Postprint: Reflections and Strategies for Full-Cycle Stroke Rehabilitation

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Abstract

Post-stroke patients often retain varying degrees of functional impairment. During the transition from medical institutions back to community and home settings, coordination and interaction among medical institutions at all levels, along with vertical referral mechanisms, are essential to establish an effective closed-loop system for full-cycle rehabilitation. Currently, the practical implementation of full-cycle stroke rehabilitation is gradually advancing, though certain obstacles persist. Based on the concept of full-cycle stroke rehabilitation and the current development status of community-based stroke rehabilitation, this article examines the development of the community rehabilitation component within the full-cycle framework. It emphasizes the significance of "community inflection point rehabilitation" and the necessity of establishing standards for grassroots community rehabilitation, highlights the importance of addressing all stages of the full-cycle rehabilitation process for stroke patients, explores development strategies for grassroots community rehabilitation, and aims to effectively improve the quality of life for stroke patients in community and home environments.

Full Text

Reflections and Strategies for Full-Cycle Stroke Rehabilitation

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Abstract

Post-stroke patients are often left with varying degrees of functional impairment. During their transition from medical institutions back to community and home settings, coordinated interaction and vertical referral among healthcare institutions at all levels are essential to form a robust full-cycle rehabilitation closed loop. While the implementation of full-cycle stroke rehabilitation is gradually advancing in practice, several obstacles remain. Based on the concept of full-cycle stroke rehabilitation and the current development status of community-based stroke rehabilitation, this article reflects on the development of the community rehabilitation component within full-cycle stroke rehabilitation. It emphasizes the significance of "community-based inflection-point rehabilitation" and the necessity of establishing community rehabilitation standards, highlights the importance of addressing all stages of the stroke rehabilitation cycle, explores development strategies for community-based rehabilitation, and aims to effectively improve the quality of life for stroke patients in community and home settings.

Keywords: Stroke; Full-cycle rehabilitation; Community-based rehabilitation; Rehabilitation standards

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Stroke is a cerebrovascular disease that poses a serious threat to human health, representing the leading cause of disability and death among adults in China. Characterized by high incidence, high disability rates, high recurrence, and high mortality, it imposes a heavy economic burden on families and society. The World Stroke Organization' s (WSO) *Global Stroke Fact Sheet 2022* notes that global population aging trends demand higher standards for stroke prevention, treatment, and rehabilitation, necessitating the exploration and implementation of effective medical intervention strategies. To further improve cerebrovascular disease prevention and treatment capabilities, China is gradually establishing a comprehensive, full-cycle rehabilitation medical service system, with particular emphasis on strengthening rehabilitation capacity at primary-level medical institutions and continuously innovating rehabilitation medical models. This article begins with the foundation of the full-cycle stroke rehabilitation system, briefly describes its practical application, and proposes feasible strategies for implementing full-cycle stroke rehabilitation in communities by integrating the current status of community-based stroke rehabilitation. The aim is to standardize stroke rehabilitation diagnosis and treatment services and provide a basis for the high-quality development of community-based stroke rehabilitation.

1.1 Epidemiological Overview of Stroke

Stroke is an acute cerebrovascular disease caused by sudden rupture or blockage of cerebral blood vessels leading to brain tissue damage, with clinical symptoms lasting more than 24 hours or resulting in death. Stroke survivors often experience varying degrees of functional impairment that limits their normal daily activities and reduces quality of life. Globally, stroke incidence among young and middle-aged populations (age <55 years) is rising. Research reports predict that stroke, as the second leading cause of death worldwide, will impose an increasing burden on population health and socioeconomic development between 2020 and 2050, particularly affecting low- and middle-income countries. As population aging continues to advance in China, the number of stroke survivors now ranks highest in the world. Therefore, implementing effective rehabilitation strategies is crucial for promoting functional recovery and achieving independence in daily life among stroke patients, which is essential for reducing the overall disease burden.

