

Analysis of the Feasibility of Early Screening for Alzheimer's Disease in the Domestic Context

Kaizhe Xie

Department of Nursing, Guangdong Pharmaceutical University, Guangzhou, Guangdong, China

1747332769@qq.com

Abstract. As global population aging continues to intensify, the annual incidence of Alzheimer's disease (AD) is on the rise, imposing a heavy burden on patients, their families, and society at large. The community, serving as the fundamental unit for residents' health management, plays a pivotal role in disease prevention and provides a platform for the early screening of AD. This study primarily focuses on the feasibility of conducting early AD screening within community public health. It analyzes the applicability of various screening techniques, such as cognitive function assessment scales, imaging examinations, and biomarker detection, within the community setting. It also examines the compatibility between community public health resources and the screening process and investigates the community's willingness to do such screening. Meanwhile, it delves into issues like residents' enthusiasm for participation and the integration of resources across different communities, aiming to optimize community public health services, enhance AD prevention and treatment, facilitate early detection and intervention, and alleviate related burdens.

Keywords: Alzheimer's Disease; Early Screening; Early Detection; Intervention.

1. Introduction

Alzheimer's disease represents a chronic neurological disorder that impacts memory, thinking, and behavior. It is a progressive condition prevalent among older adults, characterized by abnormal protein clumps and fiber tangles in the brain, which lead to nerve cell damage, resulting in a decline in memory and the emergence of emotional and behavioral problems. In 2019, over 50 million people worldwide suffered from cognitive impairments that included Alzheimer's disease. Against the backdrop of global aging, especially in countries like China and Japan, the incidence of this disease is steadily increasing. The community is crucial for health management and an excellent early screening platform [1]. However, at present, most diagnoses are made in the mid-to-late stages, thereby missing the optimal window for intervention. At the community public health level, screening work is not being carried out systematically and effectively, and issues related to the application of techniques, residents' awareness, and resource allocation are being encountered. Meanwhile, medical approaches for treating Alzheimer's disease are still undergoing further research and improvement.

Table 1. Statistics on Aging, Alzheimer's Disease, and Other Dementias in China in 2019 [2]

Description	Specific Data (in 2019)
The number of people aged 60 and above in China	280.04 million
Proportion of the total national population in China	19.8%
The number of people aged 65 and above in China	209.78 million
Proportion of the total national population in China	14.9%
The number of patients with Alzheimer's disease (AD) and other dementias in China	13,143,950 cases
Proportion of the global number of patients with AD and other dementias	25.5%
The age-standardized prevalence rate of AD in China	788.3 per 100,000 people
The number of deaths caused by AD and other dementias in China	320,715 cases
Proportion of the global number of deaths caused by AD and other dementias	19.8%
The global burden of disease caused by AD and other dementias (person-years)	25,276,989
Proportion of the global burden of disease caused by AD and other dementias from China	23.6%

This study aims to analyze the feasibility of the hierarchical model of "community primary screening (using scales) + hospital refined screening (imaging/biomarkers)" in combination with the current status of domestic community medical resources. This model is suitable for large-scale primary screening in communities due to the simplicity and low cost of the MoCA scale. It can connect community primary screening with hospital refined screening through hierarchical diagnosis and treatment. With pilot foundations in some regions and the government's potential to optimize resources, it has room for promotion. The goal is to promote the systematic implementation of early screening and improve the early detection rate of Alzheimer's disease.

Enhancing our efforts and making the screening process more comprehensive for the early detection of Alzheimer's disease is urgently needed.

2. Progress in Early Screening Techniques for Alzheimer's Disease

In clinical practice, the commonly employed early screening techniques for Alzheimer's disease encompass cognitive function assessment scales, imaging examinations, biomarker detection, and other approaches. These techniques contribute to the early detection of Alzheimer's disease from diverse perspectives, each possessing unique advantages and application values. However, they also encounter limitations and demand different considerations regarding their applicability within practical application scenarios [3].

2.1 Cognitive Function Assessment Scales

Cognitive function assessment scales are a category of screening tools that are relatively straightforward and widely utilized. For instance, the Montreal Cognitive Assessment (MoCA) swiftly conducts a preliminary assessment of patients' cognitive function through question-and-answer formats and the execution of simple tasks. It examines multiple dimensions, including orientation, memory, attention, calculation ability, and language ability. In clinical practice, thanks to its ease of implementation, it can complete the detection within a relatively short timeframe and demonstrates a certain degree of sensitivity and specificity in screening patients with moderate to severe Alzheimer's disease. This enables medical staff to identify individuals with conspicuous cognitive impairment quickly. According to the article by Xin Siyu and Ju Yanxiu, their studies have indicated that the Montreal Cognitive Assessment (MoCA) holds a relatively high value in screening for mild cognitive impairment (MCI) among community older people [4]. It can evaluate cognitive functions and contribute to the early diagnosis of MCI, thereby preventing its progression to Alzheimer's.

