Examining the Effects of Cognitive Training in Older Adults with Mild Cognitive Impairment

Alessandra Moruzzi

Edson College of Nursing and Health Innovation, Arizona State University

Author Note

Alessandra Moruzzi is a Doctor of Nursing Practice student at Edson College of Nursing and Health Innovation at Arizona State University. She has a Bachelor of Science in Nursing degree from the University of Tennessee and is a licensed registered nurse in the state of Arizona.

I have no known conflict of interest to disclose. Correspondence concerning this article should be addressed to Alessandra Moruzzi, Edson College of Nursing and Health Innovation, Arizona State University, 550 North 3rd Street, Phoenix, Arizona 85004. Email: amoruzzi@asu.edu.

Abstract

Mild cognitive impairment (MCI) is the decline in memory, thinking, or judgment in older adults that is abnormal but is not severe enough to be categorized as dementia. The current number of people in the U.S. diagnosed with MCI in 2020 was over 12 million, which is estimated to nearly double by 2060, exponentially raising healthcare costs and caregiving needs. Additionally, those who are diagnosed with MCI are more likely to develop dementia. This project aims to improve cognition in older adults diagnosed with MCI by administering an at-home cognitive training program over 12-16 weeks. This quantitative study uses the Montreal Cognitive Assessment (MoCA) as the primary outcome measure and is guided by Bandura's self-efficacy theory. The MoCA is an internationally utilized cognitive test that is reliable and valid with good internal consistency (Cronbach alpha of 0.83). Participants were tested pre-intervention and post-intervention using the MoCA. The sample size of this study was (n=2). All participants significantly improved their MoCA scores after completing the at-home cognitive training program. Participants signed an informed consent form before participating, and the Arizona State University Internal Review Board approved the project.

Keywords: mild cognitive impairment, cognitive training, older adults, Montreal Cognitive Assessment

Examining the Effects of Cognitive Training on Cognitive Function in Older Adults

Older adults in the United States (U.S.) are living longer than any of the previous generations. With this increased longevity, there is also an increase in the number of older adults who live long enough to develop mild cognitive impairment. Mild cognitive impairment (MCI) can lead to devastating outcomes including social isolation, loss of independence, and decreased

quality of life. Cognitive impairment in the elderly is a fast-growing problem that deserves to be increasingly investigated and discussed more frequently with all aging adults.

Problem Statement

MCI is the decline in memory, thinking, or judgement in older adults that is abnormal, but is not severe enough to be categorized as dementia (Mayo Clinic, 2023; National Institute on Aging, 2021). For example, those with MCI might begin to forget things more often, have difficulty following conversations, miss important dates or social events, fail to follow directions, or experience trouble coming up with words (Mayo Clinic, 2023; U.S. Department of Veterans Affairs, 2020). Screening for MCI is completed annually with a primary care provider during a routine physical. However, it can be offered at any time and signs are often first noticed by a close family member of the patient.

MCI is finally being recognized and properly diagnosed more than ever before. The number of people in the U.S. diagnosed with MCI in 2020 was 12.23 million, which is estimated to nearly double by 2060, exponentially raising healthcare costs and caregiving needs (Rajan et al., 2021). Additionally, recent epidemiological data suggests the prevalence of MCI in adults over the age of 65 ranges from 8.4%-22%, with a noticeable increase to 35% in those over the age of 85 (Manly et al., 2022; Alzheimer's Association, 2022a). The population at the highest risk for MCI is rapidly growing and are living longer, thus increasing the risk of older adults developing MCI.

Purpose and Rationale

Unfortunately, those who have MCI are much more likely to develop dementia, especially within the first year after diagnosis (National Institute on Aging, 2021; Cleveland Clinic, 2019). Measures need to be taken to ensure older adults can live long, satisfying, and

healthy lives. Currently, only one in five Americans are familiar with MCI (Alzheimer's Association, 2022a). The purpose of this paper is to raise awareness of MCI, examine current practice guidelines, and explore possible interventions to delay the progression of MCI.

Background and Significance

It is important to establish the significance of MCI and its impact on the lives of otherwise healthy older adults. Most adults are currently unaware of MCI and often feel embarrassed to discuss any subjective signs with their family or healthcare provider. One of healthy People 2030's objectives is dedicated to increasing the number of adults who have discussed signs and symptoms of cognitive decline with a provider, because right now it is estimated that only half of those experiencing worsening memory are discussing it with their healthcare provider. (U.S. Department of Health and Human Services, 2020; Olivari et al., 2018). This is due to both older adults being particularly sensitive about their cognitive performance and primary care providers not having sufficient time to properly assess cognition in those who have multiple complex comorbidities (Sabbagh et al., 2020). To increase awareness and move toward reducing MCI in the U.S., it is best to begin by examining the background and essential elements.

Community Dwelling Older Adults

Community-dwelling older adults are those aged 65 and older who live and function independently. This population has a fundamental desire to maintain their independence, so finding interventions to help community-dwelling older adults maintain that right is essential for their well-being and quality of life (Liu et al., 2018; Dermody et al., 2020). Older adults being able to live in their own home satisfies them and significantly reduces the burden placed on family and caregivers. The population of Americans aged 65 and older will increase to 73.1

million by 2030 and is projected to rise to 85.7 million by 2050, accounting for 22% of the total U.S. population (America's Health Rankings, 2022). This population is growing exponentially, making it imperative to start exploring how to keep their cognition intact.

Training the Brain

Improving cognition and preventing further cognitive decline have been studied for decades. Teixeira-Santos et al. (2019) found that using working memory training (WMT), such as having to recall a specific sequence of stimuli, significantly improved the working memory of older adults compared to control groups who received no WMT. Another study showed that virtual reality-based cognitive training (VRCT), which consists of a series of games targeting different brain functions such as executive function, memory, and attention, improved cognitive and brain function in MCI patients when compared to the use of an exercise program (Yang et al., 2022).

The brain's neuroplasticity changes with age and the ability to learn tends to decline. However, older adults can improve their cognition and still challenge their brains. Although there is no supportive evidence stating that memory games or exercises can prevent dementia, there is evidence that computerized cognitive training (CCT) can improve memory and cognition in older adults who do not have dementia (O'Shea et al., 2019). Not only did they find improved cognition from the CCT, but they also found increased mood and reduced anxiety in participants who completed CCT. Additionally, a systematic review comparing cognitive intervention, physical exercise, and multi-component interventions found that cognitive intervention twice a week for at least 12 weeks positively affected cognition (Shao et al., 2022). There is growing evidence to show the benefit of using brain training, memory games, and other cognitive tools to improve cognition in older adults.

Internal Evidence and Setting

In a nurse-practitioner-owned and operated clinic located on the premises of a large independent senior living community in Arizona, the providers have noted that many of their residents develop MCI. The clinic's mission is to provide easily accessible and excellent care to the hundreds of older adults living in the community. Clinic staff prides themselves on establishing rapport and trust with every resident, even those who do not come to the clinic routinely. Although MCI screening is done annually with all patients at the clinic, some patients refuse to take the MoCA screening due to fear of failure.

Additionally, the clinic has no standardized protocol or guidelines if a patient has suspected MCI. As stated previously, many primary care providers need to be made aware of new therapies and interventions that can help their patients suffering from cognitive decline or MCI. The providers want to give their patients the tools they need to continue their life of independence and slow the progression of any noticeable cognitive changes.

PICOT Question

A review of the literature led to a clinically relevant PICOT question: In older adults with mild cognitive impairment, how does cognitive training compared with usual care affect cognitive scores? This question led to the following exhaustive search.

Search Strategy

The literature review to answer the PICOT question involved searching three main data bases: CINAHL, PubMed, and PsycInfo. These were selected due to their strong association with the topic of MCI and wealth of innovative interventions. All three data bases are renowned and have an outstanding record for their contributions to changing practice.

