



Remote Learning for Adults with Mild Cognitive Impairment in the New Landscape of COVID-19 Restrictions

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ABSTRACT

Introduction: Mild Cognitive Impairment (MCI) is a transitional stage between the expected cognitive decline of normal aging and the more serious decline of dementia. Research interest focuses on the protection of this transition, through a combination of therapeutic interventions. **Materials and Methods:** 45 individuals with MCI who were followed up by the interdisciplinary team of our Memory School attended an online remote educational program that consisted of a series of cognitive and occupational therapy interventions designed to maintain their cognitive, executive, motor and emotional skills during the COVID-19 period. At baseline and at twelve-month follow-up all patients underwent several neuropsychological tests that included the Montreal Cognitive Assessment (MoCA), the Mini Mental State Examination (MMSE), the Functional Cognitive Assessment Scale (FUCAS), the Geriatric Depression Scale (GDS) and the Functional Rating Scale of Symptoms of Dementia (FRRSD). Also, the Barthel Index scale and the Timed Up and Go (TUG) test were utilized to assess functionality and mobility, respectively. **Results:** Within twelve months participants' performance did not change significantly (MoCA; $p=0.908$, MMSE; $p=0.625$, FUCAS; $p=0.782$; GDS; $p=0.218$, FRRSD; $p=0.18$, Barthel Index; $p=0.317$, TUG; $p=0.68$). Results confirmed the hypothesis that cognitive, executive, motor and behavioral skills can be maintained through an online educational protocol during the COVID-19 lockdown period. **Conclusions:** It is proposed that similar educational protocols should be included in the design of strategic directions in the field of healthcare in MCI and dementia, especially in health crisis situations.

Keywords: remote learning, mild cognitive impairment, COVID-19

INTRODUCTION

Coronavirus disease 2019 (COVID-19) pandemic has caused an unprecedented, prolonged, public health crisis, which, (as of May 2022), has claimed the lives of more than 6 million people globally (1), but also fundamentally transformed the way in which people live and interact (2). The limitations posed in physical proximity through stay-at-home orders, quarantine, and social distancing recommendations in an effort to reduce the virus' spread (3), have not only highlighted the underlying weaknesses of our social "support systems" for at risk populations such as older adults, but may have also disproportionately affected older adults through possibly increasing loneliness and social isolation (4-6). Social isolation is associated with manifestation of neuropsychiatric symptoms (7) and cognitive deterioration (8), even in cognitively healthy older adults and is a social determinant of physical and mental health in older people. The social distancing for COVID-19 has been shown to have a detrimental impact in elderly people's mental well being and cognitive function (9, 10).

MCI is a term used to describe the transitional stage between the expected cognitive decline of normal aging and the more serious decline of dementia. A variety of criteria is used to define MCI, whereas most include the triad of a subjective cognitive concern, an objective impairment in at least one cognitive domain, and largely preserved independent functioning (11-13). Preventing the risk and rate of transition to dementia is a key point in research and clinical

practice (14-16). Studies on neuroplasticity during old age focus on prevention in "asymptomatic" individuals, who are at risk based on family history or genetic and neuroimaging evidence, suggesting the onset of a neurodegenerative process. Early intervention in such individuals may protect against the loss of synapses and dendrites resulting from pathology, such as β -amyloid deposition (17). This intervention refers to educational programs adjusted to the needs of the elderly.

But what does Adult Education in elderly mean? The education of the elderly includes all kinds of learning after the compulsory education and until the end of their active life (18). Elderly, when taking part in a learning program, have certain characteristics as adult learners. Their motivation for participation is directly related to their needs, they have specific goals, but they do not always reveal the reasons for their involvement in a training program (19), which is often the coverage of their free time (20). Their experience so far is valuable, as they use it as a starting point for their learning. However, they are easily discouraged and give up their effort, especially if they feel that they do not succeed or that the educational environment is not suitable for them (21). Lazaridou (22) and Kedraka & Sidiropoulou (23) emphasized that through the participation of elderly in learning activities, their lives regain meaning.

