Balance is an essential factor in diabetes prevention, education, care, research and support. The front cover graphic design reflects the concept of the medicine circle or medicine wheel, an ancient and powerful symbol of healing and balance. The quadrants of the circle can be interpreted as representing the importance of balance in all aspects of human existence: spiritual, emotional, physical and intellectual.
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In June 1996, Manitoba’s Minister of Health declared diabetes to be a major public health issue and epidemic in Aboriginal people and Seniors (over age 55 years) of all populations. This was based on evidence documented by the Epidemiology and Diabetes & Chronic Diseases Units of Manitoba Health in their ongoing Diabetes Burden of Illness Study.

Diabetes: A Manitoba Strategy is Manitoba’s response to the epidemic of diabetes and was released in November 1998. A Steering Committee with five Working Groups addressed the continuum of Diabetes Prevention, Education, Care, Research and Support.

A key recommendation from the Care Working Group was:

‘Develop Manitoba Diabetes Care Recommendations for the care of people with diabetes, consistent with the Canadian Diabetes Association Clinical Practice Guidelines.’

In 1992, the Canadian Diabetes Advisory Board first published Clinical practice guidelines for treatment of diabetes mellitus. In 1998, the Canadian Diabetes Association re-wrote the guidelines to reflect evidence-based clinical practice. In 2003 and again in 2008, the guidelines were extensively revised and expanded to meet the growing needs of diabetes prevention and care. The Canadian Diabetes Association 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (Can J Diabetes. 2008; 32(suppl 1): S1-S201) were published in December 2008.

The 2010 Manitoba Diabetes Care Recommendations incorporate and reflect the expansion and revision of the national guidelines.
The **Manitoba Diabetes Care Recommendations** are an adaptation of the national guidelines, for province-wide use in Manitoba. Additional information has been added to provide practical details in specific areas. The goal of the **Manitoba Diabetes Care Recommendations** is to provide the standards of care for diabetes in the community, in a clear and precise format. Issues beyond the scope of these recommendations should be referred to members of a specialized diabetes health care team.

The **Manitoba Diabetes Care Recommendations** provide the evidence and standards of practice for the Manitoba Regional Diabetes Program and Risk Factor & Complication Assessment training.

The intended audience for the **Manitoba Diabetes Care Recommendations** includes primary care physicians, diabetes educators and other health care professionals.
Manitoba Diabetes Care Recommendations

Prevention 2

Prevention
**Prevention**

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

**Classification**

**Type 1 Diabetes**
- Pancreatic beta cell destruction that usually leads to absolute insulin deficiency
- Prone to diabetic ketoacidosis
- Auto-immune mediated

**Type 2 Diabetes**
- Ranges from predominantly insulin resistance with relative insulin deficiency to predominantly insulin secretory defect with insulin resistance
- Generally, not prone to diabetic ketoacidosis

**Gestational Diabetes Mellitus**
- Glucose intolerance with first onset or recognition during pregnancy

**Other**
This includes a wide variety of less common conditions, for example:
- genetic defects of pancreatic beta cell function
- genetic defects in insulin action
- drug-induced ex: corticosteroid-induced
- disease of the endocrine pancreas
- endocrine disorders known to cause diabetes.
Diagnosis

**DIAGNOSTIC CRITERIA for DIABETES**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the presence of classical symptoms of diabetes: thirst, frequent urination, blurred vision, fatigue or weight loss</td>
<td>Random Plasma Glucose ≥ 11.1 mmol/L</td>
</tr>
<tr>
<td>Fasting Plasma Glucose (FPG)</td>
<td>Fasting Plasma Glucose ≥ 7.0 mmol/L</td>
</tr>
<tr>
<td>75 gram Oral Glucose Tolerance Test (OGTT)</td>
<td>2 hour glucose value ≥ 11.1 mmol/L</td>
</tr>
</tbody>
</table>

The FPG of 7.0 mmol/L and 2 hour PG of 11.1 mmol/L represent threshold values for micro and macrovascular complications. A confirmatory test should be done on a separate day. This second test is not necessary for the diagnosis of diabetes in children or adults with classical symptoms, as metabolic decompensation may occur quickly.

The American Diabetes Association (ADA), the International Diabetes Federation (IDF) and the European Association for the Study of Diabetes (EASD) are examining the use of A1C for the diagnosis of diabetes. The Joint International Expert Committee has suggested that an A1C value ≥ 6.5% could be used for the diagnosis of diabetes. However, there are no current position statements recommending A1C instead of the standard diagnostic tests in use at present. Limitations to the A1C test include the presence of anaemia resulting in false negatives, non-standardization of the A1C test procedure and cost.

**PLASMA GLUCOSE VALUES for DIAGNOSIS of IFG, IGT and DIABETES**

<table>
<thead>
<tr>
<th>Condition</th>
<th>FPG (mmol/L)</th>
<th>2hPG in a 75-g OGTT (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFG</td>
<td>6.1-6.9</td>
<td>NA</td>
</tr>
<tr>
<td>IFG (isolated)</td>
<td>6.1-6.9</td>
<td>&lt; 7.8</td>
</tr>
<tr>
<td>IGT (isolated)</td>
<td>&lt; 6.1</td>
<td>7.8-11.0</td>
</tr>
<tr>
<td>IFG and IGT</td>
<td>6.1-6.9</td>
<td>7.8-11.0</td>
</tr>
<tr>
<td>Diabetes</td>
<td>≥ 7.0</td>
<td>or ≥ 11.1</td>
</tr>
</tbody>
</table>

Used with permission from Can J Diabetes. 2008;32(suppl 1):S1-S201

**Prediabetes**

Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT) identify earlier stages of glucose intolerance or prediabetes. Prediabetes is a practical term that refers to either IFG or IGT. Both are associated with an increased risk of developing type 2 diabetes. IGT alone is also associated with an increased risk of developing cardiovascular disease (CVD).
Screening for Type 2 Diabetes

Whole population screening for type 2 diabetes is not recommended. Regular testing for type 2 diabetes should be part of a person’s periodic health assessment performed by a primary health care provider.

Guidelines for Screening

Testing for type 2 diabetes in individuals without risk factors is recommended every 3 years, beginning at age 40. Individuals with risk factors should be tested more frequently and/or from an earlier age.

Risk Factors for Type 2 Diabetes

• First degree relative with type 2 diabetes
• Member of a high-risk group (for example, Aboriginal, Hispanic, Asian, South Asian or African descent)
• History of IGT or IFG
• History of gestational diabetes
• Hypertension
• Dyslipidemia
• Overweight or obesity, particularly abdominal obesity
• Vascular disease
• Presence of diabetes-related complications
• Polycystic ovarian syndrome (PCOS)
• Acanthosis nigricans
• Schizophrenia and/or use of atypical antipsychotic medications

The recommended test is a Fasting Plasma Glucose (FPG), using a fasting venous sample.

Capillary screening with a glucose meter is acceptable when:
• trained individuals are performing the test and appropriate follow-up testing is arranged, and
• a quality assurance program is in place to monitor the accuracy of results.

Screening for Type 2 Diabetes in Children

Children ≥ 7 years of age should be considered for screening for type 2 diabetes every 2 years using a FPG test, if they meet 2 or more of the following criteria:
• obesity (BMI ≥ 95th percentile for age and gender)
• member of a high-risk ethnic group and/or family history of type 2 diabetes, especially if the child was exposed to diabetes in utero
• signs or symptoms of insulin resistance (including acanthosis nigricans, hypertension, dyslipidemia)
• PCOS
• IGT
• use of atypical or other antipsychotic medications.

Very obese children (BMI ≥ 99th percentile for age and gender) who meet the criteria above should have an OGTT performed annually.
A Fasting Plasma or Fasting Capillary Glucose $\geq 7.0$ mmol/L is positive for diabetes. A confirmatory test should be done on a separate day utilizing a fasting venous sample.

This second test is not necessary for the diagnosis of diabetes in children or adults with classical symptoms, as metabolic decompensation may occur quickly.

**Risk Factor Assessment for Type 2 Diabetes and Cardiovascular Disease**

The metabolic syndrome of insulin resistance is a common metabolic state characterized by some or all of the following conditions:

- insulin resistance and abnormal glucose tolerance and/or diabetes
- overweight
- abdominal obesity
- hypertension
- dyslipidemia
- vascular disease
- PCOS
- acanthosis nigricans.

Individuals with the metabolic syndrome have a significant risk of developing cardiovascular disease.