2.2 Imaging Examinations

Imaging examinations play a vital role in the early screening of Alzheimer's disease. In the research conducted by Huang Jian and Wang Zhi, a technique known as complex network analysis technology is mentioned [4]. Based on graph theory, this technique views the brain as a complex network of interconnected regions. Analyzing the topological structure of the brain network, such as the connection strength of nodes, the clustering coefficient of the network, and the path length, among others, enables a deeper understanding of the brain's function and information processing mechanism in healthy and diseased states. In the context of research on Alzheimer's disease, complex network analysis can reveal alterations in the connectivity of patients' brain networks, offering a novel perspective for comprehending the neuropathological basis of the disease [5]. Early diagnosis is of utmost importance in the treatment and management of Alzheimer's disease, and complex network analysis has opened up new opportunities for the early identification of the disease. Relevant studies have demonstrated that in the early stages of Alzheimer's disease, specific changes occur within the brain network. For example, the connectivity between specific brain regions and networks may be weakened. These early network changes can then be regarded as potential markers, allowing for the identification of Alzheimer's disease even before the manifestation of clinical symptoms. Recently,

some studies have developed predictive models based on network analysis with machine learning and statistical models. These models aim to identify individuals at high risk of developing Alzheimer's disease and to monitor the progress of the disease. Such models integrate information from multiple aspects, including brain imaging, genetic information, and clinical data, and exhibit relatively high prediction accuracy. Accurately monitoring the progress of the disease is the key to the effective management of Alzheimer's disease, and complex network analysis can serve as a novel means for this purpose. Research has shown that regular conduction of brain network analysis can monitor the dynamic changes in the structure and function of the brain network of Alzheimer's disease patients, thereby facilitating the tracking of the disease's progress, evaluating patients' responses to treatment, and enabling corresponding adjustments to the treatment strategy [6].

2.3 Biomarker Detection

Biomarker detection provides a more objective and direct foundation for the early screening of Alzheimer's disease. Given the pressing need for early screening and diagnosis of Alzheimer's disease (AD), considerable attention has been directed towards utilizing biomarkers for the specific diagnosis of the disease. These specific biomarkers are closely associated with the pathological manifestations of AD as well as the occurrence and development of the condition, and they hold significant importance for the early diagnosis of AD, predicting the progression from mild cognitive impairment to AD, and evaluating the treatment effects. In recent years, researchers have achieved remarkable progress in studying diagnostic biomarkers for AD, promoting the early diagnosis and effective treatment of this disease. Some researchers have adopted biochemical techniques, such as serological and urine analyses, to conduct early diagnoses of AD. Serological tests can detect amyloid- β ($A\beta$), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) in serum. Urine analysis can also detect $A\beta$ in urine.

Additionally, molecular biology techniques have also been applied to the early diagnosis of AD. Among them, the polymerase chain reaction (PCR) can detect the genetic markers of AD, which is beneficial for early diagnosis. Currently, some researchers are also leveraging genomics techniques to detect gene mutations of AD to provide accurate diagnostic information [7].

3. Community Feasibility Evaluation

By combining the methods mentioned above, the table analyzes the operational difficulty, cost-effectiveness, accuracy, and other aspects of various techniques within a community and explores their applicability.

Table 2. Comparison of Comprehensive Performance of Different Screening Methods in

Alzheimer's Disease Screening

Screening Method	Degree of Operational Difficulty	Cost-Effectiveness	Accuracy	Applicability in Community Settings
Cognitive Function Assessment Scales	Relatively easy.	Low cost	Certain value	Suitable; Can initially screen out
Imaging Examinations (Taking Complex Network Analysis Technology as an Example)	Complicated operation.	High cost	Relatively high prediction accuracy	Difficult
Biomarker Detection	Some are easy and some are difficult	Costs vary greatly depending on the type of detection	Provide an objective basis	Simple tests assist in community screening; Complex tests require external collaboration or referrals.

By synthesizing the advantages and disadvantages of several standard early screening technologies for Alzheimer's disease, a hierarchical model of "community primary screening (MoCA) + hospital referral (imaging/biomarkers)" is proposed. As a free and concise cognitive screening tool, the Montreal Cognitive Assessment (MoCA) is increasingly popular, and it can be applied to individuals with sensory impairments (such as visual impairment) who cannot undergo standard MoCA screening. Trained community workers or residents can use the MoCA scale to conduct preliminary screening for target populations or self-screening in community health service centers, elderly care institutions, and other settings. Community health service centers determine whether patients are at risk of cognitive impairment based on the scoring criteria of the MoCA scale. Patients with scores below the threshold are initially identified as high-risk groups for cognitive impairment and require further rescreening or referral. Meanwhile, the primary screening results are recorded in patients' health files for subsequent follow-up and evaluation. When community primary screening identifies patients at risk of cognitive impairment, they should be promptly referred to the relevant specialties of higher-level hospitals. After referral, patients typically need further examinations to confirm the diagnosis, among which imaging examinations and biomarker detection are highly effective methods [8].

