Advances in Health Management Strategies for Cognitive Function in Community-Dwelling Populations with Mild Cognitive Impairment: A Postprint

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Abstract

As the primary care setting for mild cognitive impairment (MCI), community primary healthcare institutions are essential for implementing cognitive health management for MCI populations. Currently, there is a lack of specific procedures and protocols for MCI cognitive health management in community settings. This article, based on the "Structure-Process-Outcome"three-dimensional quality structure theoretical model, reviews community MCI cognitive health management strategies from three dimensions: functional departments and organizational structure (Structure), health management programs (Process), and outcome evaluation systems and methods (Outcome), aiming to provide support and reference for the implementation of standardized and proceduralized MCI cognitive health management practices in Chinese communities.

Full Text

Preamble

Review and Monograph

Advances in Community Cognitive Function Health Management Strategies for Individuals with Mild Cognitive Impairment

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Abstract As the primary treatment setting for mild cognitive impairment (MCI), community primary medical institutions must implement cognitive function health management for the MCI population. Currently, communities lack specific processes and protocols for MCI cognitive function health management. Based on the "Structure-Process-Outcome" three-dimensional quality structure theoretical model, this study reviews community MCI cognitive function health management strategies across three dimensions: functional departments and organizational structure (Structure), health management programs (Process), and effect evaluation systems and methods (Outcome), aiming to provide support and reference for standardized and process-oriented MCI cognitive function health management practices in Chinese communities.

[**Key words**] Cognitive dysfunction; Mild cognitive impairment; Community; Cognitive function; Health management; Review

Mild cognitive impairment (MCI), as a preclinical stage of dementia, represents cognitive decline more severe than normal aging but not meeting dementia diagnostic criteria [1-2]. The prevalence of MCI in China ranges from 15.4% to 32% [3-4], with higher rates in community settings than clinical contexts (25% vs. 20%) [5]. The annual progression rate from MCI to dementia is 10%-15%, while the reversion rate to normal cognition is as high as 24% [6]. Therefore, the MCI stage represents the "optimal window" for improving cognitive function. Since 2020, the National Health Commission has piloted the "Elderly Cognitive Function Health Management Public Welfare Project" in primary medical institutions [7]. Given MCI' s clinical significance for dementia prevention, this project should be extended to MCI populations. However, communities currently lack specific processes and protocols for MCI cognitive function health management.

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Introduction

Mild cognitive impairment (MCI) represents a critical intervention point for dementia prevention, yet community-based health management systems remain underdeveloped. This review systematically examines existing strategies to provide a framework for implementing comprehensive MCI management in community settings.

Literature Search Strategy

We conducted computerized searches of PubMed, Web of Science, Embase, CINAHL, CNKI, VIP Database, Chinese Biomedical Literature Database, Wanfang Data Knowledge Service Platform, UpToDate, and WHO websites from database inception to November 2023. Chinese search terms included: "轻度认知障碍," "认知功能障碍," "轻度认知损害," "记忆门诊," "记忆诊所," "组织结构," "设施," "设备," "医生," "护士," "职责," "资质," "筛查," "诊断," "干预," "随访," "管理," "效果评价," "质量改进." English search terms included: "mild cognitive impairment," "mild cognitive disorder," "mild cognitive decline," "memory clinic," "organizational structure," "facility," "equipment," "healthcare professional," "nurse," "duty," "qualification," "screen," "diagnose," "intervention," "follow-up," "management," "effect evaluation," "quality improvement." We used a combination of MeSH terms and free-text terms. Inclusion criteria were high-quality literature related to health management of MCI populations; exclusion criteria were irrelevant topics, unavailable full text, and non-Chinese/English languages.

