

Exercise on Referral for Mild Cognitive Impairment – June 2021 report

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Introduction

Mild Cognitive Impairment (MCI) was recently recognised as a disorder of cognition where memory and thinking is reduced, but importantly the capacity to lead an independent life and care for oneself remains^{1,2}. Often, those diagnosed with MCI, along with their families, are aware of a change in their baseline mental state, but it is important that the distinction of functional independence has been made as this allows patients to take steps to improve their future prospects.

MCI inherently constitutes a population with a well described and increased risk of progression to dementia^{3,4}. Not only can this group be encouraged to partake in their own autonomy, for example by determining how best to manage their finances and future clinical preferences while they remain independent, but there may be interventions that reduce overall progression to dementia. Growing literature on reducing progression to dementia within at-risk populations has largely culminated in the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER)⁵ in 2015. This was the first large-scale randomised controlled study to demonstrate a positive effect of multiple lifestyle interventions on progression to dementia diagnoses within at-risk populations. It involved optimisation of exercise, metabolic and vascular disease, diet, cognitive training and social interaction.

In particular, the beneficial effect of exercise on progression to dementia in at-risk populations has become clearer in recent years⁶. However, this effect is less clear in the MCI population specifically. An improvement in global cognitive function following exercise was reported by Song and colleagues⁷, but there is no specific analysis of the impact of exercise on progression from MCI to dementia in the literature to date.

Endeavouring to improve the rates of dementia for patients in our region, we have developed an Exercise on Referral (EoR) scheme for patients with MCI, to build on this evidence base for improving dementia outcomes. Our plan evolved following the success of other lifestyle interventions for chronic health conditions in the region. These included the Think Health for Your Memory (THYMe) project, where participants with MCI were helped to devise techniques for self-management of their cognition, as well as receiving cognitive training⁸; and the ESCAPE pain project, where participants with joint disease undertook exercise sessions⁹.

Our EoR scheme aims to increase the exercise undertaken by participants via exercise sessions held at local leisure centres. We hope that this will reduce rates of progression from MCI to dementia, although this will not be directly assessed in this project. Exercise has been established as a clinical recommendation for patients with MCI, so helping participants to exercise effectively is not a change to current practice. Therefore, this service is being offered as part of a quality improvement project.

Methods

At the time of writing, 17 patients with a diagnosis of MCI were recruited to the EoR scheme from records of those under the care of the Brain Centre, North Bristol NHS Trust and Avon and Wiltshire Mental Health Partnership NHS Trust, from the dates of July to September 2019 and February to March 2020. These patients were recruited after screening patients with a diagnosis of MCI under the care of these institutions, which totalled 44 patients. Patients with a diagnosis of dementia were excluded. All patients on this list were offered take part in the EoR scheme, and many declined for reasons such as employment or disability. From July-September 2019, 10 patients opted to participate in the EoR programme (Cycle 1). For the February-March 2020 cycle of the EoR scheme (cycle 2), 7 patients opted to participate, including 4 from the original list and an additional 3 patients with MCI identified at clinics at the Brain Centre.

These patients were enrolled onto a 12 week programme of exercise sessions taking part at Henbury Leisure Centre and Kingswood Leisure Centre, both based in Bristol in the United Kingdom. These were instructor-led group sessions where participants were guided through tailored aerobic and resistance exercises. Sessions were once-weekly, lasting

60-90 minutes. Participants were coached during the sessions about how they can incorporate exercise into their lifestyle and setting goals for exercise, as well as being led through a variety of exercises including those they could do at home. The aim was for participants to complete the programme feeling motivated to exercise and be equipped and able to find resources to help continue their own exercise.

We initially aimed to run four 'cycles' of the EoR programme. This would have involved running the 12-week programme four times, for different groups and measuring their response to the programme as detailed below. Cycle 1 started in September 2019 and the exercise programme concluded in December 2019. Cycle 2 was due to start in March 2020, but the Coronavirus Disease 2019 (COVID-19) pandemic resulted in national efforts to reduce transmission and this unfortunately led to the programme being postponed. Due to the ongoing COVID-19 pandemic, there is no timeline set to restart the programme, but the Brain Centre does hope to resume this programme in future.

