

Adherence to Canadian Diabetes Association Clinical Practice Guidelines for Patients Attending an Outpatient Diabetes Education Centre

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ABSTRACT

Background: Clinical practice guidelines can be a useful tool in the effort to improve patient outcomes.

Objective: To determine the percentage of patients attending the Diabetes Education Centre at the Lions Gate Hospital for whom monitoring frequencies, laboratory targets, and medication therapy (as recommended in the 2003 clinical practice guidelines of the Canadian Diabetes Association) were achieved.

Methods: Health records were reviewed for all patients with type 2 diabetes mellitus who were 19 to 69 years of age at the time of their first visit to the Diabetes Education Centre and whose first visit took place in 2004.

Results: Initial monitoring frequencies for hemoglobin A_{1c}, lipid profile, urinary albumin to creatinine ratio, and eye examination were achieved for a high proportion of the 167 patients who met the study criteria (63% to 93%). Recommended laboratory targets for hemoglobin A_{1c} were achieved for a high proportion of patients (93%), but the rate was lower (21% to 44%) for other targets (fasting plasma glucose, blood pressure, low-density-lipoprotein cholesterol, and ratio of total cholesterol to high-density-lipoprotein cholesterol). Less than 60% (25% to 56%) of eligible patients received recommended medications (antihyperglycemic agents, antihypertensive agents, statins, and acetylsalicylic acid).

Conclusions: For most patients, recommendations for initial monitoring were met, but more work is needed to ensure that laboratory targets are achieved, that appropriate medication therapy is initiated, and that the management of cardiovascular risk factors is emphasized.

Key words: type 2 diabetes mellitus, guideline adherence, quality assessment

RÉSUMÉ

Historique : Les guides de pratique clinique peuvent constituer un outil utile pour essayer d'obtenir de meilleurs résultats thérapeutiques.

Objectif : Déterminer le pourcentage de patients utilisant les services du Centre d'éducation sur le diabète de l'hôpital Lions Gate, pour lesquels les fréquences de contrôle, les objectifs de valeurs de laboratoire et le traitement médicamenteux étaient conformes aux Lignes directrices de pratique clinique de 2003 de l'Association canadienne du diabète.

Méthodes : Les dossiers médicaux de tous les patients atteints de diabète de type 2 et qui étaient âgés de 19 à 69 ans au moment de leur première visite en 2004 au Centre d'éducation sur le diabète ont été examinés.

Résultats : Les fréquences de contrôle initiales pour l'HbA_{1c}, le bilan lipidique, le rapport albuminurie/créatininurie et l'examen ophtalmologique (de 63 % à 93 %) ont été respectées chez un fort pourcentage des 167 patients qui ont satisfait les critères d'admissibilité. Le pourcentage de ces patients chez qui ont été atteintes les valeurs de laboratoire recommandées était élevé pour ce qui est de l'HbA_{1c} (93 %), mais bas (de 21 % à 44 %) pour ce qui est des autres valeurs cibles (glycémie à jeun, tension artérielle, cholestérol des lipoprotéines de basse densité, et rapport cholestérol total:cholestérol des lipoprotéines de haute densité). Moins de 60 % (de 25 % à 56 %) des patients admissibles ont reçu les médicaments recommandés (hypoglycémifiants, antihypertenseurs, statines et acide acétylsalicylique).

Conclusions : Les recommandations relativement au contrôle initial ont été satisfaites chez la plupart des patients, mais plus d'efforts devront être consentis pour atteindre les valeurs de laboratoire cibles, amorcer un traitement médicamenteux approprié et accorder plus d'importance à la prise en charge des facteurs de risque cardiovasculaire.

