Post-print of a Survey Study on the Status of Community Rehabilitation Service Capacity of Village Doctors in China

Authors: Chen Xiufang, Li Siqing, Hu Dan, Gao Shuhong, Chen Jiaying, Zhang Chaoyang, Shuhong Gao, Chen Jiaying

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Abstract

Background: Village doctors are the most accessible providers of rehabilitation services for chronic disease patients, disabled elderly, and disabled persons in rural areas. With the advancement of the hierarchical medical system policy, the rehabilitation service capacity of village doctors has attracted attention.

Objective: To understand the mastery of community rehabilitation service capacity among village doctors, analyze the deficiencies in their rehabilitation service capacity, and propose strategies for capacity improvement.

Methods: From July to August 2020, using a combination of multi-stage stratified cluster sampling and typical sampling, village doctors from five provinces in the eastern, central, and western regions of China were selected for investigation. The content involved the possession of rehabilitation function assessment and community rehabilitation guidance capabilities among village doctors, as well as the extent to which each capability met work requirements.

Results: A total of 3,916 valid questionnaires were collected. Among the surveyed village doctors, 2,391 (61.1%), 3,704 (94.6%), and 2,365 (60.4%) possessed rehabilitation function assessment capability, community rehabilitation guidance capability, and comprehensive community rehabilitation service capability, respectively. Comparisons of the possession rates of rehabilitation function assessment capability, community rehabilitation guidance capability, and comprehensive community rehabilitation service capability among village doctors in the eastern, central, and western regions showed statistically significant differences ($P<0.001$), with village doctors in the western region having lower possession rates for all capabilities. Comparisons of the possession rates of rehabilitation function assessment capability and comprehensive community rehabilitation service capability among village doctors with different educational back-

grounds and practice qualifications showed statistically significant differences (P<0.05), with village doctors with education below high school/secondary vocational school having higher possession rates, and general practitioners having higher possession rates. The proportions of village doctors reporting the need to provide six service capabilities in daily work were 73.5% (2,880/3,916) for muscle strength grading assessment, 73.8% (2,891/3,916) for motor function assessment, 74.1% (2,900/3,916) for joint mobility assessment, 96.3% (3,773/3,916) for rehabilitation guidance for common disease patients, 95.9% (3,754/3,916) for rehabilitation guidance for chronic disease patients, and 89.1% (3,490/3,916) for rehabilitation guidance for disabled patients. Regarding the extent to which capabilities met work requirements, the proportion of the three rehabilitation function assessment capabilities meeting work requirements did not exceed 75%, while the rates of the three patient rehabilitation guidance capabilities meeting work requirements were 92.4% (3,487/3,916), 91.7% (3,441/3,916), and 85.6% (2,987/3,916), respectively.

Conclusion: The overall possession of community rehabilitation service capabilities among village doctors in China is relatively good, but deficiencies exist in the community rehabilitation service capabilities of village doctors in the western region. The community rehabilitation service capabilities of village doctors can basically meet the needs of villagers, but as a continuous rehabilitation service model where acute phase is in hospitals and recovery phase returns to the community gradually takes shape, rural residents will have higher demands for community rehabilitation services from village doctors. Capacity building strategies such as practical training should be implemented to enhance the rehabilitation service capabilities of village doctors and address capability gaps.

Full Text

Competence of Community-Based Rehabilitative Service among Rural Doctors in China

CHEN Xiufang[1], LI Siqing[2], HU Dan[3], GAO Shuhong[4], *CHEN Jiaying*[1,4], ZHANG Zhaoyang[4]

[1]Kangda College of Nanjing Medical University, Lianyungang 222000, China
[2]School of Continuing Education, Nanjing Medical University, Nanjing 211166, China
[3]School of Health Policy and Management, Nanjing Medical University, Nanjing 211166, China
[4]China Rural Health Association, Beijing 100061, China

Corresponding authors: CHEN Jiaying, Professor/doctoral supervisor; E-mail: jychen@njmu.edu.cn
GAO Shuhong; E-mail: 651774009@qq.com

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Abstract

Background: Rural doctors serve as the most accessible providers of rehabilitative services for patients with chronic diseases, disabled elderly individuals, and people with disabilities in rural areas. With the advancement of tiered diagnosis and treatment policies, the rehabilitative service competence of rural doctors has attracted increasing attention.

