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Effective Environmental Factors in Encouraging Iranian Mothers to Have Physiologic Birth through Facilitating it: An Exploratory Factor Analysis

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ABSTRACT

Background: With the decrease in physiologic birth due to fear, researchers became interested in the mechanisms affecting mothers' tendency to deliver naturally. Studies have indicated that environmental factors significantly influence the fear experienced by women during labor. This research aims to examine the extent to which environmental parameters can facilitate Iranian mothers in managing their fear during physiologic childbirth.
Methods: The comparative analysis drawn from the relevant literature about environmental factors and mothers' perception of these factors has led to a reevaluation of this subject. Consequently, a research project was carried out, using a structured questionnaire and employing the exploratory factor analysis methodology.
Results: According to the findings, the most important environmental factors that encourage Iranian mothers to physiologic delivery are as follows: "objective quality of life (Eigenvalue of 9.400)", "attractive environmental stimuli (Eigenvalue of 6.267)", "environmental and physical health (Eigenvalue of 5.126)", "friendly atmosphere (Eigenvalue of 4.596)", "environmental vitality (Eigenvalue of 4.375)", "environmental privacy (Eigenvalue of 3.866)" and "tangible technology (Eigenvalue of 3.689)".
Conclusion: Promoting the environmental quality of the delivery room through architectural interventions such as interior design and the general configuration, can help mothers, their partners, and medical staff in managing childbirth more effectively, ultimately leading to a higher incidence of physiologic delivery.

1. Introduction

Encouraging mothers to opt for physiologic birth is known as a sustainable model among researchers. The World Health Organization (WHO) recommends that the rate of cesarean birth (C-section) should not exceed 10-15% [1]. However, in Iran, the rate of C-sections in 2013 was reported to be 42% in public hospitals and 90% in private hospitals [2], with an estimated overall prevalence of cesarean delivery at 48% [3]. Despite the safety of C-sections in most countries, evidence suggests that there are no benefits to maternal or neonatal outcomes with unnecessary C-sections [1, 4]. In contrast, compared to vaginal delivery, cesarean delivery is associated with increased risks of fertility complications, long-term childhood outcomes [5], maternal and neonatal intensive care unit admission [6], offspring overweight [7], inadequate

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breastfeeding practices, early maternal complications, and sexual dysfunction [8]. In addition, elective cesarean section is linked to an increased incidence of maternal morbidity, including puerperal febrile morbidity, wound infections, and breastfeeding problems [9]. A study reported that a major reason for spontaneous C-sections is inadequate labor management [10]. An Iranian study reported fear of labor pain, noisiness, disinclination toward non-private areas, and stressfulness of delivery wards as the main reasons for the increased rate of C-sections [11]. In Iran, maternal education and grand multiparity are among the demographic and social factors associated with cesarean section delivery, while a previous cesarean section is a key obstetric-medical factor. Notably, fear of normal-vaginal delivery (NVD) appears to be the most prominent obstetric-medical factor leading to cesarean section delivery [12]. The role of the environment in facilitating physiologic childbirth is important for maternal fear management, [13] and can either support or hinder physiologic birth [14]. In particular, labor, delivery, and recovery (LDR) rooms can provide optimal conditions for using non-drug pain relief techniques including the use of balls, tubs, and emotional support from partners or midwives [15]. Recent research conducted in the United States has shown that the physical design of a hospital's birthing unit may affect the rate of Cesarean section deliveries, as highlighted in a recent publication by Ariadne Labs and MASS Design Group [16]. In developed countries, women's preferences during childbirth generally include access to a clean room, the ability to stay in a single room throughout labor, and the ability to move around freely [17]. Considering that the cultural, economic, and social contexts of each society can significantly influence human experiences [18], this study focuses on a group of Iranian mothers who may have different environmental needs compared to mothers in developed countries. The analytical stages of this study aim to explore the perceptions of Iranian mothers regarding the environmental factors that facilitate physiologic childbirth and mitigate the fear of labor. By examining maternal perceptions of the delivery environment, healthcare staff can better understand the needs and expectations of expectant mothers [19]. Furthermore, this research can provide solutions and improvement of maternity department programs to increase the physiologic birth rate. According to the literature, this study is among the limited number of investigations into the environmental requirements of expectant mothers and focuses on the perceptions of first-time mothers.