Truluck et al. (24) investigated what kind of learning programs older people want to participate in and concluded that the suggestions are for activities that promote sociability, such as travelling and engaging in social activities, while Lamb & Brady (25) found that the motivation of older people for learning is related to their need to fill their free time qualitatively. Aventisian-Pagoropoulou (26) noted that the interests of older people often focus on health issues, which they are very likely to face. Therefore, the purpose of educational interventions on older adults is to restore the skills that have been reduced with aging (27). The condition on which rehabilitation is based is that the abilities in which the elderly experience a discount are ultimately important for maintaining or improving their daily cognitive functionality. The ultimate goal of aging education, either to reverse the decline or to promote stability, is to support older adults so that they can remain independent for longer periods of time, an issue with significant policy and budgetary implications for aging societies (28-29).

There is intense research activity in the field of MCI regarding the effectiveness of the rehabilitation interventions. A variety of therapeutic cognitive interventions are suggested in combination with physical exercise (30-31). The systematic review by Ge et al. (32) examined cognitive rehabilitation in MCI using technological means, such as virtual reality, interactive games and videos and highlighted the potential benefits of using technology on designing educational interventions. Researchers trying to explain the superiority of these interventions over the more traditional cognitive educational programs found that it is related to usability and motivation, due to the interaction and real-time feedback from the technological mean, offering many promising beneficial effects of knowledge. It turns out that computerized cognitive education leads to improved cognitive, executive and emotional functionality (33-35). Based on these findings, we attempted to study the effect of an online program of cognitive and motor education of older people on the course of cognitive, executive, motor and emotional skills in individuals with MCI during the COVID-19 period. The purpose of the study was to provide useful research data in the field of educational programs for the elderly, but also to enable participants to be able to self-assess and find ways to strengthen their cognitive profile.

MATERIALS AND METHODS

Participants

45 individuals who were followed up by the interdisciplinary team of the Outpatient Dementia Clinic of the University Neurological Clinic of the Alexandroupolis University General Hospital and participated in the activities of the Memory School were enrolled in the present study. Participants' demographic characteristics are summarized in Table 1. All procedures performed in the study were in accordance with the ethical standards of the Democritus University Ethics Committee, which approved its conduct, and with the standards of the Helsinki declaration (1964) and its later amendments. Informed consent was obtained from all participants of the study.

Table 1 Demographic characteristics of the participants

Age	
Mean value	72,16
Median value	70
Standard deviation	5,68
Variance	32,3
Range	19
Minimum	63
Maximum	82
Years of education	
Mean value	10,84
Median value	6
Standard deviation	4,33
Variance	18,7
Range	11
Minimum	6
Maximum	17
Sex	
Men	21
Women	24

Inclusion/exclusion criteria

The diagnostic criteria for the diagnosis of MCI, as proposed by Petersen and codified in the DSM-V were utilized: (a) subjective cognitive impairment, including reports from patient, family member or other informant or clinician; (b) cognitive impairment, as evidenced by comprehensive neuropsychological examination; (c) evidence of a gradual decline in objective cognitive skills - greater than expected for age - without falling within the diagnostic range of dementia; (d) retained general cognitive and daily functioning and (e) the absence of a previous diagnosis of dementia and other mental condition (eg depression, delirium, intoxication or psychosis), which could explain the observed lesion on the geriatric depression scale (GDS) ≤ 6 (36).

Additional inclusion criteria were: the participants a) already attended the program of our outpatient "Memory School" before COVID-19 period and (b) had no visual or auditory impairment.

Procedure

The protocol was designed taking into consideration the instructions provided by the American Psychological Society and the guidelines for tele-psychology (45). Each participant was informed by phone by the two researchers who implemented the program (AT and PV) and the importance of continuing the educational intervention was explained. They were informed about the conditions of the sessions and the possibility of leaving at any time they choose.

A laptop connected to the internet was used for the teleconferences. The subjects were instructed to use a fixed internet connection and a device of sufficient size, such as a laptop or desktop computer. Alternatively, they could use a tablet or mobile phone. At the beginning of each session, researchers verified that the patient could see and hear adequately. A prerequisite for a successful outcome seemed to be the provision of the necessary technological equipment (sufficient / high speed internet, good camera quality, operating microphone) and the resolution of technical issues that may arise. An important component is the existence of as much controlled environment as possible in order to avoid external distractions.