Objective: To assess the current state of community-based rehabilitative service competence among rural doctors in China, identify existing deficiencies, and propose strategies for capacity enhancement.

Methods: From July to August 2020, we conducted a survey using multistage stratified cluster sampling combined with purposive sampling to select rural doctors from five provinces across eastern, central, and western China. The survey examined their competence in rehabilitation function assessment, community rehabilitation guidance, and whether these competencies met their actual work requirements.

Results: A total of 3,916 valid questionnaires were collected. Among the respondents, 2,391 (61.1%) possessed rehabilitation function assessment competence, 3,704 (94.6%) possessed community rehabilitation guidance competence, and 2,365 (60.4%) possessed comprehensive community-based rehabilitative service competence. Statistically significant differences were observed across regions ($P<0.001$), with western regions showing the lowest competence rates. Significant differences were also found in rehabilitation function assessment and comprehensive service competence among doctors with different educational backgrounds and practicing qualifications ($P<0.05$). Notably, doctors with high school/technical secondary school education or below demonstrated relatively higher competence rates, as did general practitioners. Regarding service demands in daily practice, 73.5% (2,880/3,916), 73.8% (2,891/3,916), and 74.1% (2,900/3,916) of rural doctors reported needing to provide muscle strength grading assessment, motor function assessment, and joint mobility assessment, respectively. For rehabilitation guidance, 96.3% (3,773/3,916), 95.9% (3,754/3,916), and 89.1% (3,490/3,916) reported needing to provide guidance for patients with common diseases, chronic diseases, and disabilities, respectively. However, the proportion of doctors whose assessment competencies met work requirements did not exceed 75% for any of the three assessment domains. In contrast, the proportions for guidance competencies were 92.4% (3,487/3,916), 91.7% (3,441/3,916), and 85.6% (2,987/3,916), respectively.

Conclusion: The overall community-based rehabilitative service competence

of rural doctors in China is satisfactory, though significant deficiencies exist in western regions. While current competence levels can basically meet villagers' needs, demand will increase substantially as a continuous rehabilitation service model (hospitalization during acute phase and community-based recovery) takes shape. Targeted measures, particularly practical training, should be implemented to enhance the rehabilitative service capacity of rural doctors and address identified gaps.

Keywords: Rural doctor; Community-based rehabilitative service; Rehabilitation function assessing competence; Community rehabilitation guiding competence; Eastern, central and western regions

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Introduction

With economic development, people' s expectations for quality of life have risen progressively. Population aging has intensified, leading to a rapid increase in the number of disabled elderly individuals, which affects their quality of life and demand for care services. Concurrently, changes in disease patterns have resulted in higher prevalence of chronic diseases, with associated pain and functional impairment also impacting patients' quality of life. Consequently, the rehabilitation needs of disabled and semi-disabled elderly individuals, as well as chronic disease patients, have grown rapidly in recent years. Moreover, most rehabilitation services do not require complex technology and can be delivered economically, conveniently, and effectively at primary healthcare institutions.

In 2021, the National Health Commission issued the "Opinions on Accelerating the Development of Rehabilitation Medical Work," advocating for the active development of community-based rehabilitation and supporting primary healthcare institutions in providing rehabilitation services to elderly individuals with disabilities or advanced age, chronic disease patients, and people with severe disabilities. Rural doctors (village doctors) constitute the foundation of China' s rural healthcare service network, bearing the critical responsibility of safeguarding the health of rural residents and serving as important "guardians" of health in rural areas. Due to urbanization and increased migration of rural laborers to cities, most rural areas in China now experience higher aging rates than urban areas, accompanied by higher prevalence of chronic diseases, greater proportions of elderly individuals, and larger numbers of disabled elderly compared to urban regions. Rehabilitation for chronic disease patients, disabled elderly, and people with disabilities in rural areas primarily relies on township and village healthcare workers, with village doctors playing an especially important role due to their accessibility.

This study investigates the current state of community-based rehabilitative service competence among rural doctors in China, analyzes existing deficiencies, and aims to provide references for enhancing the rehabilitative service capacity of the rural doctor workforce.

