

Postprint: Development of an Evaluation Index System for Community Cognitive Impairment Screening Services Based on the RE-AIM Framework

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Abstract

Background: China has launched a national action plan for dementia prevention and treatment, with various localities actively conducting cognitive function screening among community-dwelling elderly populations. However, there is currently no suitable evaluation standard to serve as an assessment basis for community-based cognitive impairment screening initiatives. **Objective:** To construct an evaluation index system for community-based cognitive impairment screening services based on the RE-AIM framework, providing a reference for the assessment and quality control of large-scale community cognitive function screening projects for elderly populations across different regions. **Methods:** Through literature review and policy analysis, a draft index system was initially developed around the five dimensions of the RE-AIM framework. From October 2023—January 2024, 15 experts were selected to conduct Delphi expert consultation to construct the evaluation index system for community cognitive impairment screening services, and the product method was employed to determine index weights. **Results:** The expert participation coefficients for the two rounds of consultation were 100% and 93.3%, the expert authority coefficients were 0.83 and 0.86, and the expert opinion coordination coefficients were 0.242 and 0.265 ($P < 0.001$). The final established index system comprised 5 first-level indicators, 15 second-level indicators, and 20 third-level indicators. The first-level indicators and their weights were: screening accessibility (0.2035), screening effectiveness (0.2035), organizational adoptability (0.1948), screening implementability (0.2035), and screening sustainability (0.1948). **Conclusion:** This study preliminarily explored and constructed an evaluation index system for community cognitive impairment screening services, comprising 5 first-level indicators, 15 second-level indicators, and 20 third-level indicators, which demonstrates good scientific validity and reliability, and holds certain reference value for improving

the assessment system for cognitive impairment screening.

Full Text

Construction of an Evaluation Index System for Community-Based Cognitive Impairment Screening Services Based on the RE-AIM Framework

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Abstract

Background: China has launched a national Alzheimer's disease prevention and treatment promotion action, with communities actively conducting cognitive function screening among older adults. However, no suitable evaluation standards currently exist to assess community-based cognitive impairment screening programs.

Objective: To construct an evaluation index system for community-based cognitive impairment screening services using the RE-AIM framework, providing a reference for quality control and performance assessment of large-scale screening initiatives.

Methods: Through literature review and policy analysis, a preliminary index system was developed based on the five dimensions of the RE-AIM framework. From October 2023 to January 2024, 15 experts were selected to participate in a two-round Delphi consultation to refine the evaluation index system. The multiplier method was used to determine indicator weights.

Results: The expert participation rates were 100% and 93.3% for the two rounds, with authority coefficients of 0.83 and 0.86, respectively. The Kendall's coordination coefficients were 0.242 and 0.265 ($P < 0.001$). The final index system comprised 5 first-level indicators, 15 second-level indicators, and 20 third-level indicators. The first-level indicators and their weights were: screening reachability (0.2035), screening efficacy (0.2035), organizational adoption (0.1948), implementation (0.2035), and maintenance (0.1948).

Conclusion: The constructed community cognitive impairment screening service evaluation index system demonstrates good scientific validity and reliability, offering valuable reference for improving screening assessment frameworks.

Keywords: cognitive impairment; screening; RE-AIM framework; community; evaluation index system; Delphi method

Methods

1.1 Development of the Preliminary Index System

A comprehensive literature review was conducted using Chinese search terms including “cognitive impairment,” “dementia,” “mental health,” “screening,” and “evaluation/assessment,” and English search terms including “RE-AIM,” “cognitive impairment,” “dementia,” “mental health,” “screening,” and “evaluation/assessment.” The search strategy combined subject headings with free-text terms across PubMed, Web of Science, CNKI, and Wanfang databases. Additionally, policy documents on cognitive impairment screening and prevention were retrieved from official websites of health authorities at various levels to understand current research and evaluation practices.

Using the five dimensions of the RE-AIM framework as the foundational structure and incorporating guidance documents such as the “Work Plan for Exploring Characteristic Services for Depression and Alzheimer’s Disease Prevention and Treatment,” a pool of candidate indicators with common and representative characteristics was established. Following principles of hierarchy, independence, operability, and accessibility, a preliminary index system was drafted comprising 5 first-level indicators, 14 second-level indicators, and 22 third-level indicators. This study was approved by the Medical Ethics Committee of Zhejiang University School of Public Health (ZGL202101-1).

1.2 Delphi Expert Consultation

A two-round Delphi expert consultation was conducted from October 2023 to January 2024 to construct the community cognitive impairment screening service evaluation index system. The consultation process incorporated expert feedback and group discussions to finalize the system.

1.2.1 Expert Selection and Consultation Process Fifteen experts were invited using purposive sampling based on the following criteria: (1) bachelor’s degree or above, or intermediate professional title or above; (2) minimum five years of work experience in disease prevention and control, health administration, mental health services, or community work; and (3) willingness to participate. Consultation forms were distributed via email and social media platforms.

