilitating the process of pain [7].

National Childbirth Trust (NCT) is the largest charity institute in England, which supports parents in the birth process. Extensive research has been performed in this institute; among the most important studies is one conducted by [4]. They stated that women believe that the birth environment can affect the convenience or difficulty of birth pain. Women have clear expectations about the environment, facility, and controlling it for maximum convenience and support during pain [4]. In another research, by investigating the experiences of women about the birth environment, they found out that the environment in which women give birth can make differences in convenience or difficulty. It is vital for women that their room be clean, comfortable, and homelike. They also need to feel that they can easily move around and have access to a private toilet. Also, adequate facilities and equipment help women to mitigate pain, and eventually, they need the support of companions and midwives [3].

Investigation of mothers' perceptions of the hospital is another point that has been investigated. For example, Martell presented categorizations related to the hospital, including the environment, physical conditions, sociocultural conditions, probabilities, and consequences of it. He emphasized that the environment is still considered a concern, and according to nurses, some aspects of the environment may hinder the improvement of women, where alteration of the hospital environment can affect the promotion of positive perception and experiences for mothers [16]. Qualitative interviews with hospitalized mothers for investigating their perceptions is a method performed by [33] in their investigation on women in the maternity ward of the hospital. Considering their experiences and expectations, they stated that the birth environment makes a difference regarding the positive or negative experiences of women. They also found that neonatal care can be realized when the mother and companions feel trust and peace when transferring from home to the hospital [33].

The key variables of the sense of safety and satisfaction with the birth environment and its impact on the mother and personnel have been of interest to Foureur. In their research, assuming that many of the current birth environments negatively affect satisfaction with maternal care at levels of stress, communication patterns, and birth outcomes, they examined the available evidence. The results suggested that safe healthcare, communications, and birth environment can yield assurance for the patient [25]. In the research by Lyndon et al. to investigate mothers' safety when they are hospitalized, they interviewed 17 women with 29-47 years of age. They found out that the experiences and perceptions of women about safety during birth are dependent on the emotional and physical factors in the environment, and safety is a function of factors including the environment, care organization, interpersonal interactions, and human communications [15].

In sum, all these studies suggest that both physical conditions and individual factors affect mothers. The suitable environment in the maternity ward causes the development of a sense of security and satisfaction with the environment in mothers. Moreover, the needs and expectations of mothers as the main pillar in the birth process should be considered. The literature reviewed above suggests that the physical environment and its design have a considerable effect on the psychological conditions of mothers, where the wants of mothers are different before, during, and after birth across different hospital spaces. Environmental factors have been listed and examined in many studies. However, according to mothers' expectations, the identification of environmental factors and ranking their importance have often neglected.

3. RESEARCH METHODOLOGY

3.1. Method

First, the questionnaire was developed, distributed in the maternity ward of hospitals, and completed by mothers. Then, factor analysis was performed and the research hypotheses were tested. For performing the factor analysis and testing the hypotheses, SPSS software was used. This method allows the possibility of testing the accuracy of research hypotheses based on the effectiveness of spaces in the maternity ward on the mothers, which indicated the significance of the obtained coefficients. Then, the Friedman test was used to rank the variables of the questionnaire. Eventually, by concluding each variable in the four domains, the ranking of the effectiveness of the four domains in relation to each other was determined.

3.2. Instrument

The data collection instrument was a 26-item questionnaire designed in six sections. The questionnaire was based on a Likert scale, where the items were graded as six-point including very low, low, relatively low, very much, much, and fairly much, and the responses were valued numerically. The six spaces included communication spaces, hospitalization room, nursing station, neonatal room, operation room, and external space, with each contained three items except for the operation

room which contained 11 items. The questionnaire variables were extracted based on the investigated background of the research and classified across four domains of BUDSET. Among the reviewed factors in literature, only variables were included in the instrument that we had at our hospitals according to the facilities, services, and type of hospital design. Each item examined one of the environmental factors in the birth environment. Table 1 presents the content structure of the questionnaire based on the four domains of BUDSET [30], as well as the measured variables.