The databases were searched using specific key terms to yield the most relevant results to the PICOT question. The initial search began by using the following terms: *older adults or elderly or geriatric, mild cognitive impairment, MoCA or Montreal cognitive assessment, cognitive function tests, memory games or memory exercises.* This initial search yielded 929 results in PubMed, 14 results in CINAHL, and 207 results in PsycInfo. Keywords were then added to further refine the search: *cognitive training, brain games, and computer training.* Search limits were set to focus on publications from the last five years (2018-2023) that were written in English. Additionally, only meta-analysis, correlational studies, experimental studies, randomized controlled trials, and systematic reviews were included in the search to yield the highest level of evidence.

Inclusion Criteria, Exclusion Criteria, and Limitations

After briefly reviewing the title and abstracts of the final yield, inclusion criteria were established to eliminate any irrelevant studies. Publications that used the MoCA as an outcome measure were the only type included. Also, studies needed to be completed on older adults with no other cognitively limiting medical conditions like recent stroke patients, post-operative patients, dementia patients or Parkinson's patients.

Final Search Yield

The final search criteria yielded 50 results from PubMed, 37 results from CINAHL, and 19 results from PsycInfo. Grey literature was also searched including the National Institutes of Health and various medically credentialed websites including Mayo Clinic and Alzheimer's Association. Rapid critical appraisals were done on approximately 30 articles found to be best aligned with the PICOT question. Ten final studies were selected for this literature review

including nine randomized controlled trials (RCTs) and one systematic review with meta-analysis (Appendix A).

Critical Appraisal and Synthesis of Evidence

Evaluating the quality of evidence of the ten selected articles began using a rapid critical appraisal (RCA) tool (Melnyk & Fineout-Overholt, 2019). All studies included in this literature review were considered high-level evidence due to being RCTs or systematic reviews (see Appendix A, Table A1). Qualitative studies were not included in this review because of the quantitative nature of the outcome measures for evaluating MCI.

Several different countries are represented in the literature, with only three studies conducted in the U.S. (see Appendix A, Table A2). This speaks to the applicability and international interest in older adults with MCI but expresses the need for more research in the U.S. on this topic. Sample sizes varied from small to large, with stronger evidence from those studies with a larger sample size (see Appendix A, A2), although all studies had adequate sample sizes. Outcome measures also varied, each study using specific cognitive function tests to track the participants' progress (see Appendix A, Table A1). It is helpful to see the different methods that can be used to measure cognitive function and MCI. The MoCA was used in all studies except for three, which is the most common method to measure MCI in the U.S. Additionally, the studies used in this literature review were all statistically significant ($p < 0.05$).

Every study included either in-person classes or computerized cognitive training, with one study including a written cognitive training course. Some participants had cognitive training in their homes, while others went to an outpatient clinic or local community center. A few studies had higher drop-out rates than others (see Appendix A, Table A1), usually due to unrelated medical problems or hospital admission/discharge. Three of the studies' duration was

12 weeks, while the others lasted for 3-6 weeks. The cognitive training sessions were at least once a week in each study, with various training times ranging from 30 minutes to two hours.

Conclusion of Evidence

MCI is a growing problem in the U.S. and many countries, making the call to action louder than ever. The literature has shown significant improvement in the cognitive function of older adults after implementing cognitive training programs. Additionally, the evidence shows that cognitive training can improve mood and activities of daily living in older adults. Those with MCI tend to isolate themselves due to embarrassment or inability to complete basic tasks. Cognitive training can remarkably affect the quality of life in older adults with MCI. Cognitive training should be considered as a supplemental treatment option when diagnosing and treating older adults with suspected MCI.

A quality improvement project implementing computerized cognitive training in older adults, measuring their progress with the MoCA, would be a great place to start. Computerized training would ideally happen in the patient's home at least once a week. The intervention should be at least a month, but over 6-12 weeks may yield better results. Stakeholders of this project would be the providers at a primary care clinic and the patients themselves. Initial MoCA scores would need to be collected to determine the patient's level of cognition at baseline. After computerized cognitive training, the baseline MoCA score could be compared to the post-intervention score to determine any changes or improvements.

Theory Application

Older adults with MCI are not confident in their current abilities. Cognitive training can give these individuals newfound confidence and improve their overall cognition, as seen in the literature. This concept closely reflects ideas presented in Bandura's self-efficacy theory.

Bandura's self-efficacy theory emphasizes that the expectation of personal mastery and success determines whether an individual will participate in a new task or behavior (Lenz & Shortridge-Baggett, 2002). Additionally, individuals create self-efficacy by interpreting their own capabilities from four key sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological states (see Appendix B, Figure 1). Applying this theory to the context of older adults with MCI, persistent practice with cognitive training and encouragement from their healthcare provider will lead to improved self-efficacy through mastery or restoration of cognitive skills.

Implementation Framework

Implementation frameworks are a helpful tool when initiating change. They are used to guide research smoothly into practice in a systematic manner and simplify the complex process of organizational change (Moullin et al., 2015). For the issue of MCI in older adults in the primary care setting, the chronic care model (CCM) is a fitting framework to guide a potential project proposal. The CCM is a patient-centered, evidenced based framework that aims to achieve improved health outcomes in patients with chronic health conditions (Yeoh et al., 2017). This model makes the patient an essential participant in their chronic care management. Patients with MCI should feel they have control over their care and their health. There are six key components to the CCM: self-management support, delivery system design, decision support, clinical information systems, community resources, and health system (see Appendix B, Figure 2).

This model is population based and creates a supportive, evidenced-based relationship between an informed patient and a proactive care team. MCI is a chronic and progressively worsening health condition that fits into the CCM well. Each phase of the CCM has essential

changes that are put into practice and tracked to determine if the change is beneficial for both the patient and the care team (Agency for Healthcare Research and Quality, 2017).

The first phase of the framework, self-management, will be achieved by educating patients with MCI about their condition and the typical progression. The better educated the patient is about their condition, the more empowered they are to participate in their plan of care. Next, delivery system design involves proactive provider care and established follow ups visits. This ensures the patient is seen regularly and their progress is monitored closely. Decision support involves providers using patient preferences and evidence-based guidelines to treat the patient. Providers must always use patient-centered care while also considering new, reliable strategies. Clinical information systems, like an electronic medical record, are vital in tracking the patient's progress and needs. Keeping up-to-date data on the patient is also essential. The health system, or primary care clinic, must create attainable goals for the patient and be the champion of improving care. Lastly, finding a sense of community for the patient can fill in any gaps in care.

MCI is a complex condition that requires a multidisciplinary approach and full patient involvement for the best outcome. The CCM supports this approach and could be an essential part of improving outcomes and quality of life for those with diagnosed with MCI.

Project Description

The final inclusion criteria for this project are adults over the age of 65, who have a baseline MoCA score between 11-26, are covered by Medicare. All potential participants are residents of a large senior living community in the Southwest United States. Before beginning this project, approval from Arizona State University's Internal Review Board (IRB) was obtained. A detailed protocol for this social-behavioral project was submitted and approved in

August 2023. A short consent form was created for participants (see Appendix C). Participation was voluntary and no compensation was given to participants. No funding was received or necessary for this project, however an estimated budget was created (see Appendix E).

First, a recruitment process took place to inform the senior living community residents about MCI and this project. In August of 2023, after IRB approval was obtained, an hour-long information session was held in a meeting room at the senior living community by the project creator. Multiple informational flyers (see Appendix D) about the session were posted all around the community. Over twenty potential participants came to the information session.

Ethical Considerations

Four ethical principles guided this project: respect for person(s), beneficence, justice, and non-maleficence. Participation in the project is completely voluntary and patients signed a consent form agreeing to participation and data collection (see Appendix C). Any participant that could not consent for themself to be a part of this project had their medical power of attorney consent for them.

Methods

Beginning in August 2023, interested participants visited the onsite clinic for a baseline MoCA screening (see Appendix B, Figure 3). If these patients met the inclusion criteria listed above, they were asked to sign a consent form for their project participation. Then they were referred by a clinic provider to the home health agency who administered the cognitive training program. The quality improvement project is not involved in the actual cognitive training; the purpose is to evaluate effectiveness of the program for the clinic to confidently refer patients in the future.

