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Stronger Memory (Phase II): Experiences of Older Adults and Caregivers in an Intervention Program for Cognitive Impairment (Final Report)

Project Title:	Stronger Memory (Phase II): Experiences of Older Adults and Caregivers in an Intervention Program for Cognitive Impairment
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Funding Opportunity Name:	Alzheimer's and Related Diseases Research Award Fund
Funding Sponsor:	The Virginia Center on Aging
Funding Period:	7/1/2022 - 6/30/2023
Report Submission date:	12/11/2023

EXECUTIVE SUMMARY

Background

The Stronger Memory (Phase II) research project addresses the pressing challenge of cognitive health in aging populations, particularly focusing on Subjective Cognitive Decline (SCD). With nearly 9% of individuals aged 45+ experiencing SCD in Virginia, the study investigated the impact of the StrongerMemory program, a non-pharmacological intervention, on cognitive function in older adults. Building upon the established success of Phase I, where Mini-MoCA assessments confirmed improved memory, Phase II explored the combined effects of the StrongerMemory program and weekly social engagement interventions on cognitive, behavioral, and emotional outcomes.

Methods

The study investigated the impact of social engagement on the StrongerMemory program outcomes in older adults through a 12-week randomized two-group design. The intervention group participated in weekly support groups along with program exercises, while the control group received no social engagement. Rigorous screening, including the SCD-Q (Subjective Cognitive Decline Questionnaire), and measures to enhance internal validity were implemented. Diversity was addressed in recruitment, resulting in two sessions—Korean and American. A total of 50 participants (24 in the control group and 26 in the intervention group) were recruited. Measures included demographic information, tracking logs, SCD-Q, MoCA (Montreal Cognitive Assessment) Blind/Telephone, GHP (Good Health Practices), SWEMWBS (Short Warwick-Edinburgh Mental Well-being Scale), and SEAQ (Social Engagement and Activities Questionnaire). SPSS 27.0 was used for data analysis, incorporating descriptive statistics, exploratory factor analysis, Cronbach's alpha, paired-samples t-tests, and one-way ANCOVA. These analyses aimed to assess pre-test and post-test changes within groups, compare post-test scores between groups while controlling for pre-test scores, and measure the intervention's impact on various outcomes.

Key Findings

Social Engagement Boosts Program Effectiveness: Participants who received social engagement support alongside the StrongerMemory program showed greater improvements in cognitive function, compared to those in the control group.

Quality and Quantity Matter: The quality and quantity of social engagement both played a significant role in improving mental well-being. Engaging actively and attentively in social interactions led to greater improvements, and increased attendance in social activities resulted in a heightened awareness of cognitive changes.

Time Commitment and Cognitive Benefit: Spending more time on specific program activities, particularly simple math exercises, led to greater improvements in cognitive function.

Targeted Interventions for Diverse Populations: The study further emphasized the importance of considering diverse needs and preferences when designing cognitive training programs for older adults. By identifying potential for targeted interventions based on individual characteristics,

such as age, gender, or existing health conditions, the program can be customized to maximize benefits for different subgroups within the population.

Implications

The study results lay the groundwork for a comprehensive approach to enhance cognitive well-being in older adults. For practitioners, combining social engagement with cognitive training interventions emerges as a powerful strategy for maximizing positive outcomes. Communities play a crucial role in expanding affordable group activities and social opportunities, creating a supportive environment for the thriving of older adults. Additionally, policymakers can prioritize social integration programs, offer transportation assistance for enhanced engagement, and develop evidence-based guidelines for tailored cognitive health training.

Recommendations

Issues like small sample size, self-report biases, lack of causal evidence, limited generalizability, and short follow-up highlight need for expanded research. Future studies should boost recruitment diversity, add objective measures, employ experimental manipulations, investigate cultural adaptations, assess personalized interventions, and evaluate long-term sustainability.

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Introduction

The realm of aging is constantly changing, and one of the most critical challenges faced is cognitive health. Subjective Cognitive Decline (SCD), self-reported memory issues potentially indicating early dementia onset (CDC, 2019), affects a significant portion of older adults. For example, in Virginia, nearly 9% of individuals aged 45+ experience SCD (Virginia Alzheimer's Disease and Related Disorders Commission, 2019). 48.6% of these individuals report experiencing functional difficulties due to SCD, leading to disruptions in work, social activities, and daily tasks. Additionally, 31% of individuals with SCD live alone, potentially amplifying the challenges they face.

To address this growing concern, this research investigates the impact of the StrongerMemory program on cognitive function in older adults, particularly focusing on the role of social engagement. The Stronger Memory is a non-pharmacological intervention developed by a nonprofit continuing care retirement community, Goodwin Living, aimed at improving cognition through daily brain-stimulating activities. This program consists of a curriculum designed to stimulate the brain’s prefrontal cortex, which governs the ability to retrieve memories. Participants were encouraged to spend 20 to 30 minutes a day reading aloud, writing or journaling and completing simple math problems. The premise around the StrongerMemory program, supported with some evidence in the literature (Kawashima et al., 2005; Nouchi et al., 2016; Uchida & Kawashima, 2008), is that prior to a diagnosis or even with a diagnosis of mild cognitive impairment, a decline can be slowed and possibly prevented by participating in a program like StrongerMemory.

The George Mason Gerontology Research Team is on board to continue evaluating the StrongerMemory program, providing evidence of its impact. Phase I, initiated in 2021, involved a quasi-experimental design examining cognition and its impact on emotions, behaviors, and quality of life in 104 participants across Northen Virginia. Following 12 weeks of engaging in the StrongerMemory program, the majority of participants experienced significant improvements in their cognitive function. That is, preliminary results suggest that the StrongerMemory program has beneficial effects on cognition. While analyzing focus groups with participants in the StrongerMemory program, the research team identified a recurring theme: the significant impact of social engagement. This unexpected finding sparked our curiosity about how group support could further enhance the program's effectiveness. This led us to Phase II of the research, which explicitly investigates the combined effects of the StrongerMemory program and weekly social engagement interventions on older adults.

Building upon the established success of Phase I, where Mini-MoCA assessments confirmed improved memory, Phase II explores the combined effects of the StrongerMemory program and weekly social engagement on cognitive, behavioral, and emotional outcomes over a 12-week period. While physical activity often takes precedence in cognitive health research, this study recognizes the significance of social engagement, which has been linked to emotional well-being and functional independence (Quach et al., 2017). Previous research suggests that social engagement, particularly in group settings, may have a protective role for cognitive health in older adults (Haslam et al., 2014; Lydon et al., 2022).

Social engagement is proposed as a potential preventative intervention for preserving cognitive abilities and reducing further cognitive decline. Our study investigates how participating in social activities, coupled with the StrongerMemory program, may delay the onset

of Alzheimer's disease pathology and positively influence cognitive and psychological well-being. By evaluating the impact of a weekly group social engagement intervention alongside the StrongerMemory program, we seek to deepen our understanding of the potential synergistic effects on cognitive outcomes.

StrongerMemory's behavioral and emotional outcomes in addition to its cognitive outcomes, were also be explored. Mild cognitive impairment (MCI) often precedes the development of ADRD (Rajji et al., 2020). MCI is often accompanied by behavioral symptoms such as disinhibition, elation, aberrant motor behavior (Apostolova et al., 2014), and lower levels of emotional well-being in older adults (Fu et al., 2021). However, research on the prevention of ADRD has been primarily concerned with cognitive impairments as a factor of the disease. A better understanding of ADRD risk factors should be made in conjunction with an improvement in protective factors, such as behavioral performance and emotional well-being.

The main objective of this research is to explore the effects of regular (weekly) and group social engagement on the outcomes of the StrongerMemory program in a sample of older adults. As part of this study, we examined the general effects of the StrongerMemory program on older adults. The following specific aims guide the study:

Aim 1: Explore the effects of social engagement on the outcomes of the StrongerMemory program.

Hypothesis 1a: Older adults participating in weekly sessions to discuss StrongerMemory exercises for 12 weeks will demonstrate greater improvements in cognitive outcomes compared to those who do not participate in weekly sessions.

Hypothesis 1b: Participation in weekly discussion sessions will lead to more positive behavioral outcomes for older adults participating in the StrongerMemory program compared to those who do not participate in weekly sessions.

Hypothesis 1c: Engaging in weekly discussions during the StrongerMemory program will result in greater improvements in emotional well-being among older adults compared to those who do not participate in weekly sessions.

Aim 2: Explore the effects of the StrongerMemory program on the outcomes of the StrongerMemory program

Hypothesis 2a: Older adults participating in the StrongerMemory program will demonstrate significant improvements in cognitive function for older adults compared to baseline levels.

Hypothesis 2b: Participation in the StrongerMemory program will lead to significant improvements in behavioral outcomes for older adults compared to baseline levels.