1. Current Status and Challenges in Community MCI Cognitive Function Health Management

Although guidelines and expert consensus on MCI cognitive function health management have been published domestically and internationally—covering MCI screening, risk factor control, exercise guidelines, cognitive training consensus, and lifestyle recommendations for cognitive disorder prevention [8-11]—these have not focused on implementation in community settings. Moreover, validation studies have primarily examined single health management projects, lacking systematic, process-oriented health management strategies. While community chronic disease health management models are mature, adding MCI screening, diagnosis, and follow-up management is feasible. However, MCI health management has not yet been incorporated into China' s community public health service system, leaving MCI individuals without timely management and missing the optimal intervention window while remaining at high risk for dementia progression.

Community-based MCI cognitive function health management faces numerous challenges. First, effective implementation requires supporting infrastructure (space, facilities, equipment, and personnel), yet community primary medical institutions lack relevant infrastructure and organizational structures for cognitive function health management. Second, MCI cognitive function health

management involves collaboration among multiple stakeholders, but coordination channels and communication mechanisms among medical institutions, social service agencies, and volunteers remain unestablished. Third, most studies focus on implementing and validating single health management projects, neglecting implementation evaluation at the community organizational level, resulting in content and evaluation that lack systematic, comprehensive, and process-oriented approaches. Additionally, MCI individuals have limited access to health information, leading to low awareness and insufficient attention to MCI. Meanwhile, adherence to cognitive function health management is also affected by personal interests, preferences, and time constraints, further limiting personalized support and long-term health management planning.

Currently, comprehensive, process-oriented MCI cognitive function health management strategies and standards are lacking in community settings. Donabedian's "Structure-Process-Outcome" three-dimensional quality structure theoretical model, proposed for evaluating management protocol quality and effectiveness, is widely applied. "Structure" refers to health management environment attributes, including physical resources (infrastructure and equipment), human resources (quantity and qualifications of medical staff), and organizational structure. "Process" refers to the interactive nature of medical and nursing content provided by healthcare professionals and received by patients. "Outcome" refers to results following health management, including individual health status, intervention effects, and patient satisfaction. These three dimensions are closely related and mutually influential [12]. This study focuses on community settings, systematically reviewing relevant research on community MCI populations (including systematic reviews, expert consensus, recent practice guidelines, and RCTs), and evaluates community MCI cognitive function health management strategies across three dimensions—functional departments and organizational structure (Structure), health management programs (Process), and effect evaluation systems and methods (Outcome) (see Figure 1 [Figure 1: see original paper]) to propose corresponding strategies and provide theoretical reference for community practice.

2. Community MCI Cognitive Function Health Management Strategies

2.1 "Structure" –Functional Departments and Organizational Structure Setup

Memory clinics, as novel functional departments for early-stage dementia and MCI assessment, management, and education, have gained widespread attention and development domestically and internationally due to their advantages in early diagnosis and promoting intervention initiation. However, consensus on diagnostic and management protocols for memory clinics has not been reached due to differences in organizational structure, service scope, funding support, and education and training. The UK' s "Memory Service National Accredita-

tion Program" emphasizes that memory clinics should be clean and comfortable, with dementia-friendly facilities including clear signage and appropriately sized seating [13]. China' s memory clinic establishment guidelines also specify that such environments should include consultation rooms, neuropsychological assessment rooms, and laboratories [14]. Nevertheless, community primary medical institutions still lack cognitive training clinics or rooms. While Shanghai and other regions have begun piloting community memory clinic services, 48.5% of community physicians report lacking venues and facilities for MCI screening and management [15].

Furthermore, multidisciplinary teams are essential for community MCI management. Memory clinics should include general practitioners, psychiatric specialists, neuropsychological assessors, nurses, and pharmacists [14-16]. Currently, staffing varies significantly between domestic and international memory clinics. Neuropsychologists comprise 94% of Dutch memory clinic staff but only 14% in Ireland [17]. In Shanghai, 40% of general practitioners believe their communities lack professional MCI management teams [15]. Previous studies on professional education and training for memory clinics have emphasized the importance and future development trends of multidisciplinary collaboration, standardized training, continuous professional development, and program evaluation training [18]. Therefore, the development of MCI multidisciplinary team collaboration models, optimization of training programs, and establishment of long-term service evaluation mechanisms should be included in MCI health management strategy development plans.