The first-round questionnaire collected basic information on experts’ education, professional title, work area, and experience. Experts were asked to score each indicator on importance, familiarity, judgment basis, and impact level, and to provide specific comments. After the first round, the research team compiled

and analyzed the responses, then shared the results along with proposed modifications for the second round of consultation.

1.2.2 Scoring System Importance was rated on a 5-point scale: very important (5), important (4), moderately important (3), slightly important (2), and not important (1). Familiarity was scored as: very familiar (1), relatively familiar (0.8), moderately familiar (0.6), slightly familiar (0.4), and not familiar (0.2). Judgment basis comprised four aspects: theoretical analysis, practical experience, reference to domestic/international literature, and intuition, each with three impact levels (high, medium, low) carrying specific values: theoretical analysis (high=0.3, medium=0.2, low=0.1), practical experience (high=0.5, medium=0.4, low=0.3), literature reference (high=0.1, medium=0.1, low=0.1), and intuition (high=0.1, medium=0.1, low=0.1).

1.2.3 Indicator Screening and Weight Calculation The threshold method was applied for indicator selection: (1) full-mark rate threshold = mean - standard deviation, with indicators scoring above retained; (2) arithmetic mean threshold = mean - standard deviation, retaining indicators above; and (3) coefficient of variation threshold = mean + standard deviation, retaining indicators below. To avoid premature elimination of important indicators, expert opinions and group discussions were fully considered. Using importance scores from the second round as initial weights, the percentage weight method calculated normalized weights for first-level indicators, while the multiplier method computed combined weights for second- and third-level indicators.

1.3 Statistical Analysis

Data entry and analysis were performed using EpiData 3.1 and SPSS 26.0. Normally distributed continuous data were expressed as ($\bar{x} \pm s$). The following parameters were calculated: (1) Expert participation coefficient: measured by valid response rate, with rates >70% indicating high participation; (2) Expert authority coefficient (Cr): calculated as $(C_a + C_s)/2$, where C_a is judgment coefficient and C_s is familiarity coefficient, with $Cr \geq 0.7$ indicating high reliability; (3) Expert opinion coordination: assessed using Kendall's W coefficient, with $P < 0.05$ considered statistically significant.

Results

2.1 Expert Characteristics

Fifteen experts were selected, including 7 males (46.7%) and 8 females (53.3%). All held university degrees or higher: 1 bachelor's (6.7%), 3 master's (20.0%), and 11 doctoral degrees (73.3%). Senior professional titles (associate professor or above) accounted for 93.3%. Expertise areas included health administration (2,

13.3%), teaching/research (8, 53.3%), disease prevention and control (3, 20.0%), and community work (2, 13.3%). Average work experience was 13 years (range: 5-30 years), with 10 experts (66.6%) having ≥ 10 years of experience.

2.2 Expert Consultation Reliability

2.2.1 Expert Participation In the first round, 15 questionnaires were distributed and 15 valid responses were received (100%). In the second round, 15 questionnaires were distributed with 14 valid responses (93.3%). Both rounds exceeded the 70% threshold, indicating high expert engagement.

2.2.2 Expert Authority The first-round authority coefficient was 0.83 ± 0.06 ($Ca = 0.82 \pm 0.08$, $Cs = 0.84 \pm 0.04$). The second-round coefficient was 0.86 ± 0.03 ($Ca = 0.88 \pm 0.03$, $Cs = 0.84 \pm 0.06$). Both rounds exceeded 0.8, demonstrating high expert authority.

2.2.3 Expert Opinion Coordination The overall Kendall's W coefficient increased from 0.242 in the first round to 0.265 in the second round ($\chi^2 = 145.319$ and 156.001, respectively, $P < 0.001$), indicating good coordination and increasing consensus among experts. Detailed coefficients for each indicator level are shown in Table 1.

2.3 Delphi Consultation Results

2.3.1 First Round The first-round questionnaire included 5 first-level, 14 second-level, and 22 third-level indicators. Importance scores ranged from 3.00 to 4.87, with 30 indicators scoring > 4.0 . Full-mark rates ranged from 13.33% to 86.67%, with 21 indicators exceeding 50%. Coefficients of variation ranged from 0.07 to 0.54, with 30 indicators below 0.25 (Table 2). Based on threshold criteria (full-mark rate $> 35.58\%$, mean > 3.72 , coefficient of variation < 0.3182), 9 indicators were deleted, 8 modified, and 14 added after comprehensive discussion.

