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PAPER

Evaluation of cognitive assessment and cognitive intervention for people with multiple sclerosis

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Objectives: Cognitive problems in multiple sclerosis are common but any possible benefits of treatment remain uncertain. The aim of the study was to evaluate the benefits of providing a psychology service, including cognitive assessment and intervention, to patients with multiple sclerosis.

Method: The study was a single blind randomised controlled trial. A total of 240 patients with clinically definite, laboratory supported, or clinically probable multiple sclerosis were recruited from an multiple sclerosis management clinic and assessed on a brief screening battery. They were randomised into three groups. The control group received no further intervention. The assessment group received a detailed cognitive assessment, the result of which was fed back to staff involved in the patients' care. The treatment group received the same detailed cognitive assessment and a treatment programme designed to help reduce the impact of their cognitive problems. Patients were followed up 4 and 8 months later on the general health questionnaire (GHQ-28), extended activities of daily living scale, SF-36, everyday memory questionnaire, dysexecutive syndrome questionnaire, and memory aids questionnaire.

Results: The three groups were compared on the outcome measures at 4 and 8 months after recruitment. There were few significant differences between the groups and those that occurred favoured the control group. Overall, the results showed no effect of the interventions on mood, quality of life, subjective cognitive impairment or independence.

Conclusions: The study failed to detect any significant effects of cognitive assessment or cognitive intervention in this cohort of people with multiple sclerosis.

Cognitive problems are common in patients with multiple sclerosis.[1] Recent estimates of the prevalence vary from 43% to 72%.[2] It is acknowledged that the recruitment source of the patients and the type of multiple sclerosis influence the prevalence rate estimated, with community based populations[3] and those with relapsing-remitting multiple sclerosis[4] have lower rates. Memory, attention, speed of information processing, and executive functioning have been shown to be affected[5–9] whereas recognition memory, implicit learning, and speech comprehension[1] remain intact.

Rao[10] stated that one direction for future research lay in understanding the effects that cognitive dysfunction may have on the patients' everyday lives. Cognitive impairment has been found to be related to poorer social activities,[11] low mood,[12] and greater handicap.[13] Langdon and Thompson[14] suggested that mild attentional difficulties have a significant impact on patients' everyday lives through affecting their ability to work or enjoy leisure activities. More severe cognitive impairment presents a major barrier to rehabilitation. Patients with cognitive impairments fail to comply with management advice, because they forget advice and take longer to acquire new skills, or to adapt to increasing disability.

It is recognised that cognitive impairment in multiple sclerosis is often overlooked, or attributed to other problems. For example, Rao *et al*[11] reported that families and carers attributed cognitive deficits to depression or to other forms of emotional disturbance. The assessment of cognitive abilities can increase insight into everyday functioning and lead to a decrease in the functional impact of the disease.[14] If cognitive deficits are recognised early, it may facilitate the planning of other rehabilitation services, as well as reducing the patients' level of dependence. Identifying cognitive deficits and providing recommendations is part of the clinical service, particularly in rehabilitation units, and contributes to the care package for people with multiple sclerosis. However psychological assessment with advice on the management of cognitive problems is carried out in only a minority of patients although the potential contribution of such provision has been acknowledged.[15 16]

Multidisciplinary inpatient rehabilitation, including cognitive assessment, has been shown to lead to benefits in relation to disability, handicap, emotional wellbeing, and quality of life in a randomised controlled trial, but the contribution of the cognitive assessment was not measured.[17] Evaluations of specific interventions for cognitive problems have demonstrated beneficial effects in patients with a range of neurological conditions, such as stroke and traumatic brain injury.[18] Little research has been carried out to assess the benefits of cognitive assessment and cognitive rehabilitation in people with multiple sclerosis. Jonsson *et al*[19] conducted a neuropsychological intervention for patients with multiple sclerosis with mild to moderate cognitive and behavioural impairment. Forty patients were randomly allocated to receive either training in compensatory strategies and neuropsychotherapy, or a non-specific intervention. The treatment group receiving

