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Original Article

Board Game Intervention to Improve Cognitive and Daily Functioning in Elderly People with Mild Cognitive Impairment: A Randomized Controlled Trial

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SUMMARY

Objective: To examine the effectiveness of a 12-week board game intervention for seniors with mild cognitive impairment (MCI) in improving cognitive functioning and scores on the instrumental activities of daily living (IADL) scale.
Methods: A single-blind randomized controlled trial was conducted to collect data from a long-term care facility in central Taiwan. Sixty-eight MCI seniors were recruited and randomized into a board game group (trial group) and a health promotion group (control group). Participants in both groups received a 2-hour intervention once a week for 12 weeks, with the trial group receiving 12 weeks of board games and the control group receiving 12 weeks of health promotion activities. Before and after the intervention, the primary assessment was conducted using the Saint Louis University Mental Status Exam, Contextual Memory Test, and Trail Making Test part-A; the secondary assessment was conducted using the IADL scale.
Results: The results of the primary assessment indicated that the participants in the trial group showed significant differences in immediate recall and delayed recall compared to the control group ($p < 0.01$). The results of the secondary assessment indicated that participants in the trial group differed significantly ($p < 0.01$) only on the item of using the telephone compared to the control group.
Conclusions: Compared to the health-promoted MCI seniors, those who participated in the board game had significant improvements in memory (immediate recall and delayed recall), but not in IADL (except for using the telephone).

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1. Introduction

According to statistics from Taiwan in 2017, there were 3.19 million senior citizens over 65 years of age, accounting for 14% of the total population, so Taiwan is officially a "senior society." Among them, 18.32% were senior citizens with mild cognitive impairment (MCI) and 7.93% were senior citizens with dementia.[1] With the rapid increase in the number of older adults in Taiwan, it is expected that the number of older adults with MCI will also increase rapidly. MCI is defined as a person's cognitive decline exceeding his/her expected level of age and education, usually during the transition from normal cognition to dementia.[2] Different from dementia, however, MCI seniors are not affected in basic activities of daily living (BADL), but are cognitively impaired in instrumental activities of daily living (IADL).[3]

MCI seniors begin to lose IADL first, and the impairment usually begins with telephone use, followed by the ability to go out and the use of appliances.[4] IADL require more complex cognitive abilities than BADL, so when cognitive function declines rapidly, there is a high risk of future dementia.[4] Memory deterioration is the most common clinical symptom of MCI, primarily immediate recall and delayed recall, which has the most significant impact compared to other cognitive functions and has a high risk of turning into dementia within two years.[2,5] However, MCI seniors have the opportunity to recover through cognitive training and lifestyle interventions (but not when they develop dementia).[6] Therefore, finding an intervention to maintain the cognition and IADL of MCI seniors is of utmost importance.

Previous studies have shown that many interventions have positive effects on the cognitive function of the elderly, such as physical activity,[7,8] music therapy,[9] art therapy,[10] and board games.[11] While all of these interventions are effective for seniors, physical activities require a more spacious venue, and arts activities (e.g., music or art therapy) are optional for seniors in general and not every senior is willing to participate. Board games offer a new alternative that increases the motivation of seniors to continue participating in and learning new activities, and are an effective way to prevent MCI.[11]

Most traditional board games have fixed structured rules in which dice are rolled or cards are played to complete the structured game tasks, but the game context tends to be incompatible with the past life experiences of seniors.[12] Many board games with featuring

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including intuitive responses, visual search, immediate recall, and social interaction, have been developed in the past, such as Heart Attack and Everybody's Got a Problem.[13] Although these board games are popular among Taiwanese seniors and have the potential to entertain and enhance cognitive functions, they are often popular for a short time because the design concepts are from European and American countries and the tasks are very structured, which differs from the life experiences of Taiwanese seniors. Therefore, it is difficult to use them in a systematic design for learning courses and apply them in daily life.[14] Some occupational therapists in Taiwan designed an innovative board game called "Sammy Robot," which is not a traditional dice rolling or card game (not a fixed structured game), but can be operated without the need to edit the program through cardboard electronic devices. This board game can be designed by program leaders as a localized daily life task, and there is an opportunity to enhance the cognitive and daily life functions of MCI seniors.

