Research Article

The Efficacy of Cognitive Training for Elderly Chinese Individuals with Mild Cognitive Impairment

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The age of the population is shifting toward the elderly range, which may lead to an increased risk of mild cognitive impairment (MCI). The aims of this study are to evaluate the cognitive function in elderly people using the Montreal Cognitive Assessment (MoCA), to identify the relationship between cognitive function and different characteristics, and to evaluate the efficacy of the intervention after six months of cognitive training. In this study, we included 2886 subjects aged ≥60 years in the baseline survey, and 140 subjects with MCI who participated in the baseline survey were randomly divided into an intervention group (N = 70) and a control group (N = 70). The control group was not provided any intervention measures, and the intervention group was administered cognitive training. The education level, monthly income, sleep time, exercise time, reading times, and time spent engaging in community activities and performing housework were positively correlated with MoCA scores, but age was negatively correlated with MoCA scores. The total MoCA score of the intervention group increased from 19.77 ± 2.24 points to 21.09 ± 2.20 points after six months of cognitive training, but the score of the control group decreased from 20.41 ± 2.10 points to 19.17 ± 2.57 points. The two-way repeated-measures ANOVA revealed a very significant effect of the interaction between time and cognitive training on the total MoCA score. Seventeen participants in the intervention group improved to normal levels, and no participants progressed to dementia after six months of cognitive training. Thus, the efficacy of the intervention was statistically significant. Our study concludes that older age is associated with a cognitive decline. Factors that are more likely to protect against cognitive decline included a higher education level and monthly income, sufficient sleep time, regular physical exercise and reading, frequently engaging in community activities, and continuing to perform housework. Moreover, the cognitive training intervention is effective and may help to decrease the deterioration of cognitive function in patients with MCI, and the interaction between intervention time and cognitive training significantly improves cognitive function.

1. Introduction

The pace of population aging is increasing dramatically worldwide, with many social, economic, and health implications. The global population aged greater than 60 years is expected to increase from 605 million in 2000 to 1.2 billion by 2025 and to 2 billion by 2050; approximately two-thirds of these older people live in low-income and middle-income countries (LMICs) [1]. The rapid growth of the elderly population in China, which will exceed 400 million by 2033, will represent the largest number of elderly individuals in any country in the world [1]. This growing number of older individuals will lead to an increase in the incidence of aging-related disorders such as mild cognitive impairment (MCI) in older populations [2], underscoring the need for innovative programs to prevent MCI [3].
MCI is a clinical condition characterized by a reduction in memory and/or other cognitive processes that are insufficiently severe to be diagnosed as dementia but are more pronounced than the cognitive decline associated with normal aging [4]. MCI is an intermediate state between normal cognition and dementia, with essentially preserved functional abilities [5]. Therefore, this condition is easily underestimated [6]. The diagnosis of MCI is based mainly on the patient’s history and a cognitive examination [7], and the Montreal Cognitive Assessment (MoCA) is a useful instrument to detect mild impairments in cognition and has become a common tool used to diagnose both MCI and dementia [8]. The global prevalence of MCI in the population aged ≥60 years is up to 38.60% [9], but it is approximately 11.00–20.00% among older Chinese adults [1, 10, 11]. MCI is a risk factor for dementia [12] and is associated with a 6-fold increased risk of Alzheimer’s disease (AD) [13]. Additionally, more than 50.00% of people with MCI subsequently develop dementia [14].