Abbreviations: TEA, test of everyday attention; BADS, behavioural assessment of the dysexecutive syndrome; RMT, recognition memory test; VESPAR, verbal and spatial reasoning task; RR, relapsing-remitting; PP, primary progressive; NART, National adult reading test; BRB-N, brief repeatable battery; SRT, selective reminding test; PASAT, paced auditory serial addition test; FAS, word fluency test; SDMT, symbol digit modalities test; IQR, interquartile range; GHQ, general health questionnaire; PHC, physical health composite score; MHC, mental health composite score; OQoL, overall quality of life; SQoL, satisfaction with quality of life; EADL, extended activities of daily living index, EMQ, everyday memory questionnaire; DEX, dysexecutive syndrome questionnaire; MAQ, memory aids questionnaire; GNDS, Guy's neurological disability scale

direct intervention were significantly less depressed than the control group on the Beck depression inventory at the end of intervention and at 6 month follow up. There were no significant differences on a range of cognitive assessments.

There is a dearth of information on the effectiveness of rehabilitation strategies in people with multiple sclerosis. In particular there is little evidence to support the provision of a detailed assessment of cognitive function or of intervention strategies for cognitive impairment in multiple sclerosis, despite cognitive problems being very commonly reported. Therefore the aim of this study was to evaluate the benefits of providing a psychology service to offer cognitive assessment with intervention to patients with multiple sclerosis.

METHOD

Patients with either clinically definite, clinically probable, or laboratory supported multiple sclerosis[20] were recruited from a multiple sclerosis management clinic at the University Hospital, Nottingham. To be eligible for inclusion in the study patients had to live within a 20 mile radius of the hospital, to be able to cooperate with assessment for 30 minutes at a time, and consent to take part. Selection criteria were based on the assumption that patients might benefit as much from being told that they had no cognitive deficit as from one being identified. Therefore patients were not excluded on the basis of a cognitive screening assessment. However, all patients recruited were assessed on a brief screening battery consisting of the shortened version of the National adult reading test (NART)[21] as a measure of premorbid intelligence and the brief repeatable battery (BRB-N)[22] to evaluate verbal memory,

visual memory, attention and speed of information processing, to check the comparability of the groups at randomisation. In addition, the ambulation index[23] was administered as a measure of physical mobility, the Guy's neurological disability scale (GNDS)[24] as a measure of effects of multiple sclerosis and mood was assessed on the general health questionnaire-28 (GHQ-28).[25] The occupation, educational history, and the disease duration and course were established.

The study was a single blind randomised controlled trial. After the screening assessment patients were randomly allocated by telephoning an independent department who had a computer generated allocation list. Patients were allocated to one of three groups:

Group A: control

Patients received no further psychological assessment. The results of the screening assessment were not given to the medical and rehabilitation staff or patients or their relatives.