Home health nurses visited the participants in their own homes twice a week for 30-45 minutes with a tablet device to administer cognitive training (cognitive training involves brain and memory games created by the home health agency to target Visuospatial/Executive, Naming, Memory, Attention, Language, Abstraction, Delayed Recall, and Orientation). The project creator administered MoCA screenings before and after the participants completed the program to assess the effectiveness of the program and track results for the project site (clinic). The cognitive training program (known as the acronym ICAN) lasted for 12-16 weeks depending on the participants progress and baseline MoCA score.

Outcome Measure and Instrumentation

As previously mentioned, the MoCA was used as the primary outcome measure and the only instrument being used in this project. The MoCA is a commonly used assessment tool utilized by healthcare providers to determine global cognition in older adults (age 65 and older). The MoCA (see Appendix B, Figure 3) was published in 2005 by Dr. Ziad Nasreddine as a tool to better assist providers in screening for mild cognitive impairment (Nasreddine et al., 2005).

The MoCA is scored out of 30, is one page in length, and takes an average of 10 minutes to administer. The MoCA assesses the following cognitive functions: short term memory recall, visuospatial abilities, aspects of executive function, language, attention, concentration, working memory, and orientation to time and place (Nasreddine et al., 2005). The test includes delayed recalling of five words, drawing, identifying animals by picture, performing simple subtraction, listing words that start with the letter F, repeating back complex sentences, and asking basic orientation questions like todays date. The psychometric properties of the MoCA show that test-retest reliability of the MoCA is good, with an average point change of only 0.9 when patients were tested 35 days apart (Nasreddine et al., 2005). Additionally, the MoCA yielded a Cronbach

alpha of 0.83, proving the scale is reliable and has good internal consistency (Nasreddine et al., 2005). The MoCA cut off score was established as 26. If a participants scored less than 26 then it was indicative of MCI. The MoCA was found to have excellent sensitivity for MCI (90%), which is more sensitive than the Mini Mental Status Examination (Nasreddine et al., 2005).

Data Collection and Analysis

The primary outcome measure for this quality improvement project is the MoCA score. A MoCA was administered initially by clinical providers or the project creator to establish a baseline score for each participant. Once the baseline MoCA was collected, participants began the cognitive training program. Once the participant completed ICAN program, the project creator screened them again using the MoCA. The data was initially recorded on the original MoCA test paper, which was scanned into the patients' electronic medical record at the clinic and then shredded. The MoCA score was then entered into a data program called Intellectus on project creator's locked personal computer. All patient identifiers were removed from the data before being input into the computer. Only a randomly assigned subject identification number, gender, age, and race were used. The total MoCA score (out of 30 points) will be used for final data analysis.

Results

The sample size of this study was (n=2). Descriptive statistics analysis explains there was one male and one female participant. Both participants were white, with an average age of 86. Participant A had a pre-total score of 19 on his MoCA. After completing the cognitive training for 12 weeks, his post intervention-total score was 27. Participant B had a pre-total score of 17 on her MoCA. After completion of the cognitive training program for 16 weeks, her post intervention total score was 24. Both post intervention MoCA examinations were administered

by the project creator within two months of the participants finishing their cognitive training. Statistical significance could not be analyzed due to low number of participants.

The project site was informed of the significant improvement in cognition of these participants. The clinic's owner is pleased with these results. Her goal is to assist patients in maintaining their independence for as long as possible. The data shows that Montreal Cognitive Assessment (MoCA) scores improve from this program. She now has concrete evidence to recommend this as a first-line treatment for qualifying patients. She will direct her other providers to recommend this program and enroll more patients. These patients will reap the benefits of this effective program.

Discussion

All participants in this project had significant improvement in their MoCA scores and therefore in their cognition. Participant A scored 8 points higher on his post-intervention exam, putting him at a total MoCA score of 27. This is improvement was higher than anticipated and this patient responded to the cognitive training very well. Participant B also had significant improvement with increasing their score by 7 points. Both participants enjoyed the program and felt like their cognition had improved.

The first limitation of this project is the small sample size. With only two participants, it is hard to know how statistically significant the data is. Another is the strict inclusion criteria set forth by Medicare. Homebound status patients are the only ones who this program is available for, which limits who qualifies. Additionally, there was a sudden staff turnover at the home health agency who administered the program, so the program is temporarily paused until further notice, which also contributed to the low sample size.

Improving cognition and preventing further cognitive decline has been studied for decades. A recent study showed that virtual reality-based cognitive training (VRCT), which consists of a series of games targeting different brain functions such as executive function, memory, and attention, improved cognitive and brain function in MCI patients when compared to the use of an exercise program (Yang et al., 2022). The brain's neuroplasticity changes with age and the ability to learn tends to decline. However, older adults can improve their cognition and still challenge their brains. Although there is no supportive evidence stating that memory games or exercises can prevent dementia, there is evidence that computerized cognitive training (CCT) can improve memory and cognition in older adults who do not have dementia (O'Shea et al., 2019). Not only did they find improved cognition from the CCT, but they also found increased mood and reduced anxiety in participants who completed CCT.

Implications for Practice Change

MCI diagnosis, management, and treatment are established issues in aging adults in the U.S. and worldwide. The evidence shows that cognitive training is a new but successful approach to treating MCI in older adults. The evidence shows that computerized cognitive training significantly improved cognition in older adults with MCI. MCI screening is relatively standardized in the U.S. and usually occurs at an annual physical for older adults. However, guidelines and treatment of MCI are less standardized. Primary care providers might know how to recognize MCI, but only 23% report being up to date on current therapies addressing MCI and 73% of providers simply recommend lifestyle changes as initial treatment (Alzheimer's Association 2022b). Educating providers on new protocols and therapies like this for older adults with MCI is essential.

Conclusion

Discovering the best approaches to treating and managing MCI is ongoing. Older adults with MCI deserve a high quality of life and maintain their independence for as long as possible. New evidence shows the benefits of computerized cognitive training to improve overall cognition in this population. Primary care providers being able to diagnose MCI early and intervene with the best intervention and treatment plan can significantly improve the lives of those living with MCI.

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Appendix A
Evaluation and Synthesis Tables

Table A1

Evaluation Table for Quantitative Studies

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
Tian et al., (2022), Cognitive training program improves cognitive ability and daily living ability in elderly patients with mild cognitive impairment **Country:** China **Funding:** No funding was received for conducting this study.	Inferred: Adaptation Model of Nursing	**Design:** RCT **Purpose:** To evaluate the efficacy of cognitive function training interventions in elderly patients with MCI and provide a basis for clinical nursing intervention in MCI patients.	**N=** 93 (n=47 intervention group, n=46 control group) **Demographics:** Age between 60-80, MCI diagnosis, literate, 33 males and 60 females **Setting:** Cangzhou Central Hospital **Exclusion:** patients that had other psychiatric disorders, patients involved in other cognitive training, patients who had vascular dementia	**IV1:** 30 minutes of daily personalized cognitive training for 6 weeks **DV1:** Mini Mental Status Examination (MMSE) scores **DV2:** Montreal Cognitive Assessment (MoCA) scores **DV3:** Activities of Daily Living (ADL) Scale scores **DV4:** Barthel Index (BI) scores **DV5:** Serum levels of S100β and	**Tools:** MMSE, MoCA, ADL Scale, BI, and CobasE411 automatic electrochemiluminescence analyzer (for serum level analysis) **Validity/ Reliability:** MoCA: has high test-retest reliability ($p < 0.001$). Sensitivity (90%) and specificity (87%) for MCI. MMSE: sensitivity of 88.3% (95% CI of 81.3% to 92.9%) and a specificity of 86.2% (95% CI, 81.8% to 89.7%)	**Statistical Tests Used:** Mann-Whitney test and mixed ANOVA as well as Chi-square test and Fisher's exact	**DV1:** average scores increased from 25.41 to 27.17 ($p=0.0002$) **DV2:** average scores increased from 22.79 to 27.43 ($p=0.0029$) **DV3:** scores had no statistically significant difference ($p=0.7840$)	**Level of Evidence:** level 2 evidence **Strengths:** -strong study design with RCT -specific/clear exclusion and inclusion criteria -reliable tools used for outcome measures -strong statistical analysis tests used **Weakness:** -6 weeks, short amount of time