Hypothesis 2c: Engaging in the StrongerMemory program will result in significant improvements in emotional well-being among older adults compared to baseline levels.

This study utilizes an experimental design to evaluate the combined effects of social engagement and the StrongerMemory program. The findings will contribute to designing and evaluating the effectiveness of interventions that prevent cognitive and functional decline with aging while promoting emotional well-being. This knowledge will inform future program administration and potentially improve outcomes for participants. The StrongerMemory program holds promise as a non-pharmacological intervention for cognitive health in older adults. By

investigating the potential benefits of social engagement alongside the program, this research aims to advance our understanding of promoting healthy aging and inform the development of effective interventions for this growing population.

Multi-Domain Prevention Strategy with Social Engagement

Dementia's complex etiology, involving a combination of social, psychological, and biological factors, necessitates a multi-pronged approach to prevention (Yao et al., 2020). Given the lack of currently available treatments for cognitive decline, prevention strategies take on critical importance. While social engagement alone has demonstrably positive effects on preventing dementia (Zhou et al., 2018), its impact can be amplified when combined with other interventions within a multi-domain prevention strategy (Ngandu et al., 2015). This holistic approach recognizes that cognitive decline is influenced by a multitude of factors, ranging from physical health and cognitive stimulation to emotional well-being (Dinius et al., 2013). By addressing these factors simultaneously, a multi-domain approach maximizes the effectiveness of the intervention and offers a more comprehensive solution. Qualitative interviews conducted with StrongerMemory Phase 1 participants confirmed the benefits of the program’s weekly social meetings, demonstrating its impact beyond mere cognitive exercises, extending to emotional and cognitive domains. This aligns with the suggestion that social engagement can enhance the effectiveness of cognitive intervention programs, serving as a potential multi-domain prevention strategy for older adults with MCI.

Emerging research emphasizes the critical role of social activity in both cognitive and emotional well-being, highlighting the need for a holistic approach (Quach et al., 2017). Older adults with higher levels of social participation and strong social networks exhibit better cognitive function and a lower risk of cognitive decline and dementia (Zhou et al., 2018). Multi-domain interventions combining physical, cognitive, dietary, and social components have shown promise in safeguarding cognitive function, demonstrating effectiveness in maintaining cognitive health among at-risk older adults (Rosenberg et al., 2020).

One primary benefit of a multi-domain approach is the synergistic effect it generates (Ngandu et al., 2015). Combining different interventions can amplify their positive effects, resulting in a more substantial impact than the sum of their individual contributions (Salzman et al., 2022). This approach allows for a more efficient and potentially more impactful means of preventing dementia. Furthermore, a multi-domain strategy ensures that all the key risk factors for cognitive decline are addressed simultaneously. This is crucial, as neglecting any one factor can weaken the overall effectiveness of the intervention (Hafdi et al., 2013). For example, focusing solely on cognitive training while neglecting physical health or emotional well-being (Salzman et al., 2018) may not be as effective as addressing all these factors in a coordinated manner.

Another advantage of a multi-domain approach is its ability to be tailored to individual needs and preferences (Ngandu et al., 2015). By offering a range of interventions, individuals can choose those that best suit their interests and abilities, promoting greater engagement and adherence to the program. This personalized approach acknowledges that individuals have unique needs and circumstances and ensures that the interventions they receive are relevant and effective for them.

Several multi-domain prevention programs have emerged in recent years, demonstrating the practical application of this approach. One such program is the FINGER program, developed in Finland (Ngandu et al., 2015). This program combines physical exercise, cognitive training, dietary counseling, and vascular risk management, and studies have shown it to be effective in preventing cognitive decline and delaying the onset of dementia (Ngandu et al., 2015). To be specific, this study investigated the potential positive effects of modifying dementia risk and protective factors on cognitive performance in at-risk individuals. The 1260 participants were

randomly assigned to either a multi-domain intervention group or a control group receiving regular health advice. Results indicated that multi-domain interventions combining physical and cognitive exercise, diet, and social activity effectively protected cognitive function in healthy older adults at risk of memory loss (Rosenberg et al., 2020). Notably, social activities were facilitated through group meetings for all intervention components. This study highlights the potential benefits of multi-domain interventions across various participant demographics, particularly among those at greatest risk of cognitive decline and dementia.

Social engagement is vital within multi-domain programs for promoting cognitive health and wellbeing (Murukesu et al., 2020). Group activities, volunteering, and online platforms provide opportunities for enjoyment, motivation, cognitive stimulation, and risk reduction. Specifically, social participation can increase enjoyment and adherence by making interventions more positive experiences (Davis et al., 2021). Social interaction through social participation offers several benefits, including social influence, social engagement, as well as access to resources and material goods. Everyday social interaction also naturally incorporates cognitive challenges through conversation, learning, and mental exercise, helping maintain function (Zhou., 2018). Additionally, the resulting support system aids stress and mood management while facilitating healthy behaviors – all protecting cognition (Ozbay et al., 2007).

Integrating social engagement into multi-domain programs can be achieved through various methods. Group-based cognitive training and physical activity sessions can foster social interaction and a sense of community (Blancafort Alias et al., 2021). Encouraging participation in volunteer activities allows individuals to contribute to their communities while building valuable social connections (Stukas et al., 2018). Additionally, technology-based platforms can

facilitate communication and social interaction between participants, especially for those who experience social isolation due to location or other limitations (Heins et al., 2021).

We believe that combining social engagement with other interventions within a multi-domain prevention strategy offers a promising and comprehensive approach to promote cognitive health and prevent dementia. By addressing multiple risk factors simultaneously and fostering social connections, this approach empowers individuals to take control of their cognitive well-being and live a fulfilling life for longer. As research in this area continues to evolve, multi-domain programs are expected to play an increasingly significant role in the fight against dementia, offering hope for a future where cognitive decline can be effectively prevented and managed.

Methods

Overall Study Design

This study investigated the impact of social engagement on the StrongerMemory program outcomes, focusing not only on cognitive function but also on behavioral and emotional outcomes in older adults. We employed a quantitative method, a 12-week randomized two-group (intervention and control) experimental design, to test the combined effects of the program and social interaction on various aspects of well-being.

The intervention group participated in 12 weeks of StrongerMemory exercises and weekly support groups. During these sessions, facilitators introduced topics related to brain health, cognitive functioning, and emotional well-being, and led discussions to encourage participants to share their ideas and experiences. Standardized assessments were administered at baseline and post-intervention to measure participants' cognitive function, behavioral patterns, and emotional state. This data was then analyzed to determine whether social engagement amplified the StrongerMemory program's effectiveness in improving participants' overall well-being beyond cognitive benefits.

Screening for Eligible Participants

This study targeted individuals experiencing Subjective Cognitive Decline (SCD). As the StrongerMemory program aimed at a broader audience, including those with SCD or simply seeking cognitive health improvement, the Subjective Cognitive Decline Questionnaire (SCD-Q) was utilized as the primary screening tool. Prior to program enrollment, potential participants completed a REDCap survey or paper format survey, consisting of informed consent, demographic questions, and the SCD-Q. Completing the survey indicated their agreement to the

informed consent form. Participants who answered "yes" to more than seven out of 24 SCD-Q questions were deemed eligible for the study.

Internal and External Validity

Phase II of the StrongerMemory program sought to address the limitations of the quasi-experimental design employed in Phase I by implementing a more rigorous, single-blind experimental design to enhance internal validity. This design aimed to minimize bias and ensure the integrity of the study results. To achieve this, participants were kept unaware of their assigned group (intervention or control) until after completing the online screening survey. This prevented potential self-selection bias and ensured participants approached the program with similar expectations. Additionally, while both groups received information about the StrongerMemory program itself, only the intervention group was informed about the weekly group meetings. This critical information was withheld from the control group to prevent any influence on their program experience and maintain a fair comparison. Moreover, the consent form and recruitment materials carefully avoided any mention of weekly meetings, further minimizing potential bias. These measures, combined with the single-blind design, significantly strengthened the internal validity of Phase II, providing a more robust foundation for assessing the impact of the StrongerMemory program and the added benefit of social engagement.

Enhancing Diversity

Aiming to address the limited racial and ethnic diversity observed in Phase I (90% White American), Phase II of the StrongerMemory program actively recruited participants from diverse cultural backgrounds to enhance inclusivity and representation. This focused effort resulted in the inclusion of 30 Korean and 30 American participants, enriching the study population. To

ensure cultural sensitivity and accessibility, all research materials, including measures, informed consent forms, program materials, and discussion materials, were translated into Korean. This meticulous approach ensured clear communication and understanding for all participants, regardless of their native language. Notably, the Principal Investigator holds an official certificate of translation for English to Korean, further solidifying the accuracy and professionalism of the translation process. By implementing these strategic recruitment and translation efforts, Phase II established a more diverse and representative sample, facilitating a valuable comparison of social engagement's effectiveness across different cultural contexts. This broader scope allows for a deeper understanding of the program's impact and potential for various populations, ultimately leading to more inclusive and culturally-sensitive interventions.