Group B: assessment

Patients received detailed cognitive assessment taking about 3 hours. Patients were assessed on measures of memory, attention, and executive functioning using the Wechsler memory scale revised,[26] Stroop neuropsychological screening test,[27] and modified card sorting test,[28] and were asked to complete an everyday memory questionnaire (EMQ revised version,[29] based on Sunderland *et al*[30]) using a five category response scale (once or less in last month/never; more than once a month but less than once a week; about once a week; more than once a week but less than once a day; once or more a
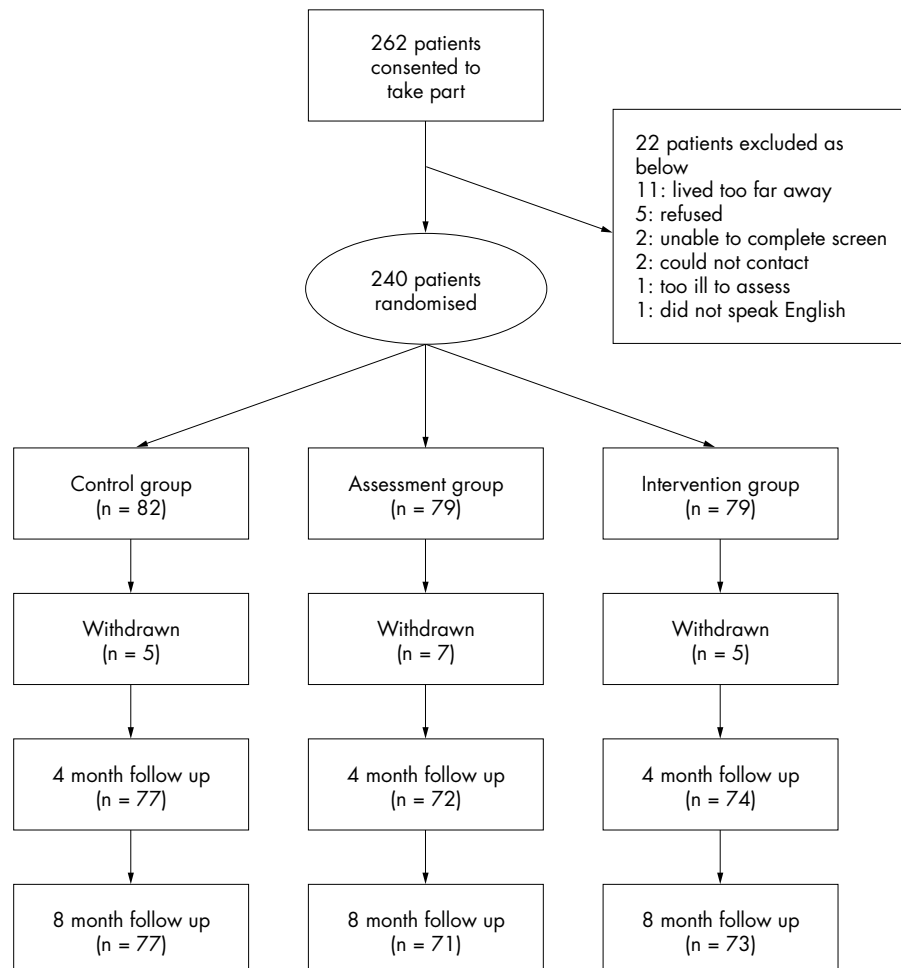

Figure 1 Profile of the sample.

Table 1 Biographical and baseline characteristics of patients with multiple sclerosis (MS)

	Group			
	Control (n)	Assessment (n)	Intervention (n)	p Value*
Sex:				
Men	25	16	26	0.20
Women	52	56	48	
Type of MS:				
SP	35	33	26	0.40
RR	37	35	35	
PP	6	6	7	
Unknown	4	5	12	
Living:				
Alone	17	9	9	
Cohabiting	54	60	61	0.34
Parental home	6	3	4	
Employment status:				
Working	28	33	28	0.45
Not working	49	39	46	
	Median	Median	Median	p Value†
Age	40.5	43.0	43.0	0.46
Age left education	16.0	16.0	16.0	0.18
Ambulation index	3	4	4	0.42
GNDS Total	15.5	16.0	18.0	0.48
Q1: cognitive	2	2	2	0.92
NART	101	106	103	0.09
BRN-B				
SRT Total	46	46	45	0.98
SRT Delay	6	6	6	0.78
10/36 Total	19	16	18	0.08
10/36 Delay	7	6	6	0.12
PASAT Easy	39	37	41	0.41
PASAT Hard	27	25	28	0.58
FAS	34	35	35	0.83
SDMT	49	46	47	0.33

*χ^2 comparison; †Kruskal-Wallis comparison.
SP, secondary progressive; RR, relapsing-remitting, including benign; PP, primary progressive; GNDS, Guy's neurological disability scale; NART, national adult reading test; BRB-N, brief repeatable battery; SRT, selective reminding test; PASAT, paced auditory serial addition test; FAS, word fluency test; SDMT, symbol digit modalities test.

day). Further assessments were selected on the basis of patients' performance and included the test of everyday attention (TEA),[31] behavioural assessment of the dysexecutive syndrome (BADS),[32] doors and people,[33] recognition memory test (RMT),[34] and the verbal and spatial reasoning task (VESPAR).[35] The assessments were selected according to the nature of the patients' problems, so that they were representative of cognitive assessments used in clinical practice. An assistant psychologist under the supervision of a chartered clinical psychologist conducted the assessments. Formal psychological reports were sent to the patients' general practitioners and hospital staff involved in the patients' care. The information obtained was summarised for patients and when the patients agreed, their relatives.

