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Development of Evaluation Indicators for Coordinated Regional Health Development: Postprint

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Date: 2023-04-19T11:18:50+00:00

Abstract

Background: Regional health collaborative development, through constructing a rationally structured and functionally positioned regional collaborative entity to provide continuous medical services, by fully implementing resource integration and information sharing, and leveraging the service characteristics and expertise of regional medical centers and community health service centers, can truly achieve the goal of optimizing resource allocation. Existing evaluation indicators for regional health collaborative development are primarily outcome-based, relatively singular, and lack systematicity. Relevant research is needed to fill the gaps in this field.

Objective: This study aims to construct an evaluation index system for regional health collaborative development, providing a scientific basis for assessing regional collaborative development capacity.

Methods: Through research methods such as literature analysis and semi-structured interviews, elements of regional health collaborative development were collected to preliminarily construct an evaluation index system. Subsequently, 19 experts familiar with regional health collaboration in Shanghai (from general practice, medical education, administrative management, and public health management) were selected using stratified sampling as consultation subjects. From December 2020 to March 2021, two rounds of consultation were conducted using the Delphi method, and the Analytic Hierarchy Process was employed to evaluate the weights of indicators at all levels and test the logical consistency of indicators at all levels, ultimately establishing the evaluation index system for regional health collaborative development.

Results: The effective response rates for the two rounds of expert consultation questionnaires were 95.0% and 100.0%, respectively, with expert authority coefficients of 0.87 and 0.92, respectively. The preliminarily constructed regional

health collaborative development index system comprised 4 first-level indicators, 12 second-level indicators, and 31 third-level indicators. The weights of the 4 first-level indicators were 0.387, 0.296, 0.187, and 0.130, respectively. The consistency ratios for indicators at all levels were <0.100.

Conclusion: The preliminarily constructed evaluation index system for regional health collaborative development demonstrates strong scientific rigor and practicality, can identify problems and deficiencies in collaborative models serving community health service centers, and lays a theoretical and practical foundation for guiding regional model practice in subsequent steps.

Full Text

Development of the Coordinated Regional Health Development Assessment System

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Abstract

Background: Coordinated regional health development aims to optimize resource allocation by constructing a well-structured and functional regional collaborative system to provide continuous medical services, leveraging the unique features and strengths of medical centers and community health centers within a region via fully integrating resources and sharing information. However, current available systems for assessing coordinated regional health development mainly focus on outcomes, which are relatively non-diversified and unsystematic, thus further research is required to fill this gap.

Objective: We aimed to construct an evaluation system for coordinated regional health development to provide scientific evidence for evaluating the coordinated development capacities of regions.

Methods: We collected essential factors related to coordinated regional health development through a literature review and semi-structured interviews, and used them to construct a draft version of the Coordinated Regional Health

Development Assessment System (CRHDAS). Then we selected 19 experts who were familiar with coordinated regional health development (engaging in general medicine, medical education, administrative management, and public health management) from Shanghai using stratified sampling to attend two rounds of online combined with offline Delphi questionnaire surveys from December 2020 to March 2021 to determine the weights of the indicators and test the logical consistency of the weights of indicators at each level using Analytic Hierarchy Process. After that, we established the final version of CRHDAS.

Results: The effective response rate and authoritative coefficient were 95.0% and 0.87, respectively, for the first round of survey, and were 100.0% and 0.92, respectively, for the second round of survey. The CRHDAS consists of four first-level indicators (with corresponding weights of 0.387, 0.296, 0.187 and 0.130), 12 second-level indicators, and 31 third-level indicators. The consistency ratios for the weights of three levels of indicators are <0.100.

Conclusion: The CRHDAS is of high-level scientificity and practicality, which can help identify problems and deficiencies of the collaboration mode between community health centers, providing a theoretical and practical basis for guiding coordinated regional health practice in the future.

Keywords: Coordinated regional health development; Community health services; Outcome assessment, health care; Health inequities; Index system

