

# The Kelowna Diabetes Program: Bridging the Gap Between Testing Guidelines and Reality

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## ABSTRACT

### OBJECTIVE

A laboratory-based program is described that assists physicians and their patients with diabetes in meeting Canadian Diabetes Association (CDA) practice recommendations for laboratory testing. The program also supports self-management of diabetes by providing laboratory results directly to patients as well as their physicians.

### METHODS

The program is described in detail, and data from an uncontrolled case series are reported.

### RESULTS

After 5.5 years of operation, 69% of people presumed to have diabetes in the study area of the Central Okanagan, British Columbia (BC), have been registered in the Kelowna Diabetes Program, and 98% of family physicians participate. Program participants are more likely to have laboratory testing at or near CDA-recommended frequencies than both program non-participants and all BC residents with diabetes. Program participants are also more likely to meet CDA targets for glycosylated hemoglobin, low-density-lipoprotein cholesterol and systolic blood pressure than program non-participants.

### CONCLUSIONS

A laboratory-based program that provides people with

## RÉSUMÉ

### OBJECTIF

On décrit un programme en laboratoire qui aide les médecins et leurs patients atteints de diabète à suivre les recommandations de l'Association canadienne du diabète (ACD) concernant les épreuves de laboratoire. Le programme favorise aussi la prise en charge du diabète par le patient en donnant les résultats des épreuves de laboratoire directement aux patients en plus de les donner aux médecins.

### MÉTHODE

Le programme est décrit en détail et des exposés de cas non contrôlés sont présentés.

### RÉSULTATS

Après 5,5 ans d'existence du programme, 69 % des personnes chez qui on soupçonnait un diabète dans la région d'Okanagan Centre, en Colombie-Britannique (C.-B.), étaient inscrites au programme diabète de Kelowna et 98 % des médecins de famille y prenaient part. Les participants sont plus susceptibles que les non-participants et les résidents de la C.-B. de se soumettre à des épreuves de laboratoire selon la fréquence recommandée par l'ACD et d'atteindre les objectifs établis par l'ACD pour les taux d'HbA<sub>1c</sub>, le cholestérol LDL et la pression systolique.

### CONCLUSIONS

Un programme en laboratoire qui permet de donner les résultats directement aux patients et d'établir un horaire pour les épreuves peut accroître la fréquence des épreuves et améliorer le contrôle métabolique si on considère la proportion des résultats qui sont conformes aux objectifs de l'ACD. Une étude indépendante menée par l'autorité provinciale des services de santé de la Colombie-Britannique avec le concours du ministère de la Santé de la Colombie-Britannique est en cours et vise à comparer les résultats cliniques des personnes diabétiques participant au programme et

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diabetes with their own test results and supports a schedule for laboratory testing can lead to improvements in testing frequencies and appears to promote improved metabolic control as measured by the proportion of test results meeting CDA targets. An independent study by the BC Provincial Health Services Authority in conjunction with the BC Ministry of Health is now underway and will compare clinical outcomes for people with diabetes in this program with those for people with diabetes from a similar community in which there is no centrally organized support for diabetes testing.

#### KEYWORDS

Clinical practice guidelines, chronic disease management, direct reporting to patients, self-management of diabetes, supported diabetes care

## INTRODUCTION

Despite the ready availability of guidelines for diabetes management (1,2), a minority of people with diagnosed diabetes meet the glycemic targets recommended by such guidelines (3-5). A recent Canadian study (6) found a significant gap between familiarity with diabetes clinical practice guidelines and their application in clinical practice by family physicians. This is unfortunate, as the literature is rich with evidence of the benefits of regular testing and of meeting targets for various laboratory parameters (7-13). Karter found that glycated hemoglobin (A1C) levels were 0.6% (absolute) lower for those with type 2 diabetes and 1.0% (absolute) lower for those with type 1 diabetes who met American Diabetes Association recommendations for testing frequency compared to those who did not (14). Additionally, Stratton reported a 37% decrease in microvascular complications for every 1% (absolute) reduction in A1C for people with type 2 diabetes (9).

Various approaches have been used to improve diabetes management, employing concepts from chronic disease management models (15). A critical element of all these approaches is the acknowledgment that the patient is both a key stakeholder and a primary decision maker who must take personal responsibility for his/her self-management on a daily basis (16). The importance of regular A1C monitoring for optimal diabetes management is well recognized, and studies have suggested a relationship between patient knowledge of A1C values and improved glycemic control (17,18).