Group C: intervention

Patients received a detailed cognitive assessment as provided for group B and formal psychological reports were sent to the professionals involved in the patients' care and to patients and their relatives. In addition, patients received a cognitive rehabilitation programme for any deficits identified. The intervention programmes incorporated various techniques according to the nature of the cognitive deficit identified. This included training in the use of diaries, calendars, notebooks, and lists, as well as specific techniques such as visual mnemonics to aid memory. Patients were visited for up to a maximum of 6 months after the assessments were completed. Progress in treatment was monitored using weekly diaries, which were completed for 3 weeks before the intervention and at regular intervals after intervention.

An independent assessor, who was unaware of the group allocation, assessed the outcome at 4 and 8 months after randomisation. The outcome measures were selected to examine the effect of the intervention on disability. Cognitive impairments are likely to affect a person's daily life and therefore it is the impact of these on daily life that was the main focus. The outcome measures completed with the patient were as follows: extended activities of daily living scale (EADL)[36] to assess independence in instrumental activities of daily living, GHQ-28[25] to assess mood, everyday memory questionnaire (EMQ),[29] and dysexecutive syndrome questionnaire (DEX)[32] to assess cognitive disability, a memory aids questionnaire (MAQ) to evaluate the extent to which patients attempted to compensate for memory impairment, and the SF-36[37] to assess quality of life. Two additional questions from the SF-54[38] were included, patients were asked to provide a rating of their quality of life and to rate how satisfied they were with their quality of life. The GNDS[24] was administered to monitor neurological status. Carers or family members completed the GHQ-28 about their own mood and an everyday memory questionnaire and a dysexecutive syndrome questionnaire about the patient, to identify cognitive disabilities that may not have been noticed.

RESULTS
Patients

A total of 262 patients were considered for inclusion in the study. Of these, 22 patients were excluded; 11 lived too far away, two could not be contacted to arrange a screening visit,

Table 2 Comparison of outcome measures

	Time (months)	Control Median	IQR	Assessment Median	IQR	Intervention Median	IQR	p Value†
Patient outcomes:								
GHQ	4	21.0	13–34	21.0	13–31	22.0	15–34	0.73
GHQ	8	18.0	13–35	18.5	13–35	21.0	15–36	0.59
SF36:								
PHC	4	25.6	21–45	27.1	20–47	31.4	24–41	0.45
MHC		44.7	36–55	44.7	35–57	46.9	39–55	0.55
OQoL		7.0	5–8	6.0	5–7	6.0	4–8	0.15
SQoL		4.0	4–5	4.0	4–5	4.0	4–5	0.32
SF36:								
PHC	8	30.0	25–38	32.1	25–42	30.7	24–38	0.55
MHC		47.3	36–57	49.3	33–58	46.9	36–54	0.76
OQoL		6.5	5–8	6.0	4–7	6.0	4–8	0.04*
SQoL		5.0	4–8	4.0	3–5	4.0	3–5	0.04*
EADL	4	48.0	37–60	43.0	37–60	45.0	25–56	0.23
EADL	8	47.5	37–59	44.5	26–61	42.0	27–55	0.21
EMQ	4	16.5	7–42	18.5	5–31	17.0	7–35	0.69
EMQ	8	14.0	7–37	15.0	5–31	15.0	6–32	0.76
DEX	4	17.0	9–32	16.0	7–31	20.0	13–27	0.77
DEX	8	16.5	9–32	18.0	7–31	18.0	10–29	0.98
MAQ	4	10.0	7–15	11.0	7–14	10.0	5–16	0.92
MAQ	8	10.0	7–14	9.0	6–15	10.0	5–14	0.80
Carer outcomes:								
GHQ	4	22.0	14–31	24.0	16–35	22.0	13–29	0.35
GHQ	8	18.0	13–30	18.5	13–32	21.0	12–32	0.59
EMQ	4	14.0	3–35	11.5	4–28	21.0	5–34	0.90
EMQ	8	10.0	3–31	10.0	3–25	13.0	3–29	0.88
DEX	4	17.0	9–33	11.5	7–31	11.5	8–32	0.80
DEX	8	10.0	9–32	10.0	7–28	13.0	8–31	0.72