Methods

1.1 Survey Subjects From July to August 2020, we employed multi-stage stratified cluster sampling combined with purposive sampling. First, based on geographic distribution, we selected six provinces (municipalities) from eastern, central, and western China where tiered diagnosis and treatment had been well implemented and where strategies for enhancing primary care capacity had distinctive features. These included Jiangsu and Zhejiang (eastern region), Anhui and Henan (central region), and Gansu and Chongqing (western region). Due to the COVID-19 pandemic, the survey in Zhejiang could not be conducted, and the sample size in Jiangsu was doubled accordingly. Second, based on urban economic development levels and primary healthcare organization development, we selected two prefecture-level cities from each province: Changzhou, Suzhou, Yancheng, and Xuzhou in Jiangsu; Hefei and Fuyang in Anhui; Kaifeng and Xuchang in Henan; and Baiyin and Dingxi in Gansu. In each selected city, we chose one urban district and one county (city) using the same criteria. All doctors from primary healthcare institutions (community health service centers/stations, township health centers, and village clinics) in these districts and counties were included in the questionnaire survey. This paper focuses on the analysis of village doctors from these sample areas.

Inclusion criteria comprised: (1) all doctors practicing in village clinics, including licensed (assistant) physicians, rural doctors, and newly recruited medical students without practicing qualifications; and (2) individuals whose workplace was in township health centers or community health service centers at the time of the survey but whose practicing qualification was "rural doctor."

1.2 Survey Content and Methods We utilized the "Family Doctor Individual Competence Self-Assessment Questionnaire" developed by our research team based on the previously established "Family Doctor Health Service Competence Indicator System." The questionnaire was distributed to each primary care doctor through the Wenjuanxing platform for self-completion and submission. Prior to the survey, all participants were informed that the data would be used solely for research purposes, would not be linked to individual performance evaluations, and that participation was voluntary and anonymous to ensure objective self-assessment. Survey personnel were responsible for organizing and reviewing returned questionnaires. The study was approved by the Ethics Committee of Nanjing Medical University (Approval No.: 南医大伦审 (2020) 589 号), and all participants provided informed consent.

A total of 4,308 questionnaires were distributed. After excluding 392 from unwilling respondents or invalid submissions, 3,916 valid questionnaires were collected, yielding a valid response rate of 90.90%. The survey collected basic information including age, education level, and practicing qualifications, as well as self-assessed job competencies. This paper focuses on competencies related

to community-based rehabilitative services, including commonly used rehabilitation assessment methods and community rehabilitation guidance. Rehabilitation function assessment competence refers to mastery of knowledge and functional assessment methods commonly used in rehabilitation, including muscle strength grading assessment, motor function assessment, and joint mobility assessment. Community rehabilitation guidance competence primarily includes guidance for patients with common diseases, chronic diseases, and disabilities. In determining whether a rural doctor possessed community-based rehabilitative service competence, we applied the criteria shown in .

1.3 Survey Personnel and Quality Control The survey was conducted in July 2020 by uniformly trained investigators comprising faculty members, graduate students, and undergraduate students from the research team. During the investigation, the research team communicated with health administrative departments in the sample areas to ensure survey support and mobilization. Investigators promptly reviewed collected questionnaires to ensure data consistency, completeness, and logical validity. After data collection, sample verification was performed to guarantee questionnaire quality.

1.4 Statistical Methods Data were analyzed using SPSS 22.0. Categorical data were expressed as relative frequencies, and inter-group comparisons were performed using chi-square tests. Statistical significance was set at $P<0.05$.

Results

2.1 Basic Characteristics of Rural Doctors The survey included 3,916 rural doctors. Age distribution was dominated by the 45-60 age group [2,367/3,916 (60.4%)], with doctors under 30 accounting for only 0.7% (26/3,916). Educational attainment was primarily high school/technical secondary school or below [2,813/3,916 (71.8%)], though the proportion of doctors with college education or above was relatively high in western regions at 37.5% (410/1,094). Regarding practicing qualifications, the majority were rural doctors [2,067/3,916 (52.8%)], followed by licensed (assistant) physicians [1,512/3,916 (38.6%)]. The proportions of licensed (assistant) physicians in eastern, central, and western regions were 56.9% (489/859), 35.9% (705/1,963), and 29.1% (318/1,094), respectively. Statistically significant differences were observed across regions in age, education, and practicing qualifications ($P<0.01$), as shown in .

