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Feasibility Analysis of Small-scale Construction in a Large General Hospital

Ange Lin*

The First Affiliated Hospital of Wenzhou Medical University, Wenzhou 325000, Zhejiang, China
laggal@qq.com
**corresponding author*

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Abstract: Risk analysis is an important tool to ensure the quality of construction and to reduce the damage caused by construction to things and people around. Risk assessment in hospital construction is more difficult to analyze due to the complex situation of small construction projects in large hospitals and the specificity of the people active in the building. To assess the potential hazards that may be caused by the construction in the hospital, the Delphi expert survey method was used to conduct a study to derive the corresponding risk levels and importance ranking of the influencing factors, and further analysis was conducted based on the actual situation to provide quantitative data analysis and theoretical reference for the risk assessment of the construction.

1. Introduction

With China's economic development and the increasing demand for high-quality medical services, large-scale medical buildings have begun to appear in large numbers in China[1]. To maintain the normal use of medical buildings and to match the need for facility upgrades for medical activities, large hospitals require long-term minor construction modifications[2]. Risk analysis for small-scale construction projects within hospital buildings in China is still in the stage of exploration and discovery, and the available research information is incomplete and is being plagued by many potential risks. Unlike ordinary civil building construction, construction of operating medical buildings may affect the medical safety of patients in addition to the conventional construction safety risks[3-4]. In this paper, the risks of a small construction project in a hospital in Wenzhou are studied, and the risks arising from the construction are evaluated with the help of data analysis to provide a reference for the study of construction safety in large medical buildings.

2. Research Description

This paper is based on the experience and data from a large number of minor construction modifications in a large general hospital in Wenzhou, Zhejiang, China. Considering the diversity of construction content in hospitals and the possibility of changes due to medical activities at any time, the construction safety assessment needs to focus on the experience of the assessors. Therefore, the

Delphi method, also known as the expert survey method, which was introduced in 1946 by the Rand Corporation, was selected for this study to take advantage of the experience and knowledge of the participating experts[5-6].

3. Rationale of the Delphi Method

According to the Delphi method, risk factors to be evaluated need to be determined first based on the demand situation of the research subject. Then experts with extensive experience with the research subject are invited to judge the factors according to the experimentally derived scale. After collecting all the experts' opinions, these assessments are compiled and collated, and then the contents are anonymously fed back to all the experts for another judgment. If the second round of pooling and collating experts' evaluation opinions cannot reach a unanimous conclusion, then a new round of anonymous feedback and judgment operation is continued until all experts reach a unanimous opinion, as shown in Fig. 1.

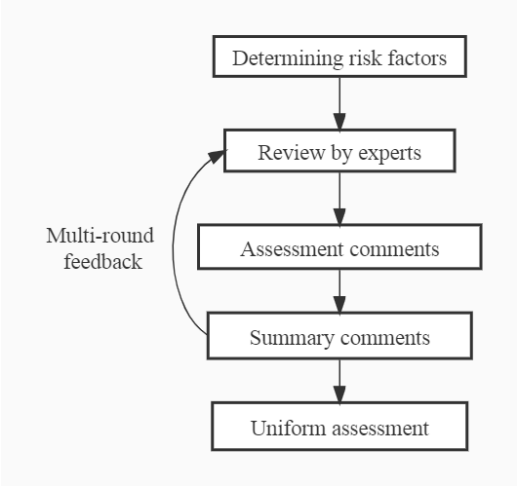

Fig. 1 Delphi method flow chart

4. Results

Table 1. Risk judgment table

Categories	Contents	Risk likelihood rating	Risk-consequence rating
Construction difficulty	Construction scale		
	Construction content		
	Construction period		
Environmental safety	Noise pollution		
	Dust pollution		
	Chemical pollution		
Subsequent maintainability	High maintenance costs		
	High maintenance difficulty		
Renovation practicality	Functionality		
	Aesthetics		

According to the possible risks and hidden dangers of construction in the hospital, we divided the construction feasibility assessment into four aspects: construction difficulty, environmental safety, subsequent maintainability and renovation practicality, as shown in Table 1. The table for risk evaluation is the carrier of expert opinions and is one of the most core data in the experiment. The quality of the design of the table is closely related to the results obtained from the final experiment. The design of Table 1 is based on the experience of a large number of small

construction projects, and can reflect more exactly the various types of risks that may be encountered in the construction of the hospital studied in this paper.

