Postprint: Development of a Competency Assessment Indicator System for Primary Care General Practitioners

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Abstract

Background: The tiered healthcare system constitutes a crucial component of deepening healthcare system reform and establishing a basic medical and health system with Chinese characteristics. Primary healthcare institutions are essential components of the tiered healthcare service system, serving as "gatekeepers" of residents' health. General practitioners, as the core human resource element of primary healthcare institutions, have job competency that directly affects the service capacity of these institutions.

Objective: To construct a job competency indicator system for primary care general practitioners, providing a basis for primary healthcare institutions to evaluate the job competency of general practitioners.

Methods: From September to December 2022, 13 industry experts were consulted using the Delphi expert consultation method; the Analytic Hierarchy Process (AHP) and entropy method were used to determine indicator weights.

Results: Through two rounds of Delphi expert consultation, this study optimized and screened the indicator system, ultimately constructing an evaluation system for primary care general practitioners consisting of 5 first-level indicators and 27 second-level indicators. The weights of indicators at all levels were determined using the Analytic Hierarchy Process combined with the entropy method, among which the basic public health service capacity indicator had the highest weight and was identified as the core indicator. The indicator system passed small-sample reliability and validity tests, with results at acceptable levels.

Conclusion: A preliminary evaluation indicator system for primary care general practitioners has been constructed, which can help primary healthcare institutions select capable personnel and provides a reference basis for evaluating the job competency of primary care general practitioners.

Full Text

Construction of Evaluation Index System for Post Competency of Primary Care General Practitioners

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Abstract

Background
The hierarchical diagnosis and treatment system is crucial for deepening the medical and health system reform and establishing the basic medical and health system with Chinese characteristics. Primary care institutions play an essential role in hierarchical diagnosis and treatment system by assuming the role of "gatekeepers" of residents' health. The post competency of general practitioners, who are the core of primary care institutions, significantly influences the service capacity of these institutions.

Objective
To construct an indicator system for the evaluation of post competency of general practitioners in primary care institutions.

Methods
From September to December 2022, 13 medical professionals were consulted through two-round Delphi expert consultation method; the hierarchical analysis and entropy method was used to calculate the weights of the indicators.

Results
The indicator system was optimized and sifted through two rounds of Delphi expert consultation, the evaluation system of primary general practitioners was finally constructed, consisting of 5 primary indicators and 27 secondary indicators. The weights of the indicators at all levels were clarified through the hierarchical analysis combined with the entropy method, in which the basic public health service capacity indicator had the highest weight and was the core indicator. The indicator system was tested for reliability and validity by small samples, and all of them were at an acceptable level.

Conclusion
An indicator system for evaluation the post competency of general practitioners in primary care institutions was constructed, contributing to the selection and appointment of general practitioners, which will provide an objective reference for the evaluation of post competence of general practitioners in primary care institutions.

Keywords
Primary care general practitioners; Post competency; Evaluation indicator; Indicator system; Delphi method; AHP

Introduction

The continuous advancement of the hierarchical diagnosis and treatment system and integrated healthcare service system has increasingly highlighted the importance of service capacity in primary care institutions. The general practitioner workforce constitutes the core of primary care institutions' service capacity and is key to fulfilling the role of "gatekeepers" for residents' health. The post competency of general practitioners directly influences the service quality of primary care institutions [1]. The "13th Five-Year Plan for Deepening Medical and Health System Reform" emphasizes the need to enhance the professional attractiveness and service capacity of primary care institutions and strengthen the construction of primary care talent teams with general practitioners as the focus [2-3]. However, although the total number of medical and health professionals nationwide has achieved the targets set forth in the "13th Five-Year Plan for Health and Wellness", the total number of general practitioners still falls short of meeting China's overall demand [4]. Given the reality of talent shortages, improving the general practitioner training system and enhancing the post competency of general practitioners in primary care institutions represent important pathways for promoting the construction of the hierarchical diagnosis and treatment system and integrated healthcare service system. Nevertheless, there is currently a dearth of in-depth research on competency indicators and conditions for primary care general practitioners [5-6]. This study constructs an evaluation index system for the post competency of primary care general practitioners through the Delphi expert consultation method, analytic hierarchy process, and entropy method, aiming to improve the service capacity of primary care institutions and provide a reference for optimizing the general practitioner training system.