Over the past few decades, the identification of the factors predicting cognitive decline has become increasingly important in the field of geriatrics [15] to facilitate targeted interventions. Researchers anticipate that the detection of cognitive decline and delivery of interventions to at-risk individuals at this earliest stage may prove more effective in preserving cognitive function [15]. However, the existing reviews and previous meta-analyses have reported varying findings concerning the benefits of cognitive training. While several studies reported the benefits of cognitive training [16–19], others have found little or no advantage [20–23]. Several reviews report a benefit of cognitive strategies. In a recent study, the practice of 6 months of dancing training positively affected body composition and increased fitness performance, memory functions, and anxiety in elderly people [24]. We hypothesized that cognitive training might improve cognitive functions and delay the progression from MCI to AD. We evaluated the cognitive function of elderly people using MoCA scores, as no published studies among Chinese populations have used the MoCA scores of elderly people to evaluate the effect of cognitive training. The aims of our study are to evaluate the cognitive function of elderly people using the Beijing version of the Montreal Cognitive Assessment (MoCA-BJ) [25] and then to identify whether cognitive function correlates with different characteristics. In addition, we aim at evaluating the efficacy of the intervention after three and six months of cognitive training.

2. Materials and Methods

2.1. Design. In the baseline survey, the study used the cluster sampling method to select 3000 subjects from three communities in Nanning, Guangxi, China. All subjects were selected from community-dwelling elderly people that were notified on the telephone by community health workers from July to September of 2017. A structured interviewer-administered questionnaire was used to collect data on sociodemographics and lifestyle factors for the subjects; MoCA-BJ [25] was used to evaluate the cognitive function. The evaluation included 7 cognitive domains: visuospatial and executive function (trail-making B task (1 point), cube copy (1 point), and clock-drawing (3 points)), naming (3 points), attention (forward/backward digit span (2 points), vigilance/tapping (1 point), and serial 7 subtraction (3 points)), language ((sentence repetition (2 points) and verbal fluency (1 point)), abstraction (the 2-item verbal abstraction, total of 2 points), delayed recall/short-term memory (5 points), and orientation (6 points) [25, 26]. The total score of MoCA-BJ [25] was 30 points.

We conducted an open-label randomized controlled trial among 140 subjects with MCI who were randomly selected from the baseline survey within a community. Selected subjects were randomly assigned to the intervention group (N = 70) and the control group (N = 70). The control group was not provided any intervention measures. The cognitive training was controlled and executed by the designer, and it was conducted from May to December of 2018. The study used the group training method for the intervention group, and the participants in the intervention group all gathered in a classroom and were provided cognitive training every two weeks for six months by the designer; each training session lasted approximately 90 minutes. The cognitive training intervention included memory training, attention training, and calculation training. Memory training included seven-piece board recovery training, picture-reading memory, reading aloud, and reciting phrases; attention training included colour reaction training and Schulte Grid training; and calculation training included two simple calculation questions and one simple application question for calculation in each intervention process. Then, the participants in the intervention and control groups were evaluated using the MoCA-BJ [25] by investigators at the third and sixth months.

Participation in the study was voluntary; individuals who agreed to participate signed an informed consent form. The study protocol was approved by the Ethics Committee of Guangxi Medical University.

2.2. Sample Size Calculation. Because the baseline survey was a cross-sectional survey, the sample calculation formula $N = D \times (U \alpha^2 \times \pi \times (1 - \pi) / \delta^2)$ was used to calculate sample size in this study. The lowest prevalence of MCI in elderly individuals aged ≥60 years was reported to be approximately 5.00% [27]. If $\alpha = 0.05$, $u_{\alpha} = 1.96$, the overall prevalence ($\pi$) = 5.00%, the error tolerance ($\delta$) = 1.00%, and the accuracy of survey ($D$) = 1.50, the required sample size would be 2766 using the formula listed above. In this study, considering the rates of loss to follow-up, nonrespondents, and invalid questionnaires, the sample size was increased to 3000.

