

A Preliminary Evaluation of a Disease Management Programme for Patients with Diabetes Mellitus and Hypertension in a Primary Healthcare Setting

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Abstract

Introduction: The Comprehensive Chronic Care Programme (CCCP) is an intensified programme designed to provide comprehensive care for the management of diabetes mellitus, hypertension and hyperlipidaemia at a primary healthcare setting. A formative study was done to evaluate the effectiveness of the CCCP compared to the normal polyclinic management of diabetes mellitus. **Materials and Methods:** Control of diabetes (HbA1c) and hypertension (blood pressure) in 63 diabetic patients of a pilot CCCP was compared with 100 diabetic patients not on the programme (non-CCCP) after a 6-month follow-up. Paired t-tests were conducted for differences in mean HbA1c values between baseline and after 6 months. The H-rank test was applied to check for significant differences in change categories of hypertension control between CCCP and non-CCCP cases. **Results:** In the CCCP group, there was a two-point decrease in HbA1c after 6 months and 65.1% of the patients showed improvement. The proportion of patients achieving optimal diabetic control increased from 9.5% to 36.5%. Conversely, there was deterioration in the non-CCCP group with decrease in the proportion of patients achieving optimal diabetic control from 31% to 21%. Of the hypertensive patients in the CCCP group, 54.5% showed an improvement in blood pressure (BP) control while 44% of the non-CCCP group showed improvement at 6 months. **Conclusions:** CCCP, a comprehensive chronic disease management programme, is effective for good diabetic control of patients with diabetes mellitus.

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Key words: Disease management programme, Primary healthcare setting

Introduction

Chronic diseases are the main causes of morbidity and mortality in developed countries. In most developed countries, the problems of a rising prevalence of chronic disease and escalating costs have forced healthcare policymakers to look for ways to provide cost-effective healthcare for chronic disease patients.

Singapore's multiethnic population is about 4 million, of which 7.3% were 65 years of age or more in year 2000. This will increase to 20% in 2030 and a corresponding increase in the number of patients with chronic diseases can be expected.^{1,2}

The prevalence of diabetes mellitus in Singapore for those aged 18 years and above has doubled almost every 8 years from 1.7% in 1977 to reach 8.6% in 1992, before reaching a plateau at 9% in 1998. Around 250,000 of adult

Singaporeans have diabetes.^{3,4} The prevalence of hypertension in those aged 30 years and above was 27.3% in 1998. This is equivalent to 550,000 people with hypertension. The prevalence of hyperlipidaemia currently is around 25%.³

Need for a Comprehensive Chronic Care Programme

Every year there are about 3 million attendances at the polyclinics in Singapore. Attendances at 9 National Healthcare Group Polyclinics (NHGPs) for hypertension, diabetes mellitus, hyperlipidaemia, coronary artery disease and cerebrovascular disease account for one-fifth of the total attendances. Hypertension, diabetes mellitus and hyperlipidaemia account for 80% to 90% of all chronic conditions seen in the polyclinics.

Diabetes mellitus, hypertension and hyperlipidaemia are major risk factors to the leading conditions responsible for

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high morbidity and mortality among Singaporeans. Good control of these 3 disease conditions will reduce important complications from these 3 conditions setting in, such as coronary artery disease, cerebrovascular disease, renal failure, blindness and diabetic foot complications. These complications collectively contribute to 40% of total deaths in Singapore and are responsible for much morbidity, increased healthcare costs and a poor quality of life for those afflicted with these diseases.

These 3 chronic conditions are mainly managed at the primary care level. Good care by family physicians will definitely retard progression of these diseases to their dreaded complications. Recognising this important principle, the Ministry of Health spearheaded the Comprehensive Chronic Care Programme (CCCP), working with the polyclinic management teams of both clusters to draw up a structured comprehensive protocol for good care.

Table I shows classification of patients into the 4 diabetic categories [category (CAT) 1 to CAT 4], according to disease severity and whether there are co-morbidities or complications with end-organ damage. This classification is also linked to expectations of resource utilisation required for the management of patients in each category. A patient in CAT 4 is expected to utilise more resources than a patient in CAT 3. In the presence of complications, the patient will be classified as CAT 4, regardless of whether he has hypertension and/or hyperlipidaemia.

