A Qualitative Study of the Rural Hypertension Health Management Model in Shandong Province Based on the ICCC Framework (Postprint)

Authors: Zhang Shuo, Fu Yingjie, Chang Lele, Sun Xiaojie, Sun Xiaojie

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Abstract

Background: The prevalence of hypertension in rural areas of China is extremely severe, making the prevention, control, and management of hypertension in rural areas particularly important. Objective: Based on the Innovative Care for Chronic Conditions Framework (ICCC) proposed by WHO, this study summarizes the characteristics and deficiencies of the rural hypertension health management model in Shandong Province and proposes targeted recommendations. Methods: Using stratified sampling, 9 townships and 36 villages within them were selected from Heze A County, Jinan B District, and Weihai C City in Shandong Province. Semi-structured interviews were conducted face-to-face with a total of 84 individuals, including hypertension management personnel at all levels, medical staff, and hypertension patients. NVivo 12 software was used to code and analyze the interview transcripts around the elements of the macro, meso, and micro levels of the ICCC framework. Results: At the macro level, rural hypertension management in Shandong Province is overall in a positive policy environment, implementing and enforcing national chronic disease-related policies and publicizing chronic disease management; however, prominent issues include an imperfect policy system framework, poor integration within the health system, a shortage of professional hypertension management talent, and inadequate funding support. At the meso level, medical institutions at all levels strive to promote continuity of medical services, but further strengthening is needed in organizing and equipping family doctor teams, as well as promoting and using information systems. At the micro level, the cooperation and enthusiasm of patients, families, and family doctor teams need to be improved. Conclusion: The government should vigorously leverage its leadership and supervisory role, formulate and integrate relevant policies, and promote integration among various departments; increase financial support to address the shortcomings of relative

shortage of health human resources and weak information technology infrastructure in rural areas, thereby promoting high-quality medical services; emphasize tripartite interaction among patients and families, health service teams, and community partners to promote patient self-management.

Full Text

Preamble

Qualitative Research on Rural Hypertension Health Management Models in Shandong Province Based on the ICCC Framework

Zhang Shuo[12], Fu Yingjie[12], Chang Lele[12], Sun Xiaojie[12]*

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1. Centre for Health Management and Policy Research, School of Public Health, Cheeloo College of Medicine, Shandong University, Jinan, Shandong 250012, China
2. NHC Key Lab of Health Economics and Policy Research (Shandong University), Jinan, Shandong 250012, China

Corresponding Author: Sun Xiaojie, Professor, Doctoral Supervisor; E-mail: xiaojiesun@sdu.edu.cn

Abstract

Background: The prevalence of hypertension in rural China is extremely serious, making the prevention and control of hypertension in rural areas particularly important. **Objective:** Based on the Innovative Care for Chronic Conditions Framework (ICCC) proposed by WHO, this study summarizes the characteristics and shortcomings of rural hypertension health management models in Shandong Province and proposes targeted recommendations. **Methods:** Using stratified sampling, we selected 9 towns and 36 villages from A County in Heze, B District in Jinan, and C City in Weihai, Shandong Province. Semi-structured interviews were conducted face-to-face with 84 respondents, including hypertension managers at all levels, medical staff, and hypertensive patients. NVivo 12 software was used to code and analyze interview texts according to the macro, meso, and micro elements of the ICCC framework.

Results: At the macro level, rural hypertension management in Shandong Province generally operates within a positive policy environment, implementing and publicizing national chronic disease policies. However, prominent issues include an incomplete policy framework, poor integration within the health

system, a shortage of hypertension management professionals, and inadequate financial support. At the meso level, medical institutions at all levels strive to promote continuity of care, but further strengthening is needed in organizing and deploying family doctor teams and promoting information system usage. At the micro level, the cooperation and enthusiasm of patients, families, and family doctor teams need improvement.

Conclusion: We recommend strengthening government leadership and supervision to formulate and integrate relevant policies and promote departmental integration; increasing financial support to address shortages in rural health human resources and weak information infrastructure to promote high-quality medical services; and emphasizing the tripartite interaction among patients/families, health service teams, and community partners to promote patient self-management.