The sample sizes of the intervention and control groups were calculated using G-Power 3.1.9.4 (Kiel University, Kiel, Germany). According to the study by Anderson-Hanley et al. [28], the average and standard deviation of MoCA scores for the intervention and control groups are 24.70 ± 3.56 and 23.20 ± 4.97 points, respectively. Therefore, we substituted the average and standard deviation of MoCA scores reported in the study by Anderson-Hanley et al. [28] into the sample size calculation formula and calculated the sample size needed.
into G-Power 3.1.9.4 to calculate the validity. The validity of the intervention and control groups was 0.726 and 0.347, respectively, and the intermediate validity was 0.536. Based on a validity = 0.536, α = 0.05, u α = 1.96, β = 0.20, and power of the tests (1 – β) = 0.80, we used the independent-samples t test to calculate the sample size with G-Power 3.1.9.4, and the sample sizes of the intervention and control groups were 56 and 56, respectively. In this study, considering the rates of loss to follow-up and nonrespondents, the sample sizes of the intervention and control groups were increased to 70 and 70, respectively.

2.3. Sample Inclusion and Exclusion Criteria. In the baseline survey, subjects aged ≥60 years who had lived in Nanning for more than six months and were fluent in local dialects were all able to be included in this study. Subjects suffering from the following diseases were excluded: brain tumours, Parkinson’s disease, unstable internal medical diseases that could influence brain function or cognitive function, a history of acute cerebrovascular disease within three months, active epilepsy, dementia, severe sensory impairment, or a history of mental illness.

When selecting the participants for the intervention and control groups, subjects aged ≥60 years who had lived in Nanning for more than six months, were fluent in the local language, and had complained of memory loss or the decreased abilities of daily living or were diagnosed with MCI in the baseline survey were all included in this study. Subjects who suffered from the following diseases were excluded: patients with psychiatric disorders or who were not fluent in the local language, patients with serious somatic diseases or severe sensory disorders, or patients who had been diagnosed with dementia and neurological disorders in the baseline survey. Additional exclusion criteria were patients who were unable to continue to participate in the intervention process for personal or family reasons or withdrew by themselves, patients who did not participate in the intervention process for three or more sessions, or patients who experienced other serious illnesses in the intervention process.

2.4. Diagnostic Criteria for MCI and Dementia. MCI was diagnosed if the subject met the following criteria: memory complaint, normal activities of daily living, normal general cognitive function, abnormal memory for age, and a lack of dementia [29]. The MoCA score is used to diagnose MCI, and the subject is diagnosed with MCI if the MoCA score is ≤23 points [30] or with dementia if the MoCA score is ≤14 points [31]. In addition, because the education level may influence the MoCA score [26], the following criteria were used to diagnose MCI in this study: the optimal number of points is <17 for illiterate individuals, <20 for individuals with 1 to 6 years of education, and ≤23 for individuals with 7 or more years of education [32].

2.5. Statistical Analysis. All data were entered by double entry using EpiData 3.0 and were analysed using IBM SPSS 23.0. In the baseline survey, a t-test or one-way ANOVA was used to analyse differences in MoCA scores in subgroups stratified by demographic characteristics, and the Spearman correlation analysis was used to analyse whether MoCA scores correlated with different demographic characteristics. For the intervention study, the outcome variables were analysed using two-way repeated-measures ANOVA. The within-subject factor was the time (baseline and 3 and 6 months after the intervention), and the between-subject factor was the cognitive training (intervention or control group). Post hoc pairwise comparisons with the Bonferroni adjustment were applied when significant interaction effects were observed. The Greenhouse–Geisser correction was used when Mauchly’s test of sphericity was violated. Partial eta-squared ($\eta^2_p$) values were reported to confirm the effect size in the two-way repeated-measures ANOVA tests. Moreover, the chi-square test was used to evaluate the effect of the intervention on MoCA scores by assessing the prevalence of participants whose score improved to normal, decreased to dementia, or did not change. Statistical significance was established at $p < 0.05$.

3. Results

3.1. Basic Information Obtained from the Baseline Survey. Of the participants included in the baseline survey ($N = 2886$), 58% were male and the mean age of the participants was 68.99 ± 5.92 years. Notably, 28.86% (833/2886) of the participants were diagnosed with MCI, 8.49% (245/2886) with dementia, and 7.31% (211/2886) with neurological diseases.

