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## A maternity hospital in Shenyang indoor environment performance influence factor analysis

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### Abstract

In recent years, the city air pollution level of PM<sub>2.5</sub>, ozone, nitrogen oxides and sulfur dioxides in our country occupies first place. Indoor environmental problems caused by outdoor air pollution are increasingly significant. Indoor environment of hospital which is a special public building has special requirement. The feature of maternity hospital is crowded, heavy energy consumption, weakness of maternal and neonate, generate the sick and the patients need the better indoor environment quality. Therefore, this paper takes hospital building as research object by using questionnaire method, which analyzes the indoor comprehensive environmental performance of hospital, such as the air quality, the thermal environment, the light environment, and the acoustic environment. Results show that most of the patients is satisfied with the indoor comprehensive environmental performance of hospital, and only a small part is dissatisfied with the sound environment and the outdoor vision. This paper provides a research base for establishing a complete evaluation system and method of comprehensive indoor environmental performance of maternity hospital, which will help in building environmental monitoring systems and improving the level of public participation in the construction of hospital management.

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**Keywords:** Severe cold and cold regions; Obstetrical and gynecological hospital; Environmental performance

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## 1. Introduction

Since 2013, is mainly caused by PM<sub>2.5</sub> haze weather has hit most areas in China, the victim area having 1.9 million km<sup>2</sup>, the resulting cancer mortality rates and birth defects is increasing year by year. Therefore, the problem that caused by the outdoor air pollution has been increasingly, even become one of the focus in our country [1]. Obstetrics and gynecology hospital as a kind of special public buildings, because it has characteristic of high energy consumption, crowded, the weak of maternal and newborn. So the patient and his or her family member indoor will have special requirements for the indoor environment. However, the study of current epidemiological only take up a small portion of all in our country, which focus on indoor environment performance and the relationship between pregnancy, maternal and newborn health in this kind of building. The characteristic of cold region is short cool summer, a little dry weather, large temperature ranges in a year and a long cold and large wind in winter [2]. This article will provide a technical support hospital in establishing a comprehensive performance evaluation system of indoor environment.

## 2. Method

This research object is the integrated environmental performance of a maternity hospital building in cold region. Then conducted a questionnaire survey, about the feeling and evaluation of patients to the indoor environment of this hospital.

Through the ‘hospital building indoor environment quality questionnaire’, analyze the influencing factors of indoor comprehensive environment in hospital. Mainly includes basic information, air quality, thermal wet environment, sound environment and light environment four parts. Compiling this questionnaire based on consulting a large number of relevant essay [3-5], reviewed by experts, made pre-investigation, then tested for several rounds. Then make the corresponding adjustment to a small scale of ambiguous and incomplete options, or misleading problems.

100 female patients have been selected randomly from a maternity hospital to participate in this questionnaire. Team members illustrated the significance and method of this questionnaire in every ward, explained matters in detail, filled out in secret way, issued and immediately recycled the questionnaire on the spot. All patients are aware of the purpose of this study, and voluntarily participate in it. The total number of issued questionnaire is 150, among them there were 132 have been recycled, which 100 valid questionnaires were selected as samples. By using SPSS13.0 statistical software analyze data.

## 3. Results

As shown in figure 1 and figure 2, there are the age information and degree information of respondents. The patients involved in this study were aged from 16 to 53 years old, among them, there have 12 people are 20 years of age, 28 are 21-29 years old, 23 are 30-39 years old, 19 are 40-49 years old, 18 are aged over 50 years old. The scope of patients' cultural degree: 32 are short-cycle courses and under degree, 39 are bachelor's degree, 22 are master's degree, 7 are doctor's degree.