The researchers paid special attention to verbal communication and continuous visual contact to ensure the attention of the participants. The instructions were very precise to avoid unnecessary repetition and the material was also well organized and accessible. The effectiveness of the program was discussed with the participants during implementation and appropriate adjustments were made, as needed. The duration of each session ranged from 45-60 minutes, depending on the cognitive and emotional level of each participant, with a frequency of twice a week for consecutive four months of application.

The educational program

The program was divided into 2 parts, cognitive and motor interventions and was coordinated by the neuropsychologist and the occupational therapist of the Memory School.

Cognitive interventions consisted of:

- a) Online cognitive learning applications, such as Memory Motivation (MeMo), designed to prevent cognitive impairment and cognitive activation (44). The MeMo program was implemented by a team of health professionals from the Institut Claude Pompidou, Association IA, CoBTek lab, Université Côté d'Azur, Nice, France and was translated into Greek at the initiative of the University Neurology Clinic of the Democritus University of Thrace. It includes recreational activities and exercises aimed at strengthening and practicing cognitive functions with the main target categories being memory, adaptability and attention. Available for free at the following link: <http://www.memory-motivation.org/home-4/>. The SOCIABLE program (<https://www.sociable.gr/el>), a pioneering service of personalized mental empowerment through modern technologies, consisting of activities for empowering functions, such as attention, language, logic, memory, orientation, construction and executive abilities was also utilized.
- b) Personalized cognitive training sessions that can be printed on paper. The cognitive exercises were formulated based on the needs of each participant, according to the results of their neuropsychological assessment.

Motor and functional interventions included:

- a) Activities to maintain and enhance mobility, such as using the body weight in a sitting or standing position, paying attention to the gait muscles, balance exercises and sensory

stimulation. More specifically, the motor program included exercises with imitation of a motor model, exercises in a sitting position / standing posture with support of the upper limbs on a wall, exercises that had to be performed after a physical demonstration, such as exercises with rubber bands for the upper limbs, sitting and standing exercises with barbells, isometric exercises in upright and semi-sitting position, balance exercises (monopod support, use of ball), upper and lower limb coordination exercises with or without object use and double work exercises during gait, such as simultaneous gait and motor or cognitive gait.

- b) Reminiscence techniques.
- c) Retraining - maintenance of daily life activities, such as description of instructions for preparation and execution of daily activities (cooking, shopping, personal hygiene, communication).

Measures

Each participant underwent a series of neuropsychological assessments and a semi-structured interview. According to the design of the study, they were assessed initially and after 12 months, immediately after the completion of the educational program.

Neuropsychological assessments included:

- a) The Mini Mental State Examination (MMSE) that assesses the cognitive status and is considered to have high levels of sensitivity for the detection of dementia. It consists of 11 subtests, with a maximum score of 30 (37).
- b) The Montreal Cognitive Assessment (MoCA) test that was created in 1996 and has high accuracy in detecting MCI. The official translation into Greek was used (Version 7; <http://www.mocatest.org>, accessed on 20 March 2020) (38).
- c) The Functional Cognitive Assessment Scale (FUCAS) that was designed to assess executive functions in the daily activities of patients with MCI and dementia (39).
- d) The Functional Rating Scale of Symptoms of Dementia (FRSSD) that was designed to assess the patient's functionality in daily activities based on the caregiver's perspective (40)
- e) The Geriatric Depression Scale (GDS) for the detection of depressive symptoms in a geriatric population. (The official translation into Greek and access <https://web.stanford.edu/~yesavage/GDS-Greek.html>) (41).

Moreover, the Barthel index scale (42) and the Timed Up and Go (TUG) test (43) were utilized to assess functionality and mobility, respectively.

At the end of the program implementation, each participant was given a questionnaire of three open-ended questions to assess the feedback through their participation in the training process.

Statistical analysis

Analysis was performed with SPSS statistical data analysis software. The values in the tables are presented as an average for all variables, which are quantitative. For data analysis, comparisons were made between the different estimates (A' evaluation, B' evaluation) using the Paired - Samples T test for the variables following normal distribution (parametric control) and Related - Samples T test (non-parametric control) for variables that do not follow a normal distribution. Specifically, in the variables that do not follow a normal distribution, the Wilcoxon

test was used in order to calculate the difference between the estimates and to find the P-value. The P-value was compared based on the value of 0.05 and the result was obtained with a 95% confidence interval.

