

Effects of a Multicomponent Intervention With Cognitive Training and Lifestyle Guidance for Older Adults at Risk of Dementia:

A Randomized Controlled Trial

Pengfei Wang, MM; Tingting Yang, PhD; Wenjia Peng, PhD; Meng Wang, MPH; Xiaoli Chen, MPH; Yinghua Yang, PhD; Yanyan Huang, MM; Yihua Jiang, BPM; Feng Wang, MPH; Shuangyuan Sun, MPH; Ye Ruan, PhD; Yan Ding, MM; Ye Yao, PhD; and Ying Wang, PhD

Abstract

Objective: This study examined the effects of a multicomponent intervention program on cognitive function in community-dwelling older adults with mild cognitive impairment (MCI) and subjective cognitive decline (SCD).

Methods: This was a 2-arm, randomized controlled trial in which a multicomponent intervention was applied. Participants were recruited from June 2020 to August 2020, randomization and intervention began in August 2020, and the entire program ended in January 2021. It included cognitive training (mnemonic strategy training) and lifestyle guidance (diet, sleep, and exercise guidance) for 7 weeks. A total of 123 Chinese community-dwelling older adults experiencing MCI or SCD were randomly divided into a multicomponent

intervention group (n = 62) and a health education group (n = 61). The global cognitive function was measured using the Mini-Mental State Examination (MMSE). The cognitive domains outcomes included memory functions measured using the immediate and delayed tests of the Auditory Verbal Learning Test (AVLT) and Logical Memory Test (LMT), and executive function and attention measured using the Digital Symbol Substitution Test (DSST) and Digit Span Test (DST). Data were collected at baseline and postintervention.

Results: For cognitive outcome, the results of linear mixed-effect model showed significant time × group effects in the MMSE (Cohen d = 0.63 [95% CI, 0.27 to 1.00], F = 10.25, P = .002). This study found significant time × group effects in AVLT-immediate (Cohen d = 0.47 [95% CI, 0.11 to 0.83], F = 8.18, P = .005), AVLT-

delayed (Cohen d = 0.45 [95% CI, 0.10 to 0.81], F = 4.59, P = .034), LMT-delayed (Cohen d = 0.71 [95% CI, 0.34 to 1.07], F = 4.59, P = .034), DSST (Cohen d = 0.27 [95% CI, -0.08 to 0.63], F = 4.83, P = .030), and DST (Cohen d = 0.69 [95% CI, 0.33 to 1.05], F = 8.58, P = .004).

Conclusions and Implications: The results support the feasibility and effectiveness of the multicomponent intervention program in improving cognitive function in community-dwelling older adults at risk of dementia. The high adherence of this program shows its potential for promotion in the community and supports a larger and longer trial.

Trial Registration: Chinese Clinical Trial Registry (ChiCTR2200061420).

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Author affiliations are listed at the end of this article.

According to the World Health Organization, there are approximately 55 million dementia patients globally, and this number is estimated to rise to 78 million by 2030; the global societal cost of dementia is expected to increase to US \$2.8 trillion by 2030.¹ Additionally, family members of patients with dementia face huge physical and psychological burdens.² China's

population is aging significantly faster than in other low- and middle-income countries.³ The number of patients with dementia in China is approximately 10 million, ranking the highest worldwide.⁴

With approximately 60% of patients diagnosed with dementia currently living in communities⁵ with a large population, inadequate management of patients with

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Editor's Note

We encourage authors to submit papers for consideration as a part of our Focus on Geriatric Psychiatry section. Please contact Jordan F. Karp, MD, at jkarp@psychiatrist.com, or Gary W. Small, MD, at gsmall@psychiatrist.com.

Clinical Points

- Older adults with mild cognitive impairment or subjective cognitive decline have higher risks of dementia compared to those with normal cognition, but there are few studies of multicomponent interventions for Chinese community-dwelling older adults at risk of dementia.
- For older adults at risk of dementia, mnemonic strategy-based cognitive training combined with a lifestyle guidance program had positive results on cognitive function and feasibility for community replication.

dementia or mild cognitive impairment (MCI) at the community level increases the burden of cognitive impairment.⁶ The community, as the first point of contact for patients with dementia,⁷ needs to strengthen the management of dementia and its preceding stages and develop community-based intervention programs for older adults without dementia to delay or even avoid dementia.