Keywords: Innovative Care for Chronic Conditions Framework; Rural; Hypertension health management; Qualitative research

Introduction

Hypertension is one of the most common chronic diseases and a major risk factor for cardiovascular disease [1]. The number of hypertensive patients in China has reached nearly 300 million, with a prevalence rate of 27.5% [2-3] and a rising trend. With the deepening of population aging, more than half of the elderly population now suffers from hypertension, with a prevalence rate of 90% among those over 80 years old. Furthermore, the direct economic burden of hypertension accounts for 6.61% of total health expenditures [4]. Compared to urban areas, rural hypertensive patients have lower overall income, family economic conditions, education levels, health literacy, and access to medical resources [5]. A recent national survey showed that the prevalence of hypertension in rural areas (crude rate 28.8%) is higher than in urban areas (crude rate 26.9%), while the awareness, treatment, and control rates in rural areas are far lower than in urban areas, making the prevention and control of hypertension in rural areas particularly important [6]. Hypertension has brought a heavy disease burden to residents and society, becoming a major public health problem [7], and strengthening government-led hypertension health management is urgent [8]. However, few scholars have used qualitative research methods to deeply explore the characteristics and shortcomings of hypertension health management models in rural areas.

Therefore, understanding the current status of rural hypertension health management and exploring rural hypertension health management models is of great significance for improving the efficiency of rural hypertension health management work.

The World Health Organization (WHO) proposed a model for chronic disease

management and prevention in 2002, namely the Innovative Care for Chronic Conditions Framework (ICCC) [9]. Practice has proven that the ICCC framework is more suitable for analyzing chronic disease prevention and management models in low- and middle-income countries, providing references for solving problems such as fragmented health services, lack of infrastructure, and low resource utilization [10]. Therefore, this study introduces the ICCC framework to analyze rural hypertension health management models in Shandong Province, summarizes the characteristics and shortcomings of rural hypertension prevention and management, and proposes targeted recommendations for improvement.

1.1 Theoretical Foundation

The ICCC framework consists of three levels: creating a positive policy environment (macro level), coordinating healthcare organizations and community organizations (meso level), and prepared, informed, and proactive three parties (micro level). The macro level includes six elements: leadership and advocacy, strengthening intersectoral partnerships, policy integration, financial support, human resource configuration and development, and legislative support. The meso level includes healthcare organizations and community organizations. Healthcare organizations can promote continuous and coordinated services, optimize services through leadership and incentives, organize and equip health service teams, use information systems, and support patient self-management and prevention. Communities can take measures to raise residents' awareness, improve outcomes through leadership and support, organize and coordinate community resources, and provide complementary services. The micro level includes prepared, informed, and proactive patients and families, health service teams, and community partners. The macro, meso, and micro levels coordinate and interact with each other and are inseparable. Only when the three levels are organically combined can each component' s role be maximized and the best chronic disease prevention and management outcomes be achieved (see Figure 1) [Figure 1: see original paper].

1.2 Study Subjects

Based on preliminary literature research and according to socio-economic development levels and geographic distribution, we used stratified sampling to select 9 towns and 36 villages from A County in Heze (western Shandong), B District in Jinan (central Shandong), and C City in Weihai (eastern Shandong). From each county, we selected 1 county CDC, 3 township health centers, and 12 village clinics as sample sites, resulting in a total of 3 county CDCs, 9 township health centers, and 36 village clinics as field survey sites. The fieldwork was completed between June and July 2021.

This study used semi-structured interviews with three types of participants: hypertension managers, medical staff, and hypertensive patients. Hypertension managers included directors of chronic disease departments at county CDCs

and township health centers. Medical staff included doctors engaged in chronic disease prevention and treatment at township health centers and village clinics. Hypertensive patients included those with both ideal and non-ideal blood pressure control (50% each).

1.3.1 Interviews

Following the principle that "sample size depends on information saturation," this study adjusted the sample size in a timely manner based on actual information saturation. A total of 84 participants were interviewed, including 12 hypertension managers, 36 medical staff, and 36 hypertensive patients. Before formal interviews, the researchers conducted pilot interviews with 6 participants (2 from each group). After discussion and repeated revision by research team members, the final interview outline was formed.

