

Research on Medical Service Quality Evaluation from the Perspective of Structure-Process-Outcome

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Abstract: This study evaluates medical service quality in China using the Structure–Process–Outcome (SPO) framework. An index system covering healthcare resource allocation, service processes, and health outcomes was developed, with indicator weights determined by the entropy method. The overall quality score is 5.99, suggesting a moderately high level. However, a substantial urban–rural gap persists—urban residents score 6.34 on average, compared to only 2.19 for rural residents. The structure dimension receives the lowest score, indicating that resource allocation remains a key constraint. While urban quality varies little across regions, rural areas consistently show low levels. These findings highlight the need to strengthen rural healthcare infrastructure and workforce to promote balanced development.

1. Introduction

Medical service quality is an important indicator for evaluating the performance of the health system and the level of residents' health security, and it also serves as a crucial foundation for achieving health equity^[1]. With the sustained economic and social development and the continuous advancement of healthcare system reform, the overall level of China's medical service system has significantly improved. However, notable disparities persist between urban and rural areas in terms of healthcare resource allocation, medical service accessibility, and health outcomes^[2]. How to scientifically evaluate the quality of medical services and identify the sources of its disparities has become a critical issue in current public health and health economics research^[3]. In the field of medical quality evaluation, the Structure–Process–Outcome (SPO) model is widely applied^[4]. This model was proposed by American scholar Donabedian in the 1960s. Its core idea is to systematically evaluate the quality of medical services from three dimensions: healthcare structure, service process, and health outcomes. Specifically, "structure" primarily refers to the resource conditions of medical institutions, including medical personnel, equipment, and facilities; "process" reflects the diagnosis and treatment behaviors and service utilization during the delivery of medical services; and "outcome" represents the ultimate impact of medical services on patients' health status and satisfaction. This theoretical framework can comprehensively reveal the mechanisms

underlying the formation of medical service quality, and thus has been widely applied in international medical quality evaluation research^[5].Based on the SPO model, this paper constructs a medical service quality evaluation index system covering the three dimensions of structure, process, and outcome, and uses the entropy method to determine the indicator weights^[6].A comprehensive evaluation of the quality of medical services in urban and rural areas of China is conducted. Meanwhile, by comparing the differences between urban and rural areas as well as across various regions, the spatial distribution characteristics of medical service quality are further analyzed. This aims to provide a theoretical basis and policy reference for optimizing the allocation of medical resources and promoting the balanced development of medical services.

2. Objects and Methods

2.1 Data Sources and Sample Description

The data in this paper are mainly derived from three sources: first, the China Health Statistical Yearbook, used to obtain information on medical resource allocation and the operation of medical institutions at the provincial level; second, the China Medical Security Statistical Yearbook, used to obtain institutional indicators such as medical insurance coverage, the number of enrollees, and benefit levels in each province; and third, microdata from the China Family Panel Studies (CFPS), used to reflect individual-level medical service utilization and quality perception. During data processing, based on individual samples from the CFPS, the micro-survey data were integrated with macro-statistical data through provincial-level matching. After data cleaning and variable matching, a comprehensive dataset containing 9,689 individual samples was ultimately formed. This dataset, based on information from 2022, covers both urban and rural residents and can reflect differences in medical resources and institutional environments across regions, providing data support for subsequent multi-level empirical analysis.

2.2 Research Methods

Under the guidance of the SPO theoretical framework and with reference to relevant literature, this paper constructs a medical service quality evaluation index system from the three dimensions of structure, process, and outcome^[7].Among them, the structure dimension primarily reflects the allocation of medical resources, including the number of medical personnel and the level of medical facilities. The process dimension reflects the utilization of medical services and the efficiency of medical activities. The outcome dimension reflects the effectiveness of medical services from two aspects: health outcomes and residents' subjective evaluations. Specific indicators include: the number of licensed (assistant) physicians per 1,000 people, the number of licensed registered nurses per 1,000 people, the number of licensed physicians per 1,000 people, the number of beds in medical and health institutions per 1,000 people, per capita healthcare expenditure, the average number of daily patient consultations per physician, the average number of daily inpatient bed-days per physician, the hospital delivery rate, the maternal mortality rate, residents' health status, the evaluation of medical standards at healthcare facilities, and the satisfaction with medical conditions at healthcare facilities. To avoid potential bias introduced by subjective weighting, this paper adopts the entropy method to determine the indicator weights. The entropy method is an objective weighting approach based on the degree of data dispersion, reflecting the amount of information provided by each indicator by measuring its information entropy. Generally, the greater the variation of an indicator, the more information it contains, and the higher its weight in the comprehensive evaluation.