Occupational therapists have sufficient knowledge to intervene with MCI seniors in a case-centered manner. Through activity design and hygiene, occupational therapists develop designing function-based activities to intervene in the daily life of patients to enhance their cognitive and daily functioning.[15,16] In summary, this study used a 12-week board game (Sammy Robot) to intervene with MCI seniors, and an occupational therapist designed various daily life tasks based on the domains of IADL, in the hope that MCI seniors would adapt to real home situations and improve their cognitive and IADL performance. The purpose of this study was to investigate the effect of 12 weeks of board game intervention on cognitive function and IADL improvement in MCI seniors.

2. Methods

2.1. Study design and participants

This study was a single-blind randomized controlled trial. Data were collected at a long-term care facility in central Taiwan for a total of four months from March to June 2020. The inclusion criteria were (1) senior citizens aged 65 years or older without a diagnosis of dementia and (2) mild neurocognitive impairment on the Saint Louis University Mental Status Exam (SLUMSE). The exclusion criteria were (1) non-national senior citizens, (2) unable to understand the content and complete the questionnaire, (3) unable to participate in the full 12-week intervention, and (4) had an acute illness such as a cold during the trial. Participants were randomized into a trial group and a control group, and they were not aware of their assignment to the trial or control group and were subjected to blocked randomization.[17] Blocked randomization is a commonly used clinical trial design to allow each participant to be randomized into either a trial or control group and to reduce bias.[18] Therefore, in this study, the two groups, the trial group (board game intervention) and control group (general health promotion intervention), were assigned to four blocks of one group according to the blocked randomization method (1:1), yielding an assignment list of AABB, ABAB, ABBA, BBAA, BABA, and BAAB (A for the trial group and B for the control group). This study was approved by the Research Ethics Committee of China Medical University Hospital (CRREC-108-141). In addition, this study is registered in the ClinicalTrials.gov Protocol Registration and Results System (NCT 04964011).

The sample size for this study was estimated with a validity criterion of 0.8 and a significance criterion α of 0.05 (two-tailed) using G-power software (3.1.0). The effect size required to estimate the mean difference between the two groups using the formula was 80%, and the sample size required was 26 in each group. A total of 34 (68) MCI seniors were recruited for each group and participants were required to sign a written consent form before starting the intervention. A pre-test was administered one week prior to the start of the intervention, which included a cognitive assessment and an IADL assessment. The cognitive assessment was conducted using the SLUMSE, the Contextual Memory Test (CMT), and the Trail Making Test part-A (TMT-A); IADL was assessed using the IADL scale. The MCI seniors in the trial group received a board game intervention for 12 weeks; the MCI seniors in the control group received general health promotion for 12 weeks. The post-test was administered to the trial and control groups within one week after the intervention, and the assessment was the same as the pre-test. The flow of the study is shown in Figure 1.

2.2. Intervention

The trial group was led by an occupational therapist who has been working for six years. The intervention comprised 1 week of board game instruction and 11 weeks of board game tasks (combined with daily tasks), for a total of 12 weeks, once a week for 2 hours, for a total of 24 hours of intervention. This study used "Sammy Robot" developed by Gigo, a Taiwanese company. To achieve the goal, the participants had to input commands for the Sammy Robot to move, turn, and act. The commands were programmed through command cards to operate the Sammy Robot to complete the task. In other words, the participants had to arrange the command cards according to the game task and let the Sammy Robot read the cards first (see Figure 2) and then put it on the game map. The Sammy Robot would move according to the instructions of the cards to complete the game task. Moreover, to improve the IADL and help participants operate the Sammy Robot, we produced a "health education handbook" for each participant in the experimental group.