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
Bias: Authors deny any conflict of interest or bias.			or other neurological disorders that could lead to dementia, patients with substance abuse issues or serious physical illness, patients with depression, and patients with less than primary school education **Attrition:** 13 discontinued the study	Neuron specific enolase (NSE) **Definitions:** MMSE: widely used simple cognitive function assessment MoCA: cognitive screening instrument for identifying MCI and dementia ADL Scale: patients with a score >60 have basic self-care ability, 40-60 require help, 20-40 require maximum assistance BI: measures ability to perform ADLs Serum levels of S100β and Neuron specific enolase (NSE): biomarkers			**DV4:** scores had no statistically significant difference (p=0.6326) **DV5:** significant decrease in NSE serum average from 26.33 to 10.52 in the intervention group, S100β =significant decrease from serum average of 547.55 to 279.76 in the intervention group – p value for both = 0.0001	-14% dropout rate of study **Feasibility:** this study could be repeated using the same parameters at any other hospitals in other countries **Application:** cognitive training in older adults can improve MMSE and MoCA scores and reverse biomarkers of brain tissue damage

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				for brain tissue damage				
Phirom et al. (2020), Beneficial effects of interactive physical-cognitive game-based training on fall risk and cognitive performance of older adults **Country:** Thailand **Funding:** The Research and Researchers for Industries Project and The Thailand Science Research and Innovation	Inferred: cognitive changes with age	**Design:** RCT **Purpose:** to evaluate the effects of an interactive physical-cognitive game-based training program on fall risk and cognitive function of older adults	**N=**40 (n=20 intervention group, n=20 control group) **Demographics:** over 65 years old with average age of 70.21, 82.5% female, all community dwelling **Setting:** local community center or village health club **Exclusion:** major cognitive impairment, depressive symptoms (based on Thai Geriatric Depression Scale), history of	**IV1:** interactive game-based training program for cognitive and physical functioning 3x per week for 60 mins over 12 weeks (Xbox 360 Kinect) **DV1:** Physiological profile assessment (PPA) score **DV2:** Timed up and go test (TUG) score **DV3:** MoCA score **Definitions:** PPA: validated tool for quantifying fall risk, mild risk=0-1, moderate risk 1-2, and high risk >2 TUG: widely used screening test for	**Tools:** PPA, TUG, MoCA **Validity/ Reliability:** MoCA: has high test-retest reliability ($p < 0.001$). Sensitivity (90%) and specificity (87%) for MCI.	**Statistical Tests Used:** Shapiro-Wilk test, independent sample t-test, chi square test, and two-way-mixed-model ANOVA	**DV1:** intervention group showed increased performance ($p=0.015$) **DV2:** TUG times improved after 12 weeks improved in intervention group ($p=0.001$) **DV3:** MoCA scores improved w/ intervention ($p<0.05$)	**Level of Evidence:** level 2 evidence. **Strengths:** -even group number for control and intervention group -clear inclusion/exclusion criteria -valid tools of measurement used for outcome measures **Weakness:** -not a traditional RCT -mostly female participants

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Bias: Authors deny any conflicts of interest of connection to products used in this study			neurological diseases, health problems affecting stepping ability, unstable health conditions that preclude exercise **Attrition:** 1participant did not complete the final re-assessment	fall risk in older adults, time >14 secs indicates fall risk MoCA: cognitive screening instrument for identifying MCI and dementia –26-30 points is normal, 19-21 represents MCI, 18 points or below suggests dementia				-no long term follow up **Feasibility:** this could be a repeated study in other communities who have access to the same technology **Application:** findings are not generalizable to older, frail adults—only to community dwelling, healthy, high functioning older adults
Peng et al. (2019). The efficacy of cognitive training for elderly Chinese individuals with mild cognitive impairment **Country:** China	Inferred: health promotion theory	**Design:** RCT with cluster sampling method **Purpose:** evaluate the efficacy of a cognitive training intervention on the cognitive function of	**N**=140 (control group n=70, intervention group n= 70) **Demographics:** Over 60 years old, community-dwelling, 58% male, Chinese	**IV1:** 90-minute cognitive training sessions every 2 weeks **DV1:** MoCA-BJ (MoCA Beijing edition) scores after 3 months	**Tools:** MoCA-BJ: cognitive screening tool with 7 parts adapted from the MoCA. Highest score is 30, a score less than or equal to 23 indicates MCI **Validity/ Reliability**: MoCA: has high test-retest reliability ($p < 0.001$).	**Statistical Tests Used:** t-test, one-way ANOVA, chi-square test ($p<0.05$)	**DV1:** improved MoCA scores ($p<0.001$) **DV2:** improved MoCA scores ($p<0.001$)	**Level of Evidence:** level 2 evidence. **Strengths:** -good sample size of 70 in each group -reliable tools and methods used

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
Funding: Scientific and Technological Tackling Plan of Scientific Research and Technological Development Projects **Bias:** The authors deny bias or any conflicts of interest		elderly Chinese individuals	**Setting:** University in Nanning, China **Exclusion:** unstable medical conditions, active epilepsy, dementia, severe sensory impairment, history of cerebrovascular disease, and mental illness history **Attrition:** not mentioned by authors	**DV2:** MoCA-BJ scores after 6 months **DV3:** progression to dementia **Definitions:** MCI: reduction in memory or cognitive processes that are not dementia but not related to normal aging	Sensitivity (90%) and specificity (87%) for MCI.		**DV3:** the intervention group: 0 patients progress to dementia; control group: 4 total progressed to dementia	-strong research design (RCT) **Weakness:** -level of education and illiteracy were not taken into account when evaluating MoCA-BJ scores -all cognitive training sessions were group based and not individualized **Feasibility:** This is a reasonably easy study to repeat in other communities in other countries using the MoCA **Application:** could be applied to practice due to the increased MoCA

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
								scores and no progression to dementia in the intervention group
Yang et al. (2020). Construction and evaluation of multidomain attention training to improve alertness attention, sustained attention, and visual-spatial attention in older adults with mild cognitive impairment: A randomized controlled trial **Country:** Taiwan **Funding:** Ministry of	Inferred: Health promotion theory	**Design:** RCT **Purpose:** to construct a model for multidomain attention training and evaluate its effects on specific attention capabilities and other cognitive functions in older adults with MCI.	**N=78** Control group n=39, intervention group n=39 **Demographics:** 16 men, 62 women, mean age of 79.5 **Setting:** retirement centers and community housing for elders in Taiwan **Exclusion:** diagnosis of dementia, severe mental illness or behavioral problems, severe sensory or communication	**IV1:** 18 sessions lasting 45 minutes each (three sessions/week over 6 weeks) of cognitive training on a tablet using different games **DV1:** Trail Making Test **DV2:** Digit Vigilance Test **DV3:** MMSE **DV4:** MoCA **Definitions:** Trail Making test: contains Part A and Part B that measure visual spatial	**Tools:** Trail making test, digital vigilance test, MMSE, and MoCA **Validity/ Reliability:** MoCA: has high test-retest reliability ($p < 0.001$). Sensitivity (90%) and specificity (87%) for MCI. measuring their respective outcomes. MMSE: sensitivity of 88.3% (95% CI, 81.3% to 92.9%) and a specificity of 86.2% (95% CI, 81.8% to 89.7%), Trail making test: TMT A between 76-89%, TMT B 86-94%	**Statistical Tests Used:** Independent t-test, chi-square, and two-tailed tests using a significance level of $p>0.5$	**DV1:** Reaction time did not decline in long term follow up **DV2:** no improvement **DV3:** significant improvement in orientation and memory at 3 month and 6 month follow up ($p<0.37$) **DV4:** significant improvement	**Level of Evidence:** level 2 evidence. **Strengths:** -training modes were based on patient's neurological status -simple/easy to use training for the participants **Weakness:** -outcome measures limited to intensity of attention -few comparison studies **Feasibility:** This study could be easily repeated and