The hypertension manager interview outline included five main sections: (1) implementation of hypertension health management promotion measures; (2) interdepartmental partnerships; (3) relevant policies and legislation; (4) funding; and (5) staffing. The medical staff interview outline included three main sections: (1) medical service provision; (2) health service team staffing; and (3) information system usage. The hypertensive patient interview outline included five main sections: (1) health knowledge; (2) health behaviors; (3) family support; (4) family doctor services; and (5) medication adherence.

Interviewers consisted of 6 teachers, master' s students, and doctoral students from the Centre for Health Management and Policy Research at Shandong University, all with extensive interview experience, good communication skills, and systematic training in qualitative research methods. Two additional master' s students served as recorders. Interviews lasted 60-90 minutes. With participants' informed consent, all interviews were audio-recorded, and researchers noted participants' expressions, gestures, and key statements. Within 24 hours after each interview, two recorders independently transcribed and analyzed the recordings; any discrepancies were resolved through discussion. After transcription, all texts were returned to participants for review and confirmation to ensure the authenticity and reliability of the analysis.

1.3.2 Coding

This study used NVivo 12 software (developed by QSR International in Australia) to code and analyze interview transcripts. Considering the complexity of the interview texts, this study employed the "integrated approach" proposed by Miles and Huberman [11], using a combination of deductive and inductive methods for systematic coding and analysis. The coding process was as follows: First, interview documents were divided and categorized according to the three participant groups. Second, based on actual interview content and the macro, meso, and micro levels of the ICCC framework, 13 first-level nodes were identified. Finally, the specific content of first-level nodes was used as reference points.

Through repeated reading and sentence-by-sentence analysis, statements with the same or similar meanings (i.e., reference points) were inductively coded as second-level codes (open coding). More reference points indicated higher frequency of mention and greater attention to that content. Given that qualitative research is heavily influenced by researcher and participant subjectivity, two research team members independently coded the textual data using NVivo 12 and conducted consistency analysis; any differences were resolved through discussion by the coding team. The final analysis yielded 13 first-level nodes and 52 second-level nodes, with a total of 1,304 coding instances (reference points).

1.3.3 Research Ethics

This study was approved by the Medical Ethics Committee of the Centre for Health Management and Policy Research at Shandong University (Approval No.: ECCHMPSDU20210404). Before each interview, interviewers introduced themselves and explained the background, purpose, and main topics of the interview to gain participants' trust. All participants signed informed consent forms.

2.1 Macro Level: Positive Policy Environment

2.1.1 Positive and Proactive Advocacy

Advocacy and health education activities can effectively raise public awareness of chronic disease prevention and control. Qualitative interviews revealed that all study areas, under government leadership, implemented multiple measures to publicize hypertension health knowledge. Specifically, 20.51% of areas regularly held hypertension health lectures and played educational videos, while 23.08% produced hypertension prevention brochures and bulletin boards. Additionally, one hypertension manager in Area B specifically mentioned, "We also regularly hold Salt Reduction and Hypertension Prevention Awareness Day events." However, 51.28% of hypertension managers reported that these measures were not very effective due to rural elderly being illiterate, hard of hearing, or unable to understand the content, and that advocacy efforts were insufficient and merely formalistic (see Table 1).

2.1.2 Strengthening Intersectoral Partnerships

Strong partnerships among government departments have the potential to influence chronic diseases. Regarding intersectoral partnerships, 28.85% of areas reported relatively close connections between the health system and other social departments such as housing construction bureaus, schools, and market supervision bureaus. For example, the CDC in Area B collaborated with the housing construction bureau to plan a "Healthy Walking Street," the CDC in Area A worked with schools on a "Little Hands Pulling Big Hands" program, and the CDC in Area C partnered with the market supervision bureau on "Salt Reduction and Hypertension Prevention in Restaurants" campaigns. However, 71.16%

of hypertension managers stated that there were few connections within the health system itself, particularly lacking top-level design for medical-preventive integration. As one hypertension manager in Area C noted, "No department provides guidance on how to integrate. Medical care is still handled by hospitals, and prevention is still handled by the CDC."

