Building Healthy Lifestyles
Vascular Protection
Diabetes
Clinical Guide
We would like to acknowledge the contribution of the following groups:

- Vascular Protection Interdisciplinary Working Groups
- Chronic Disease Physician Advisory Group
- Chronic Disease Clinical Leadership Group
- Specialist Consultants
- Vascular Protection Clinical Champions
- CHR Diabetes Advisory Group

Utilizing the Chronic Care model, these groups developed the Vascular Protection: Type 2 Diabetes Clinical Guide as a decision-support tool for improved functional and clinical outcomes. This Guide supports primary care interdisciplinary team-based practice with a strong focus on self-management.

Please use and reproduce with acknowledgements to the Chinook Health Region.

Chronic Disease Management and Prevention Network
An Alberta Health Capacity Building Initiative

Chinook Health Region
Lethbridge, AB
April 2006
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1. Diagnosis

a. Definition

Diabetes mellitus: is a metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, impaired insulin action or both.

b. Risk Factors

Some prescription medications may also increase an individual’s blood glucose levels and may, in combination with the other risk factors, place the individual at an increased risk for developing diabetes. These prescription medications are included in the following table:

### Risk Factors for Type 2 Diabetes

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 40 years</td>
<td></td>
</tr>
<tr>
<td>First-degree relative with diabetes</td>
<td></td>
</tr>
<tr>
<td>Member of high-risk population (e.g. people of Aboriginal, Hispanic, South Asian, Asian or African descent)</td>
<td></td>
</tr>
<tr>
<td>History of IFG (Impaired Fasting Glucose) or IGT (Impaired Glucose Tolerance)*</td>
<td></td>
</tr>
<tr>
<td>Presence of complications associated with diabetes</td>
<td></td>
</tr>
<tr>
<td>Vascular disease *</td>
<td></td>
</tr>
<tr>
<td>History of GDM (Gestational Diabetes Mellitus)</td>
<td></td>
</tr>
<tr>
<td>History of delivery of a macrosomic infant ( &gt; 4 kg or approximately 9 lbs)</td>
<td></td>
</tr>
<tr>
<td>Hypertension* (Blood Pressure ≥ 140/90)</td>
<td></td>
</tr>
<tr>
<td>Dyslipidemia*</td>
<td></td>
</tr>
<tr>
<td>Obesity* (Body Mass Index-BMI- ≥ 30kg/m²)</td>
<td></td>
</tr>
<tr>
<td>Abdominal obesity* (Waist Circumference for men ≥ 102 cm/40 or women ≥ 88cm/35 in)</td>
<td></td>
</tr>
<tr>
<td>Polycystic ovary syndrome* (characterized by amenorrhea, hirsutism and infertility)</td>
<td></td>
</tr>
<tr>
<td>Acanthosis nigricans* (a darkening of the skin's pigments especially noted on the neck and axilla areas)</td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td></td>
</tr>
</tbody>
</table>

* High dose Thiazides (25mg) are associated with hyperglycemia

Other possible medications are: phenytoin, lithium, growth hormones, thyroid hormones, dobutamine, barbiturates, smoking, diltiazem, rifampin, and protease inhibitors.

### Prescription Medications That May Increase Blood Glucose Levels

<table>
<thead>
<tr>
<th>Medication</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atypical Antipsychotics (Clozapine)</td>
<td>↓ Insulin secretion; Weight gain</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>↓ Insulin secretion; ↓ Insulin sensitivity</td>
</tr>
<tr>
<td>Diuretics (Thiazides* and Loop)</td>
<td>↓ Insulin secretion; ↓ Insulin sensitivity</td>
</tr>
<tr>
<td>Glucocorticoids</td>
<td>↑ Gluconeogenesis; ↓ Insulin sensitivity</td>
</tr>
<tr>
<td>Nicotine Acid (Niacin)</td>
<td>↓ Insulin sensitivity</td>
</tr>
<tr>
<td>Oral Contraceptives</td>
<td>↓ Insulin sensitivity</td>
</tr>
<tr>
<td>Sympathomimetics</td>
<td>↑ Gluconeogenesis</td>
</tr>
<tr>
<td>Estrogen Containing Compounds</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

* Metabolic Syndrome is diagnosed when 3 or more of the risk determinants are present. They are: **Fasting Plasma Glucose (FPG) ≥ 6.1 mmol/L, B.P. ≥ 130/85, Triglycerides (TG) ≥ 1.7 mmol/L, High Density Lipoprotein (HDL): men < 1.0 mmol/L and women < 1.3 mmol/L** and **Abdominal obesity**: Waist Circumference for men ≥ 102 cm/40 in OR women ≥ 88cm/35in.
1. Diagnosis

There are also some over-the-counter medications that are associated with hyperglycemia and may interfere with glucose levels. They are outlined as follows:

<table>
<thead>
<tr>
<th>Over-the-counter Medications That May Affect Blood Glucose Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeine</td>
</tr>
<tr>
<td>Ephedrine, epinephrine</td>
</tr>
<tr>
<td>Phenylephrine</td>
</tr>
<tr>
<td>Phenylpropanolamine</td>
</tr>
<tr>
<td>Sugar</td>
</tr>
<tr>
<td>Vitamin B</td>
</tr>
<tr>
<td>Vitamin C</td>
</tr>
</tbody>
</table>

**c. Screening for Type 2 Diabetes**

**Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT)**

Every 3 years for individuals ≥ 40 years of age with no other risk factors. Earlier and/or more frequently for individuals < 40 years of age with risk factors and as clinically indicated in individuals ≥ 40 years of age with other risk factors.

**Obese children ≥ 10 years of age** should be considered for screening for type 2 diabetes every 2 years using Fasting Plasma Glucose (FPG) test if they meet 2 of the following criteria:

- member of a high-risk ethnic group
- family history of type 2 diabetes, especially if the child was exposed to diabetes in utero
- acanthosis nigricans
- PCOS
- hypertension
- dyslipidemia

An Oral Glucose Tolerance Test (OGTT) may also be considered as a screening test in this population.

Ideally, in order to diagnose diabetes, the “gold standard” is to use the 75g OGTT. However, there is a rare group of individuals who may not be able to tolerate such a test. In these cases, a meal of 75g carbohydrate may be optional. The following is a sample meal of a 75g carbohydrate load:

**Breakfast:**
- 2 slices of toast
- 1 tbsp honey
- 1 cup milk
- 1 small orange

**Lunch:**
- 1 pita
- sliced beef, cheddar cheese and lettuce (optional)
- 1 cup carrot sticks
- 1/3 cup apple juice
- 3/4 cup diet yogurt

**d. Signs and Symptoms**

Severe symptoms of hyperglycemia may include:
- Polyuria
- Polydipsia
- Weight loss
- Polyphagia

Subtle symptoms of hyperglycemia may include:
- Fatigue / weakness
- Blurred vision
- Impaired healing of wounds, cuts and infections
- Pain, numbness and tingling
- Itchy skin
- Nausea, vomiting and abdominal pain
- No symptoms

Not all individuals with diabetes have obvious symptoms of the disease. There are many people who have undetected diabetes for several weeks, months or years because they experience such subtle symptoms, which could be attributed to the natural aging process or other chronic conditions. Therefore, it is no wonder that “up to 2.7% of the general adult population have undiagnosed type 2 diabetes” (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003: S10).