**Strategies for Prediabetes States**

For individuals with prediabetes, the following strategies can be used:

- a structured program of lifestyle modification that includes moderate weight loss and regular physical activity should be implemented to reduce the risk of type 2 diabetes.
- pharmacologic therapy with metformin (biguanide) or acarbose (alpha-glucosidase inhibitor) can be considered in individuals with IGT. In those individuals without known CVD or at significant risk for CVD, a thiazolidinedione (TZD) can also be considered.
Manitoba Diabetes Care Recommendations

Education 3

Education
Education

**Diabetes Health Care Team**

Diabetes care requires the daily commitment of the person with diabetes to balance appropriate lifestyle choices and pharmacologic therapy, through the acquisition of specific self-management diabetes knowledge and skills. Initial and ongoing diabetes education for the person with diabetes and his or her family should be considered an integral part of diabetes care. This requires the support of a multidisciplinary team of diabetes health care professionals and providers. The Diabetes Health Care (DHC) team is the structure that provides this support.

Central to the DHC team is the person with diabetes and his or her family. Also central to this team is the primary care physician and/or a diabetes specialist as well as the team of community-based diabetes educators and diabetes health care providers. All children with type 1 diabetes and their families should be referred to a DHC team for children and adolescents immediately upon diagnosis.

When required, the DHC team may be expanded to include other health care and community service specialists and providers. The DHC team should provide comprehensive, shared care that facilitates ongoing participation and communication amongst all its members.
### Target Blood Glucose and A1C Levels

**TARGET BLOOD GLUCOSE and A1C LEVELS for ADULTS**

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>FPG/preprandial PG (mmol/L)</th>
<th>2-hour postprandial PG (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target for most patients</td>
<td>≤ 7.0</td>
<td>4.0 – 7.0</td>
</tr>
<tr>
<td>Normal range (consider for patients in whom it can be achieved safely)</td>
<td>≤ 6.0</td>
<td>4.0 – 6.0</td>
</tr>
</tbody>
</table>

1 Treatment goals and strategies must be tailored to the person with diabetes, with consideration given to individual risk factors.

A1C = glycated hemoglobin  FPG = fasting plasma glucose  PG = plasma glucose

Used with permission from Can J Diabetes. 2008;32(suppl 1):S1-S201

**TARGET BLOOD GLUCOSE and A1C LEVELS for CHILDREN and ADOLESCENTS**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>A1C (%)</th>
<th>Preprandial PG (mmol/L)</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6</td>
<td>&lt; 8.5</td>
<td>6-12.0</td>
<td>Extreme caution is required to avoid severe hypoglycemia because of the risk of cognitive impairment in this age group</td>
</tr>
<tr>
<td>6-12</td>
<td>&lt; 8.0</td>
<td>4.0-10.0</td>
<td>Targets should be graduated to the child's age</td>
</tr>
<tr>
<td>13-18</td>
<td>≤ 7.0</td>
<td>4.0-7.0</td>
<td>Appropriate for most patients</td>
</tr>
</tbody>
</table>

A1C = glycated hemoglobin  PG = plasma glucose
Manitoba Diabetes Care Recommendations

Clinical Assessment
Care

Clinical Assessment

History

Current Status

- Time of onset and progression of symptoms of diabetes (thirst, urinary frequency, blurred vision, weight loss, infections of the urinary tract, skin or vaginal areas)
- Presence of symptoms of diabetes-related complications including eye, kidney, cardiovascular, cerebrovascular and peripheral vascular function, neurological function, hypoglycemia unawareness, skin and foot problems

Diabetes Assessment

- Previous diabetes education
- Self Blood Glucose Monitoring (SBGM)
  - Current records
  - Frequency
  - Lab/meter correlation
- Eating habits including meal/snack frequency and composition, food choices and weight history
- Level of physical activity
- Diabetes medications
  - Oral agents
  - Insulin dosage, adjustment and algorithms
- Hypoglycemia - frequency and awareness
- Vaccination status in adults - influenza and pneumococcus
- Health determinants, including family and/or other supports, education, employment and health beliefs

Diabetes Complication Assessment

- Review of previous
  - A1C values
  - BP
  - BMI / waist circumference (WC)
  - Lipid profile
  - Microalbuminuria screen
  - Monofilament assessment of feet
  - Retinopathy screen

Past History

- Gestational diabetes
- PCOS
- Cardiovascular (CVD), cerebrovascular (CVA) and/or peripheral vascular disease (PVD)
- Conditions requiring long-term corticosteroid use (as a cause of diabetes)
- Pancreatic disease (as a cause of diabetes)
- Depression

Family History

- Diabetes
- Cardiovascular disease
- Hypertension
- Dyslipidemia
- Autoimmune disease (type 1 diabetes)

Medications

- All prescription and non-prescription medications
- Alcohol
- Smoking
- Allergies
Physical Exam

General
• BMI: kg/m²
• WC
• Pulse and BP

Head & Neck
• Eyes
  • Cataracts
  • Fundoscopic exam (does not replace retinal assessment through dilated pupils by experienced examiner)
• Teeth and gums
• Thyroid

Cardiovascular & Peripheral Vascular Exam
• Presence of signs of congestive heart failure
• Peripheral pulses, bruits

Skin
• Injection sites
• Signs of dyslipidemias
• Acanthosis nigricans
• Infections (ex: fungal)

Foot Exam
• Screening for vascular integrity
  • Colour
  • Skin and nail condition
  • Peripheral pulses
  • Presence of infection or ulceration
• Screening for peripheral neuropathy
  • Semmes-Weinstein 10 gram monofilament assessment
  • Presence of vibration or proprioception senses
  • Presence of ankle reflexes

Investigations

Glycemic Control
• A1C

Complication Assessment
• Baseline serum electrolytes, creatinine and liver function tests in adults
• Fasting lipid profile in adults >30 years
• TSH
• Microalbuminuria screen
• Calculation of estimated glomerular filtration rate (eGFR) by MDRD formula (or lab testing if available) or creatinine clearance by Cockcroft-Gault formula (or lab testing)
• Retinal exam through dilated pupils by experienced examiner
• Resting electrocardiogram (EKG) or exercise EKG (if indicated) for adults > 40 years or diabetes >15 years
<table>
<thead>
<tr>
<th>Clinical Diabetes Assessment Flow Chart</th>
<th>Initial Assessment</th>
<th>Routine Follow-up (2-4 months)</th>
<th>Annually</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Assessment</strong></td>
<td>• Complete history &amp; physical exam including diabetes assessment</td>
<td>Diabetes assessment including: • Review of cardiovascular risk factors • Medication review • BMI / WC • BP • Foot exam as indicated • Neurological assessment as indicated</td>
<td>Update diabetes assessment including: • Review of cardiovascular risk factors • Medication review • BMI / WC • BP • Foot exam • Neurological assessment as indicated • Vaccination status in adults as indicated</td>
</tr>
<tr>
<td><strong>Investigations for Glycemic Control</strong></td>
<td>• A1C</td>
<td>• SBGM records • A1C</td>
<td>Lab/meter correlation</td>
</tr>
<tr>
<td><strong>Investigations for Complication Assessment</strong></td>
<td>• Baseline serum electrolytes, creatinine, liver function tests in adults • Fasting lipid profile • TSH • Microalbuminuria screen ± eGFR • Retinal exam • Resting (or exercise) EKG (if indicated) for adults (&gt; 40 yrs) or diabetes &gt;15 yrs</td>
<td>Monitor: • Serum electrolytes, creatinine, liver function tests as indicated • Fasting lipid profile as indicated • Microalbuminuria as indicated</td>
<td>• Retinal assessment through dilated pupils as indicated • Microalbuminuria screen (in the absence of nephropathy) • Determination of eGFR (in the presence of nephropathy)</td>
</tr>
<tr>
<td><strong>Diabetes Care Plan</strong></td>
<td>• Determination of target blood glucose goals • Diabetes Education • Glycemic control/complication monitoring and interventions</td>
<td>• Progress towards target blood glucose goals • Diabetes Education • Glycemic control/complication monitoring and interventions</td>
<td>• Progress towards target blood glucose goals • Diabetes Education • Glycemic control/complication monitoring and interventions</td>
</tr>
</tbody>
</table>
Oral Antihyperglycemic Agents

General Notes
The choice of oral agent(s) is individually determined. The objective in selecting a particular agent is its ability to achieve and maintain target blood glucose and A1C levels. Most often an insulin sensitizer, metformin, is the agent of first choice. Combinations of oral agents in sub-maximal dosages may result in more rapid and improved glycemic control. The general approach is to use oral agents, singly or in combination, dependent on their ability to decrease and maintain A1C levels. Safety, specific side effects, tolerability, ease of use and expense must also be considered. Oral agents may be used effectively in combination with insulin, often basal insulin (intermediate or long-acting) once or twice daily.