2.1.3 Policy Integration and Legislation

The ICCC framework indicates that policies can protect the rights of chronic disease patients to some extent, and that integrating chronic disease policies can effectively reduce overlaps in the health system. Regarding policies, all areas conducted hypertension management work guided by the national "Hypertension Health Management Service Standards." Areas B and C also developed local policies such as "Chronic Disease Prevention and Control Plans." However, 59.09% of hypertension managers reported that there were few policies and legislation specifically targeting rural hypertension prevention and management, and that existing policies were not yet integrated. As one hypertension manager in Area C mentioned, "The total pool of basic public health funds is fixed, and some money must be given to village doctors. But some village doctors are very old with poor eyesight and can' t perform their duties. How can we give them money? This is like two policies conflicting—one emphasizes that this money must go to village doctors, while the other can' t assess their work."

2.1.4 Financial Support

The ICCC framework states that financing should be an important means to encourage strategic implementation. Regarding financial support, hypertension and other chronic disease management funds only come from basic public health funds, representing a single source. Additionally, 47.54% of hypertension managers reported issues with insufficient funding amounts, delayed disbursement, and lack of dedicated use. As one hypertension manager in Area A noted, "Chronic disease funds only come from basic public health funds, with almost no other sources, and no special funds for hypertension." A manager in Area C stated, "The funding is still relatively small, and sometimes it can' t arrive on time." Notably, hypertension managers in both Areas B and C reported that although the COVID-19 pandemic in 2020 had some impact on hypertension management work, the state did not reduce basic public health fund disbursements, and no region reduced the proportion of hypertension management funds.

2.1.5 Staffing and Development

Educating chronic disease management personnel can effectively advance healthcare work. Qualitative interviews revealed that although 46.58% of hypertension managers reported that their areas regularly provided guidance and training to relevant personnel, training effectiveness and assessment results were poor. Regarding human resource allocation, 53.43% of hypertension managers reported

issues such as low education levels, old age, weak capabilities among current staff, and a shortage of high-level professionals. Regarding staffing during the COVID-19 pandemic, one hypertension manager in Area B mentioned, "We were already short-staffed, and when the pandemic came, we had to allocate some people to pandemic control work." Meanwhile, a manager in Area C also noted, "Now with pandemic prevention and control, chronic disease management is even more understaffed."

Table 1 Interview Text Data Information of Macro Level

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
Positive and Proactive Advocacy	Conduct hypertension health lectures, play educational videos		
	Produce hypertension prevention brochures and bulletin boards		
	Regularly hold Salt Reduction and Hypertension Prevention Awareness Day events (Area B)		
	Advocacy measures have poor effectiveness		
	Advocacy efforts are insufficient and merely formalistic		
Strengthening Intersectoral Partnerships	Collaborate with housing construction bureau to plan "Healthy Walking Street" (Area B)		

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
	Collaborate with schools on "Little Hands Pulling Big Hands" program (Area A)		
	Partner with market supervision bureau on "Salt Reduction and Hypertension Prevention in Restaurants" (Area C)		
	Few connections within the health system		
	Lack of top-level design, poor medical-preventive integration		
Policy Integration and Legislation	Work guided by national "Hypertension Health Management Service Standards"		
	Develop local policies such as "Chronic Disease Prevention and Control Plans" (Areas B and C)		
	Lack of policies and legislation targeting rural areas		

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
	Hypertension-related policies not yet organically integrated		
Financial Support	Hypertension-related funds come from basic public health funds		
	Single source of hypertension funds		
	Insufficient hypertension funds, no special funds for hypertension management		
	Delayed funding disbursement, no dedicated use		
Staffing and Development	Regular guidance and training for hypertension management personnel		
	Poor training effectiveness and assessment results		
	Current staff have low education, old age, and weak capabilities		
	Shortage of high-level professionals		

*Number of interview materials containing this node; **Percentage of second-

level nodes within first-level nodes.

2.2 Meso Level: Coordinated Healthcare Organizations

2.2.1 Promoting Continuous and Coordinated Services

Healthcare institutions at all levels need to consider the entire disease course of chronic disease patients and provide continuous and coordinated services. In addition to providing basic diagnosis and treatment services, healthcare institutions in all study areas conducted follow-ups for hypertensive patients an average of twice per quarter, with good implementation. Regarding referrals, most areas provided two-way referrals, but 23.08% of medical staff reported difficulties with referrals. As one medical staff member in Area A noted, "Referrals are quite difficult because of competition for patient sources. Lower-level hospitals don' t want to refer patients upward after admitting them, and higher-level hospitals don' t want to refer them downward."