2.2 Competence in Community-Based Rehabilitative Services The overall competence rates were 61.1% (2,391/3,916) for rehabilitation function assessment, 94.6% (3,704/3,916) for community rehabilitation guidance, and 60.4% (2,365/3,916) for comprehensive community-based rehabilitative service competence. Statistically significant differences existed across eastern, central, and western regions in all three competence domains ($P<0.001$), with western

regions showing the lowest rates. Specifically, western region doctors demonstrated lower competence in rehabilitation function assessment, community rehabilitation guidance, and comprehensive service competence, with rates of 62.7% (1,763/2,813), 61.9% (1,742/2,813), respectively.

Competence rates for specific assessment domains were relatively low, with muscle strength grading, motor function, and joint mobility assessment each reaching only approximately 60%. In contrast, guidance competence for all three patient categories exceeded 80%. For rehabilitation function assessment, central region doctors showed higher competence rates across all three specific assessment items, while western region doctors exhibited lower competence. Regarding community rehabilitation guidance for patients with common diseases and chronic diseases, competence rates exceeded 90% overall, with both eastern and central regions surpassing 95%. Guidance for disabled patients showed a national average competence rate of 83.6% (3,275/3,916), with western region doctors showing a lower rate of 77.9% (852/1,094), as detailed in .

2.3 Competence by Doctor Characteristics The survey revealed statistically significant differences in rehabilitation function assessment competence and comprehensive community rehabilitation service competence among doctors with different educational backgrounds and practicing qualifications ($P<0.05$). Regarding education, doctors with high school/technical secondary school education or below demonstrated higher competence rates in both rehabilitation function assessment and comprehensive service competence. Conversely, doctors with bachelor' s degree or above showed lower competence rates at 54.9% (62/113) and 54.0% (61/113), respectively. In terms of practicing qualifications, general practitioners exhibited relatively higher competence rates in rehabilitation function assessment and comprehensive service competence at 68.9% (208/302) and 68.2% (206/302), respectively. No statistically significant differences were found in community rehabilitation guidance competence across different education levels or practicing qualifications ($P>0.05$), as shown in .

2.4 Service Demands and Competence Adequacy Among the 3,916 surveyed doctors, the proportions reporting need for specific services in daily practice were 73.5% (2,880/3,916) for muscle strength grading assessment, 73.8% (2,891/3,916) for motor function assessment, 74.1% (2,900/3,916) for joint mobility assessment, 96.3% (3,773/3,916) for common disease patient guidance, 95.9% (3,754/3,916) for chronic disease patient guidance, and 89.1% (3,490/3,916) for disabled patient guidance. However, the proportion of doctors whose assessment competencies met work requirements was generally low, with none of the three assessment domains exceeding 75.0%. In contrast, community rehabilitation guidance competencies showed higher adequacy rates, with common disease and chronic disease guidance exceeding 90.0%, while guidance for disabled patients reached 85.6% (2,987/3,490). Eastern and central region doctors achieved over 80.0% adequacy in specific assessment items, while western region rates were below 65.0%. Eastern region doctors demonstrated particularly high adequacy

in guidance competencies, all exceeding 90.0%, as presented in .

Discussion

3.1 Overall Competence of Rural Doctors in Community-Based Rehabilitative Services Complete rehabilitative services typically involve rehabilitation assessment, treatment planning, and guidance provision. Our findings indicate that while rehabilitation function assessment competence among rural doctors is relatively low, community rehabilitation guidance competence is comparatively high. In practice, rehabilitation assessment primarily serves treatment planning and is usually performed by specialists who formulate rehabilitation plans. Rural doctors' roles mainly involve implementing these plans and providing patient guidance, which explains the lower work demands for assessment competence compared to guidance competence. Nevertheless, assessment competence still exceeds the proportion of doctors who report needing it, suggesting it can basically meet villagers' needs.

Significant regional disparities exist, with western regions showing lower competence rates. Interestingly, western regions have a higher proportion of doctors with college education or above, likely due to recent government policy incentives such as targeted free medical education programs and improved compensation for primary healthcare workers, which have attracted more highly educated personnel to western regions. However, these doctors may have insufficient clinical experience due to shorter tenures, resulting in lower service competence. The finding that both competence possession and adequacy rates are lower in western regions indicates that despite improved educational attainment, capacity deficiencies remain prominent.