Mots clés : diabète de type 2, observance des lignes directrices, évaluation de la qualité

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INTRODUCTION

Diabetes mellitus affects over 2 million Canadians.¹ Type 2 diabetes accounts for 90% of these cases, and its incidence is increasing dramatically.¹ Complications include cardiovascular disease, stroke, hypertension, dyslipidemia, nephropathy, neuropathy, and retinopathy.² Diabetes and its complications cost the Canadian health care system an estimated \$13.2 billion every year.¹

It has been established that improvements in the management of diabetes can reduce the occurrence and progression of many complications.^{3,5} To provide a framework for the management of diabetes in Canada, the Canadian Diabetes Association (CDA) developed its "Clinical Practice Guidelines [CPGs] for the Prevention and Management of Diabetes in Canada," the most recent version of which was published in 2003.²

Several Canadian studies have assessed adherence to the CDA CPGs. Groups in both Newfoundland and Ontario found poor adherence to the monitoring frequencies and laboratory targets recommended by the CDA in its 1992 CPGs.^{6,7} Likewise, Toth and others,⁸ working in Alberta, found poor adherence to laboratory targets and variable receipt of medications recommended in the 1998 version. More recently, a national study also reported poor adherence to the 1998 laboratory targets.⁹

In contrast to this evidence of poor adherence, Conway and others¹⁰ found that the laboratory targets outlined in a draft of the CDA's current (2003) CPGs were, in fact, attainable in practice.

A quality assessment of adherence to current practice guidelines for patients attending the Diabetes Education Centre at the authors' hospital has not previously been performed. Lions Gate Hospital is a 246-bed community acute care facility in North Vancouver, British Columbia. The hospital's Diabetes Education Centre is an outpatient facility serving a population of 169 000. Each year, patients newly diagnosed with type 2 diabetes are referred by a general practitioner or an endocrinologist to attend a series of 5 educational sessions that span 20 months (Appendix 1). The Diabetes Education Centre is staffed by nurses and dietitians who educate patients, document progress at each session, and send feedback to physicians (by fax) when necessary. A lifestyle consultant and a pharmacist each provide an educational lecture to patients.

The objective of this study was to determine the percentage of patients for whom monitoring frequencies, laboratory targets, and medications, as recommended in

the 2003 CPGs of the CDA, were achieved. To the authors' knowledge, no other studies have measured adherence to the 2003 CPGs since their publication, and none have comprehensively assessed all 3 of the aforementioned sets of outcomes with respect to any version of the CDA's CPGs.

METHODS

This quality assessment was performed at the Diabetes Education Centre of Lions Gate Hospital. The study was approved by the University of British Columbia Clinical Research Ethics Board.

The primary quality indicator was the 2003 version of the CDA CPGs.² However, CPGs may lack explicit guidance for evaluating implementation of various recommendations, such as which targets are most crucial.¹¹ Therefore, a second quality indicator, the Quality Indicator Set for Diabetes, was also used.¹² This guide for assessing the quality of diabetes care within health care systems was created by the Canadian Consensus for Standardized Evaluation of Quality Improvement Interventions in Type 2 Diabetes and is intended to be used in conjunction with the 2003 CPGs of the CDA.¹¹ For the purposes of this study, it was used to assist in selecting which CDA recommendations would be reported (Table 1). Specifically, patient results related to CDA recommendations were reported if those recommendations were reiterated in the Quality Indicator Set for Diabetes and the data were available.

This study involved a review of health records. Consecutive patients were identified and included if they had type 2 diabetes, were 19–69 years old, and had attended a session 1 class at the Diabetes Education Centre between January 1 and December 31, 2004. Potential participants were excluded if they had died during the study period. Patient data were collected up to and including February 14, 2006.

Three sets of outcomes were determined: (1) the percentage of patients for whom CDA-recommended monitoring frequency was achieved for hemoglobin A_{1c}, lipid profile, urinary albumin to creatinine ratio, and eye examination; (2) the percentage of patients for whom CDA-recommended laboratory targets were achieved for fasting plasma glucose, hemoglobin A_{1c}, blood pressure, low-density-lipoprotein (LDL) cholesterol, and the ratio of total to high-density-lipoprotein (HDL) cholesterol; and (3) the percentage of eligible patients who received CDA-recommended medications, specifically antihyperglycemic agents, antihypertensive agents, statins, and acetylsalicylic acid.