Leveraging medical alliances for hypertension management can effectively provide coordinated medical services. Interviews revealed that only 11.24% of areas used medical alliances to conduct hypertension management work. As one medical staff member in Area B mentioned, "Medical alliance work is being promoted, not just empty talk. Higher-level medical institutions can indeed provide some support to lower-level institutions." However, medical alliance work in most areas remained at the policy issuance stage. As one medical staff member in Area C stated, "Our area just has the name of a medical alliance but doesn' t do practical work. The national policy is a good policy, but it doesn' t mean much to us." Meanwhile, a medical staff member in Area A also noted, "Medical alliances haven' t been well implemented because professional knowledge and techniques require guidance from higher-level professionals, but no one comes."

2.2.2 Optimizing Services Through Leadership and Incentives

In rural areas, county-level medical institutions mainly play a leadership and supervision role. For example, the CDC in Area C quarterly reviewed follow-up reports (10 cases) and questioned patients to verify follow-up rates. However, 66.07% of medical staff reported that current staff enthusiasm was poor, hospitals lacked relevant incentive mechanisms, and leadership and supervision from higher authorities needed strengthening. As one medical staff member in Area C mentioned, "Currently there are no incentive measures, let alone an incentive mechanism. Everyone is almost unwilling to continue this work."

2.2.3 Organizing and Equipping Health Service Teams

The ICCC framework holds that managing chronic diseases requires health service teams to have appropriate materials, medical equipment, professional knowledge, and skills. The health service teams in the study areas mainly referred to family doctor teams, composed of physicians, nurses, and public health per-

sonnel, with few general practitioners participating. Teams were assigned to different areas based on village population. Regarding family doctor teams, one medical staff member in Area A stated, "Family doctors are not just nominal. They can oversee public health projects and go to the grassroots level to hold health lectures." However, 75% of medical staff reported that family doctors remained only at the policy level, with their work merely to cope with higher-level inspections. The shortage of specialists and high-level personnel, poor collaboration, and lack of economic incentives resulted in low operational efficiency and low contract rates for family doctor teams, which currently cannot match the advanced models of foreign family doctors.

2.2.4 Using Information Systems

Medical information systems play a supportive role in hypertension management and serve as an auxiliary tool for doctors to conduct follow-ups and management. Regarding information system usage, only 29.46% of areas used information systems for diagnosis and treatment. As one medical staff member in Area B stated, "The information system has reduced some of our pressure. We can see patients' health records upon login, and our hospital is also developing telemedicine." However, 70.53% of areas had not yet achieved information connectivity due to limitations in human, financial, and material resources. As one medical staff member in Area A noted, "The information system is not yet perfect. Doctors cannot see patients' information and medical records, and hospitals cannot see each other' s patient information." A medical staff member in Area C also mentioned, "Village doctors are very old and don' t know how to use mobile phones or computers, making it impossible to promote information systems."

2.2.5 Supporting Patient Self-Management and Prevention

To guide hypertensive patients to actively engage in prevention and self-management, the vast majority of study areas distributed "oil-limiting pots" and "salt-limiting spoons" to residents and urged hypertensive patients to regularly measure blood pressure and take antihypertensive medication. However, 50.33% of medical staff reported that these measures were poorly effective due to low education levels and weak chronic disease prevention awareness among rural elderly hypertensive patients.

Table 2 Interview Text Data Information of Meso Level

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
Promoting Continuous and Coordinated Services	Conduct follow-ups for hypertensive patients quarterly		

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
	Provide two-way referral services		
	Use medical alliances for hypertension management (Area B)		
	Patient source competition prevents effective referral implementation		
	Medical alliance work remains only at policy issuance stage		
Optimizing Services Through Leadership and Incentives	County-level medical institutions play leadership and supervision role		
	Leadership and supervision need strengthening		
	Poor staff enthusiasm, lack of incentive mechanisms		
Organizing and Equipping Health Service Teams	Family doctors conduct grassroots lectures (Area A)		
	Lack of economic incentives, few general practitioners		
	Low family doctor contract rates, remains at policy level		

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
Using Information Systems	Can view residents' health records (Area B)		
	Developing telemedicine (Area B)		
	Not yet fully achieved information connectivity		
	Difficulties using information systems due to human/financial/material constraints		
Supporting Patient Self-Management and Prevention	Distribute "oil-limiting pots" and "salt-limiting spoons"		
	Doctors urge regular blood pressure measurement		
	Doctors remind patients to take medication		
	Low education levels reduce intervention effectiveness		
	Poor patient prevention awareness and self-management ability		

*Number of interview materials containing this node; **Percentage of second-level nodes within first-level nodes.

