Postprint: Development of an Evaluation Index System for the Integrated Medical-Preventive Service Capacity of Primary Care Physicians

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Abstract

Background As an inevitable outcome to meet the growing medical and health needs of residents, the integration of medical care and preventive care can effectively promote public health. As pioneers in delivering integrated medical and preventive care services, the competency evaluation of primary care physicians plays a crucial role in advancing this integration. However, evaluation indicators for primary care physicians' competency in integrated medical and preventive care services have not yet been fully explored and established.

Objective To construct an indicator system for primary care physicians' competency in integrated medical and preventive care services, providing a reference for evaluating and improving such competency.

Methods From June to August 2023, purposive sampling was employed to select consulting experts among three categories of personnel: those engaged in theoretical research on integrated medical and preventive care, practical work in this field, and administrative management. This study conducted two rounds of expert consultation using the Delphi method. After obtaining informed consent from experts, consultation questionnaires were sent via WeChat or email. The indicator system for primary care physicians' competency in integrated medical and preventive care services was discussed and finalized based on expert consultation. Finally, the Analytic Hierarchy Process was used to determine the weight of each indicator.

Results The response rate for the first round of consultation questionnaires was 96.7%, and 100.0% for the second round. The expert authority coefficient was 0.885. The Kendall' s coefficients of concordance for the two rounds of expert consultation were 0.181 ($P<0.001$) and 0.371 ($P<0.001$), respectively. Ultimately, an indicator system for primary care physicians' competency in

integrated medical and preventive care services was constructed, comprising 3 first-level indicators, 9 second-level indicators, and 26 third-level indicators.

Conclusion The indicator system for primary care physicians' competency in integrated medical and preventive care services constructed in this study is scientific and reliable, and it identifies the core elements of such competency, providing a reference for the precise evaluation of primary care physicians' competency in integrated medical and preventive care services.

Full Text

Construction of Evaluation Indicator System for Primary Care Doctors' Service Capability in Integration of Medical and Preventive Care

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Abstract

Background
The integration of medical and preventive care has emerged as an essential strategy to address the increasing healthcare demands of the population and effectively enhance public health outcomes. Primary care doctors play a pivotal role in implementing the integration of medical and preventive services, making the assessment of their competencies essential for advancing this integration. However, the indicators for evaluating primary care doctors' service capabilities in the integration of medical and preventive care have not yet been comprehensively explored and established.

Objective
This study aims to develop an indicator system for assessing the service capability of primary care doctors in the integration of medical and preventive care, providing a reference framework for evaluating and improving their competencies.

Methods
From June to August 2023, purposive sampling was employed to select consulting experts specializing in theoretical research, practical implementation, and administrative management related to the integration of medical and preventive services. A two-round Delphi method was conducted following informed consent, with questionnaires distributed via WeChat or email. The proposed competency evaluation framework was discussed, refined, and finalized. Analytic hierarchy process (AHP) was subsequently utilized to determine the weight of each indicator.

Results
The response rates for the first and second rounds of consultation were 96.7% and 100%, respectively. The expert authority coefficient was 0.885. Kendall' s coefficients of concordance for the two rounds were 0.181 (P<0.001) and 0.371 (P<0.001), indicating significant consensus among experts. The finalized framework comprises three primary indicators, nine secondary indicators, and 26 tertiary indicators.

Conclusion
The constructed indicator system is scientifically rigorous and reliable, identifying the core elements required to assess the service capabilities of primary care doctors in the integration of medical and preventive care. This framework provides a valuable reference for accurately evaluating and enhancing the capacity of primary care doctors to integrate medical and preventive services.

Keywords: Physicians, primary care; Primary care doctors; Integration of medical and preventive care; Service capability; Indicator system; Delphi method; Analytic hierarchy process

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1.1 Study Participants

From June to August 2023, we employed purposive sampling to select consulting experts from three categories: theoretical researchers in medical-preventive integration, practitioners implementing medical-preventive integration, and administrative managers. Selection criteria included: (1) possessing research foundation or practical experience in medical-preventive integration and familiarity with primary healthcare; and (2) voluntary participation with commitment to complete both rounds of Delphi consultation. Based on these criteria and considering both authority and representativeness, we selected 30 experts, comprising 11 primary care doctors, 13 university scholars, and 6 administrative managers from provincial, municipal, and county-level health departments responsible for medical-preventive integration.

1.2.1 Literature Review Method

We systematically searched academic databases (PubMed, CNKI, MEDLINE, etc.) using keyword combinations. Chinese keywords included "primary care doctors," "medical-preventive integration," "service capability," and "indicator system." English keywords included "Integrated Health Services," "Service Capability," "Primary Care Doctors," and "Indicator System." Through literature synthesis and iterative discussions, we identified evaluation indicators related to primary care doctors' medical-preventive integration capabilities, encompassing medical knowledge, technical skills, health management, information technology application, and team collaboration. This process yielded a preliminary indicator system with 3 primary indicators, 9 secondary indicators, and 27 tertiary indicators.

