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Construction of an Evaluation System for Cleaning Service Quality in County-Level Primary Hospitals

Yin Wang[1,2]

[1]Wenzhou Medical University, Ouhai District, Wenzhou 325035, Zhejiang, China
[2]Affiliated Dongyang Hospital of Wenzhou Medical University, Dongyang, Zhejiang, China

Abstract: ***Objective:*** ***To develop an evaluation index system for assessing the cleaning service quality in county-level primary hospitals, providing a basis for further standardizing cleanliness management in these institutions.*** ***Methods:*** ***Based on the SERVQUAL model, the evaluation index system was determined through literature research and the Delphi method, and the index weights were calculated using the Analytic Hierarchy Process (AHP).*** ***Results:*** ***The response rates of the two rounds of expert consultation were both 100%, with expert authority coefficients of 0.82 and 0.80 respectively, indicating high expert authority; the Kendall coefficients were 0.213 and 0.314 respectively, showing good consensus among experts.*** ***Conclusion:*** ***The index system developed in this study demonstrates systematicness and scientificity, serving as an effective evaluation tool to support service quality management in county-level primary hospital cleaning.***

Keywords: County-level primary hospitals; Hospital cleaning; SERVQUAL model; Cleaning service evaluation.

1. INTRODUCTION

Hospitals are environments with a high concentration of patients and pathogens. Substandard cleaning practices can result in elevated rates of healthcare-associated infections, extended lengths of stay, and increased hospitalization costs. In extreme cases, it may even pose a threat to life [1]. The modern healthcare paradigm is transitioning from being “disease-centered” to “patient-centered.” A hygienic, tidy, and odor-free healthcare environment constitutes a fundamental patient need, directly influencing their level of acceptance and satisfaction regarding the hospital’s overall service quality. Serving as countywide medical centers, county-level hospitals shoulder the critical responsibility of delivering medical services to populations in county seats, peripheral towns, and rural areas—predominantly rural residents. Moreover, compared to community healthcare centers and township health centers, the operational scale of county-level hospitals is substantially larger, thereby presenting formidable challenges to their sanitation management. At present, although cleaning operations in the majority of grassroots county-level hospitals have been contracted to professional cleaning agencies, the regulatory oversight of these contractors remains predominantly executed by the hospitals’ administrative personnel [2]. With the shift of hospital governance from direct administration to regulatory oversight, a significant number of grassroots county-level hospitals currently lack a comprehensive cleaning quality evaluation system. Full-process monitoring remains unfulfilled; the evaluation criteria are fragmented and deficient in specific standards and explicit quantitative metrics. Consequently, assessments are predominantly retrospective, with issues merely being identified at the final stage. It is thus evident that to effectively manage and supervise cleaning operations in grassroots county-level hospitals, establishing a scientific and quantifiable evaluation system for cleaning service quality and management is imperative.

2. MATERIALS AND METHODS

2.1 Theoretical Basis

Finnish scholar Grönroos defined service quality as the comparison of the difference between customers’ service expectations and perceived service performance. Building upon this, the “PZB” team, consisting of American marketing scholar Parasuraman et al., posited that service quality is determined by whether the actual service meets customer expectations, and subsequently proposed the SERVQUAL model [3]. The SERVQUAL model assesses customers’ service expectations prior to the service experience, and their service perceptions afterwards. It then calculates the gap between the two, formulated as SQ (Service Quality) = P (Perception) - E (Expectation). The evaluation yields three possible scenarios: when $SQ > 0$, it indicates that the service quality exceeds customer expectations; when $SQ = 0$, it indicates that the service quality matches customer expectations; when $SQ < 0$, it

indicates that the service quality falls short of customer expectations and requires improvement [4].

2.2 Research Methods

2.2.1 Literature Review Method

By conducting literature retrieval in databases such as CNKI, Wanfang Data, and VIP using keywords including "hospital cleaning," "SERVQUAL," "service quality," and "evaluation," this study followed the principles of operability, hierarchy, and scientificity in selecting evaluation indicators, and preliminarily designed an evaluation system for the cleaning service quality in grassroots county-level hospitals based on SERVQUAL theory.

2.2.2 Delphi method

Given the high level of specialization and strong practical relevance of the research fields, the consultation subjects of this study primarily include hospital vice presidents in charge of logistics, directors of general affairs, infection control experts, and hospital cleaning supervisors. The inclusion criteria for experts were: (1) the area of expertise is logistics management, infection control management, or cleaning management; (2) a working experience of ≥ 5 years in the relevant field; (3) holding a bachelor's degree or above; (4) voluntary participation in this study and the ability to complete two rounds of expert consultation on time. Based on a literature review, an expert panel of 10 to 15 members is considered appropriate. Taking into account the scale of the indicator system, this study ultimately selected 15 eligible experts for consultation [5].

2.2.3 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a method for multi-criteria decision analysis. It simplifies the decision-making process by decomposing complex problems into multiple hierarchical structures. In the field of evaluation and laboratory management [6], AHP helps determine the relative importance and weights of various factors, thereby providing a scientific basis for decision-making. This method combines qualitative and quantitative approaches, enabling it to address many practical problems that traditional optimization techniques cannot tackle, and thus has a wide range of applications.