Features of the CCCP

The CCCP is characterised by:

a) Team-based approach for collective care of patients

The healthcare team comprises family physician, case manager, podiatrist and dietician.

b) Active role of case managers

Case managers are nurse educators who are specially trained to manage patients with diabetes, hypertension and hyperlipidaemia. They provide customised support care for the patient, monitor his progress and attendances for the important components of care under the CCCP at the time when they are due and actively recall the patient when he defaults follow-up. Customised health education is tailored to the individual patient's lifestyle. Patients who are initiated into the CCCP will be discharged back into the general patient pool after achieving better control of their disease state.

c) Dedicated time for consultation with healthcare team

Consultation time by the doctor averages 15 minutes at each visit and up to 45 minutes by the case manager. This is longer than the average of 7 to 10 minutes spent by the doctor or 20 minutes by the nurse educator for patients on

TABLE I: DISEASE CATEGORIES FOR DIABETES MELLITUS, HYPERTENSION AND HYPERLIPIDAEMIA

Disease	Category	Remarks
Diabetes mellitus	1	On diet control only
	2	On oral medication and or insulin
	3	With co-morbidities (hypertension and or hyperlipidaemia)
	4	With complications arising from diabetes mellitus, such as retinopathy, nephropathy, peripheral vascular disease, lower limb amputations, ischaemic heart disease, stroke, etc.
Hypertension	1	On diet control only
	2	On oral medication only
	3	With co-morbidity (hyperlipidaemia)
	4	With complications arising from hypertension, such as nephropathy, ischaemic heart disease, stroke, etc
Hyperlipidaemia	1	On diet control only
	2	On oral medication only
	4	With complications arising from hyperlipidaemia, such as ischaemic heart disease, stroke, etc

Note that there is no Category 3 for hyperlipidaemia.

the usual polyclinic programme for management of these 3 conditions. CCCP patients who are difficult to control or stabilise are referred to Master of Medicine (Family Medicine)-trained doctors.

d) Structured clerking notes

Clinical pathways embedded in structured clerking notes are utilised. Reminders and prompts are given at regular intervals for the doctor to review glycosylated haemoglobin (HbA1c) and low-density lipoprotein (LDL-c) levels. In addition, should blood pressure reading, HbA1c or LDL-c rise persistently above target levels, prompts flag out suggested consultation with senior family physicians or referral to hospital specialists.

Material and Methods

CCCP was implemented as a pilot project in Choa Chu Kang (CCK) polyclinic from 1 October 2000. A formative review of the effectiveness of the CCCP was made comparing only the CAT 3 and 4 patients with diabetes enrolled in the CCCP with those on normal polyclinic management.

Selection and Enrolment of Patients with Diabetes into the Pilot CCCP

At the start of the pilot CCCP, all doctors at CCK polyclinic were asked to enrol patients with diabetes mellitus into the programme. On the average, the programme enrolled about 10 patients with diabetes (from CAT 1 to 4) per working day, and consisted both 'new' patients

TABLE II: DEMOGRAPHICS OF CCCP AND NON-CCCP PATIENTS IN THE STUDY

Study group		CCCP	Non-CCCP
No. of patients		63	100
Diabetic category	CAT 3	38 (60.3%)	43 (43%)
	CAT 4	25 (39.7%)	57 (57%)
	New	27 (42.8%)	3 (3%)
Gender	Male	25 (39.7%)	39 (39%)
	Female	38 (60.3%)	61 (61%)
Race	Chinese	45 (71.4%)	75 (75%)
	Malay	12 (19.0%)	15 (15%)
	Indian	6 (9.5%)	9 (9%)
	Others	0	1 (1%)
Age (y)	Below 40	2 (3.2%)	4 (4%)
	40-59	37 (58.7%)	31 (31%)
	60-79	24 (38.1%)	57 (57%)
	80 and above	0	8 (8%)
	Mean	56.5 ± 9.7	62.0 ± 12.1

CAT: category; CCCP: Comprehensive Chronic Care Programme

(diagnosis made within 6 months at time of enrolment) and 'old' patients who were receiving long-term follow-up at the polyclinic (diagnosis made more than 6 months ago). For our study, we retrospectively identified all patients enrolled in CCCP between 1 October 2000 and 31 December 2000. There were 83 CAT 3 and 4 patients with diabetes. The clinical progress of these CCCP patients was compared against CAT 3 and 4 patients on normal polyclinic management (known as the non-CCCP group) seen during the same period (October 2000 to December 2000). There were 128 patients in the non-CCCP group. Table II shows the demographics of these 2 groups of patients.