3. Results

3.1 Demographic Characteristics of Residents

A total of 9,689 samples were included in this study, comprising 3,328 rural samples and 6,361 urban samples. Overall, differences were observed between urban and rural residents in terms of medical service quality, demographic characteristics, socioeconomic status, and medical service utilization, with most variable differences being statistically significant ($P < 0.001$). Regarding the core indicator, the mean medical service quality score for rural residents was 2.19, significantly lower than the 6.34 for urban residents, indicating a pronounced urban-rural disparity. Age structure showed little difference, with average ages of 39.13 years and 39.99 years for rural and urban residents, respectively. In terms of gender, the proportion of males in rural areas (60.5%) was slightly higher than that in urban areas (55.3%). Differences in employment security, chronic disease status, and healthcare resource utilization were more pronounced between urban and rural areas: urban residents had a higher proportion of job security (54.9%) and a higher prevalence of chronic diseases compared to rural residents. Regarding healthcare facility choice, urban residents were more concentrated in general hospitals, while rural residents had relatively dispersed sources of medical care. Additionally, significant differences existed between urban and rural residents in the type of medical insurance and education level. Rural residents were predominantly covered by the New Rural Cooperative Medical Scheme and had lower education levels, whereas urban residents were more likely to be enrolled in the Urban Employee Basic Medical Insurance and had a higher proportion of high school education or above. For details, see Table 1.

Table 1 Demographic Characteristics

Variable	Rural (n=3328)	Urban (n=6361)	P-value
Healthcare Service Quality	2.19 ±0.46	6.34 ±0.71	<0.001
Age	39.13 ±12.22	39.99 ±11.52	<0.001
Gender			<0.001
Male	2013 (60.5%)	3521 (55.3%)	
Female	1315 (39.5%)	2840 (44.7%)	
Employment Security			<0.001
Yes	1089 (32.7%)	3496 (54.9%)	
No	2239 (67.3%)	2865 (45.1%)	
Chronic Disease			<0.001
Yes	274 (8.2%)	719 (11.3%)	
No	3054 (91.8%)	5642 (88.7%)	
Healthcare Facility Visited			<0.001
General Hospital	1058 (31.8%)	3144 (49.5%)	
Specialized Hospital	192 (5.8%)	465 (7.3%)	
Community Health Service Center	589 (17.7%)	807 (12.7%)	
Community Health Service Station	443 (13.3%)	433 (6.8%)	
Clinic	1045 (31.4%)	1512 (23.8%)	
Health Insurance Type			<0.001
Public Medical Care	44 (1.3%)	202 (3.2%)	
Urban Employee Basic Medical Insurance	648 (19.5%)	2456 (38.6%)	
Urban Resident Basic Medical Insurance	88 (2.6%)	594 (9.3%)	
Supplementary Medical Insurance	16 (0.5%)	102 (1.6%)	
New Rural Cooperative Medical Scheme	2020 (60.7%)	2007 (31.6%)	
Urban-Rural Resident Basic Medical Insurance	253 (7.6%)	570 (9.0%)	
Education Level			<0.001
Illiterate / Semi-illiterate	243 (7.3%)	191 (3.0%)	
Primary School	588 (17.7%)	561 (8.8%)	
Junior High School	1276 (38.4%)	1768 (27.8%)	
Senior High School / Technical School	530 (15.9%)	1288 (20.2%)	
Junior College	396 (11.9%)	1152 (18.1%)	
Bachelor's Degree	274 (8.2%)	1259 (19.8%)	

Master's Degree	19 (0.6%)	127 (2.0%)	
Doctoral Degree	2 (0.06%)	15 (0.2%)	
Marital Status			<0.001
Unmarried	648 (19.5%)	1006 (15.8%)	
Married	2509 (75.4%)	4989 (78.5%)	
Cohabiting	10 (0.3%)	38 (0.6%)	
Divorced	113 (3.4%)	243 (3.8%)	
Widowed	48 (1.4%)	85 (1.3%)	

3.2 Characteristics of the Structure-Process-Outcome Dimensions

From the perspective of the three major dimensions, medical service quality exhibited significant differences across structure, process, and outcome. The average score for the structure dimension was 3.99, the lowest among the three dimensions, indicating that medical resource allocation remains a weak link in the current healthcare system. Among its indicators, the number of licensed registered nurses per 1,000 people scored the highest at 4.85, while the number of licensed (assistant) physicians per 1,000 people scored the lowest at only 3.34, suggesting a relative shortage of primary care human resources. The average score for the process dimension was 6.88, higher than that of the structure dimension. Within this dimension, the hospital delivery rate achieved the highest score of 9.47, indicating the stable operation of China's maternal and child health service system. The scores for the average daily inpatient bed-days per physician and the average daily patient consultations per physician were 6.44 and 4.72, respectively, reflecting a relatively high level of medical service utilization. For the outcome dimension, the average score was 6.15. Among its indicators, satisfaction with medical conditions at healthcare facilities received the highest score of 6.98, whereas residents' health status scored relatively low at only 4.28. Overall, the performance of the health outcome dimension was relatively good, but there remains room for improvement. The comprehensive medical service quality score, calculated by aggregating the three dimensions, was 5.99, indicating that the overall level of medical service quality in China is above average. For details, see Table 2.