To determine the effect of this programme on cognition, well-being and exercise in the long-term, a number of outcomes were planned for measurement at baseline, after the EoR scheme (at 3 months) and again 12 months after completion of the exercise scheme (at 15 months) as a measure of lifelong change in exercise. These outcomes were assessed by a combination of mailing questionnaires with stamped return envelopes and seeing patients in clinic for cognitive testing.

To monitor cognition, patients were invited to clinic to be assessed with the Montreal Cognitive Scale (MOCA)¹⁰ by trained registered nurses at the time-points above.

To measure exercise undertaken by participants, an exercise monitoring and self-efficacy questionnaire was developed based on validated work including the EPIC-Norfolk Physical Activity Questionnaire¹¹, Bandura's guide to self-efficacy scales¹² and the Australian Adult Pre-Exercise Screening Tool¹³. The questionnaire we produced was guided by these works, but as most validated physical exercise screening questionnaires are very extensive, we hoped to reduce the risk of respondent fatigue by creating a shorter questionnaire. This is available to view in Appendix 1.

Like other local lifestyle intervention programmes, we also wanted to measure how well motivated our participants were to take care of their health, and whether our EoR scheme had an effect on 'Patient Activation'. This is defined by the NHS as "the knowledge, skills and confidence a person has in managing their own health and care"¹⁴. NHS England have produced tool for assessing this, the Patient Activation Measure (PAM). We were granted 50 PAM licenses to assess activation and this was completed using the Insignia form granted by Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group, following completion of questions by participants. Results at baseline were used to inform and tailor the exercise sessions in the hope of improving interaction with the programme. PAM includes a calculated score out of one-hundred, and uses this score to put a patient into a category of patient activation as follows:

"Level 1: Individuals tend to be passive and feel overwhelmed by managing their own health. They may not understand their role in the care process.

Level 2: Individuals may lack the knowledge and confidence to manage their health.

Level 3: Individuals appear to be taking action but may still lack the confidence and skill to support their behaviours.

*Level 4: Individuals have adopted many of the behaviours needed to support their health but may not be able to maintain them in the face of life stressors."*¹⁴

Wellbeing was assessed using the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS), a validated psychometric scale for monitoring overall mental well-being¹⁵.

Qualitative data was also collected during and at the conclusion of cycle 1, for the purpose of informing ongoing and future exercise sessions. Participants were invited to group meetings at the 6-week date and again at the conclusion of exercise sessions, where a set of standardised questions were asked (Appendix 2). Participant replies only, excluding patient identifiable information, were collated in a Microsoft Excel spreadsheet.

We also sought feedback from the instructors running these exercise sessions following the conclusion of cycle 1, to inform future cycles, using the same methodology as for participants.

Data sets were assigned to patient identification numbers (ID) to maintain anonymity and MOCA, exercise monitoring, PAM and WEMWBS outcomes were copied into Microsoft Excel 2013 for analysis.

Statistical analysis of the data was performed using the paired one-tail T-test to compare each outcome variable against its equivalent at the different time points as described. Statistical significance was observed where $p < 0.05$ ($\alpha = 0.05$).

Results

Of the 10 participants from cycle 1, the mean age was 80.9 (range 78-84). 8 were male and 2 were female. Results are summarised in Table 1. Unfortunately, due to some questionnaires being incorrectly complete, some data collection forms not being returned and some non-attendance for cognitive testing, not all patients have complete data for all outcome measures. However, most data was collected with good overall engagement from participants, and qualitative feedback suggests that the data collection was mostly well received.

Cognition, as measured by MOCA, had a small decline between baseline and 3 months, from a mean of 23.2 to 22.1 (median 24 to 22.5). The average values at 3 months are likely to be slightly confounded by one participant having a particularly low score, where the participant also recorded hearing loss. Adjusting for this datum at 3 months, the mean rises to 22.7 (median rises to 23). At 15 months, the mean MOCA values decreased slightly further to 21.7 (median decreased to 20). There were no significant differences observed between any of these time points.

WEMWBS outcomes showed a small increase in wellbeing after the exercise sessions, with a rise from a mean of 46.3 to 49.1. This falls within the 'moderate wellbeing' category for both outcomes. It remained stable at the 12 month follow up, with the mean decreasing very slightly to 48.5. Comparison of WEMWBS between all three time points yielded no significant differences.