Evidence indicates that lower levels of blood glucose at the time of initial therapy have been found to be associated with lower A1C levels over time and decreased long-term complications. With this in mind, the person with diabetes will have better long-term control of diabetes if the diagnosis and treatment intervention is initiated early when the metabolic abnormalities of diabetes are usually less severe.

Contraindications
- Type 1 diabetes.
- Metformin for those individuals with renal impairment (contraindicated if CrCl/eGFR < 30 mL/min and/or serum creat >150 μmol/L; caution if CrCl/eGFR < 60 mL/min and/or serum creat >130 μmol/L), hepatic impairment (AST/ALT > 3x upper limit of normal) or significant congestive heart failure.
- Thiazolidinediones (TZDs) should not be used in combination with daytime insulin.
- Women of childbearing age (oral agents are possibly teratogenic).
- Children <18 years with type 2 diabetes is a relative contraindication, as few studies indicating safety or efficacy have been reported in this age group. In adolescents with type 2 diabetes, metformin or insulin may be considered if glycemic targets are not met through lifestyle changes.

Oral Agents and Seniors
Risk of hypoglycemia and drug interactions must be considered. Gliclazide or glimepiride may be preferable to glyburide as they are associated with less risk of hypoglycemia. Glyburide often is the cause of significant hypoglycemia.

Start with a low dose and increase slowly. Side effects of medications may be much more debilitating in an older person.
### ORAL ANTIHYPERGLYCEMIC AGENTS

<table>
<thead>
<tr>
<th>Oral Agent</th>
<th>Mechanism of Action</th>
<th>Dosage</th>
<th>Action Time</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biguanides (Insulin Sensitizer)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Metformin Glucophage | • Insulin sensitizer  
• Reduces hepatic glucose output | • Start 250-500 mg bid ac meals  
• Start with low dose and increase slowly  
• Maximum dose 2550 mg/day in divided doses | 8 hrs | • Does not promote weight gain  
• Rarely causes hypoglycemia  
• Can be used in combination with daytime insulin | • GI:  
• Nausea  
• Bloating  
• Diarrhea  
Slow increase in dose decreases these side effects  
Contraindicated with renal or hepatic impairment, or CHF |
| **Sulfonylureas (Insulin Secretagogue)** |                             |                         |             |                                               |                                                    |
| Glyburide Diabeta  | • Stimulates pancreatic secretion of insulin | • Start 2.5-5 mg od or bid ac meals  
• Maximum dose 10 mg bid | 16-24 hrs | • May cause weight gain  
• May cause hypoglycemia | | |
| Gliclazide Diamicron | as above | • Start 80 mg od  
• Maximum dose 160 mg bid | 8-16 hrs | Causes less hypoglycemia than glyburide  
• May cause weight gain | | |
| Diamicron MR as above | | • Start 30 mg od  
• Maximum dose 120 mg od | 24 hrs | | | |
| Glimepiride Amaryl  | as above | • Start 1-2 mg od  
• Dosage range is 1-8 mg od | 24 hrs | • May be used in combination with daytime insulin  
• May cause less hypoglycemia than glyburide  
• May cause less weight gain | |
## ORAL ANTIHYPERGLYCEMIC AGENTS

<table>
<thead>
<tr>
<th>Oral Agent</th>
<th>Mechanism of Action</th>
<th>Dosage</th>
<th>Action Time</th>
<th>Benefits</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alpha-Glucosidase Inhibitors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| *Acarbose* Prandase         | • Inhibits glucosidase enzymes in carbohydrate digestion                                | Start 25 mg with first bite of food | Best effect seen post-prandially   | No hypoglycemia if used alone          | • GI: bloating, flatus  
• Start with low dose and increase slowly to decrease GI side effects  
• "Beano" counteracts action  
• When treating hypoglycemia in the presence of acarbose, use dextrose tablets, milk or honey                                      |
|                             | • Decreases post-prandial glucose rise                                               | Titrate weekly to usual dose of 50-100 mg/meal |                      |                                       |                                                                                                                                             |
| **Meglitinides (Insulin Secretagogue)** |                                                                                       |                 |                      |                                       |                                                                                                                                             |
| *Repaglinide* Gluconorm     | • Stimulates pancreatic insulin secretion                                             | Start 0.5 mg taken 0-30 min before each meal | Short-acting; stimulates insulin secretion in response to glucose rise at meal time | • Controls post-prandial glucose rise  
• Provides flexibility to fit varied meal-times      | • May cause hypoglycemia                                                                 |
|                             | • Different mechanism from sulfonylureas                                              | Or titrate according to CHO intake (1 mg/15gCHO) |                      |                                       |                                                                                                                                             |
|                             | • Dosages available as 0.5, 1, 2 mg                                                 | Dosages available as 0.5, 1, 2 mg |                      |                                       |                                                                                                                                             |
| **Thiazolidinediones or TZDs (Insulin Sensitizer)** |                                                                                       |                 |                      |                                       |                                                                                                                                             |
| *Rosiglitazone* Avandia     | • Insulin sensitizer  
• Insulin action improved in liver, muscle and adipose tissue | 2-8 mg daily as a bid dosage | Effect seen after 6 weeks | • May cause weight gain, peripheral edema, macular edema or CHF  
• Rare occurrence of osteoporosis in women  
• Contraindicated in CHF, hepatic impairment (monitor LFTs regularly)  
• Should not be used in combination with daytime insulin |                                                                                                                                             |
|                             |                                                                                       |                 |                      |                                       |                                                                                                                                             |
| *Pioglitazone* Actos        | • Insulin sensitizer  
• Insulin action improved in liver, muscle and adipose tissue | 15-45 mg daily | Effect seen after 6 weeks | May ↓ TG, ↑ HDL  
• May cause weight gain, peripheral edema, macular edema or CHF  
• Rare occurrence of osteoporosis in women  
• Contraindicated in CHF, hepatic impairment (monitor LFTs regularly)  
• Should not be used in combination with daytime insulin |                                                                                                                                             |
|                             |                                                                                       |                 |                      |                                       |                                                                                                                                             |
| *Rosiglitazone/Metformin Combination* Avandamet | As per rosiglitazone and metformin | R(1-4 mg)/M(500-1000 mg) | As per rosiglitazone and metformin |                                       |                                                                                                                                             |
| **Incretins (Augments Insulin Action)** |                                                                                       |                 |                      |                                       |                                                                                                                                             |
| *Sitagliptin* Januvia       | Augments insulin action  
• 100 mg daily (50 mg daily with renal impairment) | 4-6 weeks |                     | • Weight neutral  
• Low risk hypoglycemia  
• Long-term safety unknown |                                                                                                                                             |
### MANAGEMENT OF HYPERGLYCEMIA IN TYPE 2 DIABETES

#### Clinical Assessment

<table>
<thead>
<tr>
<th>Lifestyle Intervention (initiation of nutrition therapy and physical activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C &lt;9.0%</td>
</tr>
</tbody>
</table>

- **Initiate metformin**
  - Consider initiating metformin concurrently with another agent from a different class; or
  - Initiate insulin

If not at target

Add an agent best suited to the individual based on the advantages/disadvantages listed below and the information contained in Table 1 (agents listed in alphabetical order)

<table>
<thead>
<tr>
<th>Class</th>
<th>A1C</th>
<th>Hypoglycemia</th>
<th>Other advantages</th>
<th>Other disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-glucosidase inhibitor</td>
<td>↓</td>
<td>Rare</td>
<td>Improved postprandial control</td>
<td>GI side effects</td>
</tr>
<tr>
<td>Incretin agent: DPP-4 inhibitor</td>
<td>↓ to ↓</td>
<td>Rare</td>
<td>Improved postprandial control</td>
<td>New agent (unknown long-term safety)</td>
</tr>
<tr>
<td>Insulin</td>
<td>↓↓↓</td>
<td>Yes</td>
<td>No dose ceiling</td>
<td>Weight gain</td>
</tr>
<tr>
<td>Insulin secretagogue: Meglitinide Sulfonylurea</td>
<td>↓ to ↓</td>
<td>Yes</td>
<td>Improved postprandial control</td>
<td>Requires TID to QID dosing</td>
</tr>
<tr>
<td>TZD</td>
<td>↓</td>
<td>Rare</td>
<td>Durable monotherapy</td>
<td>Weight gain</td>
</tr>
<tr>
<td>Weight loss agent</td>
<td>↓</td>
<td>None</td>
<td>Weight loss</td>
<td>GI side effects (orlistat)</td>
</tr>
</tbody>
</table>

If not at target

- Add another drug from a different class or
- Add bedtime basal insulin to other agent(s); or
- Intensify insulin regimen

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

- A1C = glycated hemoglobin
- BP = blood pressure
- CHF = congestive heart failure
- DPP-4 = dipeptidyl peptidase-4
- GI = gastrointestinal
- TZD = thiazolidinedione

**Note:** Physicians should refer to the most recent edition of the Compendium of Pharmaceuticals and Specialties (Canadian Pharmacists Association, Ottawa, Ontario, Canada) for product monographs and for detailed prescribing information.