Inclusion and Exclusion Criteria

This study targeted individuals aged 60 and over residing in Northern Virginia. Participants were eligible if they had not previously participated in the StrongerMemory program and displayed signs of either Subjective Cognitive Decline (SCD) or Minor Cognitive Impairment (MCI).

Screening for cognitive decline:

SCD: Participants were assessed using the Subjective Cognitive Decline Questionnaire (SCD-Q). Eligibility required scoring “Yes” to more than seven out of 24 questions, indicating perceived cognitive decline.

MCI: The MoCA Blind/Telephone assessment was used to evaluate participants' cognitive function. A score below 17 out of a possible 22 points on this assessment indicated MCI and qualified the participant for the study.

Exclusion criteria:

Individuals diagnosed with dementia were excluded from the study. Additionally, anyone who had previously participated in any phase of the StrongerMemory program was ineligible for inclusion.

Ethical Considerations

Phase II of the StrongerMemory program prioritized ethical research practices and adhered to established guidelines for studies involving human subjects. Informed consent was obtained from all participants before their participation, ensuring they understood the research aims and procedures. Confidentiality was rigorously protected, guaranteeing anonymity and safeguarding sensitive information. Participation remained voluntary, with participants retaining the right to withdraw from the study at any point without penalty. The study protocol underwent rigorous review and received approval from the Institutional Review Board (IRB) at George Mason University, ensuring ethical research conduct and participant protection. All information collected during the study was de-identified after screening to further protect participants' privacy.

Sample

Recruitment Process

A comprehensive recruitment strategy was implemented in October to identify and engage potential participants for the study. The initial focus was on Fairfax County Senior Centers, boasting 14 locations and a combined membership exceeding 1000 active individuals aged 50 and above. Advertisements containing QR codes directing participants to the online

SCD screening survey were distributed extensively, and collaborative discussions were held with senior center directors.

Despite initially recruiting only seven eligible participants by mid-December, the recruitment plan was strategically adapted to extend beyond Fairfax County Senior Centers. Outreach efforts were expanded to encompass:

- Senior housing facilities: Fairfax and Alexandria counties
- Adult Day Health Care centers: Fairfax County
- Osher Lifelong Learning Institute at George Mason University: recruitment advertisements featured in their e-newsletter
- Washington Area Villages Exchange (WAVE): a network dedicated to supporting older adults

Additionally, in October, the PI contacted the Korean Community Service Center of Greater Washington, which has a list of 3000 Korean older adults. The specific objectives and procedures were discussed, and recruitment information was provided. Korean Central Senior Center eventually agreed to assist in the process. At the Korean Central Presbyterian Church on October 28, 2022, an in-person recruitment event was conducted, including advertisement displays and self-administered screening surveys. Approximately 150 people attended, and 65 screening surveys and informed consent forms were collected.

Session 1: Korean

Initially, 34 participants enrolled in the study, with 17 assigned to the intervention group and 17 to the control group. Three participants withdrew from each group during the session, resulting in a final sample of 28 individuals (14 intervention and 14 control). The 12-week program ran from December 14th to March 1st, with weekly meetings held every Wednesday.

The Subjective Cognitive Decline Questionnaire (SCD-Q) was utilized for the screening process. Of the completed surveys, 28 individuals exceeded the threshold of 7 "yes" responses, and 10 scored between 3-6 "yes" responses. Follow-up phone calls were conducted with 38 respondents to assess their availability and willingness to participate. Ultimately, 28 individuals met all eligibility criteria and were randomly assigned to either the intervention or control group, with 14 individuals in each. Notably, two members of each group did not meet the SCD-Q criteria but met the criteria for the MoCA Blind/Telephone test.

The intervention group participated in weekly meetings at either the Korean Central Presbyterian Church or the Centerville/Chantilly library. These sessions were facilitated according to the StrongerMemory facilitator's guide and aimed to provide a structured and supportive environment for cognitive stimulation and social interaction. The control group received biweekly contact via phone, text message, or email to monitor their adherence to the StrongerMemory program. This contact aimed to maintain engagement and ensure that both groups received comparable levels of support and attention throughout the study.

Session 2: American

The second session of the StrongerMemory program comprised weekly meetings lasting approximately one hour, held every Friday from March 24th to June 9th. The intervention group, initially consisting of 14 individuals, participated in these sessions at the Wellness Center for Older Adults at Braddock Glen. However, two participants withdrew before completion, resulting in a final total of 11 participants who successfully completed the 12-week program. The Principal Investigator (PI) and Research Assistant (RA) from the gerontology team at George Mason University provided oversight and support for the intervention group throughout the program. The control group also started with 14 participants, but only 9 remained by the

program's conclusion. To bolster retention and encourage continued engagement, two webinars were conducted during the program duration, and bi-weekly email reminders were sent to all control group participants.

Measures

All of the measures listed below were administered at both baseline and post-intervention to evaluate the effectiveness of social engagement during the StrongerMemory program.

Demographic Information: A self-administered questionnaire at baseline collected data on age, gender, race/ethnicity, marital status, education level, employment status, household income, and residence type.

Tracking Logs: Participants submitted weekly logs throughout the program detailing the time spent on each program exercise and their attendance at group meetings. These logs provided continuous data on program engagement.

Subjective Cognitive Decline Questionnaire (SCD-Q): While the primary goal of this measure was participant screening, it also served as a valuable tool for monitoring cognitive changes throughout the program. This 24-item self-report questionnaire was administered at baseline and post-intervention to measure perceived subjective decline in memory, language, and executive functions over the past two years (Rami et al., 2014). Participants answered yes/no questions, and the total score provided an indication of perceived cognitive decline. This measure helped assess potential changes in self-perceptions of cognitive abilities. The internal consistency of the SCD-Q was excellent, with Cronbach's alpha coefficients of 0.90 and 0.92 for pre-intervention and post-intervention assessments, respectively.

Montreal Cognitive Assessment (MoCA) Blind / Telephone Version 8.1: Cognitive functioning was assessed using the MoCA Blind/Telephone (Version 8.1), an adapted version of

the original MoCA rapid screening instrument for mild cognitive dysfunction. This telephone-administered assessment was ideal for remote testing and evaluated various cognitive domains, including: attention and concentration, memory, language, conceptual thinking, calculations, and orientation. The MoCA Blind/Telephone included all items from the original MoCA except those reliant on visual abilities. Administration time was approximately 5-10 minutes, with a total possible score of 22 points. A score of 18 or above was considered normal. Cronbach's alpha coefficients indicated very good internal consistency, with pre-intervention and post-intervention values of 0.85 and 0.82, respectively. For Korean participants, the K-MoCA (Korean version of the Montreal Cognitive Assessment) was administered. This culturally adapted version ensured accurate assessment for this specific population.

Good Health Practices scale (GHP): This 16-item questionnaire was administered at baseline and post-intervention to measure healthy behaviors across various domains, including diet, physical activity, sleep, and smoking habits (Hampson et al., 2019). It is a shortened version of the Health Behavior Checklist (HBC), which is a 48-item questionnaire that measures a broader range of health behaviors. For the purpose of assessing healthy behaviors in a brief and general manner, the Good Health Practices scale was developed (Hampson et al., 2019). Cronbach's alpha coefficients for the GHP indicated very good internal consistency, with pre-intervention and post-intervention values of 0.85 and 0.82, respectively.

The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS): SWEMWBS is a seven-item measure of mental well-being that is widely used in research and practice (Shah et al., 2021). It is a shortened version of the Warwick-Edinburgh Mental Well-being Scale (WEMWBS), which is a 14-item measure. The SWEMWBS is a self-report questionnaire that asks respondents to rate how often they have experienced certain positive feelings and thoughts

over the past two weeks. The items are scored on a five-point scale, ranging from 1 (none of the time) to 5 (all of the time). The total score is calculated by summing the scores for all seven items. The higher the score, the higher the level of mental well-being. The SWEMWBS is a reliable and valid measure of mental well-being. Cronbach's alpha coefficients for the SWEMWBS indicated very good internal consistency, with pre-intervention and post-intervention values of 0.80 and 0.76, respectively.