This grading model integrates community-based initial screening with hospital referral, fully leveraging the extensive coverage of community health services and the professional diagnostic capabilities of hospital specialties. Large-scale initial screening in communities enables the rapid identification of potential patients with cognitive impairment, thereby improving the early detection rate of the disease. However, according to the survey results of 616 community residents in Guangzhou, China, the awareness rate of the graded diagnosis and treatment model is low (only 32.1% of residents have heard of the graded diagnosis and treatment model). The unclear referral system between medical institutions at all levels and the interest factors lead to a low referral rate. Limited community medical standards, residents' ignorance of the functions of community health service institutions, unwillingness to seek initial consultation in communities (only 33.0% of residents choose to visit communities for minor illnesses), and distrust of general practitioners—all these indicate that the graded diagnosis and treatment model has not been well implemented. There are still many obstacles to its development [9]. To address such situations, the government and relevant departments should increase investment in and rational allocation of medical resources, establish a sound referral mechanism and green channels, and ensure that patients receive specialized diagnosis and treatment on time.

4. Proposed Model

Community-based health service institutions play a pivotal role in the early screening of Alzheimer's disease, and their current resource status directly impacts the implementation of such screening activities. In the "Reply to Proposal No. 18 of the Third Session of the Sixteenth People's Congress of Xihu District" released by the People's Government of Xihu District, Hangzhou City, it is noted that the hardware facilities and basic functions of local community health service centers (stations) have witnessed improvements. Nevertheless, their services remain available for further enhancement [10].

Regarding human resources, there are plans to optimize and adjust the total staffing quota of grassroots medical and health institutions by considering factors like the regional service population. Specifically, 55 individuals are scheduled to be newly recruited in 2024 to improve the workforce structure. Moreover, by relying on the "urban medical consortium," endeavors will be made to reinforce further education and rotation training of personnel, aiming to enhance the overall quality of the workforce. In terms of material resources, in collaboration with the expert team from the Seventh People's Hospital of Hangzhou City, an elderly dementia prevention and treatment pilot project will be launched in the community health service centers of the sub-districts, and a "memory joint clinic" will be established. Additionally, the district intends to construct new medical care beds for older people. Regarding early screening for Alzheimer's disease, it is projected that the historical

medical data in health records will be combined with the physical examinations of the elderly to complete the cognitive screening for 13,200 older adults aged 65 and above. However, the source and guarantee of funds were not elaborated on in detail.

5. Challenges and Proposed Solutions

The early screening of Alzheimer's disease faces multi-dimensional challenges that require systematic and targeted solutions. At the institutional level, there is insufficient policy support and resource allocation—early screening has not yet been fully integrated into routine medical insurance programs, leaving primary medical institutions short of special funds for equipment procurement and venue expansion. Additionally, there is a lack of inter-departmental collaboration mechanisms, resulting in inefficient referral processes between communities, hospitals, and medical insurance departments. Community health service centers also lack standardized screening procedures and quality control systems, which undermines the reliability of screening results. Policy safeguards should be strengthened to address these issues: cognitive screening should be included in national public health service projects with earmarked equipment and venue upgrade funds. A three-tier collaboration mechanism involving "government-hospital-community" should be established to clarify responsibilities at each level. Meanwhile, service processes need optimization, such as developing *Community Cognitive Screening Operation Guidelines*, adopting standardized tools like the "Hui Memory" app, and building an electronic referral platform to connect community-screened positive cases with memory clinics in higher-level hospitals, shortening referral cycles.

Technically, traditional detection methods have limitations: conventional scales (e.g., MoCA) are subjective and influenced by educational background. At the same time, high-end equipment like PET/MR is costly and inaccessible to primary institutions. Blood biomarkers (e.g., P-tau181), though sensitive, require multi-center validation to reduce false positives. Moreover, data management and technology integration are inadequate—community screening data is not linked with hospital diagnostic data, and AI-assisted screening systems (e.g., voice recognition, image analysis) remain underutilized. A stratified technology application approach is needed: for primary screening in communities, a combination of "blood P-tau181 testing + AI voice interaction scales" can balance cost and accuracy, as seen in Hainan Province, where the "Haiyiban" app enabled self-screening for brain health, covering 40,000 people in 2024. For secondary hospital screening, suspected cases can undergo PET/MR or cerebrospinal fluid testing, combined with multi-modal biomarkers (A β , tau, YWHAG) to enhance specificity. Technological innovation and equipment deployment to grassroots levels should be promoted, such as introducing mobile screening vehicles equipped with portable MRI and blood testing devices for regular community outreach, as well as developing AI-assisted diagnostic systems based on large language models to analyze multi-dimensional data (e.g., voice, gait) and reduce reliance on specialized physicians.