†Kruskal-Wallis comparison; *significant at p<0.05.
IQR, Interquartile range; GHQ, general health questionnaire–28; PHC, physical health composite score; MHC, mental health composite score; OQoL, overall quality of life (SF-54 question 53); SQoL, satisfaction with quality of life (SF-54 question 54); EADL, extended activities of daily living index; EMQ, everyday memory questionnaire; DEX, dysexecutive syndrome questionnaire; MAQ, memory aids questionnaire; GNDS, Guy's neurological disability scale.

Table 3 Comparison of groups using parametric analysis

Outcome measure	Comparison Group	Group	Mean difference	Effect size	p Value	95% CI Lower bound	Upper bound
GHQ-28	Control	Assessment	−2.37	0.18	0.64	−8.51	3.78
	Control	Treatment	−2.13	0.17	0.69	−8.22	3.97
	Assessment	Treatment	0.24	0.02	1.00	−6.12	6.60
SF-36	Control	Assessment	−1.03	0.08	0.82	−5.12	3.06
Physical health	Control	Treatment	0.43	0.03	0.97	−3.66	4.52
composite	Assessment	Treatment	1.46	0.10	0.69	−2.69	5.61
SF-36	Control	Assessment	1.16	0.11	0.86	−4.05	6.64
Mental health	Control	Treatment	1.10	0.11	0.87	−4.11	6.31
composite	Assessment	Treatment	−0.01	0.01	1.00	−5.35	5.23

GHQ-28, general health questionnaire–28; PHC, physical health composite score; MHC, mental health composite score.

two were unable to complete the screening assessments, one did not speak English, five refused, and one was too ill to be assessed.

Eighty two patients were randomised to the control group (group A), 79 to the assessment group (group B) and 79 to the intervention group (group C). Seventeen patients withdrew from the study after randomisation, leaving 77 in the control group, 72 in the assessment group, and 74 in the intervention group (fig 1).

There were 156 women and 67 men with an average age of 43 years (SD 10) (table 1). There were no statistically significant differences between the three groups in relation to any demographic factors. Baseline screening assessments also showed no significant differences between groups.

Comparison of outcome measures
The three groups were compared on the outcome measures at 4 and 8 months after recruitment using a Kruskal-Wallis one way analysis of variance (ANOVA) (table 2). There were no significant differences between the three groups on measures of mood (GHQ-28), independence in activities of daily living (EADL), subjective reports of dysexecutive syndrome (DEX), everyday memory problems (EMQ), frequency of memory aids used (MAQ) or neurological status (GNDS).

Physical and mental health composite scores were calculated from the SF-36.[39] There were no significant differences between the three groups on the composite scores. Significant differences were found on both the questions assessing overall quality of life (Q53 and Q54 from the SF-54) at 8 months

(p<0.05) but not at 4 months. Patients in the control group rated their quality of life and satisfaction with quality of life significantly higher in comparison with patients in the assessment group, but not the treatment group.

There were no statistically significant differences between the three groups on measures of carer/relative mood (GHQ-28), carer ratings of DEX, or EMQ, either at 4 or 8 months (table 2).

Patients were classified into those who had cognitive problems (those who scored below recommended cut offs on the BRB-N, or scored greater than 1 on the mental disability question from the GNDS) and those who did not. There were still no significant differences between the three groups on outcome measures.