Introduction

Since the reform and opening up, China's medical system has undergone continuous deepening. In this process, researching the positioning of medical institutions at various levels, promoting the implementation of the hierarchical diagnosis and treatment system, fostering rational healthcare-seeking patterns, and advancing the development of China's health undertakings have become key priorities of medical system reform [1]. While Shanghai has been enhancing its chronic disease management and health education capabilities, it has also shifted the focus of its current medical and health system reform to the construction of regional medical centers. As a crucial lever for realizing the hierarchical diagnosis and treatment system, regional medical center construction plays an important and pivotal role in establishing broad coverage of health resources, meeting people's needs for diagnosis and treatment of common and frequently occurring diseases, and improving the medical technology capabilities of primary-level medical and health institutions. In November 2019, the Shanghai Municipal Government issued the "Implementation Opinions on Enhancing Regional Medical Service Capacity and Improving the Hierarchical Diagnosis and Treatment System," launching the first batch of 25 regional medical centers, with an additional 21 centers added by 2021. The goal is to address the contradiction between people's growing medical service demands and the unbalanced and insufficient development of medical resources, promote the scientific

layout and rational utilization of medical resources, and provide higher-quality, higher-level, equalized, and homogenized basic medical service systems for regional populations [2].

Coordinated regional health development refers to the overall planning of medical resources to achieve their optimal utilization within a specific region, coordinating the cooperation and development between regional medical centers and community health service centers. It should include medical collaboration, research cooperation, and talent resource sharing [3-4]. The evaluation of regional medical center construction is a complex process, and a complete set of theoretical research and assessment standards is currently lacking. Existing indicators related to medical center construction can be categorized into several types: evaluation indicators for regional medical quality [5], performance evaluation of medical consortia [6], and medical cost evaluation indicators [7-8]. Upon analysis and comparison, these evaluation indicators are primarily "outcome"-based, lacking research on "structure" and "process" indicators, and have not formed a systematic evaluation indicator system for coordinated regional health development. This study analyzes the construction goals and content of Shanghai's regional medical centers in terms of coordinated regional health development, and uses scientific methods to study the service capacity of regional medical centers. The aim is to construct a systematic, comprehensive, and scientific regional medical center evaluation and construction indicator system oriented toward "public welfare" and "functional positioning," forming a real-time, dynamic evaluation and supervision system for regional medical centers, and providing guidance for the construction of regional medical centers through evaluation-promoted development.

Methods

Literature Review and Semi-Structured Interviews

In August 2021, we conducted a computer-based search of CNKI, VIP, and Wanfang Data using the Chinese search terms "medical consortium," "medical collaboration," "evaluation system," "performance assessment," and "indicator system" to obtain literature related to regional health collaboration, with the search period from January 1, 2010 to May 1, 2021. We reviewed current progress in regional health collaboration, organized evaluation indicator systems, and constructed a theoretical framework pool for the evaluation indicator system. From October 1, 2020 to December 1, 2021, we used semi-structured interviews to select doctors and health policy managers engaged in regional medical center projects to understand their opinions and suggestions on evaluation indicators. Based on these results, we established an indicator system item pool, which was then discussed by the research team to delete and integrate items, preliminarily constructing a coordinated regional health development evaluation indicator system consisting of 4 first-level indicators, 11 second-level indicators, and 32 third-level indicators.

Delphi Method for Indicator System Development

Expert Consultation Questionnaire Design The expert consultation questionnaire included the following sections: (1) Expert background information, including years of practice, highest education level, and professional title. (2) A consultation form for the coordinated regional health development evaluation indicator system, with each indicator evaluated using a 5-point Likert scale and a space for modification comments to allow experts to describe their views and provide suggestions on indicators. (3) Indicator familiarity and scoring basis, with familiarity divided into 6 levels and scoring basis divided into work experience (0.5, 0.4, 0.3), theoretical analysis (0.1, 0.2, 0.3), intuitive feeling (0.1, 0.1, 0.1), and domestic and international literature (0.1, 0.1, 0.1), each categorized into small, medium, and large levels.

Expert Selection We selected experts from Shanghai who were familiar with coordinated regional health development. To ensure comprehensive and broad expertise, the panel included not only general medical experts but also medical education experts, public health management experts, and administrative management experts responsible for general practice-related fields. Selection criteria were: (1) More than 5 years of work experience in health management and some understanding of coordinated regional health development; (2) Bachelor's degree or higher and associate senior professional title or above; (3) Willingness to actively participate based on personal opinions and cooperate to complete the consultation; (4) Deep understanding and comprehension of the consultation content.

Delphi Procedure From December 2020 to March 2021, we conducted two rounds of expert consultation using a modified Delphi method. After questionnaire collection, we analyzed expert opinions and calculated the coefficient of variation (CV), mean importance score, and full-score ratio for each indicator. We used threshold methods to screen indicators, with threshold criteria of mean importance score ≥ 3.50, full-score ratio $\geq 20\%$, and CV ≤ 0.25. After the first round, we combined expert opinions with group discussions to delete and adjust relevant indicator content, provided feedback to experts, and redistributed the revised indicator system for the second round.

