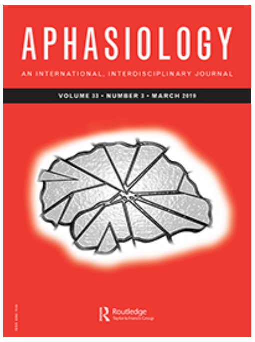

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Group external memory aid treatment for mild cognitive impairment

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ABSTRACT

Background: Although individuals with mild cognitive impairment (MCI) often live independently, instruction on compensatory strategies could assist individuals with complex daily tasks. External memory aids (EMA) are evidence-based compensatory strategies that support cognitive communication impairments. Often EMAs are included within multi-strategy-based interventions; however, limited research has examined solely training several EMAs to individuals with mild memory impairments and the long-lasting outcomes.

Aims: The aims of this study were to examine the effect of structured group EMA treatment for individuals with possible MCI on their: (1) functional use of EMAs to compensate for memory impairments compared to before treatment; (2) cognitive skills post-treatment; and (3) do these changes maintain for 6 weeks and 18 months following intervention.

Methods & Procedures: The researchers employed an experimental pre-/post-group treatment design and collected 6-week and 18-month follow-up data. Six participants were divided into two groups. Participants completed 6 weekly group treatment sessions training three categories of EMAs. Group 1 began treatment immediately and Group 2 started treatment following the conclusion of treatment for Group 1.

Outcomes and Results: Participants increased their functional EMA use following treatment on a Role Play Activity. Group mean scores on the Montreal Cognitive Assessment (Nasreddine et al., 2005) increased following treatment. Inconsistent retention of skills was documented for both functional EMA use and cognitive skills during follow-up assessment.

Conclusions: With treatment, individuals with possible MCI learned to use EMAs during functional activities. Mixed results related to retention of skills indicated the potential importance of booster treatment to reinforce EMA use. Future research should aim to investigate additional methods to measure functional EMA use prior to and following intervention.

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Mild cognitive impairment (MCI)

Approximately 20% of older Americans are currently living with MCI (Roberts & Knopman, 2013). People with MCI experience changes in memory that are greater than expected due to normal aging; however, their ability to complete basic activities of daily living remains relatively intact (Petersen, 2004). MCI is now included within neurocognitive disorder (NCD), according to the DSM-V (American Psychiatric Association, 2013). The DSM-V distinguishes between mild and major NCD classification based on cognitive impairment and completion of activities of daily living. Although people within the mild classification often live independently, they may require compensatory strategies to maintain social relationships and complete cognitive communication tasks. Individuals with MCI primarily have impairments in short-term memory; however, communication difficulties are often observed (Constantinidou, Wertheimer, Tsanadis, Evans, & Paul, 2012; Doty, 2007; Johnson & Lin, 2014). Limited research exists to guide clinicians working with these individuals to support cognitive communication impairments.

Cognitive interventions for individuals with memory impairments include compensatory and restorative approaches. Most of these approaches were developed for individuals with dementia or traumatic brain injury; only recently, cognitive interventions have been adapted for individuals with MCI. Researchers have evaluated the changes in cognition, function, and quality of life following a variety of cognitive interventions for individuals with MCI. Systematic reviews (Jean, Bergeron, Thivierge, & Simard, 2010; Stott & Spector, 2011) revealed that most of the reviewed studies involved instruction for internal (e.g., mnemonics) or external (e.g., calendar) memory strategies. Several studies concluded that individuals with MCI could learn compensatory memory strategies (Troyer, Murphy, Anderson, Moscovitch, & Craik, 2008). Instruction in the use of external strategies resulted in greater improvements in functional tasks for individuals with MCI than those who received instruction in the use of internal strategies (Stott & Spector, 2011).

External memory aids

(EMAs)

Many types of EMAs exist, such as weekly planners, written schedules, calendars, and timers to support memory, and notebooks, memory wallets, and log books to support communication impairments (Bourgeois, 2013; Garrett & Yorkston, 1997; Hersh & Treadgold, 1994; Sohlberg & Mateer, 2001). When provided with appropriate instruction, EMAs allow individuals to compensate for their cognitive communication impairments in daily activities (Sohlberg & Mateer, 2001). Early instruction in EMAs is likely beneficial for people with MCI, because their procedural memory is relatively intact enhancing the opportunity to learn a new skill (Constantinidou et al., 2012).

Successful use of EMAs requires systematic evidence-based instruction in their functional use. Existing studies have mostly investigated interventions for the use of multiple strategies instead of only instruction in the use of EMAs. Kinsella et al. (2009) examined the effectiveness of a problem-solving approach for memory impairments delivered via group treatment for 52 participants diagnosed with MCI. The participants learned across five sessions about memory as a multifactorial construct, EMAs, strategies for organizational and attention skills, as well as internal memory aids and general coping strategies.

Following group treatment, the participants increased their knowledge and use of memory strategies as indicated on the Multifactorial Memory Questionnaire (MMQ; Troyer & Rich, 2002). The researchers measured prospective memory using the *Reminder Task* and *Envelope Task* (Huppert, Johnson, & Nickson, 2000; Wilson et al., 2008). Participants' mean scores increased following treatment, with a medium-sized group effect. The researchers concluded that early intervention with this population via group treatment could minimize everyday memory failures (Kinsella et al., 2009).