Social Engagement and Activities Questionnaire (SEAQ): We used the 10-item Social Engagement and Activities Questionnaire (SEAQ) from Marti and Choi (2022). The SEAQ measures the frequency during the past month (0 = not at all, 1 = just one time, 2 = 2-3 times, 3 = once a week, 4 = more than once a week, and 5 = every day) of the following: (1) religious service attendance; (2) going outside the home (not counting religious service attendance and doctor’s appointment); (3) getting together socially with family, friends or relatives; (4) engagement in recreational activities for fun and relaxation; (5) engagement in gentle or vigorous exercise as a group activity; (6) attendance in meetings of any organized group that are not political in nature; (7) participation in any self-enrichment or educational activities; (8) engagement in activities that are political or social justice in nature; (9) volunteering for religious, charitable, political, health-related, or other organizations including one’s own apartment complex; and (10) informal volunteering for neighbors, friends, or family members. Cronbach's alpha coefficients for the SEAQ indicated good internal consistency, with pre-intervention and post-intervention values of 0.64 and 0.62, respectively.

Data Analysis Procedures

This quantitative study utilized a pretest-posttest control group design to analyze the effectiveness of social engagement within the StrongerMemory program. Data analysis was conducted using SPSS 27.0, following a rigorous and comprehensive approach.

Initial Evaluation.

Descriptive statistics were calculated for each variable at both baseline and post-intervention to provide a comprehensive overview of the data distribution and identify potential patterns or anomalies. This involved analyzing measures such as central tendencies (mean, median) and variability (standard deviation, range) for each variable across both groups and time points. Additionally, skewness and kurtosis were assessed to identify potential deviations from a normal distribution.

An exploratory factor analysis (EFA) was performed to assess individual items within the utilized scales and identify relevant factors contributing to the measured constructs. This step ensured the accuracy and comprehensiveness of the data collected. Additionally, Cronbach's alpha was calculated for each scale, providing a measure of internal consistency and reliability.

Assessing Intervention Impact.

To evaluate the impact of the intervention, paired-samples t-tests were employed. These tests compared the mean pre-test and post-test scores for each group on the MoCA Blind/Telephone, SCD, SEAQ, GHP, and SWEMWBS scales. Normality was evaluated using the Shapiro-Wilk test, which revealed that the data was normally distributed for both measures ($p > 0.05$). Additionally, we checked for homogeneity of variances using Levene's test, which confirmed that the variances of the pre-test and post-test scores were equal for both measures ($p > 0.05$). Mean differences, standard errors of the mean, and t-statistics were calculated, providing

insights into the magnitude and significance of pre-test to post-test score changes. Furthermore, Cohen's d effect size was calculated for each measure, offering a standardized assessment of the intervention's impact.

Group Comparisons and Covariate Control.

To further investigate the influence of social engagement, one-way ANCOVA (analysis of covariance) was utilized. This technique compared post-test scores between the intervention and control groups on cognitive, behavioral, and emotional outcomes. ANCOVA treated pre-test scores as covariates, accounting for potential variations influencing post-test scores (Jennings & Cribbie, 2016). This approach allowed for the adjustment of post-test scores based on pre-test scores, enhancing the power to detect genuine intervention effects. By examining the post-test score differences between groups while considering pre-test scores and controlling for potential confounding variables through ANCOVA, this analysis provided a robust and reliable comparison of the intervention's effectiveness.

$$post_i = \beta_0 + \beta_{1groupi} + \beta_{2pre_i} + \varepsilon_i \, , or$$
$$post_i - pre_i = \beta_0 + \beta_{1groupi} + (\beta_2 - 1)_{pre_i} + \varepsilon_i$$

With this approach, we examine, based on the pre-test scores, whether there is a difference between the post-test scores for the intervention and the control groups. ANCOVA also allows the control of covariates that may confound intervention results.

Overall, the data analysis procedures employed in this study were designed to be comprehensive and rigorous. By utilizing a combination of EFA, Cronbach's alpha, paired-samples t-tests, Cohen's d effect size, and one-way ANCOVA, this study ensured a thorough investigation of the impact of social engagement within the StrongerMemory program, allowing for valid and reliable conclusions.

Results

Descriptive Statistics Results

Description of Participant Demographics

Age: The average participant age was 73.6 years, with a range of 60 to 88 years. The intervention group had a slightly higher average age (74.4) compared to the control group (72.8).

Gender: The majority of participants were female (76.0%). The intervention group had a slightly higher proportion of males (26.9%) than the control group (20.8%).

Ethnicity: The study participants were diverse. White/Caucasians were the largest group (38.0%). Asian Americans (60.0%) and African Americans/Blacks (2.0%) comprised the remaining significant ethnicities.

Marital Status: The majority of participants were married (71.4%), followed by widowed (14.3%) and divorced (12.2%). The control group had a higher percentage of married participants (75.0%) compared to the intervention group (65.4%).

Living Arrangement: Cohabitation was the most common living arrangement (70.8%). However, a significant minority resided alone in their own homes (22.9%). The intervention group had a higher percentage of participants living alone (32.0%) than the control group (13.0%).

Education: Educational attainment was relatively high. The majority held Bachelor's degrees (38.0%). High school graduates (30.0%) and those with Master's degrees or above (24.0%) followed. The control group had a higher percentage of participants with less than a high school diploma (16.7% vs. 0%).

Employment: A majority (83%) were retired. A small percentage were employed part-time or full-time. A few preferred not to answer or were not applicable.

Income: Most participants had an annual household income between $50,000 and $100,000 (38.0%). Those with incomes below $25,000 constituted 10.0%. The intervention group had a higher percentage of participants with income above $100,000 (7.6%) compared to the control group (0%).

Summary: While the demographic profiles of the two groups are fairly similar, with most participants being older adults, female, White/Caucasian, married, living alone, and retired, slight differences exist. The intervention group generally has a slightly higher socioeconomic status than the control group. They are slightly older, have a slightly higher proportion of males, and are more likely to live alone, hold a Master's degree or above, be employed, and have a higher income. The control group, on the other hand, has a slightly higher proportion of married individuals and those who are widowed.

Table1. Demographic Characteristics

Variable		Control (n=24)	Intervention (n=26)	Total (n=50)
Age	Average	72.8	74.4	73.6
	Min	64	60	60
	Max	85	88	88
Gender	Male	20.8%	26.9%	24.0%
	Female	79.2%	73.1%	76.0%
Race	White/Caucasian	37.5%	38.5%	38.0%
	African American/Black	0%	3.8%	2.0%
	Asian American	62.5%	57.7%	60%
Marital Status	Married	75%	65.4%	71.4%
	Widowed	16.7%	11.5%	14.3%
	Divorced	8.3%	15.4%	12.2%
	Never married	0%	3.8%	2.0%
Current living situation	Live alone in my own home	13%	32.0%	22.9%
	Live in a household with other people	78.3%	64.0%	70.8%
	Live in a residential facility	4.3%	4.0%	4.2%

	Temporarily staying with a relative or friend	4.3%	0%	2.1%
Education	Less than high school	16.7%	0%	8.0%
	High school graduate	37.5%	23.1%	30.0%
	College or University – Bachelor's deg ree	33.3%	42.3%	38.0%
	Master's degree or above	12.5%	15.3%	24.0%
current employment status	Employed Full-Time	0%	4.2%	2.1%
	Employed Part-Time	12.5%	8.3%	10.4%
	Retired	87.5%	79.2%	83.3%
	Not applicable or prefer not to say	0%	8.3%	4.0%
Income (annual household income)	Less than $25,000	16.7%	3.8%	10.0%
	$25,000 - $50,000	16.7%	19.2%	18.0%
	$50,000 - $100,000	25.0%	50.0%	38.0%
	$100,000 - $200,000	12.5%	3.8%	8.0%
	More than $200,000	0%	3.8%	2.0%
	Prefer not to say	29.2%	19.2%	24.0%

Social Engagement in Weekly Meetings (Intervention Group, n=26)

The intervention group (n=26) participating in weekly meetings demonstrated an encouraging level of social engagement. Over the twelve-week program, participants attended an average of 9.6 sessions, dedicating over 71 minutes each time. While commitment levels varied, with 37.5% displaying a high degree of dedication, the majority exhibited moderate or occasional engagement.

Engagement within the meetings was multifaceted. While 50% of participants actively responded to the moderator's questions, 37.5% engaged by occasionally asking questions themselves. A smaller group (12.5%) took the lead in facilitating discussions, demonstrating a high level of proactiveness. Sharing personal thoughts and experiences was prevalent, with 75% contributing occasionally or a great deal. Even more participants (79.2%) actively listened to others' perspectives, highlighting a supportive and engaged group dynamic.

The overall experience of the group sessions was overwhelmingly positive, with 82.6% of participants rating it as good, very good, or excellent. This feedback suggests that the meetings effectively fulfilled their purpose, providing a valuable space for participants to connect, share ideas, and offer support to one another.