Analytic Hierarchy Process for Weight Determination

Based on expert interview results, we divided the average importance scores into basic importance and decision importance. The Analytic Hierarchy Process (AHP) used a 9-point scale to create pairwise comparison matrices. We assigned values to the relative importance of indicator pairs based on decision importance and calculated the consistency ratio (CR) for the pairwise comparison matrices. If CR < 0.100, the consistency of the hierarchical ranking was considered satisfactory. Based on expert consultation results, we first used AHP software to establish a three-level structural model for the coordinated

regional health development evaluation indicator system, then completed the AHP consultation questionnaire design for indicator weighting questions, and finally imported expert scores to calculate weight results.

Statistical Analysis

We used Excel 2016 and SPSS 23.0 software for statistical analysis, with count data expressed as relative numbers. Expert positive coefficient = number of valid Delphi interview results / number of included experts [9]. Expert authority coefficient = (expert's judgment basis + expert's familiarity with the issue) / 2, where judgment basis = theoretical analysis + practical experience + domestic and international references + subjective judgment, and familiarity scores were assigned as: very familiar = 0.9, relatively familiar = 0.7, generally familiar = 0.5, not very familiar = 0.3, unfamiliar = 0.1. We used AHP to determine indicator weights at all levels and test logical consistency, with $P < 0.05$ considered statistically significant.

Results

Expert Panel Characteristics

Among the 20 experts invited, 19 ultimately responded to the survey questionnaires. Among the 19 experts, 10 were male and 9 were female; all had more than 10 years of practice experience; 12 held bachelor's degrees, 4 held master's degrees, and 3 held doctoral degrees; 7 experts were very familiar with the field, and 12 were relatively familiar with the field (Table 1).

Expert Response Rates and Authority

The first round of expert consultation (January 2021) distributed 20 questionnaires, with 19 valid questionnaires returned, yielding an effective response rate of 95.0%. The second round (February–March 2021) distributed 19 questionnaires, with 19 valid questionnaires returned, yielding an effective response rate of 100.0%.

Expert Authority Coefficients

The first round's judgment basis, familiarity, and authority coefficient were 0.84, 0.90, and 0.87, respectively. The second round's judgment basis, familiarity, and authority coefficient were 0.91, 0.93, and 0.92, respectively.

Indicator Modification and Finalization

After the first round of consultation, the mean importance scores for first-level indicators were 4.42–4.84, with CV of 0.08–0.11; for second-level indicators, 4.21–4.95, with CV of 0.05–0.11; and for third-level indicators, 4.11–4.84, with CV of 0.08–0.17. Based on indicator screening criteria, expert consultation,

and research group discussions, we made the following modifications: (1) Added 2 second-level indicators under first-level indicators: "Implementation of integrated specialist-generalist community disease joint diagnosis, treatment, and prevention" and "Establishment of information systems"; no indicators were deleted. (2) Added 7 third-level indicators: "Internet-based medical care," "Coordinated medical service mechanism," "Establishment of imaging diagnosis centers and ECG review centers," "Appointment services for senior hospital experts," "Stakeholder evaluation of two-way referral," "Number of community physicians participating in training," and "Level of community project approval"; no indicators were deleted; 2 indicators were modified: "Expert community visits" was changed to "Experts conducting teaching clinics in community" and "Experts conducting teaching ward rounds and difficult case discussions in community," and "Total regional referral volume" was changed to "Trends in total upward and downward referral volume within the region."

After the second round, the mean importance scores for first-level indicators were 4.60–4.93, with CV of 0.052–0.110; for second-level indicators, 4.13–4.83, with CV of 0.086–0.136; and for third-level indicators, 4.13–4.86, with CV of 0.07–0.24. No further modifications were suggested by experts in the second round.

Final Indicator System

The final coordinated regional health development assessment system consists of 4 first-level indicators, 12 second-level indicators, and 31 third-level indicators. The importance scores, coefficients of variation, weights, and combined weights of the indicator system are shown in Table 2 . The CR values for all levels of indicators were <0.100, indicating reasonable indicator weight settings.

Discussion

Importance and Practicality of the Indicator System

Coordinated regional health development through overall planning can effectively adjust and optimize the structural layout of medical resources. By establishing regulations and systems, different types of medical and health institutions within a region can develop in a differentiated manner with complementary advantages, forming a synergistic mechanism. This provides multi-level quality medical services, facilitates the shift of health promotion work toward primary-level institutions, ensures vertical integration of medical and health resources, and promotes the formation of a hierarchical diagnosis and treatment pattern. Through rational resource allocation, it improves the overall capacity and level of medical health technology services to meet population health needs.