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Science and Technology **Bias:** no bias noted and no bias disclosed by authors			disorder, receipt of CT in the last year **Attrition:** 14 participants	attention and alertness Digital Vigilance Test: measures sustained attention MMSE: measures cognitive function using a total score of 30 points			in orientation and memory at 3 month and 6 month follow up ($p<0.23$)	done in other communities in different countries using the same model. **Application:** more research and comparison is needed before application.
Bernini et al. (2021). A double-blind randomized controlled trial of the efficacy of cognitive training delivered using two different methods in mild cognitive impairment in Parkinson's disease: Preliminary report of	Inferred: health promotion theory	**Design:** RCT **Purpose:** assess the efficacy of computerized cognitive training (CCT) with the same stimulation activities using traditional paper and pencil techniques (PCT) and with an active control group	**N=53** (n=18 CCT group, n=12 PCT group, n=18 control group) **Demographics:** diagnosis of idiopathic Parkinson's disease, between ages 50-80 years old, over 5 years of education **Setting:** Neurorehabilitation	**IV1:** CCT (3 weeks total, 4 one-on-one sessions per week, 45 mins each) **IV2:** PCT (3 weeks total, 4 one-on-one sessions per week, 45 mins each) **DV1:** global cognition (MMSE and MoCA)—primary outcome **DV2:** Episodic long-term memory	**Tools:** MMSE, MoCA, Logical memory test, Rey's 15 word test, Rey complex figure, Raven's matrices, Frontal assessment Battery, semantic fluence, phonological fluency, Verbal span, Digit span, Corsi's block tapping test span, Attentive Matrices, Trail Making test A and B **Validity/ Reliability:** MoCA: has high test-retest reliability (ICC = 0.92, $p < 0.001$).	**Statistical Tests Used:** Spearman's correlation, Kruskal-Wallis test for inter-group comparisons, no normality tests completed due to small sample size	**DV1:** CCT group significant improvement in MoCA ($p=0.001$) and global cognition **DV2:** no improvement in any group **DV3:** significant improvement in CCT	**Level of Evidence:** level 2 evidence. **Strengths:** -one on one sessions with participants -can be retested on individuals with other cognitive dysfunction **Weakness:**

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
benefits associated with the use of a computerized tool. **Country:** Italy **Funding:** Italian Ministry of Health **Bias:** no bias noted, and no bias disclosed by authors			unit in Italian hospital **Exclusion:** cognitive impairment due to a pre-existing condition, concomitant psychiatric disease, severe medical comorbidities, severe sensory or motor disturbances, recent deep brain stimulation **Attrition:** 5 participants	**DV3:** Logical-executive functions **DV4:** working memory **DV5:** Attention/processing speed **Definitions:** Many different tools and screening tests are used for each specific outcome	Sensitivity (90%) and specificity (87%) for MCI. Trail making test: TMT A between 76-89%, TMT B 86-94%		group (p=0.027), no improvement in PCT or control groups **DV4:** no improvement in any group **DV5:** CCT group showed significant improvement in MoCA and global cognition (p=0.016), PCT and control group showed no improvement	-too many outcome measures to evaluate -small sample size with uneven group numbers -long term effects/retention not evaluated -performed on Parkinson's patients only **Feasibility:** This study could be completed on a different patient population, but this many outcome measures is not feasible to repeat **Application:** CCT training appears to be more effective than traditional paper

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								and pencil training in older adults
Zhong et al. (2021). Effects of virtual reality cognitive training in individuals with mild cognitive impairment: A systematic review and meta-analysis **Country:** China **Funding:** authors state no outside funding was received **Bias:** Authors deny bias or conflicts of interest	Inferred: intervention theory	**Design:** Systematic review and meta-analysis **Method:** conducted using the Cochrane Handbook for Systematic Reviews of Interventions **Purpose:** Analyze the effects of VR cognitive training and synthesize its outcomes on global cognitive function and memory	**Sample:** (n= 17) **Demographics:** Average age: 62.8-87.2 years old **Setting:** Korea, China, United States, Turkey, Pakistan, and Belgium **Attrition:** not mentioned by authors	**IV1:** VR CT **DV1:** global cognitive function **DV2:** specific cognitive domains **DV3:** instrumental ADLs **Definitions:** VR CT: playing games using head mounted displays to complete ADLs, training tasks, and memory training modules	**Tools:** MoCA, MMSE, trail making test, digit span backward test, and IADLs **Validity/ Reliability:** MoCA: has high test-retest reliability (ICC = 0.92, $p < 0.001$). Sensitivity (90%) and specificity (87%) for MCI. MMSE: sensitivity of 88.3% (95% confidence interval [CI], 81.3% to 92.9%) and a specificity of 86.2% (95% CI, 81.8% to 89.7%), Trail making test: TMT A between 76-89%, TMT B 86-94%	**Statistical Tests Used:** Significance was set at $p<0.05$, Cochran's Q for heterogeneity	**DV1:** MoCA significantly improved ($p=0.03$) **DV2:** significantly improved executive function ($p<0.001$) **DV3:** no improvement ($p=0.15$)	**Level of Evidence:** Level 1 evidence. **Strengths:** -looked at studies form many different countries -used proper analysis tools and recommendations **Weakness:** -only 17 studies were analyzed -small sample sizes in some studies -duration of VR training not consistent in all studies **Feasibility:** This kind of systematic

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								review could be done again with more specific criteria
McDougall et al. (2019) Memory training for adults with probable mild cognitive impairment: A pilot study **Country:** U.S. **Funding:** not mentioned by authors **Bias:** no bias identified	Stated: Bandura's self-efficacy theory	**Design:** RCT **Purpose:** evaluate the efficacy of memory training and health training in people with probable MCI	**N=39** (memory group n=19; health group n=20) **Demographics:** community dwelling older adults without dementia, 69% female **Setting:** community center **Exclusion:** no MCI diagnosis **Attrition:** 0	**IV1:** 20 hours of memory training classes twice weekly and four booster sessions delivered three months post intervention **IV2:** 20 hours of health promotion classes **DV1:** MMSE **DV2:** Center for epidemiologic studies scale (CESD) **DV3:** Memory self-efficacy questionnaire (MSEQ)	**Tools:** MMSE, CESD, MSEQ **Validity/ Reliability:** MMSE: sensitivity of 88.3% (95% confidence interval [CI], 81.3% to 92.9%) and a specificity of 86.2% (95% CI, 81.8% to 89.7%), CESD: alpha reliability= 0.78; MIA: alpha reliability=0.91; MSEQ alpha reliability=0.95	**Statistical Tests Used:** Linear regression model, independent t-tests	**DV1:** improved MMSE scores in memory training group (p=0.39) **DV2:** no significant difference between groups (p=0.64) **DV3**: no significant findings in either group (p=0.19)	**Level of Evidence:** RCT is considered level 2 evidence. **Strengths:** **-**repeated using a previously successful study model **Weakness:** -small sample -participants not formally diagnosed by a doctor for MCI **Feasibility:** -this study may be hard to repeat using the same