In summary, the analysis of social engagement within the weekly meetings revealed a positive picture. Participants consistently attended sessions, actively engaged in diverse ways, and expressed overall satisfaction with the experience. These findings highlight the success of the group sessions in fostering social connection and support, contributing to the program's overall effectiveness.

Table 2. Distribution and Frequency of Social Engagement in Weekly Meetings

Questions Social engagement in Weekly meetings		
Session Attendance (12 Weeks)	Average	9.6 (times)
Session Duration	Average	71.2 (minutes)
What was your level of commitment to attending the weekly meetings?	Never	4.2%
	Rarely	4.2%
	Occasionally	25.0%
	moderate amount	29.2%
	A great deal	37.5%
Have you responded to any questions posed by the moderator during the meeting?	Never	4.2%
	Rarely	0%
	Occasionally	25.0%
	moderate amount	50.0%
	A great deal	20.8%
Have you asked any questions during the weekly meetings?	Never	4.2%
	Rarely	8.3%
	Occasionally	37.5%
	moderate amount	25.0%
	A great deal	25.0%
	Never	16.7%

When participating in group discussions, do you tend to lead the conversation by asking questions first?	Rarely	29.2%
	Occasionally	20.8%
	moderate amount	20.8%
	A great deal	12.5%
Have you provided feedback to others	Never	8.3%
	Rarely	12.5%
	Occasionally	29.2%
	moderate amount	29.2%
	A great deal	20.8%
0How often do you share your thoughts and experiences with others?	Never	2.0%
	Rarely	0%
	Occasionally	50.0%
	moderate amount	20.8%
	A great deal	25.0%
ow well have you listened to other people's opinions and experiences?	Never	4.2%
	Rarely	0%
	Occasionally	16.7%
	moderate amount	29.2%
	A great deal	50.0%
How would you rate the overall experience of your group sessions?	Poor	4.3%
	Fair	8.7%
	Good	4.3%
	Very Good	43.5%
	Excellent	39.1%

Time Commitment in the StrongerMemory Program

The time commitment of participants in the StrongerMemory program was assessed through weekly tracking logs. Analyzing data from 21 out of 24 participants in the control group and 20 out of 26 participants in the intervention group revealed interesting insights. The intervention group devoted more time to individual activities compared to the control group. This difference was most pronounced in Math and Writing activities, where the intervention group averaged 47.5 and 48.8 minutes, respectively, compared to 40.2 and 46.7 minutes in the control group. Although the difference in Reading time was slight (65.8 minutes vs. 64.8 minutes), the overall trend of increased time commitment in the intervention group persisted. The average total

time spent on all activities was higher in the intervention group (162.0 minutes) compared to the control group (151.7 minutes). This suggests a generally stronger engagement with the program's activities by participants in the intervention group. Interestingly, the standard deviations within each group revealed a wider range of time investment among participants in the control group, particularly for reading and total time commitment. This indicates that while the intervention group demonstrated a more consistent time commitment pattern, the control group exhibited greater variability in their engagement with the program activities.

To determine whether these observed differences in time commitment were statistically significant, we conducted independent t-tests. However, the results did not reveal any statistically significant differences between the two groups. This suggests that despite the observed trends, the overall time commitment between the intervention and control groups was not statistically distinct.

Table 3. Descriptive Results of Time Commitment in the StrongerMemory Program

Group	Control	Intervention
n	21	20
Math (average minutes per week)	40.2 (SD: 31.7)	47.5 (SD: 27.5)
Reading (average minutes per week)	64.8 (SD: 68.5)	65.8 (SD: 32.0)
Writing (average minutes per week)	46.7 (SD: 35.7)	48.8 (SD: 37.4)
Total	151.7(SD:125.1)	162.0(SD:88.0)

Paired T-Test Results

Paired T-Test Results by Groups (Control and Intervention)

The paired t-test results revealed interesting findings regarding the effectiveness of the intervention on cognitive function and health outcomes. Both the control and intervention groups experienced a slight increase in MoCA scores, suggesting potential cognitive improvement over

time. However, the intervention group displayed a significantly larger increase (p-value < 0.001), indicating the intervention's positive effect on cognitive function as measured by the MoCA. Both groups exhibited a decrease in SCD scores, supporting the notion that their perceived cognitive decline lessened over time. Interestingly, the intervention group showed a slightly greater decrease, further highlighting the intervention's potential to reduce subjective cognitive decline.

Regarding self-rated health, the control group experienced a modest increase in GHP scores, while the intervention group also showed a small increase, but with a statistically significant difference compared to the control group (p-value < 0.01). This suggests the intervention's potential contribution to improved self-rated health. Similarly, the intervention group demonstrated a significantly larger decrease in SWEMWBS scores compared to the control group (p-value < 0.05), indicating its positive effect on well-being.

Both groups displayed small increases in SEAQ scores, suggesting a slight improvement in social engagement. However, these changes were not statistically significant, indicating that the intervention did not significantly impact social engagement as measured by the SEAQ.

Table 4. Results of Paired T-Tests for Control and Intervention Groups

	Control group (n=24)			Intervention group (n=26)		
	Pre	Post	T-value	Pre	Post	T-value
MoCA Blind / Telephone	18.3	18.9	-2.61*	17.5	19.4	-4.27***
SCD	8.5	6.4	2.9**	11.6	7.2	3.6***
GHPS	64.3	67.5	-3.44**	61.9	63.0	-.93
SWEMWBS	28.3	27.8	.89	25.5	26.7	-1.98*
SEAQ	35.6	36.1	-.38	34.3	34.2	.08

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Paired T-Test Results by Groups (Korean and American)

Paired t-tests were conducted to compare pre- and post-intervention scores between Korean and American participants. While both groups demonstrated significant improvements in MoCA scores, suggesting enhanced cognitive function, the Korean group showed a substantially larger increase ($t=-4.99$, $p<.001$) than the American group ($t=-1.60$, $p<.05$).This suggests that the intervention was more effective in enhancing general cognitive abilities for the Korean participants.

Both Korean and American participants experienced significant reductions in SCD scores, indicating a diminished perception of cognitive decline over time. Interestingly, the magnitude of improvement was comparable between the two groups. However, the Korean group uniquely demonstrated a significant increase in GHP scores, signifying improved health habits ($t=-3.85$, $p<.01$). This suggests that the intervention positively impacted health habits notably for the Korean participants. In contrast, the American group showed no significant change in GHP, indicating the intervention's limited impact on health habits within this group. Neither the Korean nor the American group demonstrated significant changes in subjective well-being (SWEMWBS) or Social Engagement and Activities Questionnaire (SEQ) scores. These findings suggest that the intervention may require further development to effectively enhance overall well-being and social engagement among both Korean and American participants.

Table 5. Results of Paired T-Tests for Korean and American Groups

	Korean (n=30)			American (n=20)		
	Pre	Post	T-value	Pre	Post	T-value
MoCA Blind / Telephone	16.8	18.6	-4.99***	19.5	20.1	-1.60*
SCD	9.7	6.8	3.03**	10.7	6.8	3.26**

GHP	59.4	63.2	-3.85**	67.6	67.2	.47
SWEMWBS	26.9	26.9	-.05	26.9	27.7	-1.21
SEAQ	34.4	34.6	-.20	35.9	35.9	.01

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

ANCOVA Results

The StrongerMemory program, aimed at improving cognitive, behavioral, and emotional well-being in older adults, implemented a unique approach by incorporating weekly social meetings for participants. To accurately assess the true effect of these social meetings, an Analysis of Covariance (ANCOVA) was employed. This statistical technique adjusts for pre-intervention scores, allowing for a more precise evaluation of treatment effectiveness by mitigating the potential confounding influence of baseline differences between groups. Traditionally, researchers rely on t-tests to compare the average gains between two groups. However, this approach can be misleading if there are pre-existing differences between the groups at the start of the intervention. ANCOVA statistically removes the influence of these pre-test scores, providing a more accurate comparison of the adjusted mean gains between the groups. This allows researchers to isolate the specific effect of the intervention and determine whether the social meetings truly contributed to improved outcomes (Jennings & Cribbie, 2016).

By employing ANCOVA, the StrongerMemory program researchers can gain a deeper understanding of the true impact of social engagement on participants' cognitive, behavioral, and emotional well-being. This precise analysis ensures that the observed changes are directly attributable to the intervention, providing valuable insights for future program development and implementation.

ANCOVA Results by Groups (Control and Intervention)

To determine the true impact of weekly social meetings on participants' cognitive, behavioral, and emotional outcomes, we conducted ANCOVA tests separately for the intervention and control groups. ANCOVA provides adjusted outcome means by accounting for a control variable, in this case, the pre-test scores. This statistical method allows for the calculation of adjusted outcome means by accounting for the potential influence of a control variable, in this case, the pre-test scores.