RESULTS

Results on tests

Differences between the initial and final assessment in the scores of cognitive, executive, behavioral and motor tests are presented in Table 2. As evidenced, no statistically significant differences were observed at 12-month follow-up.

Table 2. Scores on tests during the study period

MOCA	24,76 (2,17) ^d	24,12 (3,40)	-0,64	.908
MMSE	27,4 (1,80)	27,32 (1,63)	-0,08	.625
FUCAS	43,52 (1,85)	43,6 (2,30)	+0,08	.782
GDS	2,64 (1,87)	1,96 (1,24)	-0,68	.061
FRSSD	4,08 (1,80)	4,48 (1,98)	+0,4	.218
BARTHEL	78 (8,4)	76 (7,8)	-2,00	.317
TUG	12 (2,4)	10,75 (1,98)	-1,25	.068

^{a,b} Values are presented as average.

^c Paired - Samples T test for the variables that follow a normal distribution and Related - Samples T test for variables that do not follow a normal distribution.

^d Values in parentheses refer to the standard deviation.

Results on feedback questionnaire

The method of content analysis was used to record the results of the feedback questionnaire (Figure 1).

Question 1. After your participation in the program, did the image you had of yourself change?

- "It gave me hope to improve my memory."
- "To be more confident."
- "To observe better."
- "Be aware of memory difficulties."

Question 2. Would you say that your participation in the program made you rediscover your beliefs about your cognitive status and your life, in general?

- "It helped me do more things, read crossword puzzles, etc."
- "To have more optimism in everything."
- "It helped me understand my cognitive status."
- "To strengthen my social relationships and not be ashamed to forget."

Question 3: Did your participation in the program feel like it led you to examine the perceptions you had as a trainee? As an individual?

- "As a teacher, I liked the change of role from teacher to student."
- "I feel like it helped me a lot as a person."
- "I felt better in my daily life."
- "I felt active and useful."

Figure 1. Content analysis of the feedback questionnaire

DISCUSSION

The present study aimed to investigate the efficacy of a remote learning program on cognitive and motor functioning in individuals with MCI during the COVID-19 period. The results of the analysis between the two evaluations do not show any statistically significant change, confirming the research hypothesis that systematic combination training can be effective even through remote learning. The fact that cognitive, executive, motor and behavioral tests did not show a statistically significant reduction is a finding that contributes to the research literature of remote cognitive training techniques.

A similar study conducted in Greek population during COVID-19 period (46) concluded that there was no deterioration in cognitive, executive and emotional functionality, which is attributed exclusively to quarantine. It emphasized the causal correlation of changes in neuropsychological tests with the normal development of MCI. As protective factors they presented the importance of telemedicine support and online psychosocial interventions, providing activities with meaning and significance for the participants. Similar studies in the international literature have shown that due to the pandemic, cognitive (47), emotional (48) and functional (49) deterioration was observed in people with MCI. Researchers discuss the challenges related to remote interventions during the pandemic and propose a formulation to overcome obstacles adapting to the needs of patients in a period of social and economic crisis (50-53).

The programs in which elderly participate need to be designed exclusively for seniors, responding to their needs and interests, in order to meet their special learning conditions, as indicated by Rodriguez and Zapico (54). An advantage of this training protocol was that the

program included multidimensional cognitive training with computerized cognitive exercises, which largely aims at memory training and compensatory cognitive rehabilitation. A technique that has been shown to have positive results at many levels of functionality (55).

The combination of cognitive with motor empowerment and its enrichment with psychosocial support is a complete program, which can work protectively for the course of MCI (56-58). However, the duration of these benefits has not been clarified, a point that has been reported in the SMART research results (28), which showed that cognitive education can protect memory from deterioration only during the intervention, suggesting that the benefits of cognitive interventions depend on continuing education in multiple cognitive areas, highlighting the importance of continuity in the care of people with MCI.

Dealing with the confinement due to COVID-19 included management options, such as keeping patients informed of current external reality and maintaining a daily routine of sustained physical, cognitive, and recreational activities (59). Panerai et al. (60) found that COVID-19 tele-occupational therapy, with telephone sessions combined with emotional support, appeared to be an effective approach to managing neuropsychiatric symptoms and of mood, as it can also contribute to the improvement of cognitive functionality.