Bourgeois (2013) expanded upon Kinsella et al.'s (2009) group intervention study with activity-based training for individuals with MCI. The treatment emphasized the importance of goal-oriented treatment targets and group training. This study examined eight participants with MCI who completed a 10-week group treatment program for memory impairments. The researcher taught multiple cognitive support strategies (i.e., written supports, organization, routines, active observation, and verbal elaboration) and encouraged participants to use the strategies that worked best for them. Bourgeois (2013) measured objective memory performance using the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) pre- and post-training and reported maintenance or decrease in scores following treatment. Strategy use, as measured by the MMQ, increased following treatment. Participants reported using at least one strategy (most frequently used: calendars, routines, visual cues, and written reminders), and seeing improvement in the performance of everyday tasks that required memory skills. Long-term maintenance of trained strategy use was not measured. It is unknown if EMA use maintained following treatment or if maintenance would be more lasting if training focused exclusively on EMAs. Teaching only EMAs could allow for greater repetition of concepts and more robust learning effects. In addition, group treatment could potentially be more personalized to the individual's cognitive communication needs when training only one strategy.

Sohlberg and Mateer (1989) developed a formal training program consisting of teaching EMAs in three phases (i.e., acquisition, application, and adaptation) for individuals with traumatic brain injury. Research has shown that individuals with TBI experience fewer everyday memory failures when trained to use EMAs using this approach compared to supportive group treatment (Schmitter-Edgecombe, Fahy, Whelan, & Long, 1995).

Few MCI treatment studies involve instruction in EMAs using a structured approach like Sohlberg and Mateer's three-phase training program (1989). Greenaway, Duncan, and Smith (2012) instructed people with MCI to use calendars/planners through the *Memory Support System*, a pocketsize calendar (two pages per day) and note taking system. The researchers trained 20 dyads (individuals with MCI and their caregiver), for 12, 1-hr sessions across 6 weeks, to use EMAs through the three-phase training program (Sohlberg & Mateer, 1989). The MSS included three sections: (1) appointment, (2) "to do" items, and (3) journaling. The researchers reported the trained participants significantly improved activities of daily living as measured by the memory scale of *The Everyday Cognition* (Farias et al., 2008) following intervention and 8 weeks later; however, these changes were not maintained at the 6-month follow-up. The findings of this study suggest individuals with MCI can learn to use EMAs for up to 8 weeks provided appropriate training, and the use of an explicit single strategy treatment of sufficient training duration (Stott & Spector, 2011).

To better understand how to provide the most effective instruction in compensatory memory strategies for people with MCI, researchers need to evaluate the type of training program and EMA that is most likely to produce long lasting outcomes. To date, no treatment programs for people with MCI have included Sohlberg and Mateer's (1989) three-phase training approach using a group model. The current study evaluated an intervention program that incorporated individualized training within a group format. Specifically, the researchers evaluated the effects of a structured group treatment intervention on functional EMA use, cognitive abilities, and long-term maintenance of skills.

Research questions

(1) What is the effect of structured group treatment for individuals with possible MCI on their functional use of EMAs to compensate for memory impairments compared to before treatment and do these changes maintain for 6 weeks and 18 months following intervention?
(2) What is the effect of structured group treatment for individuals with possible MCI on their cognitive skills post-treatment and do these changes maintain for 6 weeks and 18 months following intervention?

Methods

Participants

Individuals in the current study's community-based sample self-reported memory impairments and completed activities of daily living independently. Seven females (aged 72–88 years) requested to be involved in the study and completed study consent procedures. The participants lived independently at the same senior retirement apartment complex, spoke English as their first language, and reported no prior learning or language impairments. The independent retirement living complex is for individuals above the age of 62 who require no in-home medical or functional assistance. Participants were distinguished from individuals with major NCD in that according to self and staff report, they completed basic activities of daily living independently (Petersen, 2004). Exclusion criteria also included a self-reported history of psychiatric illness and a score greater than 25 on the MoCA. The researchers used the MoCA as a descriptive measure to confirm the presence of mild memory impairment representative of possible MCI. Six participants scored an overall mean of 23 (range = 21–25) on the MoCA (which is within the range of MCI (21–25)) (Nasreddine et al., 2005) (Table 1). Only one potential participant was excluded from the study due to her MoCA score of 26. The participants were randomly divided into two nearly equivalent groups of three people each [Group 1: MoCA – *M* (*SD*) score = 23.6/30 (1.5); Group 2: 23.3/30 (2.0)]. Group 1 participants were older (*M* = 82 years, *SD* = 8.7) than Group 2 participants (*M* = 74 years, *SD* = 1.0).

Table 1. Participant demographics.