Patient activation showed a small improvement, demonstrated by a mean overall PAM score of 62.3 at baseline increasing to 66.4 at 3 months (median 60.6 to 72.5), and remaining higher than baseline at 15 months with a mean score of 65.2 at 15 months (median 63.1). However, while PAM level increased from a median of 3 to 4 from baseline to 3 months, it returned to 3 at 15 months, demonstrating no change over the pilot period; the evidence behind PAM rests largely on PAM level rather than raw score¹⁴. There were no significant changes to the raw PAM scores throughout the period.

Throughout the pilot period, overall volume of exercise actually decreased according to the raw data, as demonstrated by a mean decrease in total minutes of exercise (encompassing all four categories in the data collection [see Appendix 1]) from 324 at baseline to 282 at 15 months (median 60 to 270), despite a small increase at 3 months to 484 (median 350). Similarly, when broken down by type of exercise, there were decreases over the 12 month period in volume of each, despite an increase at 3 months (table 2). However, looking closely at the data, participant 8 has notably different outcomes compared to the rest of the participants. Looking again at the dataset after excluding this participant from analysis, the overall exercise increases from a mean of 170 minutes to 266 minutes over the 15 months. Regardless of the data selection, there were no significant changes noted.

Unfortunately, motivation to exercise also appeared decreased slightly over the 15 months, with a decrease in mean 'self-efficacy' scores from 46.8 to 44.0 (median 47 to 42), although there was an encouraging rise at 3 months to a mean of 60.5 (median 65). Statistical comparison of each of these time points yielded no significant change.

On terms of qualitative data, sessions were very well received. All participants responding during group feedback sessions had positive comments about the instructors and how the sessions were led.

"It was much more varied than I expected. I thought it would just be aerobics. As one of the probably older people here, she has been very caring and attentive, and very kind. She is very cautious, making sure nobody gets hurt."

Participants did not feel there was a noticeable difference to their lives with MCI at the 3 month point. One participant further commented that it may have had some impact on another participant's physical health. However, others felt the instructors were mindful of this, and tried to avoid unintended injury.

“From a memory point of view I don't think there's any change there. Physically [participant] has problems with the hip, but she's had more discomfort since she started doing it. At the moment it's eased.”

“The exercises have been manageable and the fitness advisor has been monitoring us well. He makes sure you set it right otherwise you could do yourself damage.”

Participants did have concerns about being able to attend on a weekly basis, finding this very demanding, and this was reflected by poor attendance at exercise sessions during some weeks of the programme. Unfortunately, comprehensive data on attendance has not been collected for cycle 1, but in lieu of this finding we plan to record attendance at future sessions.

Participants also expressed that they would have liked additional information about the project, especially regarding what exercise would be involved.

“All we knew was that it was an exercise course with no detail before we started. I think that maybe a bit more detail about what it's all about on terms of a gentle introduction in the studio and walking around doing simple lifts and things like that.”

“It would be useful to get a brief summary of the exercise included and stressing that the exercise is supervised.”

On terms of intention to exercise after the sessions were finished, most participants indicated a willingness to try. Quantitative data on this is pending for the 15 month data collection for cycle 1.

“I doubt whether I will, because I've got a wonderful life with my wife. I don't mind going to an exercise once or twice a week, but I don't have much interest in it now.”

“I think we'll give it some serious thought. I wouldn't guarantee it but I'd give it some serious thought.”

“It is my intention to pick things up a bit. Age is but a number, I don't let that inhibit me. My wife will go with me.”

“I've got a chronic back condition, so I don't exercise every day, but I think I'm going to take up those exercises that I was given. A lot of it is transferrable.”

All participants expressed that they would recommend the programme to others with MCI.

Asked about how they found the data collection questionnaires, most participants expressed no concerns about them. However, some participants were unable to recall the questionnaires, and others did find them difficult to complete.

Feedback was also sought from the programme instructors. Generally they found the groups easy to manage and had good engagement. However, major issues highlighted were difficulty with transport, and once again, attendance. Other minor issues have been highlighted for improvement in subsequent cycles, but not recorded in this report.