Feedback from participants throughout the training program adds value to the usefulness of the remote learning process, as it ensures continuity in providing appropriate counseling (61). However, there were restrictions during the implementation of the program, such as the inability to access the Internet or any technological means, which excluded some participants and the environmental distractions during the implementation of the training program.

Of particular interest is the impact of computerized training programs on participants' psychosocial health with research supporting the improvement of their emotional status (62), mobilizing them for active participation in educational activities and increasing their quality of life (63). The sense of self-efficacy they can experience by participating in complex training activities (64) provides an incentive for the overall improvement of participants' self and social functioning.

The feedback questionnaire provided useful information to examine the way participants changed their perceptions about their thinking, feeling, and role. These conclusions are linked to the theoretical framework of transformational learning, in which transformation after a training program enables learners to change their mindset in ways that are more inclusive, discreet, open, thoughtful and emotionally capable of change (65-66). Adult education programs should therefore be designed to promote critical reshaping, active participation, and constructive dialogue.

The results of the present study can be used to design strategic directions and set standards in the field of health care in MCI and dementia, including government agencies to coordinate emergency response plans for the protection and care of the elderly during COVID-19 pandemic, which is likely to continue with varying severity in different areas.

Limitations of the study

The present study is a pilot study and its results can not be generalized, as the number of participants was small and could not be compared with a control group. The online training protocol, although well-structured, was the first to be implemented and required several modifications to adjust to the needs of each participant. Nevertheless, importance was given to the research process to ensure the validity and reliability of the study, contributing to the existing literature of therapeutic educational interventions in times of crisis in order to maximize the benefits in primary care.

CONCLUSIONS

Elderly when faced with a learning process, in addition to cognitive requirements, often face psychosocial barriers, however, they seem to have the basic premise for learning, the "power" that Rogers (67) mentions, which encourages the learner in the learning situation. Thus, the present research showed that well-organized therapeutic remote learning protocols for elderly, if they integrate them into a learning process, tend to remove these barriers and can contribute positively to maintaining cognitive, executive, motor and emotional functionality and in protecting the deterioration of people with MCI in dementia. It is therefore proposed to include remote learning protocols in the design of services that provide health care to the elderly, as COVID-19 and other limiting factors may burden the rehabilitation process in neurocognitive disorders.

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References

- [1]. Tsamakis K, Rizos E, Manolis AJ, et al. COVID-19 pandemic and its impact on mental health of healthcare professionals. *Exp Ther Med*. 2020; 19(6):3451-3453.
- [2]. Dragioti E, Li H, Tsitsas G, Lee KH, et al. A large-scale meta-analytic atlas of mental health problems prevalence during the COVID-19 early pandemic. *J Med Virol*. 2022; 94(5):1935-1949.
- [3]. Tsamakis K, Gavriatopoulou M, Schizas D, et al. Oncology during the COVID-19 pandemic: challenges, dilemmas and the psychosocial impact on cancer patients. *Oncol Lett*. 2020; 20(1):441-447.
- [4]. Tsamakis K, Triantafyllis AS, Tsiptsios D, et al. COVID-19 related stress exacerbates common physical and mental pathologies and affects treatment (Review). *Exp Ther Med*. 2020;20(1):159-162.
- [5]. Tsamakis K, Tsiptsios D, Ouranidis A, et al. COVID-19 and its consequences on mental health (Review). *Exp Ther Med*. 2021;21(3):244.
- [6]. Greig F, Perera G, Tsamakis K, et al. Loneliness in older adult mental health services during the COVID-19 pandemic and before: Associations with disability, functioning and pharmacotherapy. *Int J Geriatr Psychiatry* 2021; 37(1):10.
- [7]. Mok VCT, Pendlebury S, Wong A, et al. Tackling challenges in care of Alzheimer's disease and other dementias amid the COVID-19 pandemic, now and in the future. *Alzheimers Dement*. 2021; 17(5): 906-907.