With the prevalence of diabetes now approaching 9% in Ontario (19) and increasing across Canada (20,21), the need for improvements in the management of diabetes has become more urgent. In this paper we describe a program created and administered by Valley Medical Laboratories, a community laboratory in Kelowna, British Columbia (BC), that assists people with diabetes and their physicians in meeting Canadian Diabetes Association (CDA) recommendations for laboratory testing.

ceux des personnes diabétiques d'un milieu semblable mais dans lequel il n'y a pas d'appui organisé pour les épreuves de laboratoire.

#### MOTS CLÉS

Lignes directrices de pratique clinique, prise en charge à long terme, résultats donnés directement aux patients, prise en charge du diabète par le patient, soins diabétologiques assistés

## METHODS

### Program description

Program participants are more likely to have laboratory testing at or near CDA-recommended frequencies than both program non-participants and all BC residents with diabetes. Program participants are also more likely to meet CDA targets for glycated hemoglobin, low-density-lipoprotein cholesterol and systolic blood pressure than program non-participants. Operation began in January 2002. The program includes a patient registry; a scheduling and reminder process; unique reports for physicians; and reporting of results directly to people with diabetes within 1 week of testing. It serves the Central Okanagan region of British Columbia, a group of communities with a combined population of approximately 162 000 people.

### Registration

Most new patient registrations are initiated by physicians using a laboratory requisition. When patients present to the laboratory in this way, they are registered immediately. Additionally, each year on October 31 and April 30, laboratory results for the preceding 6 months are searched, potential new participants are identified (i.e. not yet registered and appearing to have diabetes based on fasting blood glucose, random blood glucose or A1C results), and a list is sent to the appropriate participating family physician. Based on physician feedback, 1 of 3 scenarios follows for each potential new participant:

1. No physician response: It is anticipated that these individuals will likely be re-identified in subsequent searches.
2. Not appropriate to participate: Participating physicians are provided with recommended exclusion criteria to determine whether individuals are eligible for the program or not. Individuals who are not eligible to participate are classified as non-participants and registered immediately.
3. Appropriate to participate: These individuals are mailed

a package that explains the program, the importance of regular testing, an invitation to participate and instructions on how to get additional information. Depending on patient response, 1 of 3 scenarios then follows:

- a) The patient does not reply. Processing is the same as for #1.
- b) The patient informs the laboratory that he/she does not want to participate. Processing is the same as for #2.
- c) The patient informs the laboratory he/she wants to participate by attending the laboratory in a fasting state and bringing the letter of invitation with him/her. The patient is classified and registered when he/she attends the laboratory.

Although there is no written consent to participate in the program, each potential participant has the choice of whether or not to participate, and consent is considered to be implied when individuals undertake the registration process.

### Database and classification

A field in the laboratory information system (LIS) is reserved for program registration purposes, and this facilitates compilation of reports based on searches within the LIS. A limited number of classifications is used:

1. DP: Participant, use of insulin uncertain
2. DPI: Participant, uses insulin
3. DPNI: Participant, does not use insulin
4. DPNPMD: Patient of a non-participating physician
5. DPRPT: Non-participant by patient choice
6. DPRMD: Non-participant on physician recommendation
7. DPDEC: Deceased
8. DPMVD: Moved away from area

These classifications are grouped for functional data analysis as follows: participants, classifications 1–3; non-participants, classifications 4–6; other, classifications 7, 8.

The DPRMD classification is used when the family physician informs the laboratory that the program is not appropriate for a particular patient. As the program is aimed at long-term management and prevention of complications, participation is generally discouraged by those with a terminal disease, advanced medical illness or age > 85 years. Participation by those < 19 years of age is also discouraged, as these individuals usually have parents, a family physician and a pediatrician supervising their management. Additionally, reports to patients flag results that exceed adult targets, and customization to pediatric targets would be difficult.

### Scheduling and testing

Although physicians can specify any testing frequency for their patients, most follow the program defaults based on the 2003 CDA clinical practice guidelines (1). These include A1C every 3 months; blood pressure (BP) at every visit; and lipids, urinary albumin-creatinine ratio (ACR) and verifica-

tion of glucose meter accuracy annually. Each laboratory location has automated BP measuring devices, and laboratory test codes have been created for systolic and diastolic BPs.