*Less hypoglycemia in the context of mixed meals*

Used with permission from Can J Diabetes. 2008;32(suppl 1):S1-S201
General Approach Based on Glycemic Control

**A1C < 9.0%**
- Start with metformin

**A1C > 9.0%**
- Start with combination therapy with metformin and one of the following:
  - Secretagogue
    - Glyburide
    - Gliclazide (usually the mono release formulation)
    - Glimepiride
  - Incretin
    - DPP-IV Inhibitor - Sitagliptin
  - Meglitinide
    - Target is post prandial hyperglycemia only
  - TZD
    - Prudent to avoid in those with CVD occurrence and/or high risk profile
    - If choosing a TZD, clinical evidence may recommend pioglitazone rather than rosiglitazone

In the presence of marked hyperglycemia with a risk of metabolic decompensation including glucose toxicity with sustained blood glucose > 15 mmol/L and symptoms with unintended weight loss, **start with (basal) insulin ± metformin ± secretagogue**.

Reassessment Management

Reassess in a timely manner, within 4 - 6 weeks. If glycemic control is not within or approaching target then reassess lifestyle factors and consider adding another oral agent and/or basal insulin. Aggressive combination therapy from the onset in newly diagnosed type 2 diabetes, including the use of basal insulin, can be effective.
Manitoba Diabetes Care Recommendations

4 Insulin
Insulin

Guidelines For Use

Type 1 Diabetes
Insulin is essential for people with type 1 diabetes and should be initiated at the time of diagnosis. Referral to a specialized DHC team is recommended for children and adolescents immediately upon diagnosis.

A basal/bolus regimen with the support of a DHC team is strongly recommended for individuals with type 1 diabetes. Basal/bolus regimens use intermediate-acting insulin or a long-acting insulin analogue once or twice daily as the basal insulin and a rapid-acting as the bolus insulin for meals.

Type 2 Diabetes
Insulin may be very effective in improving glycemic control in people with type 2 diabetes who have not achieved target blood glucose levels through lifestyle changes and/or oral antihyperglycemic agents. Insulin may be the appropriate first choice treatment in individuals with consistent hyperglycemia (PG > 15 mmol/L).

A basal/bolus regimen is recommended for young adults with type 2 diabetes who require insulin and can be considered for any person with type 2 diabetes.

Insulin Initiation - General Notes

• Insulin can be started on an outpatient basis.
• Diabetes education and support is necessary. Close contact between the DHC team and the person starting insulin is needed to review the impact of food intake (including carbohydrate counting), activity, insulin injection technique, SBGM interpretation, dosage adjustments and problem solving.
• Several regimens are possible. All regimens need to be individualized to the person with diabetes.
• A basal/bolus or multiple dose insulin regimen using intermediate or long-acting insulin for the basal dose and rapid-acting insulin for the bolus dose is increasingly preferred. Support from a DHC team will be required.
• Insulin pump therapy (continuous subcutaneous insulin infusion or CSII) should be initiated by a DHC team involving a diabetes specialist.
## INSULIN TYPES

<table>
<thead>
<tr>
<th>Type</th>
<th>Trade Name</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid Acting Insulin Analogue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LISPRO (H)</td>
<td>Humalog</td>
<td>10-15 min</td>
<td>1.0-1.5 hrs</td>
<td>3-5 hrs</td>
</tr>
<tr>
<td>ASPART (NR)</td>
<td>NovoRapid</td>
<td>10-15 min</td>
<td>1.0-1.5 hrs</td>
<td>3-5 hrs</td>
</tr>
<tr>
<td>GLULISINE (A)</td>
<td>Apidra</td>
<td>10-15 min</td>
<td>1.0-1.5 hrs</td>
<td>3-5 hrs</td>
</tr>
<tr>
<td><strong>Short Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGULAR (R)</td>
<td>Humulin R Novolin ge</td>
<td>0.5-1 hr</td>
<td>2-4 hrs</td>
<td>6-8 hrs</td>
</tr>
<tr>
<td><strong>Intermediate Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH (N)</td>
<td>Humulin N Novolin ge NPH</td>
<td>1-3 hrs</td>
<td>4-8 hrs</td>
<td>12-18 hrs</td>
</tr>
<tr>
<td><strong>Long Acting Insulin Analogue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glargine (La)</td>
<td>Lantus</td>
<td>90 min</td>
<td>No peak</td>
<td>24 hrs</td>
</tr>
<tr>
<td>Detemir (D)</td>
<td>Levemir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Premixed (Short/Intermediate Acting, R/NPH)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/90</td>
<td>Humulin (*premix available)</td>
<td>0.5 hr</td>
<td>2-12 hrs</td>
<td>12-18 hrs</td>
</tr>
<tr>
<td>30/70*</td>
<td>Novolin ge</td>
<td>2-3 hrs</td>
<td>12-18 hrs</td>
<td></td>
</tr>
<tr>
<td>40/60</td>
<td></td>
<td>1 hr</td>
<td>12-18 hrs</td>
<td></td>
</tr>
<tr>
<td>50/50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Premixed Insulin Analogue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25% Rapid Acting and 75% Intermediate Acting</td>
<td>Mix 25</td>
<td>15 min (Rapid Acting portion)</td>
<td>1 hr</td>
<td>10-14 hrs</td>
</tr>
<tr>
<td>30% Rapid Acting and 70% Intermediate Acting</td>
<td>NovoMix 30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### INSULIN ACTION CURVE

- **Rapid**
- **Short**
- **Intermediate**
- **Long**

**HOURS**

**INSULIN ACTION**

**Rapid**

**Short**

**Intermediate**

**Long**

**HOURS**
Insulin Regimens

The following insulin regimens are listed in the common order in which to administer in type 2 diabetes. Any regimen may be initially chosen depending on individual circumstances.

**BEDTIME INSULIN AND ORAL AGENTS**

<table>
<thead>
<tr>
<th>oral agent</th>
<th>and</th>
<th>oral agent</th>
<th>and</th>
<th>oral agent</th>
<th>and</th>
<th>N, La, D</th>
</tr>
</thead>
<tbody>
<tr>
<td>amac</td>
<td></td>
<td>lunch</td>
<td></td>
<td>pmac</td>
<td></td>
<td>hs</td>
</tr>
</tbody>
</table>

**Indications:** Type 2 diabetes, to lower fasting glucose levels and to allow oral agents to have optimal effect.

- Start with ≤ 5 units of insulin at hs if the person is lean; ≤ 10 units of insulin at hs if the person is not lean
- Alternatively, may calculate the starting dosage by 0.2 – 0.3 units/kg (0.1 - 0.2 units/kg if there is a particular concern for hypoglycemia)
- Titrate the insulin dosage according to the first morning SBGM value by 1 - 2 units every 3 days until the SBGM values reach target
- Correction dosage for rapid insulin: 1 – 2 units for every 3 mmol/L over 7 mmol/L can sometimes be used at meals along with oral agents

**DAYTIME INSULIN AND ORAL AGENTS**

Insulin (single or mixed) twice daily amac and pmac with oral agents (except TZDs).