- [8]. Ismail, II, Kamel, WA, Al-Hashel, JY. Association of COVID-19 Pandemic and Rate of Cognitive Decline in Patients with Dementia and Mild Cognitive Impairment: A Cross-sectional Study. *Gerontology and Geriatric Medicine*, 2021; 7, 23337214211005224.
- [9]. Sepúlveda-Loyola W, Rodríguez-Sánchez I, Pérez-Rodríguez P, et al. Impact of Social Isolation Due to COVID-19 on Health in Older People: Mental and Physical Effects and Recommendations. *J Nutr Health Aging*; 2020:1–10.
- [10]. De Pue S, Gillebert C, Dierckx E, et al. The impact of the COVID-19 pandemic on wellbeing and cognitive functioning of older adults. *Sci Rep*. 2021; 11(1):4636.
- [11]. Albert MS, DeKosky ST, Dickson D, et al. The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimers Dement* 2011; 7(3):270–279.
- [12]. Ganguli M. Can the DSM-5 framework enhance the diagnosis of MCI? *Neurology* 2013; 81(23): 2045–2050.
- [13]. Tsamakis K, Mueller C. Challenges in Predicting Cognitive Decline in Dementia with Lewy Bodies. *Dement Geriatr Cogn Disord* 2021; 50(1):1-8.
- [14]. Espinosa A, Alegret M, Valero S, et al. A longitudinal follow-up of 550 mild cognitive impairment patients: evidence for large conversion to dementia rates and detection of major risk factors involved. *J Alzheimers Dis* 2013; 34(3): 769–780.
- [15]. Petersen RC, Lopez O, Armstrong MJ, et al. Practice guideline update summary: Mild cognitive impairment: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. *Neurology* 2018; 90 (3): 126–135.
- [16]. Sachs-Ericsson N, Joiner T, Plant EA, Blazer DG. The influence of depression on cognitive decline in community-dwelling elderly persons. *Am J Geriatr Psychiatry* 2005; 13(5): 402–408.
- [17]. Bewernick BH, Schlaepfer TE. Chronic depression as a model disease for cerebral aging. *Dialogues Clin Neurosci* 2013; 15(1): 77–85.
- [18]. Kokkos A. *Adult Education: Detecting the field*. Athens, Greece: Metaimio; 2005.
- [19]. Hiemstraand R, Sisco B. *Individualizing instruction*. San Francisco: Jossey-BassPublishers; 1990.
- [20]. Glendenning F. Education for older adults. *Int J Lifelong Educ* 2001; 20(1): 63-70.
- [21]. Findsen B, Formosa M. *Lifelong Learning in Later Life*. Sense Publishers; 2011.
- [22]. Lazaridou A. *Education in third age*. Athens, Greece: Scientific Association of Adult Education; 2010.
- [23]. Kedraka A, Sidiropoulou K. Is everyone happy that grandma goes to school? *Adult Educ* 2018; 42: 12-22.
- [24]. Truluck J, Kim YS, Valentine T. Participation Patterns and Learning Selections of Senior Members of a Learning in Retirement Organization. *Adult Learn* 2010; 21(1-2): 31-36.
- [25]. Lamb R, Brady EM. Participation in lifelong learning institutes: What turns members on? *Educ Gerontol* 2005; 31: 207 – 224.
- [26]. Avertisian-Pagoropoulou A. *Psychology of the third age*. Athens, Greece: Ellinika Grammata; 2008.
- [27]. Winocur G, Craik FI, Levine B, et al. Cognitive rehabilitation in the elderly: overview and future directions. *J Int Neuropsychol Soc* 2007; 13(1): 166–171.
- [28]. Barulli D, Stern Y. Efficiency, capacity, compensation, maintenance, plasticity: emerging concepts in cognitive reserve. *Trends Cogn Sci* 2013; 17(10): 502–509.
- [29]. Carreiras M, Seghier ML, Baquero S, et al. An anatomical signature for literacy. *Nature* 2009; 461(7266): 983–986.
- [30]. Barban F, Annicchiarico R, Pantelopoulos S, et al. Protecting cognition from aging and Alzheimer's disease: a computerized cognitive training combined with reminiscence therapy. *Int J Geriatr Psychiatry* 2016; 31(4): 340–348.