Table 1. Summary of Recommendations of the 2003 Clinical Practice Guidelines of the Canadian Diabetes Association

Parameter	Recommendation
Monitoring	
Hemoglobin A _{1c}	Once every 3 months
Lipid panel	Once at baseline
Urinary albumin to creatinine ratio	Once at baseline, then once yearly
Eye examination	Once at baseline, then once every 2 years
Laboratory targets	
Fasting plasma glucose	4–7 mmol/L within 2–3 months*
Hemoglobin A _{1c}	≤ 7.0% within 6–12 months†
Blood pressure	Systolic < 130 mm Hg, diastolic ≤ 80 mm Hg‡
LDL cholesterol	< 2.5 mmol/L‡
Ratio total cholesterol to HDL cholesterol	< 4‡
Medications	
Antihyperglycemic agent	If fasting plasma glucose > 7 mmol/L within 2–3 months*
Antihypertensive agent	If blood pressure ≥ 130/80 mm Hg§
Statin	If LDL cholesterol ≥ 2.5 mmol/L§
Acetylsalicylic acid	If atherosclerotic risk factors present¶

HDL = high-density lipoprotein, LDL = low-density lipoprotein.

*Reported as fasting plasma glucose level within 3 months.

†Reported as hemoglobin A_{1c} ≤ 7% within 12 months.

‡Based on most recent measurement available during study period.

§Reported at any time during study period.

¶Defined as Framingham 10-year risk score ≥ 10%.

Table 2. Definition of Time Frames

Recommended Time Frame	Defined Time Frame, Including Grace Period
Baseline	3 months before to < 1 month after session 1*
3 months	1 month to < 4.5 months after session 1
6 months	4.5 months to < 9 months after session 1
12 months	9 months to < 15 months after session 1
18 months	15 months to < 21 months after session 1
24 months	21 months to < 27 months after session 1

*Session 1 refers to the first day the patient attended the Diabetes Education Centre.

Within each patient's health record, the date of diagnosis of type 2 diabetes was collected from the physician's referral form. Laboratory results were available for use in this study if they had been gathered and recorded by staff of the Diabetes Education Centre. If more than one set of laboratory results was available for any given time frame, the most recent set was used. Smoking, alcohol use, exercise, medications, eye examinations, and comorbidities were self-reported by the patient and documented in the health record. At each visit to the Diabetes Education Centre, staff also recorded the patient's body mass index and blood pressure, as well as information about any issues that had been addressed during the visit.

All dates were calculated from the patient's first visit to the Diabetes Education Centre. If a CPG recommendation stated that a target was to be achieved within a

specific span of time (e.g., hemoglobin A_{1c} < 7.0% within 6–12 months), we determined if the target had been achieved at the shortest time point (6 months in the example) or at the longest time point (12 months in the example), answered affirmatively if it had been achieved at either time point, and reported it as having been achieved within the longest time point ("within 12 months" in the example). For each recommended time frame, a grace period was defined to allow for the reality that patient visits cannot always be scheduled on the exact follow-up date and to incorporate clinical judgement (Table 2).

A patient was deemed to meet the criteria for "atherosclerotic risk factors" if the calculated Framingham 10-year risk score for coronary heart disease was 10% or more.¹³ Metabolic syndrome was defined as 3 or more of the following risk determinants: fasting plasma



Table 3. Baseline Characteristics of 167 Adult Patients with Type 2 Diabetes Mellitus Attending a Diabetes Education Centre in British Columbia