In order to measure the reliability of the instrument, the Cronbach alpha coefficient was employed (Table 2). First, to investigate the reliability, the questionnaires were initially completed by 30 individuals as the initial sample. After general modification and confirmation, the questionnaire was distributed among 107 studied samples and completed in selected hospitals.

3.3. Population and sampling

Golestan province is located in the north of Iran. Gorgan and Gonbad are the largest cities of this province, situated in the west and east of the province, respectively. They are indeed considered as healthcare centers for their surrounding cities. Hence, to complete the questionnaire, the hospitals of these two cities were considered as the sample because of encompassing a wide range of clients in the province. In each of these two cities, one state hospital and one large private hospital were chosen for the research (Table 3).

The plan of the maternity ward of the studied hospitals was similar to the typical pattern used in the country, following a linear pattern. These hospitals represent simple and compressed design types with minimum required facilities for care. So, the results of such a study can also be useful to study the design of the maternity ward of other developing countries. In order to determine the numbers of mothers in the hospitals of Golestan province in Iran, which have been considered as population, Cochran formula was used. By using this formula, the sample size was calculated as 89. Taking sample size attrition into account, 107 questionnaires were distributed across the hospitals of this province and completed (Figure 1).

Table 1. The variables constituting the research instrument

Domain	Variables
Fear cascade	Effect of openings- the size of the communication space- post-birth noise- view to the outside- spaciousness of the room- single-bedroom- pre-birth space- pre-birth noise- external noise
Facilities	Easy and quick access to the W.C.- view to the neonatal hospitalization environment- easy access of the nursing station to the neonate- easy access to the neonatal and breastfeeding room
Aesthetics	Natural light in connecting spaces- space color- natural light in the hospitalization room- ventilation of the environment- the temperature of the environment- arrangement of equipment and objects- view to the green and open space- easy access to the green space
Support	Mother's view to the neonate- view and access to the companion- view and access to the nursing station- access to service spaces- view and access to the doctor and midwife's room

Table 2. Measuring the questionnaire reliability

Cronbach's alpha coefficients	Number of questions	Spaces
92%	3	Communication spaces
88%	11	Hospital room
93%	3	Nurse station
86%	3	Neonatal room
83%	3	Operating Room
85%	3	Outer space

Table 3. The hospitals studied in the research

Hospital name	Beski-Gonbad (private)	Payambar-Gonbad (state)	Falsafi-Gorgan (private)	Hakim Jorjani-Gorgan (state)

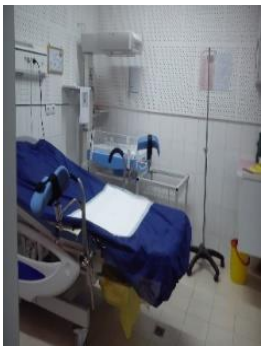
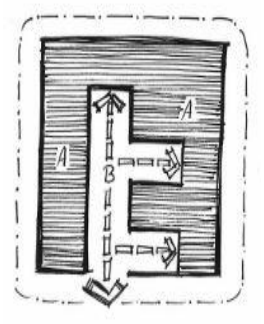
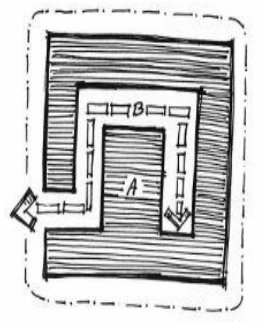
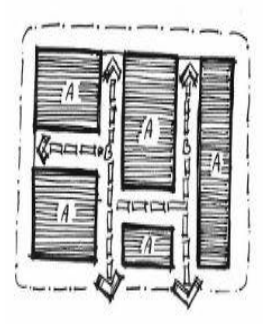
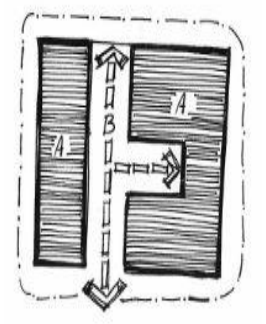
Hospital name	Beski-Gonbad (private)	Payambar-Gonbad (state)	Falsafi-Gorgan (private)	Hakim Jorjani-Gorgan (state)
Childbirth environment				
Communication spaces				
Maternity ward Plan				

Fig 1. Maternity ward of the selected hospitals

4. DATA ANALYSIS

4.1. Descriptive statistics

From among the respondents of the questionnaires, 58% were younger than 30 years old, and 42% were between 30 and 40 years of age. In terms of income, 9, 67, and 31 had low, medium, and high incomes, respectively. Eventually, in terms of the level of education, 11, 34, 10, 40, and 5% had below diploma, diploma, associate degree, bachelor's, and master's degree, respectively (Table 4).