- [31]. Fiatarone Singh MA, Gates N, Saigal N, et al. The Study of Mental and Resistance Training (SMART) Study-Resistance Training and/or Cognitive Training in Mild Cognitive Impairment: A Randomized, Double-Blind, Double-Sham Controlled Trial. *J Am Med Dir Assoc* 2014; 15(12): 873–880.
- [32]. Ge S, Zhu Z, Wu B, McConnell ES. Technology-based cognitive training and rehabilitation interventions for individuals with mild cognitive impairment: A systematic review. *BMC Geriatr* 2018; 18(1): 213.
- [33]. Liang J, Xu Y, Lin L, et al. Comparison of multiple interventions for older adults with Alzheimer disease or mild cognitive impairment. *Medicine (Baltimore)* 2018; 97(20): e10744.
- [34]. Xu Z, Sun W, Zhang D, et al. Comparative Effectiveness of Interventions for Global Cognition in Patients with Mild Cognitive Impairment: A Systematic Review and Network Meta-Analysis of Randomized Controlled Trials. *Front. Aging Neurosci* 2021; 13: 653340.
- [35]. Zhang H, Huntley J, Bhome R, et al. Effect of computerised cognitive training on cognitive outcomes in mild cognitive impairment: a systematic review and meta-analysis. *BMJ Open* 2019; 9(8): e027062.
- [36]. Sachs-Ericsson N, Blazer DG. The new DSM-5 diagnosis of mild neurocognitive disorder and its relation to research in mild cognitive impairment. *Aging Ment Health* 2015; 19(1): 2-12.
- [37]. Folstein MF, Folstein SE, McHugh PR. Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; 12(3): 189–198.
- [38]. Julayanont P, Phillips N, Chertkowand H, Nasreddine ZS. The Montreal Cognitive Assessment (MoCA): Concept and Clinical Review in Larner AJ. (ed.) *Cognitive Screening Instruments: A Practical Approach*. Springer: London: Springer; 2013. pp. 111–152.
- [39]. Kounti F, Tsolaki M, Kiosseoglou G. Functional cognitive assessment scale (FUCAS): a new scale to assess executive cognitive function in daily life activities in patients with dementia and mild cognitive impairment. *Hum Psychopharmacol Clin Exp* 2006; 21(5): 305–311.
- [40]. Hutton JT, Dippel RL, Loewenson RB. Functional rating scale for the symptoms of dementia in Gallo JJ, Reichel W and Andersen L (eds.) *Handbook of geriatric assessment*. Rockville MD: Aspen Publishers;1998. pp. 77-80.
- [41]. Fountoulakis KN, Tsolaki M, Iacovides A, et al. The validation of the short form of the Geriatric Depression Scale (GDS) in Greece, *Aging (Milano)* 1999; 11(6): 367–372.
- [42]. Mahoney FI, Barthel DW. Functional evaluation: The Barthel Index. *Md State Med J* 1965; 14: 61-5.
- [43]. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1992; 39(2): 142-8.
- [44]. Robert P, Manera V, Derreumaux A, et al. Efficacy of a Web App for Cognitive Training (MeMo) Regarding Cognitive and Behavioral Performance in People with Neurocognitive Disorders: Randomized Controlled Trial. *J Med Internet Res* 2020; 22(3): e17167.
- [45]. Joint Task Force for the Development of Telepsychology Guidelines for Psychologists. Guidelines for the practice of telepsychology. *Am Psychol* 2013; 68(9): 791–800.
- [46]. Tsatali M, Moraitou D, Poptsi E, et al. Are There Any Cognitive and Behavioral Changes Potentially Related to Quarantine Due to the COVID-19 Pandemic in People with Mild Cognitive Impairment and AD Dementia? A Longitudinal Study. *Brain Sciences* 2021; 11(9): 1165.
- [47]. van Maurik LS, Ingrid S, Bakker ED, et al. Psychosocial Effects of Corona Measures on Patients with Dementia, Mild Cognitive Impairment and Subjective Cognitive Decline. *Front Psychiatry* 2020; 11: 585686.
- [48]. Canevelli M, Valletta M, Toccaceli Blasi M, et al. Facing Dementia during the COVID-19 Outbreak. *J Am Geriatr Soc* 2020; 68(8): 1673-1676.
- [49]. Padala KP, Parkes CM, Padala PR. Neuropsychological and Functional Impact of COVID-19 on Mild Cognitive Impairment. *Am J Alzheimers Dis Other Demen* 2020; 35: 153331752096087.