2. Materials and Methods

The present study employs a descriptive-analytical research methodology. In the descriptive phase, the concepts of physiologic childbirth and the related indicators were studied. Additionally, the descriptive section reviews the issues and features of childbirth in Iran. As the number of studies in this field in Iran is limited, the researchers conducted interviews with Iranian mothers, and medical and architectural experts, and made observations during physiologic childbirth, all of which were performed by Deljoo Ghamgosar F (the first author). The extracted codes were based on both the literature and interviews and Sahragard Monfared NS (the third writer), an expert in methodology, categorized the codes based on their differences or similarities. Then the connections and relationships between the subfactors were identified to organize the main factors (performed under the supervision of the second author, Yazdanfar SA, the corresponding author). No software was used in this section. Consequently, Table 1 outlines the environmental needs of laboring mothers and serves as the theoretical framework for assessing the spatial needs of mothers. In the analytical stage, a research questionnaire was designed based on the research goals, mothers' preferences, and the theoretical framework. Then, its reliability and validity were measured based on the opinions of experts and statistical tests. For the evaluation of the questionnaire, an exploratory model of the environmental preferences of mothers during childbirth based on the sample was developed via classification and amalgamation of the variables into major factors using exploratory factor analysis. The study aims to investigate the effective environmental characteristics of childbirth rooms that facilitate physiologic birth and encourage mothers to birth physiologically based on the Iranian mothers' perception. The significance of this study lies in the fact that identifying mothers' priorities can help improve the development programs for the maternity department and increase physiologic birth rates by enhancing the quality of LDR rooms. As shown in Table 1, the classification of environmental criteria related to successful physiologic childbirth includes 6 dimensions: mental comfort, physical comfort, quietness, darkness and solitude, partners' comfort, and safety. These dimensions are related to mothers' satisfaction and can be evaluated to identify the efficient physiologic childbirth space that encourages mothers to have physiologic childbirth. This study employs a direct measurement approach to separately and explicitly measure respondents' evaluations of different attributes and the relative importance weight of each attribute. The experimental questionnaire comprises two sections: The first section collects demographic data, which is coded alphabetically to determine the characteristics of the statistical sample in terms of education, number of births, and age. The second section is designed to analyze the research data to achieve the purpose of this research. The mother's preference questions were compiled and elaborated from the factors related to the environmental needs of women given physiologic childbirth, as presented in the previous section (Table 1), under 6 items and 37 sub-items: mental comfort, physical comfort, quietness, darkness and solitude, partners' comfort, and safety. The mothers' preference levels were assessed using a 4-point Likert scale ranging from very high, high, low, to very low. To avoid deviation in the results of the questionnaire caused by people choosing the neutral/median point was eliminated.

Table 1: Factors related to the environmental needs of women given physiologic birth

Content	Goal		Toward physiologic delivery
			Mother s satisfaction
Environmental Components	Mental comfort	Clean room	*
		Beautiful room	*
		View and landscape	*
		Access to private green space and open area	*
		Access to clock	*
		Aromatherapy	*
	Physical comfort	Possibility of walking around in a private area	*
		Possibility of moving up ramps and stairs	*
		Access to shower room	*
		Access to comfortable double bed	*
		Access to a hospital bed	*
		Access to a bathtub	*
		Access to a delivery pool	*
		Access to a private bathroom	*
		Access to foodstuff	*
		Access to non-drug pain relief equipment	*
	Quiet	Music-assisted control	*
		Preventing sounds from leaving the delivery room	*
		Reduction of sounds coming from the corridor and nursing station	*
		Reduction of sounds coming from other delivery rooms	*
	Darkness and solitude	Natural and artificial light control	*
		Maternal room visibility control	*
	Spouse′ s comfort	Resting space in the delivery room	
		Resting space outside the delivery room	
		Showering without a wetting spouse	
		Access to foodstuff	
		Access to a separate bathroom	
		Freedom in entering and leaving the delivery room	
		Access to a smoking room	
	Safety	Physical: Availability of resuscitation equipment	*
		Mental: resuscitation equipment being out of sight	*