3.2. MoCA Scores of the Baseline Survey. Table 1 summarizes the MoCA scores. The total MoCA score was 21.69 ± 4.64 points.

3.3. Distribution of MoCA Scores according to Demographic Characteristics. The results for the MoCA scores in subgroups stratified by different demographic characteristics are shown in Table 2. According to the t-test or one-way ANOVA, MoCA scores were statistically significantly associated with gender ($p < 0.001$), age ($p < 0.001$), education level ($p < 0.001$), monthly income ($p < 0.001$), sleep time ($p < 0.001$), exercise time ($p < 0.001$), reading times ($p < 0.001$), time spent engaging in community activities ($p < 0.001$), and time spent performing housework ($p < 0.001$). Spearman’s correlation analysis indicated positive correlations between the education level ($p < 0.001$), monthly income ($p < 0.001$), sleep time ($p < 0.001$), exercise time ($p < 0.001$), reading times ($p < 0.001$), time spent engaging in community activities ($p < 0.001$), and time spent performing housework ($p < 0.001$) with MoCA scores, but age ($p < 0.001$) was negatively correlated with MoCA scores.

3.4. Basic Information Obtained from the Intervention and Control Groups. Table 3 summarizes the availability and basic characteristics of subjects at baseline and at 3 and 6
months of follow-up. No significant differences in gender and mean age were observed among the participants in the intervention and control groups at different evaluation points. More subjects in the intervention group were lost to follow-up at 3 months (11 versus 7) and 6 months (16 versus 11) of follow-up.

3.5. MoCA Scores of the Intervention and Control Groups.

The MoCA scores of the intervention and control groups are shown in Table 4. The total MoCA score of the intervention group increased from 19.77 ± 2.24 points to 20.64 ± 2.49 and 21.09 ± 2.20 points after three and six months of cognitive training, respectively, but the score of the control group decreased from 20.41 ± 2.10 points to 19.40 ± 2.57 and 19.17 ± 2.57 points, respectively. The two-way repeated-measures ANOVA showed very significant effects of the interactions between time and cognitive training on the total MoCA score ($p < 0.001$) and the MoCA scores for attention ($p = 0.001$), vigilance ($p = 0.046$), language ($p = 0.009$), delayed recall ($p = 0.044$), and orientation ($p = 0.013$). The MoCA scores for vigilance ($p = 0.001$), sentence repetition ($p < 0.001$), and verbal fluency ($p = 0.001$) differed over time (Table 5).

3.6. Efficacy of the Intervention. After 3 months, some participants in the intervention group improved to normal levels (23.73%, 14/59) and none progressed to dementia (0.00%, 0/59), while only one participant in the control group (1.59%, 1/63) improved to normal levels and one progressed to dementia (1.59%, 1/63). After 6 months, some participants in the intervention group improved to normal levels and one participant in the control group (1.59%, 1/63) improved to normal levels and three progressed to dementia (1.59%, 1/63). The chi-square test showed the significant effect of cognitive training on converting to normal MoCA scores after 3 and 6 months of intervention ($p < 0.001$; Table 6).

4. Discussion

To the best of our knowledge, this study is the first to evaluate the cognitive function of elderly people aged ≥60 years in a community-based setting in Nanning using the MoCA-BJ. In our previous study, the overall prevalence of MCI in the population aged ≥60 years was 27.27% [33], which is higher than in other Chinese studies (11.00%–20.00%) [1, 10, 11] but lower than in the city of Guilin, Guangxi, China (37.00%) [34]. When comparing our findings with other international studies including different criteria for defining MCI performed in Asia, the USA, and Europe, a wide range of the prevalence of MCI from 7.90% to 38.60% [9, 13], 5.60% to 27.65% [35, 36], and 5.00% to 20.00% [37], respectively, emerged. A potential explanation for the differences in these results might be the analysis of different regions and countries using different evaluation tools, methods, or criteria to evaluate MCI. Although the researchers used the same tools and criteria to evaluate MCI in the same country, the test results may vary due to the differences in the sociodemographic characteristics of the participants.