If the patient is fasting at the initial visit, all tests are performed. If the patient is not fasting, only the A1C is drawn, and the patient is advised to come fasting at the next visit. At each visit, participating patients are given a card indicating their next testing date, and this is reinforced within 2 weeks when they receive their results by mail.

### Reminder process

Index cards, filed by month, are kept at each laboratory location. When patients attend for testing, their card is marked to indicate the tests done and moved forward to the next appropriate month for that patient's schedule of testing. Participants who attend the laboratory are informed of their next testing month. If a patient fails to attend, his/her index card remains in the file at the end of the month. Before moving these cards forward to the next month, each laboratory location submits a list of "no-shows" to the main laboratory. The main laboratory uses the lists of no-shows to produce a computer-generated reminder letter for each patient. No-shows are given 2 months' grace, so that if the patient has still not attended by the end of the next month, his/her index card is simply moved forward an additional month. If the patient still has not attended by the end of the second month, a new reminder letter, marked "Final Notice" is generated and mailed, and the 2-month grace period repeats. If the patient still has not attended by the end of the second grace period, he/she is reclassified as a non-participant (DPRPT) and the family physician is notified.

### Reports to physicians

Physicians receive standard laboratory reports. In addition, every 6 months they receive a list of their patients identified as potential new participants and a list of their participating patients with an A1C >8% in the preceding 6 months. Annually, in conjunction with the October 31 reports, physicians receive a list of all registered participants and a list of all registered non-participants. These reports are formatted to facilitate feedback and specifically seek information regarding any required changes in classification or testing frequency.

### Reports to patients

Introduced in January 2006, the patient progress report (Figure 1) is perhaps the most significant recent development of the Kelowna Diabetes Program. A patient progress report is generated whenever a new A1C is done for a participating patient, and includes the 2 most recent A1C results, the most recent BP results and the most recent low-density-lipoprotein cholesterol (LDL-C) and total cholesterol/high-density lipoprotein cholesterol (TC/HDL-C) ratio (Figure 1). The report contains explanations of each test

Figure 1. Kelowna Diabetes Program sample patient progress report



## Valley Medical Laboratories

### Kelowna Diabetes Program: Progress Report for Patients

Prepared: April 4, 2008

(Mock data)

Thank you for participating in the Kelowna Diabetes Program. We are pleased to offer you this report of your most recent diabetes tests. This report is intended to help you in understanding where you currently stand, and also to give you goals to reach for in managing your diabetes. We intend to continue sending you updated results following each visit to our laboratory for diabetes testing.

Please review these results with your doctor. Please do not call the laboratory.

EINSTEIN, Albert 105-537 Speedoflight Ave KELOWNA, BC V1Y 6J5	Health Number: 981234567  Dr. BETHUNE, NORMAN
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Complications of diabetes such as heart disease, stroke, kidney failure and blindness can be greatly reduced or even prevented by controlling your "ABC's" (A1C, Blood Pressure, Cholesterol).

Test results that exceed Canadian Diabetes Association recommendations are shown in a shaded box.

If there is no result for any test, that test was not performed in the past year.

TEST	YOUR MOST RECENT TEST		TARGET	COMMENTS
	DATE	RESULT		
<b><u>A1C</u></b>	02-Apr-2008	7.8 %	Less than 7%	At your last visit for diabetes testing on January 3, 2008 your A1c level was: 7.3
<b><u>Blood Pressure</u></b> (Systolic)	02-Apr-2008	128	Less than 130	
<b><u>Cholesterol</u></b> (LDL)	27-Nov-2007	3.6	Less than 2.0	
<b><u>Cholesterol</u></b> (Risk Ratio)	27-Nov-2007	4.5	Less than 4.0	
<b><u>Eye Examination</u></b>	Every person with diabetes should have an eye examination on a regular basis. The laboratory does not do eye examinations. Please discuss this with your doctor.			

**\*\* Your next diabetes tests should be done on or about July 2, 2008. \*\***  
(Unless otherwise specified when you were at the laboratory, or otherwise arranged by your doctor.)

Please come to your usual lab facility at 2-616 KLO Road. An appointment is not required.  
If you will be away at that time, please contact the laboratory (868-3965).