**e. Testing and Evaluation**

- Fasting Plasma Glucose (FPG)
- CPeptide and insulin levels to determine type 1 and type 2 diabetes

**f. Further Testing**

- Referral to internal medicine, diabetes specialist if diagnosis is uncertain
1. Diagnosis

Diabetes

**g. Algorithm**

*In the absence of other risk factors, a Fasting Plasma Glucose (FPG) of 5.7–6.0 mmol/L does not require further investigation, except routine screening at appropriate intervals.*

*A confirmatory laboratory glucose test (FPG, casual Plasma Glucose (PG), or a 2hPG in a 75-g Oral Glucose Tolerance Test (OGTT)) must be done on another day in all cases in the absence of unequivocal metabolic decompensation.*

2hPG = 2-hour Plasma Glucose
CVD = Cardiovascular Disease
FPG = Fasting Plasma Glucose
IFG = Impaired Fasting Glucose
IGT = Impaired Glucose Tolerance
OGTT = Oral Glucose Tolerance Test
PG = Plasma Glucose

Adapted from Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003: S11.
2. Classification/Type/Staging

a. Stages/Types of Disease

Classification of Diabetes

- **IFG (Impaired Fasting Glucose)** is a practical term for “prediabetes” and places the individual at risk of developing diabetes and its complications. The term refers to a metabolic stage intermediate between normal glucose homeostasis and diabetes. The individual’s fasting blood glucose levels would be between 6.1-6.9 mmol/L.

- **IGT (Impaired Glucose Tolerance)** is a practical term for “prediabetes” and places the individual at risk of developing diabetes and its complications. The term refers to a metabolic stage intermediate between normal glucose homeostasis and diabetes. The individual’s two hour plasma glucose levels would be between 7.8 -11.0 mmol/L.

- **Type 1 Diabetes** is primarily the result of pancreatic beta cell destruction and is prone to ketoacidosis. An autoimmune process is often involved, but the etiology of the 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 Mellitus** is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.
## TYPES OF DIABETES – KEY CHARACTERISTICS

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type 1 Diabetes</th>
<th>Type 2 Diabetes</th>
<th>Gestational Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% of Diabetes Cases</td>
<td>90% of all Diabetes Cases</td>
<td>Approximately 4% of Non-Aboriginal Pregnancies</td>
<td></td>
</tr>
</tbody>
</table>

### Overview
- **Type 1 Diabetes**: Autoimmune process destroys the beta cells of the pancreas. Very little or no insulin secreted. Prone to diabetic ketoacidosis (DKA).
- **Type 2 Diabetes**: A combination of one or more of the following may occur:
  - Insulin resistance
  - Delayed insulin response
  - Decreased insulin secretion
  - Increased hepatic glucose output
- **Gestational Diabetes**: Pancreas is unable to produce enough insulin to overcome insulin resistance caused by placental hormones.

<table>
<thead>
<tr>
<th>Age of Onset</th>
<th>Usually &lt; 30 years</th>
<th>Usually &gt; 30 years</th>
<th>Usually develops between 24 and 28 weeks of gestation and does not persist postpartum</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Body Type</th>
<th>Usually lean individuals</th>
<th>80% are overweight.</th>
<th>More common in overweight women</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Family History of Diabetes</th>
<th>Seldom</th>
<th>Common</th>
<th>Common</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Symptoms of Onset</th>
<th>Acute, severe, sudden</th>
<th>Subtle, gradual</th>
<th>Asymptomatic</th>
</tr>
</thead>
</table>

### Management
- **Type 1 Diabetes**:
  1. Calculated meal plan or carbohydrate counting
  2. Insulin therapy is essential
  3. Physical activity
- **Type 2 Diabetes**:
  1. Healthy eating and physical activity to promote weight loss and reduce insulin resistance
  2. The addition of antihyperglycemic agents may be required if healthy eating and activity do not achieve goal blood glucose levels
  3. A combination of oral antihyperglycemic agents and/or insulin may be required to achieve blood glucose levels
  4. Type 2 diabetes is progressive and the individual should expect changes in his/her management plan over time (More oral agents and/or insulin only may be required for management)
- **Gestational Diabetes**:
  1. A calculated meal plan and regular physical activity that is suitable for pregnancy are encouraged throughout the pregnancy
  2. Oral antihyperglycemic agents are contraindicated during pregnancy
  3. Insulin therapy may be required if healthy eating and increased activity do not achieve goal blood glucose levels
3. Chronic Disease Patient Care Flowsheet

**Diabetes Patient Care Flow Sheet**

**Comorbid Conditions**

<table>
<thead>
<tr>
<th>Year of Diagnosis</th>
<th>Diabetes Type 1</th>
<th>Diabetes Type 2</th>
</tr>
</thead>
</table>

**Date:**

<table>
<thead>
<tr>
<th>REVIEW ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glycemic Control</strong></td>
</tr>
<tr>
<td>Pre-prandial (4-7)mmol/L</td>
</tr>
<tr>
<td>2-hour Post-prandial (5-10)mmol/L</td>
</tr>
<tr>
<td>A1C ≤ 7.0%</td>
</tr>
<tr>
<td>Hyperglycemic medications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Blood Pressure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>BP ≤ 130/80 mm Hg</td>
</tr>
<tr>
<td>Antihypertensive medications</td>
</tr>
<tr>
<td>ACE/ARB</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Other</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Waist Circ. m&lt;102 cm (40 in)</td>
</tr>
<tr>
<td>f&lt; 88 cm (35 in)</td>
</tr>
<tr>
<td>Lower extremity inspection</td>
</tr>
<tr>
<td>Address smoking, activity</td>
</tr>
<tr>
<td>Nutrition</td>
</tr>
<tr>
<td>Other medications: [ ] ASA [ ] Intolerant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Labor Tests</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk targets: LDL&lt;2.5 mmol/L</td>
</tr>
<tr>
<td>TC:HDL-C&lt;4.0</td>
</tr>
<tr>
<td>Antihyperlipidemic medications</td>
</tr>
</tbody>
</table>

Screen for Microvascular Complications: Type 1 annually ≥ 15 years old with ≥ 5 years tv of DM. Type 2 at diagnosis then every 1 - 2 years or as indicated.

<table>
<thead>
<tr>
<th><strong>Self Management</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foot</strong></td>
</tr>
<tr>
<td>Random albumin/creatinine ratio</td>
</tr>
<tr>
<td>Creatinine clearance (Cockcroft-Gault) or MDRD-GFR</td>
</tr>
<tr>
<td>Serum creatinine</td>
</tr>
<tr>
<td>Refer for dilated eye exam</td>
</tr>
<tr>
<td>Check for loss of sensation 10g monofilament/vibration at great toe Left +/- Right +/-</td>
</tr>
<tr>
<td>Sexual dysfunction</td>
</tr>
<tr>
<td>Anxiety, depression, economic concerns</td>
</tr>
<tr>
<td>Referrals: Education/specialist, etc.</td>
</tr>
<tr>
<td>Vaccinations: [ ] Pneumococcal (once lifetime) [ ] Annual influenza vaccine</td>
</tr>
</tbody>
</table>

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December/04
Clinical assessment and initiation of nutrition therapy and physical activity

Mild to moderate hyperglycemia (A1C <9.0%)
- Overweight (BMI ≥25 kg/m²)
  - Biguanide alone or in combination with 1 of:
    - insulin sensitizer*
    - insulin seretagogue
    - insulin
    - alpha-glucosidase inhibitor

Non-overweight (BMI <25 kg/m²)
- 1 or 2† antihyperglycemic agents from different classes
  - biguanide
  - insulin sensitizer*
  - insulin seretagogue
  - insulin
  - alpha-glucosidase inhibitor

Marked hyperglycemia (A1C ≥9.0%)
- Basal and/or preprandial insulin
- 2 antihyperglycemic agents from different classes†
  - biguanide
  - insulin sensitizer*
  - insulin seretagogue
  - insulin
  - alpha-glucosidase inhibitor

If not at target
- Add a drug from a different class or
  Use insulin alone or in combination with:
    - biguanide
    - insulin seretagogue
    - insulin sensitizer*
    - alpha-glucosidase inhibitor

If not at target
- Add an oral antihyperglycemic agent from a different class or insulin*