An important factor to consider when selecting a cognitive test is how its performance is influenced by demographic factors, such as age and education level [38], and a 1-point lower MoCA score is associated with a 34.00% increased risk of cognitive decline [39]. According to recent studies, the MoCA score is negatively correlated with age and is significantly higher for younger elderly people [40]. The MoCA score is also positively correlated with the education level ($r = 0.460–0.660$) [41, 42]; these results are consistent with our study. Furthermore, sleep disturbance is prevalent and predicts cognitive decline in older people and in patients with neurodegenerative disorders [43], whereas physical activity [44] and good reading habits [45] are factors that protect against cognitive decline. These results are also consistent with our study. Therefore, maintaining good quality sleep, regular exercise, and good reading habits are necessary for elderly people to prevent cognitive decline. In the present study, participants who engaged in a greater number of community activities and performed more housework were less likely to experience cognitive decline. Many studies have shown that social engagement may help decrease the risk of further cognitive decline [44], and a deterioration in the ability to perform housework is a potentially important indicator of an evolving cognitive impairment in some older people [46]. The social groups and family of older individuals should encourage and support their participation in as many social and family activities as possible. In our study, a higher monthly income was also a protective factor that prevented cognitive decline in elderly people. This result requires more in-depth investigations in future studies for confirmation.

Cognitive training may improve the cognitive function of patients with MCI and may decrease the rate at which MCI progresses to dementia [44, 47, 48] or AD [49]. More than 50.00% of people with MCI subsequently develop dementia [14]. Currently, cognitive training is frequently used in patients with MCI, and it generally includes physical activity training and mental training. This study is the first to investigate the efficacy of a cognitive training intervention in elderly individuals from three communities in Nanning, Guangxi, China. A substantial proportion of individuals with MCI revert to normal cognition in follow-up studies.
with no intervention measures [35]. In our study, significantly higher improvements to normal levels were observed after cognitive training in the intervention group (31.48%, 17/54) than in the control group (1.69%, 1/59); these changes were even present after three months of intervention (23.73%, 14/59 versus 1.59%, 1/63). Therefore, although a substantial proportion of individuals with MCI in the control group improved to normal levels, we still recommend cognitive training as the best and most effective method for improving the cognitive functions of patients with MCI.

According to some studies, cognitive training exerts beneficial effects on visuospatial/executive function, attention, language, delayed recall, and orientation in individuals with MCI [45, 50, 51]. In our study, cognitive function was improved in the intervention group after six months of