In the process of coordinated development between tertiary hospitals and primary-level medical and health institutions within a region, both parties need a profound understanding of collaborative cooperation, while the effectiveness of synergy depends on the establishment of good collaborative

capabilities [10]. The significance of constructing this evaluation indicator system lies in three aspects: (1) **Summarizing practical experience in coordinated regional health development.** Using the evaluation system can comprehensively and intuitively understand and assess the current status of coordinated development between regional medical centers and community health service centers. Shanghai currently has 46 regional medical centers, each collaborating with community health service centers across different districts of Shanghai, with varying degrees of collaborative development and potentially lacking exchange and communication of collaborative experience. By applying unified evaluation standards, horizontal and vertical comparisons can be made among peer institutions, leading to more rational understanding of coordinated development, thereby standardizing development pathways and truly implementing proper developmental positioning [11]. (2) **Providing evaluation references for relevant administrative departments.** By evaluating the collaborative service capacity of medical and health institutions, those with stronger comprehensive capabilities can be identified for prioritized cultivation and resource allocation [12]. (3) **Deepening practical application of coordinated regional health development.** The process of applying the evaluation system is also a process of summarizing and absorbing collaborative development experience. The obtained experience can be standardized and further applied to revise and improve the evaluation indicator system, enabling both evaluators and evaluatees to identify weak links and advantages in the collaboration process, thereby targeting shortcomings and truly achieving evaluation-promoted construction to deepen practical application.

Analysis of Indicator System Results

Following the basic construction principles of indicator systems and combining them with the target requirements of coordinated regional health development connotation elements, this study referenced three aspects for indicator construction: (1) **Rationality principle.** Starting from the layout of tertiary hospitals supporting communities within the region to ensure clear and rational system design. (2) **Systematic principle.** Coordinated regional health development is based on the development needs of community health service centers, adopting a three-dimensional model for community support. Therefore, this study used the Analytic Hierarchy Process to design the indicator system to ensure a more comprehensive and systematic evaluation system. (3) **Guidance principle.** The evaluation indicator system design should reflect the actual situation of achieving synergistic effects and mutual support to comprehensively enhance collaborative capabilities.

The developed coordinated regional health development assessment system for regional medical centers includes 4 first-level indicators, 12 second-level indicators, and 31 third-level indicators. Among the 4 first-level indicators, “Organizational management implementation” has the highest weight of 0.387, followed by “Regional medical collaboration,” “Research collaboration,” and “Talent cultiva-

tion collaboration," with weights of 0.296, 0.187, and 0.130, respectively. This result indicates that experts unanimously agree that organizational management implementation plays the most critical role in the indicator system. Coordinated regional health development is a consortium constructed by district-level hospitals and communities for common development. Its organizational management differs from that of individual hospitals. Due to the complexity of involved units, the systems related to operation and management affect whether the regional health collaborative system can operate efficiently. Only with collaborative value concepts, filling institutional gaps, and establishing a clear rights and responsibilities benefit distribution mechanism can effective cooperation among individuals within the regional health collaborative system be ensured to achieve a "one plus one greater than two" effect [13]. Some scholars have suggested establishing management departments such as councils and supervisory boards to coordinate internal and external interest relationships, improve the management system of medical consortia, and ensure the effectiveness and fairness of policies within the regional health collaborative system to avoid low efficiency and interest conflicts [14].

Among second-level indicators, "Talent cultivation strategy" has the highest weight, indicating that experts have high expectations for shaping general practice medical talents through multiple channels and levels. Through the talent cultivation collaboration model of regional health, providing support for innovative talent team construction and human resources for primary-level medical and health institutions within the region is an important condition for improving their service capacity. Conducting further study and continuing education within the regional health collaborative system can improve clinicians' diagnosis and treatment levels, reserve professional talents for the regional health collaborative system, and provide human resources support for its sustainable and high-quality development. Among third-level indicators, the weight of further study is slightly higher than that of continuing education and training. Both are important pathways for enhancing the capabilities of primary-level physicians, especially general practitioners. Medical education is lifelong education, and regional health collaborative systems with relatively close geographical locations can reduce the impact of time and space factors and improve the accessibility of further study and continuing education [15-16].