If not at target
- Intensify insulin regimen or add:
  - biguanide
  - insulin seretagogue**
  - insulin sensitizer*
  - alpha-glucosidase inhibitor

Timely adjustments to and/or additions of oral antihyperglycemic agents and/or insulin should be made to attain target A1C within 6 to 12 months

THERAPEUTIC NOTES
Key adverse effects
Gastrointestinal upset, loose bowels
- biguanide
Hypoglycemia
- insulin, insulin secretagogues (less with gliclazide, glimepiride, nateglinide and repaglinide than with glyburide)
Edema, fluid retention
- insulin sensitizers, rarely with insulin
Moderate weight gain
- insulin, insulin secretagogues, insulin sensitizers

Key precautions/contraindications
Hepatic disease
- glyburide, biguanide, insulin sensitizers
Significant renal insufficiency
- biguanide, sulfonylureas
Significant cardiia failure
- biguanide, insulin sensitizers
Sulfa allergy
- sulfonylureas

* When used in combination with insulin, insulin sensitizers may increase the risk of edema or CHF. The combination of an insulin sensitizer and insulin is currently not an approved indication in Canada.
**If using preprandial insulin, do not add an insulin secretagogue.
†May be given as a combined formulation: rosiglitazone and metformin (Avandamet™).

Physicians should refer to the most current Compendium of Pharmaceuticals and Specialties (Canadian Pharmacists Association, Ottawa, ON) and product monographs for detailed prescribing information.

A1C = glycosylated hemoglobin
BMI = Body Mass Index
CHF = Chronic Heart Failure
# 4. Management Strategies for Health Teams

## a. and b. Goals of Management and Key Clinical Targets

<table>
<thead>
<tr>
<th>Content</th>
<th>Target Population</th>
<th>Initial Recommendations</th>
<th>Goal Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glycemic Control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Blood Glucose            | All DM Individuals         | • People with Type 1 diabetes should measure their BG at least three times/day  
• The frequency of testing for individuals with Type 2 diabetes varies depending upon their glycemic control and management regime* (see SBGM, p 16)  
• Complete a capillary blood glucose value (finger poke) simultaneously with a venous FPG to ensure meter accuracy  
• The targets for pre-prandial PG are 4.0-7.0 mmol/L and 2hr postprandial PG goals are 5.0-10.0 mmol/L for adult population Type 1 and Type 2 (see Self Blood Glucose Monitoring - SBGM, p 16)  
• If it can be safely achieved, lowering PG goals to 4.0-6.0 mmol/L and 2hr postprandial PG to 5.0-8.0 mmol/L can be considered  
• Encourage Annual fasting meter/lab comparisons with no more than a 20% variance |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| A1C                      | All DM Individuals         | • Measure A1C approximately every 3-6 months  
• The target for most patients is ≤ 7.0% (or 0.070) (see Blood Glucose Targets, p 16)  
• If it can be safely achieved, lowering the goal of an A1C to 6.0% should be considered (or 0.060) |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| **Hypertension**         |                            |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Blood Pressure           | All DM Individuals         | • Measure blood pressure at every diabetes visit  
• Blood Pressure targets are < 130/80 mm Hg for all individuals with or without diabetic nephropathy |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Weight and Waist Circ.   | All DM Individuals         | • Waist circumference values of ≥ 102 cm (40 inches) in men and ≥ 88 cm (35 inches) in women are associated with increased health problems  
• The individual should work to attain a BMI between 18.5-24.9 (kg/m²)  
• A weight reduction of 5-10% is encouraged |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| **Other**                |                            |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Smoking                  | All DM Individuals         | • Awareness of the risks associated with smoking and diabetes  
• Smoking cessation is strongly encouraged due to the linkage between diabetes and CVD |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Activity                 | All DM Individuals         | • Brisk walking is generally a safe place to start  
• Sessions should be 10 minutes at a time spread out at least in 3 non-consecutive days  
• Accumulation of at least 30 minutes per week for people with Type 2 diabetes |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Nutrition                | All DM Individuals         | • Suggest portion control  
• Encourage all food groups  
• Limit sugars, fat, salt, alcohol and caffeine  
• Encourage Individual/group counseling  
• Use Canada’s Guidelines for Healthy Eating as a guide |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
| Antiplatelet Therapy     | All DM Individuals, unless intolerant | • Encourage people with Type 2 diabetes to adopt a healthy lifestyle to lower risk of CVD  
• Continually assess risk reduction  
• If tolerated, low dose of ASA |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                          |
<table>
<thead>
<tr>
<th>Content</th>
<th>Target Population</th>
<th>Initial Recommendations</th>
<th>Goal Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipids</td>
<td></td>
<td></td>
<td><strong>Lipids</strong></td>
</tr>
<tr>
<td>Lipid Panel</td>
<td>All DM Individuals</td>
<td>• Complete a fasting lipid profile at the time of diagnosis and then every 1-3 years as is clinically indicated</td>
<td>• For high risk individuals, the goals for LDL are &lt; 2.5mmol/L with a TC : HDL ratio of &lt; 4.0mmol/L.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• For moderate risk individuals, the goals for LDL are &lt; 3.5 mmol/L with a TC : HDL ratio of &lt; 5.0 mmol/L.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The optimal TG level is &lt; 1.5 mmol/L</td>
</tr>
<tr>
<td>Kidney</td>
<td></td>
<td></td>
<td><strong>Kidney</strong></td>
</tr>
<tr>
<td>ACR</td>
<td>All DM Individuals</td>
<td>• Screen individuals with Type 2 diabetes at the time of diagnosis and yearly thereafter</td>
<td>• If the ACR is within normal limits (men &lt; 2.0 mg/mmol and women &lt; 2.8 mg/mmol) then an annual follow-up screen is indicated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• If elevated, see page 12</td>
</tr>
<tr>
<td>Creatinine Clearance or MDRD-GFR</td>
<td>All DM Individuals</td>
<td>• Measure serum creatinine levels and estimate creatinine clearance annually in those individuals with diabetes without albuminuria and at least every 6 months in those with albuminuria</td>
<td>• Normal serum creatinine levels range between 40-105 umol/L and a normal MDRD is &gt; 60 ml/min</td>
</tr>
<tr>
<td>Eyes</td>
<td></td>
<td></td>
<td><strong>Eyes</strong></td>
</tr>
<tr>
<td>Dilated Eye Exam</td>
<td>All DM Individuals</td>
<td>• Screening and evaluation for retinopathy at the time of diagnosis for the individual with type 2 diabetes</td>
<td>• Tailor the interval for follow-up assessments to the severity of the retinopathy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• In those individuals with no or minimal retinopathy, the recommended interval is 1-2 years</td>
</tr>
<tr>
<td>Neuropathy</td>
<td></td>
<td></td>
<td><strong>Neuropathy</strong></td>
</tr>
<tr>
<td>10g Monofilament Assessment</td>
<td>All DM Individuals</td>
<td>• Screening for peripheral neuropathy at onset of diagnosis and annually thereafter in people with type 2 diabetes</td>
<td>• Foot examinations in adults by both patients and healthcare providers is an integral component of diabetes management to decrease the risk of foot lesions and amputations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A 10g monofilament at the great toe can be used to detect any change/loss of sensation</td>
<td></td>
</tr>
<tr>
<td>Sexual Dysfunction</td>
<td>All Men with DM</td>
<td>• Begin screening for Erectile Dysfunction (ED) at diagnosis of Type 2 diabetes</td>
<td>• Periodic re-assessment</td>
</tr>
<tr>
<td>Content</td>
<td>Target Population</td>
<td>Initial Recommendations</td>
<td>Goal Recommendation</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mental Health</td>
<td>All DM Individuals</td>
<td>• Regular screening of individuals with diabetes for psychosocial problems, depression and anxiety disorders&lt;br&gt;• Stress, inadequate social and family support, entrenched belief systems and ineffective coping skills may have a negative impact on self-care and glycemic control&lt;br&gt;• Atypical, antipsychotic medications may induce hyperglycemia</td>
<td>• Encourage regular screening for psychological concerns and interventions towards self-care</td>
</tr>
<tr>
<td>Referrals</td>
<td>All DM Individuals</td>
<td>• Group or individual counseling sessions may be offered depending upon the learning needs of the individual</td>
<td>• Self care is achieved by all clients with diabetes</td>
</tr>
<tr>
<td>Vaccinations:</td>
<td>All DM Individuals</td>
<td>• Encourage vaccinations to lessen the stress of influenza or pneumococcal bacteremia on the individual with diabetes</td>
<td>• Annual vaccinations for influenza are encouraged to reduce the risk of complications associated with these epidemics&lt;br&gt;• Once a lifetime premium for pneumococcal</td>
</tr>
<tr>
<td>• Pneumococcal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Annual Flu Shot</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DM = Diabetes mellitus  
BG = Blood glucose  
PG = Plasma glucose  
A1C = Regular glycosylated hemoglobin  
LDL = Low density lipoprotein  
TC : HDL = Total cholesterol, high density lipoprotein ratio  
TG = Triglyceride  
ACR = Albumin to Creatinine Ratio  
MDRD-GFR = Modification of Diet in Renal Disease -Glomerular Filtration Rate
c. Non-Pharmacologic Strategies