Outcome indicators monitored for these 2 groups of CAT 3 and 4 patients over a 6-month period were HbA1c and systolic and diastolic blood pressures. Only CAT 3 (with co-morbidities) and CAT 4 (with complications) patients were studied because evidence from the United Kingdom Prospective Diabetes Study (UKPDS) has shown that tight blood pressure control was associated with a significant reduction in heart failure, stroke, microvascular complications and diabetes-related deaths.⁵

For the control of diabetes, HbA1c was used as the outcome indicator as it was not subjected to daily fluctuations compared to venous glucose levels. The same laboratory at CCK Polyclinic conducted the HbA1c test for all the patients in the CCCP and non-CCCP groups. An 'improvement' in control of diabetes at 6 months was defined as the repeat HbA1c belonging to a better category than the baseline category. 'Status quo' was defined as the result remaining in the same category at 6 months and a 'deterioration' was defined as the result being in a worse category than its baseline category (Table III).

TABLE III: DISTRIBUTION OF PATIENTS INTO THE DIFFERENT HbA1C CATEGORIES AT BASELINE AND 6 MONTHS FOR BOTH CCCP AND NON-CCCP GROUPS

Study group		CCCP	Non-CCCP
No. of diabetes patients		63	100
HbA1c (Baseline)	Total	63	100
	CAT 3	38 (60.3%)	43 (43%)
	CAT 4	25 (39.7%)	57 (57%)
	Good (<7.0)	6 (9.5%)	31 (31%)
	Moderate (7.0-7.9)	8 (12.7%)	18 (18%)
	Poor (8.0-8.9)	11 (17.5%)	20 (20%)
HbA1c (6-month)	Very poor (9.0-9.9)	7 (11.1%)	11 (11%)
	Extremely poor (≥10.0)	31 (49.2%)	20 (20%)
	Mean	9.81 ± 2.22	8.28 ± 1.94
	Good (<7.0)	23 (36.5%)	21 (21%)
	Moderate (7.0-7.9)	14 (22.2%)	26 (26%)
	Poor (8.0-8.9)	11 (17.5%)	21 (21%)
HbA1c (6-month)	Very poor (9.0-9.9)	7 (11.1%)	14 (14%)
	Extremely poor (≥10.0)	8 (12.7%)	18 (18%)
	Mean	7.82 ± 1.75	8.28 ± 1.69

CAT: category; CCCP: Comprehensive Chronic Care Programme

To measure the control of blood pressure, systolic and diastolic blood pressures were used as outcome indicators. Blood pressure (BP) was measured by the doctor using a mercury sphygmomanometer during each consultation. An 'improvement' in control of hypertension at 6 months was defined as the repeat BP at 6 months belonging to a better category than the baseline category. 'Status quo' was defined as the result remaining in the same category at 6 months and 'deterioration' was defined as the result being in a worse category than its baseline category.

Control of LDL-c cannot be evaluated in this study

TABLE IV: THE CHANGE IN CONTROL OF DIABETES AT 6 MONTHS

Change in control of diabetes	CCCP	Non-CCCP
Improvement	41 (65.1%)	26 (26%)
Status quo	19 (30.2%)	45 (45%)
Deterioration	3 (4.8%)	29 (29%)
(P < 0.001)		
Change in control of diabetes	CCCP (new)	CCCP (old)
Improvement	21 (77.8%)	24 (66.7%)
Status quo	5 (18.5%)	9 (25.0%)
Deterioration	1 (3.7%)	3 (8.3%)
(P = 0.58)		
Change in control of diabetes	CCCP (old)	Non-CCCP (old)
Improvement	24 (66.7%)	30 (30.9%)
Status quo	9 (25.0%)	36 (37.1%)
Deterioration	3 (8.3%)	31 (32.0%)
(P = 0.001)		

CCCP: Comprehensive Chronic Care Programme

because repeat LDL-c tests were not due yet for many patients by the end of the study period. A later study will be able to assess any change in the control of hyperlipidaemia.