The data were collected over 3 months during the summer of 2021 using a simple random sampling method. Based on the results of 15 pilot questionnaires, it was determined that a minimum sample size of 150-160 primiparous mothers was sufficient according to Cochran's formula, as most of their characteristics were found to be similar in terms of age, economic status, and level of education. The questionnaires were distributed among 160 mothers who were at least 2 h past physiologic childbirth recovery at hospitals in Tehran (the capital of Iran) and Zanjan (one of the largest cities in Iran where Iranian mothers from west and western north of Iran come for childbirth). However, seven mothers refused to fill out the questionnaire due to their bad moods. The questionnaires were prepared using on-site techniques and were conducted as interviews in the postpartum room on different days of the week. The average time taken to complete the questionnaire was approximately 15 min, which was within the expected range. The data collected from the questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) version 26 (IBM Corp., Armonk, New York, USA) for Windows. The variables related to the preferences of mothers were classified into major factors through exploratory factor analysis. To ensure reliable analyses, the value of Cronbach's alpha was determined to be 0.836, which indicates that both the research and its results are reliable. The next section of the paper is the analysis of the collected data and assessment of the findings.

3. Results and Discussion

3.1 Background Information on Mothers

Table 2 provides an overview of the demographic data and characteristics of the mothers who participated in this study. The median age of the participants was 31 years, with an interquartile range of 20-45. The majority of the mothers (58.83%) had a bachelor's degree, while 37.25% had a postgraduate degree. The majority of the participants (88.24%) were employed. All participants had a physiologic delivery and were primiparous.

Table 2: Demographic information on mothers (n=153)

Variables		Employment status	
		n	%
Age	20-25	9	5.89
	25-30	45	29.41
	30-35	63	41.17
	35-40	33	21.57
	40-45	3	1.96
Education	Primary school	3	1.96
	High school	3	1.96
	Bachelor degree	90	58.83
	Postgraduate	57	37.25
Employment status	Not-employed	18	11.76
	Part-time	63	41.18
	Full-time	60	39.22
	Self-employed	12	7.84

3.2 Reported Mothers' Views and Descriptions of Birthplace Environment

Table 3 shows the frequencies of the mother's feelings about the birthplace environment. The majority of the participants (82.4%) believed that having a private bathroom was of very high importance, while a significant percentage (78.4%) had a similar opinion about a private shower. 74.5% of the participants considered reducing the noise from other rooms as very highly important. A substantial percentage of participants (70.6%) expressed that the importance of clear wayfinding was of very high importance, and 68.6% shared the same view about reducing the noise from wards and corridors while also having LDR and pain relief equipment.

3.3 Scores for Individual Items Assessing Mother's Feeling about Birth Environment

The mothers' attitudes toward the delivery room were assessed by calculating the mean ± standard deviation for the individual items of the questionnaire (37 items). The highest positive attitude score (3.82 ± 0.385), which was obtained by very high scorers, was mainly for the item "*I want to have a private bathroom.*" This was followed by some items with positive scores ranging from high to very high, including "I do not want other people to be able to see me." (mean score of 3.80 ± .491), "*My room should be clean.*" (mean score of 3.78 ± .541), "I want to have a private shower room." (mean score of 3.75 ± 0.523). Conversely, the lowest negatively scored item was "*I want to be able to see the resuscitation equipment* ", which had a mean score of 2.39 ± 1.218 (Table 4).