Self Blood Glucose Monitoring (SBGM)

SBGM is one of the most important and essential components of diabetes self-management. It allows individuals with diabetes to monitor daily changes in blood glucose, which enables them to make decisions and take action based on informed judgment.

How Often?

- The frequency of monitoring in those individuals with Type 2 diabetes should be individualized depending on glycemic control and type of therapy
- For most people with Type 2 diabetes who treat with insulin or oral antihyperglycemic agents, SBGM is recommended at least once per day
- In many situations, more frequent testing may be required to provide the information needed to make behavioral or treatment adjustments

When to Monitor?

Encourage individuals to include both pre-prandial (before meals) and 2-hour post-prandial (after meals) blood glucose monitoring depending upon their medication regime, lab work results, etc. The following are two examples of before and after meal testing schedules:

- **Once per Day (Before Meals)**
  - Day 1: Before Breakfast
  - Day 2: Before Lunch
  - Day 3: Before Supper
  - Day 4: Before Bedtime Snack
  - Repeat cycle

- **Once per Day (After Meals)**
  - Day 1: 2-hr after Breakfast
  - Day 2: 2-hr after Lunch
  - Day 3: 2-hr after Supper
  - Repeat cycle

Blood Glucose Targets

<table>
<thead>
<tr>
<th>Targets for glycemic control (ADULTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C (%)</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Target for most patients</td>
</tr>
<tr>
<td>Normal range (consider for patients in whom it can be achieved safely)</td>
</tr>
</tbody>
</table>


The same glycemic targets apply to otherwise healthy, elderly individuals as to younger people with diabetes. In people with multiple comorbidities, high level of functional dependency and limited life expectancy, goals are more conservative and clinicians should work to avoid symptoms of hyperglycemia and prevent hypoglycemia.

<table>
<thead>
<tr>
<th>Targets For Glycemic Control (CHILDREN AND ADOLESCENTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>&lt; 5</td>
</tr>
<tr>
<td>5-12</td>
</tr>
<tr>
<td>13-18</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Adapted from Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003: S85.

Nutrition

Lifestyle choices, such as nutrition and physical activity, are key components in the treatment and management of diabetes. Please note: nutritional education may be offered in group classes or on an individual basis. The following are general guidelines for nutritional therapy:

<table>
<thead>
<tr>
<th>General Nutrition Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eat three meals each day (and snacks if recommended)</td>
</tr>
<tr>
<td>Eat at regular times (space main meals 4-6 hours apart with snacks, if required, eaten at least 2 hours before the next meal)</td>
</tr>
<tr>
<td>Eat foods high in fibre</td>
</tr>
<tr>
<td>Choose lower fat foods</td>
</tr>
<tr>
<td>Limit sugars and sweets</td>
</tr>
<tr>
<td>Limit “dietetic” foods</td>
</tr>
<tr>
<td>Caution fad diets</td>
</tr>
<tr>
<td>Limit salt and salty foods</td>
</tr>
<tr>
<td>Use Canada’s Food Guide to Healthy Eating as a guide</td>
</tr>
</tbody>
</table>

Adapted from Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003: S85.
Once an individual has an understanding of the general nutritional guidelines, more detailed information may be required to enhance diabetes management. Consider the following suggestions:

### Nutrition Management For Diabetes

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>• 50-55% of the total caloric intake comes from carbohydrates</td>
</tr>
<tr>
<td></td>
<td>• Found in foods such as grains and grain products, fruits, sweet vegetables and milk products</td>
</tr>
<tr>
<td></td>
<td>• Sucrose intake of up to 10% of total daily energy intake is acceptable</td>
</tr>
<tr>
<td></td>
<td>• Artificial sweeteners may be used in moderation</td>
</tr>
<tr>
<td></td>
<td>• Sugar alcohols (Maltitol, Mannitol, Sorbitol, Isomalt and Xylitol) are nutritive sweeteners. An intake of ≤ 10g/day of sugar alcohols are thought to be safe.</td>
</tr>
<tr>
<td></td>
<td>• Foods with low to moderate glycemic index (GI) should be selected more often than high GI foods</td>
</tr>
<tr>
<td>Protein</td>
<td>• 15-20% of total caloric intake comes from protein</td>
</tr>
<tr>
<td>Fat</td>
<td>• &lt; 30% of total caloric intake comes from fats with less than 10% from saturated and trans fats and less than 10% from polyunsaturated fats</td>
</tr>
<tr>
<td>Alcohol</td>
<td>• Alcohol intake should be limited to ≤ 2 standard drinks/day or ≤ 14 standard drinks/week for men and ≤ 9 standard drinks/week for women</td>
</tr>
<tr>
<td>Vitamin and Mineral Supplements</td>
<td>• There is no evidence to support that individuals with diabetes benefit from taking vitamin and mineral supplements</td>
</tr>
</tbody>
</table>

### Physical Activity

Regular physical activity helps to:
- Control blood glucose levels
- Improve lipid profile
- Lose weight
- Lower blood pressure
- Improve cardio respiratory fitness
- Decrease insulin resistance
- Decrease stress
- Increase vigor

### Physical Activity Guidelines

<table>
<thead>
<tr>
<th>Type</th>
<th>Recommendations</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic</td>
<td>• 150 minutes/week of moderate-intensity exercise</td>
<td>Brisk walking</td>
</tr>
<tr>
<td></td>
<td>• Spread out over 3 non-consecutive days</td>
<td>Biking</td>
</tr>
<tr>
<td></td>
<td>• Increase to 4 or more hours/week</td>
<td>Dancing</td>
</tr>
<tr>
<td></td>
<td>• Sessions should be at least 10 minutes at a time</td>
<td>Raking Leaves Swimming</td>
</tr>
<tr>
<td>Resistance</td>
<td>• 3 times/week</td>
<td>Weight lifting</td>
</tr>
<tr>
<td></td>
<td>• Start with 1 set of 10-15 repetitions</td>
<td>Weight machines</td>
</tr>
<tr>
<td></td>
<td>• Progress to 2 sets of 10-15 repetitions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Then to 3 sets of 8 repetitions, 3 times/week</td>
<td></td>
</tr>
</tbody>
</table>

**GOAL for Physical Activity:**

150 minutes per week
d. Pharmacologic Strategies

This section is devoted to effectively managing adult Type 2 Diabetes.

