Chronic disease self-management and cognitive training programme to improve diabetic control in older outpatients with memory complaints: a randomised trial

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KEY MESSAGE

In older diabetic patients with cognitive impairment, the chronic disease self-management and cognitive training programme was effective in improving memory but did not promote self-management or glycaemic control.

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Introduction

Older diabetic people are at risk of cognitive decline and dementia.[1] Cognitively impaired older diabetic patients may be more frail and more prone to problems with drug adherence than their cognitively normal counterparts. This results in poorer diabetic control and long-term complications.

Chronic disease self-management programmes (CDSMPs) have been shown to have long-lasting effects on self-efficacy and health care utilisation. A locally adapted 6-week, group-based CDSMP has shown significant improvement in older people with chronic diseases in terms of self-management behaviours, self-efficacy, and subjective health-related quality of life, particularly in mental health.[2] Nonetheless, the benefits of CDSMP may be limited in cognitively impaired older diabetic patients. Cognitive training has been shown to be effective in improving cognitive function in older people. A locally designed cognitive training programme for older people with subjective memory complaint has shown benefits in reasoning and memory after 12 weeks' training in those with primary or lower education.[3] A combination of this cognitive training programme and CDSMP may promote self-management activities and improve glycaemic control in cognitively impaired older diabetic patients. It is hypothesised that the combination of disease self-management intervention and cognitive training will improve diabetic control in such patients. We also examined changes in disease self-management habits, psychological health, medication adherence, and cognitive function.

Methods

Outpatients with type-2 diabetes mellitus aged ≥65 years were recruited from general outpatient clinics and specialist outpatient clinics in Shatin and Tai Po areas. Inclusion criteria were: (1) recent glycosylated haemoglobin (HbA1c) level of 7% to 9% without change in diabetes medication within 3 months, and (2) subjective memory complaints as suggested by a Chinese Memory Symptoms Score of ≥3 out of 5. Exclusion criteria were: (1) post-secondary education, (2) an abbreviated Geriatric Depression Scale score of >1, (3) diagnosis of dementia or other terminal illness, and (4) significant disability. Written informed consent was obtained from both participants and caregivers.

All potential subjects were clinically assessed by a geriatrician in the research clinic. A research assistant compiled the clinical information, conducted cognitive tests (Mini-Mental State Examination, Verbal Fluency Test and Controlled Oral Word Association Test [for executive function], International Shopping List test and Continuous Paired Associate Learning test in the computerised Cogstate Neuropsychological Test Battery [for verbal and visual-spatial episodic memory performances]), and completed the General Health Questionnaire and Chinese version of the Diabetes Management Questionnaire. The latter is a self-report structured questionnaire to record the frequency of different diabetes management activities including diet

control, exercise, medication adherence check, haemostix monitoring, blood pressure measurement, and foot inspection. It was administered to both participants and caregivers. Caregiver involvement in each diabetic management activity was similarly recorded.

Subjects were randomly assigned to either the intervention (CDSMP) or control group. The research assistant involved in follow-up assessments was blinded to patient assignment. Attending doctors were advised to keep diabetic medication unchanged in the first 4 months. Assessments were repeated at month 4 and month 12.

The CDSMP comprised 10 weekly 2.5-hour sessions in consecutive weeks, conducted in a small group setting (6-8 participants) at Prince