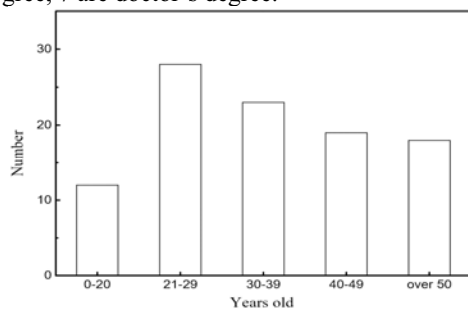


Fig. 1. Age information

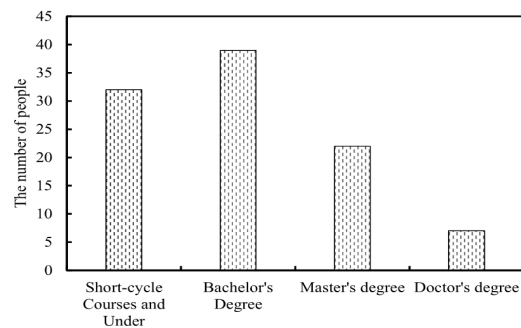


Fig.2. Education information

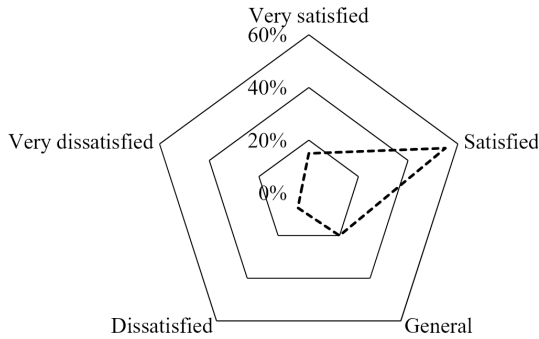


Fig. 3. Overall environment satisfied

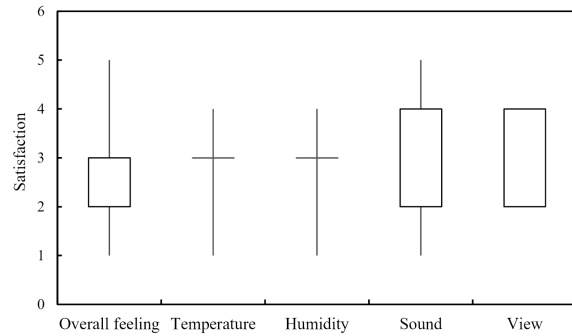


Fig. 4. Indoor environment satisfied

The overall environment of the hospital building was basically satisfactory. To be exactly, 15% patients were very satisfied; 55% patients were satisfied; 20% patients considered general; 7% patients were dissatisfied; 3% patients were very dissatisfied.

For the air quality of hospital building has 80% patients were satisfied with, 20% patients on the ward air quality were not satisfied. Dissatisfied patients think the main cause of the poor air quality is poorly ventilated air and crowded. The function of ward for pregnancy, maternal and infant, and because of the Chinese traditional ideas make fewer ventilated, result in the poorly ventilated. On the other hand, hospital building belong to a kind of special public buildings, for the crowded and complex character. Generated poorly indoor air quality, hampered people's physical and psychological condition, made patients appearing upset, dizziness, fatigue, anorexia, and so on, went against the patient's recovery. As a result of all the above reasons combined, I will give some suggestion to improving indoor air quality. Such as, strengthen the work of publicity and education of patients; change the traditional ideas; optimize of air conditioning system operation; timely clean and regularly maintain air conditioning equipment.

The survey shows that most of hospitalized patients were satisfied with the temperature of ward. The appropriately temperature, can meet the needs of the majority of patients. But it is also found that 10% of patients was not satisfied with ward temperature. The reason that patients are not satisfied with ward temperature caused by his ward day lighting is insufficient, even no day lighting. In addition, due to the differences of individual condition, patients in Multi world ward feeling about temperature is different. The results of evaluation are greatly influenced by personal, caused far from the evaluation result. As far as possible from the above results, it is suggested that wards as far as possible set at sunny side, optimize the structure of heat preservation, improve the doors and windows of air tightness, and reduce cold infiltration from windows. Considering the patient's age, physical condition, and various protective measures, arranged wards to prevent patient discomfort, affect the rest and health.

There are 95% of the patients are satisfied with the humidity of hospital building. It's mean that the humidity of hospital is suitable for most patients, and that can meet the needs of patients. The survey only in cold region, which the natural climate characteristics is drying climate and large winds in winter. That's why the reason most patients were satisfied with the humidity in ward. Given these reason, I will propose some advice. Setting a reasonable temperature and humidity, by comprehensive think of indoor temperature and humidity; optimizing the operation and management of air conditioning.

Surveys show that there are 34% of patients are dissatisfied with the sound environment of hospital architecture. The main reason is that the poorly soundproof effect of the wall, leading to the noise affects patients have a good rest. Second, this hospital building is located in the center of city, so the traffic is busier and noisy than other places. In addition, it can't inevitable that the noise of the air conditioning equipment operating. Suggest that manager setup more silencing partition, noise reduced equipment, and sound absorption device, in order to reduce the noise of the ward. Providing patients, a quietly place to have a rest.

With light environment, according to the survey there are 29 patients said dissatisfied. On the one hand, the indoor natural lighting is affected by the architecture itself towards, on the other hand, the hospital building is located in the center, which in the downtown area full of skyscrapers. However, due to the construction conditions

cannot be improved, it is recommended that the patient increase outdoor activity time, for the purpose of helping the body recovery.

## 4. Results

### 4.1. Correlation analysis between number and air quality satisfaction

The results show that the number and ward air quality satisfaction is correlated, and it is positively correlated. The size of the test is less than 0.01, means it's a significant correlation. We can see the more number the lower the satisfaction of the quality of the air from the consequence.