Older adults with MCI and subjective cognitive decline (SCD) are at greater risk of developing dementia than older adults with normal cognition.^{8–10} The natural pathogenesis of Alzheimer disease (AD) begins with SCD, which progresses to MCI at a rate of 6.67% per year; approximately 50% of patients with MCI will develop AD within 5 years.¹¹ Interventions for at-risk older adults in the early stages before dementia develops, such as MCI or SCD, can effectively delay or even prevent the onset of dementia.^{12,13}

One such intervention is a widely used form of cognitive training based on mnemonic strategies, which has demonstrated good results in improving cognitive function for individuals with MCI and SCD.^{14–17} Mnemonic strategies can be widely conceptualized as cognitive methods that contribute to the organization and association of new information, thus increasing the depth of processing.¹⁸ Mnemonic-strategy interventions usually include teaching participants about brain structure, how memory functions, and training memory strategies and guiding their application in everyday life.¹⁹

Multidomain lifestyle interventions have been shown to be effective in preventing dementia.^{20,21} In general, cognitive impairment is complex and multifactorial, and older adults with cognitive impairment have multidimensional influences, such as physical activity,^{22,23} lifestyle factors such as diet^{24,25} and sleep,^{26,27} and social interaction.^{28,29} Therefore, individuals with cognitive impairment require multicomponent interventions to obtain optimal prevention. A Finnish intervention study on the prevention of cognitive impairment and disability (FINGER) is the first large-scale multidomain intervention study, using diet, exercise, and cognitive training to prevent cognitive decline and dementia in at-risk older adults,³⁰ which suggests that a multicomponent

intervention can be used to improve cognitive function in people at high risk of dementia.

Therefore, multicomponent interventions may be more effective in improving cognitive function and preventing dementia in older adults at risk of dementia. This study combined and implemented mnemonic strategy-based cognitive training with a multidomain lifestyle intervention to explore whether there would be an improvement in cognitive function and generalizability of the intervention to older adults in the community.

There are few studies on multicomponent interventions for community-dwelling older adults at risk of dementia, particularly in China. Therefore, we conducted a randomized controlled trial to understand the effectiveness of a 7-week group-based multicomponent intervention program, which includes mnemonic strategy training and multidomain lifestyle guidance, on improving cognitive function in community-dwelling older adults at risk of dementia. The cognitive domains addressed included global cognitive function (memory, executive function, and attention). Additionally, attendance of the participants during the intervention was recorded.

METHODS

Study Design

This study was a single-blind, 2-arm, randomized controlled trial of a multicomponent intervention program with community-dwelling older adults. Older adults who attended a previous cognitive impairment screening program in Minhang District, Shanghai, in August 2019 were invited to participate in this study.³¹ Participants at risk of dementia were randomly assigned to the intervention or control group using a 1:1 ratio. All assessors were blinded to allocation and were not involved in the intervention activities. The intervention was carried out in small groups to ensure intervention effects. Participants in the intervention group were divided into 3 groups to participate in the intervention sequentially. We tested the effectiveness of the intervention protocol after the intervention. This study was approved by the Ethics Review Committee of Fudan University School of Public Health (IRB#2020-07-0840) and was registered with the Chinese Clinical Trial Registry (ChiCTR2200061420). Participants who agreed to participate in the study provided written informed consent before participating in the program.

Participants

Community-dwelling older adults with MCI or SCD were recruited. The initial inclusion criteria for all participants were as follows: (1) aged ≥ 55 years, (2)

primary school education or above, (3) community-dwelling, and (4) had subjective memory complaints. Inclusion criteria for participants with MCI³² were as follows: (1) subjective memory complaints, preferably confirmed by an informant; (2) Montreal Cognitive Assessment Scale Basic (MoCA-B)³³ scores ≤ 19 , 22, or 24 for participants who had primary school, middle school, or higher education, respectively, and Mini-Mental State Examination (MMSE)³⁴ scores ≥ 23 ; (3) overall intact activities of daily living; (4) without dementia; and (5) without other medical explanations for the cognitive impairment. Inclusion criteria for participants with SCD were as follows: (1) subjective memory complaints, (2) no objective cognitive impairment as measured by the MoCA-B and MMSE, and (3) overall intact activities of daily living.

The exclusion criteria were as follows: (1) cognitive impairment caused by other diseases (including but not limited to cerebrovascular disease, central nervous system infection, Parkinson disease, metabolic encephalopathy, folic acid and vitamin B₁₂ deficiency, and hypothyroidism); (2) nervous system diseases (such as stroke, Parkinson disease, and epilepsy); (3) mental disorders included in the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition; (4) serious diseases of the heart, lung, liver, kidney, or hematopoietic system; (5) participated in any other similar cognitive intervention within 30 days of the study; and (6) other reasons for not completing the study.

Interventions

The control group received a 7-week routine health education program. The health education program was carried out with health education lectures that included protection in daily life for older adults at risk of dementia: prevention of self-harm, prevention of falls, prevention of accidents, prevention of unsafe medications, prevention of wandering, and prevention of poor lifestyle habits, as well as health education for family members of older adults at risk of dementia, including how to make older adults feel close and connected during caregiving, avoiding exposure to dangerous objects, and taking older adults for regular memory checkups. There was also preventive content on dementia prevention, including its causes as well as its precursors. The lectures were given once to the older adults and once to their family members, and there was no homework or other interaction with the control group other than the lectures.

The intervention group participated in the 7-week multicomponent intervention program. The multicomponent intervention included cognitive training (mnemonic strategy training) and lifestyle guidance intervention (diet, sleep, and exercise guidance). The intervention was implemented by

professionals, such as general practitioners in community health service centers and public health doctors in mental health centers, who received unified training to ensure standardization and quality of the intervention.