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				Definitions: Center for epidemiologic studies scale: assessed somatic complaints Metamemory in adulthood: measures memory knowledge Memory self-efficacy questionnaire: predicts memory performance				measures and same training techniques of in person class sessions and booster classes **Application:** This is a study that has been done before and was repeated with similar results. Application to practice is justified.
Harvey et al. (2021) Improvements in cognitive performance with computerized training in older people with and without	Inferred: health promotion theory	**Design:** RCT **Purpose:** examine the cognitive benefits of combining computerized training with previously developed	**N=94** **Demographics:** English speaking adults, 60 years or older, 20/60 vision, capable of using computer, 90% female	**IV1:** 24 sessions of CFAST program **IV2:** 24 sessions of computerized CT and CFAST **DV1:** BAC **Definitions:** BAC measures critical	**Tools:** BAC **Validity/ Reliability:** Reliability of 0.88	**Statistical Tests Used:** Wilk's lambda with Pillais	**DV1:** scores improved significantly in both groups ($p<0.05$)	**Level of Evidence:** level 2 evidence. **Strengths:** -ethnically diverse sample

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cognitive impairment: Synergistic effects of skills-focused and cognitive focused strategies **Country:** U.S. **Funding:** NIA grants and Wallace Coulter Innovation Foundation **Bias:** a few of the researchers are employees of iFunction, the company used for the CT		CFSAT in older adults	**Setting:** three south Florida community centers **Exclusion:** unable to use a computer, MoCA score below 26 **Attrition:** 0	domains of cognition related to everyday function				Six domains of cognition examined **Weakness:** -skills training tasks were focused on skill not cognition -more females than males **Feasibility:** feasible to be repeated using the same measures or potentially different tools to measure outcomes **Application:** combined training leads to better benefits on cognition and real-world application

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Citation	**Theoretical/ Conceptual Framework**	**Design/ Method/ Purpose**	**Sample/Setting**	**Variables**	**Measurement/ Instrumentation**	**Data Analysis**	**Results/ Findings**	**Level of Evidence; Application to practice; Generalization**
Lee et al. (2020). Home-based adaptive cognitive training for cognitively normal older adults: Initial efficacy trial **Country:** U. S. **Funding:** National Institutes of Health/National Institutes on Aging **Bias:** Two of the authors are employees of Posit Science and could benefit from a successful CT program	Inferred: Wear and Tear Theory	**Design:** RCT **Purpose:** examine the effect of CT on older adults' cognitive ability	**N=**68 **Demographics:** Between ages 65-79, English speaking, 97% Caucasian **Setting:** Iowa City community center **Exclusion:** unable to use a computer, dementia diagnosis, MoCA score <25 **Attrition:** 11	**IV1:** Computerized CT at home 5 days per week **DV1:** Overall cognitive composite score **DV2:** Composite level analysis for each cognitive domain **Definitions:** Overall cognitive score: includes processing speed, working memory, and executive control combined score using z-test	**Tools:** Attentional blink task, flanker task, spatial working memory, digit symbol substitution task, letter comparison, pattern comparison, Trails A & B **Validity/ Reliability:** Trail making test: TMT A between 76-89%, TMT B 86-94%, attentional blink task reliability 0.73 and 0.68, spatial working memory reliability 0.493 to 0.857, digit symbol substitution has a highly reliable test and re-test ability, both letter comparison and pattern comparison tests have high reliability	**Statistical Tests Used:** Cohen's d, mixed effect linear regression	**DV1:** increased in post intervention scores ($p<0.05$) **DV2:** Processing speed and working memory there was a significant interaction for the intervention group ($p<0.05$)	**Level of Evidence:** level 2 **Strengths:** -similar group sizes -multiple domains of cognition tested **Weakness:** -small sample size -not a diverse demographic **Feasibility:** Feasible to be repeated in community dwelling older adults with computer access **Application:** Larger sample size and repeat testing

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
								to ensure practice application
Srisuwan et al. (2019). Effects of a group based 8-week multicomponent training on cognition, mood, and activities of daily living among healthy older adults: A one year follow-up of a randomized control trial **Country:** Thailand **Funding:** Thai Health Promotion Foundation	Inferred: health promotion theory	**Design:** RCT **Purpose:** to assess the effectiveness of a multicomponent CT on cognition, mood, and instrumental ADLs one year after completion	**N=**77 (n=40 intervention group, n=37 control group) **Demographics:** over 60 years old, community-dwelling **Setting:** Geriatric clinic in Bangkok **Exclusion:** MoCA <26, neurological or medical conditions effecting participation in program activities (hearing loss, psychiatric problems, etc) **Attrition:** 4	**IV1:** five 120-minute CT sessions over 3 months **DV1:** Cognitive function **DV2:** Instrumental ADLs **DV3:** Mood **Definitions:** Instrumental ADLs: complex everyday tasks such as managing finances, laundry, and transportation	**Tools:** MoCA, Alzheimer's Disease Assessment Cognitive Subscale, Hospital Anxiety and Depression Scale, The Chula ADL **Validity/ Reliability:** MoCA: has high test-retest reliability (ICC = 0.92, $p < 0.001$). Sensitivity (90%) and specificity (87%) for MCI. Alzheimer's disease assessment cognitive subscale reliability: 0.91. Hospital anxiety and depression scale: 0.86 reliability.	**Statistical Tests Used:** Independent t-test, Fisher's exact test, Mann-Whitney U test, ANOVA	**DV1:** significant improvement in MoCA scores in intervention group ($p>0.001$) **DV2:** no significant difference **DV3:** significant improvement in intervention group in anxiety ($p=0.004$) but not in depression ($p=0.097$)	**Level of Evidence:** level 2 **Strengths:** **-**strong sample size -equal control and intervention group sizes -high level of evidence **Weakness:** -results only from Thai individuals -greater percentage of females to males **Feasibility:** could be conducted in other countries with similar sample size and parameters

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
Bias: no apparent bias								**Application:** can be applied to practice if successful in other regions

Key: **ADL** Activities of Daily Living, **BAC** Brief Assessment of Cognition, **CFSAT** Computerized Functional Skills Training, **CT** Cognitive Training **CI** Confidence Interval**, DV** Dependent Variable, **IV** Independent Variable, **MCI** Mild Cognitive Impairment, **MMSE** Mini-Mental Status Examination, **MoCA** Montreal Cognitive Assessment, **PPA** Physiological Profile Assessment, **RCT** Randomized Controlled Trial, **TUG** Timed Up and Go **VR** Virtual Reality

Table A2

Synthesis Table

Studies	Bernini et al., 2021	Harvey et al., 2021	Lee et al., 2020	McDougall et al., 2019	Peng et al., 2019	Phirom et al., 2020	Srisuwan et al., 2020	Tian et al., 2022	Yang et al., 2020	Zhong et al., 2021
Design	RCT	RCT	RCT	RCT	RCT	RCT	RCT	RCT	RCT	SR & MA
LOE	II	II	II	II	II	II	II	II	II	I
Sample & Setting										
Sample Size	53	94	68	39	140	40	77	93	78	17-82
M-Age	74.61	73.12	66.2	72.56	79.5	70.21	66.2	66.76	79.5	62.8-87.2
Setting	Hospital	CC	Home	CC	University	CC	Clinic	Hospital	CC	CC & Clinics
Country	Italy	U.S.	U.S.	U.S.	China	Thailand	Thailand	China	Taiwan	China, Turkey, Pakistan, Belgium, Korea, and U.S.
Measurement Tool										
MoCA	x				x	x	x	x	x	x
MMSE	x			x				x	x	x
TM A&B	x		x						x	x
BAC		x								
ADLs/IADLs Test						x	x	x		x
Other Cognitive Function Tests	x		x	x	x	x	x		x	x
Interventions										
Computerized CT	x	x	x						x	x
IPCT Class				x	x		x	x		
Computerized CT & PT						x				
Written CT	x									
Total Duration of Intervention	3 weeks	12 weeks	10 weeks	8 weeks	6 months	12 weeks	3 months	6 weeks	6 weeks	3 weeks to 24 weeks
Frequency of Intervention	4x per week	2x per week	5 days per week	2x per week	Every 2 weeks	3x per week	5 total sessions	Daily	3x per week	Varied