Participant	Group	Age (years)	Years of education	Vision screening	Hearing screening	MoCA score
1	1	88	12	Pass	Pass	24
2	1	72	14	Pass	Pass	25
3	1	86	12	Pass	Pass	22
Mean (*SD*)		82 (8.71)	12.66 (1.55)			23.66 (1.5)
4	2	75	12	Pass	Pass	24
5	2	75	14	Pass	Pass	25
6	2	74	14	Pass	Pass	21
Mean (*SD*)		74 (1)	13.33 (1.15)			23.33 (2.0)

Materials

Screening

Participants' self-reported medical history and ability to complete activities of daily living were obtained through a structured interview of auditorily presented questions. The examiner documented information obtained from the interview on a demographic form. Questions regarding medical history inquired about medications specific to cognitive functioning, psychiatric illness, stroke, neurological disorders, and language/learning impairments. The participants were also asked questions related to functional independence. For example, the examiner asked, "what daily activities do you need assistance with and why?" The researcher then restated the question specifically to gain information about cooking, cleaning, bathing, and dressing. In addition, the director of the senior living facility was asked the same questions regarding each participant to confirm independent completion of daily tasks. Functional vision and hearing screenings were administered to assess impairments that may significantly impact a small group conversation. The participants' hearing was assessed for standard pure tone averages (i.e., 500 Hz, 1,000 Hz, and 2,000 Hz) at 25 dB HL (within normal hearing classifications) using a portable audiometer (Clark, 1981; Lin, Thorpe, Gordon-Salant, & Ferrucci, 2011). Five participants passed the hearing screen at 25 dB HL and one participant passed at 30 dB HL. This pass criterion was deemed appropriate because of the testing environment noise level and mild hearing loss classification that did not impact functional conversation (Huang & Tang, 2010). All of the participants passed the vision screen. The vision screening consisted of a visual scanning task in which the participant pointed to her name from foil names written in 18-point font on a piece of white paper (five rows of four names each).

Dependent measures

The participants' functional EMA use was evaluated with a researcher-designed Role Play Activity in which a pre-recorded, 2-min voicemail about an upcoming event (e.g., doctor appointment) was played (Online Appendix A includes an example transcript). To reduce practice effects, the researchers developed several voicemails following the same format. The information within the voicemails (e.g., the type of appointment) were altered each administration. The version of the voicemail was randomly administered to each participant. The examiner told the participants they would hear a voicemail and be asked questions immediately following the recording. The examiner told the participants they could use any of the EMAs on the table (i.e., notepad, calendar, or iPad) during the task. After the voicemail played, the examiner asked seven Wh-questions about facts from the recording. The examiner documented live, using a scoring sheet, recall accuracy (i.e., accurate/inaccurate) and type of EMA used (i.e., none, notepad, calendar, or iPad) for each question. The answers to the Wh-questions were scored as either correct (1 point) or incorrect (0 points). For example, if the participant provided the incorrect date of the appointment no points were awarded for that question. The scores ranged from 0 to 7, which was accurate responding to the seven Wh-questions. A second rater scored the video recordings of the assessment sessions using the scoring sheet.

Participants' perceived functional use of a variety of EMAs was measured with the MMQ-Strategy subtest. Participants rated their use of 19 strategies as either *all the time* (4), *often* (3), *sometimes* (2), *rarely* (1), or *never* (0). Higher scores represent greater frequency of strategy use (maximum score = 76). The researchers used the *Immediate Recall* and *Delayed Recall* subtests of the *Arizona Battery for Communication Disorders of Dementia* (ABCD;Bayles & Tomoeda, 1993) as an additional measure of cognitive ability.

Treatment materials

The researchers trained three categories (i.e., calendar, timer, and personal information) of EMAs. Within each category, the participants used three types of aids; including a range of no-tech to high-tech aids (Table 2). The researchers provided the types of aids within each EMA category for participants to use and keep during treatment and home practice; however, the iPad versions of the EMAs were only used during assessment and treatment sessions.

Design

The Duquesne University Institutional Review Board approved this study. The study implemented an experimental pre-/post-group treatment design to evaluate the effects of training EMAs during treatment group (Group 1) on participants' functional EMA use and cognitive skills in comparison to the delayed treatment group (Group 2). Group 1 and 2's participants completed individual pre-treatment assessments at the same time period to examine equivalence of groups prior to intervention. Following the pre-treatment assessment sessions, participants in Group 1 completed 6 weekly group treatment sessions and a single post-treatment assessment session immediately following treatment. Participants in Group 2 did not receive treatment immediately to serve as a control to compare individuals who did receive intervention (Group 1) to individuals who did not (Group 2). Therefore, participants in Group 2 completed an additional assessment (second pre-treatment session) during the same time period as Group 1 participant's post-treatment assessment sessions. Following the second pre-treatment session, participants in Group 2 completed 6 weekly group treatment sessions, and a single post-treatment assessment session immediately following treatment. Participants in Group 1, during the

Table 2. Types of external memory aids.

Calendars (Weeks 1 and 4)	Timers (Weeks 2 and 5)	Personal information (Weeks 3 and 6)
iPad calendar	iPad alarm and stopwatch	iPad notes application
Paper monthly	Stopwatch	Memory wallet
Planner (weekly and monthly)	Handheld: manual and electronic clip-on	Planner (contacts, passwords, and note pages)

Table 3. Study procedures.