Table 4. Descriptive statistics

Characteristics	Frequency	Percent
Level of Education		
Under the diploma	12	11
Diploma	36	34
Associate degree	11	10
Bachelor degree	43	40
Masters	5	5
Ph.D.	0	0
Age		
Less than 30 years	62	58
30 to 40 years	45	42
Over 40 years old	0	0
Income		
Low	9	8
Medium	67	63
High	31	29

4.2. Factor analysis

The first, factor analysis validity test is KMO or Bartlett's significance level test. When the KMO value is larger than 0.6, factor analysis can be easily performed. The higher this value, the greater the suitability and adequacy of the sampling will be. In this research, this coefficient was obtained as 0.854 (Table 5).

Table 5. The results obtained from the Bartlett test and KMO index

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy.		.854
Bartlett's test of Sphericity	Approx. Chi-Square	1673.351
	df	325
	Sig.	.000

Considering the KMO number (larger than 0.6) and Bartlett's test significance number (sig<0.05), it can be

stated that the data are suitable and eligible for performing factor analysis.

4.3. Testing research hypotheses

There was a significant relationship between environmental factors of the six aforementioned spaces and hospitalized mothers. According to the t-statistic table of hypotheses (Table 6), for the path of the relationship between environmental factors and mothers, for each hypothesis it is as follows: communication spaces (17.305), patients' room (53.738), nursing station (29.484), neonatal room (40.937), operation room (35.494), and external space (29.366). According to the t-statistic table, the value obtained for all hypotheses has been above the significant threshold (i.e. 1.96). Based on this coefficient, it can be concluded that there is a significant relationship between the effect of the environmental factors of the different maternity ward spaces on mothers. Accordingly, every single hypothesis of the research is confirmed.

According to the ANOVA test (Table 7) and F-factor, the effect of the maternity ward spaces on mothers is confirmed, and all of the questioned factors are significant to mothers.

Table 6. The t-statistic tables of hypotheses

Coefficients						
Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
Communication spaces	(Constant)	4.454	.257		17.305	.000
	Mother	-.063	.069	-.090	-.924	.358
Hospital room	(Constant)	4.422	.082		53.738	.000
	Mother	-.014	.022	-.062	-.640	.031
Nurse station	(Constant)	3.741	.127		29.484	.000
	Mother	.013	.034	.036	.372	.011
Neonatal room	(Constant)	4.544	.111		40.937	.000
	Mother	-.040	.030	-.130	-1.346	.081
Operating room	(Constant)	4.132	.116		35.494	.000
	Mother	.005	.031	.016	.160	.003
Outer space	(Constant)	4.369	.149		29.366	.000
	Mother	-.046	.040	-.113	-1.164	.007

Table 8 presents the rank of each of the specified variables. The questionnaire includes 26 items, with each examining one variable. Generally, each of these factors affects the physical or emotional conditions of mothers. In this research, the extent of importance of each of the mothers' opinions has been measured, which has been ranked in the following (Table 8).

Table 9 outlines the four domains in the order of effectiveness of the environmental domains. Aesthetics with a score of 3.20 claimed the first rank, followed by facility, fear, and support with 2.90, 2.18, and 1.72, respectively.