2.2 "Process"—Design of Cognitive Function Health Management Programs

2.2.1 Screening and Diagnosis Screening and diagnosis of MCI are prerequisites for community MCI population health management. Relevant evidence summaries and expert consensus on MCI screening and diagnosis have been published domestically and internationally. The diagnostic process should include medical history assessment, physical examination, neuropsychological testing, and etiological and taxonomic diagnosis [8]. However, previous studies and clinical practices have primarily used neuropsychological testing for community MCI screening, without excluding cognitive impairment caused by reversible factors (such as thyroid dysfunction, infection, and vitamin B12 deficiency) through etiological diagnosis. Additionally, post-diagnostic support can provide patients with necessary information and emotional support while reducing stigma [19]. Currently, research on post-diagnostic support for MCI populations is scarce, and the specific methods, content, and facilitating/hindering factors of post-diagnostic support represent important future research directions.

2.2.2 Risk Factor Control The Lancet International Commission on Dementia Prevention, Intervention, and Care identifies modifiable risk factors associated with MCI as including physical diseases, negative emotions, and unhealthy

lifestyle factors [20].

(1) Disease Risk Management Associated with Cognitive Impairment: Hypertension, diabetes, hyperlipidemia, and cardiovascular/cerebrovascular diseases are risk factors for MCI [21]. For hypertension management, personalized blood pressure treatment combined with physical exercise, reasonable diet, and cognitive training provides cognitive benefits for MCI individuals with hypertension [22]. For MCI individuals with diabetes, strict glycemic control may increase hypoglycemia risk; glycated hemoglobin below 8.0%-8.5% is set as the control target for this population [23]. Meanwhile, UpToDate' s best clinical practice guidelines recommend timely identification of multiple vascular risk or disease burden markers associated with cognitive decline and implementation of corresponding prevention measures [24]. Stroke prevention strategies include blood pressure control, smoking cessation, statin therapy, antiplatelet therapy, and anticoagulant or antithrombotic treatment for individuals with atrial fibrillation [25].

Tooth loss and hearing loss also influence cognitive decline [26-27]. Community healthcare providers should strengthen health education and functional maintenance regarding oral and hearing health for MCI populations. Additionally, the incidence of potentially inappropriate medications (PIM) among elderly MCI groups is as high as 59.1% [28]. Communities should play an active role in reducing PIM by conducting safe medication education, comprehensively evaluating medication risk-benefit ratios, and advocating alternative treatments using multiple non-pharmacological interventions. Notably, polypharmacy, hearing decline, and gait instability increase fall risk; attention should be paid to evaluating and improving home environments for MCI populations, including developing fall prevention measures and advocating installation of 24-hour emergency call systems.

Currently, family doctor teams in Shanghai' s Jiading and Yangpu districts have implemented effective comprehensive chronic disease management services for MCI based on chronic disease health management protocols, but execution requires strengthening government drivers, healthcare provider implementation functions, and MCI individual cooperation [29].

(2) Emotional Management Associated with Cognitive Impairment: Depression, anxiety, and apathy are risk factors for cognitive decline in MCI [30]. Individuals with high perceived stress have 3.66-3.85 times higher MCI risk than normal individuals [31]. Therefore, community healthcare providers should closely monitor emotional assessment and management in MCI individuals. Multiple studies show that cognitive intervention, physical exercise, transcranial magnetic stimulation, and multi-component interventions based on cognitive intervention can improve depressive symptoms in MCI [32-34]. Virtual reality technology and empowerment-based educative psycho-behavioral programs can also improve anxiety and apathy in MCI [35-36]. Psychoeducation-based interventions and cognitive defusion training programs can effectively reduce perceived stress levels in MCI individuals [37-38].

However, community practice faces numerous challenges in managing emotions in MCI groups, including insufficient understanding of neuropsychiatric symptoms, lack of professional training and resources, perception differences between MCI individuals and healthcare providers, and lack of personalized and comprehensive psychological interventions. Communities need to strengthen healthcare provider training and establish MCI emotional management platforms in collaboration with higher-level hospitals or specialized institutions, drawing on mature emotional intervention strategies to advance community practice.