| Characteristic                          | Sample (N) | MoCA score (Mean ± SD) | t test/one-way ANOVA | Spearman correlation analysis |
|----------------------------------------|------------|------------------------|----------------------|-------------------------------|
|                                        |            |                        | t/F value | p value | r     | p value |
| Total                                  | 2886       | 21.69 ± 4.64           |           |         |       |         |
| Gender                                 |            |                        |           |         |       |         |
| Male                                   | 1201       | 22.47 ± 4.16           | 7.893     | <0.001  |       |         |
| Female                                 | 1685       | 21.13 ± 4.89           |           |         |       |         |
| Age (years)                            |            |                        |           |         |       |         |
| 60–64                                  | 284        | 24.02 ± 3.26           | 145.736   | <0.001  | -0.418| <0.001 |
| 65–69                                  | 1356       | 23.07 ± 3.71           |           |         |       |         |
| 70–74                                  | 644        | 21.18 ± 4.07           |           |         |       |         |
| 75–79                                  | 343        | 18.98 ± 4.99           |           |         |       |         |
| ≥80                                    | 259        | 16.76 ± 5.68           |           |         |       |         |
| Education level (years of education)   |            |                        |           |         |       |         |
| Illiteracy (0 years)                   | 306        | 15.13 ± 4.96           |           |         |       |         |
| Primary school (6 years)               | 934        | 20.72 ± 4.16           |           |         |       |         |
| Middle school (9 years)                | 836        | 22.83 ± 3.52           |           |         |       |         |
| High school (12 years)                 | 508        | 23.99 ± 3.34           |           |         |       |         |
| College (≥13 years)                    | 302        | 24.32 ± 2.95           |           |         |       |         |
| Monthly income ($)                     |            |                        |           |         |       |         |
| 0                                      | 399        | 18.36 ± 5.58           |           |         |       |         |
| 1–148                                  | 351        | 19.61 ± 4.83           |           |         |       |         |
| 149–297                                | 596        | 21.48 ± 4.26           |           |         |       |         |
| 298–446                                | 904        | 22.74 ± 3.91           |           |         |       |         |
| 447–595                                | 364        | 23.63 ± 3.59           |           |         |       |         |
| ≥596                                   | 272        | 23.63 ± 3.35           |           |         |       |         |
| Sleep time (hours/day)                 |            |                        |           |         |       |         |
| <4                                     | 129        | 17.88 ± 5.34           | 29.271    | <0.001  | 0.132 | <0.001 |
| <6                                     | 1394       | 21.55 ± 4.66           |           |         |       |         |
| <8                                     | 1097       | 22.09 ± 4.36           |           |         |       |         |
| ≥8                                     | 266        | 22.65 ± 4.41           |           |         |       |         |
| Exercise time (hours/week)             |            |                        |           |         |       |         |
| 0                                      | 502        | 18.74 ± 5.33           |           |         |       |         |
| <1                                     | 1650       | 21.95 ± 4.40           |           |         |       |         |
| ≥1                                     | 637        | 23.10 ± 3.74           |           |         |       |         |
| ≥2                                     | 97         | 23.29 ± 3.41           |           |         |       |         |
| Reading (times/week)                   |            |                        |           |         |       |         |
| 0                                      | 1564       | 20.35 ± 4.89           |           |         |       |         |
| 1–2                                    | 707        | 22.93 ± 3.70           |           |         |       |         |
| 3–5                                    | 270        | 23.79 ± 3.77           |           |         |       |         |
| ≥6                                     | 345        | 23.59 ± 3.81           |           |         |       |         |
| Community activities (times/week)      |            |                        |           |         |       |         |
| 0                                      | 776        | 20.71 ± 5.24           |           |         |       |         |
| 1–3                                    | 1249       | 21.71 ± 4.47           |           |         |       |         |
| 4–6                                    | 627        | 22.60 ± 4.24           |           |         |       |         |
| 7–9                                    | 198        | 22.43 ± 3.94           |           |         |       |         |
| ≥10                                    | 36         | 22.31 ± 3.19           |           |         |       |         |
| Housework (times/week)                 |            |                        |           |         |       |         |
| 0                                      | 287        | 19.80 ± 5.45           |           |         |       |         |
| 1–2                                    | 639        | 21.90 ± 4.24           |           |         |       |         |
| 3–5                                    | 546        | 21.75 ± 4.24           |           |         |       |         |
| ≥6                                     | 1414       | 21.96 ± 4.71           |           |         |       |         |
### Table 3: Basic information of the intervention and control groups.