1.2.2 Delphi Method

This study employed a two-round Delphi method. After obtaining informed consent, questionnaires were distributed via WeChat or email. The consultation process involved: (1) an explanatory letter introducing the research background, objectives, indicator framework, consultation procedures, and instructions; (2) expert demographic information including name, age, education, professional title, and years of work experience; (3) evaluation of each indicator' s importance using a 5-point Likert scale, along with space for modification suggestions; and (4) assessment of experts' judgment basis (Ca) and familiarity (Cs). The Ca scoring assigned points for theoretical analysis (0.3, 0.2, 0.1), practical experience (0.4, 0.3, 0.2), literature references (0.2, 0.15, 0.1), and intuitive judgment (0.1, 0.05, 0) across large, medium, and small categories. The Cs scoring assigned 1, 0.8, 0.6, 0.4, and 0.2 points for very familiar, familiar, moderately familiar, slightly familiar, and unfamiliar, respectively. Indicators failing to meet the criteria of mean $ $4, coefficient of variation $ $0.25, and full-score ratio $ $50% were eliminated. Based on 23 suggestions from 10 experts in the first round, we adjusted, deleted, or merged indicators, resulting in modifications to 1 primary indicator, 8 secondary indicators, and 10 tertiary indicators, plus the addition of 3 tertiary indicators and deletion of 4 tertiary indicators. The second round consultation asked experts to rate the revised indicators' importance using the same scoring method.

1.2.3 Analytic Hierarchy Process (AHP)

AHP is a multi-objective decision analysis method widely applied in indicator system weighting. The procedure involved: (1) establishing a hierarchical structure with goal, criteria, sub-criteria, and alternative layers; (2) constructing judgment matrices using pairwise comparisons based on expert importance rating differences and Satty' s 1-9 scale; (3) calculating matrix weights by identifying the maximum eigenvalue (λmax) and its corresponding eigenvector (Vmax), then normalizing the eigenvector to sum to 1; (4) conducting consistency tests by

calculating the consistency index (CI) and consistency ratio (CR), with CR<0.1 indicating acceptable consistency; and (5) computing composite weights using the product method, where secondary indicator composite weight = primary indicator weight × secondary indicator weight, and tertiary indicator composite weight = secondary indicator composite weight × tertiary indicator weight.

1.3 Statistical Methods

Data entry was performed using EpiData 3.1, and statistical analysis was conducted using SPSS 25.0. Descriptive statistics summarized expert demographics. Expert engagement was measured by questionnaire response rate, with >70% considered satisfactory. Expert authority coefficient (Cr) was calculated as (Ca+Cs)/2, with Cr>0.7 indicating high authority. Expert consensus was assessed using Kendall' s W coefficient, where values closer to 1 indicate better agreement, P<0.05 indicates statistical significance, and W>0.3 is generally considered satisfactory. Excel was used to construct judgment matrices and calculate indicator weights.

2.1 Basic Characteristics of Experts

The 29 participating experts included 20 males and 9 females. Age distribution showed fewer experts under 35 (17.2%) and more over 46 (34.5%). Regarding work experience, 31.0% had 11-15 years, while 17.2% each had 21-25 or 26-30 years. Professional titles were predominantly associate senior level (44.8%), with relatively balanced distribution among senior, intermediate, junior, and no-title categories. Among the 29 experts, university faculty and primary care doctors each accounted for 37.9%, while administrative managers comprised 24.1%. Detailed demographics are presented in Table 1 .

2.2 Expert Engagement and Authority

The first round distributed 30 questionnaires, receiving 29 valid responses (96.7% response rate). The second round distributed 29 questionnaires, receiving all 29 back (100.0% response rate), demonstrating strong expert engagement. The mean Ca, Cs, and Cr values were 0.866, 0.871, and 0.869, respectively. Two experts with Cr values of 0.625 and 0.675 were excluded from weight setting, resulting in a final Cr of 0.885 (>0.7), indicating high expert authority.

2.3 Expert Opinion Coordination

The first-round Kendall's coefficient was 0.181 (P<0.001), indicating suboptimal consensus but statistically significant differences. The second-round coefficient improved substantially to 0.371 (P<0.001), demonstrating significantly better agreement (Table 2).

2.4.1 First-Round Delphi Results

Primary indicator importance scores ranged from 4.24-4.83 (coefficient of variation: 0.08-0.20). Secondary indicators scored 4.31-4.90 (CV: 0.06-0.23). Tertiary indicators scored 3.83-4.79 (CV: 0.09-0.44). Three items failing to meet inclusion criteria (mean<4, CV>0.25, full-score ratio<50%) were eliminated. Ten experts provided 23 suggestions; 21 were adopted. For example, experts suggested removing the emphasis on "follow-up" from "C12 Infectious disease detection, reporting, and follow-up management." Final modifications included adjusting 1 primary indicator, 8 secondary indicators, and 10 tertiary indicators, adding 3 tertiary indicators, and deleting 4 tertiary indicators (Table 3).