(3) Lifestyle Management Associated with Cognitive Impairment: Research shows that unhealthy lifestyles—including physical inactivity, unreasonable diet, sleep disorders, smoking, alcohol consumption, and social isolation—are risk factors for MCI [21]. Therefore, community healthcare providers should identify unhealthy lifestyles in MCI individuals and develop personalized intervention plans. Regarding exercise, aerobic exercise, resistance training, and multi-modal exercise interventions have all been proven to improve cognitive function [39]. Evidence regarding activity types, frequency, intensity, and exercise management for older adults with cognitive decline provides guidance for community-based MCI exercise management [9].

Currently, dietary patterns associated with cognitive health primarily focus on the Mediterranean diet, Dietary Approaches to Stop Hypertension (DASH), and the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet, all of which improve overall cognitive function and reduce cognitive decline risk through anti-inflammatory and antioxidant mechanisms [40-41]. Additionally, supplementation with folic acid, B vitamins, vitamin D, and probiotics can improve cognitive function in MCI individuals [42]. Pro-inflammatory diets (red meat, processed meat, and sweets) increase cognitive impairment risk [43] and should be reduced. Sleep intervention studies for MCI populations have examined cognitive behavioral therapy for insomnia, structured physical exercise programs, and mindfulness therapy [44-45], though consensus on their effectiveness for cognitive function and emotional improvement has not been reached.

Community healthcare providers should also address smoking, alcohol consumption, and social isolation in MCI populations. Interventions to reduce or stop alcohol consumption should be provided, along with smoking cessation services, free quitline counseling, and information technology-based smoking cessation interventions [27]. Regarding social engagement, ZHU et al. [46] found that lack of social opportunities, excessive family responsibilities, closed neighborhood relationships, and low information technology usage affect MCI individuals' social participation. Therefore, building dementia-friendly community environments and actively developing group activities and information technology training programs are priorities. Multi-domain lifestyle intervention programs for MCI populations conducted abroad have significantly improved cognitive function and reduced cognitive decline risk, providing valuable references for community healthcare providers [47].

2.2.3 Cognitive Function Maintenance **(1) Health Education:** Health education provides necessary knowledge and information for maintaining health, preventing disease, and choosing healthy lifestyles, empowering individuals with health decision-making rights and enhancing autonomous health management capabilities. The 2022 Alzheimer' s Association report showed that 43% of residents are unaware of the MCI concept, and 55% equate MCI with "normal aging" [48]. Awareness of MCI among Chinese community residents ranges from 25.5% to 56% [49-50], indicating low community awareness requiring strengthened public health education. Previous studies found that group health education effectively improves negative emotions in MCI individuals [51], while transtheoretical model-based behavior-oriented health education effectively improves cognitive function and quality of life [49]. However, health education intervention studies focusing on community-dwelling elderly MCI populations remain limited, and community implementation pathways for health education need further clarification to improve public participation in cognitive function health management.

(2) Cognitive Training: Compared with cognitive stimulation and cognitive rehabilitation, cognitive training is more suitable for MCI populations [10]. Regarding training modalities, process-based, multi-modal comprehensive training and computer-assisted cognitive training can serve as cognitive intervention programs for MCI [52]. Recently, digital therapeutic-based cognitive intervention programs using computer cognitive training combined with wearable devices, virtual reality, and physical stimulation for adaptive difficulty training can achieve preventive or therapeutic effects [53], though the digital divide and user-friendliness for older adults require attention.