(1) Establish a hierarchical structure model. The Analytic Hierarchy Process comprises the goal layer, the criteria layer, and the execution layer. In this study, the hospital cleaning service quality is designated as the goal layer, the primary indicators as the criteria layer, and the secondary indicators as the execution layer.

(2) Construct judgment matrices and assign values. Pairwise comparisons of the importance of factors within the same level are conducted, and values are assigned based on the Saaty scale to form judgment matrices and calculate the weights.

(3) Calculate weights and perform consistency checks. First, calculate the geometric mean of the judgment matrix; then, normalize it to obtain the weight vector W. Calculate the maximum eigenvalue (λmax), conduct a consistency test, and ultimately derive the consistency ratio (CR). If $CR < 0.1$, it indicates that the results have satisfactory consistency.

2.3 Statistical Analysis

Excel 2024 was used for data entry. SPSS 31.0 was employed to calculate the mean, standard deviation (SD), coefficient of variation (CV), expert enthusiasm coefficient, and degree of expert authority. SPSS PRO software was utilized to determine the weights of the evaluation indicators, construct the hierarchical structure and judgment matrices of the evaluation indicator system, and assess the consistency of the indicators. The inclusion criteria for the evaluation indicators in both rounds were a mean > 3.5 and a $CV < 0.25$ [7].

3. RESULTS

3.1 Characteristics of the Experts

From June to July 2025, expert consultation by correspondence was conducted. The general characteristics of the experts are presented in Table 1.

Table 1: Basic characteristics of the experts

Item	Number (n)	Percentage (%)
Gender		
Female	7	46.67
Male	8	53.33
Age (years)		
30~39	4	26.67
40~49	6	40.00
≥50	5	33.33
Institution Type		
Tertiary public medical institutions	11	73.33
Secondary or primary public medical institutions	4	26.67
Administrative Position		
(Vice) President	4	26.67
(Deputy) Director	6	40.00
Main Field		
Logistics management	12	80.00
Infection management	3	20.00
Education Level		
Bachelor's degree	11	73.33
Master's degree	3	20.00
Doctoral degree	1	6.67
Working Years		
5~10	3	20.00
11~20	3	20.00
21~30	5	33.33
＞30	4	26.67

3.2 Expert Responsiveness

The degree of expert enthusiasm is determined by the questionnaire response rate. Both the response rate and the valid response rate for the two rounds of expert consultation were 100%, indicating a good level of expert enthusiasm. In the first round, 10 experts provided valid suggestions (66.67%), and in the second round, 7 experts provided valid suggestions (53.33%), demonstrating that experts showed a high level of enthusiasm and engagement during both rounds of consultation.

3.3 Expert Authority and Degree of Consensus

The expert authority coefficients (Cr) for the two rounds of consultation were 0.82 and 0.80, respectively, indicating that the results of the two rounds of expert consultation are reliable. The Kendall's coefficients were 0.213 and 0.314, respectively, and the difference was statistically significant ($P<0.001$), demonstrating that the results are acceptable.

3.4 Indicator Refinement

Drawing upon the SERVQUAL model, this study determined the first-level indicators for the service quality of county-level grassroots hospitals, which include reliability, responsiveness, tangibles, assurance, and empathy, and designed 25 second-level indicators under these first-level dimensions. To ensure the scientific validity and rationality of the evaluation indicators, this study adopted a mean > 3.5 and a coefficient of variation (CV) < 0.25 as the screening criteria, excluding indicators that failed to meet these standards. The first-level indicators encompass the five dimensions of the SERVQUAL model, demonstrating high representativeness and importance. Based on the expert consultation feedback and results analysis, adjustments were made to some of the other evaluation indicators.

During the first round of expert consultation, "the proportion of cleaning staff below the statutory retirement age" was added to the "tangibles" dimension, as experts considered age to be a significant factor influencing the work efficiency of cleaning staff; "frequency of hospital hygiene patrols" was added to the "reliability" dimension, as experts believed that hospital hygiene supervision is also a crucial influencing factor.

In the second round of expert consultation, the indicator "service attitude of cleaning staff" was added to the

"tangibles" dimension, since their attitude directly impacts the experience of patients and healthcare personnel; additionally, the indicator "time for cleaning staff to enter wards" under the "responsiveness" dimension was modified to "working hours of cleaning staff align with patient needs", because hospital cleaning is not limited to entering wards, and working hours that align with patient needs better reflect the level of responsiveness.

3.5 Weighting Scheme of the Evaluation Indicator System

Currently, the most widely adopted approach for the AHP judgment matrix is to compare the mean importance values. Based on the Saaty scale, judgment matrices were constructed to calculate the weights of the evaluation indicators, followed by consistency tests. All CR values were < 0.1, indicating good consistency among the expert judgments. The calculated CR values across all levels of the hierarchy were also < 0.1, demonstrating that the consistency tests were passed. Consequently, the final weights of the evaluation indicators were determined, as presented in Table 2.