Statistical Method

The H-rank test was applied to check for significant differences in change categories of hypertension control between CCCP and non-CCCP. This non-parametric test was chosen because the change categories (deterioration, status quo and improvement) were ordinal in nature. Paired *t*-tests were conducted for difference in mean HbA1c values between baseline and after 6 months.⁶ In addition, Pearson chi-square statistic was used to test the difference in the improvement recorded by the 'old' patients in the CCCP group vis-à-vis the 'old' patients in the non-CCCP group. Pearson chi-square test, Fisher's exact test and two-sample *t*-test (two-tailed) were used to evaluate the appropriateness of the 'old' patients in the non-CCCP group to serve as the comparison group for the 'old' patients in the CCCP group in this non-equivalent control group pretest-posttest sub-analysis.⁷ All statistical tests were carried out at 5% level of significance and the data were entered into Stata 6.0 (Stata Corporation, 702 University Drive East, College Station, TX 77840, U.S.A.) for analysis.

Study Population

A total of 83 CAT 3 and 4 patients with diabetes were enrolled into the CCCP. During the first 6 months, 8 patients defaulted follow-up at CCK polyclinic or were transferred to another polyclinic or tertiary hospital for management of their diabetes. 1 patient died and another 11 either opted out of the CCCP or had incomplete data collection. There were 63 (76%) patients left in the CCCP study group after 6 months and among them, 38 (60.3%) were identified as CAT 3 and 25 (39.7%) were CAT 4 patients with diabetes. In the non-CCCP group, there were 128 (CAT 3 and 4) patients with diabetes who visited CCK polyclinic during the period from 1 October 2000 to 31 December 2000. Among them, 14 defaulted follow-up at CCK polyclinic or were transferred to another polyclinic or tertiary hospital for diabetic management; 14 patients had incomplete data collection and were excluded from the study. There were a total of 100 (78.1%) patients for analysis in the non-CCCP study group, of which 43 (43%) were CAT 3 and 57 (57%) were CAT 4 patients.

The CCCP group had 27 patients out of 63 (42.8%) who were newly diagnosed patients with diabetes, of which 20 (74%) were CAT 3 and 7 (26%) were CAT 4. In the non-CCCP group, only 3 out of 100 (3%) were newly diagnosed and all were in the CAT 4 diabetic category.

There were more females than males in both the CCCP (60.3%) and non-CCCP (61%) groups of patients. The

racial distribution of the patients is similar to that of the general patient profile seen at CCK polyclinic. The patients in the CCCP group were between the ages of 33 and 75 years. The mean age was 56.5 ± 9.65 . For the non-CCCP group, their ages ranged from 35 to 90 years and the mean age was 62.0 ± 12.1 .

Hypertension was present as a co-morbidity in about 7 out of 10 patients in the CCCP group. In the non-CCCP group, it was present in 9 out of 10 patients. The percentage of diabetic patients in the CCCP group with hyperlipidaemia was similar to the non-CCCP group (87.3% and 88.0%, respectively).

Results

Comparing Control of Diabetes Between the CCCP and non-CCCP Patients

The distribution of the HbA1c readings (baseline and 6 months) in the various categories among the CCCP and non-CCCP groups is shown in Table III.

CCCP Group:

The mean baseline HbA1c at enrolment into the CCCP was 9.81 ± 2.22 . The mean baseline HbA1c for CAT 3 patients (9.27 ± 2.07) was lower than that of CAT 4 patients (10.64 ± 2.22). After 6 months into the CCCP, the mean HbA1c for the entire group of CCCP patients dropped to 7.82 ± 1.75 . There was a significant improvement in control of diabetes after 6 months ($P < 0.001$). The CAT 3 patients recorded a mean HbA1c of 7.47 ± 1.45 , while the CAT 4 patients averaged 8.34 ± 2.06 . Both groups showed a significant difference from their baseline HbA1c result. ($P < 0.001$).