To improve cognitive training effectiveness, community healthcare providers should comprehensively assess MCI individuals' cognitive impairment severity, family background, and accessible medical and social resources before implementation to ensure personalized and targeted training programs. Training intensity should be ensured, with recommendations of no less than 30 minutes per session, at least 3 sessions per week, and total training time of no less than 20 hours per training cycle [10]. Currently, numerous barriers exist in implementing cognitive training programs for MCI populations at the community level, including ensuring program accessibility and reach, balancing personalization and standardization, maintaining individual engagement and adherence, comprehensively evaluating program effects, and integrating multiple treatment approaches. Therefore, interdisciplinary collaboration must be strengthened to promote community cognitive training effectiveness, accessibility, and sustainability.

2.2.4 Follow-up Management Follow-up is crucial for monitoring MCI progression, aiming to achieve continuous management, establish effective and practical communication mechanisms, and provide ongoing comprehensive medical services. Follow-up periods for MCI populations have not been standardized,

ranging from 0.5 to 2 years post-diagnosis [14,54]; for those with hypertension, follow-up at 3-6 months after initial MCI diagnosis is recommended [22]. Previous research suggests follow-up services should be conducted based on disease severity, intervention effectiveness, and adherence [14]. For MCI individuals with chronic diseases, healthcare providers should regularly monitor blood pressure, blood glucose, and biochemical indicators during follow-up and dynamically adjust treatment plans [55].

Additionally, most MCI caregivers experience high burden; caregiver health management should be included in follow-up plans. Currently, community follow-up management for MCI populations primarily relies on research projects, with lack of awareness among community healthcare providers and incomplete follow-up management systems constraining sustained community practice. Community follow-up models for MCI remain to be established.

2.3 "Outcome" –Evaluation System and Methods for Cognitive Function Health Management Effects

The RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework proposed by GLASGOW is widely used for evaluating public health interventions [56]. This framework emphasizes evaluating intervention design and implementation effects across five dimensions: reach, effectiveness, adoption, implementation, and maintenance. Communities can reference the RE-AIM framework to evaluate the practical effects of MCI cognitive function health management at individual and organizational levels.

2.3.1 Evaluation of Reach Reach refers to intervention coverage and acceptability. Coverage can be assessed through the number and proportion of participants receiving interventions [56], while adherence and satisfaction are commonly used to evaluate acceptability [57-58]. Intervention-specific adherence assessment tools can evaluate acceptability, such as the Mediterranean Diet and Culinary Index for assessing adherence to Mediterranean dietary interventions in MCI [59], and attendance records or training diaries evaluating exercise or cognitive training programs [60-61]. Satisfaction is also an important indicator for evaluating health management quality. Most previous studies used self-developed satisfaction questionnaires or interviews to assess MCI individuals' subjective experiences and acceptability of interventions [62-63], though specific evaluation dimensions and content have not reached consensus.

2.3.2 Evaluation of Effectiveness Effectiveness refers to the impact of health management on important outcomes, including cognitive function, cognitive function-related indicators, and disease awareness rates. Overall cognitive function can be measured using paper-based, electronic, and information-based cognitive testing tools or technologies. Domain-specific assessments are crucial for accurately diagnosing MCI subtypes and developing personalized management plans, with specific tools such as the Auditory Verbal Learning Test, Digit

Span Test, and Stroop Color-Word Test evaluating memory, attention, and executive function [64]. However, considering education level effects on test results, improving diagnostic and time efficiency, exploring superior cognitive assessment tools, and developing integrated overall and domain-specific assessment technologies remain urgent priorities.

Notably, physical functions such as gait speed and muscle strength [65], neuropsychiatric symptoms [30], and sleep quality [66] can also indirectly reflect MCI health management effects. Additionally, disease awareness rate is a common indicator for evaluating health management effectiveness in older individuals, though most scholars use self-developed questionnaires [50,67], lacking consensus-based MCI awareness survey tools. These indicators are feasible for community collection. Healthcare providers should focus on the association between physical and cognitive functions when constructing and evaluating MCI health management protocols, timely preventing and intervening in adverse outcomes, and establishing multidimensional indicators to comprehensively evaluate baseline and post-intervention status to improve overall health management effectiveness.