- [50]. Sm-Rahman A, Lo CH, Ramic A, Jahan Y. Home-Based Care for People with Alzheimer's Disease and Related Dementias (ADRD) during COVID-19 Pandemic: From Challenges to Solutions. *Int J Environ Res Public Health* 2020; 17(24): 9303.
- [51]. Devita M, Bordignon A, Sergi G, et al. The psychological and cognitive impact of Covid-19 on individuals with neurocognitive impairments: research topics and remote intervention proposals. *Aging Clin Exp Res* 2021; 33: 733–736.
- [52]. Locke DEC, Khayoun R, Shandera-Ochsner AL, et al. Innovation Inspired by COVID: A Virtual Treatment Program for Patients with Mild Cognitive Impairment at Mayo Clinic. *Mayo Clin Proc Innov Qual Outcomes* 2021; 5(5): 820–826.
- [53]. Yahara M, Niki K, Ueno K, et al. Remote Reminiscence Using Immersive Virtual Reality May Be Efficacious for Reducing Anxiety in Patients with Mild Cognitive Impairment Even in COVID-19 Pandemic: A Case Report. *Biol Pharm Bull* 2021; 44(7): 1019–1023.
- [54]. Rodríguez J, Zapico BH. *Producing and Adapting Educational Materials with and for the Elderly in Rural and Urban Contexts*. In: www.iufm.fr; 2007.
- [55]. Jeong JH, Na HR, Choi SH, et al. Group- and Home-Based Cognitive Intervention for Patients with Mild Cognitive Impairment: A Randomized Controlled Trial. *Psychother Psychosom* 2016; 85(4): 198–207.
- [56]. Klados MA, Styliadis C, Frantzidis CA, et al. Beta-Band Functional Connectivity is Reorganized in Mild Cognitive Impairment after Combined Computerized Physical and Cognitive Training. *Front Neurosci* 2016; 10: 55.
- [57]. Olazarán J, Muñiz R, Reisberg B, et al. Benefits of cognitive-motor intervention in MCI and mild to moderate Alzheimer disease. *Neurology* 2004; 63(12): 2348–235.
- [58]. Styliadis C, Kartsidis P, Paraskevopoulos E, et al. Neuroplastic Effects of Combined Computerized Physical and Cognitive Training in Elderly Individuals at Risk for Dementia: An eLORETA Controlled Study on Resting States. *Neural Plast* 2015;2015: 172192.
- [59]. Goodman-Casanove JM, Dura-Perez E, Guzman-Parra J, et al. Telehealth home support during COVID-19 Confinement for community-dwelling older adults with mildcognitive impairment or Mild dementia: survey study. *J Med Internet Res* 2020; 22(5).
- [60]. Panerai S, Raggi A, Tasca D, et al. Telephone-Based Reality Orientation Therapy for patients with dementia: A pilot studyduring the COVID-19 Outbreak. *Am J Occup Ther* 2021; 75(2).
- [61]. ManeraV, Petit PD, Derreumaux A, et al. Kitchen and cooking, a serious game for mild cognitive impairment and Alzheimer's disease: A pilot study. *Front Aging Neurosci* 2015; 7(24).
- [62]. González-Palau F, Franco M, Bamidis P, et al. The effects of a computer-based cognitive and physical training program in a healthy and mildly cognitive impaired aging sample. *Aging Ment Health* 2014; 18(7): 838–846.
- [63]. Hagovská M, Dzvoník O, Olekszyová Z. Comparison of Two Cognitive Training Programs with Effects on Functional Activities and Quality of Life. *Res Gerontol Nurs* 2017; 10(4): 172–180.
- [64]. Mansbach WE, Mace RA, Clark KM. The Efficacy of a Computer-Assisted Cognitive Rehabilitation Program for Patients with Mild Cognitive Deficits: A Pilot Study. *Exp Aging Res* 2017; 43(1): 94–104.
- [65]. Cranton P. Transformative learning in action: Insights from Practice. *New Directions for Adult and Continuing Education*. No. 74. San Francisco: Jossey-Bass; 1997.
- [66]. Mezirow JD and Associates. *Learning as transformation*. San Francisco: Jossey-Bass; 2000.
- [67]. Rogers A. *Adult Education*, Athens: Metechmio; 1999.