**Indications:** Type 2 diabetes.

- Long or intermediate-acting insulin analogue
- Initial dosage: ≤ 5 units BID if person is lean; ≤ 10 units BID if person is not lean
- Alternatively, may calculate the starting dosage by 0.2 – 0.3 units/kg
- Titrate the dosage according to SBGM by 1 - 2 units every 3 days until SBGM values reach target

<table>
<thead>
<tr>
<th>Insulin + oral agent</th>
<th>and</th>
<th>Insulin + oral agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>amac</td>
<td></td>
<td>pmac or hs</td>
</tr>
</tbody>
</table>

**Abbreviations:**

- amac = before breakfast
- pmac = before supper
- hs = bedtime
- R = Regular insulin
- H = Lispro insulin
- NR = insulin Aspart
- N = NPH insulin
- La = Glargine insulin
- D = Detemir insulin
- BID = twice daily
- TID = three times daily
- QID = four times daily
- A = Apidra
**BASAL/BOLUS: QID**

**Indications:** Either type 1 or type 2 diabetes for optimal control. This regimen requires close contact with the DHC team.

**Dosage:** 40 to 50% of TDD (N,La,D) at hs. Balance given as premeal H,NR,A based on insulin/CHO ratio.

<table>
<thead>
<tr>
<th>H,NR,A</th>
<th>and</th>
<th>H,NR,A</th>
<th>and</th>
<th>H,NR,A</th>
<th>and</th>
<th>N,La,D</th>
</tr>
</thead>
<tbody>
<tr>
<td>amac</td>
<td>lunch</td>
<td>pmac</td>
<td>hs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Basal Insulin**
- If starting as a new regimen, initial dosage is ≤ 5 units at hs if the person is lean and ≤ 10 units if the person is not lean
- Titrate the dosage according to the FPG by 1 - 2 units every 3 days until the FPG values reach target
- Alternatively, may calculate the starting dosage by using 50% of calculated TDD*

**Bolus (Rapid) Insulin**
- Rapid insulin dosage may be determined by the insulin/CHO ratio (‘carb counting’), starting with 1 unit rapid insulin / 15 g CHO
- Alternatively, rapid insulin dosage could be determined as a ‘flat dosage’ for each meal based on an average CHO intake for each meal, calculated at 1 - 2 units / 15 g CHO to begin
- Correction dosage for rapid insulin: 1 - 2 units per 3 mmol/L > 7 mmol/L at meals only. It is not recommended to use a correction at night if the person is using a long-acting analogue as this increases the risk for nocturnal hypoglycemia

*Alternatively, TDD can be calculated as 0.2 – 0.3 units/kg to start (0.1 – 0.2 units/kg if there is a concern about hypoglycemia). The basal insulin dosage would be approximately 50% of the calculated TDD.
BASAL/BOLUS: TID

N amac and hs and H, NR (or R), A amac and pmac.

Indications: Either type 1 or type 2 diabetes; may provide optimal control.

Dosage: 50 to 70% of TDD (2/3 N and 1/3 H, NR, A) amac and 15 to 25% of TDD (H, NR, A) pmac and 15 to 25% of TDD (N) at hs.

N & H,NR,A and H,NR,A and N
amac pmac hs

- This option is meant for those using NPH as their basal insulin rather than a long-acting analogue
- This regimen is often a step-wise progression from a previous insulin regimen where the previous insulin dosages can be adapted

Basal Insulin
- If starting as a new regimen, initial dosage is ≤ 5 units at hs if the person is lean and ≤ 10 units if the person is not lean
- Titrate the dosage according to the FPG and pre-supper PG by 1 - 2 units every 3 days until the BG values reach target
- Alternatively, may calculate the starting dosage by using 50% of calculated TDD

Bolus (Rapid) Insulin
- Rapid insulin dosage may be determined by the insulin/CHO ratio for breakfast and supper only in this regimen
- Alternatively, rapid insulin dosage could be determined as a ‘flat dosage’ for each meal, based on an average CHO intake for each meal calculated at 1 unit / 15 g CHO to begin
- Correction dosage for rapid insulin: 1 – 2 units per 3 mmol/L > 7 mmol/L at meals only, not at night if person is using a long-acting analogue
Hypoglycemia Management

Examples of 15 grams of carbohydrate for the treatment of mild to moderate hypoglycemia (> 2.8 mmol/L):

- 15 g of glucose in the form of glucose tablets (1 tablet = 5 g CHO)
- 15 ml (3 teaspoons) or 3 packets of table sugar dissolved in water
- 175 ml (3/4 cup) of juice or regular soft drink
- 6 Lifesavers (1 = 2.5 g CHO)
- 15 ml (1 tablespoon) of honey

Remember, 15 g of glucose usually raises BG by 2 mmol/L within 20 minutes.
Insulin Therapy for Children with Type 1 Diabetes

- All children/adolescents with newly diagnosed type 1 diabetes should be referred to a specialized pediatric DHC team immediately upon diagnosis.
- A basal/bolus regimen is recommended for children and adolescents with type 1 diabetes from the time of diagnosis.
- Insulin dosage adjustments need to be made daily during the first 2 weeks following diagnosis.
- For young children, rapid-acting insulin may be given after the meal, thus allowing the dosage to be adjusted for what the child actually eats.
- Insulin requirements will decrease 1-2 months after diagnosis, when weight is regained, appetite decreases and insulin secretion recovers temporarily (honeymoon phase).
- Insulin doses for basal insulin will increase with age and body size.
- Insulin/CHO ratio for bolus insulin will increase with age and body size.
- Correction dose of rapid-acting insulin will vary with age and body size.
Manitoba Diabetes Care Recommendations

4th Edition

Complication Assessment and Intervention
Manitoba Diabetes Care Recommendations

Retinopathy
Retinopathy

Guidelines for Screening

• Type 1 diabetes: eyes should be examined at 15 years of age or within 5 years of diagnosis.
• Type 2 diabetes: eyes should be examined at diagnosis (or after puberty).
• Screening for retinopathy should be performed by experienced professionals either in-person or through their interpretation of photographs.
• The follow-up interval for those individuals with no or minimal retinopathy is yearly for type 1 diabetes and every 1-2 years for type 2 diabetes.

<table>
<thead>
<tr>
<th>SCREENING for RETINOPATHY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When to initiate screening</strong></td>
</tr>
<tr>
<td>• 5 years after diagnosis of type 1 diabetes in all individuals ≥15 years of age</td>
</tr>
<tr>
<td>• In all individuals at diagnosis of type 2 diabetes</td>
</tr>
<tr>
<td><strong>Screening methods</strong></td>
</tr>
<tr>
<td>• 7 standard field, stereoscopic-colour fundus photography with interpretation by a trained reader (gold standard)</td>
</tr>
<tr>
<td>• Direct ophthalmoscopy or indirect slit-lamp fundoscopy through dilated pupil</td>
</tr>
<tr>
<td>• Digital fundus photography</td>
</tr>
<tr>
<td><strong>If retinopathy is present</strong></td>
</tr>
<tr>
<td>• Diagnose retinopathy severity and establish appropriate monitoring intervals (1 year or less)</td>
</tr>
<tr>
<td>• Treat sight-threatening retinopathy with laser therapy</td>
</tr>
<tr>
<td>• Review glycemic, BP and lipid control, and adjust therapy to reach targets as per guidelines</td>
</tr>
<tr>
<td>• Screen for other diabetes complications</td>
</tr>
<tr>
<td><strong>If retinopathy is not present</strong></td>
</tr>
<tr>
<td>• Type 1 diabetes: rescreen annually</td>
</tr>
<tr>
<td>• Type 2 diabetes: rescreen every 1-2 years</td>
</tr>
<tr>
<td>• Review glycemic, BP and lipid control, and adjust therapy to reach targets as per guidelines</td>
</tr>
<tr>
<td>• Screen for other diabetes complications</td>
</tr>
</tbody>
</table>

Used with permission from Can J Diabetes. 2008;32(suppl 1):S1-S201
Nephropathy and Hypertension

Frequency

Screening for Nephropathy

- Type 1 diabetes: at 12 years of age and 5 years after the onset of diabetes. Continue screening annually.
- Type 2 diabetes: at the time of diagnosis. Continue screening annually.

Used with permission from Can J Diabetes. 2008;32(suppl 1):S1-S201
1. Management of hypertension
   This is the most important aspect of the intervention for microalbuminuria or overt nephropathy.

