Clinical Practice Guidelines (CPG) for the Management of Diabetes in Canada
Judi Whiting, BScN, MHSc, CDE Manager, Education and Services Saskatchewan Division, Canadian Diabetes Association

Background
Approximately 5% of Canadians (about 1.5 million) have diabetes and the number is expected to reach 3 million by 2010. Diabetes is the leading cause of coronary artery disease, new cases of blindness and kidney disease in adults. Diabetes is costly both to individuals and society. Newer research has proven that blood glucose control matters: the better the glucose level, the less the microvascular disease. In 1998 the Canadian Diabetes Association (CDA) published updated recommendations for the management of diabetes. These recommendations are evidence-based, referenced and graded according to the level of supporting evidence. The CPG were published in the Canadian Medical Association Journal. Readers can obtain a copy of the CPG through a Division Office of the CDA or by calling the national toll-free number (1-800-BANTING) or through the CDA web-site (www.diabetes.ca)

Classification of Diabetes
In the new classification of diabetes, the terms "insulin-dependent diabetes" and "non-insulin dependent diabetes" are eliminated. The new definitions are not connected to the diabetes treatment.

- **Type 1 diabetes** encompasses diabetes that is primarily a result of pancreatic beta-cell destruction and that is prone to ketoacidosis. This form includes cases due to an autoimmune process and those for which the etiology of beta-cell destruction is unknown

- **Type 2 diabetes** may range from predominant insulin resistance with relative insulin deficiency to a predominant secretory defect with insulin resistance

- **Gestational diabetes** refers to glucose intolerance with onset during pregnancy

Diagnosis
The previous diagnostic criteria (level of fasting venous plasma glucose > 7.8 mmol/L) lacked sensitivity with many people remaining undiagnosed. The diagnostic fasting plasma glucose level has now been **lowered** to 7.0 mmol/L. This level was found to be the best predictor of for the development of microvascular disease.

Two other terms are also used in diagnostic testing: **impaired glucose tolerance (IGT)** and **impaired fasting glucose (IFG)**, see Table 2. The latter is new in these CPG. People with test values in the IGT or IFG ranges are at higher risk to develop diabetes and cardiovascular disease.

**Table 1 - Diagnosis of Diabetes Mellitus**
A confirmatory test must be done on another day in all cases in the absence of unequivocal hyperglycemia accompanied by acute metabolic decompensation. This must be based on laboratory measurements of venous plasma glucose.

- Symptoms of diabetes plus a casual plasma glucose level value > 11.1 mmol/L OR

- A fasting plasma glucose > 7.0 mmol/L OR

- A plasma glucose value in the 2-h sample of the oral glucose tolerance test > 11.1 mmol/L

**Table 2 Glucose levels for diagnosis**

<table>
<thead>
<tr>
<th>Category</th>
<th>FPG</th>
<th>PG 1h after 75-g glucose</th>
<th>PG 2h after 75-g glucose load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>FPG Limit</td>
<td>PG Limit</td>
<td>N/A Limit</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Impaired fasting glucose (IFG)</td>
<td>6.1 — 6.9</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Impaired glucose tolerance (IGT)</td>
<td>&lt;7.0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Diabetes Mellitus (DM)</td>
<td>&gt;7.0</td>
<td>N/A</td>
<td>&gt;11.1</td>
</tr>
</tbody>
</table>

FPG = fasting plasma glucose; PG = plasma glucose; N/A = not applicable
All values are mmol/L

**Metabolic Control and Therapy**

To a large extent the recommendations for metabolic control and therapy are based on the results of two landmark prospective studies about diabetes control and complications. Each is summarized briefly. Control of Type 1 Diabetes - Diabetes Complications and Control Trial (DCCT) The DCCT was a nine-year prospective study with over 1400 individuals with Type 1 diabetes. Half the subjects were enrolled in a standard treatment program (twice-daily insulin injections) while the others were intensively treated (multiple daily insulin injections or insulin pump therapy). The DCCT’s results clearly demonstrated that intensive treatment of individuals with Type 1 diabetes delays the onset and progression of long-term complications in those patients without complications and in those with only early complications. Intensive therapy included not only more frequent doses of insulin per day, but also self-adjustment of insulin according to meal content, exercise activity and glucose levels, frequent dietary instruction and monthly clinic visits.