Methods

1.1 Research Subjects

From September to December 2022, we invited 21 experts and scholars for consultation. Inclusion criteria were: (1) members of the Chinese Medical Asso-

ciation General Practice Branch or higher-level positions; (2) heads of primary care departments in health administrative authorities; (3) primary care service providers, health policy researchers, or general practice researchers with over 10 years of work experience; and (4) managers of primary care institutions with over five years of management experience.

1.2 Research Methods

1.2.1 Literature Research Method From August to September 2022, we searched databases and online resources including CNKI, Wanfang Data, Baidu Library, PubMed, and Web of Science for research and policies related to general practitioner competency, primary care institution service content, and hierarchical diagnosis and treatment system construction. The search timeframe was from database inception to August 31, 2022. Domestic journal articles were limited to CSSCI, Peking University Core, and CSCD sources, while dissertations were limited to doctoral theses. A total of 125 Chinese and 61 English articles were collected. We reviewed and organized the collected literature and policies, selecting five representative general practitioner competency indicator systems for comparative analysis.

1.2.2 Comparative Research Method We employed Bereday's comparative research method to describe, interpret, and compare the indicators and corresponding dimensional structures of five representative general practitioner competency models, screening out representative indicators [7-8]. Based on the actual work content of primary care institutions in China and policy orientation requirements, we established an original indicator system comprising six primary indicators and 46 secondary indicators.

1.2.3 Delphi Expert Consultation Method The expert consultation questionnaire primarily included: (1) questionnaire instructions; (2) basic expert information; and (3) a consultation form for the evaluation indicators of primary care general practitioner post competency. We used a 5-point Likert scale for experts to rate the "importance" of the original indicators and to assess their "familiarity" with each indicator, while also allowing them to provide specific comments or suggestions on the overall questionnaire design and individual indicators [9-10]. Paper-based questionnaires were administered. After collection, Excel 2021 software was used for double-entry database construction. The reliability of the expert consultation was evaluated by calculating the expert positive coefficient, authority coefficient, and coordination coefficient. The threshold method was applied to calculate the mean, coefficient of variation, and full-score ratio of indicators to facilitate indicator screening.

1.2.4 Analytic Hierarchy Process The analytic hierarchy process is a weighting method that combines qualitative and quantitative approaches [11]. By establishing a hierarchical structural model, constructing pairwise

comparison judgment matrices, and conducting consistency tests, we calculated the consistency ratio (CR) value. When CR < 0.10, the judgment matrix demonstrates acceptable consistency. The analytic hierarchy process transforms expert subjective judgments into objective descriptions, with its accuracy and reliability depending on the precision of these objective components. Therefore, consistency checks are essential to evaluate the reliability of each component [12].

1.2.5 Entropy Method Entropy value is a measure of uncertainty. In this study, its magnitude correlates with the amount of information obtained by researchers: the higher the entropy value, the more information the researcher has mastered, and the weaker the uncertainty in the research. The entropy method is an objective weighting approach that can more accurately reflect differences among indicators, thereby making weight determination more reliable and precise. Compared with subjective weighting methods, the entropy method offers higher credibility and accuracy. In this study, we used the entropy method to calculate the weights of secondary indicators and combined these results with the primary indicator weights obtained through the analytic hierarchy process to derive the final weights for the indicator system [13].

Results

2.1 Basic Characteristics of Experts

This study ultimately included 13 experts, comprising 7 males and 6 females. According to the established inclusion criteria, the expert consultation panel included 1 member of the Chinese Medical Association General Practice Branch or higher-level position, 3 heads of primary care departments in health administrative authorities, 4 university researchers in related fields, and 6 managers of primary care institutions (with some overlapping identities). All experts held bachelor's degrees or higher, with 53.85% holding master's degrees or above, and 76.92% having over 10 years of work experience in primary care services, health policy research, or general practice. These characteristics demonstrate that the expert panel possessed strong professional authority and extensive practical experience. The basic characteristics of experts are shown in .

2.2 Delphi Consultation Results

2.2.1 Expert Positive Coefficient This study conducted two rounds of expert consultation. In the first round, 21 questionnaires were distributed, with 13 returned, yielding a 61.90% effective response rate. In the second round, 13 questionnaires were distributed and all 13 were returned, achieving a 100% effective response rate. These results indicate good expert engagement, with an average positive coefficient of 80.95%. Across both rounds, 7 experts provided 28 suggestions, as detailed in .