3.4 Environmental Exploratory Factor Analysis

In the first step of factor analysis, it is essential to examine whether the data collected for such analysis are valid and appropriate. Bartlett's test and Kaiser-Meyer-Olkin (KMO) coefficient are often used for this purpose. If the KMO value is greater than 0.5, factor analysis can be performed with confidence. The KMO coefficient was 0.512 in this study, which is higher than the required value (Table 5). After verification of the validity of the collected data, significant factors were obtained by varimax rotation. The number of factors is based on predetermined eigenvalues. In this study, given the importance of covering the largest possible amount of variance, the number of factors was determined to be one, as shown in Table 6. Table 6 identifies each factor, which consists of several variables. Variables with eigenvalue less than 1 were omitted due to their lower significance. In the next step of exploratory factor analysis, each factor was named based on the commonalities of the questions that had been grouped statistically. Furthermore, each subfactor was defined and determined based on its factor loading obtained through this method. It should be noted that one item ("I do not want to see the resuscitation equipment.") was eliminated. A review of the factor loadings and their priority over each other in the data matrix revealed that only seven factors can be presented as influential in the mothers' perception of childbirth-related factors (Table 7).

3.5 Objective Quality of Life

The first factor determined by factor analysis in this study was named "objective quality of life of the delivery room". The eigenvalue variance for this factor accounted for 20% of the total 79% variance obtained for all factors, indicating a significant impact on women's perception of delivery environments. As can be seen in Table 7, respondent mothers have perceived factors that are related to their quality of life as the most critical factors in their perception of hospital-related settings. Considering the factor loadings and subfactors of this specific factor, it can be stated that creating a standardized approach to quality of life in all physiological dimensions for laboring mothers can promote subjective well-being in childbirth environments. Prior research has indicated that objective and subjective quality of life [20] are interrelated, thus emphasizing the importance of fulfilling basic physiological needs in delivery rooms to maximize mental comfort.