2. ACE inhibitors or ARB for kidney protective effect

3. Optimal glycemic control

4. Smoking cessation

5. Assess lipids

6. Antiplatelet therapy (ECASA)

FACTORS AFFECTING ACR SCREEN

<table>
<thead>
<tr>
<th>False Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Exercise within previous 24 hours</td>
</tr>
<tr>
<td>• Physiological orthostatic proteinuria</td>
</tr>
<tr>
<td>• Short term marked hyperglycemia</td>
</tr>
<tr>
<td>• Urinary tract infection</td>
</tr>
<tr>
<td>• Uncontrolled hypertension</td>
</tr>
<tr>
<td>• Congestive heart failure</td>
</tr>
<tr>
<td>• Acute febrile illness</td>
</tr>
</tbody>
</table>

INTERVENTION for MICROALBUMINURIA and/or NEPHROPATHY

| 1. Management of hypertension |
| This is the most important aspect of the intervention for microalbuminuria or overt nephropathy. |
| • Hypertension in adults with diabetes should be treated to achieve a target BP < 130/80 mm Hg |

| 2. ACE inhibitors or ARB for kidney protective effect |
| • For adults with type 1 diabetes and microalbuminuria, ACE inhibitors should be used even in the absence of hypertension. An ARB should be substituted for those unable to tolerate an ACE inhibitor. |
| • For adults with type 2 diabetes and a creatinine clearance > 60 mL/min, an ACE inhibitor or ARB should be used. For those with a creatinine clearance ≤ 60 mL/min, an ARB should be used. |

| 3. Optimal glycemic control |
| • Reinforce physical activity, appropriate food choices, self blood glucose monitoring |
| • Initiate or adjust medication, if necessary |

| 4. Smoking cessation |
| • Smoking affects renal vasculature and hypertension |

| 5. Assess lipids |
| • Microalbuminuria can be a marker for dyslipidemia |

| 6. Antiplatelet therapy (ECASA) |
| • 81-325 mg/day recommended for adults at high CVD risk |

ACE = angiotensin converting enzyme
ARB = angiotensin II receptor antagonist
### FOLLOW-UP for MICROALBUMINURIA and/or NEPHROPATHY

<table>
<thead>
<tr>
<th>1. Treat hypertension</th>
<th>Target BP &lt; 130/80 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Monitor renal function by estimated glomerular filtration rate (eGFR) or creatinine clearance (CrCl)</td>
<td>eGFR can be determined by the MDRD formula* (or by lab assay in certain jurisdictions). Creatinine clearance can be determined by the Cockcroft-Gault equation</td>
</tr>
</tbody>
</table>
| 3. Monitor ACE/ARB | - Serum creatinine may ↑ to as much as 30% above baseline, stabilizing within 2-4 weeks  
- No upper limit of creatinine re: contraindication, but caution when creatinine clearance < 30mL/min  
- Serum potassium  
- ACR: after 3 months and annually, looking for reduction |
| 4. Indications for referral | - ACR persistently > 60 mg/mmol  
- eGFR < 30 mL/min  
- ↑ serum creatinine > 30% above baseline within 3 months of ACE/ARB |

*Available at www.nephron.com/cgi-bin/MDRD_GFR.cgi
Hypertension and Diabetes

Hypertension in adults with diabetes should be treated to achieve a target BP < 130/80 mm Hg.

Treatment

- Lifestyle intervention
- Initial antihypertensive treatment (in order of choice)
  Combination treatment often required
  - ACE inhibitor
  - ARB
  - Dihydropyridine calcium channel blocker (DHP-CCB)
  - Thiazide diuretic
  - Cardioselective beta blocker

### ANTIHYPERTENSIVES

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SIDE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Inhibitor</td>
<td>Dry cough</td>
</tr>
<tr>
<td></td>
<td>Hyperkalemia</td>
</tr>
<tr>
<td></td>
<td>Increased serum creatinine</td>
</tr>
<tr>
<td>Angiotension II (ARB) Receptor Antagonist</td>
<td>No cough</td>
</tr>
<tr>
<td></td>
<td>Hyperkalemia</td>
</tr>
<tr>
<td></td>
<td>Increased serum creatinine</td>
</tr>
<tr>
<td>DHP-CCB</td>
<td>Peripheral edema</td>
</tr>
<tr>
<td>Thiazide Diuretic low dose (12.5-25 mg)</td>
<td>Increase in blood glucose, usually not significant</td>
</tr>
<tr>
<td></td>
<td>Hypokalemia</td>
</tr>
<tr>
<td>Cardioselective Beta Blocker</td>
<td>May mask symptoms of hypoglycemia, increasing</td>
</tr>
<tr>
<td></td>
<td>need for SBGM</td>
</tr>
</tbody>
</table>
Manitoba Diabetes Care Recommendations

Neuropathy
## Neuropathy

Diabetic neuropathy can affect the sensory, motor or autonomic nervous system.

### DIABETIC NEUROPATHY

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>DESCRIPTION</th>
<th>INTERVENTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse Symmetrical Polyneuropathy</td>
<td>• Common presentation is peripheral &quot;numbness and tingling&quot; involving hands and feet  &lt;br&gt; • Severe presentations have variable types of pain disrupting sleep. Neuropathic pain needs to be distinguished from intermittent claudication</td>
<td>• Amitriptyline &lt;br&gt; • Gabapentin &lt;br&gt; • Pregabalin &lt;br&gt; • Anticonvulsants (ex: Carbamazepine, Topiramate)  &lt;br&gt; With all therapies, allow 6-8 weeks to see effect.</td>
</tr>
<tr>
<td>Focal Mononeuropathies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranial</td>
<td>• Ex: third nerve palsy with ptosis</td>
<td>• Usually resolves spontaneously</td>
</tr>
<tr>
<td>Peripheral</td>
<td>• Ex: carpal tunnel syndrome &lt;br&gt; • Foot drop</td>
<td>• Usually resolves spontaneously</td>
</tr>
<tr>
<td>Radiculopathy</td>
<td>• Pain in truncal spinal nerve distribution</td>
<td>• Usually resolves spontaneously</td>
</tr>
<tr>
<td>Diabetic Amyotrophy</td>
<td>• Proximal neuropathy manifested by pain, proximal muscle weakness and muscle atrophy</td>
<td>• May respond to treatment for peripheral neuropathy</td>
</tr>
</tbody>
</table>
### DIABETIC NEUROPATHY

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>DESCRIPTION</th>
<th>INTERVENTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomic Neuropathy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Gastrointestinal dysfunction | • Gastroparesis with vomiting/abdominal bloating and pain | • Gastrointestinal motility drugs: Domperidome  
• Frequent small meals  
• Consider basal/bolus insulin regimen with rapid-acting insulin after meals as blood glucose starts to rise |
|                        |                                                                              |                                                                              |
|                        | • Diarrhea                                                                  | • Anti-diarrheal medications                                                  |
|                        |                                                                              |                                                                              |
|                        | • Constipation                                                              | • Increase water and dietary fibre                                            |
| Genitourinary dysfunction | • Difficulty with micturition  
• Incontinence or incomplete emptying (neurogenic bladder)  
• Erectile dysfunction  
• Retrograde ejaculation | • Options for erectile dysfunction include phosphodiesterase type 5 (PDE5) inhibitors, vacuum pump, intrapenile prostaglandins, injections or prosthesis  
• Urology referral |
| Cardiovascular dysfunction | • Postural hypotension  
• Atypical angina | • Postural hypotension  
• elastic stockings  
• mineralcorticoid medication  
• Atypical angina  
• high index of suspicion |
| Other                  | • Hypoglycemia unawareness (common)                                         | • Frequent SBGM                                                              |
|                        | • Anhydrosis (lack of sweating, resulting in dry cracked feet in particular) | • Use moisturizers                                                           |

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**Manitoba Diabetes Care Recommendations**
Manitoba Diabetes Care Recommendations

Foot Complications
Foot Complications

Use of Monofilament

The 10 gram Semmes Weinstein Monofilament is a nylon filament mounted on a handle that has been standardized to deliver a 10 gram force when properly applied. Screening with a monofilament is a validated method to assess for peripheral neuropathy and helps determine the risk of foot ulceration. Monofilament screening is part of the complete foot exam as outlined in the Clinical Assessment section.