The cognitive training included memory and brain health knowledge, mnemonic strategies, and application of mnemonic strategies in daily life. Mnemonic strategies included visual mnemonic, story mnemonic, face-name mnemonic, and method of loci. The trainer taught each memory strategy to the participants and guided their application of the strategies in their daily lives. In addition, participants played computerized cognitive games to further enhance the fun and acceptability of the training. Participants were required to complete 90 minutes of cognitive training 1 day each week for 7 weeks and computerized cognitive training for 20–30 minutes 3 days each week for 4 weeks.

The lifestyle guidance intervention included diet, sleep, and physical exercise guidance. Participants received lifestyle guidance on diet during week 3, sleep and stress during week 4, and exercise during week 5. Each participant in the intervention group shared their 3 daily meals in a WeChat group for trainers to record. The trainers talked to the participants about their diet and sleep each week and made suggestions for adjustments. Exercise types included tai chi, Baduanjin, yoga, and resistance bands, depending on participants' preferences, and they were required to exercise for 30 minutes 5 days per week for 7 weeks. Each week, participants were given home tasks to practice and puzzle exercises. Table 1 and Supplementary Table 1 show the details of the 7-week multicomponent intervention program.

Outcomes

Global cognitive function was measured by the MMSE. Three cognitive domains included memory, executive function, and attention. Memory function was measured using the immediate and delayed tests of the Auditory Verbal Learning Test (AVLT) and Logical Memory Test (LMT).³⁵ Executive function and attention were measured using the Digital Symbol Substitution Test (DSST)³⁶ and Digit Span Test (DST).³⁷ Additionally, we recorded and assessed attendance in the intervention.

Statistical Analysis

All analyses were performed according to the intent-to-treat principle. Baseline demographic characteristics were determined to conduct the χ^2 test for categorical data and the independent *t* test for continuous data. Changes in cognitive scores were evaluated using the linear mixed-effect model with cognitive scores as the response variable; time (between baseline and

Table 1.
Details of the Multicomponent Intervention Program

Week	Intervention content	Training form	Time allocation
Cognitive training and lifestyle guidance (diet, sleep, and exercise)			
Week 1	Program introduction	Education and group discussion and practice and home tasks	90 min/d, 1 d/wk, 7 wk
Week 2	Introduction of how memory functions and mnemonic strategies, attention training, finger exercises		
Week 3	Mnemonic strategies training: attention-flash-association, visual mnemonic, method of loci, memory habits training. Lifestyle guidance: diet guidance		
Week 4	Mnemonic strategies training: categorization mnemonic, face-name mnemonic. Lifestyle guidance: sleep guidance, stress reduction guidance, stress release exercises		
Week 5	Mnemonic strategies training: sentence mnemonic, story mnemonic, poker 24 points practice. Lifestyle guidance: exercise guidance, resistance band practice		
Week 6	Mnemonic strategies training: method of loci, body mnemonic, digital mnemonic, left-right brain training, puzzle games		
Week 7	Review of every week's course, award-winning Q&A games		
Lifestyle guidance (physical exercise)			
Weeks 1-7	The participants choose the exercises that they can adhere to for a long time. For example, tai chi, Baduanjin, resistance bands, and yoga	Education and practice and home tasks	30 min/d, 5 d/wk, 7 wk
Computerized cognitive training			
Weeks 2-5	Including virtual ATM, time swinging wildly, trajectory tracking, and mental rotation	Education and practice	20-30 min/d, 3 d/wk, 4 wk

postintervention), group, and interaction between time and group as fixed effects; and age and gender as covariates. To determine the magnitude of exercise effects, we calculated Cohen *d* effect sizes. The outcome scores were calculated as *Z* scores, which standardized to the baseline scores and SD, with higher scores suggesting better postintervention performance compared with baseline. Statistical significance was set at $P < .05$ (2-tailed). All statistical analyses were undertaken using SPSS version 26.

RESULTS

Figure 1 shows the flow diagram of the participants. A total of 123 participants from Xinzhuang Town, Minhang District, Shanghai, were enrolled in the trial and assigned to the intervention group ($n = 62$) and the control group ($n = 61$); however, 3 intervention group participants and 4 control group participants withdrew during the study period.

Participants' Characteristics

Table 2 shows the baseline characteristics of the participants in the intervention and control groups. At baseline, participants had a mean age of 67.10 years ($SD = 4.57$). There were 75 (61.0%) women, and the average number of years of education was 11.22 ($SD = 3.13$).