The percentage of patients who managed to achieve optimal HbA1c levels ($< 7\%$) increased from 9.5% to 36.5% over the 6-month study period. There was a corresponding decrease in the percentage of patients with poor control (HbA1c 8% or more) from 77.8% to 41.3%.

Among the 63 patients with diabetes in the CCCP study group, 41 (65.1%) recorded an improvement in their control of diabetes with a decrease of HbA1c result, 19 (30.2%) remained status quo while 3 (4.8%) showed deterioration (Table IV). A comparison of the 'new' and 'old' patients with diabetes showed no statistical difference in the improvements made between these 2 groups ($P = 0.58$).

Non-CCCP Group:

Similar analysis was made for the patients in the non-CCCP group (Table III). The mean baseline HbA1c for the non-CCCP patients was 8.28 ± 1.94 . The mean baseline HbA1c for CAT 3 patients was 8.38 ± 1.88 and this was comparable to the CAT 4 patients (8.21 ± 2.00).

The mean HbA1c at 6-month for the entire non-CCCP group was 8.28 ± 1.69 . There was no significant change in

their control of diabetes at 6 months ($P = 0.99$). The CAT 3 and CAT 4 patients registered a mean HbA1c of 8.37 ± 1.69 and 8.21 ± 1.70 , respectively, at 6 months. Both groups did not show any significant difference from their baseline HbA1c result ($P = 0.99$ and $P = 1.00$, respectively).

The percentage of patients who managed to achieve optimal HbA1c levels ($<7\%$) decreased from 31.0 to 21.0 % over the 6-month study period. There was also an increase in the percentage of patients with poor control (HbA1c 8% or more) from 51.0% to 53.0%.

Among the 100 patients with diabetes in the non-CCCP study group, 26 (26%) recorded an improvement in their control of diabetes with a decrease of HbA1c result, 45 (45%) remained status quo while 29 (29%) patients showed deterioration (Table IV).

There was significant difference in the improvement recorded by the 'old' patients in the CCCP group vis-à-vis the 'old' patients in the non-CCCP group ($P = 0.001$). The 2 groups were compared and found not to be significantly different in distribution of diabetes category, race or gender.

Control of diabetes among patients in the CCCP group has definitely shown significant improvement at 6 months into the programme for both the CAT 3 and 4 patients. There was an average 2-point decrease in HbA1c after 6 months. However, there was no significant difference in average HbA1c recorded in the non-CCCP group. There were more patients in the CCCP group showing improvement in their control of diabetes compared to the non-CCCP group ($P < 0.001$) at 6 months. In the non-CCCP group, a greater proportion showed deterioration in their control of diabetes.

Comparing Control of Blood Pressure Between the CCCP and Non-CCCP Patients with Hypertension and Diabetes

Table V shows the distribution of patients into the different blood pressure categories at baseline and 6 months for both the CCCP and non-CCCP groups.

CCCP Group:

There were 44 (25 CAT 3 and 19 CAT 4) patients with a co-morbidity of hypertension and diabetes. Their mean baseline BP was: systolic blood pressure (SBP) = 142.1 ± 16.4 mm Hg; diastolic blood pressure (DBP) = 82.84 ± 10.3 . At 6 months, their SBP was 134.2 ± 10.1 mm Hg and DBP was 80.5 ± 7.8 . There was some improvement in the control of BP 6 months later in the CCCP group with an average decrease in SBP of 7.9 mm Hg and DBP of 2.4 mm Hg. There were 24 patients (54.5%) who recorded an improvement in control of BP, 15 (34.1%) remained in status quo while 5 (11.4%) patients showed deterioration (Table VI).