Groups	Week 1	Weeks 2–7	Week 8	Weeks 9–15	Week 16	1.5 year
Group 1	Pre-treatment assessment	Group treatment	Post-treatment assessment	No treatment	6-week follow-up assessment	18-month follow-up assessment
Group 2	Pre-treatment assessment	No treatment	Second pre-treatment assessment	Group treatment	*Post-treatment assessment*	18-month follow-up assessment

same time period as Group 2 participant's post-treatment assessment sessions, completed a 6-week follow-up assessment session, to examine retention of intervention skills. All participants completed an 18-month follow-up assessment session after treatment concluded to examine long-term changes (Table 3 shows the study schedule). Participants completed the sessions in a quiet room at the senior retirement apartment complex. The sessions lasted approximately 90 min and were video-recorded. In addition, half of the treatment sessions were transcribed for treatment fidelity and scoring reliability purposes.

Procedures

Pre-treatment

During the individual pre-treatment assessment session, all participants completed the screening measures (i.e., vision and hearing screenings, a medical history and functional status interview guided by the demographic form, and the MoCA). If the participant met the study criteria, the examiner administered the remaining assessment measures (i.e., ABCD-*Immediate Recall*, Role Play Activity, MMQ-Strategy, and ABCD-*Delayed Recall*).

Treatment

Each participant completed 6 weekly group treatment sessions, during which the examiner trained three categories of EMAs following a detailed training manual. As shown in Table 2, two non-concurrent sessions were dedicated to each category of EMAs. Within each category, three EMA types (ranging from high-tech to low-tech) were taught to the participants. During each treatment session, the examiner trained the EMAs in three phases, such as *acquisition, application*, and *adaptation* (Sohlberg & Mateer, 1989). The integration of the three-phase training approach within the current group treatment is described below.

Introduction of the treatment approach

During the first session, the examiner provided the participants with a schedule of the 6-week treatment program. Next, the examiner described the EMAs categories and types included in treatment.

Introduction of a new category of external aids

The introduction of a new category of EMAs was the *acquisition phase*. The first category of EMAs was explained to the participants using a handout (see Online Appendix B). The examiner discussed how to use each aid and appropriate situations for using the aid.

The participants also shared how they currently used any of the EMA types and contributed ideas for situations that might benefit from the use of EMAs.

Functional practice

The next phase was the *application phase*, which involved various role-play scenarios using the EMAs to promote functional use. For example, the examiner said, "If your friend is having a surprise birthday party, how could you use this aid to remember the date, time and type of party. Show me…." Group members were instructed to provide each other feedback and brainstorm alternative approaches. During this phase for sessions 1 through 3, participants used each type of EMA to complete the role-play scenarios. This provided participants with exposure to all EMA types and multiple opportunities to practice within an EMA category. During sessions 4 through 6, participants chose which type/types of EMAs they wanted to use within the category to complete the role-play scenarios. Approximately five role-play scenarios were completed during this phase of treatment resulting in repetitive practice. Examples of calendar role-play activities included scheduling appointments, planning dinners, and organizing rides for grandchildren. Timer role-play activities involved timing items in an oven, a workout routine, and remembering to get laundry. Finally, personal information examples included emergency contact information, doctors' names, and grandchildren clothing sizes.

Explanation of home practice with new aids

The final phase was the *adaptation phase*, which involved using the aid in a naturalistic environment. At the end of each session, the researchers provided a home practice handout. The handout provided questions for participants to reflect upon their experiences using the aid throughout the week. The homework promoted generalization and worked toward establishing routine use of the EMA. All six participants completed homework and shared examples of positive and negative functional EMA use.

Review of home practice activity

Following home practice, the participants started the next session with group discussion. Guided by their home practice handout, the participants described use of the EMA during the home practice activity and provided each other with suggestions. The participants provided feedback to each other and indicated similarities and differences in their experiences. The participants often used other participants' ideas and altered their EMA use based on the home practice discussion.

Post-treatment

Both groups completed individual post-treatment assessments immediately following treatment. During assessments the researchers administered the dependent measures (i.e., Role Play Activity, MMQ-Strategy, MoCA, and ABCD-subtests).

Follow-up

Participants in Group 1 completed an individual 6-week follow-up session. Participants in both groups completed an individual 18-month follow-up session. During both follow-up assessment sessions, the researchers administered the dependent measures.

Data analysis and reliability

The researchers compared between groups and within participant's pre-/post-dependent measure scores to examine the effect of treatment on participants' functional EMA use and cognitive skills. The data were analyzed using descriptive statistics and non-parametric statistics to examine the effect of treatment on participant maintenance of functional EMA use and cognitive skills. Due to the small sample size and unequal scores across groups, the researchers conducted the Wilcoxon signed-rank test and the Wilcoxon rank-sum test. Participants' pre-treatment to post-treatment assessment scores and post-treatment to 18-month follow-up assessment scores were compared to examine changes within participants over time using the Wilcoxon signed-rank test. The researchers also compared post-treatment assessment scores of Group 1 to pre-treatment assessment scores of Group 2 to examine treatment differences across groups using the Wilcoxon rank-sum test. The first and second pre-treatment scores of participants in Group 2 were averaged together to reduce testing error.