**Building Healthy Lifestyles Diabetes Program**

<table>
<thead>
<tr>
<th>INSULIN ACTION</th>
<th>INSULIN</th>
<th>Rapid-Acting Analogue Humalog® (insulin lispro) Novorapid® (insulin aspart)</th>
<th>Fast-Acting Humulin®-R Novolin® ge Toronto</th>
<th>Intermediate-Acting Humulin®-L Humulin®-N Novolin® ge NPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Clear</td>
<td>Clear</td>
<td>Cloudy</td>
<td></td>
</tr>
<tr>
<td>Onset</td>
<td>10 – 15 min</td>
<td>0.5 – 1 hour</td>
<td>1 – 3 hours</td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>60 – 90 min</td>
<td>2 – 4 hours</td>
<td>5 – 8 hours</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>4 – 5 hours</td>
<td>5 – 8 hours</td>
<td>Up to 18 hours</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSULIN ACTION</th>
<th>INSULIN</th>
<th>Long-Acting Humulin®-U</th>
<th>Extended Long-Acting Analogue Lantus® *(insulin glargine)</th>
<th>Premixed Humalog® Mix25 TM Humulin® (20/80, 30/70) Novolin® (10/90, 20/80, 30/70, 40/60, 50/50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Cloudy</td>
<td>Clear</td>
<td>Cloudy</td>
<td>A single vial or cartridge contains a fixed ratio of insulin (% rapid or fat-acting to % intermediate-acting insulin)</td>
</tr>
<tr>
<td>Onset</td>
<td>3 – 4 hours</td>
<td>90 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>8 – 15 hours</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>22 – 26 hours</td>
<td>24 hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Approved, but not yet available in Canada

Action Times of Insulin

Rapid-Acting (clear)

Humalog (insulin lispro) or Novorapid (insulin aspart) is a rapid-acting insulin that begins working 10 – 15 minutes after an injection. It peaks (works the hardest) in 60 – 90 minutes and lasts 4 – 5 hours in the system. This is an INJECT and EAT insulin.

Fast-Acting (clear)

Humulin R or Novolin Toronto is a short-acting insulin that begins working 30 – 60 minutes after an injection. This insulin peaks in 2 – 4 hours and lasts 5 – 8 hours in the system.

Intermediate-Acting (cloudy)

Humulin N or Novolin NPH is the most common intermediate acting insulin that begins working 1 – 3 hours after an injection. This insulin peaks in 5 – 8 hours and lasts up to 18 hours in the system.

Humulin L is a less common intermediate-acting insulin that begins working 1 – 3 hours after an injection. This insulin peaks in 5 – 8 hours and lasts up to 18 hours in the system.

Long-Acting (cloudy)

Humulin U is a long-acting insulin that begins working 3 – 4 hours after an injection. This insulin peaks in 8 – 15 hours and lasts 22 – 26 hours in your system.

Extended Long-Acting (cloudy)

Lantus (glargine): This insulin begins to work 90 minutes after an injection. This insulin does not peak and lasts 24 hours in the system.

Premixes (cloudy)

Premixes have a percentage of rapid or fast-acting to a percentage of intermediate-acting insulin mixed together: Humalog Mix 25; Humulin 20/80, 30/70; Novolin 10/90, 20/80, 30/70, 40/60, 50/50.

NOTE: The action of insulin may vary in each individual. Insulins in the same category should not be used together.
## Oral Medications for Type 2 Diabetes

### Insulin Secretagogues

**Sulfonylureas – Second Generation**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Major Actions</th>
<th>Dosage</th>
<th>Dosing Schedule</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
<th>Common Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glyburide</strong>&lt;br&gt;“Diabeta”</td>
<td>● Stimulates insulin secretion&lt;br&gt; ● Enhances the number and sensitivity of insulin receptors&lt;br&gt; ● Reduces hepatic glucose production</td>
<td>STARTING DOSE: 5 mg QD – BID&lt;br&gt; MAXIMUM DAILY DOSAGE: 20 mg</td>
<td>● 1 – 2 times daily with breakfast and/or supper</td>
<td>2 – 4 hr</td>
<td>18 – 24 hr</td>
<td>10 hr</td>
<td>● Hypoglycemia&lt;br&gt; ● Nausea&lt;br&gt; ● Heartburn&lt;br&gt; ● Stimulates appetite&lt;br&gt; ● Usually not recommended for use in elderly due to hypoglycemic effect&lt;br&gt; ● Contraindicated with other insulin secretagogues</td>
</tr>
<tr>
<td><strong>Gliclazide</strong>&lt;br&gt;“Diamicron”</td>
<td>● Same as Glyburide</td>
<td>STARTING DOSE: 80 mg QD – BID&lt;br&gt; MAXIMUM DAILY DOSAGE: 320 mg</td>
<td>● 1 – 2 times daily with breakfast and/or supper</td>
<td>4 – 6 hr</td>
<td>12 – 24 hr</td>
<td>10 hr</td>
<td>● Hypoglycemia (usually not as pronounced as Glyburide)&lt;br&gt; ● Nausea&lt;br&gt; ● Tolerated better in the elderly&lt;br&gt; ● Contraindicated with other insulin secretagogues</td>
</tr>
<tr>
<td><strong>Gliclazide Modified Release</strong>&lt;br&gt;“Diamicron”&lt;br&gt;MR</td>
<td>● Same as Diamicron, modified release over 24 hours</td>
<td>STARTING DOSE: 30 mg QD</td>
<td>● Once daily at breakfast time</td>
<td>6 – 12 hr</td>
<td>24 hr</td>
<td>16 hr</td>
<td>● Hypoglycemia (usually not as pronounced as Glyburide)&lt;br&gt; ● Nausea&lt;br&gt; ● Tolerated better in the elderly&lt;br&gt; ● Contraindicated with other insulin secretagogues</td>
</tr>
<tr>
<td><strong>Glimepiride</strong>&lt;br&gt;“Amaryl”</td>
<td>● Require functioning Beta cells&lt;br&gt; ● Can increase sensitivity of penperal tissues to insulin</td>
<td>STARTING DOSE: 1 mg QD&lt;br&gt; MAXIMUM DAILY DOSAGE: 8 mg QD</td>
<td>● Daily with breakfast or first main meal&lt;br&gt; ● Once 2 mg dosage is reached, titrate by no more than 1 mg at 1 – 2 week intervals</td>
<td>2 – 3 hr</td>
<td>9 hr</td>
<td>● Hypoglycemia&lt;br&gt; ● G.I. disturbances, such as nausea, fullness, vomiting, abdominal pain, diarrhea&lt;br&gt; ● Use cautiously with renal / hepatic dysfunction</td>
<td></td>
</tr>
<tr>
<td>MEDICATION</td>
<td>DRUG NAME GENERIC / TRADE</td>
<td>MAJOR ACTIONS</td>
<td>DOSAGE</td>
<td>DOSSING SCHEDULE</td>
<td>PEAK</td>
<td>DURATION</td>
<td>HALF LIFE</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>---------------</td>
<td>--------</td>
<td>------------------</td>
<td>------</td>
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<td>-----------</td>
</tr>
</tbody>
</table>
| Repaglinide | *Gluconorm* | • Stimulates insulin secretion  
• Dependent upon functioning beta cells  
• Targets post-prandial blood glucose levels | STARTING DOSE: 0.5 – 4.0 mg TID with meals  
A fourth dose may be given with an extra meal | 0.5 – 4 mg administered directly before meals 3 or 4 times per day  
If meals are skipped or delayed, the dose of Gluconorm should be omitted or delayed  
Dosage adjustments should be made at one week intervals  
2 hour post-prandial testing is helpful to assess effectiveness of Gluconorm  
No snacks are required between meals | 1 hour | Less than 4 hours | 1.0 – 1.4 hr | • Hypoglycemia  
• Contraindicated with other insulin secretagogues (Sulfonylureas, Amino Acid Derivatives)  
• Contraindicated with Prandase (Acarbose)  
• Use cautiously in individuals with impaired liver function |
| Nateglinide | *Starlix* | • Stimulates insulin secretion  
• Dependent upon functioning beta cells  
• Targets post-prandial blood glucose levels | STARTING DOSE: 120 mg TID with meals  
A fourth dose may be given with an extra meal | 120 – 180 mg administered directly before meals 3 or 4 times per day  
If meals are skipped or delayed, the dose of Starlix should be omitted or delayed  
2 hour post-prandial testing is helpful to assess effectiveness of Starlix  
No snacks are required between meals | 1 hour | 3 – 4 hr | 1.5 hr | • Hypoglycemia  
• Contraindicated with other insulin secretagogues (Sulfonylureas, Amino Acid Derivatives)  
• Contraindicated with Prandase (Acarbose)  
• Use cautiously in individuals with impaired liver function |
## ORAL MEDICATIONS FOR TYPE 2 DIABETES