Adherence

Overall, participants were able to comply with the intervention requirements. For the intervention group,

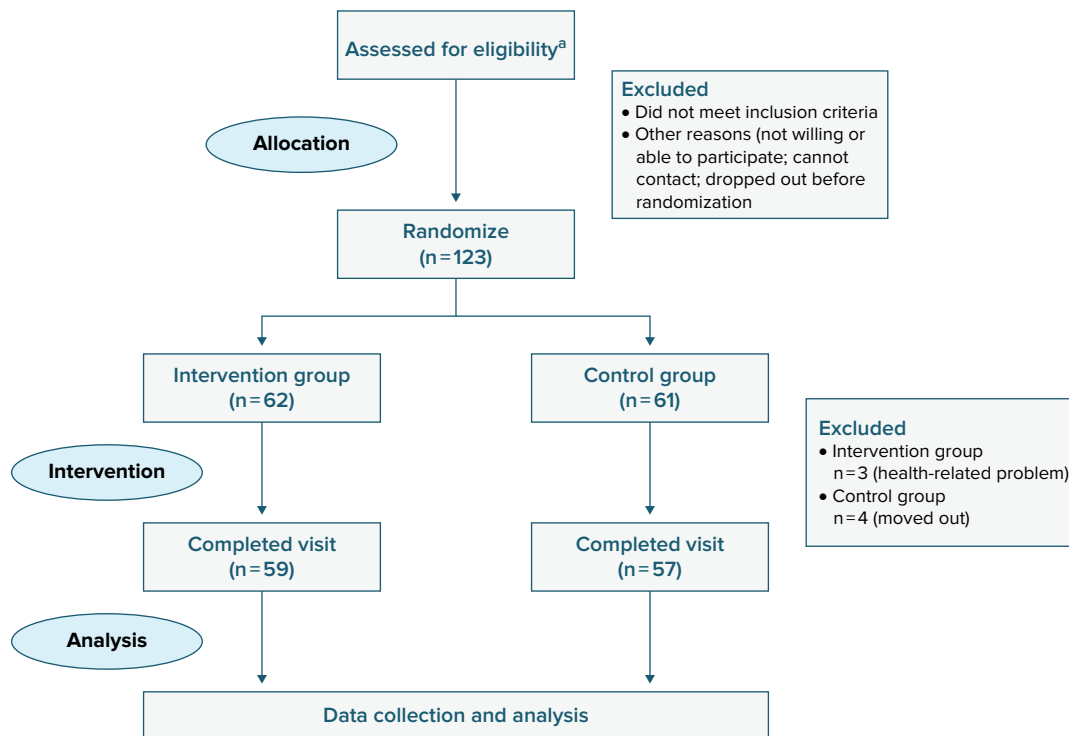
the overall attendance rate of the participants was 92.01%. Supplementary Table 2 shows the details of participants' attendance in the intervention group. For the control group, the overall attendance rate of the participants and their families was 100.00%.

Cognitive Outcome

Table 3 shows the cognitive outcomes at postintervention in the intervention group and the control group as well as time \times group effects. Figure 2 shows the comparison of *Z* score means between the intervention group and the control group. The results of the linear mixed-effect model showed a significant time \times group effect in the MMSE (Cohen $d = 0.63$ [95% CI, 0.27 to 1.00], $F = 10.25$, $P = .002$). When examining the within-group changes after the intervention, the MMSE scores increased significantly in the intervention group ($d = 0.94$) and decreased slightly in the control group ($d = -0.14$).

This study found significant time \times group effects in AVLT-immediate (Cohen $d = 0.47$ [95% CI, 0.11 to 0.83], $F = 8.18$, $P = .005$), AVLT-delayed (Cohen $d = 0.45$ [95% CI, 0.10 to 0.81], $F = 4.59$, $P = .034$), LMT-delayed (Cohen $d = 0.71$ [95% CI, 0.34 to 1.07], $F = 4.59$, $P = .034$), DSST (Cohen $d = 0.27$ [95% CI, -0.08 to 0.63], $F = 4.83$, $P = .030$), and DST (Cohen $d = 0.69$ [95% CI, 0.33 to 1.05], $F = 8.58$, $P = .004$). For the within-group differences after the intervention, the intervention group showed significant improvements in AVLT-immediate ($d = 5.52$), AVLT-delayed ($d = 1.53$), LMT-delayed ($d = 2.07$), and DSST ($d = 5.49$), while the control group showed no significant improvements.

Figure 1.
Flow Diagram of a Randomized Controlled Trial of a Multicomponent Intervention for Older Adults at Risk of Dementia



^aThe older adults assessed for eligibility had participated in an MCI screening program. Participants were first recruited from the early screening program (N = 2,525).

Abbreviation: MCI = mild cognitive impairment.

DISCUSSION

This is the first study on a multicomponent intervention focusing on mnemonic strategy training and lifestyle intervention targeting community-dwelling older adults at risk of dementia in China. We found it effective in improving participants' cognitive function. The program showed potential as an effective intervention; however, it warrants further validation with larger sample sizes and longer follow-up. The training components included in this intervention program are simple to implement and do not require specific equipment. The program requires community workers with a medical background to participate in a 2-day training session and obtain the courseware and the associated computer program (computerized cognitive training games). The significant improvements, good adherence, and replicability of trainers' training suggested its suitability for community replication for older adults at risk of dementia.