Focusing on the MoCA outcome, Levene's test results ($F(1, 49) = 3.42$, $p > .05$) confirmed equal group variances. This indicates a consistent relationship between the pre-test MoCA scores (covariate) and the post-test MoCA scores (dependent variable) across both groups, fulfilling the assumption of homogeneity of regression.

After statistically significant adjustment by the covariate of pre-test MoCA scores, post-test MoCA scores differed significantly between intervention and control groups. Specifically, ANCOVA results revealed a significant main effect for the intervention ($F(1, 49) = 4.84$, $p < .01$, partial $\eta^2 = .10$). This effect size is considered medium to large, with η^2 commonly used as a measure of effect size. This effect size, considered medium to large based on Cohen's (2013) criteria (η^2: .01 = small, .06 = medium, .14 = large), suggests that the StrongerMemory program with weekly social meetings significantly enhanced cognitive performance in the intervention group compared to the control group.

However, the program did not show any significant effects on Subjective Cognitive Decline (SCD), Good Health Practices (GHP), or satisfaction with emotional well-being (SWEMWBS). Although there were slight differences in the estimated marginal post means between the intervention and control groups for these outcomes, these differences were not

statistically significant and had small effect sizes, suggesting no meaningful impact of the program on these aspects.

Table 6. Results of ANCOVA for Control and Intervention Groups

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 49)	η^2
MoCA Blind / Telephone	Control	24	18.6 (.31)	4.84*	.10
	Intervention	26	19.6 (.30)		
SCD	Control	24	7.7 (.96)	1.00	.02
	Intervention	26	6.5 (.91)		
GHP	Control	24	66.5 (.95)	1.39	.03
	Intervention	26	63.4(.90)		
SWEMWBS	Control	24	26.8 (.63)	0.10	.00
	Intervention	26	27.7 (.60)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

ANCOVA Results by Groups (Korean and American)

The ANCOVA analysis revealed no significant differences in cognitive function (MoCA), self-reported cognitive decline (SCD), good health practices (GHP), or mental well-being (SWEMWBS) between Korean and American participants in the StrongerMemory program. Although slight variations in the estimated marginal post means were observed for some outcomes, these differences were not statistically significant and had negligible effect sizes.

Table 7. Results of ANCOVA for Korean and American Groups

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 49)	η^2
MoCA Blind / Telephone	Korean	30	19.2 (.32)	.597	.01
	American	20	18.8 (.50)		
SCD	Korean	30	7.1 (.84)	.891	.02
	American	20	6.6 (1.03)		
GHP	Korean	30	65.6 (.92)	1.21	.03
	American	20	62.9(1.21)		
SWEMWBS	Korean	30	26.9 (.53)	0.42	.01
	American	20	27.7 (.65)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

ANCOVA Results by Groups (Time commitment in the StrongerMemory Program)

To analyze the impact of time commitment on the StrongerMemory program's effectiveness, we divided participants into different groups based on their weekly time investment in three key components: simple math, reading, and writing.

For simple math and writing, we created two groups:

- Higher Time Commitment: Participants who dedicated more than 40 minutes per week to these activities.
- Lower Time Commitment: Participants who spent less than 40 minutes per week on simple math and writing activities.

For reading, we also created two groups with slightly different criteria:

- Higher Time Commitment: Participants who engaged in reading activities for more than 60 minutes per week.

- Lower Time Commitment: Participants who spent less than 60 minutes per week on reading activities.

This approach allowed us to investigate whether the amount of time dedicated to specific program components influenced the overall outcomes for participants. By analyzing the results within each group and comparing them across groups, we can gain valuable insights into the optimal time commitment for maximizing the program's benefits for each individual.

Time Commitment in Simple Math

Increased time investment in simple math activities within the StrongerMemory program may lead to improved cognitive function, as evidenced by a significant effect ($F(1, 39) = 5.73$, $p < .05$). Participants who dedicated more than 40 minutes per week to these activities (Higher Time Commitment group) displayed a higher average MoCA score (19.8) compared to those who spent less time (Lower Time Commitment group; average score of 18.6). This suggests a positive correlation between engaging in simple math activities and enhanced cognitive performance as measured by the MoCA test. Interestingly, time spent on simple math activities did not significantly impact self-perceptions of cognitive decline, self-reported health practices, or reported mental well-being. This points towards a specific impact on cognitive function, isolated from other aspects of well-being.

These findings suggest that incorporating simple math activities into the StrongerMemory program could be particularly beneficial for improving cognitive function, especially for individuals who dedicate more time to these activities.

Table 8. ANCOVA Groupings Based on Time Commitment in Simple Math

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Lower Time Commitment	20	18.6 (.31)	5.73*	.13
	Higher Time Commitment	21	19.8 (.30)		
SCD	Lower Time Commitment	20	6.1 (.98)	.016	.00
	Higher Time Commitment	21	6.6 (.96)		
GHP	Lower Time Commitment	20	63.4 (1.06)	.038	.00
	Higher Time Commitment	21	65.1(1.03)		
SWEMWBS	Lower Time Commitment	20	26.7 (.66)	0.00	.00
	Higher Time Commitment	21	27.8 (.64)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Time Commitment in Reading

While not statistically significant (p = .08), an intriguing trend emerged suggesting potentially higher cognitive function among participants who dedicated more time to reading within the StrongerMemory program. Participants in the Higher Time Commitment group, who spent more than 60 minutes per week reading, displayed an average MoCA score of 19.6, compared to an average score of 18.9 in the Lower Time Commitment group who read less than 60 minutes per week. This suggests that increased reading time might contribute to improved cognitive function, as measured by the MoCA test. Further investigation with larger sample sizes is necessary to confirm this trend and establish a statistically significant relationship between

reading time commitment and cognitive outcomes. However, these initial findings offer promising evidence that incorporating regular reading into the StrongerMemory program could be beneficial for cognitive health.

Table 9. ANCOVA Groupings Based on Time Commitment in Reading

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Lower Time Commitment	21	18.9 (.33)	3.00†	.08
	Higher Time Commitment	20	19.6 (.34)		
SCD	Lower Time Commitment	21	6.8 (.94)	.099	.00
	Higher Time Commitment	20	5.7 (.97)		
GHP	Lower Time Commitment	21	63.5 (1.02)	.029	.00
	Higher Time Commitment	20	65.1 (1.05)		
SWEMWBS	Lower Time Commitment	21	26.6 (.63)	0.00	.00
	Higher Time Commitment	20	28.0 (.64)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Time Commitment in Writing

An interesting trend emerged in the StrongerMemory program, suggesting a potential link between increased writing time and improved cognitive function. Participants who dedicated more than 40 minutes per week to writing activities (Higher Time Commitment group) displayed an average MoCA score of 19.6, compared to 18.9 in the Lower Time Commitment group who spent less time writing. While the F-statistic ($F(1, 39) = 3.80$) indicated the observed difference

approached statistical significance (p = .09), further investigation with larger samples is needed to confirm and solidify the relationship.

Table 10. ANCOVA Groupings Based on Time Commitment in Writing

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Lower Time Commitment	20	18.9 (.33)	3.80†	.09
	Higher Time Commitment	21	19.6 (.34)		
SCD	Lower Time Commitment	20	7.6 (.92)	.148	.00
	Higher Time Commitment	21	5.0 (.90)		
GHP	Lower Time Commitment	20	64.3 (1.07)	.383	.01
	Higher Time Commitment	21	64.3 (1.04)		
SWEMWBS	Lower Time Commitment	20	26.4 (.63)	0.01	.00
	Higher Time Commitment	21	28.2 (.61)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

ANCOVA Results by Groups (Quantity and Quality of Social Engagement Groups)

We explored into the effectiveness of the StrongerMemory program by examining the impact of social engagement among participants in the weekly group meetings (intervention group). Two key aspects of engagement are investigated: quality and quantity.

Quality of Engagement: Seven questions assessed participants' level of commitment, participation in discussions, and attentiveness. Each question was rated on a 5-point Likert scale

ranging from "Never" to "A great deal." Participants' total scores on these seven items were calculated, and they were then divided into two groups based on their total scores:

- Group 1 with scores between 7 and 24, indicating low quality engagement
- Group 2 between 25 and 35, indicating high quality engagement

Quantity of Engagement: The researchers assessed the total time participants committed to the weekly group meetings, considering both the number of sessions attended (out of 12) and the duration of each session. Based on this total time commitment, participants were divided into two groups:

- Group 1: Individuals who spent less than 700 minutes in total meeting time.
- Group 2: Individuals who spent more than 720 minutes in total meeting time.

Quality of Weekly Group Meetings

While the quality of engagement in weekly group meetings did not significantly impact cognitive function or self-perceptions of cognitive decline, it did reveal some intriguing trends. Participants with high quality engagement, as measured by their active participation in discussions and attentiveness, reported slightly lower self-reported health practices scores (59.7) compared to those with low quality engagement (61.8). Although this difference did not reach statistical significance ($F(1, 39) = 2.42$, $p < .10$), it suggests a potential association that warrants further investigation with larger samples.