Table 3: Sample Descriptive Statistics

Variables	Low n(%)	Very low n(%)	High n(%)	Very high n(%)
I want to have access to aromatherapy equipment.	9 (5.9)	36 (23.5)	78 (51.0)	30 (19.6)
My room should be clean.	3 (2.0)	24 (15.7)	126 (82.4)	3 (2.0)
My room's furniture should be beautiful.	12 (7.8)	27 (17.6)	45 (29.4)	69 (45.1)
My room's window should give me a nice view of the outside.	3 (2.0)	21 (13.7)	57 (37.3)	72 (47.1)
I want to have access to a private open green space such as a yard.	3 (2.0)	12 (7.8)	36 (23.5)	102 (66.7)
I want to have access to a private comfortable area to walk around with my spouse.	3 (2.0)	9 (5.9)	57 (37.3)	84 (54.9)
I want to be able to listen to my favorite music.	9 (5.9)	33 (21.6)	51 (33.3)	60 (39.2)
I want to be made sure that no one will hear my voice.	3 (2.0)	12 (7.8)	42 (27.5)	96 (62.7)
The sounds coming into my room from the corridor and the nursing station should be minimized.	3 (2.0)	18 (11.8)	27 (17.6)	105 (68.6)
I want to be able to control the natural and artificial lighting in my room.	0 (0)	15 (9.8)	72 (47.1)	66 (43.1)
I want to have access to the ceiling and wall lighting.	9 (5.9)	27 (17.6)	57 (37.3)	60 (39.2)
My room should be painted with warm and non-hospital colors.	0 (0)	30 (19.6)	66 (43.1)	57 (37.3)
I want to be able to control my room's temperature.	3 (2.0)	6 (3.9)	42 (27.5)	102 (66.7)
I want to be in a room designed for me, not a patient.	3 (2.0)	18 (11.8)	51 (33.3)	81 (52.9)
My room's furniture should have warm colors.	18 (11.8)	36 (23.5)	48 (31.4)	51 (33.3)
My room's furniture should be made of wood and cloth.	30 (19.6)	21 (13.7)	66 (43.1)	36 (23.5)
Navigation in the hospital should be easy and clear.	0 (0)	18 (11.8)	27 (17.6)	108 (70.6)
I want to have a double bed.	42 (27.5)	24 (15.7)	24 (15.7)	63 (41.2)
I want to have a hospital bed.	33 (21.6)	30 (19.6)	48 (31.4)	42 (27.5)
I want to have a bathtub in my room.	42 (27.5)	39 (25.5)	27 (17.6)	45 (29.4)
I want to have a delivery pool.	51 (33.3)	21 (13.7)	36 (23.5)	45 (29.4)
I want to stay in one room during the whole process of pain and labor.	12 (7.8)	12 (7.8)	24 (15.7)	105 (68.6)
I want to be able to control people's entry to my room.	15 (9.8)	21 (13.7)	51 (33.3)	66 (43.1)
The ward should have a separate space for husbands to walk around.	0 (0)	15 (9.8)	48 (31.4)	90 (58.8)
I want to have access to a clock.	30 (19.6)	27 (17.6)	63 (41.2)	33 (21.6)
I want to have a private shower room.	0 (0)	6 (3.9)	27 (17.6)	120 (78.4)
I want to have a private bathroom.	0 (0)	0 (0)	27 (17.6)	126 (82.4)
I want to have access to drug-free pain relief equipment.	6 (3.9)	12 (7.8)	30 (19.6)	105 (68.6)
I want to have access to drinks and food.	0 (0)	6 (3.9)	45 (29.4)	102 (66.7)
I want to be in a room that looks like home.	6 (3.9)	21 (13.7)	54 (35.3)	72 (47.1)
I want to be able to arrange my room's furniture as I like.	27 (17.6)	51 (33.3)	39 (25.5)	36 (23.5)
I want to have access to natural lighting.	6 (3.9)	12 (7.8)	60 (39.2)	75 (49.0)
I want to be in a room that is suitable for the presence of my family.	3 (2.0)	3 (2.0)	60 (39.2)	87 (56.9)
I do not want other people to be able to see me.	0 (0)	18 (11.8)	129 (84.3)	6 (3.9)
I want to be able to see the resuscitation equipment.	51 (33.3)	33 (21.6)	27 (17.6)	42 (27.5)
I do not want to see the resuscitation equipment.	24 (15.7)	33 (21.6)	33 (21.6)	63 (41.2)
The sounds coming into my room from the other rooms should be minimized.	3 (2.0)	12 (7.8)	24 (15.7)	114 (74.5)