This study showed that the multicomponent intervention was effective in improving cognitive function, including MMSE, memory, executive function, and attention, in older adults at risk of dementia. This is

supported by findings in previous studies. A review has shown that a multidomain intervention yields greater improvements in global cognition, executive function, memory, and verbal fluency scores compared to a single-domain intervention.³⁸ The FINGER study in Finland, one of the largest multidomain interventions in a community, showed an improvement in overall neuropsychological test battery scores and significant improvements in executive function and processing speed in older adults at risk of dementia after 2 years of the intervention.³⁰ The Body Brain Life for Cognitive Decline, a multidomain dementia risk reduction randomized controlled trial for older adults in Australia with SCD or MCI that included dementia and lifestyle risk factors, Mediterranean diet, physical activity, and cognitive engagement, showed significant cognitive improvement in the intervention group, supporting the idea that improving lifestyle risk factors for dementia can improve cognitive performance in a short period of time.³⁹ A review found that multidomain lifestyle interventions that address multiple risk factors may delay the onset of cognitive impairment or dementia by reducing neuropathic damage and increasing cognitive reserve.²¹ However, the review also mentioned that

Table 2.
Baseline Demographic Information

Variable	Intervention group (n = 62), mean (SD)	Control group (n = 61), mean (SD)	P
Age, y	66.39 (4.24)	67.82 (4.81)	.082
Gender (male/female), n (%)	23 (39.02)/39 (60.98)	25 (40.98)/36 (59.02)	.659
Education years	11.66 (3.32)	10.77 (2.88)	.115
BMI	24.88 (3.21)	24.33 (3.08)	.339
MMSE	28.13 (1.92)	28.30 (1.60)	.291
AVLT (immediate memory)	31.89 (6.89)	31.98 (8.27)	.572
AVLT (delayed memory)	11.47 (3.39)	11.28 (3.47)	.891
LMT (immediate memory)	10.44 (4.25)	8.79 (5.01)	.052
LMT (delayed memory)	9.13 (4.18)	7.89 (4.46)	.113
DSST	33.98 (11.29)	34.69 (10.24)	.435
DST	11.51 (2.40)	10.64 (2.48)	.605

Abbreviations: AVLT = Auditory Verbal Learning Test, BMI = body mass index, DSST = Digit Symbol Substitution Test, DST = Digit Span Test, LMT = Logical Memory Test, MMSE = Mini-Mental State Examination.

Table 3.
Cognitive Outcome Comparisons in Participants at Risk of Dementia

Test	Group	Postintervention	Mean difference between postintervention and baseline (95% CI)	Adjusted mean difference (postintervention) between the intervention group and the control group (95% CI)	Time × group effects ^a																																																																																							
					Effect size Cohen <i>d</i> (95% CI) ^b	F	df	P																																																																																				
MMSE	Intervention	29.07 (1.05)	0.94 (0.38 to 1.50)**	0.91 (0.38 to 1.44)	0.63 (0.27 to 1.00)	10.25	104.10	.002																																																																																				
	Control	28.16 (1.74)	-0.14 (-0.75 to 0.47)						Memory function									AVLT-immediate	Intervention	37.41 (6.88)	5.52 (3.04 to 8.00)***	3.65 (0.79 to 6.51)	0.47 (0.11 to 0.83)	8.18	116.39	.005	Control	33.75 (8.61)	1.77 (-1.31 to 4.85)	AVLT-delayed	Intervention	13.00 (2.83)	1.53 (0.41 to 2.66)**	1.53 (0.29 to 2.77)	0.45 (0.10 to 0.81)	4.59	118.88	.034	Control	11.47 (3.86)	0.20 (-1.14 to 1.54)	LMT-immediate	Intervention	11.22 (4.39)	0.79 (-0.77 to 2.34)	2.26 (0.49 to 4.02)	0.61 (0.25 to 0.97)	2.50	112.73	.117	Control	8.96 (2.83)	0.18 (-1.68 to 2.04)	LMT-delayed	Intervention	11.20 (3.95)	2.07 (0.61 to 3.54)**	3.26 (1.56 to 4.95)	0.71 (0.34 to 1.07)	4.59	114.91	.034	Control	7.95 (5.18)	0.06 (-1.70 to 1.83)	Executive function/attention									DSST	Intervention	39.47 (11.81)	5.49 (1.33 to 9.65)***	3.18 (1.09 to 7.44)	0.27 (-0.08 to 0.63)	4.83	114.19	.030	Control	36.30 (11.36)	1.61 (-2.33 to 5.55)	DST	Intervention	11.51 (2.40)	0.72 (-0.43 to 1.87)	1.68 (0.78 to 2.58)	0.69 (0.33 to 1.05)
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^aThe linear mixed-effect model with cognitive scores as the response variable, interaction between time and group as fixed effects, and age and gender as covariates.

^bCohen *d* with 95% CI, positive effect sizes are in favor of the intervention group.

P* < .01, *P* < .001 (within-group effect).