Key: **ADL** Activities of Daily Living **BAC** Brief Assessment of Cognition **CC** Community Center **CT** Cognitive Training **IADL** Instrumental Activities of Daily Living **IPCT** In-Person Cognitive Training **LOE** Level of Evidence **MA** Meta-Analysis **M-Age** Mean Age **MMSE** Mini Mental Status Examination **MoCA** Montreal Cognitive Assessment **PT** Physical Training **RCT** Randomized Controlled Trial **SR** Systematic Review **TM A&B** Trail Making Test Part A & Part B

Studies	**Bernini et al., 2021**	**Harvey et al., 2021**	**Lee et al., 2020**	**McDougall et al., 2019**	**Peng et al., 2019**	**Phirom et al., 2020**	**Srisuwan et al., 2020**	**Tian et al., 2022**	**Yang et al., 2020**	**Zhong et al., 2021**
Time of Each Training Session	45 mins	30 mins	~40 mins	10 hours	90 mins	60 mins	2 hours	30 mins	45 mins	18-100 mins
Outcomes										
Cognitive Function	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
ADLs/IADLs						↑				
Mood							↑			
Memory			↑							

Key: **ADL** Activities of Daily Living **BAC** Brief Assessment of Cognition **CC** Community Center **CT** Cognitive Training **IADL** Instrumental Activities of Daily Living **IPCT** In-Person Cognitive Training **LOE** Level of Evidence **MA** Meta-Analysis **M-Age** Mean Age **MMSE** Mini Mental Status Examination **MoCA** Montreal Cognitive Assessment **PT** Physical Training **RCT** Randomized Controlled Trial **SR** Systematic Review **TM A&B** Trail Making Test Part A & Part B