#### Definitions:

#### **A = A1c**

A1c is a special test that measures how well you have managed your blood sugar in the previous 3 months. (What is measured is how much glucose is attached to blood cells.)

#### **B = Blood Pressure**

Blood pressure is usually stated as a number "over" a number, for example 120 "over" 80, or 120/80. The first number is the "systolic" blood pressure, and seems most relevant to diabetes complications, therefore only the systolic blood pressure is provided.

#### **C = Cholesterol**

Two types of cholesterol results are included:

**LDL:** "Low Density Lipoprotein Cholesterol" or "bad cholesterol". Less is best.

**Risk Ratio:** Compares the total amount of cholesterol to the amount of "good cholesterol" (HDL).  
The lower the ratio the better.

and recommended targets, as well as reminders of the next testing date and the importance of an annual eye examination. Results that exceed targets are highlighted. The patient progress report is mailed within 2 weeks of the test date.

## RESULTS

### Registrations

When the program was initiated, the population of the Central Okanagan was approximately 150 000 and the presumed prevalence of diagnosed diabetes in the adult population was 5%. Recent census data reveal that the population has grown to ~ 162 000, and prevalence estimates have increased to 7% (1). Table 1 indicates registrations at December 31 for 2002 to 2006, and part of 2007. As of October 31, 2007, 69% of the estimated 11 340 people presumed to have diabetes in the study area have been registered in the program, and 69% of those participate.

### Physician participation

As of October 31, 2007, of a total of 128 primary care physicians practicing in the study area and providing continuity of care, 125 (98%) actively participated in the program.

### Counts of reminder letters

In the year 2006, of 3402 first reminder letters and 762 second reminder letters were mailed; 256 people responded to

neither and were reclassified as non-participants.

### Frequency and results of testing

Table 2 outlines testing frequency for A1C, lipids, urine ACR and glucose meter accuracy for Kelowna Diabetes Program participants and non-participants, as well as for BC residents overall. The BC data are derived from BC medical services billing data, based on the number of laboratory tests ordered and the number of patients who have had a diagnosis of diabetes in each health authority. Program participants were more likely to have testing at recommended frequencies according to the CDA guidelines.

Direct reporting of laboratory results to participants was introduced in 2006. Table 3 shows how this was associated with increased adherence to the CDA guidelines for A1C testing every 3 months.

Table 4 outlines the percentage of tests meeting CDA targets for participants and non-participants for 2002 and 2006. BP data are available only for program participants. Participants were more likely to meet CDA targets for A1C and LDL-C than non-participants.

Table 5 outlines the percentage of test results meeting targets for A1C and LDL-C in relation to the annual frequency of A1C testing. Program participants having A1C testing at the frequency recommended by the CDA guidelines were more likely to achieve the guidelines' metabolic targets.

**Table 1. Cumulative Kelowna Diabetes Program registrations by year**

	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007*</b>
Total registrations	2493	3712	4792	5990	7020	7825
Participants	1856	2579	3319	4049	4829	5421
Non-participants	621	1092	1390	1841	1995	2126
Other	16	41	83	100	196	278

\*Registrations to October 31, 2007.

**Table 2. People with diabetes having selected laboratory tests done\***

	<b>≥2 A1Cs annually</b>	<b>Annual lipid profile</b>	<b>Annual urine ACR</b>	<b>Annual glucose meter accuracy verification</b>
KDP participants, %	91	80 <sup>†</sup>	77	59
KDP non-participants, %	37	38	32	4
BC residents <sup>‡</sup> , %	44	See notes <sup>†</sup>	44	NA

\*KDP year ending December 31, 2006; BC year ending March 31, 2006

<sup>†</sup>BC reports that 83% of people with diabetes had lipid testing in the 3-year period ending March 31, 2005; 92% of KDP participants had lipid testing in the 3-year period ending December 31, 2006

<sup>‡</sup>BC data received via e-mail from Jemal Mohamed, BC Ministry of Health, October 2007

A1C = glycated hemoglobin  
ACR = albumin-creatinine ratio  
BC = British Columbia

KDP = Kelowna Diabetes Program  
NA = not available

**Table 3. KDP participants having 4 A1C tests per year\* before and after direct reporting**

	<b>2005 (Before direct reporting)</b>	<b>2006 (After direct reporting)</b>
KDP participants having 4 A1Cs in the given year, %	40.6	52.3

\*<5% of non-participants had 4 A1C tests in 2005 or 2006.