Table 7. ANOVA test

ANOVA						
Model		Sum of squares	df	Mean square	F	Sig.
Communication spaces	Regression	.841	1	.841	321.564	.031
	Residual	103.429	105	.985		
	Total	104.270	106	-		
Hospital room	Regression	.041	1	.041	412.409	.031
	Residual	10.569	105	.101		
	Total	10.610	106	-		
Nurse station	Regression	.033	1	.033	177.112	.011
	Residual	25.134	105	.239		
	Total	25.167	106	-		
Neonatal room	Regression	.332	1	.332	189.812	.081
	Residual	19.230	105	.183		
	Total	19.562	106	-		

Operating Room	Regression	.005	1	.005	365.026	.003
	Residual	21.158	105	.202		
	Total	21.163	106	-		
Outer space	Regression	.446	1	.446	261.354	.007
	Residual	34.559	105	.329		
	Total	35.005	106	-		

Table 8. Ranking the effectiveness of each factor – Friedman test

Characteristic	Mean	Characteristic	Mean	Chi-Square	df	Asymp. Sig.
Easy access of the nursing station to the neonate	17.98	effect of openings	13.57	132.869	5	.002
Natural light in connecting spaces	17.60	space color	13.55			
View and access to the doctor and midwife's room	16.83	view to the neonatal hospitalization environment	13.22			
The temperature of the environment	16.53	easy access to the neonatal and breastfeeding room	13.02			
View to the green and open space	15.82	pre-birth space	13.02			
View and access to the companion	15.60	external noise	12.27			
Ventilation of the environment	15.52	pre-birth noise	12.15			
Dimensions and spaciousness of the room	14.90	the arrangement of equipment and objects	12.02			
Natural light in the hospitalization room	14.45	Mother's view to the neonate	11.72			
View and access to the nursing station	14.47	single bedroom	11.33			
Easy and quick access to the water closet	13.95	easy access to the green space	11.12			
Post-birth noise	13.90	dimensions and size of the communication space	10.62			
View to the outside	13.82	access to service spaces	2.88			

Table 9. Ranking the effectiveness of each domain – Friedman test

Domain	Mean	Chi-Square	df	Asymp. Sig.
Aesthetics	3.20	25.051	3	.002
Facility	2.90			
Fear Cascade	2.18			
Support	1.72			

5. DISCUSSION

The findings of the research suggested that the six general hypotheses, including the effect of environmental characteristics of different spaces within the maternity ward on hospitalized mothers, were confirmed. Each of these spaces includes several variables dealing with investigating the design factors of the maternity ward and their importance according to mothers. What follows discusses the main findings in terms of domains and their variables in this research.

Aesthetics was found as the most effective domain out of the four. When investigating the variables of this domain, it can be concluded that generally, visual factors and environmental convenience are vital to mothers. As soon as mothers enter the hospital for the birth, they experience pain several hours to even one day. The physical and psychological conditions of the mother in this situation involve going through the maximum stress and pain. Meanwhile, environmental elements such as the noises resulting from the pain of other mothers as well as the arrangement of medical equipment cause aggravation of their stress before birth. Similarly, Jenkinson stated that medical and emergency equipment being visible deteriorates stress in mothers [27]. The aesthetic domain results suggested that natural light is preferred to artificial light, both in the hospitalization room and in the connecting corridors. Given the hospital environment and the presence of different odors, including detergents and disinfectants, ventilation is of great importance for mothers. Furthermore, sometimes hide room temperatures can be bothersome for mothers, and in response, they feel a sense of the need to control the room temperature. For this reason, many mothers wished to be close to the

window to receive natural ventilation and fresh air. Similarly, Hauck et al. and Page also considered the ability to control environmental variables by mothers as effective to yield satisfaction with that environment [21,27]. Likewise, Symon stated that mothers desired to control environmental variables, but the midwives disagreed [6]. For most mothers, direct access and view to natural environments and green spaces were significant, in accord with the study [31]. In this regard, the allocation of a green space terrace for the labor stage and postpartum walking were among the features that mothers expected from the birth environment.

The facilities were identified as the next influential domain, according to the mothers. Hygiene facilities of private toilet and bath in the personal space of hospitalization considering the physical situation and coverage of mothers before and after birth are essential to them. In similar studies conducted [2,25,34], proper and quick access to toilets and hygiene facilities were considered as the vital factors of the birth environment. Mothers preferred the placement of the neonate immediately after birth near themselves. Paying attention to the fact that some neonates need special care and may be monitored some days in the pediatric hospitalization unit, the presence of breastfeeding space for mothers, and easy access of the mother's bed to the neonatal bed cause peace in mothers. On the other hand, having a proper view to this space from the corridor of the ward can also give assurance to mothers.