1.2 The Importance of Stroke Rehabilitation

Due to the complex and long-term nature of post-stroke sequelae, rehabilitation is a lifelong endeavor for stroke patients requiring multidisciplinary involvement across physical therapy, occupational therapy, speech therapy, and other domains. Developed countries and regions in Europe and America have long histories of rehabilitation medicine development, relatively complete supporting facilities, and have established distinctive rehabilitation service systems that provide high-quality rehabilitation services for stroke patients. However, rehabilitation medicine in China remains in its early stages, with considerable room for improvement in service systems, institutional frameworks, and resource optimization, while actively learning from international development experiences. In recent years, the Chinese government has issued important documents such as the *Notice on Accelerating the Development of Rehabilitation Medical Work* and the *Healthy China Action—Implementation Plan for Cardiovascular and Cerebrovascular Disease Prevention and Treatment (2023-2030)* to accelerate the overall development of rehabilitation medicine, creating opportunities to break through bottlenecks in stroke rehabilitation. The *"Healthy China 2030" Planning Outline* specifically states that to achieve health management for chronic diseases across all populations and throughout the entire life cycle, both prevention and rehabilitation are indispensable. This demonstrates that China' s stroke rehabilitation model is exploring a new development path centered on the "whole-person" concept.

2.1 The Connotation of Full-Cycle Stroke Rehabilitation

The quality-of-life issues resulting from varying degrees of functional impairment among stroke survivors can be effectively addressed through a full-cycle stroke rehabilitation model. Full-cycle stroke rehabilitation should be understood from four dimensions: disease cycle, graded diagnosis and treatment cycle, participant

cycle, and regional cycle. The disease cycle refers to implementing targeted rehabilitation interventions based on the changing characteristics of functional impairments at different stages of disease occurrence and development. The graded diagnosis and treatment cycle involves continuous rehabilitation management across different levels, from tertiary medical institutions to community health service centers and home settings. The participant cycle entails a team rehabilitation model requiring full or partial participation from medical workers, patients, family members, and social workers. The regional cycle emphasizes adapting the aforementioned full-cycle models to local conditions to form regionally appropriate full-cycle rehabilitation promotion and application models. Full-cycle stroke rehabilitation focuses on functional impairments caused by stroke and implements comprehensive, whole-process rehabilitation interventions according to disease, personnel, institutional, and regional characteristics, providing constructive recommendations for improving stroke diagnosis, treatment, and rehabilitation levels while alleviating regional disparities in medical resources [Figure 1: see original paper].

2.1.1 Disease Full-Cycle International consensus suggests that defining terms such as "acute," "subacute," and "chronic" is essential for identifying optimal intervention periods for stroke patients. The disease full-cycle of stroke should begin with the disease itself, grasping the different rehabilitation characteristics and priorities during the hyperacute phase (<24 hours), acute phase (1-7 days), subacute phase (>7 days to 6 months), and chronic phase (>6 months) to form a comprehensive full-cycle diagnosis and treatment model. The hyperacute phase focuses on stabilizing vital signs and monitoring disease progression, with no international consensus yet on rehabilitation intervention during this period. Acute phase rehabilitation requires rehabilitation education such as proper limb positioning based on current functional impairments, emphasizes strengthening cardiopulmonary fitness, and prepares physical reserves for further rehabilitation training. These elements can be incorporated into early preventive rehabilitation processes, and establishing a sound early preventive rehabilitation system will become a key influencing factor for functional recovery in the subacute phase and lay a solid foundation for the chronic phase when patients transition to community and home rehabilitation.

2.1.2 Graded Diagnosis and Treatment Full-Cycle The graded diagnosis and treatment full-cycle for stroke requires constructing a collaborative "tertiary hospital-community-home" model with clear division of labor and close connections, creating an effect of "upward referral and downward implementation to households."This emphasizes the extension role of community rehabilitation and other primary-level medical services to truly deliver stroke rehabilitation services to the grassroots level. Australia' s graded diagnosis and treatment model provides a useful reference, where general practitioners serve as "gatekeepers"in the referral process, issuing referral letters with personal certification to transfer patients to higher-level tertiary hospitals for medical services. Similarly, tertiary

hospitals refer patients downward based on treatment progress, transferring them back to general practitioners for post-acute rehabilitation. This model is widely implemented in Australia and represents a common working pattern. However, primary-level rehabilitation medicine is a weak link in China's medical service system, and the construction and development of primary-level rehabilitation medicine must be incorporated into healthcare reform plans, with key focus on developing community rehabilitation and constructing a sound graded medical system and two-way referral system.