The monofilament should be applied to the plantar surface of the great toe, first and fifth metatarsal heads. The total duration of time with which the monofilament should be in contact with the skin should be approximately 2 seconds. Avoid applying the monofilament to ulcer sites, calluses, scars or necrotic tissue. Ask the person where they can feel the monofilament. Ideally, the application should occur twice at the same site. Protective sensation is deemed to be present at each site if the patient correctly answers 2 out of 3 applications.

| RISK CATEGORIES and INTERVENTIONS using the SEMMES WEINSTEIN MONOFILAMENT |
|-----------------------------|---------------------------------|-------------------------------------------------|
| **RISK CATEGORY** | **CLASSIFICATION** | **INTERVENTIONS** |
| 0 | • Intact protective sensation | • Low to no risk of foot complications  
  • Education to be provided  
  • Specialized footwear not necessary at this time  
  • Examine feet at each visit or at least every 4-6 months |
| 1 | • Absent protective sensation  
  • Normal foot morphology  
  • No history of ulceration | • Examine feet at each visit or at least four times per year  
  • Appropriately fitted footwear with a soft insole  
  • Education to be provided |
| 2 | • Absent protective sensation  
  • Foot deformity present  
  • Plantar ulceration absent | • Examine feet at each visit or at least four times per year  
  • Appropriately fitted footwear with a suitable insole  
  • Education to be provided |
| 3 | • Absent protective sensation  
  • History of plantar ulcer | • Examine feet at each visit or at least four times per year  
  • Appropriately fitted footwear with a suitable insole (may need custom footwear)  
  • Education to be provided |
### CLASSIFICATION and INTERVENTION for DIABETIC FOOT ULCERS

<table>
<thead>
<tr>
<th>WAGNER’S GRADE</th>
<th>CRITERIA</th>
<th>INTERVENTIONS</th>
</tr>
</thead>
</table>
| Grade 0        | • Skin intact  
• No open lesions  
• May be non-blanching erythema | • Pare callous. Appropriate footwear to protect feet and reduce pressure over pressure points. |
| Grade 1        | • Superficial skin ulceration (may be seen under area of high pressure) | • Pare callous to expose ulcer base. Obtain specimen for culture if evidence of infection (redness, heat, pus) is present.  
• A hydroactive gel (Duoderm™, Intrasite™ or Tegagel™) covered by clean gauze is simplest approach.  
• Saline wet to dry dressings are an alternative if necrotic debris is present at the base of the wound.  
• Pressure relief is critical for healing and can be accomplished with appropriate footwear, crutches, wheelchairs and casting.  
• Infected ulcers need antibiotics. |
| Grade 2        | • Deeper ulceration, associated with infection/cellulitis  
• Does not extend to bone | • X-ray to determine if bone is involved.  
• Manage the same as Grade 1 ulcer. Use antibiotics. |
| Grade 3        | • Ulcer has extended to deeper tissue layers such as bone  
• Has abscess formation or osteomyelitis | • X-ray to determine if bone is involved.  
• Surgical debridement of infected bone.  
• Appropriate antibiotics administered.  
• Use non invasive assessment of peripheral circulation (ankle brachial index). Vascular surgical referral may be indicated. |
| Grade 4 (gangrene) | • Localized gangrene of toes, forefoot, heel | • Manage as for Grade 3 ulcer.  
• Urgent non invasive assessment of peripheral circulation. Vascular surgical referral may be indicated. |
| Grade 5 (gangrene) | • Gangrene of entire foot | • Urgent assessment as for grade 4 lesions.  
• Vascular surgical referral. |
### ANTIBIOTIC THERAPY for FOOT INFECTION

<table>
<thead>
<tr>
<th>TYPE OF INFECTION</th>
<th>MEDICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Usually associated with cellulitis surrounding an ulceration.</td>
</tr>
<tr>
<td></td>
<td>• May have a small amount of purulent material at base of ulcer. Usually aerobic gram positive cocci.</td>
</tr>
<tr>
<td></td>
<td>• May treat as outpatient.</td>
</tr>
<tr>
<td></td>
<td>• Cloxacillin 500 mg orally (po) qid</td>
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<tr>
<td></td>
<td>• Cephalexin 500 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Tmp/Smx 1 DS po bid</td>
</tr>
<tr>
<td></td>
<td>(Trimethoprim/Sulfamethoxazole)</td>
</tr>
<tr>
<td></td>
<td>• Clindamycin 300 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Amoxicillin and Clavulanic Acid 500 mg po tid</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Range from plantar abscess to cellulitis with tissue necrosis.</td>
</tr>
<tr>
<td></td>
<td>• Use antibiotics effective against staphlococci, streptococci, anaerobes and enterobacteriaceae.</td>
</tr>
<tr>
<td></td>
<td>• If not toxic, treat with local incision, drainage and antibiotics.</td>
</tr>
<tr>
<td></td>
<td>• If toxic, use parenteral antibiotic therapy until stable, then switch to oral therapy (manage as per severe infection - see below).</td>
</tr>
<tr>
<td></td>
<td>• Tmp/Smx 1 DS po bid and</td>
</tr>
<tr>
<td></td>
<td>Metronidazole 500 mg po tid</td>
</tr>
<tr>
<td></td>
<td>• Tmp/Smx 1 DS po bid and</td>
</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Ciprofloxacin 500 mg po bid and</td>
</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Ciprofloxacin 750 mg po bid and</td>
</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Amoxicillin-Clavulanic Acid 500 mg po tid</td>
</tr>
<tr>
<td><strong>Severe</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Limb or life-threatening infections requiring immediate hospitalization and parenteral antibiotic therapy.</td>
</tr>
<tr>
<td></td>
<td>• Early surgical debridement and drainage of abscesses is critical!</td>
</tr>
<tr>
<td></td>
<td>• If in doubt as to appropriate treatment, consult with Infectious Diseases Specialist.</td>
</tr>
<tr>
<td></td>
<td>• When using aminoglycosides, monitor renal function and aminoglycosides blood levels.</td>
</tr>
<tr>
<td></td>
<td>• Clindamycin 600 mg IV every 8 hours (Q8h) and Gentamicin 80 mg IV Q8h</td>
</tr>
<tr>
<td></td>
<td>• Cefoxitin 2 gm IV Q8h</td>
</tr>
<tr>
<td></td>
<td>• Cefazolin 2 gm IV Q8h and Metronidazole 500 mg IV Q8h</td>
</tr>
<tr>
<td></td>
<td>• Piperacillin and Tazobactam 3.375 gm IV Q6h</td>
</tr>
<tr>
<td></td>
<td>• Clindamycin 600 mg IV Q8h and Cefotaxime 1 gm IV Q8h</td>
</tr>
<tr>
<td></td>
<td>• Imipenem/Cilistatin 500 mg IV Q6h</td>
</tr>
<tr>
<td></td>
<td>• Meropenem 1 gm IV Q8h</td>
</tr>
<tr>
<td><strong>Osteomyelitis</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Can be managed with long term oral antibiotic therapy with agents that are well absorbed from the gastrointestinal tract and have good distribution to bone and tissue.</td>
</tr>
<tr>
<td></td>
<td>• Tmp/Smx 1 DS po bid and</td>
</tr>
<tr>
<td></td>
<td>Metronidazole 500 mg po tid</td>
</tr>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
</tr>
<tr>
<td></td>
<td>• Levofloxacin 500 mg po bid and Metronidazole 500 mg po tid</td>
</tr>
<tr>
<td></td>
<td>• Ciprofloxacin 500 mg po bid and</td>
</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
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<tr>
<td></td>
<td>• Ciprofloxacin 750 mg po bid and</td>
</tr>
<tr>
<td></td>
<td>Clindamycin 300 mg po qid</td>
</tr>
</tbody>
</table>
Although the first line therapy for many foot infections are agents such as cloxacillin, cephalaxin, clindamycin or amoxicillin clavulanic acid, the increasing prevalence of methicillin resistant Staphylococcus aureus (MRSA) in Manitoba makes consideration of an agent such as trimethoprim sulfamethoxazole (TMP/SMX) an option in situations where the risk of MRSA related infections is high. In persons who require intravenous antibiotic therapy, intravenous vancomycin would be an appropriate first line therapy for the management of infections caused by MRSA.

Although the antibiotic choices above are suggested as empiric therapy, the ideal approach is to obtain a specimen for culture, initiate empiric therapy and modify the therapy according to the results of the culture.

