Glycemic control and medication compliance in diabetic patients in a pharmacist-managed clinic in Hong Kong

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Diabetes mellitus is a cluster of metabolic disorders characterized by various degrees of insulin resistance and insulin deficiency that lead to a disturbance in blood glucose homeostasis. In Hong Kong, the age-adjusted prevalence of diabetes was 7.8% in 1990 and 7.3% in 1995.[1,2] Over 30% of patients admitted to the hospital in Hong Kong with stroke, heart failure, acute myocardial infarction, or renal failure requiring dialysis have diabetes as a major contributing factor.[3] The leading causes of death among diabetic patients in Hong Kong are renal failure and cerebrovascular accidents,[4] and some 200 diabetic patients become legally blind every year.[5] According to the government Hospital Authority, diabetes was one of Hong Kong's 10 leading causes of death in 2000. Compelling evidence exists that good blood glucose control leads to a lower frequency of the microvascular and macrovascular complications of diabetes and prevents their progression.[6,7]

In 1993, Cockram et al.[8] found that Hong Kong patients received inadequate information on diabetes. The study identified two major problems: (1) a majority (62%) of those diagnosed with type 2 diabetes mellitus did not have access to programs providing patient education and ideal management of the disease and (2) an alarming proportion (approaching 50%) of patients with diabetes were not sufficiently informed about the risk of complications, such as diabetic retinopathy. In response, a pharmacist-managed compliance clinic in a local public hospital implemented a program to monitor and treat diabetic patients. The objective of this study was to evaluate the program's impact on the care of diabetic patients with drug compliance problems.

Methods. At the Pok Oi Hospital, a 622-bed acute care and convalescence hospital in Hong Kong, patients with diabetes receive annual screenings by a nurse for complications. During the screening, the participants are assessed for retinopathy, neuropathy, and nephropathy and for their compliance with drug therapy. Noncompliance is defined as less than 80% compliance with the prescribed regimen, calculated as the number of doses actually taken divided by the number prescribed. The nurse refers noncompliant patients to the pharmacist-managed compliance clinic. The noncompliant patients are sent notices inviting them to a first visit with the pharmacist. The nurse-managed complication-screening clinic and the pharmacist-managed compliance clinic operate simultaneously once a week from 9 a.m. to 5 p.m.

Patients were recruited for the study from February 27, 2001, to February 26, 2002. To be included, patients had to have type 1 or type 2 diabetes mellitus, had to be noncompliant with their medications, had to be 18 years of age or older, had to be physically able to attend the compliance clinic, and had to have acceptable cognitive function. Patients were excluded if they had gestational diabetes or were housebound at nursing or residential homes. Informed consent was obtained from the patients during their first visit with the pharmacist.

Each patient was asked to visit the compliance clinic three times. During the first visit (week 0), the pharmacist used either direct pill counts or questioning to assess the baseline compliance rate. The second visit usually occurred at week 2 and the final visit at weeks 10–12. The reasons for the patients' noncompliance and any problems encountered in

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their therapies were documented. A 15- to 30-minute diabetes education session was arranged for each patient. During the session, the pharmacist obtained a medication history; evaluated drug compliance; provided drug information; educated the patient about diet, exercise, smoking cessation, hypoglycemia, and sick-day management; and monitored adverse drug reactions. Information on monitoring blood glucose and hemoglobin A_{1c} (HbA_{1c}) levels and preventing complications was also presented. The pharmacist gave the patient's physician therapeutic recommendations for achieving the goal of an HbA_{1c} concentration of less than 7%. At the end of the third visit, patients completed a satisfaction questionnaire.

The primary study endpoint was the change in HbA_{1c} levels. Secondary endpoints were the change in compliance rates and patient satisfaction with the service. HbA_{1c} levels and compliance rates were compared between the first (baseline) clinic visit and the third visit. Descriptive statistics were used and continuous data were reported as means and standard deviations. The two-tailed paired *t* test or the chi-square test was used where appropriate. A *p* value of <0.05 was considered significant. Statistical analyses were performed by using Microsoft Excel 1997 (Microsoft Corp., Redmond, WA).

Results. Of 95 diabetic patients recruited, 91 (96%) had complete data for analysis (4 patients did not attend one or both of the follow-up sessions and were excluded from the study). The demographic data are shown in Table 1. Only one patient (1%) had type 1 diabetes mellitus. Most of the patients (83 [91%]) were 41–70 years of age. Only half of the subjects had received secondary or tertiary education.