Table 4: Scale descriptive and psychometric properties

Variables	Mean	Variance	Std. Deviation
I want to have a private bathroom.	3.82	0.148	0.385
I do not want other people to be able to see me.	3.80	0.241	0.491
My room should be clean.	3.78	0.293	0.541
I want to have a private shower room.	3.75	0.274	0.523
I want to have access to drinks and food.	3.63	0.318	0.564
The sounds coming into my room from the other rooms should be minimized.	3.63	0.518	0.720
Navigation in the hospital should be easy and clear.	3.59	0.487	0.698
I want to be able to control my room's temperature.	3.59	0.447	0.669
I want to have access to a private open green space such as a yard.	3.55	0.533	0.730
I want to have access to drug-free pain relief equipment.	3.53	0.654	0.809
The sounds coming into my room from the corridor and the nursing station should be minimized.	3.53	0.614	0.784
I want to be made sure that no one will hear my voice.	3.51	0.535	0.731
I want to be in a room that is suitable for the presence of my family.	3.51	0.415	0.644
The ward should have a separate space for partners to walk around.	3.49	0.455	0.674
I want to stay in one room during the whole process of pain and labor.	3.45	0.893	0.945
I want to have access to a private comfortable area to walk around with my spouse.	3.45	0.493	0.702
I want to be in a room designed for me, not a patient.	3.37	0.598	0.774
I want to be able to control the natural and artificial lighting in my room.	3.33	0.427	0.653
I want to have access to natural lighting.	3.33	0.627	0.792
My room's window should give me a nice view of the outside.	3.29	0.612	0.782
I want to be in a room that looks like home.	3.25	0.714	0.845
My room should be painted with warm and non-hospital colors.	3.18	0.548	0.740
My room's furniture should be beautiful.	3.12	0.946	0.973
I want to have access to the ceiling and wall lighting.	3.10	0.810	0.900
I want to be able to control people's entry to my room.	3.10	0.970	0.985
I want to be able to listen to my favorite music.	3.06	0.856	0.925
I do not want to see the resuscitation equipment.	2.88	1.266	1.125
My room's furniture should have warm colors.	2.86	1.041	1.020
I want to have access to aromatherapy equipment.	2.84	0.655	0.809
My room's furniture should be made of wood and cloth.	2.71	1.092	1.045
I want to have a double bed.	2.71	1.612	1.270
I want to have a hospital bed.	2.65	1.233	1.110
I want to have access to a clock.	2.65	1.073	1.036
I want to be able to arrange my room's furniture as I like.	2.55	1.093	1.045
I want to have a bathtub in my room.	2.49	1.415	1.189
I want to have a delivery pool.	2.49	1.535	1.239
I want to be able to see the resuscitation equipment.	2.39	1.483	1.218

3.6 Attractive Environmental Stimuli

The second factor underlying mothers' expectations of delivery spaces is the presence of attractive environmental stimuli that can facilitate physiologic birth. Analysis of the prevailing cultural and economic status of the respondent mothers, who were generally from the middle-class stratum of Iranian society, indicates that subfactors such as double beds, hospital beds, bathtubs, delivery pools, and private rooms are among the environmental factors that generate a preference for physiologic childbirth.

3.7 Environmental Healthcare and Physical Health

The third factor influencing Iranian mothers' perception of childbirth environments is environmental healthcare. The

analysis presented in Table 7 revealed that access to a private bathroom and shower room, aromatherapy, and non-drug pain relief equipment were among the priorities for the mothers in their perception of delivery rooms. While environmental healthcare is often considered a top priority in previous literature, this study indicated that objective quality of life of delivery spaces and attractive environmental stimuli take precedence over environmental healthcare and physical health. This highlights the importance of giving due attention to the environmental and architectural elements of childbirth spaces.

3.8 Friendly Atmosphere

The fourth factor evaluated by the mothers was the vibe or atmosphere of the childbirth space. The respondents preferred to feel and see no significant difference between the childbirth space and their home in terms of form and function. This preference can be explained based on the psychological characteristics of the environment and a mother's inclination to give birth in a familiar space similar to her home, where she has spent her pregnancy period. As many environmental psychologists have mentioned, such spatial familiarity is created by the repetition of elements in the environment and can be effective in the identification process as well. Therefore, the lack of significant formal and functional differences between the childbirth environment and a mother's home can play a significant role in her mental comfort during labor.

Table 5: Measurement of the fitness of the collected data for exploratory factor analysis using KMO and Bartlett's Test

Measurement	Value
KMO Measure of Sampling Adequacy	0.512
Bartlett's Test of Sphericity	1428.351
df	666
p-Value	<0.001

3.9 Environmental Vitality

The environmental vitality factor, which has two environmental and social dimensions, was also assessed as the fifth factor of mothers' perception. Table 7 shows the results.

3.10 Environmental Privacy

As expected, protecting their privacy was essential for the respondents in this study. The interesting point is that this factor was assessed with only one question. However, assigning one factor to this single question indicates the critical significance of this factor among all environmental factors that should be taken into account in design studies.

3.11 Tangible Technology

The last factor that was assessed by the respondents regarding delivery spaces was tangible technology. Tangibility was examined by questioning the importance of the visibility of resuscitation equipment. The technologies available in delivery rooms can instill a sense of security and self-assurance for laboring mothers.