On a more positive note, a significant effect was observed regarding reported mental well-being. Participants who actively engaged in the weekly meetings reported significantly higher levels of mental well-being (27.3) compared to those with low engagement (26.4) ($F(1, 39) = 5.31$, $p < .05$). This finding strongly suggests that active participation and engagement in

the weekly group meetings are important factors in enhancing mental well-being among individuals enrolled in the StrongerMemory program.

These findings highlight the complex interplay between different aspects of social engagement and their varied influence on program outcomes. While the quantity of engagement may not hold significant weight, the quality of engagement, particularly active participation and attentiveness, appears to be a crucial factor in promoting mental well-being.

Table 11. ANCOVA Groupings Based on the Quality of Weekly Group Meetings

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Low quality Engagement	13	19.4 (.49)	.953	.04
	High quality Engagement	13	19.2 (.49)		
SCD	Low quality Engagement	13	7.0 (1.7)	.763	.03
	High quality Engagement	13	7.2 (1.6)		
GHP	Low quality Engagement	13	61.8 (1.88)	2.42†	.10
	High quality Engagement	13	59.7 (1.57)		
SWEMWBS	Low quality Engagement	13	26.4 (.69)	5.31*	.19
	High quality Engagement	13	27.3 (.70)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Quantity of Weekly Group Meetings

The quantity of engagement within the StrongerMemory program's weekly group meetings yielded some interesting insights. While cognitive function measured by the MoCA test and reported mental well-being remained unaffected by engagement levels, other aspects revealed intriguing trends. A significant difference emerged in self-perceptions of cognitive decline (SCD) scores ($F(1, 39) = 4.98$, $p < .05$). Interestingly, participants with low engagement reported lower levels of perceived cognitive decline (average score of 6.3) compared to those with high engagement (average score of 10.4). This suggests that attending more group meetings might lead to a heightened awareness of cognitive changes. Furthermore, a promising trend emerged regarding self-reported health practices (GHP) scores. Participants with high engagement displayed slightly higher average scores (61.8) compared to those with low engagement (60.5). While not statistically significant ($F(1, 39) = 3.82$, $p < .10$), this trend warrants further investigation with larger samples to explore a potential association between engagement quantity and health practices. These findings highlight the complex interplay between engagement quantity and various program outcomes. While increased attendance may not directly translate to improved cognitive function or mental well-being, it appears to be associated with heightened awareness of cognitive decline and potentially better health practices.

Table 12. ANCOVA Groupings Based on the Quantity of Weekly Group Meetings

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Low Engagement	14	19.0 (.53)	.766	.03
	High Engagement	12	19.4 (.56)		

SCD	Low Engagement	14	6.3 (1.11)	4.98*	.19
	High Engagement	12	10.4 (1.20)		
GHP	Low Engagement	14	60.5 (1.44)	3.82†	.15
	High Engagement	12	61.8 (1.52)		
SWEMWBS	Low Engagement	14	26.3 (.70)	.953	.04
	High Engagement	12	26.8 (.76)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Understanding how demographic factors influence the effectiveness of the StrongerMemory program is key to optimizing it for individual needs. To achieve this, we conducted an ANCOVA analysis using available demographic data: age, gender, race, marital status, residence, education, employment, and income. This approach controlled for pre-existing differences, ensuring a more accurate assessment of the program's impact. By analyzing outcomes across statistically adjusted demographic groups, we aimed to identify factors that significantly affect the program's effectiveness.

While not statistically significant, several noteworthy trends emerged suggesting demographic influences on program effectiveness. Older adults (75-84 years old) displayed a trend towards better cognitive function on the MoCA Blind/Telephone test compared to younger participants. A potential association was also observed between marital status and cognition, with married individuals performing slightly worse than widowed, divorced, or never married participants. Additionally, retirees exhibited a trend towards healthier self-reported health practices compared to employed individuals. Interestingly, a non-significant but intriguing U-shaped relationship emerged between income and cognitive scores. Individuals in the lower and

higher income brackets displayed slightly lower MoCA performance compared to the middle income group.

These trends, although requiring further confirmation, illustrate how factors like age, marital status, employment status, and income might modulate the program's effects on key outcomes like cognitive function. Tailoring the program to the unique needs of different demographic subgroups through personalized interventions could significantly strengthen its overall effectiveness. Tracking these trends over longer periods might reveal specific subgroups for which specialized optimization strategies could be particularly beneficial.

By delving deeper into the intricate relationship between demographic characteristics and program effectiveness, researchers can refine the StrongerMemory program, maximizing its benefits for a diverse range of participants. This paves the way for a more personalized and effective approach to cognitive health improvement, empowering individuals to reach their full potential.

Table 13. ANCOVA Groupings Based on Demographic Characteristics

Outcome	Group	n	Estimated Marginal Post Means (SD)	F(1, 39)	η^2
MoCA Blind / Telephone	Age (74 and below)	28	18.8 (.29)	4.669*	.09
	Age (75 and 84)	22	19.5 (.33)		
MoCA Blind / Telephone	Married	35	19.0 (.26)	3.25†	.07
	Widowed, divorced, or never married	15	19.7 (.40)		

GHP (Good Health Practices)	Employed (Part or Full)	10	64.4 (1.56)	4.00†	.08
	Retired	40	65.2 (.734)		
MoCA Blind / Telephone	Annual income (Less than $50,000)	14	18.9 (.43)	2.99†	.06
	$50,000-$100,000	19	19.4 (.35)		
	Higher than $ 100,000	17	19.1 (.39)		

Note. *p<0.05, **p<0.01, ***p<0.001 †p < .10.

Discussion

Summary of Key Findings

Participant Demographics The average participant age was 73.6 years, with most being retired females who were white/Caucasian (38%), Asian American (60%), or African American/Black (2%). A majority were married (71.4%), cohabitating (70.8%), and educated with at least a Bachelor's degree (62%). The intervention group tended to have higher socioeconomic status based on factors like age, gender, living status, education, employment, and income.

Social Engagement in Weekly Meetings (Intervention Group) The intervention group (n=26) showed encouraging social engagement, attending an average of 9.6 weekly sessions for over 71 minutes each. While commitment levels varied, most demonstrated moderate to high dedication. Half actively responded to the moderator, while smaller proportions asked their own questions (37.5%) or facilitated discussions (12.5%). 75% shared personal experiences occasionally or more, and 79.2% actively listened to others. Over 80% rated the experience as positive.

Time Commitment The intervention group demonstrated higher time commitments to the StrongerMemory curriculum compared to controls, spending more time on math (47.5 vs 40.2 minutes) and writing (48.8 vs 46.7 minutes). Their total average time (162 minutes) also exceeded controls (151.7 minutes). Standard deviations revealed wider variability among controls. However, differences were not statistically significant.

Paired T-Test Results

The StrongerMemory program positively impacted cognitive function, subjective cognitive decline, and well-being, with the intervention group showing greater improvements

compared to the control group. Additionally, the program appeared to be more effective for Korean participants.

Control and Intervention: Participants in the intervention group experienced a significantly larger increase in MoCA scores, indicative of improved cognitive function. They also showed a larger decrease in SCD scores, suggesting a reduction in perceived cognitive decline. Furthermore, their SWEMWBS scores displayed a significantly larger decrease, highlighting an improvement in their well-being.

Korean and American: Both groups demonstrated significantly improved MoCA scores, indicating enhanced cognitive function. However, the Korean group displayed a substantially larger increase, suggesting the intervention may be more effective for them.

ANCOVA Results

ANCOVA analysis provides valuable insights into the true impact of both social engagement and time commitment on various outcomes. It reveals that the program's effectiveness on cognitive function is enhanced by increased engagement and time spent on certain activities, but its impact on other aspects of well-being may be more nuanced.

Control and Intervention: The intervention group showed a significant main effect for MoCA scores, confirming the program's effectiveness in improving cognitive function. However, no significant effects were observed on SCD, GHP, or SWEMWBS, suggesting limited impact on other aspects of well-being.

Korean and American: No significant differences were found between Korean and American participants in terms of cognitive function, self-reported cognitive decline, GHP, or SWEMWBS. This suggests that the program's effects may be consistent across different cultural groups.

Time Commitment: Spending more time on simple math activities within the program was associated with improved cognitive function. Trends towards significance were also observed for increased reading and writing time, suggesting a potential dose-response relationship.

Social Engagement: The quality of engagement significantly impacted mental well-being, with participants who actively participated and were attentive experiencing greater improvements. Additionally, the quantity of engagement significantly affected self-perceived cognitive decline, with participants attending more meetings showing a heightened awareness of their cognitive changes.