2.2.2 Expert Authority Coefficient Experts self-evaluated their familiarity with each indicator on a scale of 1-5. After two rounds of expert consultation, the CR values showed significant improvement. The authority coefficients (CR) for the two rounds were 0.728 and 0.793, respectively, both exceeding 0.70, indicating high expert authority and credibility.

2.2.3 Expert Opinion Coordination The Kendall's coordination coefficients for the two rounds of expert consultation were 0.163 and 0.652, respectively, with P-values of 0 for both rounds (see). The second-round coordination coefficient showed significant improvement and exceeded 0.6, indicating that expert opinions converged toward consensus after the first-round indicator modifications, with good current consistency and reliable scoring results.

2.2.4 First-round Consultation Results Using the threshold method on expert scores combined with expert opinions, indicators were deleted or modified. The threshold values for mean, full-score ratio, and coefficient of variation were 4.220, 46.5%, and 0.220, respectively. Based on the threshold method results and expert opinions, five secondary indicators were deleted (public health prevention and control experience, public health prevention and control practice, teaching satisfaction, research design, statistical skills).

2.2.5 Second-round Consultation Results In the second round of expert consultation, the threshold values for mean, full-score ratio, and coefficient of variation were 4.547, 56.76%, and 0.068, respectively. Based on the threshold method results and expert opinions, three secondary indicators were deleted (physical and mental care, teaching output, teaching skills) and four indicators were modified (communication skills, humanistic care, work efficiency, teaching improvement). After two rounds of consultation, the number of experts providing comments decreased significantly from the first round. Compared with the first round, the mean and full-score ratio of primary and secondary indicators increased, the coefficient of variation decreased, and threshold values increased, indicating that expert opinions converged with reduced dispersion and improved coordination. Therefore, a third round of consultation was deemed unnecessary.

2.3 Indicator Weight Determination

2.3.1 Analytic Hierarchy Process Results Based on the two-round Delphi expert consultation results, we constructed a 5-order judgment matrix for the five dimensions of basic medical service capacity, basic public health service capacity, communication and teamwork capacity, humanistic care and professional competency, and comprehensive management capacity. The weight values for the five dimensions were 0.359, 0.361, 0.104, 0.116, and 0.060, respectively, with CR = 0.031, passing the consistency test (see).

2.3.2 Entropy Method Results The entropy method is an objective weighting approach. This study used the entropy method to verify the weights of the 27 secondary indicators. As shown in , the weights among the 27 secondary indicators were relatively uniform, all around 0.037.

2.3.3 Final Indicator Weights Using the analytic hierarchy process and entropy method weighting results, we determined the final model weights. Basic public health service capacity emerged as the most important indicator in the model, followed by basic medical service capacity, humanistic care and professional competency, communication and teamwork capacity, and comprehensive management capacity (see).

2.4 Reliability and Validity Testing

2.4.1 Reliability and Validity Tests We used reliability and validity tests to verify the model's reliability and consistency. The overall Cronbach's α coefficient for the five primary indicators was 0.981, while the α coefficients for the secondary indicators were 0.957 for basic medical service capacity, 0.956 for basic public health service capacity, 0.957 for communication and teamwork capacity, 0.954 for humanistic care and professional competency, and 0.959 for comprehensive management capacity. The α coefficients for all dimensions exceeded 0.9, indicating high questionnaire reliability [14-15]. For validity testing, KMO and Bartlett's tests were conducted, yielding a KMO value of 0.949 and a Bartlett's test P-value <0.01, leading to rejection of the null hypothesis of an identity correlation matrix and indicating the questionnaire's suitability for factor analysis.

2.4.2 Confirmatory Factor Analysis We conducted confirmatory factor analysis on the research results, validating 27 specific indicators across five factors. The effective sample size for this analysis was 143, exceeding five times the number of questionnaire items. All measurement items had P-values <0.001, and standardized loading coefficients were all above 0.7. Analysis revealed that the AVE values for all five factors exceeded 0.5, and CR values all surpassed 0.7, indicating high convergent validity of the results. For discriminant validity analysis, the square roots of AVE values for all five indicators were greater than the maximum absolute values of their respective inter-factor correlation coefficients, suggesting good discriminant validity for all indicators.