Table 6: Determined factors and their eigenvalues, variance percentage, and cumulative variance percentage

Factor	Eigenvalue	Eigenvalue variance percentage	Variance percentage cumulative frequency
First factor	9.400	20.000	20.000
Second factor	6.267	11.532	31.532
Third factor	5.126	8.448	39.981
Fourth factor	4.596	7.017	46.998
Fifth factor	4.375	6.419	53.417
Sixth factor	3.866	5.043	58.460
Seventh factor	3.689	4.564	63.024

The objective of this study was to examine the dissimilarities in Iranian mothers' perceptions of the environmental attributes of physiologic childbirth spaces which can help them manage their fear during physiologic childbirth. Indicators were established based on the viewpoints of experts and scholars to evaluate the aforementioned characteristics. The theoretical framework of this study for evaluating the status of childbirth spaces comprised six environmental variables, which were selected from previous research and interviews: (1) mental comfort, (2) physical comfort, (3) quietness, (4) darkness, (5) solitude, and (6) safety. Additionally, the factors that were identified as criteria for Iranian mothers' perception of childbirth spaces were determined through a questionnaire and exploratory factor analysis and included the following: (1) objective quality of life of the delivery room, (2) attractive environmental stimuli, (3) environmental healthcare and physical health, (4) friendly atmosphere, (5) environmental vitality, (6) environmental privacy, and (7) tangible technology. There is a notable disparity between the factors extracted from the theoretical framework of the study and the factors obtained from the factor analysis. This divergence indicates the sociocultural contrasts between Iranian mothers and the sample populations of studies conducted in other countries. The difference in perception of the environmental variables of childbirth spaces may be largely attributed to Iran's first rank in medicated childbirths among all countries. Based on the aforementioned findings, it is crucial to take into account factors such as the objective quality of life of delivery rooms and attractive environmental stimuli, given their significant factor loading in mothers' perception of childbirth spaces. These factors can potentially promote physiologic childbirth over voluntary C-sections. Consequently, the following suggestions can be made regarding the architectural design of LDR rooms, based on the research results: (1) Using large windows with the possibility of covering and light control is one of the design solutions due to the wide view and the increase in lighting, providing the need to have a dark and isolated space based on mothers' preferences. (2) Determining the appropriate per capita and depth of private, green open, or semi-open spaces to take a walk with their partners that aligns with the

socio-cultural context of each mother can be an effective strategy to promote pain control. Providing private spaces that ensure mothers' privacy and prevent them from being visible to others, this strategy can help promote pain management during childbirth. (3) Incorporating warm and non-white colors, such as purple, orange, and yellow, into each room can create a home-like atmosphere for mothers and improve wayfinding and accessibility for medical staff in emergencies. (4) Meeting the mothers' need for temperature control, regulating people's exit and entrance, and managing artificial and natural light can be another criterion to boost her sense of confidence in controlling pain during childbirth. (5) Using sound insulation materials in both interior and exterior walls can prevent other mothers' voices from entering the room, reassure the mother not to vocalize loudly, and reduce hallway and station noises during childbirth that increase mothers' satisfaction and pain control. (6) Providing furniture with warm colors, wood, and fabric materials, and the possibility of moving them according to the needs of each mother is effective in mothers' satisfaction. (7) Providing access to a private toilet, delivery pool, bathtub, and non-medical pain relief devices, in addition to their availability, can facilitate delivery positions for mothers and reduce their requests for drug interventions. One of the differences between the results of this study and other studies is the low importance of the tangibility of technologies, such as resuscitation equipment. In contrast, in other studies, the presence of technology has been found to have significant psychological effects on mothers and their partners. Some studies have reported that technology creates a sense of security, while others have found that it includes fear and anxiety. It is possible that in developed countries, where the medicalization of childbirth has a longer and stronger history, mothers have a more precise mental perception of the presence of technology and its effects during childbirth. In contrast, in Iran, where the trend towards C-sections has increased in recent years, and the natural approach to childbirth is still prevalent, the presence or absence of technology in the delivery room may have less of an effect on mothers. Iranian women may have limited practical experience with the use of technology during childbirth, which could contribute to their relatively lower emphasis on the importance of technological tangibility in childbirth spaces.