3.2 Rural Doctors'Competence Basically Meets Villagers'Needs Overall, rural doctors'community-based rehabilitative service competence adequately meets villagers' needs, primarily because guidance competence shows high adequacy rates. This likely reflects the frequent opportunities village doctors have to provide rehabilitation guidance in daily practice. Although assessment competence adequacy is lower than guidance competence, it still exceeds the reported need for such skills, indicating basic adequacy.

Regional variations are evident, with western regions lagging behind. This suggests that capacity-building efforts should focus not only on improving the quality of the primary care workforce but also on strengthening clinical skills training, as basic healthcare services constitute the core of primary care. Therefore, increasing the deployment of high-quality medical talent to village-level institutions must be accompanied by enhanced on-the-job training and improved rehabilitative operation skills to better meet rural residents' community rehabilitation needs.

3.3 High Demand for Community-Based Rehabilitative Services from Rural Residents The survey demonstrates substantial demand for rehabilitative services, with over 70% of doctors reporting need for assessment skills and over 90% reporting need for guidance competencies. As China' s integrated healthcare system develops and tiered diagnosis and treatment advances, a continuous rehabilitation service model featuring hospitalization during acute phases and community-based recovery will gradually emerge, further increasing rural residents' demands for community rehabilitation services.

Our findings also reveal serious aging and quality issues within the rural doctor workforce. Strengthening workforce development is essential to ensure stability and sustainability of service provision. Improving the quality of rural doctors will enhance villagers' trust in village-level health organizations and facilitate the implementation of tiered diagnosis and treatment. To address the high demand for community rehabilitation services, systematic and standardized primary-level rehabilitation service protocols should be designed to ensure service quality, promote node-based rehabilitation management, guarantee service effectiveness, improve patient compliance with community-based rehabilitation, and support tiered diagnosis and treatment.

3.4 Practical Training Facilitates Competence Development The mastery of community-based rehabilitative service competence appears associated with practical experience. The negative correlation between competence and educational level—where doctors with high school/technical secondary school education or below demonstrated better competence—likely reflects that lower-educated doctors are often experienced veterans with more hands-on practice opportunities. While differences across practicing qualifications showed no clear pattern, general practitioners exhibited relatively higher competence rates, suggesting that general practice training benefits primary care capacity development.

To enhance rural doctors' rehabilitative service competence, several measures are recommended. First, newly recruited doctors should receive systematic training in community rehabilitation services, particularly guidance for different health conditions, with emphasis on practical exercises such as appropriate traditional Chinese rehabilitation techniques. Second, given the practical nature of rehabilitation services, operational training should be strengthened through instructional videos, hands-on demonstrations, and specialist guidance at the primary care level. Third, integrated healthcare system mechanisms should be improved to promote collaboration between hospitals and communities, ensuring quality rehabilitation services.

This study comprehensively analyzed the current status, competence possession, and service demands of rural doctors across eastern, central, and western China from the perspectives of rehabilitation function assessment and community rehabilitation guidance. We identified capacity deficiencies and regional disparities and proposed targeted recommendations. While the assessment tool

used has been validated as appropriate for the Chinese context, this study has limitations. First, competence assessment relied on self-evaluation rather than objective measurement through examinations, which may deviate from actual competence levels. Second, the perspective is limited to doctors' self-assessment, whereas the service recipients are rural residents. Future research should incorporate evaluations from the demand side to provide multi-dimensional evidence for capacity improvement.

References

[1] HE Y X, WU Y X, YANG S, et al. A Meta-analysis of disability status among elderly patients with chronic diseases in China[J]. Chinese General Practice, 2025, 28(02): 159-168. DOI: 10.12114/j.issn.1007-9572.2023.0886.

[2] LI X, QIU Z Y, YANG J, et al. Rehabilitation 2030: a call for action to scale up rehabilitation[J]. Chinese Journal of Rehabilitation Theory and Practice, 2017, 23(4): 380-384. DOI: 10.3969/j.issn.1006-9771.2017.04.003.