Discussion

Since the founding of the People's Republic of China, the construction of the medical and health service system has consistently been a priority. Over the years, China has continuously advanced the development of a multi-level social security system, establishing a state-dominated "low-level welfare-type" three-tier medical and health service system and essentially achieving universal medical insurance coverage [16]. In 2015, the State Council issued guidance on

promoting hierarchical diagnosis and treatment, calling for further deepening of medical reform to establish a hierarchical diagnosis and treatment system with Chinese characteristics featuring "first contact at the primary level, two-way referral, and vertical integration" [17]. The core of this system lies in improving the service quality and supply capacity of primary care institutions, guiding patients' choice of first-contact facilities. Through multi-level coordination involving primary-level first contact and two-way referral, the system aims to enhance healthcare accessibility and continuity while alleviating treatment pressures on large hospitals, ultimately achieving the goal of "minor and chronic illnesses in the community, major and complex illnesses in hospitals." As the foundational component of the overall medical and health system, primary care institutions bear crucial responsibilities for basic medical and public health services, playing an irreplaceable role in consolidating the infrastructure of the hierarchical diagnosis and treatment system.

The "13th Five-Year Plan for Deepening Medical and Health System Reform" emphasizes enhancing the professional attractiveness and service capacity of primary care institutions and strengthening primary care talent teams with general practitioners as the core [2]. The general practitioner workforce is central to primary care institutions' service capacity and key to fulfilling the "gatekeeper" responsibility for residents' health. General practice is characterized by a broad and comprehensive knowledge system, requiring general practitioners to master diagnostic and treatment skills and theoretical principles for common and frequent diseases across multiple disciplines, while also possessing knowledge in preventive medicine, rehabilitation medicine, evidence-based medicine, psychology, and sociology. In practice, general practice emphasizes continuous, coordinated, and accessible service delivery [18].

The 2011 "Guiding Opinions of the State Council on Establishing the General Practitioner System" clarified a standardized training approach for general practitioners featuring "one model, three unifications, and two pathways" [19]. Under the current training program, the three-year standardized general practitioner training requires no less than 33 months of practical work, including 27 months of clinical specialty rotation in general hospitals and six months of primary care practice. Under China's current policy advocating for a three-tier medical institution layout, the training and career selection trends for general practitioners show a pattern of "training in tertiary hospitals, practicing in primary care." Objective differences exist in job functions between primary care institutions and general practice positions in comprehensive hospitals, yet no clear research conclusions have been reached regarding the competency elements for primary care general practitioners.

Based on this background and the objective requirements for independent practice, this study designed an indicator system for evaluating the post competency of primary care general practitioners by integrating multiple classic competency elements and incorporating the specific practice requirements of primary care institutions in China. By applying this indicator system to assess the compe-

tency levels of general practitioners in primary care institutions, we aim to provide feedback and recommendations on the existing general practitioner training model and offer suggestions for talent selection and appointment in primary care institutions.

Through two rounds of Delphi expert consultation, we optimized and refined the indicator system. The average expert positive coefficient across both rounds was 80.95%, with the final round achieving 100%, demonstrating high expert engagement. Both rounds exceeded 0.70, indicating high credibility. The final-round Delphi coordination coefficient was 0.652, showing significant improvement from the first round and exceeding 0.6, suggesting high consistency in expert opinions. The mean, coefficient of variation, and full-score ratio of the retained indicators all met the threshold screening criteria. Using the analytic hierarchy process combined with the entropy method, we clarified the weights of indicators at all levels, with basic public health service capacity receiving the highest weight as the core indicator. The indicator system passed small-sample reliability and validity testing at acceptable levels.

In accordance with the principles of the Delphi expert consultation method, analytic hierarchy process, and entropy method, the indicator system constructed in this study aligns with the job responsibilities of primary care general practitioners while reflecting the requirements of China's healthcare system development for these professionals. However, due to limitations in research scope and conditions, certain deficiencies remain in this indicator system. To further optimize the evaluation system for primary care general practitioners, future research plans include refining and improving the indicator system through empirical research and standardized assessment, enabling more objective and comprehensive evaluation of primary care general practitioner post competency and promoting optimization of the general practitioner training system.

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Author Contributions

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Conflict of Interest

This article has no conflict of interest.

Note: Figure translations are in progress. See original paper for figures.