Table 2: Evaluation Indicator System for Cleaning Service Quality in County-Level Primary Hospitals

Primary Indicator	weight	Secondary Indicator	weight	combination weight
A1 Tangibility	0.26313	The appearance and grooming of B1 cleaning staff	0.08931	0.00235
		The service attitude of the B2 cleaning staff	0.15835	0.04167
		B3 Cleaning Staff Operating Procedures	0.12171	0.03203
		The proportion of employees below the statutory retirement age (B4)	0.23203	0.06154
		The overall spirit and demeanor of the B5 cleaning team	0.14599	0.03841
		The availability of modern cleaning tools for B6 facilities	0.14227	0.03757
		The cleanliness level of the environment at B7 Hospital	0.11304	0.02974
A2 Reliability	0.31595	The stability of the B8 cleaning staff team	0.16353	0.05224
		The labor discipline of B9 cleaning staff	0.14009	0.04426
		Quality of B10 Cleaning Staff Training Programs	0.13828	0.04329
		The standardization of final disposal procedures for B11 cleaning staff	0.13773	0.04352
		Frequency of health inspections at B12 Hospital	0.18593	0.05874
		The performance capability of B13 Cleaning Company	0.12965	0.04096
		The completeness of the B14 Cleaning Company's management systems	0.10478	0.03311
A3 Responsiveness	0.16838	B15 Health Improvement Timeline	0.23157	0.03900
		The working hours of B16 cleaning staff meet patient requirements.	0.34403	0.05793
		B17: Time required by the cleaning staff to handle daily emergency incidents	0.20603	0.03469
		The quality of cleaning services during the B18 holiday period	0.21836	0.03677
A4 Guarantee	0.14732	The proportion of loyal employees among B19 cleaning staff	0.21131	0.03113
		Satisfaction with B20 Cleaning Services	0.46916	0.06912
		B21: Satisfaction of cleaning staff with the company's reward and punishment system	0.31954	0.04707
A5 Empathetic Quality	0.10522	The B22 cleaning staff ensures the privacy protection of patient information.	0.12471	0.01312
		The B23 cleaning staff provides assistance services.	0.21947	0.02310
		B24 Cleaning Company proactively sought opinions from both patients and healthcare professionals.	0.19661	0.02069
		The B25 cleaning staff's respect and care for patients	0.45921	0.04832

4. DISCUSSION

4.1 Significance of constructing a quality evaluation system for cleaning services in county-level primary hospitals

Currently, the main problems existing in the cleaning services of county-level grassroots hospitals are: ① the lack of unified standards for hygiene supervision; ② the absence of a complete and coherent closed-loop supervision system [8]. ③ the generally advanced age of the cleaning staff; ④ the severe prevalence of substandard practices in actual cleaning operations [9]. ⑤ numerous potential risks of healthcare-associated infections within the hospital; ⑥ the dominance of subjective experience in the traditional management model and the lack of objective and effective evaluation criteria [10]. Therefore, in response to the characteristics that cleaning quality is "difficult to quantify and multi-dimensional," this study utilized the Delphi method to gather opinions from various experts—including cleaning supervisors, infection control personnel, and logistics administrators—to determine the initial indicators. Subsequently, a multi-round consensus approach was employed to screen these indicators.

Finally, the Analytic Hierarchy Process (AHP) was applied to quantify the indicator weights, ultimately establishing a practical evaluation system for hospital cleaning service quality with scientific rigor. The secondary indicators established in this system are characterized by being quantifiable, operational, and digitally capturable, which facilitates the implementation of routine management. The original design intent is to support horizontal benchmarking and comparison of cleaning quality across multiple campuses of a single hospital or among different hospitals, thereby precisely identifying problems and driving continuous quality improvement.

4.2 Weight Analysis of Evaluation indicators for Cleaning Service Quality in County-level Primary Hospitals

The weights of the evaluation indicators fully reflect their relative importance and impact. This study employed the expert consultation method to screen the evaluation indicators and the Analytic Hierarchy Process (AHP) to determine their weights. The weights of the first-level indicators are as follows: Tangibles (0.26313), Reliability (0.31595), Responsiveness (0.16838), Assurance (0.14732), and Empathy (0.10522). These weights reflect the various factors influencing the cleaning service quality in county-level grassroots hospitals. Among the first-level indicators, “Reliability” (0.31595) and “Tangibles” (0.26313) carry the highest weights. This indicates that the cleaning staff’s ability to fulfill their service duties, as well as their attitude and professional image, have a significant impact on the overall quality of cleaning services.

4.3 Limitations of This Study

The expert panel in this study was primarily composed of cleaning supervisors, infection control personnel, and logistics administrators, lacking the participation of frontline cleaners, patients, and clinical healthcare workers. This may lead to the indicator design overlooking operational feasibility and actual perceptions. Consequently, relevant indicators need to be adjusted based on practical conditions, and they also require further refinement in future research.

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