2.3 Micro Level: Prepared, Informed, and Proactive Three Parties

In the ICCC framework, the micro level involves the joint action of patients and families, health service teams, and community partners. This tripartite partnership is unique to chronic disease care. Only when patients and families, health service teams, and community partners are prepared, informed, proactive, and work together can good outcomes be achieved (see Table 3).

Regarding hypertensive patients, the vast majority in the study areas were aware of their condition and actively sought treatment, but only 5% mentioned having a blood pressure monitor at home. However, 46% of village doctors reported that some elderly hypertensive patients were difficult to change in terms of thinking and behavior, had weak self-management abilities, and commonly exhibited non-adherence to medical advice and poor medication compliance. As one village doctor in Area A noted, "Some villagers don' t listen to us. We ask them to come for blood pressure measurement, but they don' t come. We ask them to take medication, but they don' t take it properly." One elderly hypertensive patient in Area B stated, "I think when I have a headache, my blood pressure is high, so I take medicine. When I don' t feel uncomfortable, I don' t take it." Another patient even said, "I never measure my blood pressure, and I don' t even know I have hypertension."

Regarding patient families, 21.5% of patients mentioned that due to children working away from home long-term or spouse death, family members could not provide direct support and help, resulting in less family care. Regarding family doctor teams, 48.75% of village doctors mentioned that rural health human resources were insufficient to achieve one-on-one contract management. As many as 51.25% of patients mentioned, "I don' t know what a family doctor is." Community partners in the ICCC framework are groups of non-professionals in the community that can provide complementary services. However, almost all village doctors in the study areas reported that since most young people in rural areas work away from home long-term and elderly people have declining physical function and reduced labor capacity, they cannot form groups, and community partners have not yet played a role in rural areas.

Table 3 Interview Text Data Information of Micro Level

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
Prepared, Informed, and Proactive Patients and Families	Patients are aware of their condition		
	Patients actively seek treatment		

First-Level Node	Second-Level Node	Reference Points* (n)	Proportion** (%)
	Patients have blood pressure monitors at home		
	Elderly hypertensive patients difficult to change in thinking and behavior		
	Poor patient self-management and medication compliance		
	Insufficient family support for patients		
Prepared, Informed, and Proactive Health Service Teams	Patients don’ t understand family doctors		
	Insufficient health human resources for one-on-one contract management		
Prepared, Informed, and Proactive Community Partners	Young people work away from home, no community partners/groups		
	Community partners have not yet played a role in rural areas		

*Number of interview materials containing this node; **Percentage of second-level nodes within first-level nodes.

3 Discussion and Recommendations

The ICCC framework is a triadic system composed of policy environment, healthcare institutions and communities, and patients and families. Its guiding principles are "evidence-based decision-making, population focus, prevention focus, quality focus, integration, and flexibility and adaptability," which are basically consistent with the principles of "coordinated planning, joint construction and sharing, prevention first, and classified guidance" proposed in China' s "Medium and Long-Term Plan for Chronic Disease Prevention and Treatment (2017-2025)." Moreover, the macro, meso, and micro levels of the ICCC framework also align with China' s comprehensive chronic disease prevention and treatment mechanism of "government leadership, departmental collaboration, social mobilization, and public participation." Additionally, research by Wang Lu et al. [12] has shown that the ICCC framework is more suitable for analyzing chronic disease prevention and management models in low- and middle-income countries. Therefore, using the ICCC framework to analyze rural hypertension health management models in China is appropriate and significant.

3.1 Macro Level

At the macro level, although rural hypertension health management has a relatively positive policy environment, many deficiencies remain. Due to limited knowledge levels among rural elderly, promotional activities such as hypertension health lectures have poor effectiveness. Connections within the health system are relatively loose, especially regarding medical-preventive integration, which differs from the findings of Yuan Shasha et al. [13], possibly due to regional differences in sampling. Policies and legislation can protect the rights of chronic disease patients to some extent, and educating chronic disease management personnel can effectively advance healthcare work [14]. However, rural hypertension management currently faces problems such as an incomplete policy framework, single and insufficient funding sources, and a shortage of professional talent [15], seriously hindering the development and progress of rural chronic disease management.