Table 2 Scores of Healthcare Service Quality in Structure–Process–Outcome Dimensions

Criterion Level	Score	Indicator	Score
Structural Dimension	3.99	Practicing (Assistant) Physicians per 1,000 Population	3.34
		Registered Nurses per 1,000 Population	4.85
		Practicing Physicians per 1,000 Population	3.93
		Hospital Beds in Medical Institutions per 1,000 Population	4.35
		Per Capita Healthcare Expenditure	3.47
Process Dimension	6.88	Daily Outpatient Visits per Physician	4.72
		Daily Inpatient Bed-Days per Physician	6.44
		Hospital Delivery Rate	9.47
		Residents' Health Status	4.28
Outcome Dimension	6.15	Maternal Mortality Rate	6.57
		Evaluation of Medical Service Level	6.75
		Satisfaction with Medical Conditions	6.98
Overall Score	5.99		

3.3 Urban-Rural Disparities in Medical Service Quality

From the perspective of urban-rural disparities, a significant imbalance exists in China's medical service quality. Descriptive statistical results show that the average medical service quality score for urban residents is 6.34, compared to only 2.19 for rural residents, revealing a pronounced gap

between the two. Further analysis incorporating box plots indicates that urban medical service quality not only has a higher overall level but also exhibits relatively greater internal variation. In contrast, rural medical service quality is predominantly concentrated in the lower range, with a more concentrated distribution. This suggests that the overall development level of the rural healthcare system in China remains relatively low. The formation of the urban-rural gap in medical service quality is closely related to factors such as the uneven distribution of medical resources, insufficient service capacity of primary healthcare institutions, and disparities in the allocation of medical personnel. For details, see Table 3.

Table 3 Descriptive Statistics of Healthcare Service Quality

Sample	Mean	Standard Deviation	Minimum	Maximum
Urban	6.34	0.70	4.19	8.28
Rural	2.19	0.46	0.87	3.92
Overall	4.92	2.07	0.87	8.28

3.4 Regional Disparity Analysis

At the regional level, the average medical service quality scores for urban areas in the eastern, central, western, and northeastern regions were 6.166, 6.415, 6.503, and 6.444, respectively. Overall, the differences in medical service quality levels among urban areas across regions were relatively limited, indicating that the urban healthcare system has shown a certain degree of balanced development nationwide. In contrast, the overall medical service quality in rural areas remained at a relatively low level, with regional rural scores concentrated between 2.22 and 2.37, significantly lower than those in urban areas. Regional disparities were primarily reflected in subtle variations among urban areas, while rural areas exhibited a pattern of uniformly low levels with limited differences across regions. For details, see Figure 1.

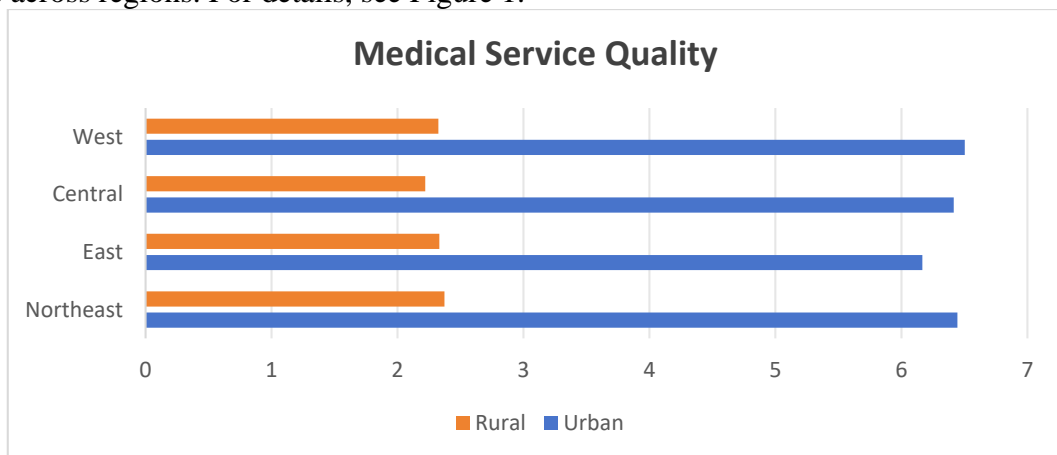


Figure 1 Healthcare Service Quality between Urban and Rural Areas across Four Regions

4. Conclusion

Based on the Structure-Process-Outcome theoretical framework, this paper constructed an evaluation index system for medical service quality and employed the entropy method to comprehensively measure the levels of medical service quality in urban and rural areas of China. The results indicate that the overall medical service quality in China is at an upper-middle level, yet a significant gap persists between urban and rural areas. From the dimensional structure perspective, the structure dimension scored the lowest, suggesting that medical resource allocation, particularly

healthcare human resources, remains a key constraint on improving medical service quality. Medical service quality in urban areas showed relatively small variations across different regions, while rural areas exhibited uniformly low levels with limited regional disparities. Therefore, in future health policy formulation, priority should be given to strengthening the allocation of medical resources in rural areas and enhancing the service capacity of primary healthcare institutions. Additionally, improving mechanisms for medical personnel training and mobility will help gradually narrow the urban-rural gap in medical service quality, thereby promoting the balanced development of the healthcare system.

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