To examine treatment fidelity, two raters scored 20% of the treatment sessions. The raters used a checklist (from the treatment procedure manual) to compare their scores with the examiner's scores of the treatment videos and transcriptions. Overall percent agreement was calculated to be 87% (85–90%) documenting excellent inter-rater reliability.

To examine inter-rater reliability of the Role Play Activity, a second rater watched the assessment sessions. The rater used the Role Play Activity scoring sheet to score the participant's recall accuracy and EMA use. After independent scoring, the rater and examiner compared scoring sheets; 100% point-to-point agreement was obtained.

Results

Functional EMA use

Role Play Activity

As shown in Tables 4 and 5, the recall accuracy mean score during pre-treatment for Group 1 was 3.33 (*SD* = 2.88) and Group 2 was 5.66 (*SD* = 1.52; maximum score = 7.00). Following treatment, Group 1 increased their mean recall accuracy score to 6.00 (*SD* = 0)

Table 4. Group 1's role play activity scores and EMA type.

	Pre-treatment		Post-treatment		Immediate follow-up		Long-term follow-up	
	Recall (7)	EMA use	Recall (7)	EMA use	Recall (7)	EMA use	Recall (7)	EMA use
P1	5	0	6	1: notepad	7	1: notepad	6	1: notepad
P2	5	1: notepad	6	1: notepad	7	1: notepad	7	1: notepad
P3	0	0	6	1: notepad	3.5	½: notepad	2.5	1: notepad
Mean	3.33	.33	6	1	5.83	.83	5.16	1

Table 5. Group 2's role play activity scores and EMA type.

	Pre-treatment		Second pre-treatment		Post-treatment		Long-term follow-up	
	Recall (7)	EMA use	Recall (7)	EMA use	Recall (7)	EMA use	Recall (7)	EMA use
P4	4	0	6	0	4	2: iPad, notepad	3	0
P5	6	1: notepad	4	0	7	1: notepad	7	1: notepad
P6	7	1: notepad	7	1: notepad	7	1: notepad	4.5	1: notepad
Mean	5.66	.66	5.66	.33	6.00	1.33	4.83	.66

and Group 2's second pre-treatment mean maintained at 5.66 (SD = 1.25)). Following treatment, Group 2's mean score was 6.00 (SD = 1.73). Only Group 1 was assessed at the 6-week post-treatment. As shown in Table 4, Participants 1 and 2 increased their post-treatment Role Play Activity score of 6.00–7.00 and Participant 3 post-treatment score of 6.00 decreased to 3.50 during 6-week follow-up assessment. During 18-month follow-up assessment, Group 1's mean score decreased from 5.83 (SD = 2.02) to 5.16 (SD = 2.36) and Group 2's mean score also decreased from 6.00 (SD = 1.73) to 4.83 (SD = 2.02). A Wilcoxon signed-rank test indicated that the post-test ranks were not statistically significantly higher than the pre-test ranks, $N = 5$, $T = 2$; $p > 0.05$. A Wilcoxon rank-sum test indicated that the difference between Group 1's and Group 2's summed ranks immediately following treatment of Group 1 was not statistically significant, $T = 9$, $p > 0.05$.

In addition to recall accuracy, the Role Play Activity provided information about the types of EMAs participants used. Only Participants 2, 5, and 6 used a notepad during the pre-treatment assessment. During Group 2's second pre-treatment, Participant 6 maintained EMA use and no other participants used an EMA. Following treatment, all participants used an EMA (five participants used a notepad). Participant 4 began the assessment using the iPad and switched to the notepad half way through the assessment.

During 6-week follow-up, Participants 1 and 2 continued to use the notepad. Participant 3 used the notepad halfway through the 6-week follow-up task; the questions she answered correctly were when the notepad was used. During 18-month follow-up assessment, five of the participants used a notepad during the Role Play Activity (Participant 4 did not use an EMA). A Wilcoxon signed-rank test revealed no statistically significantly difference between post-test and follow-up ranks, $N = 4$, $p > 0.05$.

MMQ-Strategy

Higher scores on the MMQ-Strategy subtest indicated greater frequency of daily strategy use to compensate for memory impairments (maximum score = 76). As shown in Tables 6 and 7, Group 1's MMQ-Strategy pre-treatment mean score was 35.66 (SD = 7.76)

Table 6. Group 1's total dependent measure scores.

	MMQ-Strategy				MoCA				ABCD-*Immediate*				ABCD-*Delayed*			
	Pre	Post	Im.F	Lt.F	Pre	Post	Im.F	Lt.F	Pre	Post	Im.F	Lt.F	Pre	Post	Im.F	Lt.F
P1	42	39	37	42	24	28	29	29	17	17	17	17	17	17	17	17
P2	27	36	35	27	25	28	28	25	14	16	17	15	15	14	15	15
P3	38	44	50	32	22	26	27	25	10	13	16	16	11	11	16	15
Mean	35.6	39.6	40.6	33.6	23.6	27.3	28.0	26.3	13.6	15.3	16.6	16.0	14.3	14.0	16.0	15.6

Table 7. Group 2's total dependent measure scores.