TABLE V: DISTRIBUTION OF PATIENTS INTO THE DIFFERENT BLOOD PRESSURE CATEGORIES AT BASELINE AND 6 MONTHS FOR HYPERTENSIVE DIABETIC PATIENTS IN BOTH CCCP AND NON-CCCP GROUPS

Study group		CCCP	Non-CCCP
No. of diabetic patients with hypertension	Total	44	91
	CAT 3	25	38
	CAT 4	19	53
Blood pressure (baseline)			
Normal (SBP <130 and/or DBP <85)		4 (9.1%)	15 (16.5%)
High-normal (SBP 130-139 and/or DBP 85-89)		9 (20.5%)	23 (25.3%)
Mild HPT (SBP 140-159 and/or DBP 90-99)		17 (38.6%)	38 (41.8%)
Moderate HPT (SBP 160-179 and/or DBP 100-109)		13 (29.5%)	10 (11.0%)
Severe HPT (SBP ≥ 180 and/or DBP ≥ 110)		1 (2.3%)	5 (5.5%)
Mean	SBP	142.1 ± 16.4	138.9 ± 19.3
	DBP	82.8 ± 10.3	80.8 ± 8.9
Blood pressure (6-month)			
Normal (SBP <130 and/or DBP <85)		5 (11.4%)	19 (20.9%)
High-normal (SBP 130-139 and/or DBP 85-89)		20 (45.5%)	34 (37.4%)
Mild HPT (SBP 140-159 and/or DBP 90-99)		17 (38.6%)	23 (25.3%)
Moderate HPT (SBP 160-179 and/or DBP 100-109)		2 (4.5%)	11 (12.1%)
Severe HPT (SBP ≥ 180 and/or DBP ≥ 110)		0 (0%)	4 (4.4%)
Mean	SBP	134.2 ± 10.1	136.8 ± 18.5
	DBP	80.5 ± 7.8	79.1 ± 8.41

CCCP: Comprehensive Chronic Care Programme; DBP: diastolic blood pressure; HPT: hypertension; SBP: systolic blood pressure;

Note: "Normal" patients were patients diagnosed with hypertension and adequately treated such that the blood pressure falls within the "normal" blood pressure definition; likewise for the other categories.

TABLE VI: THE CHANGE IN CONTROL OF BLOOD PRESSURE AT 6 MONTHS

Change in control of blood pressure (6-month)	CCCP	Non-CCCP
Improvement	24 (54.5%)	40 (44.0%)
Status quo	15 (34.1%)	25 (27.5%)
Deterioration	5 (11.4%)	26 (28.6%)

($P = 0.27$)

Non-CCCP Group:

A similar comparison was made with the 91 patients who had hypertension and diabetes in the non-CCCP Group. There were 38 CAT 3 and 53 CAT 4 patients. Their mean baseline BP was: SBP = 138.9 ± 19.3 mm Hg and DBP = 80.8 ± 8.9 . At the end of 6 months, the SBP was 136.8 ± 18.5 mm Hg and DBP was 79.1 ± 8.4 mm Hg. The average decrease after 6 months for SBP and DBP was 2.1 mm Hg and 1.7 mm Hg, respectively. There were 40 (44.0%)

patients who recorded an improvement in their control of BP, 25 (27.5%) remained in status quo while 26 (28.6%) patients showed deterioration (Table VI).

Both the CCCP and non-CCCP groups who had diabetes with hypertension showed some clinical improvement in blood pressure control. However, there was no statistically significant difference in the response to intervention between the 2 groups ($P = 0.27$).

Discussion

The CCCP is a disease management programme with appropriate resources for the good control of patients with diabetes mellitus, hypertension and hyperlipidaemia. It provides a systematic, comprehensive and team-based approach to managing patients with these 3 chronic conditions which together account for 80% to 90% of all chronic conditions seen in the polyclinics. Clinical pathways and guidelines are utilised by having them embedded in structured clerking notes to prompt the doctors. This is especially useful for junior doctors who just joined the polyclinics and may not be familiar with the clinical guidelines.

At the end of 6 months of monitoring, the study shows that a higher proportion of patients in the CCCP managed to achieve lower levels of HbA1c compared to those not in the CCCP. There was an average 2-point decrease in HbA1c in the CCCP group after 6 months. No significant difference in average HbA1c was recorded in the non-CCCP group.