Each intervention was divided into three parts: warm-up (30 min), main activity (60 min), and extended discussion (30 min). The warm-up was to review the previous week's activities and self-check items, the main activity was to complete the week's daily tasks according to the health education handbook, and the extended discussion was when the board game leader led the MCI seniors to share and discuss the week's daily tasks. In the first week, each par-

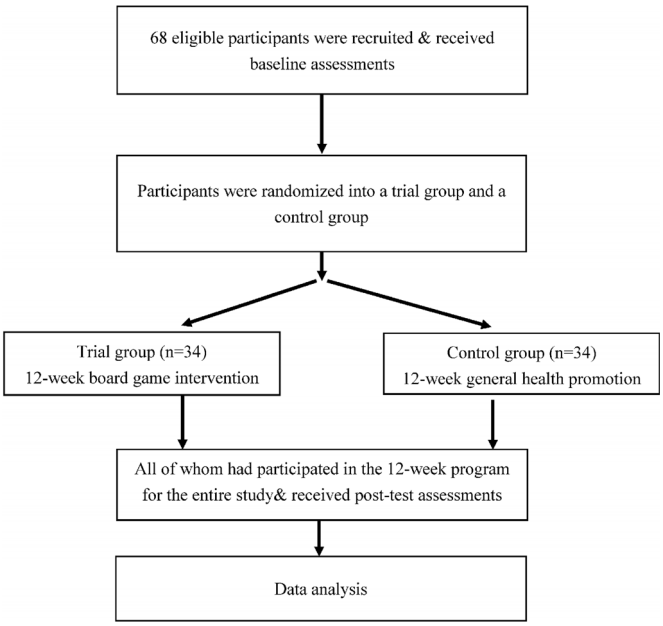

Figure 1. Flow chart of participants through study.

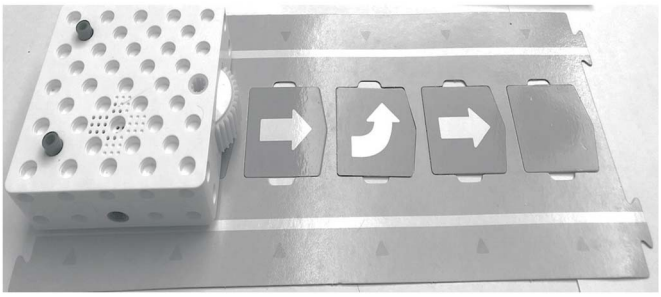

Figure 2. The picture of "Sammy Robot".

ticipant received a health education handbook containing "how to play board games," "health education content," and "self-check items," and the board game leader explained the health education handbook. Starting from the second week, each time we reviewed the content of the previous week's health education, we checked whether the MCI seniors had followed the self-check items in the health education handbook after returning home.

The health education handbook of this study is compiled concerning the gameplay and rules of the Sammi Robot, in other words, it is adapted based on the gameplay of the board game itself. The content of the health education handbook was divided into 12 chapters based on 12 weeks of board game tasks, which were designed by researchers combining daily tasks and board game play, and revised by 3 experts and scholars (2 assistant professors from the Department of Occupational Therapy and 1 assistant professor from the Department of Nursing). Each week's board game tasks were combined with daily tasks; that is, the tasks of daily life for that week were the tasks that the board game (Sammy Robot) had to complete. This design tries to improve the participants' IADL in 11 aspects (Chapter 2 to 12 of the health education handbook). The occupational therapist provided appropriate assistance nearby and recorded the participant's performance.

Chapter 1 of the Health Education Handbook, "Getting to Know Sammy," introduced how to play the board game. Chapter 2, "Stop to Watch and Listen on the Road," reminded seniors to pay attention to traffic signs and follow the signs and lights; therefore, the traffic signs were designed on the map of the Sammy Robot. Chapter 3, "Gourmet," introduced food and sharing information with others; therefore, the Sammy Robot was designed to buy food. Chapter 4, "Agility," reminded seniors to pay attention to the environment and the risk factors that may cause falls; therefore, the Sammy Robot was designed to avoid obstacles. Chapter 5, "Hotline for You and Me," taught seniors how to call a specific person; therefore, the Sammy Robot was designed to visit relatives and friends. Chapter 6, "Master of Storage," taught seniors to sort household items and place them in the appropriate place; therefore, the Sammy Robot was designed to place daily necessities in the correct position. Chapter 7, "Shopping for Fruits and Vegetables," taught seniors to shop by following a list and paying the correct amount of money; therefore, the Sammy Robot was designed to purchase items. Chapter 8, "Eating Together," encouraged seniors to help their families prepare meals; therefore, the Sammy Robot was designed to prepare meals. Chapter 9, "Pills, Know How to Take Them," taught seniors to read and understand the reminders on prescription labels when taking medication; therefore, the Sammy Robot was designed to take medicine. Chapter 10, "Dressing for the Seasons," taught seniors to understand how to dress for the seasons and to pay attention to the appropriateness of their clothing; therefore, the Sammy Robot was designed to pick up clothes. Chapter 11, "Sweeping Robots," encouraged seniors to care about the cleanliness of their home environment and understand the importance of regular cleaning habits; therefore, the Sammy Robot was designed to clean. Chapter 12, "Traveling with Sammy," helped seniors to learn about travel destinations and encouraged them to plan trips; therefore, the Sammy Robot was designed to travel.