The noncompliance rate increased from 8% (7 patients) for monotherapy to 31% (28 patients) for triple-drug therapy, although no regression analysis was conducted. The reasons for noncompliance are summarized in Table 2. Forgetfulness was the most commonly cited reason (56 patients [62%]). Among patients who forgot, 52 (67%) forgot to take metformin; 8 (12%), sulfonylureas; 2 (10%), acarbose; and 1

Table 1.
Patient Demographics (*n* = 91)

Characteristic	Value
No. (%) men	44 (48.4)
Duration of diabetes, yr (range)	9 (2–27)
Age, yr (range)	55 (25–75)
Age, no. (%)	
<30 yr	1 (1.0)
30–40 yr	8 (8.8)
41–50 yr	26 (28.6)
51–60 yr	26 (28.6)
61–70 yr	27 (29.7)
>70 yr	3 (3.3)
Education, no. (%)	
None	10 (11)
Primary	34 (37.4)
Secondary	43 (47.2)
Tertiary	4 (4.4)
Comorbidity at baseline, no. (%)	
Retinopathy	32 (35)
Neuropathy	20 (22)
Nephropathy	8 (9)
Hypertension	48 (53)
Dyslipidemia	50 (55)
Other	14 (15)
One or more comorbidities	79 (89)
Body mass index, no. (%)	
<23 (normal weight)	19 (20.9)
23–25 (overweight)	13 (14.3)
>25 (obese)	59 (64.9)
Treatment regimen at baseline, no. (%)	
Sulfonylureas	1 (1.1)
Metformin	10 (10.9)
Acarbose	0 (0)
Sulfonylureas plus metformin	55 (60.5)
Sulfonylureas plus metformin plus acarbose	13 (14.3)
Insulin only	0 (0)
Insulin plus oral hypoglycemic	12 (13.2)
Antidiabetic medicines used per pt., no. (%)	
1 drug	11 (12.0)
2 drugs	66 (72.6)
3 drugs	14 (15.4)
Long-term medicines used per pt., no. (%)	
1 drug	7 (8)
2 drugs	22 (24)
3 drugs	28 (31)
≥4 drugs	34 (37)

Table 2.
Reasons Cited by Patients for Noncompliance (*n* = 91)[a]

Reason	No. Patients (%)
Forgetfulness	56 (61.5)
Adverse effects	23 (25.3)
Wrong belief about treatment	8 (8.8)
Not realizing the treatment had been changed	6 (6.6)
Other	2 (2.2)

[a]Total percentage exceeds 100 because some patients cited more than one reason.

(8%), insulin. Thrice-daily administration was associated with the highest rate of noncompliance (83% [46 patients]), followed by twice-daily dosing (15% [8]) and once-daily dosing (2% [1]). Forty-four (84%) of patients taking a thrice-daily drug forgot to take the second dose; patients missed the first dose and the third dose 9% (5 patients) and 7% (4 patients) of the time, respectively. Patients younger than 40 years had the lowest frequency of forgetfulness (5% [3 patients]), compared with 30% [19], 32% [20], and 32% [20] for the age groups 40–49, 50–59, and ≥60 years, respectively.

The mean ± S.D. HbA_{1c} concentration was 7.43% ± 1.57% at baseline and 7.15% ± 1.33% at the end of the study ($p < 0.005$) (Table 3). Among the 51 patients (59%) with poor glycemic control at baseline (HbA_{1c} concentration, >7%), the mean ± S.D. HbA_{1c} concentration decreased from 8.41% ± 1.42% to 7.71% ± 1.45% ($p < 0.001$). Among the 56 patients (62%) who received only the pharmacist's intervention, without change of treatment by a physician, the HbA_{1c} concentration declined from 7.71% ± 0.98% to 7.36% ± 0.87%, or 0.35% (difference not significant). The mean ± S.D. compliance rate was 41.3% ± 25.6% at baseline and 97.8% ± 8.9% at the end of the study ($p < 0.005$). Most patients were satisfied with the clinic, but satisfaction did not change significantly between the first visit (75 patients [82%] extremely satisfied) and the last visit (86 patients [95%]).

Discussion. Medication noncompliance has a significant impact on morbidity, mortality, and quality of life in diabetic patients.[9-11] Problems with compliance may be related to patient demographics, the complexity of the drug regimen, dosage frequency, adverse effects, or some combination of these. The percentage of noncompliant patients was similar between the sexes in this study. However, patients with more education appeared to have better compliance than those with less education.

It is commonly believed that elderly patients are less adherent to therapy because of declining cognitive function. This was not the case in this study. There are two possible explanations for this. First, older patients are more likely to have disease progression, leading to increased awareness of the illnesses and better motivation to comply with treatment. Second, older patients in Hong Kong often have support from family members or caretakers.

During treatment, diabetic patients may not always understand their disease, and they may forget or misunderstand the instructions given by physicians and pharmacists. Some patients in the study group adjusted the dosage of their medications according to the severity of their hyperglycemic symptoms. Some patients did not even know the purpose of the drugs, while others took their medications at inappropriate times (such as, in the case of acarbose, long before meals). Enhancing patients' medication knowledge could improve compliance. In a study by Raji et al.,[12] 106 patients with HbA_{1c} concentrations greater than 8.5% were randomly assigned to either intensive or passive education. Patients from both groups were found to have substantial improvement in HbA_{1c} levels; thus, an educational intervention was effective, regardless of its intensity.