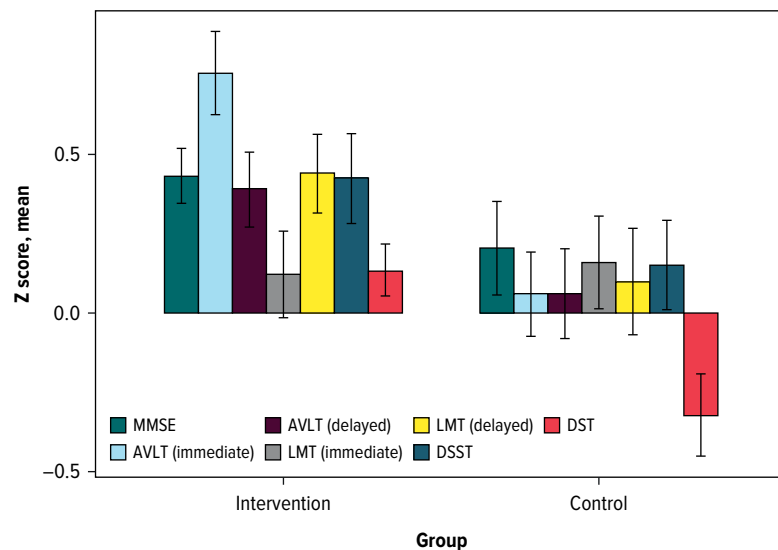
Abbreviations: AVLT = Auditory Verbal Learning Test, DSST = Digit Symbol Substitution Test, DST = Digit Span Test, LMT = Logical Memory Test, MMSE = Mini-Mental State Examination.

multidomain interventions on single measures, such as MMSE or MoCA, showed no significant improvement in global cognition and only a slight improvement. The present study showed that a similar multicomponent intervention was effective in improving global cognitive function in Chinese community-dwelling older adults.

At the end of the intervention, the AVLT and LMT-delayed scores improved more in the intervention group than in the control group, which indicates a significant

improvement in memory. The mnemonic strategy training in the multicomponent intervention of this study may have played a role in the improvement of memory function because it mainly trains participants in memory skills and helps them to store memories more effectively. These results are consistent with studies on the effects of mnemonic strategy training with older adults with SCD or MCI,^{40,41} and imaging results of mnemonic strategy training have shown improvements in brain activity.^{15,42}

Figure 2.
Comparison of Mean Z Scores Between the Intervention Group and the Control Group in Participants at Risk of Dementia^a



^aError bars: ± 1 standard error.

Abbreviations: AVLT = Auditory Verbal Learning Test, DSST = Digit Symbol Substitution Test, DST = Digit Span Test, LMT = Logical Memory Test, MMSE = Mini-Mental State Examination.

In a study of older adults with SCD, participants tended to spontaneously use more mnemonic strategies to compensate for the memory decline they experienced, and using the strategies in everyday life situations made them more beneficial.⁴³ This study suggests that the effectiveness of emphasizing mnemonic strategy training in a multicomponent intervention may have a positive effect on the more effective implementation and use of mnemonic strategies in daily life to consistently strengthen memory in older adults at risk of dementia. In addition, lifestyle interventions may also play a role in memory improvement. A multicomponent holistic health group intervention study of older adults with MCI in a Chinese community showed similar results for interventions including diet, exercise, and socialization, with results showing a strong effect size on improving participants' delayed memory.⁴⁴ An intervention study⁴⁵ of older adults at risk of dementia found that an active lifestyle, defined as activity diversity in cognitive, physical, and social activities, was significantly associated with changes in global cognition and memory. Furthermore, the association between lifestyle and cognitive change produced stronger effects than specifically designed cognitive training for older adults at risk of dementia.

This study showed significant between-group effects for DSST and DST scores, suggesting that this multicomponent intervention improved participants'

executive function and attention. A study⁴⁶ of a combined diet and exercise intervention with older adults with cardiovascular disease risk factors and cognitive impairment without dementia showed that diet and exercise lifestyle changes promoted better executive function. In addition, the study identified the potential mechanisms for these lifestyle interventions to improve neurocognition and to increase functional capacity, all of which were associated with improvements in executive function. In this study, daily instruction and monitoring of diet and exercise may have led participants to follow a more active lifestyle during the intervention. In addition, group-based training caused participants to question and interact more, and computerized cognitive training required their continuous attention to the training process, which may have been associated with improvements in executive function and attention.

The participants in this study had high attendance and low dropout rates, suggesting the potential for replication and scaling of this multicomponent intervention program for a community. This multicomponent intervention program combines cognitive training with lifestyle guidance, which may be attractive to the older adult population by aiding with concerns about cognitive decline and providing guidance for their daily health needs. One review has mentioned that a multidomain intervention may have higher

adherence and greater appeal than a single intervention.²¹ In addition, no adverse events were reported with the implementation of this study, suggesting that it is safer for older adults at risk of dementia.

This study has several limitations. First, this study did not have a long follow-up period; longer follow-up observations are required to further determine the effects of the intervention. Second, the generalizability of the study results may be limited by the small sample size, and larger community randomized controlled trials are needed to test the feasibility of scaling and implementing the intervention in a community. Third, more neuropsychological tests and measures should be included to measure changes in cognitive domains and lifestyle more comprehensively. Fourth, it is possible that due to the limitations of the baseline scores, the MMSE scores in the intervention group may not reach the minimum clinically important difference. Future studies will require longer follow-up periods, larger sample sizes, and more complete and varied measures.