	MMQ-Strategy				MoCA				ABCD-*Immediate*				ABCD-*Delayed*			
	Pre	Pre2	Post	Lt.F	Pre	Pre2	Post	Lt.F	Pre	Pre2	Post	Lt.F	Pre	Pre2	Post	Lt.F
P4	34	36	39	47	24	25	25	23	12	11	09	09	12	09	11	11
P5	46	45	50	46	25	24	27	25	12	15	15	13	11	13	13	13
P6	34	36	38	36	21	24	24	23	11	11	15	14	12	09	13	11
Mean	38.0	39.0	42.3	43.0	23.3	24.3	25.3	23.6	11.6	12.3	13.6	12.0	11.6	10.3	12.3	11.6

and Group 2's mean score was a 38.00 ($SD = 6.92$). Following treatment, Group 1 increased their mean score to 39.66 ($SD = 4.04$) and Group 2's second pre-treatment mean score was 39.00 ($SD = 5.19$). Following treatment, Group 2 increased their mean score to 42.33 ($SD = 6.65$). A Wilcoxon signed-rank test indicated that the post-test ranks were statistically significantly different than the pre-test ranks, $N = 6$, $T = 1.5$, $p = 0.03$, $\alpha = 0.025$. A Wilcoxon rank-sum test indicated no statistically significant difference between Group 1's and Group 2's summed ranks immediately following treatment of Group 1, $N = 6$, $T = 12$, $p > 0.05$.

During 6-week follow-up assessment, Participants 1 and 2 decreased their MMQ-Strategy score and Participant 2 increased her score. Group 1's 6-week follow-up mean score decreased from 40.66 ($SD = 8.14$) to 33.66 ($SD = 7.63$) during 18-month follow-up assessment. Group 2's post-treatment mean score slightly increased from 42.33 ($SD = 6.65$) to 43.00 ($SD = 6.08$) during 18-month follow-up assessment. A Wilcoxon signed-rank test indicated that the 18-month follow-up ranks were not statistically significantly different than the post-treatment ranks, $N = 6$, $T = 9$, $p > 0.05$.

Cognitive skills

Montreal Cognitive Assessment

As shown in Tables 6 and 7, Group 1's pre-treatment mean score was 23.66 ($SD = 1.52$) and Group 2's mean score was 23.33 ($SD = 2.08$) (maximum score = 30). Following treatment, Group 1 increased their mean score from 23.66 to 27.33 ($SD = 1.15$). Group 2's second pre-treatment mean score was 24.33 ($SD = 0.57$). Following treatment, Group 2 increased their mean score to 25.33 ($SD = 1.52$). A Wilcoxon signed-rank test indicated that the post-test ranks were statistically significantly different than the pre-test ranks, $N = 6$, $T = 0$, $p = 0.01$, $\alpha = 0.025$. A Wilcoxon rank-sum test indicated that the difference between Group 1's and Group 2's summed ranks immediately following treatment of Group 1 was statistically significant, $N = 6$, $T = 6$, $p = 0.05$.

During 6-week follow-up assessment, Participants 1 and 3 increased their MoCA score by a point and Participant 2 maintained her score. During 18-month follow-up assessment, Group 1's mean MoCA score decreased from 28.00 ($SD = 1.00$) to 26.33 ($SD = 2.30$). Group 2's mean MoCA score decreased from 25.33 ($SD = 1.52$) to 23.66 ($SD = 1.15$). A Wilcoxon signed-rank test indicated that the 18-month follow-up ranks were not statistically significantly different than the post-treatment ranks, $N = 6$, $T = 13$, $p > 0.05$.

ABCD-subtests

As shown in Tables 6 and 7, Group 1's mean score on the ABCD-*Immediate Recall* subtest (maximum score = 17) at pre-treatment was 13.66 ($SD = 3.51$) and Group 2's mean score was 11.66 (*SD* = 0.57). Following treatment Group 1's mean score increased to 15.33 (*SD* = 2.08) and Group 2's second pre-treatment score was 12.33 (*SD* = 2.30). Following treatment, Group 2's mean increased to 13.00 (*SD* = 3.46). During 6-week follow-up assessment, Participant 1 maintained the maximum score and Participants 2 and 3 increased their scores. During 18-month follow-up assessment, Group 1's mean score slightly decreased from 16.6 (*SD* = .57) to 16 (*SD* = 1) and Group 2's mean score decreased from 13 (*SD* = 3.46) to 12 (*SD* = 2.6). A Wilcoxon signed-rank test indicated that the post-test ranks were not statistically significantly different than the pre-test ranks, $N = 5$, $T = 3$, $p > 0.05$. A Wilcoxon rank-sum test indicated that the difference between Group 1's and Group 2's summed ranks immediately following treatment of Group 1 was not statistically significant, $N = 6$, T = 7, $p > 0.05$. A Wilcoxon signed-rank test revealed no statistically significant difference between the post-test and follow-up ranks, $N = 4$, $p > 0.05$.