Noncompliance is a significant barrier to treatment efficacy. We found forgetfulness to be one of the major causes of noncompliance. Other factors included a busy life, polypharmacy, and regimen complexity. To overcome noncompliance due to forgetfulness, the pharmacist adopted a number of strategies, such as providing reminders and pillboxes. Adverse drug reactions were the second largest cause of noncompliance. Some of the adverse effects could be prevented or minimized if the patients followed instructions on how to take their medicine, such as directions for taking metformin on a full stomach instead of before meals.

Diabetic patients often have comorbidities and take many drugs, particularly cardiovascular drugs, laxatives, antigout drugs, and antihyperlipidemia agents.[13] There is evidence that increasing complexity of a regimen leads to difficulty with taking medications as prescribed.[14] Treatment complexity may also disrupt the patient's daily routine. One of the roles of the pharmacist in the compliance clinic was to improve compliance by identifying potential risks of noncompliance and suggesting treatment modifications to physicians.

Limitations of this study include the lack of a control group (it would have been difficult to recruit a control group with demographic characteristics and noncompliant behavior similar to those of the study group) and the small sample, which may not be representative of the diabetic population in Hong Kong. The short duration of the study precludes any conclusions about the possible long-term benefits of this clinical pharmacy service.

Pharmacists can contribute to most aspects of diabetes care, includ-

Table 3.
Compliance and Hemoglobin A_{1c} (HbA_{1c}) Level before and after Visits with Pharmacists (n = 91)

Variable	Mean ± S.D. Value: Baseline (First Visit)	Mean ± S.D. Value: End of Study (Third Visit)	Mean Change
Compliance rate (%)	41.3 ± 25.6	97.8 ± 1.6	56.5[a]
HbA_{1c} conc. (%)	7.43 ± 1.57	7.15 ± 1.33	–0.28[a]

[a] $p < 0.005$, two-tailed paired t test.

ing the provision of education and advice on the use of antidiabetic agents. However, pharmacists are often underutilized as educators in Hong Kong. The patient-to-pharmacist ratio is very high in Hong Kong, so pharmacists' workload is tremendously heavy.

Future studies are needed to assess the long-term benefits, impact on quality of life, and economic impact of a clinical pharmacy service in the management of diabetes patients in Hong Kong and elsewhere.

Conclusion. A pharmacist-managed compliance clinic for diabetic patients in Hong Kong improved glycemic control and compliance.

References

1. Cockram CS, Woo J, Lau E et al. The prevalence of diabetes mellitus and impaired glucose tolerance among Hong Kong Chinese adults of working age. *Diabetes Res Clin Pract.* 1993; 21:67-73.
2. Janus ED, Cockram CS. The prevalence of diabetes mellitus and impaired glucose tolerance in the Hong Kong population. Paper presented at Third International Diabetes Federation Western Pacific Regional Congress. Hong Kong; 1996.
3. Lam KS, Ma JT, Woo E et al. High prevalence of undiagnosed diabetes among Chinese patients with ischaemic stroke. *Diabetes Res Clin Pract.* 1991; 14:133-4.
4. Prevalence of small vessel and large vessel disease in diabetic patients from 14 centres. The World Health Organisation Multinational Study of Vascular Disease in Diabetics. *Diabetologia.* 1985; 28:615-40.
5. Ho PC. Preventing blindness from diabetes. *Asian Med News.* 1993; 17.
6. United Kingdom Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes (UKPD:28). *BMJ.* 1998; 317:703-13.
7. Winberger M, Kirkman MS, Sumsa GP et al. The relationship between glycaemic control and health-related quality of life in patients with non-insulin dependent diabetes mellitus. *Med Care.* 1994; 32: 1173-81.
8. Van Newkirk MR. Blindness and microvascular complications are preventable. *Hong Kong Med J.* 1996; 2:419-24.
9. Krentz AJ. Churchill's pocketbook of diabetes. New York: Harcourt; 2000:156-91.
10. Ennis KJ, Reichard RA. Maximizing drug compliance in the elderly. Tips for staying on top of your patients' medication use. *Postgrad Med.* 1997; 102:211-3,218,223-4.
11. Aburuz SM, McElnay JC, Millership JS et al. Factors affecting self-care activities, postprandial plasma glucose and A1C in patients with type 2 diabetes. *Int J Pharm Pract.* 2002; 10(suppl):R96.
12. Raji A, Gomes H, Beard JO et al. A randomized trial comparing intensive and passive education in patients with diabetes mellitus. *Arch Intern Med.* 2002; 162: 1301-4.
13. Rendell M, Lassek WD, Ross DA et al. A pharmaceutical profile of diabetic patients. *J Chronic Dis.* 1983; 36:193-202.
14. Stewart RB, Craasos GJ. Medication compliance in the elderly. *Med Clin North Am.* 1998; 73:1151-61.