Investigation of environmental elements in the domain of fear as the next influential showed that most mothers believed that the type, shape, and size of doors and windows affected their satisfaction with the environment. Large sight and available windows gave an impression of a spacious environment. Further, the mothers preferred large and spacious corridors with an organized arrangement and natural light that opened to the outside. According to the mothers, large and neatly arranged rooms are more spacious, which in turn give satisfaction. As stated before, organized space and tidy arrangement of equipment cause satisfaction of mothers with the environment [2,4,5]. Silence and peace across all stages of the presence of the mother in the hospital are crucial. Noise in the ward during hospitalization causes a sense of bother, and noise during the labor stage and before the birth causes stress and anxiety in them. Jenkinson considered the noise as a critical factor in the development of stress [2]. In this regard, they dealt with presenting some solutions such as playing music in the room and acoustic insulation to Jenkinson absorb disturbing and external noises. Symon also introduced noise as a bothersome and provocative factor for the birth environment [5]. Most mothers wished to use a single-bedroom to protect their privacy. At most, they preferred a two-bedroom since a crowd of companions causes loss of privacy and personal peace. Similarly, in some studies, privacy was mentioned as one of the most critical environmental factors, according to mothers' ideas [2,14,19].

According to the findings, the domain of support ranked next. This domain includes issues dealing with the functional aspect of spaces in the maternity ward and the manner of service provision. The companion (often the husband) can also play a significant role in both psychologically and physically to support the situation of the mother. Therefore, by allocating the required facilities and space for the companion when designing the maternity ward, one can significantly improve the condition of mothers. Some researchers also mentioned the effective role of the companion in their research [7,26]. In our study, mothers believed that hospitalization in relation to the functional spaces of the maternity ward, such as the nursing station, should have facilities such as easily and quickly accessible food and drinks. According to the mothers, access and the minimum distance between the spaces of mother and neonatal hospitalization and the doctor room as well as the nursing station was proper to them. Howard also mentioned the nursing station as the main center for the movement paths of mothers in the maternity ward during the labor process [14].

Among the 26 environmental elements investigated in the questionnaire, the factors of quick access to the nursing station, natural light, quick access to doctors, and the ability to control air temperature were identified as the main preferences of mothers. This suggests the effectiveness of both physical and psychological factors on the mothers. The proximity of the nursing station and doctor causes a sense of security in mothers. On the other hand, visual and physical factors such as the preference for natural light and air temperature control also cause the physical convenience of mothers. Meanwhile, the factors of access to service spaces, dimensions of corridors, and access to green space were the last preferences for mothers. Indeed, these elements include factors that have no special effect on the mothers in our study.

6. CONCLUSION

The present study aimed to determine the environmental factors affecting the mother in the maternity ward of Golestan hospitals. According to our findings, the aesthetic domain in these hospitals was more prominent as compared to other domains, emphasizing the fact that having a well-maintained birth environment helps mothers in delivering. In most similar research in which researchers applied BUDSET, only design factors of the birth environment were examined; however, the extent of effectiveness of these factors was ranked in the present research. On the scale of variables, the results offered that the location of the nursing station, natural light in the corridors, and view to the doctor room are indispensable variables in the studied hospitals. More work is needed to be undertaken in terms of hospital design patterns, particularly in the maternity ward and birth environment. Owing to the financial limitations and maybe designers' negligence, numerous hospitals in Iran have been designed with linear compressed patterns. That is why these factors should be extracted in similar cases in other countries so that one can understand the effect of proper design much more deeply. Upcoming research in Iran can also

concentrate on the role of these financial constraints regarding the design of hospitals.

In comparison to some developed countries such as Australia, England, and the U.S. which have performed fundamental research in this area, the level of expectation of mothers in developing countries such as Iran is far lower. Indeed, Iranian mothers do not entirely express their wants and expectations of the birth environment as they think they are not allowed to express them. It seems that more factors such as culture, ethnicity and religious beliefs, need to be taken into account associated with Iranian mothers since the contextual determinants play a crucial role here. Considering the above-mentioned points and benefiting from the women, personnel (i.e., midwives and doctors) and professional designers from other countries, Iranian designers will be able to design the birth environment with the minimum number of stressful items.

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