6. Future Directions

Based on community residents' awareness of the early screening for Alzheimer's disease, communities can adopt a series of targeted publicity, education, and measures to effectively boost residents' enthusiasm for participating in the screening. Firstly, efforts should be made to intensify the popularization of knowledge. Special lectures can be organized, where professionals are invited to explain disease-related knowledge. The duration should be controlled appropriately during these lectures, and question-and-answer sessions should be arranged to facilitate interaction. Meanwhile, various types of popular science materials need to be produced and distributed, and they should be posted and updated in multiple accessible locations within the community to ensure that residents can readily obtain them. For instance, Chengdu City in Sichuan Province has promoted 26 communities to pilot projects for elderly cognitive impairment-friendly communities, achieving favorable results [11]. Secondly, concerns and misunderstandings among residents should be eliminated. For the worry

about privacy leakage, meticulous explanations should be provided, and commitments should be publicized.

Regarding incorrect concepts residents hold, patience should be exercised to correct them and clarify the relevant principles through diverse publicity. Finally, the benefits of screening should be emphasized. Real cases of people who have benefited from early screening should be collected and shared, and experts should be invited to interpret the significance of screening, followed by the wide dissemination of relevant content.

7. Conclusion

In conclusion, as the incidence of Alzheimer's disease (AD) rises with global aging, the community's role in early AD screening is crucial. While various screening techniques have advantages and limitations in application, community health service institutions face challenges in human and material resources, etc.. They cannot fully meet screening requirements yet. Enhancing residents' participation by strengthening knowledge popularization, eliminating concerns, and emphasizing benefits is vital to improving the feasibility of early screening. A comprehensive approach integrating multiple aspects is needed to promote early detection and intervention, relieve burdens, and improve the health of older people in the community. Future efforts should focus on better integrating these elements for the sustainable development of screening work at the community level.

References

- [1] Wang Gang, Qi Jinlei, Liu Xinya, et al. Alzheimer's Disease Report in China 2024 [J]. *Journal of Diagnostics Concepts & Practice*, 2024, 23(03): 219-256. DOI: 10.16150/j.1671-2870.2024.03.001.
- [2] Cui Hongmei, Gao Hailong, Fu Chunlian, et al. Caring for the Rehabilitation of Alzheimer's Disease with Heart [C] Guangdong Cancer Rehabilitation Society. Proceedings of the 2025 "Healthy Greater Bay Area—Science Popularization Leads to Health" Forum and the First Phase of the Health Science Popularization Works Collection Activity. The Elderly Ward of Guangzhou Civil Affairs Psychiatric Hospital (Guangzhou Kangning Hospital); 2025: 76-78. DOI: 10.26914/c.cnkihy.2025.003152.
- [3] Zhao Guocheng. Four Means for the Early Screening of Alzheimer's Disease [J]. *Home Medicine. Choosing Medicines for Medical Treatment*, 2022, (05): 67.
- [4] Huang Jian, Wang Zhi. Research Progress on the Application of Complex Network Analysis Technology in Brain Structure and Functional Imaging of Alzheimer's Disease Patients [J]. *Chinese Journal of Medical Physics*, 2024, 41(08): 1053-1056.
- [5] Bao Kaixuan, He Haohui. Value Analysis of the Montreal Cognitive Assessment Scale in Screening Mild Cognitive Impairment among Community Elderly People [J]. *Chinese Community Doctors*, 2024, 40(28): 80-82.
- [6] Bai Ru, He Ting, Xie Neng. Research Progress on Diagnostic Markers of Alzheimer's Disease [J]. *Hebei Medical Journal*, 2023, 45(09): 1391-1395.
- [7] Tan J, Li N, Gao J, Wang L, Zhao Y, Yu B, Du W, Zhang W, Cui L, Wang Q, Li J, Yang J, Yu J, Xia X, Zhou P. Optimal cutoff scores for dementia and mild cognitive impairment of the Montreal Cognitive Assessment among elderly and oldest-old Chinese populations. *J Alzheimers Dis*, 2015, 43:1403 141
- [8] Cui Huaqian, Fang Guoyu, Yang Yang, et al. A Survey on the Awareness and Cognition of the Graded Diagnosis and Treatment Model among Community Residents in Guangzhou [J]. *Chinese General Practice*, 2014, 17(34): 4123-4126.
- [9] Hangzhou Municipal People's Government. Reply Letter to Proposal No. 18 of the Third Session of the Sixteenth People's Congress of Xihu District, 2024.
- [10] Take Action and Light up the Light of Memory Together. *China Society News*, 2024