MCI seniors in the control group received general health promotion and were led by instructors from the long-term care facility for 12 weeks, including 4 weeks of physical activities, 4 weeks of singing activities, and 4 weeks of art activities, once a week for 2 hours, for a total of 24 hours. In addition, this study also arranged the control group (short-term) various board game activities during the intervention process to prevent participants from discovering the group they participated in intervention group or control group.

2.3. Primary outcome

SLUMSE was used to evaluate the cognitive function of MCI seniors. SLUMSE is the most popular cognitive screening tool used worldwide to detect patients with dementia and MCI. The scale is comprised of four domains: orientation, memory, attention, and executive function. It contains 11 assessment items, with a total score of 0–30. A higher score indicates a higher level of cognition.[19] A score between 27–30 is considered normal if the participant has high school education or above, 21–26 is considered MCI, and 20 or below is considered dementia.[19] A score between 25–30 is considered normal if the participant's education level is below high school, 20–24 is considered MCI, and 19 or below is considered dementia.[19] The Taiwanese Chinese version of SLUMSE was translated and compiled by Hu,[20] and the scale has good reliability and validity.

The CMT Memory Subscale was used to assess the memory function of MCI seniors. The CMT, a standardized memory assessment tool developed by Toglia[21] for occupational therapists, was used to assess individual memory and meta-memory functions. This test consists of 2 cards with 20 items each related to a restaurant or breakfast.[22] Each card is divided into 3 dimensions: the recall subscale, the recall awareness subscale, and the memory strategy use subscale. Only the recall subscale was used in this study, which included 2 dimensions: immediate recall (20 questions) and delayed recall (20 questions). Immediate recall is the ability to recall information that was accessed within 60 seconds; delayed recall is the ability to recall information that was accessed several minutes or hours ago. The total score for both immediate recall and delayed recall was 0–20, with higher scores indicating better recall ability. This test has good reliability and validity.[23]

The TMT-A, designed by Partington,[24] was used to assess the focused attention, selective attention, and executive function of MCI seniors. The participants were recorded in terms of reaction time (in seconds), starting with the number 1 and continuing sequentially until the number 25. The test was scored based on the time required to complete the connection, with lower scores indicating better ability.[25] This test has good reliability and validity.[26]

2.4. Secondary outcomes

The IADL was used to assess IADL function in MCI seniors. The IADL is an eight-dimension scale developed by Lawton, Brody, Médecin.[27] This scale is used to assess the ability to maintain independence, which is more complex than the average individual's self-care needs. The IADL is divided into eight dimensions, including cooking, shopping, going out, housekeeping, doing laundry, making phone calls, taking medication, and managing finances. Those who check 1 or 0 are classified as disabled; additionally, check 2 to 4 are

classified as independent or partially independent, with a total score of 0–24. The scale has good reliability and validity.[28]

2.5. Data analysis

Statistical analyses were conducted using SPSS 25.0 for Mac statistical software. Descriptive statistics were first used to present basic demographic information of the participants, and Fisher's exact test was used to examine whether there were significant differences between the trial and control groups. The mean and standard deviation were then used to present the pre- and post-test scores of SLUMSE, CMT (immediate recall and delayed recall), TMT-A, and IADL, and the pair t-test was used to examine whether there were significant differences between the pre- and post-test scores (each scale score conformed to the normal distribution). Finally, after the inclusion of demographic variables, linear mixed-effects models were adopted to investigate whether there were significant differences between the trial and control groups in SLUMSE, CMT and TMT-A scores; generalized mixed-effects models were adopted to investigate whether there were significant differences between the trial and control groups in IADL scores after the intervention. The SLUMSE, CMT (immediate recall and delayed recall), TMT-A, and IADL (total score and each question) scores were used as dependent variables, while the demographic variables and board game intervention were used as independent variables. In addition, there was no significant difference in pre-test scores (including SLUMSE, CMT, TMT-A, and IADL) between the two groups.