| Category                          | Sample (N) | Loss to follow-up (N) | Age (mean ± SD) (years) |
|-----------------------------------|------------|-----------------------|-------------------------|
|                                   | Intervention group | Control group | Intervention group | Control group | Intervention group | Control group |
| **Baseline**                      |             |                       |                         |
| Gender                            |             |                       |                         |
| Male                              | 27          | 35                    | NA                      | NA            | 67.70 ± 4.44       | 69.09 ± 4.27 |
| Female                            | 43          | 35                    | NA                      | NA            | 68.81 ± 4.04       | 68.29 ± 4.27 |
| Total                             | 70          | 70                    | NA                      | NA            | 68.39 ± 4.21       | 68.69 ± 4.26 |
| **Medium-term (follow-up at 3 months)** |             |                       |                         |
| Gender                            |             |                       |                         |
| Male                              | 22          | 32                    | 5                       | 3             | 67.82 ± 4.67       | 69.25 ± 4.41 |
| Female                            | 37          | 31                    | 6                       | 4             | 68.54 ± 4.23       | 68.19 ± 4.47 |
| Total                             | 59          | 63                    | 11                      | 7             | 68.27 ± 4.37       | 68.73 ± 4.43 |
| **Final-term (follow-up at 6 months)** |             |                       |                         |
| Gender                            |             |                       |                         |
| Male                              | 20          | 29                    | 7                       | 6             | 67.95 ± 4.55       | 69.21 ± 4.59 |
| Female                            | 34          | 30                    | 9                       | 5             | 68.41 ± 4.22       | 68.37 ± 4.44 |
| Total                             | 54          | 59                    | 16                      | 11            | 68.24 ± 4.31       | 68.78 ± 4.49 |

NA: not applicable.

### Table 4: MoCA scores of the intervention and control groups.

| Cognitive function                  | Baseline (before the intervention) | MoCA score (mean ± SD) | Final-term (follow-up at 6 months) |
|-------------------------------------|------------------------------------|------------------------|------------------------------------|
|                                     | Intervention group | Control group | Medium-term (follow-up at 3 months) | Intervention group | Control group |                 |
| **Intervention group**              |                       |               |                                   |                       |                 |                 |
| Total MoCA score                    | 19.77 ± 2.24          | 20.64 ± 2.49    | 21.09 ± 2.20                      |                       |                 |                 |
| Visuospatial/executive function     | 2.61 ± 1.13           | 2.71 ± 0.97     | 2.72 ± 0.81                       |                       |                 |                 |
| Naming                              | 2.26 ± 0.74           | 2.29 ± 0.70      | 2.33 ± 0.55                       |                       |                 |                 |
| Attention                           | 4.49 ± 1.11           | 4.78 ± 1.04      | 4.96 ± 0.82                       |                       |                 |                 |
| Digit span (forward/ backward)      | 1.73 ± 0.51           | 1.76 ± 0.43      | 1.70 ± 0.46                       |                       |                 |                 |
| Vigilance (tapping)                 | 0.39 ± 0.49           | 0.58 ± 0.50      | 0.70 ± 0.46                       |                       |                 |                 |
| Serial 7 subtraction                | 2.37 ± 0.71           | 2.44 ± 0.73      | 2.56 ± 0.60                       |                       |                 |                 |
| Language                            | 1.50 ± 0.81           | 1.53 ± 0.75      | 1.56 ± 0.63                       |                       |                 |                 |
| Sentence repetition                 | 0.97 ± 0.66           | 0.73 ± 0.67      | 0.72 ± 0.60                       |                       |                 |                 |
| Verbal fluency                      | 0.53 ± 0.50           | 0.80 ± 0.41      | 0.83 ± 0.38                       |                       |                 |                 |
| Abstraction                         | 1.10 ± 0.73           | 1.14 ± 0.63      | 1.15 ± 0.60                       |                       |                 |                 |
| Delayed recall                      | 1.33 ± 1.06           | 1.64 ± 0.87      | 1.69 ± 0.70                       |                       |                 |                 |
| Orientation                         | 5.53 ± 0.76           | 5.64 ± 0.58      | 5.74 ± 0.44                       |                       |                 |                 |
| **Control group**                   |                       |               |                                   |                       |                 |                 |
| Total MoCA score                    | 20.41 ± 2.10          | 19.40 ± 2.57     | 19.17 ± 2.57                      |                       |                 |                 |
| Visuospatial/executive function     | 2.83 ± 0.87           | 2.68 ± 0.78      | 2.64 ± 0.74                       |                       |                 |                 |
| Naming                              | 2.19 ± 0.77           | 2.21 ± 0.68      | 2.22 ± 0.67                       |                       |                 |                 |
| Attention                           | 4.61 ± 0.92           | 4.49 ± 1.16      | 4.34 ± 1.14                       |                       |                 |                 |
| Digit span (forward/ backward)      | 1.83 ± 0.38           | 1.65 ± 0.48      | 1.59 ± 0.50                       |                       |                 |                 |
| Vigilance (tapping)                 | 0.37 ± 0.49           | 0.48 ± 0.50      | 0.42 ± 0.50                       |                       |                 |                 |
| Serial 7 subtraction                | 2.41 ± 0.67           | 2.37 ± 0.75      | 2.32 ± 0.71                       |                       |                 |                 |
| Language                            | 1.59 ± 0.81           | 1.32 ± 0.78      | 1.22 ± 0.72                       |                       |                 |                 |
| Sentence repetition                 | 1.06 ± 0.68           | 0.68 ± 0.59      | 0.59 ± 0.59                       |                       |                 |                 |
| Verbal fluency                      | 0.53 ± 0.50           | 0.63 ± 0.49      | 0.63 ± 0.49                       |                       |                 |                 |
| Abstraction                         | 1.11 ± 0.83           | 0.95 ± 0.63      | 0.95 ± 0.63                       |                       |                 |                 |
| Delayed recall                      | 1.46 ± 0.93           | 1.33 ± 1.00      | 1.31 ± 0.81                       |                       |                 |                 |
| Orientation                         | 5.71 ± 0.64           | 5.51 ± 0.78      | 5.59 ± 0.62                       |                       |                 |                 |
cognitive training, but the control group had deteriorated after six months. The two-way repeated-measures ANOVA identified an effect of the interaction between the intervention time and cognitive training on the total MoCA score, but statistically significant effects of the intervention time ($p = 0.453$) or grouping ($p = 0.050$) alone on the total MoCA score were not observed. Perhaps we need to expand the sample size and intervention time to verify whether the intervention time or grouping affects cognitive function in future studies.