<table>
<thead>
<tr>
<th>MEDICATION TARGET SITE</th>
<th>DRUG NAME GENERIC / TRADE</th>
<th>MAJOR ACTIONS</th>
<th>DOSAGE</th>
<th>DOSING SCHEDULE</th>
<th>PEAK</th>
<th>DURATION</th>
<th>HALF LIFE</th>
<th>COMMON ADVERSE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong></td>
<td><strong>M</strong></td>
<td><strong>ALPHA-GLUCOSIDASE INHIBITORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Small Intestines | Acarbose “Prandase” | Delays absorption of sucrose and complex carbohydrates from the gastrointestinal tract, therefore, decreasing post-prandial glucose peaks | 3 times per day with meals, taken with the first mouthful of food | 1 hour | Minimal amount absorbed systematically | 2 hours | Gastrointestinal side effects such as:  
- Fullness/bloating  
- Diarrhea  
- Flatulence  
- Weight loss  
- Hypoglycemia rare, but may occur when combined with a sulfonylurea or insulin  
- Treatment of hypoglycemia must be with Dextrosol tablets or B-D glucose tablets. Do not use other treatments as digestion is slowed by the action of Prandase  
- Do not use with Humalog or NovoRapid  
- Contraindicated with Gluconorm (Repaglinide) and Starlix (Nateglinide) |
| | | Currently approved as monotherapy for Type 2 diabetes, but can safely be combined with both Biguanides and Sulfonylureas | | | | | |
| | | | STARTING DOSE: 25 QD | | | | |
| | | | MAXIMUM DAILY DOSAGE: 300 mg | | | | |
| **L** | **I** | **INSULIN SENSITIZERS** |
| Liver | Metformin “Glucophage” | Lowers blood glucose by:  
- Inhibiting hepatic glucose production  
- Increases sensitivity of peripheral tissue to insulin leading to increased glucose uptake in muscles  
- May contribute to weight loss by decreasing appetite and slowing rate of glucose absorption from gut | 2 – 4 times daily with meals and h.s. | 2 – 4 hr | 6 hours | 1.5-3hr | Gastrointestinal side effects such as:  
- Nausea  
- Bloating  
- Diarrhea  
- Side effects lessen with lower starting dosage and often gradually diminish over time  
- Contraindicated in renal impairment, liver disease, severe cardiorespiratory compromise e.g.: CHF, excessive alcohol intake (acute or chronic)  
- Discontinue metformin 48 hours prior to IVP, angiography or surgery; can be restarted once oral intake resumes and renal function is evaluated as normal |
<p>| | | | STARTING DOSE: 500 – 850 mg QD - TID | | | | |
| | | | MAXIMUM DAILY DOSAGE: 2500 - 2550 mg | | | | |</p>
<table>
<thead>
<tr>
<th>MEDICATION TARGET SITE</th>
<th>DRUG NAME GENERIC / TRADE</th>
<th>MAJOR ACTIONS</th>
<th>DOSAGE</th>
<th>DOSING SCHEDULE</th>
<th>PEAK</th>
<th>DURATION</th>
<th>HALF LIFE</th>
<th>COMMON ADVERSE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazolidinediones (TZDs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosiglitazone “Avandia”</td>
<td></td>
<td>Decreases insulin resistance</td>
<td>4 mg</td>
<td>1 hour</td>
<td>1 hour</td>
<td>24 hours</td>
<td>3 – 4 hr</td>
<td>Upper respiratory infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreases circulating insulin levels</td>
<td>8 mg</td>
<td>24 hours</td>
<td>24 hours</td>
<td>3 – 4 hr</td>
<td></td>
<td>Headache</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreases liver glucose output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Also: ↑ HDL cholesterol ↑ LDL cholesterol ↑ Diastolic BP ↑ Micro-albuminuria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Swelling</td>
</tr>
<tr>
<td></td>
<td>Rosiglitazone Maleate/ Metformin Hydrochloride Tablets “Avandamet”</td>
<td>Combined therapy in a single tablet</td>
<td>1 – 4 mg500mg tablets once or twice daily</td>
<td>Refer to Avandia and Glucophage</td>
<td>Refer to Avandia and Glucophage</td>
<td>Refer to Avandia and Glucophage</td>
<td>Refer to Avandia and Glucophage</td>
<td>Amino Acid Derivatives</td>
</tr>
</tbody>
</table>

4. Management Strategies for Health Teams
## Oral Medications for Type 2 Diabetes

<table>
<thead>
<tr>
<th>MEDICATION TARGET SITE</th>
<th>DRUG NAME GENERIC / TRADE</th>
<th>MAJOR ACTIONS</th>
<th>DOSAGE</th>
<th>DOSING SCHEDULE</th>
<th>PEAK</th>
<th>DURATION</th>
<th>HALF LIFE</th>
<th>COMMON ADVERSE EFFECTS</th>
</tr>
</thead>
</table>
| Thiazolidinediones (TZDs) | Pioglitazone “Actos” | • Decreases insulin resistance  
• Decreases liver glucose output  
• Decreases circulating insulin levels  
Also:  
↑ HDL  
↓ Triglycerides | Single daily dose with or without food  
Medication may take 8-12 weeks to have an impact on blood glucose levels, therefore, no dosage increases should be initiated prior to this time period  
Baseline ALT liver enzyme should be drawn prior to initiation of therapy and evaluated every 2 months X 1 year and periodically thereafter  
Do not initiate therapy if ALT greater than 2.5 times the upper limit of normal  
Any ALT elevations above the normal range should be discussed with the physician prior to initiation of drug therapy | 2 hours  
3 – 4 hr with food | 24 hours | 3 – 7 hr (just Actos)  
16 – 24 hours (combined metabolites) | • Upper respiratory infection  
• Headache  
• Anemia  
• Swelling  
• Use with caution in individuals who have liver problems and/or edema  
• Can cause fluid retention and exacerbate chronic heart failure  
• Watch for symptoms of heart failure and liver disease  
• May cause premenopausal women with insulin resistance (e.g.: polycystic ovary syndrome) to ovulate  
• Not indicated for use in individuals with New York Heart Association (NYHA) Class III and IV Cardiac Status |

### Oral Hypoglycemic Agents are contraindicated:
- In Type I Diabetes
- In Diabetic Ketoacidosis
- In clients with known hypersensitivity to the drug or its inactive ingredients
- In clients who are pregnant, breastfeeding or planning a pregnancy
Adolescents (13-18 years of age) with type 2 diabetes should receive intensive counseling regarding lifestyle modification. If glycemic targets are not achieved using lifestyle modification alone, metformin or insulin should be considered.