Conclusions

The results showed that a multicomponent intervention program of mnemonic strategy training combined with lifestyle intervention including diet, sleep, and exercise instruction significantly improved global cognitive function, memory, executive function, and attention in the participants. The positive results of this randomized controlled trial suggest that it may have the potential to improve cognitive function in community-dwelling older adults at risk of dementia and can be replicated in the community.

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Author Affiliations: School of Public Health, Fudan University, Shanghai, China (P. Wang, Peng, Yao, Y. Wang); NHC Key Laboratory of Health Technology Assessment, Fudan University, Shanghai, China (P. Wang, Y. Wang); Shanghai Center for Clinical Laboratory, Shanghai, China (T. Yang, Y. Yang); Eye & ENT Hospital, Fudan University, Shanghai, China (M. Wang, Chen); Department of Geriatrics, Huashan Hospital, Fudan University, Shanghai, China (Huang); Tian Qiao and Chrissy Chen Institute Clinic Translational Research Center, Shanghai, China (Huang); Minhang District Mental Health Center of Shanghai, Fudan University, Shanghai, China (Jiang, F. Wang, Ding); Shanghai Municipal Center for Disease Control and Prevention, Shanghai, China (Sun, Ruan).

Drs P. Wang and T. Yang contributed equally to this work.

Corresponding Authors: Ying Wang, PhD (wangying1013@fudan.edu.cn), and Ye Yao, PhD (yyao@fudan.edu.cn), No. 130 Dong'an Rd, Xuhui District, Shanghai 200032, China.

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Supplementary Material

Article Title: Effects of a Multicomponent Intervention for Older Adults at Risk of Dementia: A Randomized Controlled Trial

Authors: Pengfei Wang, MM; Tingting Yang, PhD; Wenjia Peng, PhD; Meng Wang, MPH; Xiaoli Chen, MPH; Yinghua Yang, PhD; Yanyan Huang, MM; Yihua Jiang, BPM; Feng Wang, MPH; Shuangyuan Sun, MPH; Ye Ruan, PhD; Yan Ding, MM; Ye Yao, PhD; and Ying Wang, PhD

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LIST OF SUPPLEMENTARY MATERIAL FOR THE ARTICLE

1. [Table 1](#) The Details of Cognitive Training and Lifestyle Guidance
2. [Table 2](#) Attendance for Older Adults in Intervention Groups

DISCLAIMER

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

The details of Cognitive training & Lifestyle guidance

Supplementary Table 1 The details of cognitive training and lifestyle guidance

Week	Intervention content	Training form	Time allocation
Week 1 Program introduction	1.1 Intervention course launch: introduction of the program leader	-	5 min
	1.2 Introduce the program process: the time schedule of each node	-	3 min
	1.3 Introduction to the program content: measurement and intervention	-	20 min
	1.4 Introduction of program participation rules: full participation	-	2 min
	1.5 Intervention warm-up activities: flower arrangement or toy assembly	-	30 min
Week 2 Cognitive training	2.1 Self-introduction of trainer: name, dress, etc.	-	2 min
	2.2 Manifestations of cognitive impairment: forgetfulness, disorganized thinking, etc.	education	6 min
	2.3 Connotation, process and classification of memory	education	6 min
	2.4 Objective memory assessment: short-term memory of ten words	education	10 min
	2.5 Brain-friendly aspects: the four elements of memory	education	10 min
	2.6 Attention training: “kitchen furnishings”	practice	10 min
	2.7 Ways to focus attention: quiet, planning, etc.	education and practice	20 min
	2.8 Explanation and practice of finger exercises: 2-3 times	education and practice	10 min
	2.9 Course Summary	discussion	10 min
Week 2 home tasks			
Smile practice (every morning before getting up); Keep practicing finger exercises once a day and any other physical exercise of participants’ choice (more than 30 minutes); Memorize the name and dress of the trainer; Practice 3 pages of brush writing every day.			
Week 3 Cognitive training & Diet guidance	3.1 Self-introduction of trainer: name, dress, etc.	-	5 min
	3.2 Review of last week’s home tasks	education	2 min
	3.3 Finger exercises: 2 times	practice	5 min
	3.4 Review of four elements of memory improvement: sleep, diet, exercise, and stress reduction	education	10 min
	3.5 Attention-Flash-Association Strategy, Visual mnemonic	education and practice	15 min
	3.6 Method of Loci: fixed location of item placement, etc.	education and practice	10 min
	3.7 Memory habits training: repeat confirmation, advance preparation, etc.	education	10 min
	3.8 Brain-healthy diet: danger of obesity, various nutrients, etc.	education	20 min
	3.9 Course Summary	discussion	10 min
Week 3 home tasks			
Smile practice (every morning before getting up); Keep practicing finger exercises once a day and any other exercise of participants’ choice (more than 30 minutes); Memorize the name and dress of the trainer; Remember movie titles (picture mnemonic); Record and share meals in a Wechat group any day of the week: (breakfast, lunch and dinner; snacks and water), either in pictures or words; Every participant introduces his/her name in class next week (consider how to get others to remember).			
Week 4 Cognitive training & Sleep guidance & Stress reduction guidance	4.1 Self-introduction of trainer: name, dress, etc.	-	2 min
	4.2 Review of last week’s course	discussion	5 min
	4.3 Review of last week’s home tasks	discussion	5 min
	4.4 Finger exercises: 1 time	practice	5 min
	4.5 Categorization mnemonic: classify things that contain common attributes	education and practice	10 min
	4.6 Face-Name mnemonic: movie poster name memory	education and practice	10 min
4.7 Stress management and meditation: stress release exercises, etc.	education and practice	10 min	
4.8 Healthy sleep, insomnia and treatment of insomnia	education	20 min	
4.9 Course Summary	discussion	10 min	
Week 4 home tasks			
Smile practice (every morning before getting up); Keep practicing finger exercises once a day and any other exercise of participants’ choice (more than 30 minutes); Memorize the name and dress of the trainer; Practice 3 pages of brush writing every day; Remember other participants’ names.			
Week 5	5.1 Self-introduction of trainer: name, dress, etc.	-	2 min
	5.2 Review of last week’s course	discussion	5 min