The present study has several limitations. First, because we used the MoCA-BJ to evaluate the function of elderly people, the participants were required to follow the investigators’ commands. Elderly people who were illiterate or less educated might have experienced difficulty in comprehending the instructions and might not have followed the commands appropriately. These factors might have affected the MoCA scores. Second, as some participants were unable to insist on participating in the six-month cognitive training, an increase in the number of participants lost to follow-up was observed. This loss to follow-up might have influenced the accuracy of the analysis of the efficacy of cognitive training. A larger sample size might mitigate this problem. Finally, the study used the group training method for the intervention group, and all subjects were assembled in a room to deliver the training. Subjects with less education or other limitations might not have been comfortable in asking questions or clarifying any issues that they did not understand. The implementation of a smaller group based on the sociodemographic characteristics of the participants might have been a better approach. Future studies should focus on the limitations described above in the study planning process.

## 5. Conclusions

In conclusion, based on the findings of the current study, older age is associated with a cognitive decline. Factors that
are more likely to protect against cognitive decline include a higher education level and monthly income, sufficient sleep time, regular physical exercise and reading habits, frequently engaging in community activities, and continuing to perform housework. Moreover, the cognitive training intervention is effective and may help decrease the deterioration of cognitive function in patients with MCI. The interaction between intervention time and cognitive training also significantly improves cognitive function.

Data Availability
The data used to support the findings of this study are available from the corresponding author upon request. The readers can contact Professor Li Yang via e-mail (yanggli8290@hotmail.com) to obtain data.

Disclosure
Hu Jiang is the co-first author.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

Authors’ Contributions
Li Yang developed the study concept and design. Hu Jiang performed the epidemiological survey and data collation. Yukun Zuo and Xiangmin Wu assisted to perform the epidemiological survey. Zhenren Peng drafted the manuscript. Li Yang, Xiaomin Wang, Kaiyong Huang, and Abu S. Abdullah provided critical comments in revising the manuscript. All authors approved the final version of the manuscript for submission.

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