Characteristic	Sample Size*	No. (%) or Mean \pm SD
Sex (no. and % male)	167	104 (62)
Current smoker	166	30 (18)
Alcohol \geq 1 drink per week	165	99 (60)
Exercise \geq 3 times per week	162	101 (62)
Metabolic syndromet	100	90 (90)
Age on January 1, 2004 (years)	167	53 \pm 9
Days since diagnosis	167	54 (34–162)‡
No. of medical conditions	167	2.4 \pm 1.3
No. of medications	167	3.2 \pm 2.5
Body mass index (kg/m ²)	137	32 \pm 5.6
Fasting plasma glucose (mmol/L)	151	7.7 (7.1–9.9)‡
Hemoglobin A _{1c} (%)	145	7.7 \pm 2.0
Systolic blood pressure (mm Hg)	160	141 \pm 24
Diastolic blood pressure (mm Hg)	160	86 \pm 10
LDL cholesterol (mmol/L)	124	3.1 \pm 1.0
HDL cholesterol (mmol/L)		
Men	91	1.2 \pm 0.7
Women	46	1.3 \pm 0.4
Total cholesterol (mmol/L)	139	5.8 \pm 4.1
Ratio total cholesterol to HDL cholesterol	136	4.8 \pm 1.4
Triglycerides (mmol/L)	137	2.2 (1.5–3.0)‡
Urinary albumin to creatinine ratio (mg/mmol)		
Men	69	1.0 (0–3.2)‡
Women	35	0 (0–1.4)‡
Serum creatinine (μ mol/L)	53	78 \pm 13
Estimated glomerular filtration rate (mL/min)§	53	88 \pm 20

LDL = low-density lipoprotein, HDL = high-density lipoprotein.

*Sample sizes less than 167 indicate missing data.

†Defined as 3 or more of the following risk determinants¹⁴: fasting plasma glucose \geq 6.1 mmol/L, blood pressure \geq 130/85 mm Hg, triglycerides \geq 1.7 mmol/L, HDL cholesterol $<$ 1.0 mmol/L for men or $<$ 1.3 mmol/L for women, waist circumference $>$ 102 cm for men or $>$ 88 cm for women.

‡Median (interquartile range) reported for skewed data.

§Modified Modification of Diet in Renal Disease (MDRD) equation.

glucose \geq 6.1 mmol/L, blood pressure \geq 130/85 mm Hg, triglycerides \geq 1.7 mmol/L, HDL cholesterol $<$ 1.0 mmol/L for men or $<$ 1.3 mmol/L for women, and waist circumference $>$ 102 cm for men or $>$ 88 cm for women.¹⁴

Data were tabulated using Microsoft Excel 2000. The mean and standard deviation were reported for normally distributed data; the median and interquartile range were reported for skewed data.

RESULTS

Of the 349 patients with type 2 diabetes who first visited the Diabetes Education Centre in 2004, 167 (48%) met the inclusion criteria. The other patients were excluded because they did not meet age criteria (140 [40%]), they did not attend a formal Session 1 class (40 [11%]), or they died (causes of death unknown)

(2 [$<$ 1%]). Patients' data were available for a median period of 120 days (range 1–645 days) from their first visit to the Diabetes Education Centre.

Selected baseline characteristics are displayed in Table 3. Of the 167 patients, 104 (62%) were men; their mean age was 53 years, and at the time of first visit to the Diabetes Education Centre, the mean time since diagnosis was 54 days. At baseline, 30/166 (18%) patients were current smokers, 90/100 (90%) had metabolic syndrome, and the mean body mass index was 32 kg/m². Mean fasting plasma glucose, blood pressure, and LDL cholesterol were all above CDA targets.

The first set of outcomes related to achievement of recommended monitoring frequencies. One hundred and fifty-five (93%) of the 167 patients had their hemoglobin A_{1c} monitored at least once within the first 3 months. The proportion decreased to 104/167 (62%)

who had their hemoglobin A_{1c} monitored at least 2 times within the first 6 months and to only 4/89 (4%) who had hemoglobin A_{1c} monitored at least 6 times within the first 18 months. Lipids were measured at baseline in 136 (81%) of the 167 patients. The urinary albumin to creatinine ratio was measured at baseline for 106/167 (63%) patients and within the year after baseline for 71/151 (47%) patients. An eye examination was performed at baseline for 95/119 (80%) patients and within the 2 years after baseline for 25/40 (63%) patients.