As shown in Tables 6 and 7, Group 1's mean ABCD-*Delayed Recall* (maximum score = 17) pre-treatment assessment score was 14.33 (*SD* = 3.05) and Group 2's mean score was 11.66 (0.57). Following treatment, Group 1 maintained their pre-treatment mean score of 14.00 (*SD* = 3.00). Group 2's second mean pre-treatment scores decreased from 11.66 (*SD* = 0.57) to 10.33 (*SD* = 2.30). Following treatment, Group 2's mean score was a 12.33 (*SD* = 1.15). During 6-week follow-up assessment, Participant 1 maintained the maximum score and participants 2 and 3 increased their ABCD-*Delayed Recall* assessment scores. During 18-month follow-up assessment, Group 1's mean score slightly decreased from 16 (*SD* = 1) to 15.6 (*SD* = 1.1) and Group 2's mean also decreased from 12.33 (*SD* = 1.15) to 11.66 (*SD* = 1.15) on the ABCD-*Delayed Recall* subtest. A Wilcoxon signed-rank test revealed no statistically significantly difference between pre-test to post-test ranks and post-test to follow-up ranks, $N = 4$, $p > 0.05$. A Wilcoxon rank-sum test indicated that the difference between Group 1's and Group 2's summed ranks immediately following treatment of Group 1 was statistically significant, $N = 6$, $T = 6$, $p = 0.05$.

Discussion

The current study examined the effects of group treatment on enhancing EMA use and cognitive abilities of individuals within the community with possible MCI.

Functional EMA use

Role Play Activity

Overall, the results related to the primary outcome measure suggested that group EMA treatment increased the participants' functional EMA use. The Role Play Activity depicts a common cognitive communication activity of daily living, which is critical, because individuals with MCI often report having difficulties with complex activities of daily living (Constantiniduo et al., 2012). Although the Wilcoxon signed-rank test indicated a nonsignificant effect, $N = 5$, $T = 2$, $p > 0.05$, on the Role Play Activity following intervention, an overall increase in EMA use and mean score on the Role Play Activity post-treatment likely reflects a positive change in the participants' ability to participate in activities of daily living affected by their cognitive communication impairments. A significant effect was not revealed on the Wilcoxon signed-rank test because the test could not be completed at the .05 alpha level, due to the participants' maintained strategy use performance on the Role Play Activity. Although some participants did not increase performance on the Role Play Activity, maintenance of skills is important because of the possible progressive nature of the impairments. Future research should explore the data using analyses that positively support maintained performance on a measure.

Most participants used the notepad for the Role Play Activity during the post-treatment assessment. The participants may have selected the notepad because of their past experiences with its effectiveness or their level of comfort in using a notepad as compared to the other EMAs. Future research should examine the participants' rationale for selecting specific EMAs to help determine which EMAs clinicians might recommend during treatment.

Only one participant attempted to use the notes feature on the iPad following treatment. However, she was unable to use the iPad with the efficiency required to successfully complete the Role Play Activity and therefore received a lower score. Importantly, the participant realized she was not collecting the information appropriately and switched to using a notepad. This example suggests that failures during home practice and discussion within the group may have allowed the participants to self-assess their use of EMAs and consider the importance of switching strategies mid-task. Researchers have found that individuals are most likely to use an EMA outside of treatment if they have encountered periods of failed strategy use during intervention (Sohlberg & Mateer, 2001). Therefore, clinicians should continue to integrate multiple EMAs into treatments and encourage discussion of failures and successes with each type of EMA.

MMQ-Strategy

In addition to the Role Play Activity, researchers examined participants' perceptions of functional EMA use through the MMQ-Strategy subtest. The statistically significant difference of post-treatment to pre-treatment MMQ-Strategy ranks, $N = 6$, $T = 1.5$, $p = 0.03$, $\alpha = 0.025$, as indicated by the Wilcoxon signed-rank test, support the positive impact of treatment on participants' understanding and reported daily EMA use. Previous MCI strategy treatments also found positive changes in the participants' MMQ-Strategy subtest scores (Bourgeois, 2013; Kinsella et al., 2009). Although the current study's treatment only focused on one memory strategy (EMAs) and had a smaller number of participants compared to the other studies, the participants still increased their self-reported use of strategies post-intervention. Prior to intervention, the pre-treatments group means were not equal and had relatively large *SD*s [Group 1: MMQ-Strategy *M* (*SD*) score = 35.66 (7.8); Group 2: 39.66 (4.0)]. These differences could possibly be the rationale for the non-statistically significant differences indicated by the Wilcoxon rank-sum test, $N = 6$, $T = 12$, $p > 0.05$. Future research should include multiple measures to examine pre-treatment strategy knowledge to possibly better understand differences between participants.

While the gains within the current study were minimal, given the progressive nature of the participants' diagnoses and the similar findings from previous studies, the improvements in EMA use during a structured activity (i.e., Role Play Activity) and reported EMA use (i.e., MMQ-Strategy) during functional activities highlight the potential benefits of group EMA intervention for individuals with possible MCI.