4. Management Strategies for Health Teams

Screening Protocol for Diabetic Nephropathy

**SCREEN FOR ALBUMIN/CREATININE RATIO (MAUR)**
Random Daytime Urine Specimen
(See notes 1, 2, 3 & 4)

**First positive for overt proteinuria**
>26 mg/mmol for females
>30 mg/mmol for males

- Confirm overt proteinuria with urinalysis (U) and random urine protein/creatinine ratio (PRU/CRR)
- Positive urinalysis (U), and/or urine protein to creatinine ratio >0.3 mg/mmol
- Quantitate proteinuria with 24-hour timed urine specimen for protein (PRU-24) and creatinine clearance (CRR)
- >0.3 g protein/day = overt diabetic nephropathy or consider other glomerular diseases

**OVERT NEPHROPATHY**

**TYPE 1 & TYPE 2 DM**
(See notes 6a, 7)

- Treatment with an ACE inhibitor
  - Even in absence of hypertension (See note 6)

**TYPE 1 DM**
(See notes 6a, 7)

- Treatment with ACE inhibitor
  - Even in absence of hypertension (See note 6)

**TYPE 2 DM**
(See notes 6a, 7)

- May benefit from an ACE inhibitor or cardioselective Beta blocker (See note 6)

**MICROALBUMINURIA**
20-200 ug/min.
30-299 mg/day
albumin in urine

**Second positive**
>2.8 mg/mmol for females
>2.0 mg/mmol for males

- Consider 24-hour timed urine specimen for microalbumin (MAU24) and creatinine clearance (CRR)
- Confirmed elevations (See note 5)

**Negative for microalbuminuria**
≤2.8 mg/mmol for females
≤2.0 mg/mmol for males

- Repeat albumin/creatinine ratio in approx. 1 month

**Second positive**
>2.8 mg/mmol for females
>2.0 mg/mmol for males

- Consider GO TO LEFT SIDE

**Negative**
≤2.8 mg/mmol for females
≤2.0 mg/mmol for males

- Repeat in 1 year

---

1. Type 1 DM - screening initiated in individuals ≥15 years of age with a 5-year history of Type 1 DM.
2. Type 2 DM - screening initiated upon diagnosis and annually.
3. Avoid screening if patient acutely ill, febrile or engaging in strenuous activity.
4. Option - may use urine dipstick in clinic for proteinuria - if positive (>trace proteinuria) proceed directly to 24-hour timed urine specimen.
5. Confirmation required elevation in 2 out of 3 albumin/creatinine ratio measurements performed over 3 months. If uncertainty about elevation exists, consider a timed urine collection to measure the rate of microalbuminuria.
6a. Blood pressure goal ≤130/80
6b. With overt nephropathy BP goal ≤125/75
7. Other considerations:
   - Elimination of all CV risk factors (discontinue smoking, treat dyslipidemia)
   - Intensive glucose control
   - Protein as per recommended nutrient intake (consult dietitian)
   - Measure serum potassium and serum creatinine
   - If serum creatinine >130 umol/L discontinue Metformin
   - > 50% decrease in creatinine clearance rate requires a referral to a nephrologist or internist
8. ACE inhibitor use assumes no contraindications. Serum potassium and creatinine levels should be monitored 1-2 weeks after initiation of therapy or after each dosage change.
9. Monitor serum creatinine, serum potassium, 24-hour urine creatinine clearance and rate of proteinuria at least 2x/year.

*Adapted from the 1998 Clinical Practice Guidelines For The Management Of Diabetes in Canada.*
5. Management Strategies for Patients/ Clients

What is Diabetes?
Diabetes is a chronic condition whereby the body cannot properly utilize carbohydrates (glucose) from the foods that are eaten. Insulin is needed to help the body use sugar for energy. When an individual develops diabetes, the pancreas either does not produce insulin or produces very little insulin (resulting in type 1 diabetes), or the body cannot properly use the insulin that is produced (causing or resulting in type 2 diabetes). When insulin is not available, the sugar from food stays in the bloodstream causing blood glucose levels to rise. A third type of diabetes, Gestational Diabetes, is a temporary condition that occurs during pregnancy.

Carbohydrates = Foods that turn to sugar
1. Starch: breads, potatoes, pasta, rice, cereal, corn, bannock
2. Fruit and sweet vegetables: peas, carrots, beets, parsnips, turnips
3. Milk
4. Sugary foods

Insulin carries sugar to the body cells and is like a key that unlocks the cell door and lets the sugar inside.
Symptoms

Type 1 Diabetes: symptoms progress quickly and are dramatic.

Type 2 Diabetes: symptoms are slower to progress and often more subtle. Therefore, it is possible to have no apparent symptoms and be diagnosed at a non-related medical examination.

The classic symptoms of diabetes are:
- Polyuria (increased urination)
- Polydipsia (increased thirst)
- Polyphagia (excessive hunger)

However, it is possible to have any combination of the following symptoms or no symptoms at all (especially with Type 2 diabetes).

1. **Polyuria (increased urination)** – When blood glucose is high, the kidneys will filter out excessive glucose into the urine. During this process, additional water is drawn from the tissues, resulting in large volumes of urine.

2. **Polydipsia (increased thirst)** - Increased thirst is caused by the body's need to replace the fluids that are lost through increased urination, thus trying to prevent dehydration.

3. **Polyphagia (excessive hunger)** – Due to lack or inefficient insulin, or the body’s inability to use insulin (insulin resistance), the body cannot utilize its available glucose. Therefore, the body's need for energy (or rather more glucose) causes increased hunger.

4. **Fatigue/Weakness** – When glucose is unable to access the body's cells, there is no fuel source for energy, which can lead to the sensation of fatigue and weakness.

5. **Weight loss** – When the body is unable to utilize glucose as a fuel source for energy, the "starving" body cells convert fat stores to glucose. This “burning up” of fat stores results in weight loss.

6. **Blurred Vision** – High blood glucose can lead to a build up of glucose in the fluid of the eye. The excessive glucose draws in extra fluid, causing the eye's outer lens to change shape, thus distorting vision. This is a temporary change that usually improves after 6 - 8 weeks of improved blood glucose control.

7. **Impaired Healing of Wounds, Cuts and Infections** – In the presence of high blood glucose levels, the immune system is less effective, resulting in a perfect medium for the growth of bacteria and yeast. As a result, wounds, cuts and infections take longer to heal and women may be more prone to vaginal infections.

8. **Pain, Numbness or Tingling** – A build up of glucose on the lining of nerves and small blood vessels in the body's extremities can attribute to the sensations of pain, numbness and/or tingling. Most commonly, these sensations are felt in the hands and/or feet and may decrease with improved blood glucose control.

9. **Itchy skin** – High blood glucose leads to deposits of sugar crystals just beneath the skin's surface causing itchiness.

10. **Nausea, Vomiting, Abdominal Pain, Fruity Odor to the Breath and Coma** – are all the later signs and symptoms of high blood glucose that can occur when the body uses stored fat instead of glucose as an alternative source of energy. This use of fat produces an acid substance called ketones, which can build up in the blood and may lead to a diabetic ketoacidosis (DKA).

Diabetes Management

Individuals with diabetes can expect to live active, independent and vital lives if they make a lifelong commitment to careful management of the disease. As depicted in the image to the left, diabetes management may seem like a balancing act.

In order to “balance a healthy lifestyle”, an individual may require ongoing motivation, education, dedication and support. The following components of diabetes management contribute to a healthy lifestyle:

**Education** – ongoing diabetes education is the key to understanding and successfully managing diabetes. All individuals who have diabetes should be given the opportunity to learn more about the condition in order to successfully manage diabetes and make healthy lifestyle choices.

**Monitoring** – self-monitoring of blood glucose levels is an essential component of diabetes management and is recommended for all individuals who have diabetes. Monitoring also includes monitoring for ketones when indicated and regular glycosylated hemoglobin (A1C) monitoring.
Healthy Way of Eating – what, when and how much an individual eats plays an important role in regulating blood glucose levels and promoting a healthy body weight. General guidelines for healthy eating may be adequate for individuals with Type 2 diabetes who do not require insulin therapy. However, a calculated meal plan or carbohydrate counting may be an option for individuals who require insulin or for women with diabetes during pregnancy.