The second set of outcomes related to achievement of recommended laboratory targets. Fasting plasma glucose of 4–7 mmol/L was achieved within 3 months for 51 (44%) of 115 patients, and hemoglobin A_{1c} below 7% was achieved within 12 months for 108 (93%) of 116 patients. Blood pressure targets (systolic < 130 mm Hg and diastolic ≤ 80 mm Hg) were achieved for 35 (21%) of 164 patients at the most recent measurement. The most recent LDL cholesterol value was below 2.5 mmol/L in 50 (33%) of 151 patients, and the most recent ratio of total cholesterol to HDL cholesterol was below 4.0 in 54 (34%) of 160 patients.

The final set of outcomes related to receipt of recommended medications by eligible patients. Of the 64 patients with a fasting plasma glucose above 7 mmol/L within 3 months, 36 (56%) received an antihyperglycemic agent. Of the 149 patients with blood pressure of at least 130/80 mm Hg at any time, 67 (45%) received an antihypertensive agent. Of the 117 patients with a LDL cholesterol of at least 2.5 mmol/L at any time, 29 (25%) received a statin. Of the 61 patients with a Framingham 10-year risk score of 10% or greater at any time, 16 (26%) received acetylsalicylic acid.

DISCUSSION

At least 63% of the patients in this study had initial monitoring parameters measured; however, achievement of follow-up monitoring was much lower. The hemoglobin A_{1c} target was achieved for 93% of the patients, but less than 45% of patients achieved other laboratory targets. Less than 60% of eligible patients received recommended medications.

Much controversy surrounds the use of CPGs. Some guidelines do not adhere well to established methodologic standards, and the 2003 CPGs of the CDA in particular have been criticized for possible financial conflicts of interest.^{15,16} Despite this criticism, these guidelines were used as the basis for the study reported here because they represent the current standard for management of diabetes in Canada.

The results reported here concur with previous Canadian studies that evaluated adherence to recommendations for monitoring frequency, laboratory targets, and medication use set out in the 1992 and 1998 versions of the CDA guidelines,^{6,9} as well as a large US study measuring comparable outcomes.¹⁷

It was also of interest to determine how patients at the Lions Gate Diabetes Education Centre fared relative to the general population of patients with diabetes in British Columbia. As part of the BC Ministry of Health's Chronic Disease Management Initiative, the frequency of claims to the Medical Services Plan is reviewed yearly for patients with diabetes.¹⁸ The most recent results of this review (2002/2003) indicate that achievement of provincially recommended monitoring frequencies was variable: 39% for hemoglobin A_{1c}, 78% for lipid profile, 34% for urinary albumin to creatinine ratio, and 43% for eye examination.¹⁹ Although the provincially recommended monitoring frequencies were not specifically measured for the purposes of this study, the comparable monitoring frequencies recommended by the CDA were achieved for 62%, 81%, 47%, and 63% of the patients in this study, respectively. Therefore, although the BC Chronic Disease Management Initiative methodology has not been formally published, it appears that provincially recommended monitoring frequencies were achieved for a greater proportion of patients attending the Lions Gate Diabetes Education Centre than was the case for the general population of patients with diabetes in the province.

Another relevant finding is that the majority of suboptimal results pertained to undermanagement of cardiovascular risk factors. Cardiovascular disease is the primary cause of death among patients with diabetes.²⁰ In the assessment reported here, one-third or fewer of the patients met targets for blood pressure (21%) and lipids (33% for LDL cholesterol, 34% for ratio of total to LDL cholesterol), and fewer than half of eligible patients were receiving antihypertensive agents (45%), statins (25%), or acetylsalicylic acid (26%). These rates of antihypertensive, statin, and acetylsalicylic acid use are similar to those reported in other Canadian diabetes studies.^{21,22} Of particular interest, all 3 of these classes of medications were used less frequently than antihyperglycemics. This finding is in concordance with the findings of Shah and others²² and supports the conclusion of those authors that preventive care for patients with diabetes may be too focused on glycemic control and that the management of other cardiovascular risk factors may be neglected.²²