Participant	Demographic data		MOCA scores (out of 30)			WEMWBS scores (out of 70)						
	Age	Gender	Baseline	3 months	15 months	Baseline	3 months	15 months				
1	78	Male	20		20	70	67	70				
2	78	Male	25	24	23	47	43					
3	79	Male	24	25		32						
4	79	Male	24	23	20	35	40	34				
5	80	Male	28	22	29	48	50	56				
6	82	Male	26	20	20	52	47	47				
7	83	Female	17	21	19	37	46	46				
8	83	Male	24	18*	21	44	51	38				
9	83	Female										
10	84	Male	21	24		52						
Mean (SD)	80.9 (2.2)		23.2 (3.2)	22.1 (2.2)	21.7 (3.2)	46.3 (10.8)	49.1 (8.1)	48.5 (11.9)				
Median (IQR)	81 (79-83)		24 (21-25)	22.5 (20.8-24) [22.7 (1.7)]*	20 (20-22)	47 (37-52)	47 (44.5-50.5)	46.5 (40-53.8)				
P values – square brackets indicate compared values			p = 0.168			p = 0.0.245						
			p = 0.340			p = 0.288						
			p = 0.083			p = 0.381						
Participant	PAM scores (out of 100)			PAM level (1 to 4)			Exercise weekly totals (minutes)			Exercise self-efficacy scores (out of 100)		
	Baseline	3 months	15 months	Baseline	3 months	15 months	Baseline	3 months	15 months	Baseline	3 months	15 months
1	100	80.9	90.7	4	4	4	0	260	580	100	71	
2	48.9	55.6		2	3		520	350		38	59	
3	45.3			1		1	90			15		
4	39.4	42.2	43.7	1	1	3	0	150	180	0	15	
5	60.6	60.6	60.6	3	3	3	0	570	360		50	36
6	72.5	77.7	70.2	4	4	3	30	120	160	56		23
7	72.5	75	65.5	4	4	3	660	500	50	62	89	48
8	63.1	72.5	60.6	3	4		1560	1440	360	73	79	69
9												
10	58.3			3			60			30		
Mean (SD)	62.3 (17.1)	66.4 (13.0)	65.2 (14.0)				324 (495)	484 (420)	282 (173)	46.8 (30.4)	60.5 (24.0)	44.0 (16.9)
Median (IQR)	60.6 (48.9-72.5)	72.5 (58.1-76.4)	63.1 (60.6-69.0)	3 (2-4)	4 (3-4)	3 (3-3)	60 (0-520) [45 (0-197.5)] †	350 (205-535) [305 (50-71)] †	270 (165-360) [180 (160-360)] †	47 (26.3-64.8)	65 (52.3-77.0)	42.0 (32.8-53.3)
P values – square brackets indicate compared values	p = 0.387						p = 0.209 [0.163] †			p = 0.232		
	p = 0.210						p = 0.157 [0.349] †			p = 0.078		
	p = 0.109						p = 0.374 [0.279] †			p = 0.092		

Table 1 (Previous page): Outcome data for Exercise on Referral scheme for Mild Cognitive Impairment, cycle 1. MOCA, Montreal Cognitive Assessment; WEMWBS, Warwick-Edinburgh Mental Well Being scale; PAM, Patient Activation Measure (PAM levels of activation are described in methods); SD, standard deviation; IQR, interquartile range. p-values obtained using paired one-tailed T test, $\alpha = 0.05$. Missing data are due to incomplete forms, unreturned questionnaires or non-attendance for cognitive testing. Missing data were excluded from calculation of mean, median, standard deviation, interquartile range and paired one-tailed T test.

*Participant was complaining of difficulty hearing at the time of assessment. Values in square brackets are adjusted to exclude this participant.

†Participant 8 was excluded in calculation of statistics represented in square brackets due to this participant's anomalous effects on the data for this outcome, to assist comparison across time points.