**Table 3 Effect of Intensive Therapy on Microvascular Complications in the DCCT**

- **Retinopathy (eye disease)**  
  - Reduced clinically meaningful Retinopathy by 34-76% 45% 27%
  - Reduced proliferate retinopathy and laser therapy by
  - Reduced the first appearance of any retinopathy by

- **Nephropathy (kidney disease)**  
  - Reduced microalbuminuria by 35% 56%
  - Reduced clinical grade albuminuria by

- **Neuropathy (nerve damage)**  
  - Reduced clinical neuropathy by 60%

Source: Zinman B, Morrison A, Dupre J

**Control of Type 2 Diabetes - United Kingdom Prospective Diabetes Study (UKPDS)**
The UKPDS was conducted over a 20 year period and involved 5,102 participants with newly diagnosed Type 2 diabetes from 23 different centres. Participants were followed for an average of ten years. The study showed that better blood glucose control in people with Type 2 diabetes reduced overall microvascular complications by 25%. The study also showed that reducing blood pressure reduced the risk of stroke, microvascular complications and diabetes-related mortality. For every percentage decrease in HbA1c, there was a 21% reduction in any diabetes-related endpoint hazard ratio (p<0.001).

The results of the UKPDS, as illustrated in Table 4, have already led to revision of the Canadian Clinical Practice Guidelines.

**Table 4 Main Results of the UKPDS related to blood glucose control**

<table>
<thead>
<tr>
<th>Hemoglobin A1c for every percentage point decrease</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>▪ complications were reduced by</td>
<td>35%</td>
</tr>
<tr>
<td>▪ diabetes-related deaths were reduced by</td>
<td>25%</td>
</tr>
<tr>
<td>▪ all cause mortality was reduced by</td>
<td>7%</td>
</tr>
</tbody>
</table>

**Retinopathy - the relative risk reduction (RRR) was**

| ▪ for retinal photocoagulation                   | 19% |
| ▪ for cataract extraction                        | 24% |
| ▪ for progression of retinopathy over 12 years   | 21% |

**Nephropathy - the relative risk reduction (RRR) was**

| ▪ for the development of microalbuminuria        | 33% |
| ▪ for # patients who doubled their creatinine value over 12 years | 74% |

**Neuropathy - the relative risk reduction (RRR) was**

| ▪ for sensory nerve function deterioration       | 40% |

**Cardiovascular Disease - the relative risk reduction (RRR) was**

| ▪ for development of myocardial infarction       | 16% |
| ▪ for sudden death                               | 53% |

The UKPDS also examined results with a tight blood pressure control policy. These results are equally impressive with a relative risk reduction of 37% for development of microvascular disease; 34% for the progression of retinopathy by 7.5 years; 29% for development of microalbuminuria over 6 years; 44% for fatal or non-fatal stroke.

Canadian clinicians have concluded that results of the UKPDS indicate that:
Physicians must be aggressive in treating both diabetes and hypertension

Oral agents and insulin may need to be added earlier in treatment than previously thought

It is time for all health professionals to treat both diabetes and hypertension aggressively, and for patients with Type 2 diabetes to take their condition more seriously. Patient education and self-management need to be encouraged.

Readers are referred to the CPG for specific information about recommendations for:

- glucose and lipid control
- a stepwise approach to Type 2 diabetes
- recommendations for ongoing monitoring of diabetes and screening for complications

**Nutrition Guidelines**

In 1999 the Canadian Diabetes Association published Guidelines for the Nutritional Management of Diabetes Mellitus in the New Millennium: A Position Statement. This can be downloaded from the CDA web-site [www.diabetes.ca](http://www.diabetes.ca)

"Nutrition management is a key component for the long-term health and quality of life for people with diabetes. The general principles for nutrition recommendations are the same for people with diabetes as those without the condition. However, it is important that the health care team work with people with diabetes in setting realistic goals that meet the individual’s micro- and macro-nutrient, physical activity, lifestyle and medical needs. The registered dietitian is a key member in assisting the individual in reaching these goals.

Attaining and maintaining blood glucose and lipid levels as near normal as possible and preventing and/or treating diabetes-related complications and any concomitant conditions is vital to maintaining the physiological health of people with diabetes. Registered dietitians are referred to the 1998 Clinical Practice Guidelines for the Management of Diabetes in Canada for guidance."

**Summary**

The CDA’s Clinical Practice Guidelines are the first evidence-based clinical guidelines for diabetes to be published in the Americas. A shared team approach to care is promoted. The implementation of the CPG will lay a foundation for significant improvement in the metabolic control of diabetes and the quality of life for those affected by diabetes.