The CCCP group had many more patients newly diagnosed with diabetes than the non-CCCP group. Patients with newly diagnosed diabetes tend to be easier to manage (with respect to glycaemic control) than patients with diabetes for a few years. Therefore, comparisons were made between 'new' patients (defined as patients with diagnosis made within 6 months at time of enrolment) and 'old' patients (diagnosis made more than 6 months ago) enrolled in the CCCP. The findings show that both the 'new' and the 'old' patients in the CCCP showed significant improvements in HbA1c after 6 months into the programme but there was no statistical difference in the HbA1c improvements made between these 2 groups ($P = 0.58$).

Based on the Diabetes Control and Complications Trial (DCCT) and the more recent UK Prospective Diabetes Study (UKPDS), a 1% decrease in absolute HbA1c value correlates to a 35% to 60% reduction in risk for microvascular complications. Patients with optimal control of HbA1c levels have been shown by major studies (e.g. UKPDS) to have significantly reduced risk of developing chronic microvascular complications and the resulting end-organ damage. The converse is true for patients with poor control.^{4,5,8,9}

As for control of hypertension, although some improvements in blood pressure were recorded in both the CCCP and non-CCCP groups, there was however no statistical difference between the clinical improvements registered by both groups. There are a few limitations to note where blood pressure measurements are concerned. The measurement of blood pressure was taken by different doctors at CCK polyclinic using different sphygmomanometer sets. There was therefore operator and machine variability when blood pressure readings were taken. Blood pressure is also highly labile and subject to diurnal variation. This is unlike the HbA1c measurement which was done by the same laboratory at CCK and not subject to diurnal variation. It is also possible that the doctors may not be following the protocol in treating patients' blood pressure. An audit of the casenotes of patients on the CCCP would throw light on this issue. If the audit shows that the doctors are not following the protocol guidelines, then a feedback session with the doctors would be warranted. If need be, changes will be made to the clinical protocol. The paper-based casesheet is still being fine-tuned based on feedback from the end-users to make it more user-friendly. The most common complaint from the doctors was that the casesheet was onerous to use. It is hoped that this problem would be alleviated when the electronic medical records system is implemented in the polyclinics.

Hypertension is a major risk factor for all cardiovascular diseases and occurs frequently in individuals with diabetes. The co-existence of diabetes and hypertension is important, as they are multi-replicative risk factors for microvascular and macrovascular complications. The Hypertension Optimal Treatment (HOT) study has demonstrated significant reduction in cardiovascular morbidity and mortality with aggressive control of blood pressure and this effect is particularly beneficial in diabetic patients.¹⁰ Evidence from the UKPDS showed that tight blood pressure control was associated with a significant reduction in heart failure, stroke, microvascular complications and diabetes-related deaths.⁵ The American Diabetes Association, 1999 World Health Organisation-International Society of Hypertension (WHO-ISH) guidelines and Joint National Committee VI Report recommend intensive BP control in people with diabetes to maintain a BP below 130/85 mm Hg.^{4,11}

It is increasingly being recognised that adequate co-involvement of the medical team, the patient, and the family is important in effective management of diabetes mellitus. Clinical trials have demonstrated that healthcare systems that use nurses and other non-physician personnel as case managers and those with telephone-based contact are efficacious in improving glycaemic control, blood

pressure and lipid levels.¹² A key element in the success of the Diabetes Control and Complications Trial (DCCT) was the frequent clinic visits involving nurses and dieticians, and the extensive telephone access to these healthcare practitioners afforded to patients in the extensive intervention group in which HbA1c remained low throughout the study.

Availability of support, such as that provided by case managers in the CCCP, appears to be a major factor that contributes to adherence by diabetic patients to such behaviours as following a diabetic diet, taking prescribed medications, checking blood glucose and checking their feet.¹² Having more time allocated to the doctor and case manager to see each patient in the CCCP is a key feature of the programme. The doctor will be able to have more time to manage the complicated CAT 3 and 4 cases. The case manager will be able to customise the patient-education and counselling to suit the patient's needs. In the team-based approach of the CCCP, the most important person is the case manager. She spends more time with the patient and also actively tracks and recalls patients who default on follow-up. The case managers are critical in ensuring that the various components of care are done (e.g., foot screening, diabetic retino-photography) and helping patients stick to management plans.