The rating of the probability of occurrence of risk and the consequences of risk requires the design of the corresponding scale tables, as shown in Tables 2 and 3. It is difficult to label the riskiness and probability of risk occurrence with precise metric values for real events, so in the experiment a five-level scale of 0, 1, 2, 3 and 4 is used to differentiate. The participating experts gave their opinions based on the assessment of the possible risks of the project in the construction against Tables 2 and 3.

Table 2. Risk probability rating

Language descriptions	Minimal occurrence probability	Less occurrence probability	General occurrence probability	Greater occurrence probability	High occurrence probability
Scales	0	1	2	3	4

Table 3. Risk Consequence Rating

Language Descriptions	No impact	Less impact	General impact	Greater impact	High impact
Scales	0	1	2	3	4

Experts review the risk factors and finally arrive at a uniform evaluation of the construction project through the Delphi method process. The evaluation is graded according to the construction risks and consequences. Scores for probability of occurrence were accumulated for all risks involved in the graded projects, and the consequence scores were accumulated for all consequences caused. The final grading of project feasibility was performed according to the two scores, as shown in Table 4. The project feasibility rating was divided into Ⅰ, II, III and IV, representing high feasibility, average feasibility, low feasibility and very low feasibility respectively, as a reference for the final evaluation of the project.

Table 4. Project feasibility rating

Risks		Consequence rating			
		0-10	11-20	21-30	31-40
Occurrence probability rating	0-10	I	I	II	III
	11-20	I	II	III	III
	21-30	II	III	III	IV
	31-40	III	III	IV	IV

5. Discussion

The types and sizes of construction projects within hospitals vary greatly, so the comprehensive assessment process is also more complex. In this study, the risks and potential hidden factors of construction are listed in detail with reference to the experience of small-scale constructions in a hospital in Wenzhou. Evaluation criteria were established for both the probability of occurrence of risk factors and the possible consequences after occurrence, and relevant experts were invited to evaluate the hidden hazards by Delphi method. The study establishes the core elements of the evaluation system in four aspects: construction difficulty, environmental safety, subsequent maintainability and renovation practicality, and then further analyzes the possible risk factors in the above four aspects in a specific manner. The risk analysis is determined by relatively clear criteria to minimize the differences in the initial evaluation due to the subjectivity of personnel. During the evaluation process, the study turns the risks present in construction from a relatively vague state to a relatively accurate data evaluation.This is very beneficial to the proposal, approval and evaluation of construction projects, and all project participants end up with a relatively clear view of the

project's risk profile and project feasibility.

6. Conclusion

In this paper, we proposed a more feasible analysis method for assessing the feasibility of small-scale construction projects in large general hospitals, and used the Delphi expert survey method to conduct feasibility assessment and create a related survey form. The following conclusions were drawn and relevant recommendations were given:

The risk factors considered in the design of the research project are based on the situation encountered in practice. The final completion of the hospital project which necessarily includes the demand, approval, and preference of the construction department for the construction content. And there is a lack of research data on this process, so the Delphi method is used to demonstrate the feasibility so as to minimize the influence of the preferences of the people involved in the process.

Combined with the situation of small projects in the hospital in Wenzhou, it can be obtained that construction difficulty, environmental safety, subsequent maintainability and renovation practicality are the core elements of feasibility assessment. However, different medical institutions may have different requirements for this, and need to make judgments based on their own situations.

The survey table created in the research can help similar projects to quickly assess the feasibility of construction and confirm whether the final construction project is approved or not. This is a positive reference for the standardization and scientificization of construction in hospitals.

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