2.1.3 Participant Full-Cycle The participant full-cycle for stroke requires establishing a "clinical-rehabilitation-nursing" integrated work model. Since 2014, some regions have promoted graded diagnosis and treatment with chronic diseases as the breakthrough point, implementing family doctor contract services at the primary level and exploring a "1+1+N" three-division co-management graded diagnosis and treatment model combining hospital specialists, primary general practitioners, and health managers. Building on existing management policies, a "1+2+N" full-cycle rehabilitation model can be explored: one tertiary hospital as the leader, closely connecting with two communities within the district, and radiating downward to N households in the district, utilizing intelligent and information technology to provide continuous health management services for key populations such as elderly stroke patients. Within tertiary hospitals, a clinical-rehabilitation-nursing integration model should be established by building rehabilitation medical teams. It is recommended that these teams include one rehabilitation physician, 5-7 rehabilitation therapists (including physical, occupational, and speech therapists, plus 1-2 traditional Chinese medicine rehabilitation practitioners for acupuncture and massage), and several nurses trained in rehabilitation nursing. When extending this model to communities, each community rehabilitation site should be equipped with at least two rehabilitation physicians or general practitioners with rehabilitation qualifications, three professional rehabilitation therapists, and 2-3 rehabilitation nurses. General practitioners are key members of community medical institutions, but due to deficiencies in the education and training system for community general practitioners, most have not received formal systematic rehabilitation training and cannot currently meet the job requirements for rehabilitation physicians.

2.1.4 Different Regional Full-Cycle The different regional full-cycle for stroke aims to emphasize the importance of community radiation rehabilitation benefits in different regions. As a critical inflection point in the stroke rehabilitation process, communities must undertake the core work of "upward referral and downward implementation to households"to promote continuous patient rehabilitation. Significant regional disparities exist in China regarding the provision of rehabilitation services through community-based equipment, with implementation rates of 91.7% in eastern regions, 53.4% in western regions, and only 37.2% in central regions. Different regions need to develop locally adapted

full-cycle rehabilitation strategies based on varying medical policies. Taking Xiamen, Fujian as an example, since 2014, the city has used chronic diseases as a breakthrough to promote graded diagnosis and treatment, implementing family doctor contract services at the primary level and exploring a "1+1+N" three-division co-management model. This model can be adapted to develop a "1+2+N" full-cycle rehabilitation model based on existing management policies, with one tertiary hospital as the leader, closely connecting with two communities, and radiating downward to N households, fully utilizing intelligent and information technology to provide continuous health management services for key populations such as elderly stroke patients.

2.2.1 Domestic Full-Cycle Rehabilitation Practice Model Example In Zhejiang Province, Professor JIA Jie' s team from Huashan Hospital affiliated with Fudan University pioneered a full-cycle rehabilitation practice model pilot program, implementing stroke full-cycle rehabilitation under a "county medical community model" centered at the Yuhang District Fifth People' s Hospital. Patients undergo comprehensive functional impairment assessment by rehabilitation physicians in the general hospital' s rehabilitation medicine department, which forms the basis for establishing a full-cycle rehabilitation team (including rehabilitation physicians, physical therapists, occupational therapists, acupuncture and massage physicians, rehabilitation nurses, etc.) to develop rehabilitation plans. After a period of inpatient rehabilitation, patients are transferred to the community, where general practitioners review patient history, diagnosis and treatment processes, and previous rehabilitation status through the "county medical community" clinical information platform. They then conduct comprehensive community rehabilitation assessments based on the discharge rehabilitation plan provided by the general hospital, and community rehabilitation therapists implement training adapted to community rehabilitation conditions until patients are ready to return home. The full-cycle rehabilitation team then formulates corresponding environmental modification and home rehabilitation plans, which are communicated to family contract doctors for implementation. Family contract doctors, as the most fundamental role in the "county medical community" led by Yuhang District Fifth People' s Hospital, are responsible for one-on-one personalized prevention, health care, treatment, health education, and supervision and guidance of home rehabilitation training for each household after receiving professional and systematic rehabilitation training.