Cognitive skills

MoCA

Although the primary aim of the intervention was to provide instruction in the use of compensatory strategies, statistically significant rank differences between post-treatment and pre-treatment, $N = 6$, $T = 0$, $p = 0.01$, $\alpha = 0.025$, on the MoCA suggests participants' cognitive skills were indirectly affected. That is, participants demonstrated a slight increase in or maintenance of cognitive abilities during post-treatment assessments. These data should be interpreted with caution, however, because of the small sample size, and relatively small change demonstrated.

Previous research by Bourgeois (2013) indicated a slight decrease in MoCA scores post-intervention, despite improvements in memory strategy use. Bourgeois' intervention (2013) focused on a variety of memory strategies (e.g., organization, verbal elaboration, and active observation) throughout the treatment sessions. However, the current study trained a single strategy (i.e., EMAs). The preliminary results reported in Bourgeois's (2013) study suggests that the intensity and repetitive design of the current single strategy study may be a possible explanation for the increase in cognitive skills noted.

ABCD-subtest

The statistically significant difference, $N = 6$, $T = 6$, $p = 0.05$, between Group 1's and 2's summed ranks immediately following treatment of Group 1 for the ABCD-*Delayed Recall* subtest, as indicated by the Wilcoxon rank-sum test, further supports the indirect relationship between EMA treatment and change in delayed recall skills. Improved scores on both the MoCA and ABCD assessments of delayed recall provide support for a possible indirect relationship between single-strategy EMA intervention and positive effects on the participants' delayed recall skills. Future research should further explore the relationship between EMA intervention and delayed recall skills for individuals with possible MCI.

Although MCI can be a progressive condition, other studies that have examined cognitive interventions have identified improvements in cognitive abilities (e.g., Li et al., 2011). The intensity and repetition throughout the current study's single strategy, EMA, treatment approach could have had an effect on the participants' cognitive skills, compared to studies of multiple strategy approaches.

Retention of skills

Participants in Group 1 were assessed 6-week post-intervention and all participants were assessed approximately 18 months later to analyze retention of skills after a period without treatment. The differences between post-treatment and follow-up assessment scores were inconsistent and not statistically significant across all dependent measures. These data of retention of functional EMA use are similar to the results found by Kinsella et al. (2009). Both the current study and the Kinsella et al.'s (2009) study found inconsistent participant scores; however, a majority of participants reported decreased strategy use during follow-up assessments. Therefore, when some participants are not receiving treatment they perceive a decrease in daily strategy use. Individuals would probably benefit from on-going treatment or continued booster sessions once intervention is complete. The current study was the first to examine long-term (greater than 1 year) EMA use following intervention. Willis et al. (2006) examined long-term effects 5 years following cognitive training; however, the researchers provided booster training. The researchers found an increase in participants' reasoning and speed of processing when provided booster training (Willis et al., 2006). More research is needed to better examine the long-term effects of compensatory strategy-based interventions for individuals with possible progressive impairments.

Limitations

Although the current study findings provided support for group EMA treatment for a sample of individuals with possible MCI, the study included several limitations. The study sample size was small, although appropriate for an exploratory study, and limits the conclusions that can be drawn. Additionally, all the participants were women and lived in the same apartment complex. Gender and the group size may affect the dynamics and interactions within groups and should be investigated in future studies with familiar and unfamiliar group members.

Some of the findings relate to participants' self-perception of memory impairments and EMA use. Although the MMQ is a validated assessment tool, the limitations of self-reported data are still present. In the future, informants who live with the participant could also rate participants' use of EMAs to provide another measure for comparison.

Due to the exploratory community-based nature of this study, the researchers conducted limited cognitive testing without alternative forms (MoCA, ABCD-subtests) and did not seek a physician's diagnosis to include participants. Data on the rate of progression will allow researchers to best measure the relationship between the treatment and participants' cognitive skills. Overall, the current knowledge on MCI progression is inconclusive (Petersen et al., 2014). If more information was known on the rate of progression, researchers could more appropriately examine the importance of maintenance of skills. The current study's data analysis deleted cases that the participants maintained performance, resulting in a minimum p value of .0625. Future research should consider incorporating a single-participant study design. Due to the unknown rate of progression and inconsistent participant performance, a single-participant design may better account for individual differences and maintenance of skills. In addition, future research needs to continue to assess participants for longer follow-up periods and define more appropriately the exclusion criteria to reduce variability and better identify progression (Petersen et al., 2014).

Conclusions

This preliminary study employed a small community sample to describe effects of an innovative evidence-based, group treatment for EMA use in people with possible MCI. Positive findings suggest that individuals with possible MCI can learn to use EMAs and they report that EMAs positively affect their daily life by improving cognitive communication skills. Additionally, group EMA treatment resulted in small gains in objective cognitive skills for some participants. Future research should investigate the effect of various types of EMA treatments on use of aids in daily life and possible changes in cognitive skills and explore additional methods to measure these changes.

Disclosure statement

No potential conflict of interest was reported by the authors.

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