To calculate confidence intervals and effect sizes and to enable power calculations to be made by future researchers, a parametric analysis and means (SD) were computed for the two major outcome measures at 8 months (SF-36 and GHQ-28). As was found with non-parametric tests, a one way ANOVA showed no significant main effects for patient GHQ-28, SF-36 physical health composite, or SF-36 mental health composite (F=0.51, 0.36, and 0.17 respectively). Post hoc Tukey tests showed no significant effects of individual group comparisons and 95% confidence intervals (95% CIs) showed mean differences to be low. Results are shown in table 3. Overall mean (SD) score on patients' completed GHQ-28 was 24.9 (14.7) for the control group, 27.3 (15.7) for the assessment group and 27.0 (15.7) for the treatment group. Mean (SD) SF-36 physical health composite score was 31.9 (9.4) for the control group, 33.0 (11.1) for the assessment group, and 31.5 (10.0) for the treatment group. Mean mental health composite score was 46.5 (13.2) for the control group, 45.4 (13.7) for the assessment group, and 45.4 (11.9) for the treatment group**.**

DISCUSSION

Overall the outcome measures showed no significant benefits of cognitive assessment or cognitive intervention. The confidence intervals were wide, suggesting that a significant effect may have been missed on the main outcome measures. However, the differences between means and the effect sizes were small. It is unlikely that the patients in this study differed significantly from those who would be referred in clinical practice. Although 28% did not report cognitive problems on the GNDS, there were only 5% who reported no cognitive problems and had no significant impairment on the BRB-N. Further, when patients with no reported cognitive problems were excluded, there were no significant differences between groups.

Although there may have been some benefit from treatment in individual patients, it was not effective for most patients allocated to receive intervention. This may be because some were already coping with their cognitive problems in daily life and for others the cognitive problems were relatively trivial compared with their physical disabilities. The treatment was not intensive and most was carried out at home, which may account for it being less effective than the treatment evaluated by Jonsson *et al.*[19] Patients were also a very heterogeneous group, including people in various stages of relapsing-remitting multiple sclerosis. This would have contributed to the variance and made it more difficult to detect treatment effects.

The outcome measures used may not be appropriate to detect the benefits of providing an intervention. Including a measure of client satisfaction would have provided information about how patients perceived the psychological input. However, such measures have methodological problems such as selection bias, high undifferentiated levels of satisfaction, and acquiescence bias.[40] Further, other studies of rehabilitation have found effects of treatment when using similar mood

and quality of life measures[17 19] to the ones we used. A further possible problem is that the sample size was small relative to the heterogeneity of the population, but it is larger than a similar study with more favourable results.[19] The magnitude of differences between the groups was very small and often not in the predicted direction, so it is unlikely that a benefit has been missed due to lack of power in the study. Outcomes may have been measured too early, but this is unlikely as most treatment had been completed well before the final assessment.

The aim was to provide benefit partly through the provision of cognitive reports to the medical, nursing and therapy staff involved in the patients' care. However, some patients were not seen by health care professionals during the course of the study. It may be that psychological assessment and treatment would have been found to be more effective within the context of multidisciplinary teamwork. The cognitive assessment reports highlighted any emotional problems and provided recommendations for communicating with patients and managing their cognitive deficits. It is possible that the reports did not provided any new or useful information. However, this seems unlikely as many general practitioners said that the reports were easy to interpret and of some use. The recommendations were also fed back to both patients and carers, which was expected to contribute as much to patient outcome as the provision of information to professionals

There were just two significant results, which could be attributed to chance. In addition, they were in a direction against the benefits of intervention and suggest that cognitive assessment may have detrimental effects on quality of life, particularly if it is not carried out in conjunction with an intervention programme. This effect requires further study.

Thus, although this study has detected no significant effect of either cognitive assessment or cognitive intervention for a heterogeneous group of people with multiple sclerosis, it has indicated directions for future research. The selection of patients for referral to psychology services could be examined to determine who is most likely to benefit in order to direct services most effectively. In addition, the service provided was primarily for those living independently at home. Cognitive assessment and rehabilitation may be more appropriate in the context of multidisciplinary rehabilitation. Because cognitive problems were very frequent, further evaluations therefore seem justified.

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