3. Results

3.1. Participants

In this study, 68 participants were recruited (34 in the trial group), all of whom had participated in the 12-week program for the entire study. Their basic information is shown in Table 1. In the trial group, there were 15 males and 19 females with an average age of 78.7 years; for the control group, there were 15 males and 19 females with an average age of 78.0 years. The results of Fisher's exact test indicated that there was no significant difference between the trial group and the control group in terms of basic information. In addition, none of the participants in this study reported any uncomfortable reactions or withdrew from the study.

3.2. Primary outcome

The mean and standard deviation scores of SLUMSE, CMT (immediate recall and delayed recall), and TMT-A are shown in Table 2. In the trial group, there was a significant improvement in the mean of immediate recall and TMT-A after 12 weeks of intervention ($p < 0.05$); in the control group, there was no significant improvement for any of the instruments. The results of the linear mixed-effects models incorporating demographic variables are shown in Table 3. The results indicated that there was a significant difference between immediate recall and delayed recall in the trial group ($p < 0.05$); that is, the participants in the trial group had better immediate recall and delayed recall compared to those in the control group after the board game intervention.

3.3. Secondary outcomes

The mean and standard deviation scores of IADL are shown in Table 2. The mean of IADL showed a significant improvement ($p < 0.05$) after the 12-week intervention in both the trial and control groups. The results of the generalized linear mixed-effects models incorporating demographic variables are shown in Table 4. The results indicated that the trial group differed significantly only in the item of using the telephone ($p < 0.01$); thatis, the participants in the trial group were better able to use the telephone after the board game intervention compared to those in the control group.

Table 1
Demographic characteristics of the participants in the two groups.

Demographic characteristics	Board game group (n = 34)	Health promotion group (n = 34)	*p*-value (Fisher's exact test)
Gender			1.00
Male	15	15	
Female	19	19	
Age (mean ± SD)	78.74 ± 5.79	78.00 ± 6.85	0.63[a]
Years of education			1.00
≤ 9 years	32	31	
> 9 years	2	3	
Marital status			0.80
Single/divorced/widowed	21	23	
Married/cohabiting	13	11	
Exercise per week			1.00
≤ 3 days	13	12	
> 3 days	21	22	
Living status			0.37
Live alone	9	5	
Live with relatives	25	29	
Chronic diseases			0.41
≤ 2	27	23	
> 2	7	11	
Family income (NTD)			1.00
< 30 thousands	13	12	
≥ 30 thousands	21	22	

[a] Two-sample independent *t*-test.
NTD: New Taiwanese Dollars; SD: standard deviation.

Table 2
Within group comparison for the studied outcomes in the board game and health promotion groups.

	Board game group (n = 34)			Health promotion group (n = 34)		
Outcome variable	Pre-test Mean (SD)	Post-test Mean (SD)	*p*-value	Pre-test Mean (SD)	Post-test Mean (SD)	*p*-value
SLUMSE	21.91 ± 1.64	22.03 ± 1.19	0.624	21.85 ± 1.52	22.18 ± 1.40	0.221
CMT						
Immediate recall	10.00 ± 2.99	10.68 ± 2.71	0.016*	9.03 ± 3.05	8.91 ± 2.77	0.563
Delayed recall	8.71 ± 2.93	9.15 ± 3.50	0.173	7.74 ± 2.93	7.53 ± 2.57	0.393
TMT-A	229.53 ± 175.99	196.94 ± 163.08	< 0.001**	213.59 ± 142.47	216.38 ± 143.01	0.538
IADL	13.44 ± 4.22	15.65 ± 3.58	< 0.001**	13.35 ± 4.51	13.82 ± 4.21	0.019*

CMT: Contextual Memory Test; IADL: instrumental activities of daily living; SD: standard deviation; SLUMSE: Saint Louis University Mental Status Exam; TMT-A: Trail Making Test part-A.
* $p < 0.05$; ** $p < 0.01$.