Appendix B

Figures

Figure 1

Bandura's Self-Efficacy Theory

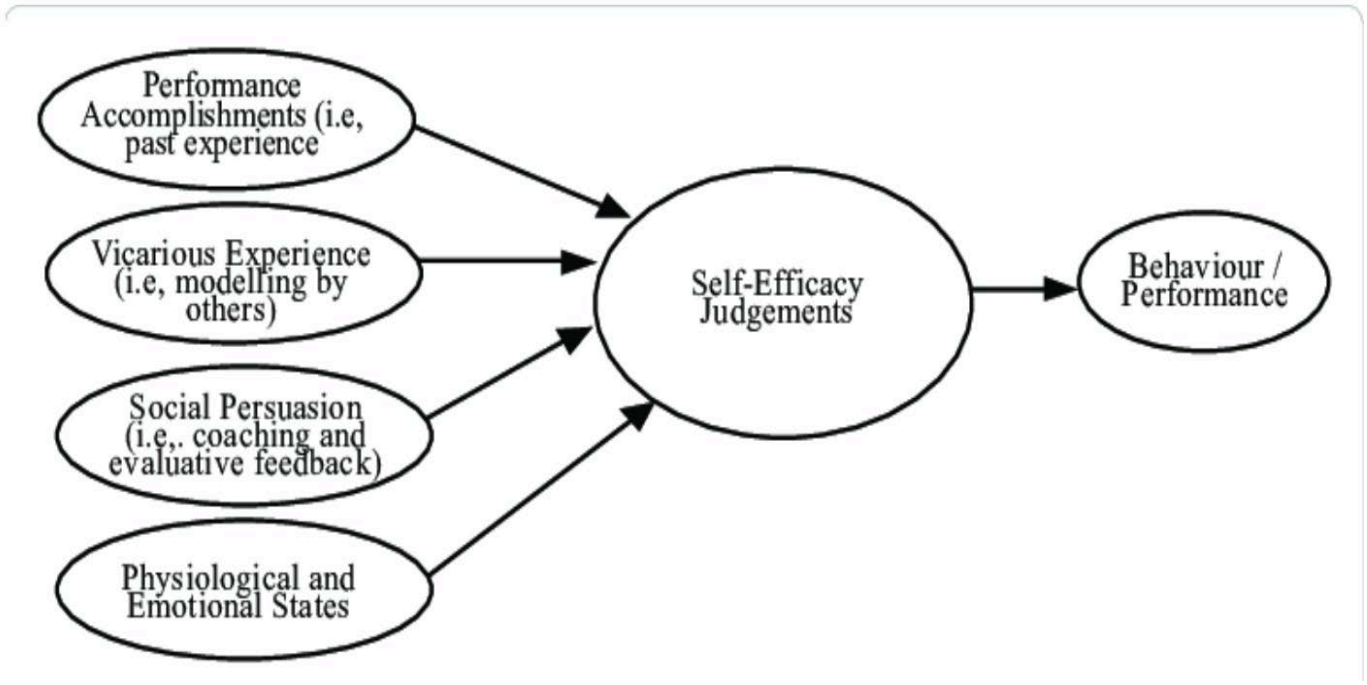


Figure 2

Chronic Care Model

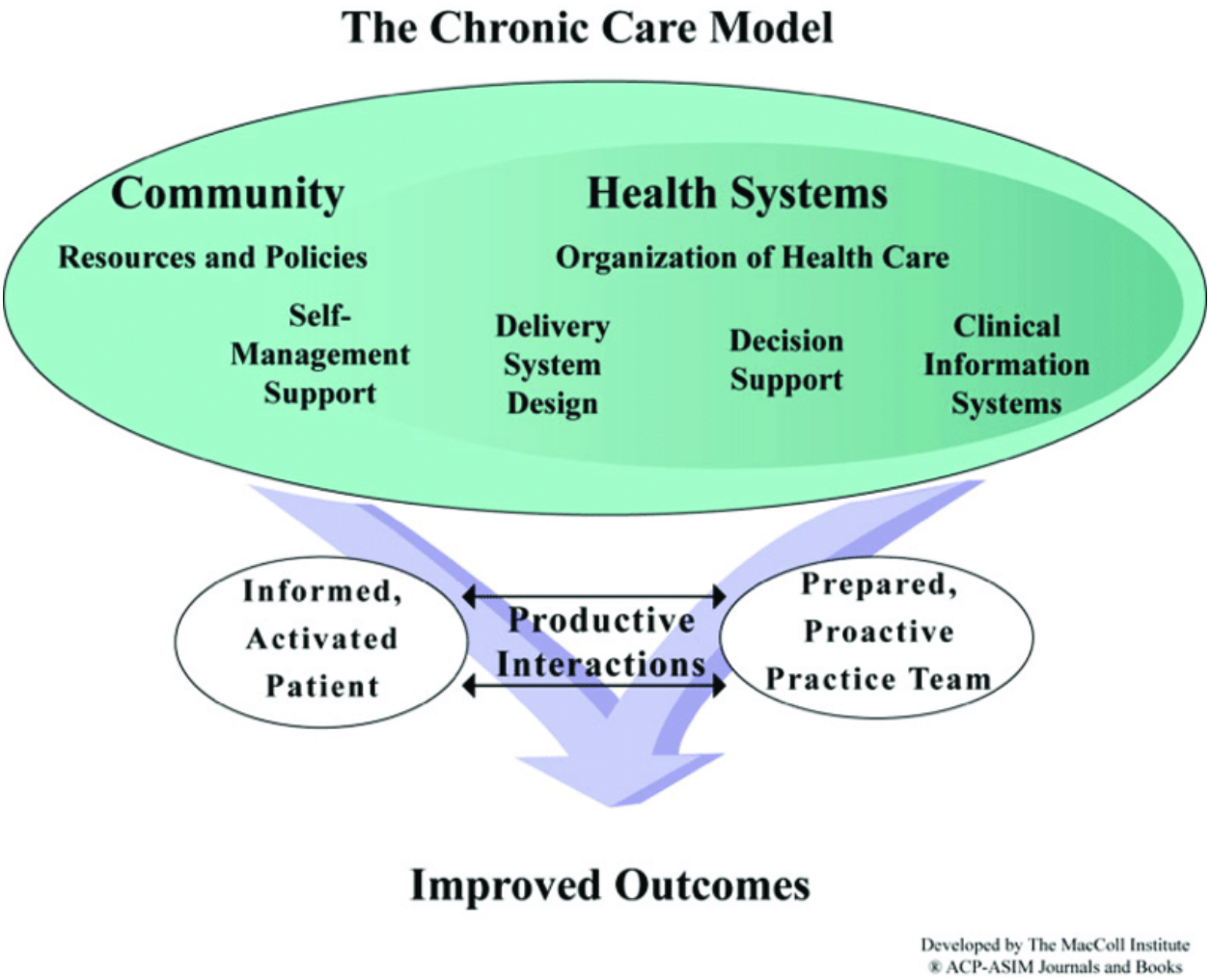
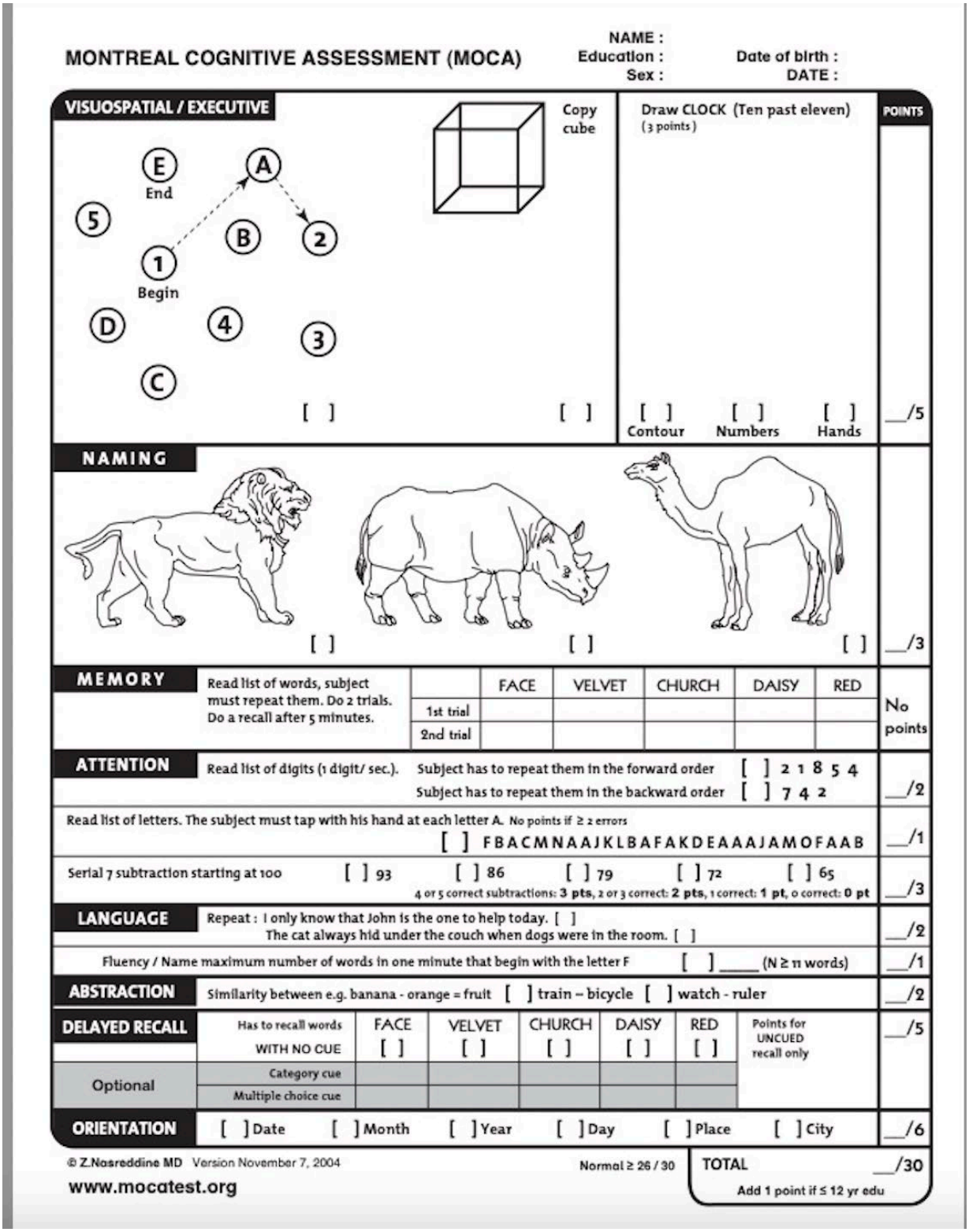


Figure 3

Montreal Cognitive Assessment



MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education :
Sex :
Date of birth :
DATE :

VISUOSPATIAL / EXECUTIVE — POINTS

Copy cube

[ ] [ ]

Draw CLOCK (Ten past eleven) (3 points)

[ ] Contour [ ] Numbers [ ] Hands

__/5

NAMING

[ ] [ ] [ ]

__/3

MEMORY — Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points

ATTENTION — Read list of digits (1 digit/ sec.).

Subject has to repeat them in the forward order [ ] 2 1 8 5 4

Subject has to repeat them in the backward order [ ] 7 4 2

__/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B

__/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**

__/3

LANGUAGE — Repeat : I only know that John is the one to help today. [ ]

The cat always hid under the couch when dogs were in the room. [ ]

__/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words)

__/1

ABSTRACTION — Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler

__/2

DELAYED RECALL

	Has to recall words WITH NO CUE	FACE	VELVET	CHURCH	DAISY	RED	Points for UNCUED recall only
		[ ]	[ ]	[ ]	[ ]	[ ]	
Optional	Category cue						
	Multiple choice cue						

__/5

ORIENTATION — [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City

__/6

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Normal ≥ 26 / 30

TOTAL __/30

Add 1 point if ≤ 12 yr edu

Appendix C

Short Consent Form

Examining the Effects of Cognitive Training on MoCA Scores in Older Adults

I am a graduate student under the direction of Dr. Monica Rauton in the Edson College of Nursing and Health Innovation-Doctor of Nursing Practice Program at Arizona State University. I am conducting a research study to determine the effect of cognitive training on MoCA (Montreal Cognitive Assessment) scores in older adults with mild cognitive impairment.
I am inviting your participation, which will involve recording of your MoCA score before and after completing the cognitive training program. You have the right not to answer any question, and to stop participation at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. You must be over 65 and have an initial MoCA score between 11-26 to participate.
There are no foreseeable risks or discomforts to your participation. Each MoCA screening takes approximately 10 minutes to administer. One will be performed before the cognitive training program. The second will be administered after the cognitive training program has been completed.

All participant identifiers and personal information will not be used or recorded. Instead, a subject ID will be assigned to each participant (ex. Subject 001 will be used in place of your name). Demographic information such as age, gender, and race will be recorded next to the subject ID. Your responses and scores will remain confidential and will not be shared with other investigators or industry partners. The results of this study may be used in reports, presentations, or publications but your name will not be used. The raw data list will be deleted after all data in analyzed and the project results are presented in April 2024.

If you have any questions concerning the research study, please contact the research team at: monica.rauton@asu.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.
By signing below you are agreeing to be part of the study.
Name:

Signature: Date:

Appendix D

Recruitment Flyer

Appendix E

Project Budget

Budget

Phase	Activities	Cost	subtotal	Total
Preparation	Design and print promotional materials and consent forms for potential participants	$50		
	Create PowerPoint presentation and printable materials for informational meeting	$100		
	Complete MoCA (Montreal Cognitive Assessment) certification course	$150		
	Print MoCA evaluation tool for screenings	$100	$400	
Delivery	Rent meeting room for project information session/presentation	$50		

	Provider referrals and MCI screening appointments	~ $150		
	Nurse home visits for cognitive training	~$25 per visit	$225	
Evaluation	MoCA screening appointments with either project leader or provider	~$150		
	Review and analysis of results	$50	$200	**$825**