Table1. The correlation between Number and Indoor Air Quality

		Number	Indoor Air Quality
Number	Pearson Correlation	1	.670(**)
	Sig. (2-tailed)		.000
	N	100	100
Indoor Air Quality	Pearson Correlation	.670(**)	1
	Sig. (2-tailed)	.000	
	N	100	100

\*\* Correlation is significant at the 0.01 level (2-tailed).

### 4.2. Correlation analysis between number, heat environment, humidity environment, air ventilation and sound environment

Table 2. Correlation between number, air ventilation, heat and humidity environment, sound environment

		Number	Air Ventilation	Heat and Humidity Environment	Sound Environment
Number	Pearson Correlation	1	.496(**)	.373(**)	.699(**)
	Sig. (2-tailed)		.000	.000	.000
	N	100	100	100	100
Air Ventilation	Pearson Correlation	.496(**)	1	.073	.178
	Sig. (2-tailed)	.000		.468	.077
	N	100	100	100	100
Heat and Humidity Environment	Pearson Correlation	.373(**)	.073	1	.467(**)
	Sig. (2-tailed)	.000	.468		.000
	N	100	100	100	100
Sound Environment	Pearson Correlation	.699(**)	.178	.467(**)	1
	Sig. (2-tailed)	.000	.077	.000	
	N	100	100	100	100

\*\* Correlation is significant at the 0.01 level (2-tailed).

The results showed that there are correlation between the number of ward and sound environment, heat and humidity environment, and it is positively correlated. The level of the test is less than 0.01, means it's a significant

correlation. It can be said the more number the less satisfied with air ventilation, the less satisfied with the overall heat and humidity environment, and the noisier ward.

#### 4.3. Number and air quality correspondence analysis

Figure 5, is a scatter diagram of corresponding analysis for the number and air quality. In this picture, the nearer distance of two points, said relationship is more closely. From it can be seen that the potential relationship between number and the overall feelings of air quality. Namely that the number is more, the less satisfied with the overall feeling of air quality. The results in line with expectations. The air quality of 1 represents very satisfied; 2 represents satisfaction; 3 on behalf of the general; 4 for not satisfied; 5 for not satisfied. 1 represents the number of people in ward is one; 2 for the number is two; the number 3 on behalf of the room living three people; the number 4 on behalf of four people; the number of 5 on behalf of five people.

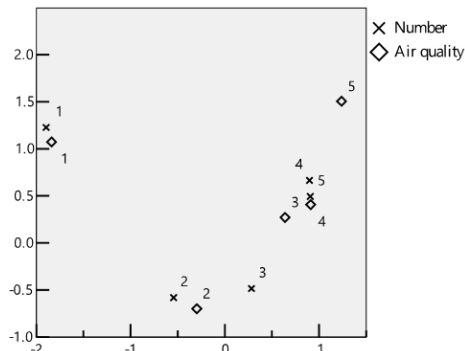


Fig. 5. Number and air quality correspondence analysis

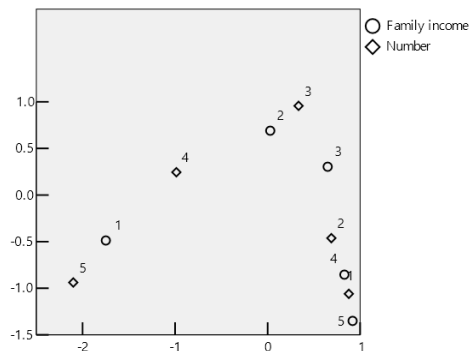


Fig. 6. Family income and number correspondence analysis

#### 4.4. Family income and number correspondence analysis

Figure 6, is a scatter diagram of corresponding analysis for the number and family income. In this picture, the nearer distance of two points, said relationship is more closely. We can find the potential relationships between family income and number. Means that the more family income, the less number in ward. The results also in line with expectations. Among them 1 on behalf of the totally family income below 4000yuan; 2 on behalf of the totally family income between 4001-8000yuan; 3 represents the totally family income between 8001-12000yuan; 4 represents 12001-1800yuan; 5 for more than 18001yuan. 1 represents the number of people is one; 2 for the number is two; 3 means three person; 4 represents four persons; 5 on behalf of five.

## 5. Conclusions

Through the study on air quality, heat and thermal environment, light environment, sound environment of this hospital building, it can be concluded that the patients are satisfied with the performance of the hospital building environment. This paper provides a research foundation for the purpose of establishing performance evaluation system and proposing a method of maternity hospital building indoor environment, which will help in building a comprehensive monitoring system of indoor air quality in hospital instruction, real-time monitoring of the ward environment quality. It is not only the request of standards of ward indoor air quality [6-10], but also the patients' requests on indoor air quality in hospital and the development direction of hospital in future. It also needs to increase the activity of public participation in the management system of hospital, enrich the form of public participated, improve the positivity of public engagement, and then establish and perfect the feedback mechanism.

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