Several limitations were found in this study. The key limitation of the study was its design. As enrolling patients randomly into the CCCP and non-CCCP groups could not be carried out in the natural setting of patient care in the polyclinic, it was not feasible to use the true control group, pretest-posttest design to assess the efficacy of the CCCP. The non-equivalent control group, pretest-posttest design was therefore used to evaluate CCCP's effectiveness, i.e. whether the CCCP was working as intended. Additionally, as discussed, blood pressure readings are subjected to variability in the operator and the sphygmomanometer used. Besides, it is also highly labile and subject to diurnal variation. It is premature to evaluate process indicators such as the number of diabetic foot screenings and diabetic retino-photography done after 6 months of follow-up. Similarly, repeat LDL-cholesterol tests were not due yet at the end of 6 months for many cases. Further evaluation of the programme could include the effectiveness of the CCCP with respect to hyperlipidaemia control as well as the issue of cost-effectiveness.

Conclusion

CCCP, a disease management programme, is effective for good control of diabetes mellitus. Providing good cost-effective care for patients with chronic illness is a pressing need in primary health care. It is hoped that the CCCP will help to meet this need to some extent.

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APPENDIX

Name _____

NRIC _____

Date _____

Time _____

FIRST VISIT (after diagnosis of DM / HT / Dyslipidaemia) (please circle)**Doctor (Name** _____ **Signature** _____)**Checklist :** (tick if done)**History**

1) Exclude secondary causes

DM ☐HT ☐Dyslipidaemia ☐

2) Explain diagnosis

☐☐☐

3) Explain natural history

☐☐☐

4) Check risk factors (pg. 1)

☐☐☐**Physical Examination**

1) Blood pressure _____ mmHg

2) Cardiovascular exam. ☐ Normal☐

Abnormal (to specify) _____

3) Chart findings of gross inspection of DM feet.

☐

4) Do fundoscopy if eye complaints present.

☐

5) Patients with severe hypercholesterolaemia:

look for xanthoma. Beware of acute

pancreatitis in patients with TG >> 5 mmol/L

Alert registrar.

☐**Investigations / Management**

1) Order DRP

☐

2) Order tests

DM panel

☐

HT panel

☐

TFT, UFEME*

☐

BGL, LFT**

3) Dietary advice

☐☐☐

4) Refer Nurse Educator / workshop

☐☐

5) Review in 2-4 weeks except for patients with mild hyperlipidaemia but without CAD risk factor who can be seen in 3-4 months' time.

☐☐☐**DM NOTE:**

- Refer to A+E if HHNK or DKA.
- Inform registrar or above if suspected Type 1 DM.
- Otherwise review in 2-4 weeks for stable Type 2 DM patients.

HT NOTE:

Inform registrar or above if patient has symptoms suggestive of malignant hypertension.

DYSLIPIDAEMIA:

Inform registrar or above if patient is suspected to have familial hypercholesterolaemia or familial hypertriglyceridaemia.

* Exclude secondary causes e.g. hypothyroidism and nephrotic syndrome if TC >8 mmol/L or LDL >4.5 mmol/L.

** Do BGL if opportunistic screen has not been done prior to diagnosis to dyslipidaemia.

Do LFT for patients (e.g. those with 2 CAD risk factors) for whom you are likely to initiate drug treatment early.

APPENDIX

FIRST VISIT (after diagnosis of DM / HT / Dyslipidaemia)

Date _____

Free text if any (Dr)	Diagnoses	Medication

Dr's appt :

Date _____

Time _____

Nurse Educator (Name _____ Signature _____)

Health Education topics : (tick if done)	DM	HT	Dyslipidaemia
1) Further discussion on natural history and complications	☐	☐	☐
2) Dietary counselling	☐	☐	☐
3) Regular exercise	☐ *		
4) Check / chart BMI Maintain ideal weight	☐ *		
5) Stop smoking	☐ *	*common for all 3 conditions	
6) Advise to buy glucometer	☐		
7) Issue pamphlet / booklet on care of DM / HT / dyslipidaemia	☐	☐	☐

Free text if any (nurse)

DM / HT / Dyslipidaemia workshop: (please circle)	DRP appt:
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