2.2.2 International Full-Cycle Model Exploration At the 2005 World Health Assembly, WHO explicitly called for the rapid implementation of universal health coverage (UHC) in all countries, aiming to provide affordable and accessible quality medical and health services to all citizens. The key to UHC lies in constructing a complete medical system from hospital to family based on disease progression. The first Stroke Recovery and Rehabilitation Roundtable (SRRR) established a new set of standards for stroke recovery research, which detailed definitions of the stroke recovery timeline and provided a basis for the

functional roles of rehabilitation intervention subjects in different periods, while also proposing a development trend of "interdisciplinary, standardized" training for stroke rehabilitation personnel. Although no internationally defined medical model exists under the "full-cycle" concept, various countries have established healthcare management service systems tailored to their national conditions to ensure the continuity, structure, and standardization of rehabilitation services. Germany utilizes general practitioners or specialists to provide outpatient medical services, referring patients to specialized or general hospitals based on their conditions for connecting medical services. The UK' s healthcare service system is based on regional integration, with clear directional divisions among medical service systems at all levels and general practitioners playing the role of "referral agents." Australia' s medical model is similar to the UK' s, but with broader service scope due to greater variations in general practitioners' working patterns. These international healthcare systems all feature two-way referral models and personnel matching, which, although not explicitly defined as "full-cycle," align with the concept and provide valuable references for China' s full-cycle rehabilitation model development.

3.1 Current Status of Community Rehabilitation

Following the 1978 International Conference on Primary Health Care and the Alma-Ata Declaration, WHO advocated community-based rehabilitation (CBR) as a strategy to improve access to rehabilitation services for people with disabilities by fully utilizing community resources. CBR is a community development strategy that provides rehabilitation, equal opportunities, and social integration for people with disabilities, requiring participation from people with disabilities themselves, their families, communities, and relevant departments and institutions in health, education, vocational, and social services. In recent years, an increasing number of policies have emphasized the importance and necessity of developing community-based rehabilitation medical services, clarifying their objectives. The *Healthy China Action—Implementation Plan for Cardiovascular and Cerebrovascular Disease Prevention and Treatment (2023-2030)* emphasizes strengthening preventive measures and innovating integrated prevention and treatment pathways for cardiovascular and cerebrovascular diseases, encouraging qualified community health service institutions to establish stroke clinics for stroke prevention and rehabilitation management. The *Notice on Accelerating the Development of Rehabilitation Medical Work* explicitly mentions the need to improve primary-level rehabilitation medical capacity, actively develop community and home rehabilitation medical services, and encourage capable institutions to extend institutional rehabilitation services to communities and households through "Internet+" and home bed services.

3.3 Community Rehabilitation Personnel Structure

Community rehabilitation is a crucial link for stroke patients to return to family and society, requiring multidisciplinary team collaboration including rehabili-

tation physicians/general practitioners, rehabilitation therapists (occupational therapists, physical therapists, speech therapists, etc.), nurses, nutritionists, psychologists, and community-related personnel (social workers, caregivers, etc.). China lacks rehabilitation specialists in communities, and general practitioners serve as core members of the community rehabilitation multidisciplinary team. However, barriers remain between general practice and rehabilitation in primary-level rehabilitation services, and standardized rehabilitation training for community general practitioners and other community rehabilitation team members needs to be advanced to form a more complete and professionally competent team.

3.4.1 Community Inflection-Point Rehabilitation

With advances in medical technology, the success rate of stroke emergency treatment has significantly improved, but the disability rate remains above 80%. Patients still require long-term continuous rehabilitation after stabilization and discharge from hospitals. "Community inflection-point rehabilitation" refers to constructing a systematic rehabilitation service flow of "general hospital rehabilitation department or tertiary rehabilitation hospital - secondary hospital rehabilitation department or specialized rehabilitation hospital - community health service center - community health service station - family" based on both large and small three-tier rehabilitation models. This approach strengthens the connecting role of community rehabilitation and forms a continuous, comprehensive full-cycle rehabilitation work model. The community serves as the carrier of the "inflection-point rehabilitation" concept, and the characteristic of stroke "community inflection-point rehabilitation" is extending training into communities and households. From the perspective of rational medical resource allocation, secondary and tertiary medical institutions or rehabilitation hospitals should focus on providing stage-specific rehabilitation treatment for acute or subacute phase patients. As the disease progresses, patients should be gradually referred to community health service centers or stations for rehabilitation, forming a sustainable, virtuous full-cycle rehabilitation intervention that maximizes medical resource utilization. Therefore, developing full-cycle stroke rehabilitation should emphasize the important extension role of primary-level medical and rehabilitation services.