Table 3
Regression coefficients based on the mixed-effects model analysis for SLUMSE, CMT and TMT-A score.

Independent variable	Dependent variables (Standard error)			
	SLUMSE[a]	CMT		TMT-A[a]
		Immediate recall[a]	Delayed recall[a]	
Group (ref: Control group)	0.13 (0.34)	1.69 (0.60)**	1.13 (0.68)**	18.16 (35.52)
Time (ref: Pre-test)	0.32 (0.34)	-0.15 (0.59)	-0.21 (0.67)	2.79 (34.97)
Group × Time (ref: Pre-test of control group)	0.03 (0.48)	0.82 (0.32)*	0.65 (0.39)*	-35.38 (49.46)

CMT: Contextual Memory Test; NTD: New Taiwanese Dollars; ref: reference group; SLUMSE: Saint Louis University Mental Status Exam; TMT-A: Trail Making Test part-A.
[a] Adjusted for gender, age, years of education, marital status, exercise per week, living status, chronic diseases, family income.
* $p < 0.05$, ** $p < 0.01$.

Table 4
Regression coefficients based on a generalized linear mixed-effects model analysis of the IADL score.

Independent variable	Dependent variables (Standard error)								
	IADL total score[a]	Using the telephone[a]	Shopping[a]	Preparing food[a]	Housekeeping[a]	Doing laundry[a]	Using transportation[a]	Handling medications[a]	Handling finances[a]
Group (ref: Control group)	0.17 (0.96)	0.22 (0.17)**	-0.00 (0.21)	0.19 (0.23)	0.04 (0.23)*	0.07 (0.18)	-0.26 (0.27)	-0.08 (0.19)	-0.08 (0.16)
Time (ref: Pre-test)	0.47 (0.96)	0.03 (0.17)	0.09 (0.21)	0.12 (0.23)	-0.03 (0.23)	0.06 (0.18)	0.18 (0.27)	0.06 (0.19)	0.06 (0.16)
Group × Time (ref: Pre-test of control group)	1.74 (1.35)	0.29 (0.16)*	0.21 (0.30)	0.15 (0.33)	0.38 (0.33)	-0.03 (0.26)	0.09(0.38)	0.41 (0.27)	0.29 (0.23)

CMT: Contextual Memory Test; NTD: New Taiwanese Dollars; ref: reference group; SLUMSE: Saint Louis University Mental Status Exam; TMT-A: Trail Making Test part-A.
[a] Adjusted for gender, age, years of education, marital status, exercise per week, living status, chronic diseases, family income.
* $p < 0.05$, ** $p < 0.01$.

4. Discussion

Without appropriate environmental stimulation and cognitive training, MCI seniors have a high risk of developing dementia in a few years.[2,5] Structured board games were often used as cognitive training to improve the cognition of MCI seniors in the past. In this study, however, a 12-week board game task (combined with daily life tasks in the community) was designed by an occupational therapist to intervene with MCI seniors by integrating the life experiences of local community seniors. The results showed that the participants in the trial group showed significant improvements in memory ability and "using the telephone" in daily life functions compared to those in the control group. This suggests that the 12-week unstructured board game tasks improved the cognitive ability of MCI seniors and were also beneficial to daily life functions. Board games have long been recognized as a form of cognitive training, which is a protective factor against cognitive impairment or dementia,[29] but repetitive structured board games tend to produce learning effects, reduce the effectiveness of cognitive training,[30] and easily make people lose interest and discard them.[14] In recent years, there have been many software games for cognitive training and dementia prevention for the elderly that provide a lot of fun (e.g., Big Brain Academy on the Wii) and have been effective in improving specific areas of cognition (e.g., working memory); however, these positive effects do not seem to transfer to daily life skills (crystallized intelligence).[31] Therefore, cognitive training should be integrated with local functional training to demonstrate better training outcomes.[32]

4.1. Primary outcomes

A recent systematic review of the literature[33] suggested although it is not easy to improve the overall cognitive functioning of MCI seniors or dementia through cognitive training, the improvement in message processing speed is promising. The results of the present study generally support this argument. Our study showed that there was no significant improvement in the pre-test and post-test scores of SLUMSE in both the trial and control groups; however, there was a significant improvement in TMT-A (related to message processing speed) in the trial group. Although the trial and control groups did not show an improvement in overall cognitive function after three months of intervention, they were able to maintain their pre-test levels without regression.