2.3.3 Evaluation of Adoption Adoption refers to the degree of participation by direct implementers and executing organizations throughout the health management protocol, reflecting feasibility and acceptability through the number, percentage, and representativeness of organizations or personnel adopting the protocol [56], or assessing healthcare providers'willingness to participate through interviews [68]. Currently, adoption is rarely applied in health management protocol evaluation studies, lacking standardized definitions and measurement methods. Meanwhile, complex and changing environments such as organizational culture, institutional resources, and reforms significantly affect adoption measurement. However, this indicator provides important reference value for continuous quality improvement and causal analysis of health management and should be included in community MCI cognitive function health management protocol evaluation indicator systems with long-term adoption data tracking.

2.3.4 Evaluation of Implementation Implementation refers to the degree to which intervention protocols are delivered as originally planned in actual work, including whether intervention content, timing, frequency, and methods are consistent with plans. Implementation can be evaluated by recording protocol execution, intervention costs, participant suggestions, and implementer reflections and experiences during intervention processes [56]. Implementation not only monitors protocol completion but also identifies obstacles and challenges. Additionally, establishing quality inspection and spot-check systems can assess intervention implementation to facilitate subsequent continuous quality improvement.

2.3.5 Evaluation of Maintenance Maintenance refers to the degree of policy or program execution over time, focusing on evaluating the stability and dura-

bility of health management protocols becoming individual or organizational behavior systems [56]. Typically, reach, effectiveness, adoption, implementation, and their influencing factors are reassessed 6 months to 2 years post-intervention to evaluate maintenance [69]. At the individual level, healthcare providers can reassess protocols' long-term effects on MCI individuals during follow-up. Research shows specific interventions such as creative expression therapy [70] and multi-component psychological interventions [71] have long-term effects on cognitive function, daily living abilities, and depressive symptoms during follow-up. However, existing studies primarily evaluate maintenance through fixed-term follow-up, paying less attention to individuals' autonomous maintenance of unsupervised training post-intervention.

At the organizational level, maintenance can be evaluated by recording organizations' continued intervention implementation and reasons for maintaining, adjusting, or suspending interventions [56]. Currently, sustainable evaluation at the organizational level is rarely applied, limiting long-term promotion and application. Additionally, the scope of maintenance remains unclear, complicating measurement and comparison across studies. As protocols are typically adjusted over time, balancing necessary adjustments with maintaining protocol consistency will be an important future exploration area.

2.4 Continuous Quality Improvement in Cognitive Function Health Management

Research shows most MCI individuals prefer multi-modal non-pharmacological intervention strategies [72], seeking disease knowledge through consulting doctors, online searches, and peer communication, focusing on treatment, prognosis, and health maintenance information [73]. Additionally, factors affecting intervention adherence include lack of personal goals, insufficient advice and emotional support, poor health status, stigma, excessive operational intensity and frequency, and monotonous intervention content [74-76]. Therefore, at the individual level, community healthcare providers should continuously assess individual preferences for intervention protocols and timely adjust hindering factors to improve adherence.

At the organizational level, based on the RE-AIM framework [77], to improve adoption, implementation, and maintenance, community primary medical institutions must continuously optimize facility, equipment, and human resource allocation, develop detailed MCI cognitive function health management operation manuals, and provide necessary training and technical support for healthcare providers to ensure effective implementation. Furthermore, MCI cognitive function health management should be integrated into routine medical practice to ensure it becomes standard work content, improving protocol sustainability.

3. Summary and Outlook

MCI populations are largely hidden in communities, making cognitive function health management crucial for early dementia prevention. Community primary medical institutions should establish required departments and organizational frameworks for MCI health management, develop process-oriented health management protocols covering screening and diagnosis, risk factor control, cognitive function maintenance, and follow-up management, and evaluate protocol application effects using the RE-AIM evaluation system to promote continuous quality improvement. Future practical applications should also emphasize feasibility, appropriateness, clinical significance, and effectiveness design, analyze facilitating and hindering factors, and develop corresponding optimization strategies to promote effective translation and improve dissemination in community primary medical institutions.

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