TABLE 1. Baseline characteristics of the intervention and control groups

Characteristic	Intervention (n=73)*	Control (n=66)*	P value
Age (years)	74.6±6.7	72.3±5.5	0.032
Female	58.9	59.1	0.982
Body mass index (kg/m^2)	25.9±3.7 (n=48)	25.7±5.0 (n=49)	0.849
Education (years)	4.9±3.5	6.0±3.8	0.091
<3 (none)	28.80	21.20	0.056
3-6 (primary)	46.60	34.80	
>6 (secondary)	24.70	43.90	
Smoking status			0.324
Non-smoker	72.6	71.2	
Ex-smoker	27.4	25.8	
Smoker	0	3	
Specialist outpatient	79.5	86.4	0.151
Duration of diabetes mellitus (years)	16.2±8.3	17.6±9.6	0.37
≤10	34.7	28.8	0.253
11-20	44.4	37.9	
>20	20.8	33.3	
Insulin therapy	53.4	57.6	0.623
Hypertension	90.4	87.9	0.631
Stroke	21.9	13.6	0.204
Ischaemic heart disease	17.8	9.1	0.135
Glycosylated haemoglobin level (%)	7.81±0.56	7.81±0.62	0.95
Systolic blood pressure (mmHg)	140±16	137±16	0.262
Diastolic blood pressure (mmHg)	78±8	76±9	0.454
General Health Questionnaire	5.32±5.29	6.17±4.95	0.33
Mini-Mental State Examination	25.4±3.2	26.2±3.1	0.163
Executive function z-score	-0.125±0.77	0.114±0.91	0.097
Memory z-score	-0.204±0.81 (n=66)	0.154±0.83 (n=69)	0.013

* Data are presented as mean ± standard deviation or % of subjects

of Wales Hospital, Alice Ho Miu Ling Nethersole Hospital, or community elderly centres. In the first hour, participants were taught chronic disease self-management skills. The second hour was dedicated to cognitive training. The programme was delivered according to a standardised teaching manual by a pair of trained professional leaders (registered social workers or allied health professionals) or elderly peer leaders who were retired older volunteers with chronic diseases.

The CDSMP is a generic programme that covers a wide range of themes, from lifestyle (diet and exercise) and healthcare (use of medication and partnership with healthcare providers) to psychosocial coping (negative emotions and cognitive symptom management, effective communication and problem solving). For this group of patients, we focused on the management of diabetes and cognitive impairment. Formats involved educational talks, group discussion, peer support, and additional strategies based on the self-efficacy theory. These strategies included performance accomplishments in self-selected goals and action planning, implementation with review of progress, behavioural modelling and social persuasion by other participants and leaders, and guided reinterpretation of symptoms and problem solving. Cognitive training included three cognitive domains: reasoning, memory, and speed-of-processing.

Each participant was expected to devise and implement an action plan for self-management and complete a small amount of homework for cognitive training every week. The action plan and homework were reviewed and discussed at the beginning of each session. In addition, family caregivers were invited to an interactive session in which they learned about cognitive impairment in diabetic patients and shared their caring difficulties.

Results

Overall, 139 patients were eligible and randomised to either the intervention (n=73; 52.5%) or control (n=66; 47.5%) group. The mean attendance rate was 86.3%; only 13 (17.8%) participants had an attendance rate of <80%. Of all patients, 63 (86.3%) in the intervention group and 56 (84.8%) in the control group completed all follow-up visits and HbA1c measurements. Compared with completers, non-completers who were lost to follow-up had a significantly better baseline HbA1c level (mean, 7.55%; standard deviation, 0.39%).

Patients in the intervention group were significantly older and had a lower memory Z score than those in the control group (Table 1). At month 4, 22 (31.4%) intervention and 23 (37.1%) control participants had medical needs to alter their diabetes medication, despite the suggestion to doctors to maintain the same diabetic medication regimen during the intervention period (Table 2). For those maintained on the same regimen, the mean HbA1c level was comparable between the two groups. At month 12, the chances of having diabetes medication upgraded or downgraded were similar between the two groups, as were changes in HbA1c levels. General Health Questionnaire was generally high in both groups at baseline and did not change significantly at follow-up (Table 2).