The performance of immediate recall and delayed recall in memory is an important criterion for determining whether MCI or Alzheimer's disease is present.[34] Table 3 shows that after correcting for demographic variables, the 12-week board game intervention was effectively in enhancing both immediate recall and delayed recall in elderly individuals with MCI, which concurs with previous studies.[35–37] During the 12-week board game session, participants focused on the entire board game task and were provided with some verbal stimulation and feedback (e.g., encouragement after completing the task), which to some extent increased the stimulation of external messages and facilitated the establishment of new cognitive neural networks, thus promoting the reorganization of brain nerve functions (the brains of MCI patients still have a high degree of plasticity).[37,38] There is a growing body of evidence showing that repetitive, prolonged cognitive training can improve the memory ability of elderly people with MCI, especially when combined with visual cues. As a result, it is possible that MCI seniors can benefit from the use of board games to improve their immediate recall and delayed recall over several months of training.

4.2. Secondary outcomes

Both the trial group and control group showed significant improvements in pre- and post-test scores on the IADL scale (Table 2), which is close to the results of previous studies.[39,40] Willis, Tennstedt, Marsiske, Ball, Elias, Koepke, Morris, Rebok, Unverzagt, Stoddard[39] evaluated the results of a longitudinal study at month 60 of a cognitive training program for seniors. The IADL scores of the seniors who participated in the cognitive training (trial group) were found to remain stable with no significant decline, whereas the IADL scores of those who

did not participate (control group) showed a continuous decline. Talassi, Guerreschi, Feriani, Fedi, Bianchetti, Trabucchi[40] study of MCI seniors revealed that the IADL scores of the trial group (30 with MCI and 24 with dementia) and the control group (7 with MCI and 5 with mild dementia) remained stable after 3 weeks of computerized cognitive training sessions, 4 times a week for 30–45 minutes each time. After controlling for demographic variables, the present study suggested that there was no significant difference in the total IADL scores between the trial and control groups, but only in the item "using the telephone". It can be inferred that both board games and health promotion programs have the potential to enhance the IADL of MCI seniors.

People are social creatures and have a need for social interaction, especially the elderly. Poor social interaction functions in the elderly may affect their mental health and impair their quality of life. Direct sensory stimulation through audio or video can reduce psychological disorders (i.e., feelings of loneliness) in older adults. In addition to face-to-face contact, social interactions are most often conducted via telephone. Our findings demonstrated that the trial group scored significantly higher than the control group in "using the telephone" in the IADL dimension. This may be due to the fact that the trial group was taught to use the telephone in one week of the program during the intervention; further, when we provided instruction and encouragement during the program, the individuals had a higher need and motivation for social interaction, and their scores on this test increased.

4.3. Limitations

Several limitations should be considered when interpreting the results of this study. First, the scales in this study were all self-reported, and although these scales are widely used and have good psychometric properties, they are not representative of true cognitive ability and daily life functions. Second, the recruitment of participants from the same long-term care facility and the limited number of participants in this study limit its explanatory power and wide application. Third, although this study was a randomized controlled trial, there may be bias, such as the subject-expectancy effect. Fourth, this study only collected data from the 12-week pre- and post-test, which may not reveal precise dynamic changes in cognitive ability or subsequent long-term effects. Finally, the results of this study showed significant improvements in the three items of immediate recall, delayed recall, and using the telephone; moreover, occupational therapists are still needed to design the curriculum and lead the board games during the board game intervention. Therefore, future research is needed to investigate the changes in the cognitive abilities and daily functioning of MCI seniors.

5. Conclusion

In this randomized controlled trial, the results of a 12-week board game intervention in MCI seniors showed significant improvement in memory (immediate recall and delayed recall), and IADL task of using the telephone. Further research is needed to examine the beneficial effects of board games on the cognitive and daily functioning of MCI seniors.

Conflicts of interest

The authors declare that they have no conflict of interest.

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