[3] XU S. International community rehabilitation service status and implications for China' s community rehabilitation development[J]. Disability Research, 2018(4): 86-95. DOI: 10.3969/j.issn.2095-0810.2018.04.016.

[4] XIE K, HU D, PENG L, et al. Current status and improvement strategies for common disease diagnosis and treatment capacity among primary care doctors in Henan Province[J]. Chinese General Practice, 2022, 25(19): 2399-2403, 2413. DOI: 10.12114/j.issn.1007-9572.2022.0140.

[5] ZHENG W, HAN X, LYU Y J. The overall situation and group differences of chronic diseases in China' s population[J]. Social Science Journal, 2022(3): 139-149.

[6] LIAN L, LI X Y, ZOU M R, et al. Construction of a family doctor health service capacity indicator system in China using a modified Delphi method[J]. Chinese Health Resources, 2021, 24(4): 448-452. DOI: 10.13688/j.cnki.chr.2021.200914.

[7] FANG G E. Learning and promoting WHO rehabilitation guidelines to develop China' s rehabilitation medical services[J]. Chinese Journal of Rehabilitation Theory and Practice, 2020, 26(1): 15. DOI: 10.3969/j.issn.1006-9771.2020.01.002.

[8] SUN Z W, XU H D, MENG Y, et al. Study on influencing factors of training effectiveness for rural doctors in Shandong Province[J]. Chinese Rural Health Service Administration, 2022, 42(9): 641-645, 659. DOI: 10.19955/j.cnki.1005-5916.2022.09.007.

[9] LI Y H, HAO T, CHEN L Z. Current status of training programs for targeted free medical undergraduates in rural areas of China[J]. Chinese General Practice,

2018, 21(16): 1989-1992, 1997. DOI: 10.3969/j.issn.1007-9572.2018.16.017.

[10] SONG K M, HAN Z Y, SONG Y, et al. Stability and attraction strategies for rural primary health service personnel: from the perspective of discrete choice experiments[J]. Chinese Health Service Management, 2019, 36(8): 616-619.

[11] ZHANG Z Y. Strengthening systematic matching as the foundation for stability and sustainable development of rural doctor workforce[J]. China Rural Health, 2022, 14(10): 15-17. DOI: 10.3969/j.issn.1674-361X.2022.10.006.

[12] LIAN L, WANG D, CHEN J Y, et al. Current status and countermeasures of community rehabilitation service capacity among primary care doctors in China[J]. Chinese General Practice, 2025, 28(4): 450-456.

[13] JI T. The absence and reconstruction of social trust in the implementation of tiered diagnosis and treatment system[J]. Chinese Medical Ethics, 2021, 34(8): 939-944. DOI: 10.12026/j.issn.1001-8565.2021.08.05.

[14] WANG J B, SHI J H, ZHOU J F, et al. Exploration of community stroke rehabilitation service model construction[J]. Chinese Primary Health Care, 2020, 34(5): 26-30. DOI: 10.3969/j.issn.1001-568X.2020.05.0008.

[15] LIAN L, CHEN J Y, WANG X X, et al. Current status and countermeasures of medical service capacity among primary care doctors in China[J]. Chinese General Practice, 2023, 26(34): 4246-4253. DOI: 10.12114/j.issn.1007-9572.2023.0289.

[16] LIAN Y Y, YU T, LI X H, et al. Discussion on current status and optimization strategies of medical rehabilitation resources in community health service centers[J]. Chinese Journal of Rehabilitation, 2018, 33(1): 85-88. DOI: 10.3870/zgkf.2018.01.026.

[17] LI Y H, XIE K, TANG W W, et al. Current status and countermeasures of common disease diagnosis and treatment capacity among primary care doctors in rural areas of central and western China[J]. Health Economics Research, 2022, 39(6): 38-41. DOI: 10.14055/j.cnki.33-1056/f.2022.06.018.

Author Contributions: CHEN Xiufang and CHEN Jiaying conceived and designed the study, drafted and revised the manuscript. LI Siqing collected and organized data and performed statistical analysis. CHEN Jiaying and HU Dan implemented the study. CHEN Jiaying, GAO Shuhong, and ZHANG Zhaoyang were responsible for quality control, review, and overall supervision.

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