Participant	Exercise by category at baseline (minutes)				Exercise by category at 3 months (minutes)				Exercise by category at 15 months (minutes)			
	Light	Moderate	Vigorous	High	Light	Moderate	Vigorous	High	Light	Moderate	Vigorous	High
1	0	0	0	0	120	50	60	30	300	0	0	280
2	260	200	30	30	350	0	0	0				
3	0	90	0	0								
4	0	0	0	0	150	0	0	0	180	0	0	0
5	0	0	0	0	0	570	0	0	0	360	0	0
6	0	30	0	0	0	120	0	0	0	160	0	0
7	420	240	0	0	250	250	0	0	0	50	0	0
8	600	960	0	0	480	840	90	30	120	120	60	60
9												
10	60	0	0	0								
Mean (SD)	149 (213)	169 (293)	3 (9)	3 (9)	193 (166)	261 (300)	21 (35)	9 (14)	100	115	10	56.7
Median (IQR)	0 (0-260)	30 (0-200)	0 (0-0)	0 (0-0)	150 (60-300)	120 (25-410)	0 (0-30)	0 (0-15)	60 (0-165)	85 (12.5-150)	0 (0-0)	0 (0-45)

Table 2: Minutes of exercise according to category per the exercise monitoring tool devised for this Exercise on Referral scheme for Mild Cognitive Impairment. SD, standard deviation; IQR, interquartile range. Missing data are due to incomplete forms or unreturned questionnaires. Missing data were excluded from calculation of mean, median, standard deviation and interquartile range. Descriptions of the categories of exercise are available in Appendix 1.

Discussion

To date, having completed only one cycle rather than the intended four, there is too little data collected for the EoR scheme to show any important change. While we have been able to do some statistical analysis, quantitative data cannot provide any robust outcomes due to small numbers and incomplete data collection. However, the qualitative data collected is encouraging, with positive and constructive feedback which from both participants and instructors, which will inform future cycles and allow us to take steps to improve them if the programme is able to resume following the ongoing COVID-19 pandemic.

Nonetheless, the data we have so far shows some encouraging results, with overall minor improvements in patient activation and wellbeing. While we observed some non-significant changes to uptake of and motivation to exercise, the social distancing measures put in place during the COVID-19 pandemic will largely confound this data making it unreliable for interpretation. The literature on the topic of physical activity during the pandemic is scarce to date, but those completed so far definitively point toward a reduction in physical activity across all ages¹⁶. Goethals et al. carried out interviews with elderly individuals in France, and this qualitative information demonstrated a reduced willingness to exercise at home, as well as highlighting a lack of support by society for the elderly to find ways to exercise at home¹⁷.

Therefore, data collected at 15 months for cycle 1 is likely to be considerably distorted due to national and regional lockdown efforts. As observed in our results, deleterious effects on exercise are likely due to the closure of leisure facilities for exercise, and a general proclivity to remain at home being encouraged.

The slight fall in MOCA throughout the pilot period could suggest normal progression of cognitive function in patients with MCI, or may suggest that at the 3 month stage, our intervention has not helped maintain cognition. Further cycles would provide additional data which would help determine whether our findings are reliable. Moreover, work to determine the rate of decline in MOCA in groups not experiencing the EoR scheme, for example a retrospective analysis of existing MOCA scores for other patients in our region may be desirable help to contextualise this and determine whether the normal rate of decline in MCI patients is the same, slower or faster than in our group.

The COVID-19 pandemic affects the older population that we are targeting with the EoR scheme as they are more vulnerable to respiratory disease. Furthermore, reduced social interaction and disrupted health services are likely to have an impact on other lifestyle factors known to be related to progression of cognitive disease as previously discussed. This may in particular confound our MOCA results, although these social engagement changes are outside of the scope of our service which is focusing on exercise only.

Considering this, if the EoR scheme resumes, it is possible that the data in this analysis will be excluded at the conclusion of future pilot cycles due to major changes in societal attitudes to exercise. Fundamentally, new baseline data should be obtained which reflects contemporary exercise behaviours in an era of social distancing, as this will be more directly comparable at the end point of this type of programme.

Prospective EoR scheme cycles may encounter problems with participation due to reasonable concern about contracting COVID-19 by participants. To offset this, we aim to continue postponing the reintroduction of the EoR scheme until national efforts to reduce transmission of COVID-19 have ended. Attempting to do so when restrictions are only lighter is not feasible, not only due to the effects described, but also due to the possibility that leisure centres where our sessions take place are unable to continue running them.