The effectiveness of community rehabilitation implementation directly affects the quality of life for stroke patients after returning to society and family. In the National Key R&D Program "Active Health and Aging-Responsive Technology" special project "Research on Elderly Full-Cycle Rehabilitation Technology System and Information Management," the project team established an intelligent information-based elderly full-cycle rehabilitation technology system centered on stroke. Adopting the principle of "unified standards, unified management," the team developed rehabilitation efficacy evaluation standards and standardized full-cycle clinical-rehabilitation-nursing integration processes for high-risk populations during acute, recovery, and chronic follow-up monitoring

phases. Through three-level promotion and application by participating units, affiliated medical consortia, and communities, the project achieved comprehensive rehabilitation coverage for elderly stroke patients with functional impairments, promoted the establishment of standardized community rehabilitation service processes, and advanced a seamless full-cycle health service system for elderly stroke rehabilitation at the community level.

3.4.2 Establishment of Community Rehabilitation Standards

Standards provide guidance for implementing rehabilitation services and generate corresponding social value through their application. Standardized rehabilitation protocols and service systems help improve medical professionals' expertise, rationally allocate medical resources, reduce medical expenditures, and provide support for referrals between medical institutions at all levels. This holds significant importance for community rehabilitation development, and constructing stroke community rehabilitation standards will help build broader, higher-quality, and more precise primary-level rehabilitation. However, China currently lacks relevant primary-level rehabilitation standards in the stroke field, awaiting attention and effort from rehabilitation professionals. Additionally, community rehabilitation development is influenced by varying regional medical levels and cultural customs, requiring consideration of local humanistic backgrounds when establishing and implementing primary-level rehabilitation standards and services.

The National Key R&D Program "Active Health and Aging-Responsive Technology" special project addresses current pain points and difficulties in primary-level community rehabilitation development. On one hand, community rehabilitation personnel shortages present a challenge. For community rehabilitation physician training, reference can be made to the clinical-to-general practice transition training with additional certification, optimizing community rehabilitation physician cultivation, position training, and practice certification mechanisms. The mismatch between community rehabilitation therapist allocation and primary-level rehabilitation needs requires corresponding policy support. On the other hand, insufficient community rehabilitation supply remains problematic. Beyond inadequate community rehabilitation medical space and beds, there is a need to strengthen rehabilitation equipment provision, particularly intelligent rehabilitation devices that can compensate for community rehabilitation therapist shortages and facilitate the extension of rehabilitation techniques from community to home. Accelerating the development of primary-level community rehabilitation services, optimizing community rehabilitation service policies and supply, and resolving these pain points will facilitate the implementation of specific community rehabilitation strategies.

Modern rehabilitation integrates the comprehensive rehabilitation concept throughout treatment, and community rehabilitation is an inevitable requirement for building a harmonious society. As a vast country with extensive territory, China has a large number of dispersed community rehabilitation

needs for stroke patients across different regions. Therefore, the field of stroke community rehabilitation should continuously build and enrich the community rehabilitation guarantee and service system in the future, including continuously promoting the implementation of standardized community rehabilitation protocols and technologies, facilitating linkage between medical institutions at all levels, strengthening rehabilitation multi-disciplinary and clinical multi-disciplinary collaborative work, and building Internet medical information technology platforms. These efforts will gradually achieve intelligent, information-based, structured, and traceable management of community rehabilitation, while also addressing talent development, science popularization, and legal system guarantees, striving to achieve theoretical and technological innovation and form an independent structural system that opens up higher application realms for full-cycle rehabilitation at the community level.

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