The CDA's 2003 CPGs recommend use of acetylsalicylic acid (unless contraindicated) for all patients with evidence of cardiovascular disease, as well as those with atherosclerotic risk factors.² Some consider people with diabetes to have the same high risk of myocardial infarction as people without diabetes who have had a previous myocardial infarction.^{23,24} This study used a conservative definition of patients eligible for treatment with acetylsalicylic acid, whereby atherosclerotic risk was defined as a Framingham 10-year risk score of 10% or greater.^{13,25} In fact, the Framingham risk score is not meant to be used for patients with diabetes, as it tends to underestimate the risk of coronary heart disease in these patients.²⁶ In addition, this risk score should only be used to calculate the risk for primary prevention, not secondary prevention. Because the current study was retrospective and because medical history was self-reported, it was impossible to distinguish patients requiring primary prevention of cardiovascular disease from those requiring secondary prevention. Despite these limitations, we chose to define atherosclerotic risk using the Framingham risk score because it has been used to guide therapy with acetylsalicylic acid in other guidelines.²⁷

The suboptimal achievement of target parameters in this study may be multifactorial. Poor adherence to treatment regimens by patients, lack of response to suboptimal laboratory results by health care professionals, and patients' lack of timely follow-up with their physicians may contribute to decreased monitoring frequency and poor achievement of metabolic targets as outlined in the CDA's CPGs. Unfortunately, because of its retrospective design, this study did not reveal the reasons for poor achievement of laboratory targets or failure to receive indicated medications in this patient population. Another design limitation was the lack of a comparator group, which would have allowed exploration of the true impact of the program on achievement of the recommendations. Other limitations included incomplete access to laboratory results, which probably resulted in underestimation of reported frequencies of laboratory monitoring. Self-reporting of medications could have led to underestimation of their use. In particular, use of acetylsalicylic acid may have been underreported, as patients may not consider this drug a "medication" (because of its nonprescription status). The medication histories in the health records often lacked detail, and the indications, doses, start and stop dates, and contraindications were not consistently recorded. Therefore, it was impossible to determine a cause-and-effect relation between laboratory results and

medication changes. Finally, the 2003 CPGs were published just 1 month before the start of the data collection period, so the recommendations might not have been fully implemented at that time.

The main strength of this study was its comprehensive assessment of a broad selection of quality indicators, including monitoring frequencies, laboratory targets, and medication use. It is also, to the authors' knowledge, the only study to date assessing adherence to the 2003 CPGs of the CDA.

The findings of this study have had an impact on the activities of the Diabetes Education Centre. A more detailed medication history will be solicited from patients, which will be facilitated by a revised documentation form. Also, there have been preliminary discussions between the Diabetes Education Centre and the Pharmacy Department with a view to increasing the pharmacist's role within the clinic. Specifically, in addition to the current role of teaching patients about their medications, the pharmacist could play an important role in making recommendations about medications to physicians. Appropriate and timely initiation and adjustment of medications could bridge the gap between monitoring and achieving treatment outcomes. The findings reported here indicate that an emphasis on the management of cardiovascular risk factors may have the greatest impact. Finally, future presentations of these results to local general practitioners and endocrinologists may help to improve outcomes by increasing awareness of gaps in treatment.

In conclusion, the results reported here demonstrate that adherence to the 2003 CPGs of the CDA could be improved for patients attending the outpatient Diabetes Education Centre of the Lions Gate Hospital. Although recommendations for initial monitoring were met for most patients, far fewer achieved laboratory targets or received medications when eligible. An ideal focus for future interventions would be to improve initiation of medications and adjustment of doses, with an emphasis on management of cardiovascular risk factors.

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Appendix 1. Topics for Sessions Presented at the Diabetes Education Centre

Session	Topic
1	Basic knowledge of diabetes (e.g., definition of diabetes, diet, blood glucose monitoring)
2	Advanced knowledge of diabetes (e.g., carbohydrate counting, understanding blood glucose patterns); lifestyle consultant present
3	Complications of diabetes and their prevention (e.g., heart disease, foot care), understanding medications; pharmacist present
4	Review of diabetes management
5	Review of diabetes management