Memory function of the intervention group showed progressive improvement. A significant interaction effect ($F(2,118)=4.43$, P=0.013) was

TABLE 2. Changes in glycosylated haemoglobin level, diabetes medication, and general health questionnaire score at follow-up

Variable	Change at month 4 from baseline		Change at month 12 from baseline	
	Intervention (n=69)	Control (n=60)	Intervention (n=67)	Control (n=62)
Median (quartile range) change in glycosylated haemoglobin level (%)	0.00 (-0.40 to 0.55)	-0.20 (-0.50 to 0.48)	0.00 (-0.50 to 0.60)	0.00 (-0.43 to 0.40)
% of subjects with diabetes medication change				
Upgrade	25.7	24.2	46.3	40.3
Downgrade	5.7	12.9	17.9	16.1
No change	68.6	62.9	35.8	43.5
Median (quartile range) change in glycosylated haemoglobin level (no medication change) [%]	0.10 (-0.30 to 0.70)	-0.20 (-0.53 to 0.53)	-0.05 (-0.33 to 0.53)	0.05 (-0.40 to 0.53)
Median (quartile range) change in General Health Questionnaire score	-1.0 (-3.00 to 2.00)	0.00 (-3.00 to 3.00)	0.00 (-3.00 to 2.00)	0.00 (-3.00 to 2.00)

TABLE 3. Cognitive scores at baseline and follow-up

Cognitive score	Intervention			Control			P value*
	Baseline	Month 4	Month 12	Baseline	Month 4	Month 12	
Mean±SD mini-Mental State Examination score	25.5±3.1	-	25.0±3.8	26.3±3.1	-	25.7±2.8	0.729
Mean±SD executive function Z score	-0.126±0.78	-0.134±0.74	0.010±0.92	0.124±0.91	0.200±0.84	0.261±0.88	0.668
Mean±SD memory Z score	-0.183±0.83	0.036±0.82	0.098±0.82	0.173±0.84	0.246±0.80	0.139±0.84	0.015

* For ANOVA group effect adjusted for age, sex, and education level

detected in the memory domain, after adjustment for age, sex, and education (Table 3). Paired *t*-tests indicated that there was a significant long-term gain in executive function in the intervention group ($t(64)=2.05$, P=0.044, $g=0.255$) but not in the control group ($t(56)=1.41$, P=0.165, $g=0.186$).

For other diabetic disease management activities, both intervention and control participants were well-engaged in self-care activities. Family caregivers were seldom involved except in diet control. At follow-up, family caregivers in the intervention group reported less exercise at month 12 (P=0.004) and less improvement in diet control at month 4, compared with the control group. Caregivers in the intervention group were more likely to be involved in glucose monitoring at month 4, and reported more frequent glucose monitoring by subjects at month 12.

Discussion

The CDSMP combined with cognitive training did not promote diabetes self-management or improve glycaemic control in older diabetic patients with cognitive impairment. It was, however, effective in improving memory in the longer term. This finding is consistent with a previous study.[3] The cognitive benefits increased with time, contrary to the waning pattern commonly observed in other cognitive-training programmes.[3,4] This suggests that the CDSMP may have resulted in some lifestyle changes (eg more social activities, better relationship with family caregivers) that led to cognitive improvement. Nonetheless, this improvement did not increase the efficacy of CDSMP in diabetic control. It is possible that early-phase short-term memory loss is not a causative factor in non-adherence in disease self-management. Executive function may be more relevant, but its improvement with cognitive training was mild and came late in the study period. Poor psychological health is another factor that adversely affected treatment adherence, disease self-management, and diabetic control. Psychological rather than self-management interventions have been suggested to be effective in improving depression in diabetic patients.[5] More specific psychological interventions (eg mindfulness exercises) may be a useful addition to our programme.

There were limitations in this study. The sample size was slightly less than estimated. In one third of subjects, diabetes medications were altered in the first 4 months. The time designated to cognitive training was restricted to 8 hours and may have limited its efficacy. The questionnaires on lifestyle and drug management for diabetes were self-report subjective measures; the accuracy might have been compromised by cognitive impairment. Older outpatients with poor diabetic control (HbA1c of >9%) were not included. This would have limited the power of our study to demonstrate the effectiveness of the programme. Cost effectiveness analysis was not performed.

Conclusion

The CDSMP and cognitive training did not improve glycaemic control or self-care activities in older diabetic patients with cognitive impairment. It was, however, effective in improving memory in the longer term.

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