2.4.2 Second-Round Delphi Results

Primary indicator importance scores improved to 4.89-4.96 (CV: 0.04-0.07). Secondary indicators scored 4.78-4.96 (CV: 0.04-0.09). Tertiary indicators scored 3.89-5.00 (CV: 0.00-0.23). The minimum mean score increased by 0.51 from the first round, all standard deviations were <1, the maximum CV was 0.23, and only 9 items had full-score ratios below 50%, indicating strong expert consensus. No modification suggestions were offered in the second round, confirming expert satisfaction with the indicator framework.

2.5 Indicator Weight Setting

The final framework after two Delphi rounds contained 3 primary, 9 secondary, and 26 tertiary indicators. Using AHP, all matrices passed consistency tests. Composite weights were calculated using the product method. Primary indicator weights were: professional knowledge and skills (49.1%), comprehensive service capability (31.2%), and professional competence (19.8%). The top five secondary indicators were disease prevention knowledge and skills (16.4%), clinical diagnosis and treatment knowledge and skills (16.4%), health management knowledge and skills (16.4%), team collaboration capability (12.5%), and doctor-patient communication (12.5%) (Table 4).

3.1 Scientific Rigor of the Indicator System

Through systematic literature review, we comprehensively collected relevant indicators to construct the preliminary evaluation system. The two-round Delphi consultation engaged experts from diverse fields including clinical medicine, public health, and management, ensuring comprehensiveness. Response rates exceeded 70% in both rounds, with most experts providing suggestions in the first round, demonstrating strong engagement. Twenty-seven experts had Cr>0.7, yielding a final mean Cr of 0.885 (>0.7), confirming appropriate expert selection with high familiarity and sound judgment. Kendall' s coefficient improved from 0.181 (P<0.001) in the first round to 0.371 (P<0.001) in the second, indicating enhanced consensus after revision. The "professional knowledge and skills" domain received the highest weight, reflecting that robust professional knowledge

is fundamental to service quality and the primary element in evaluating primary care doctors' medical-preventive integration capabilities. Within this domain, equal weights for disease prevention, clinical diagnosis/treatment, and health management underscore their equivalent importance in medical-preventive integration, consistent with previous research. Future primary care doctors must possess comprehensive knowledge and skills centered on individual health to ensure timely, effective integrated services. The relatively high weight for "comprehensive service capability" reflects the comprehensive, continuous nature of medical-preventive integration, requiring capabilities in teamwork, communication, and information technology to address health challenges. Emphasis on "team collaboration" and "doctor-patient communication" stems from the cross-sectoral nature of integrated services, demanding efficient exchange with colleagues and patients across all health stages. The focus on "information data application capability" addresses the need for seamless integration of medical, public health, and health management information systems.

3.3.1 Innovations

This study offers two key innovations. First, it focuses on individual primary care doctors as service providers. While existing research emphasizes service models or institutional-level analysis, this study examines competency requirements from the provider perspective. Second, it specifically targets medical-preventive integration service capability. Current competency research often addresses isolated aspects like medical or public health services, whereas this study explores the specific skill requirements for integrated services, aiming to enhance primary care doctors' work capacity.

3.3.2 Limitations

This study has several limitations. First, consulting experts were primarily from medical and management fields, lacking input from service recipients. Second, over half of experts were from Shandong province, potentially limiting geographic generalizability. Third, using self-administered questionnaires introduces subjective bias. Future research should incorporate qualitative interviews and surveys with both providers and recipients and introduce objective evaluation indicators to enhance the scientific rigor and practical utility of the assessment tool.

This study constructed an indicator system for primary care doctors' medical-preventive integration service capability using the Delphi method and calculated weights via AHP, providing a scientifically sound and feasible tool for comprehensive assessment. The weight calculations clarify priority areas for competency evaluation, enabling accurate assessment and quality improvement. The indicator system requires practical validation through future research that includes service recipient perspectives and objective measures for further refinement.

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Author Contributions:
CHEN Cunchuan and ZHANG Huifang conceptualized the study, designed the research, implemented the investigation, and drafted the manuscript. FAN Boyang, SUN Wenning, WANG Yingjie, and ZHANG Ao collected and organized data, performed statistical analysis, and prepared tables and figures. ZHANG Huifang and ZHAO Yang revised the manuscript. WANG Haipeng supervised quality control and review and oversaw the entire research project.

Conflict of Interest Statement:
The authors declare no conflicts of interest.

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