Stress Management – both physical and/or mental stress may cause an increase in blood glucose levels. Acquiring and practicing effective stress management skills can not only bring an increased sense of calm and order to day to day life, but also helps individuals with diabetes to better manage their condition.

Complications – the onset of complications due to diabetes (increased risk of cardiovascular disease and stroke, retinopathy, nephropathy and neuropathy) may be delayed and even prevented through effective diabetes management. Early detection of complications may be achieved through regular screening of the eyes, heart, kidneys and feet and by monitoring blood pressure.

Medication – individuals who have Type 1 diabetes will always require daily injections of insulin. Multiple daily injections (3 - 4 per day) or the use of continuous subcutaneous insulin infusion (insulin pump), are usually required to achieve target blood glucose levels.

For many individuals, Type 2 diabetes may initially be controlled by following healthy eating guidelines and keeping active. Over time, however, due to the progressive nature of diabetes, oral antihyperglycemic agents and/or insulin therapy will most likely be required to achieve optimal blood glucose control.

Motivation – controlling diabetes requires an “around the clock” commitment from the individual with diabetes. The support of family and health professionals may help keep the individual motivated. Joining support groups or going to educational programs for diabetes may also help facilitate continued motivation.

Activity – regular physical activity helps control glucose levels, provides cardiovascular benefits, promotes healthy weight and facilitates general overall health and well-being.

Healthy Eating for People with Diabetes

When we eat, food breaks down into sugar (glucose) and goes into the bloodstream. When you have diabetes, the body does not have enough insulin to move the sugar from your bloodstream to your cells. The sugar stays in your blood and cannot be used by your body for energy.

Manage diabetes by balancing the kinds and the amounts of foods eaten.

Some foods raise blood sugar:
- Carbohydrates (sugar and starches): breads, cereals, fruits, vegetables and milk.

Some foods slow down how fast sugar goes into the bloodstream:
- Protein foods: meat, fish, poultry, cheese, eggs, tofu and peanut butter
- Fats and oils: butter, margarine, gravy, oil and salad dressings
- Dietary Fiber: whole grain breads and cereals, fresh fruits, vegetables, dried peas, beans and lentils

Other factors can lower your blood sugar such as:
- Activity
- Diabetes pills and insulin

General Guidelines

1. Eat three meals each day (and snacks if recommended). Work towards eating at least 3 of the 4 main food groups at each meal. Be sure to add a protein food. If you are overweight, choose smaller servings at your meals. DO NOT skip meals.

The food groups are:
- Starch (grain products)
- Fruits and Vegetables
- Protein (meat and alternatives)
- Milk products

2. Eat at regular times. The spacing and timing of meals is very important. Allow 4 - 6 hours between main meals. Eat snacks (if recommended) at least 2 hours before the next meal.

3. Eat foods high in fibre. These are whole grains breads and cereals, fruits, vegetables and legumes (dried peas, beans, lentils).

4. Choose lower fat foods. Limit the amount of fat you add to food, such as butter, margarine, gravy, cream, oil, mayonnaise and salad dressings. Test your culinary skills by baking, barbequing, boiling, roasting and broiling more often. Limit fried, creamed, breaded or scalloped dishes.

5. Limit sugars and sweets. Read labels carefully! Look for words that mean sugar, such as glucose, fructose, lactose, corn syrup, corn sweeteners, dextrose, sucrose and invert sugar. If sugar is in the first 3 ingredients, then the product or item is high in sugar.

6. Limit dietetic foods. This includes diet candy, diet cookies, diet chocolate, etc. Discuss the use of these foods with your dietitian.

7. Limit salt and salty foods. Eat fewer processed foods, condiments and snack foods. This may help control blood pressure. Try herbs and spices instead of salt. (e.g. Mrs. Dash™, Lawry’s Natural Seasoning™, etc). Do not use No-Salt™, Half Salt™, or Co-Salt™ until you have discussed it with your dietitian.

8. Keep active every day! Walk, swim, stationary bike, etc.
## Client Checklist for Diabetes

<table>
<thead>
<tr>
<th>What to expect at each office visit with your family physician:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review blood sugar results</td>
</tr>
<tr>
<td>HgbA1C</td>
</tr>
<tr>
<td>Check blood pressure</td>
</tr>
<tr>
<td>Measure weight</td>
</tr>
<tr>
<td>Measure waist circumference</td>
</tr>
<tr>
<td>Check feet/lower legs</td>
</tr>
<tr>
<td>Review nutrition</td>
</tr>
<tr>
<td>Discuss activity</td>
</tr>
<tr>
<td>Review medications</td>
</tr>
<tr>
<td>Discuss tobacco use</td>
</tr>
<tr>
<td>Discuss alcohol use</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tests &amp; Measurements that should be done or discussed on a yearly basis, or as recommended by your health care team:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol levels monitored (you must fast for 12-14 hours)</td>
</tr>
<tr>
<td>Kidney screen (MAUR &amp; MDRD)</td>
</tr>
<tr>
<td>Urinalysis</td>
</tr>
<tr>
<td>Dilation of eyes</td>
</tr>
<tr>
<td>Monofilament foot assessment</td>
</tr>
<tr>
<td>Support systems discussed</td>
</tr>
<tr>
<td>Vaccinations</td>
</tr>
<tr>
<td>Pneumococcal (once in a lifetime)</td>
</tr>
<tr>
<td>Annual influenza vaccine</td>
</tr>
<tr>
<td>Referral for further education (BHL)</td>
</tr>
</tbody>
</table>
6. Referral to Specialists/Specialty Program

a. and b. Indications for Referral to Medical Specialists and the Building Healthy Lifestyles Diabetes Program

1. Hypoglycemia unawareness
2. Severe hypoglycemia
3. Uncontrolled diabetes
4. Pregnancy and pre-existing diabetes
5. Persistent hyperglycemia
6. Complex management issues
7. Pump management

Please refer to the Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada for indications as to when to refer to a nephrologist and/or ophthalmologist as well as for hypertension and/or lipid management.

c. Local Contacts

For general information contact Building Healthy Lifestyles at 388-6654 or 1-866-506-6651.

Clinical Guides are available on-line at:

www.chinookprimarycarenetwork.ab.ca/extranet/resources/guides.php
7. References

a. Evidence

4. BCHealthCare, 2003. Resources for People with Diabetes

b. On-line Resources

Many individuals may find on-line resources helpful. Some of the key websites for additional information are listed as follows:

- Canadian Diabetes Association [www.diabetes.ca](http://www.diabetes.ca)
- Alberta Monitoring for Health Program [www.diabetes.ca/Section_Regional/alb_amfh.asp](http://www.diabetes.ca/Section_Regional/alb_amfh.asp)
- Healthy U [www.healthyalberta.ca](http://www.healthyalberta.ca)
- Alberta Centre for Active Living [www.centre4activeliving.ca](http://www.centre4activeliving.ca)
- Dietitians of Canada [www.dietitians.ca](http://www.dietitians.ca)
- Nutrition Labeling Education Centre [www.healthyeatingisinstore.ca](http://www.healthyeatingisinstore.ca)
- Health Link Alberta [www.healthlinkalberta.ca](http://www.healthlinkalberta.ca)
- 5 to 10 a day [www.5to10aday.com](http://www.5to10aday.com)
- Inform Alberta [www.informalberta.ca](http://www.informalberta.ca)
- National Aboriginal Diabetes Association [www.nada.ca](http://www.nada.ca)

Supplementary Handouts Available

Living Well with Diabetes: Your Resource Calendar