Table 7: Factors, subfactors, and factor loadings related to mothers' perception of LDR room

Factors	Sub factors	Factor loading
Objective quality of life	My room's furniture should have warm colors.	0.993
	My room's furniture should be beautiful.	0.954
	My room's furniture should be made of wood and cloth.	0.869
	My room should be painted with warm and non-hospital colors.	0.858
	My room's window should give me a nice view of the outside.	0.843
	The sounds coming into my room from the other rooms should be minimized.	0.813
	Navigation in the hospital should be easy and clear.	0.788
	The sounds coming into my room from the corridor and the nursing station should be minimized.	0.778
	I want to have access to a private open green space such as a yard.	0.759
	I want to be able to control my room's temperature.	0.753
	My room should be clean.	0.718
	I want to have access to the ceiling and wall lighting.	0.694
	I want to be in a room designed for me, not a patient.	0.690
	I want to be able to control the natural and artificial lighting in my room.	0.677
	I want to be made sure that no one will hear my voice.	0.660
	I want to be able to listen to my favorite music.	0.639
	I want to have access to a private comfortable area to walk around with my spouse.	0.552
Attractive natural stimuli	I want to have a hospital bed.	0.954
	I want to have a bathtub in my room.	0.843
	I want to have a delivery pool.	0.759
	I want to have a double bed.	0.718
	The ward should have a separate space for partners to walk around.	0.660
	I want to be able to control people's entry to my room.	0.639
	I want to stay in one room during the whole process of pain and labor.	0.552
Environmental healthcare and physical health	I want to have a private bathroom.	0.812
	I want to have access to a clock.	0.697
	I want to have access to aromatherapy equipment.	0.646
	I want to have access to drug-free pain relief equipment.	0.641
	I want to have a private shower room.	0.677
Friendly atmosphere	I want to have access to drinks and food.	0.601
	I want to be able to arrange my room's furniture as I like.	-0.642
	I want to be in a room that looks like home.	-0.804
Environmental vitality	I want to have access to natural lighting.	-0.636
	I want to be in a room that is suitable for the presence of my family.	-0.725
Environmental privacy	I do not want other people to be able to see me.	-0.631
Tangible technology	I want to be able to see the resuscitation equipment.	-0.792

4. Conclusion

The significance of environmental factors in childbirth spaces as non-drug pain relievers and their potential to promote physiologic childbirth is a crucial area in this investigation. Architectural solutions such as interior design and the general configuration of delivery environments can help improve the environmental quality of childbirth spaces and have a positive impact on the process of delivery. These architectural solutions merit further research and investigation by environmental scientists, architects, and environmental psychologists. However, this study only evaluated the interior design parameters, and future research should consider other physiologic childbirth scales such as culture, financial issues, training classes, staff behavior, etc. It is also recommended to use more comprehensive statistical samples that represent a more diverse population. Replication of this study in different areas and comparing the responses of mothers who had C-sections with those who had natural childbirth can provide more confident results. Additionally, future research should consider the mother's importance in terms of health experts and economic potentiality and the importance of the indicators in terms of themselves.

Authors' Contributions

Faeghe Deljoo Ghamgosar: Conceptualization; Visualization; Writing-original draft; Investigation. Seyed Abbas Yazdanfar: Project administration; Writing-review & editing; Supervision. Neda Sadat Sahragard Monfared: Methodology; Writing-review & editing; Validation. Sanaz Litkouhi: Writing-review & editing; Software; Formal analysis. Hassan Yari: Writing-review & editing; Investigation; Supervision. Mina Honarbakhsh: Writing-review & editing; Investigation.

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Conflicts of Interest

The authors have declared that no competing interests exist.

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