Supplementary Material

Week	Intervention content	Training form	Time allocation
Cognitive training & Exercise guidance	5.3 Review of last week's home tasks	discussion	5 min
	5.4 Finger exercises: 1 time	practice	5 min
	5.5 Sentence mnemonic: stringing together the words to be memorized through sentences, visualizing them as much as possible	education and practice	20 min
	5.6 Story mnemonic: extension of the sentence mnemonics	education and practice	20 min
	5.7 "Poker 24 points" practice: take 4 cards and use "+ - × ÷" to calculate the number on each card to get 24	practice	10 min
	5.8 Exercise guidance and resistance band training	education and practice	20 min
	5.9 Course Summary	discussion	10 min
Week 5 home tasks			
Smile practice (every morning before getting up); Keep practicing finger exercises once a day and any other exercise of participants' choice (more than 30 minutes); Memorize the name and dress of the trainer; Practice 3 pages of brush writing every day; Flash memory of playing cards (record the most cards remembered for the week); Practice "Poker 24 points".			
Week 6 Cognitive training & Brain exercise	6.1 Self-introduction of trainer: name, dress, etc.	-	2 min
	6.2 Review of last week's course	group discussion	5 min
	6.3 Review of last week's home tasks	group discussion	5 min
	6.4 Finger exercises: 1 time	practice	5 min
	6.5 Digital mnemonic: harmonic method, image method	education and practice	10 min
	6.6 Body mnemonic: position fixed and ordered	education and practice	15 min
	6.7 Method of Loci: familiar places as a link	education and practice	10 min
	6.8 Left-right brain training: finger wrap, lupine lock	education and practice	10 min
	6.9 Course Summary	group discussion	10 min
Week 6 home tasks			
Smile practice (every morning before getting up); Keep practicing finger exercises once a day and any other exercise of participants' choice (more than 30 minutes); Memorize the name and dress of the trainer; Practice 3 pages of brush writing every day; Memorize Tang poems (3 pages per day); Practice Lupin locks until be proficient in disassembly and assembly; Make shopping lists (once a week).			
Week 7 Overall review	Review of every week's course; The four elements of memory; Visual mnemonic; Attention-Flash-Association Strategy; Sentence/Story mnemonic; Categorization mnemonic; Body mnemonic; Face-Name mnemonic	discussion	90min

Attendance of the multicomponent intervention program

62 older adults in the intervention group were divided into three groups, with 59 older adults finished all intervention sessions (19 in group 1, 16 in group 2, and 24 in group 3). As shown in Table A2, the overall attendance rate of the participants was 92.01% over the seven-week intervention, with a high attendance rate of 93.23% in group 1, 95.54% in group 2, and 88.69% in group 3. Eight of these sessions had 100.00% attendance, and the total attendance rates was 92.01%.

Supplementary Table 2 Attendance for older adults in intervention groups

Time	group 1, n (%)	group 2, n (%)	group 3, n (%)	Total, n (%)
Week 1	14 (73.68%)	16 (100.00%)	20 (83.33%)	50 (84.75%)
Week 2	19 (100.00%)	15 (93.75%)	20 (83.33%)	54 (91.53%)
Week 3	19 (100.00%)	13 (81.25%)	24 (100.00%)	56 (91.92%)
Week 4	18 (94.74%)	16 (100.00%)	23 (95.83%)	57 (96.61%)
Week 5	17 (89.47%)	15 (93.75%)	19 (79.17%)	51 (86.44%)
Week 6	19 (100.00%)	16 (100.00%)	22 (91.67%)	57 (96.61%)
Week 7	18 (94.74%)	16 (100.00%)	21 (87.50%)	55 (93.22%)
Total	124 (93.23%)	107 (95.54%)	149 (88.69%)	380 (92.01%)