A1C = glycated hemoglobin

KDP = Kelowna Diabetes Program

**Table 4. Test results meeting target levels**

	<b>A1C ≤7% 2006 (2002)</b>	<b>LDL-C &lt;2.5 mmol/L* 2006 (2002)</b>	<b>Systolic BP &lt;130 mm Hg 2006 (2002)</b>
KDP participants, %	65 <sup>†</sup> (58)	58 (33)	49 (39)
KDP non-participants, %	55 (58)	48 (35)	NA

\*The LDL-C target was reduced to 2.0 mmol/L as of January 1, 2007.

<sup>†</sup>Of the initial A1Cs done in the program for the 780 new participants in 2006, 53% were ≤7%.

A1C = glycated hemoglobin

LDL-C = low-density lipoprotein cholesterol

BP = blood pressure

NA = not available

KDP = Kelowna Diabetes Program

**Table 5. Test results meeting target vs. frequency of A1C testing\***

	<b>Number of A1C tests in 2006</b>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
A1C ≤7%, %	48	49	59	67
LDL-C <2.5 mmol/L, %	43	48	52	60

\*KDP participants 2006.

A1C = glycated hemoglobin

KDP = Kelowna Diabetes Program

LDL-C = low-density lipoprotein cholesterol

### Cost of the program

In estimating the expense of the program, both direct and indirect costs have been considered. The direct cost of the program to the healthcare system is approximately \$85 per participant per year (assuming 4 visits for A1C, annual lipid profile and urinary ACR, based on the 2007 BC Medical Services Commission Guide to fees). Administration costs of the program (not funded) are estimated at \$20 per participant per year. This includes mailing costs, stationery and administrative/computer analysis staff time at current rates of pay.

### DISCUSSION

Our data indicate improved testing frequency for participants compared with both non-participants and all BC residents, and that a greater percentage of participants met

A1C and LDL-C targets compared with non-participants. However, as the data represent an uncontrolled case series, it is recognized that definite conclusions cannot be drawn. The authors are currently working in conjunction with the BC Provincial Health Services Authority to study clinical outcomes by linking to ministry data and comparing the Central Okanagan with another BC community with similar demographics but no organized testing program.

It is encouraging, given the present emphasis on self-management, that increased adherence to A1C testing was seen after the introduction of direct reporting of results to participants in 2006. Rachmani and colleagues (22) reported that improved glycemic, lipid and BP control results from interventions that encourage patients to actively participate in their own diabetes management. Direct reporting arms patients with much of the information they need to self-manage their disease. Within 2 weeks of having a new A1C test, 100% of Kelowna Diabetes Program participants know not only their most recent A1C, but also their LDL-C, TC/HDL-C risk ratio, systolic BP and previous A1C (with targets and explanations). Anecdotally, patients have enthusiastically welcomed direct reporting of results. In 2006, 65% of A1C test results for participants in the Kelowna Diabetes Program were ≤7%. This is in contrast to 1999 to 2000 United States data that indicated only 11% of people with diabetes knew their A1C levels, and fewer than 37% of A1Cs were <7.0% (4).

Possible factors that have contributed to the success of the program are processes that require a minimum of the practicing physician's time and integrate seamlessly into the day-to-day operation of the laboratory; involvement of

laboratory staff, an advisory group of family physicians and the local diabetes education centre in program planning, development of reports unique to the program and ongoing program modifications; a simple method for tracking patient visits; a 2-letter reminder process, with <10% attrition; and direct reporting to participants.

At present, the program will be continued indefinitely, and planning is underway to expand it to the rest of the service area in the Okanagan.

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## AUTHOR DISCLOSURES

AF has received speaker honoraria from Novo Nordisk, GlaxoSmithKline, Sanofi Aventis, Astra Zeneca, LifeScan and Pfizer.

## AUTHOR CONTRIBUTIONS

DI, DC and AF contributed substantially to the conception, design, analysis and interpretation of the data, and drafted the paper. HT, LG and TF reviewed drafts of the paper and revised it critically for important intellectual content. All authors gave final approval of the version to be published.

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