2.3.2 Second Round The adjusted second-round questionnaire contained 5 first-level, 17 second-level, and 21 third-level indicators. All indicators scored above 4.0 with coefficients of variation < 0.25 , and 31 indicators had full-mark rates $> 50\%$ (Table 3). Threshold values were 39.96% for full-mark rate, 4.29 for mean, and 16.64 for coefficient of variation. After applying threshold criteria and thorough discussion, two second-level indicators ("cognitive impairment screening coverage rate among individuals aged 65 and above" and "cognitive impairment screening service satisfaction rate") and one third-level indicator ("development of cognitive impairment screening mobilization plan") were removed. The final index system comprised 5 first-level, 15 second-level, and 20 third-level indicators.

2.4 Indicator Weights

First-level indicator weights ranged from 0.1948 to 0.2035, with screening reachability, screening efficacy, and implementation each weighted at 0.2035. Second-level combined weights ranged from 0.0115 to 0.0148, with “target population cognitive impairment screening coverage rate” (0.0148) ranking highest, followed by “high-risk population detection rate” and “personnel allocation for cognitive impairment screening implementation” (both 0.0144). Third-level combined weights ranged from 0.0005 to 0.0008, with “financial allocation,” “establishment of cognitive impairment screening management leadership group,” and “professional knowledge and skills training compliance rate” tied at 0.0008 (Table 4).

Discussion

3.1 Scientific Validity and Reliability of the Index System

The selected experts represented diverse fields including health administration, academic institutions, disease prevention and control, and community work, ensuring comprehensive expertise in cognitive impairment screening and diagnosis. With high representation in education, professional titles, and work experience, the consultation results demonstrate strong scientific validity and reliability. Both rounds showed participation rates >90%, with experts providing constructive feedback, indicating high engagement and attention. Authority coefficients exceeding 0.7 and increasing coordination coefficients with significant differences across rounds demonstrate high recognition, familiarity, and consensus among experts. The decreasing coefficient of variation in the second round further confirms convergence of expert opinions. These findings collectively indicate that the constructed index system possesses high scientific validity and reliability.

3.2 Weight Analysis of the Index System

Indicator weights reflect their relative importance in evaluation. Among the five first-level indicators, screening reachability, efficacy, and implementation each exceeded 0.2, highlighting that coverage, implementation quality, and effectiveness are critical considerations in community screening evaluation. At the second level, “target population cognitive screening coverage rate” (0.0148) ranked highest, aligning with national targets for community cognitive function screening rates. The next highest weights were “high-risk population detection rate” and “personnel allocation for screening implementation” (both 0.0144). The former depends on screening tool validity, as different tools exhibit varying sensitivity and specificity, leading to heterogeneous risk detection rates. The latter reflects that adequate health human resources are crucial for screening implementation; however, professional talent shortages and inadequate incentives remain major barriers. Expanding the mental health workforce, enhancing pro-

professional competencies among primary healthcare workers, and leveraging medical social workers' pivotal roles are urgently needed. Additionally, streamlining screening processes and applying brief, human-computer interactive screening tools in primary settings can improve efficiency and ensure sustainable development of community cognitive impairment screening.

3.3 Necessity and Innovation of the Index System

In 2010, the Ministry of Health issued the “Mental Health Work Indicator Survey and Evaluation Scheme,” which included two cognitive impairment indicators (early detection and intervention rates for senile dementia) but lacked detailed evaluation content and standards. Current assessments primarily rely on policy targets, such as the 80% screening rate and public awareness rate goals specified in the “Work Plan for Exploring Characteristic Services for Depression and Alzheimer’s Disease Prevention and Treatment.” While scholars have proposed frameworks for mental health service evaluation, these lack specific, operational indicators for community cognitive impairment screening. This study’s RE-AIM-based evaluation index system encompasses five dimensions, adding “organizational adoption” and “screening maintenance” to the traditionally emphasized reach, efficacy, and implementation dimensions. This innovation highlights organizational commitment and sustainability, providing a more comprehensive assessment of screening program effectiveness. As provinces nationwide actively promote community-based cognitive impairment screening, this system offers scientific evidence and practical guidance for quality assessment, encouraging more standardized and scientific implementation.

3.4 Study Limitations and Future Directions

This study has three main limitations. First, the index system was built primarily on RE-AIM’s five core elements, potentially not fully covering all aspects of community cognitive impairment screening. Second, the limited number of experts, while carefully selected based on expertise and representation, may not fully reflect national diversity given regional variations in healthcare development; local adaptation may be necessary during application. Third, the study has not yet examined the system’s reliability, validity, or practical effectiveness, requiring future empirical research for further refinement.

Author Contributions

PANG Ting and XU Xin conceptualized and designed the study. PANG Ting and LI Wanxin conducted literature searches, implemented the Delphi consultation, and organized data. PANG Ting drafted the manuscript. LI Wanxin, ZHANG Haoran, and LIN Zhiying reviewed and edited the manuscript. XU Xin supervised quality control and bears overall responsibility for the work.

Conflicts of Interest: None declared.

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