Therefore, this study recommends: First, strengthen leadership and supervision from higher authorities, encouraging leaders and decision-makers to understand and develop effective strategies and models for managing chronic diseases like hypertension. Second, implement hypertension prevention knowledge promotion using special methods tailored to rural hypertensive patients, especially elderly patients, such as distributing brochures door-to-door with one-on-one explanations for villagers, and distributing salt-limiting spoons and oil-limiting pots door-to-door with demonstrations of how to use them. Third, improve top-level policy design, strengthen partnerships within and outside the health system, formulate relevant policies to guide "how to integrate medical care and prevention," and integrate existing policies to reduce overlaps in the health system. Finally, increase funding for chronic diseases, provide professional training for

hypertension management staff, and introduce high-quality professional talent to improve the efficiency of hypertension management.

3.2 Meso Level

At the meso level, healthcare institutions in the study areas could adopt measures such as follow-ups to promote continuity and coordination of medical services. However, most areas still had problems such as unimplemented two-way referrals, lack of incentive mechanisms, and shortage of family doctor teams, consistent with the findings of Xu Jialin et al. [10]. Hypertension health management under the medical alliance model can integrate medical institutions and doctors at all levels to provide continuous, efficient, and high-quality services for hypertensive patients. However, most areas did not fully utilize medical alliances for hypertension management work, and information connectivity had not yet been achieved [15], reducing the quality and effectiveness of medical services.

Therefore, this study recommends: First, use medical alliances and information system construction to carry out follow-ups, referrals, remote consultations, and other services to promote continuous and coordinated medical services. Second, establish scientific and comprehensive assessment and reward-punishment systems, regularly train and assess medical staff to promote high-quality medical services. Finally, learn from advanced foreign family doctor models, increase the number of general practitioners, strengthen family doctor promotion, and further improve family doctor awareness and contract rates.

3.3 Micro Level

At the micro level, although most hypertensive patients and their families were aware of the disease, due to low education levels among rural elderly hypertensive patients and difficulty changing their thinking and behavior, patient self-management effectiveness was poor, and problems such as non-adherence to medical advice and poor medication compliance were widespread. Lower socioeconomic status and lack of knowledge about hypertension and disease management are closely related to poor medication compliance [16]. Meanwhile, due to low education and professional levels, high work pressure, and low social recognition of family doctors in rural areas [17], family doctor team contract rates are directly affected. Patient self-management capabilities and the roles of family doctor teams and community partners need further strengthening.

Therefore, this study recommends: First, use family doctor teams and community partners combined with the Internet to conduct real-time supervision and management of patients, urging them to regularly measure blood pressure and take medication as prescribed to improve medication compliance and enthusiasm. Second, provide one-on-one hypertension health education for hypertensive patients to strengthen their self-management capabilities, promote informed

and proactive patients and families, and facilitate efficient hypertension management.

In summary, hypertension management faces many challenges in reality. Only by organically combining the macro, meso, and micro levels can the roles of various elements in hypertension health management be maximized. Through in-depth interviews with hypertension managers at all levels, medical staff, and hypertensive patients, and using the ICCC framework to analyze the current status of rural hypertension health management models, this study further enriches existing research findings. However, this study has some limitations: First, all participants were from Shandong Province, with a relatively small sample size and limited coverage, which may not represent the overall situation of rural hypertension health management nationwide. Second, qualitative research methods cannot fully reveal causal relationships in relevant phenomena, and the generalizability of findings may be somewhat limited. Therefore, future studies should expand sample sizes and coverage areas and combine qualitative and quantitative research to further improve rural hypertension health management models in China.

4 Author Contributions

Zhang Shuo and Sun Xiaojie conceived and designed the study. Zhang Shuo drafted and revised the manuscript. Zhang Shuo, Fu Yingjie, Chang Lele, and Sun Xiaojie collected data. Zhang Shuo and Fu Yingjie organized and analyzed data. Sun Xiaojie provided quality control and final approval and takes overall responsibility for the manuscript.

5 Conflict of Interest

The authors declare no conflict of interest.

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