Coordinated regional health development is extremely important for improving regional health service quality, and constructing an evaluation indicator system has certain theoretical and practical significance for guiding coordinated regional health development. The evaluation system constructed in this study covers medical collaboration, research collaboration, talent cultivation collaboration, and other contents, and can be primarily applied as a systematic indicator system for evaluating the current status of coordinated regional health development in Shanghai's regional medical centers.

Author Contributions: SHI Xiaoxiao was responsible for conceptualization, design, and revision of the manuscript, analysis of conclusions, and writing.

ZHANG Qianqian was responsible for feasibility analysis and implementation of the research protocol. JIN Hua was responsible for data collection and organization. SHI Jianwei was responsible for statistical processing. YU Dehua was responsible for supervision and review of the manuscript.

Conflict of Interest: The authors declare no conflict of interest.

References [1] SHI Tailai, YU Dehua. Reflections on the medical technology service capacity of regional medical centers under the background of hierarchical diagnosis and treatment [J]. Soft Science of Health, 2018, 32(9): 6-8, 15. DOI: 10.3969/j.issn.1003-2800.2018.09.002. [2] Shanghai Municipal Health Commission. Service capacity standards for regional medical centers in Shanghai [EB/OL]. [2022-08-23]. http://wsjkw.sh.gov.cn/yzgl3/20191029/, 2019. [3] YU Dehua, GUO Xuan, FU Zhedun, et al. Discussion on three-dimensional coordination model of regional health based on hierarchical diagnosis and treatment [J]. Chinese Hospital Management, 2017, 37(5): 3. [4] YU Dehua, SHI Jianwei, ZHANG Hanzhi, et al. Analysis of breakthrough points for coordinated regional health development in China [J]. Chinese General Practice, 2016, 19(34): 4163-4167. DOI: 10.3969/j.issn.1007-9572.2016.34.003. [5] HE Sichang, ZHAO Daren, SUN Boxing, et al. Effectiveness evaluation of medical consortium based on Topsis method and RSR method [J]. Chinese Hospital Management, 36, 418(5): 5. [6] FANG Pengqian, LIN Zhenwei, CHEN Shiliang, et al. Analysis of comprehensive benefits before and after the reform of core hospitals in medical consortium linkage model: a case study of Wuhan [J]. Chinese Hospitals, 2014, 18(7): 14-16. DOI: 10.3969/j.issn.1671-0592.2014.07.005. [7] GAO Peng, FAN Junhui. Research on effectiveness evaluation of Shanghai regional medical consortium based on TOPSIS-RSR method [J]. Chinese Journal of Medical Management Sciences, 2018, 8(3): 5-10. [8] XU Yinan, XIN Youqing, SHI Peina. Comprehensive evaluation of hospital trusteeship reform effect based on TOPSIS method [J]. Continuing Medical Education, 2018, 32(1): 83-86. [9] YANG Sen, FU Zhili, PAN Ying, et al. Construction and application of competency evaluation index system for general practice team leaders [J]. Chinese General Practice, 2022, 25(7): 874-881, 887. DOI: 10.12114/j.issn.1007-9572.2021.00.305. [10] YE Jiangfeng, JIANG Xue, JING Qi, et al. International comparison of integrated medical service models and its implications [J]. Management Review, 2019, 31(6): 199-212. [11] WANG Miao, YU Guangjun, LIU Haifeng, et al. Research and implementation of regional medical consortium information system based on cloud platform [J]. Chinese Hospitals, 2017, 21(8): 19-23. [12] FU Qiang, ZHANG Yuzheng. Research on construction of regional medical quality management indicator system [J]. Chinese Hospital Management, 2017, 37(1): 42-45, 49. [13] YAO Zhongjin, DONG Yan. Research on interest coordination dilemmas and collaborative governance mechanisms in medical consortium construction [J]. Chinese Hospital Management, 2021, 41(1): 15-18. [14] WANG Xinglin, CAI Hua, YAN Zhuoran, et al. Medical consortium: regional organizational practice under medical resource integration [J]. Modern Hospital Management, 2013, 11(4): 8-10. [15] LIAO Ke, LIU Wanping, PENG Zhanghui, et al. Case analysis of regional medical consortium's promoting effect on con-

tinuing medical education [J]. Medical Education Research and Practice, 2020, 28(4): 5. [16] SHAO Aiyan, ZHOU Meng, MA Meizhen, et al. Practice and exploration of personnel training in primary hospitals under medical consortium model [J]. Health Care Guide, 2020, 19(28): 3.

Received Date: 2022-10-26; **Revised Date:** 2023-04-10
Editor: ZHANG Yali

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

Source: ChinaXiv — Machine translation. Verify with original.