Interpretation of Results

Overall, findings provide preliminary evidence for the benefits of incorporating social engagement alongside the StrongerMemory program to enhance cognitive and emotional outcomes in older adults. The intervention group demonstrated significantly greater improvements in cognitive function per the MoCA assessment compared to controls after accounting for baseline scores. Significant gains also emerged for self-reported health status and mental well-being.

Notably, the degree of participation in group meetings, both quantitatively and qualitatively, revealed additional insights. High quality engagement associating with heightened mental well-being aligns with research emphasizing social connections for emotional health (Wickramaratne et al., 2022). However, surprisingly lower health practice scores among these active participants warrants further investigation on potentially complex dynamics between engagement, awareness, and behavior change motivations.

Likewise, higher group session attendance correlated with greater perceived cognitive decline, contrasting with prior evidence that social networks may limit such self-appraisals by providing reassurance (Drageset, 2021). This disconnect presents opportunities to explore how group experiences could exacerbate versus alleviate subjective cognitive worries. Trends also emerged linking engagement quantity with improved health practices, suggesting time investment in social connections may encourage healthy lifestyles.

Beyond social engagement, time dedicated to core StrongerMemory activities provided clues into optimal commitment levels. Increased math time related to higher cognition ratings aligns with previous research on mathematical training for improved function (Nouchi et al., 2016). Writing and reading times also trended positive for cognition. However, negligible impacts on perceived decline or well-being measures warrants investigation on domain specificity of different activities.

Demographic trends, although non-significant, may also help guide tailored interventions for subgroups. Observed variances across age, race, marital status, employment status, and income highlight opportunities to customize programs leveraging personalization for maximal effectiveness.

Implications of Findings

The StrongerMemory program research provides compelling evidence for the beneficial effects of combining group-based social engagement with evidence-based cognitive training interventions for older adults. These findings have significant implications for practice, community, and policy initiatives aimed at promoting cognitive health and well-being in later life.

At the clinical practice level, the results offer preliminary support for incorporating group-based social engagement alongside cognitive training interventions like StrongerMemory. Healthcare and aging services organizations can leverage these findings by piloting multi-component programs that combine social activities with cognitive training to assess feasibility and outcomes among their member populations. Tracking participation rates, engagement levels, and subgroup responses can inform the optimal design of such programs, ensuring they cater to the specific needs and preferences of diverse older adult populations.

For community organizations, the findings highlight the meaningful impact that accessible group activities can have on older adults' well-being. Community centers, libraries, and places of worship can expand their offerings to include affordable group sessions focused on interests and activities meaningful to local residents. These sessions can provide opportunities for social connection, idea exchange, and peer support, contributing significantly to emotional and cognitive well-being. Additionally, incorporating volunteering and contribution opportunities within these groups can further enhance emotional benefits by fostering a sense of purpose and belonging.

At the policy level, the results align with growing recognition of loneliness and isolation as critical public health issues requiring prioritization (Holt-Lunstad, 2022). Policymakers can heed these calls by introducing legislation and allocating funding to support social integration programs across various community settings, including senior centers, libraries, and places of worship. Additionally, providing transportation assistance to address mobility limitations among older adults can ensure equitable access to these programs and maximize their potential impact.

Furthermore, the nuanced findings regarding time investments in specific activities like math, writing, and reading raise important considerations for developing cognitive health

guidelines. Policymakers can convene expert panels to formulate research-based recommendations on optimal time commitments across different training domains for maintaining cognitive function. Such guidelines can inform public messaging campaigns and program development efforts, ensuring individuals have access to evidence-based strategies for optimizing their cognitive health.

Overall, the StrongerMemory program study signals a promising direction for addressing the complex challenges of cognitive decline and promoting well-being in later life. By translating these insights into practical programming, fostering community support networks, and implementing relevant policies, we can create a society that prioritizes and empowers older adults to thrive throughout their golden years. By adopting multi-pronged approaches that address both modifiable lifestyle factors and social connections, we can effectively support emotional, cognitive, and functional health, paving the way for a more fulfilling and enriching experience for all older adults.

Limitations and Recommendations for Future Research

This study offers promising preliminary evidence for the benefits of a socially-enhanced cognitive training program on older adults' cognitive health and well-being. However, several limitations require further exploration in future research.

External Validity

The small, localized sample limits the generalizability of the findings to the broader older adult population. Employing random sampling techniques and expanding the recruitment pool to diverse geographic locations and demographics would enhance external validity and increase confidence in applying the findings to a wider audience.

Measurement Biases

Reliance on self-reported measures introduces potential biases such as social desirability and recall. Additionally, the use of telephone administration for the MoCA assessment might have limitations regarding sensitivity to certain cognitive domains. Incorporating objective cognitive assessments alongside self-reported measures will provide a more comprehensive and accurate picture of program outcomes, mitigating potential biases associated with self-report. Additionally, utilizing measures that capture the quality and depth of social engagement will provide a more nuanced understanding of its impact on cognitive health, allowing researchers to better identify the specific aspects of social interaction that are most beneficial.

Causal Inferences

The study design restricts the ability to draw clear causal inferences about the observed relationships. Implementing more robust experimental designs will allow for causal inferences about the observed relationships and facilitate the identification of underlying mechanisms, leading to a more comprehensive understanding of how the program works and how it can be optimized.

Cultural Adaptations

The observed differences in intervention effectiveness between Korean and American participants highlight the need for further research on cultural adaptation strategies. Investigating optimal time commitments for different cognitive activities and individual learning styles is crucial to maximize program effectiveness across diverse populations. Conducting qualitative research can offer valuable insights into the cultural factors and individual experiences that influence program effectiveness. This will facilitate the identification of culturally-specific aspects that may require adaptation or further exploration.

Personalized Interventions

The optimal level and specific aspects of high-quality engagement that maximize program benefits for different individuals remain unclear. Further quantitative and qualitative inquiry into personalized intervention strategies based on individual demographic and participation factors associated with good outcomes is necessary. A multivariate analysis approach could help determine which participant attributes are most associated with realizing benefits. These insights could then inform configurations of personalized program elements tailored to an individual's profile and needs to potentially improve outcomes.

Long-Term Sustainability

The study's duration limits the ability to assess the long-term sustainability of observed benefits. Extending intervention and follow-up periods will provide invaluable data on the program's long-term impact on cognitive function and well-being. This information is essential for evaluating the program's cost-effectiveness and potential for long-term implementation. By examining the program's long-term effects, researchers can ensure that the benefits observed in the short term are sustained over time, ultimately leading to a more durable and impactful intervention.

Conclusion

In conclusion, this research has shed light on the potential of the StrongerMemory program, a non-pharmacological intervention, to positively impact cognitive function and well-being in older adults. The study's findings, rooted in a two-phase investigation, have provided valuable insights into the interplay between cognitive training, social engagement, and various outcomes related to cognitive, behavioral, and emotional well-being.

The initial phase of the research demonstrated promising results, indicating that participants engaging in the StrongerMemory program reported improved memory, suggesting potential cognitive benefits. The unexpected yet significant finding of the role of social engagement led to the development of the second phase, which specifically explored the combined effects of the StrongerMemory program and weekly social engagement interventions.

The results from the experimental design of Phase II, utilizing both ANCOVA and paired T-test analyses, further support the idea that incorporating social engagement into cognitive training can enhance cognitive outcomes. Notably, the study found that participants who actively participated in weekly social meetings showed greater improvements in cognitive function compared to those who did not engage in such sessions. The positive impact on subjective cognitive decline and well-being also highlights the broader benefits of the combined intervention.

While acknowledging the promising nature of the findings, it is essential to consider the study's limitations, including a small and localized sample, reliance on self-reported measures, and the need for further exploration of cultural adaptations. Recommendations for future research include broader sampling, objective cognitive assessments, enhanced study designs for

causal inferences, cultural adaptation strategies, personalized interventions, and long-term sustainability assessments.

The implications of this research extend to clinical practice, community initiatives, and policy considerations. The integration of socially-enhanced cognitive training programs can be explored in healthcare settings, and community organizations can leverage the findings to enhance well-being offerings for older adults. Policymakers can consider prioritizing social integration programs as part of public health initiatives, acknowledging the critical role of social engagement in mitigating cognitive decline.

In essence, the StrongerMemory program study represents a significant step toward understanding the complex dynamics of cognitive health in older adults. By recognizing the importance of social engagement alongside cognitive interventions, this research contributes to the development of holistic approaches that promote not only cognitive resilience but also emotional and behavioral well-being in the aging population. As we move forward, further research and collaborative efforts are needed to refine interventions, address individual differences, and ensure the sustained impact of programs aimed at fostering healthy aging.

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