Conclusion

In April 2021, the EoR scheme for MCI, which was instigated in August 2019, is too young to show any important changes. This is because the COVID-19 pandemic led to the halting of much non-essential work in health services, as well as efforts to reduce COVID-19 transmission by social distancing. The Brain Centre hopes to resume the project when social distancing, specifically that affecting the elderly population, is fully ceased. If this were to take many years, as currently seems likely, continuing the project in its current form may not be viable, and other means of delivery may need to be considered. This may possibly leading to new projects being conceived. At present the team delivering

the EoR scheme is monitoring the situation, and instructors and participants are awaiting further news from the Brain Centre.

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APPENDIX 1

Exercise monitoring and self-efficacy scale

Individuals will find that different forms of exercise vary in intensity. For example, some people find walking to be more tiring than others. Please read the following exercise intensity guidelines before moving onto the first question.

Light	Activity that does not cause a noticeable change in breathing rate. Can be sustained for at least 60 minutes.
Moderate	Activity that is able to be conducted whilst maintaining a conversation and can last for 30-60 minutes.
Vigorous	Activity in which conversation may not be maintained uninterrupted and will be sustained for approximately 30 minutes.
High	An intensity of exercise that cannot be sustained for longer than 10 minutes.

1) Please indicate how many minutes of each type of exercise you carry out in a typical week. This may include any form of exertion, including those during intentional or leisurely exercise and during every day activity.

Light **Minutes**
 Moderate **Minutes**
 Vigorous **Minutes**
 High **Minutes**

2) Next, please indicate how many minutes of exercise of each of the following types you would carry out in a typical week. This includes exercise performed as part of intentional or leisurely exercise or part of every day activity.

If you do not typically perform a type of exercise, please leave the box blank.

Some boxes are left blank for other types of exercise you may undertake. Please fill these in if appropriate.

Type of exercise	Number of minutes of exercise in a typical week	Type of exercise	Number of minutes of exercise in a typical week
Walking		Ball sports (e.g. football, rugby)	
Jogging/Running		Dancing	
Swimming		Aerobic (e.g. circuit training)	
Cycling		Weight-lifting	
Yoga			
Racket sports (e.g. tennis)			

3) Finally, please indicate how confident you are that you could maintain 30 minutes of any type of exercise 3 times per week under the following circumstances:

0 1 2 3 4 5 6 7 8 9 10

Cannot do at all

Certainly can do

Confidence (0-10)

During a typical week	<input type="text"/>
When you feel tired	<input type="text"/>
When the weather is bothering you	<input type="text"/>
When you are stressed or under pressure	<input type="text"/>
When you do not enjoy the exercise	<input type="text"/>
When you are busy with other commitments	<input type="text"/>
When you are exercising alone	<input type="text"/>
When you feel low in mood	<input type="text"/>
When you are suffering with health problems or an injury	<input type="text"/>
Whilst travelling or on vacation	<input type="text"/>

You have completed this questionnaire. Thank you.

APPENDIX 2

Participants were asked the following questions at 6 weeks into the exercise sessions, and again at the conclusion of the exercise sessions.

- How have you found the exercise sessions? Did they meet your expectations?
- Do you feel that the exercise sessions have made any difference to your life with MCI?
- How have you found the exercises you have been performing?
- Did you have any concerns before starting the exercise sessions?
- Do you feel that those concerns were managed?
- Do you think you will continue to exercise in the future? Why?
- Would you recommend this programme to others with MCI?
- If you started this programme again, what do you think should be done differently?
- Do you feel that you were given enough information about the programme?
- How have you found the questionnaires that we have sent you as part of this project?
- Any other comments?

Instructors were asked the following questions at the conclusion of the exercise sessions.

- How have you found delivering the Exercise on Referral Scheme?
- In future cycles of the same programme, what additional support could we offer you to help you run the programme effectively?
- In future cycles of the same programme, what changes are you thinking of making?
- How do you think we can improve engagement in the programme?
- Was the number of participants appropriate?
- Is the length of the programme appropriate?
- Do you think the participants will continue to exercise now that the programme is finished?
- Did you have any questions or queries from the participants that you needed support to answer fully?
- Were there any recurrent or important problems you encountered throughout the programme, in particular attendance?
- Any other comments?