<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>INTERVENTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Non blanching erythema over pressure points</td>
<td>• Reduce pressure with appropriate foot wear.</td>
</tr>
<tr>
<td>• Calluses and corns</td>
<td>• Reduce pressure. Pare carefully. Use pumice stone. Appropriate footwear.</td>
</tr>
<tr>
<td>• Cutaneous fungal infections</td>
<td>• Clotrimazole cream 1% or Tolnaftate cream 1% or powder applied twice daily. May require antibiotics for superimposed bacterial infection.</td>
</tr>
<tr>
<td>• Intertrigo</td>
<td>• Keep affected skin areas dry. Use antifungal cream.</td>
</tr>
<tr>
<td>• Toenail abnormalities</td>
<td>• May be hypertrophic (thick and horn-like). Cut nails every 3-6 weeks straight across to prevent formation of sharp edges.</td>
</tr>
<tr>
<td>• Paronychia (nail bed infections)</td>
<td>• Twice daily saline solution soaks and adequate nail care. Systemic antibiotics may be necessary.</td>
</tr>
<tr>
<td>• Cellulitis</td>
<td>• Requires antibiotics. The route of administration (oral vs parenteral) will depend on the severity of the infection.</td>
</tr>
<tr>
<td>• Claw Foot</td>
<td>• Need appropriate footwear and orthotic devices.</td>
</tr>
<tr>
<td>• Charcot Foot</td>
<td>• For the acute Charcot foot, reduce deformity by removing pressure with immobilizing foot in cast. For an established Charcot foot, appropriate insoles and shoes will be required.</td>
</tr>
<tr>
<td>• Ischemia</td>
<td>• A painful, cold and white extremity is a surgical emergency (may indicate acute occlusion)!</td>
</tr>
<tr>
<td>• Intermittent Claudication</td>
<td>• Regular foot care and as much walking as possible to build collateral blood flow. Referral to a vascular surgeon.</td>
</tr>
</tbody>
</table>
Manitoba Diabetes Care Recommendations

Dyslipidemia
**Dyslipidemia**

Diabetes significantly increases the risk associated with the complications of atherosclerotic vascular disease, particularly cardiovascular disease (CVD). The non-pharmacologic approach of modifying dietary fat intake and increasing physical activity is the first and key step in improving lipid levels. ECASA at a dose of 81 - 325 mg/day is recommended for adults at high CVD risk.

Most people with diabetes should be considered at high risk for CVD. Some individuals may NOT be considered at high risk such as those who are younger, have a short duration of diabetes, and who do not have diabetes-related complications and other CVD risk factors.

**CVD Risk Factors**

Screen adults beginning at age 30 if risk factors are present.

- Metabolic syndrome of insulin resistance
- IGT/Diabetes*
- Hypertension*
- Dyslipidemia*
- Obesity, particularly abdominal obesity*
- Family history of premature CVD in a first degree relative
- Smoking
- LVH (left ventricular hypertrophy)

*also characteristics of metabolic syndrome

<table>
<thead>
<tr>
<th>TARGET LIPID VALUE based on LEVEL of RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RISK LEVEL</strong></td>
</tr>
<tr>
<td>High (most patients with diabetes)</td>
</tr>
</tbody>
</table>

HDL-C = high-density lipoprotein cholesterol  
LDL-C = low-density lipoprotein cholesterol  
TC = total cholesterol

For individuals at high risk who also have established CVD, consider target LDL < 1.8 mmol/L. Once LDL target has been met, consider treatment for other lipid targets.

- TC/HDL ratio < 4
- TG < 1.5 mmol/L
- Apo B < 0.9 g/L
# TREATMENT OF DYSLIPIDEMIA

LIPID LOWERING AGENTS

<table>
<thead>
<tr>
<th>CLASS</th>
<th>ACTION</th>
<th>SIDE EFFECTS</th>
</tr>
</thead>
</table>
| Fibrates                     | • 20-50% ↓TG  
• 15-20% ↓LDL  
• 10-20% ↑HDL             | • Gastrointestinal  
• Rare risk of rhabdomyolysis when combined with statins  
• Modify dose for patients with reduced creatinine clearance |
| HMG CoA Reductase Inhibitors (Statins) | • 18-55% ↓LDL  
• 5-15% ↑HDL  
• 7-30% ↓TG               | • Rare risk of rhabdomyolysis when combined with fibrates  
• Elevated liver enzymes may be seen, regular monitoring is recommended |
| Nicotinic Acid (Niacin)      | • 5-25% ↓LDL  
• 15-35% ↑HDL  
• 20-50% ↓TG               | • Gastrointestinal  
• May raise blood glucose levels  
• Flushing: 325 mg ASA 1 hr before dose  
• Extended release formulation available |
| Bile Acid Sequestrants       | • 15-30% ↓LDL  
• 3-5% ↑HDL  
• TG may ↑                 | • May raise blood glucose levels  
• Gastrointestinal  
• May worsen hyper-triglyceridemia |
| Cholesterol Absorption Inhibitor (Ezetimibe) | ↓LDL                     | • Few side effects as not absorbed systemically  
• Will not cause malabsorption of nutrients  
• Often used in combination with a statin |

HDL-C = high-density lipoprotein cholesterol  
LDL-C = low-density lipoprotein cholesterol  
TG = triglycerides  

*Lipid targets were based on the 2015 American Diabetes Association recommendations.*

*When monotherapy plus lifestyle modification fail to achieve lipid targets, the addition of a second drug from another class should be considered.*
Manitoba Diabetes Care Recommendations

5 Pregnancy
Pregnancy

Gestational Diabetes

Definition

Gestational diabetes is glucose intolerance with first onset or recognition during pregnancy.

Screening and Diagnosis

All pregnant women should be screened for gestational diabetes at 24-28 weeks gestation.

Risk Factors

- Maternal age ≥ 35 years
- Family history of diabetes
- Identified high-risk ethnic groups including Aboriginal, Hispanic, Asian, South Asian and African
- Pre-pregnancy obesity
- PCOS
- Acanthosis nigricans
- Excess weight gain in current pregnancy
- Previous large infant (4000 g)
- Previous gestational diabetes (GDM)
- Corticosteriod use

If a risk factor is identified during the pregnancy, screening should be performed at that time. If the screen is negative but the risk factor(s) persist, screening should be repeated in the remaining trimesters.

The preferred screening test is a 50 gram oral glucose load, given at any time of day, followed by a plasma glucose at 1 hour.

- If the 1 hour value ≥ 7.8 mmol/L, proceed to the OGTT.
- If the 1 hour value ≥ 10.3 mmol/L, the diagnosis of gestational diabetes can be made.

Diagnosis

If 2 or more values are met or exceeded, the diagnosis is Gestational Diabetes. If 1 value is met or exceeded, the diagnosis is Impaired Glucose Tolerance of Pregnancy.

Impaired Glucose Tolerance of Pregnancy (IGT of Pregnancy) is carbohydrate intolerance in pregnancy and should not be confused with IGT in the non-pregnant person.

IGT of pregnancy carries some of the same implications as does GDM and therefore should be treated in the same fashion.
TARGET BLOOD GLUCOSE LEVELS for PREGNANT WOMEN with GESTATIONAL DIABETES

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting</strong></td>
<td>&lt; 5.3 mmol/L</td>
</tr>
<tr>
<td><strong>Post prandial</strong></td>
<td>1 hr &lt; 7.8 mmol/L</td>
</tr>
<tr>
<td></td>
<td>2 hr &lt; 6.7 mmol/L</td>
</tr>
</tbody>
</table>

**Management**

Nutritional therapy is the primary treatment for GDM. Women with GDM should be assessed and followed as required by a registered dietitian (as part of the DHC team) to ensure that the woman’s dietary intake/meal plan is appropriate to achieve recommended glycemic control, appropriate weight gain and adequate nutritional intake for both the woman and her baby. Physical activity should be encouraged with individualized frequency, type, duration and intensity.

If the woman with GDM does not achieve glycemic targets within 1-2 weeks of initiating nutritional therapy, insulin should be started. A variety of insulin regimens can be used, including QID, TID basal/bolus and BID split/mixed regimens. Pre-mixed insulins are not recommended. In GDM, strong consideration should be given to using a basal/bolus insulin regimen as this regimen most effectively addresses the post prandial glucose rise typically seen in GDM.

Rapid-acting analogues, lispro and aspart, can be used in pregnancy. There is insufficient evidence to date regarding the use of long-acting analogues in pregnancy. However, consideration should be given to those women experiencing nocturnal hypoglycemia with NPH. There is still a theoretical consideration that glargine should be avoided in pregnancy.

**Postpartum Follow-up**

Upon delivery, insulin may be discontinued. Postpartum (6 weeks – 6 months), the non-pregnant 75 gram 2 hour OGTT should be performed to assess for the possible development of type 2 diabetes.
Pre-Existing Diabetes and Pregnancy

Ideally, women with pre-existing diabetes will undergo pre-conception planning with their DHC team. Such planning will optimize glycemic control and assess for the presence of any maternal long-term diabetic complications.

Women with either type 1 or type 2 diabetes should optimize glycemic control to attain an A1C ≤ 7.0% in order to decrease the risks of congenital malformations, first trimester spontaneous abortion, pre-eclampsia and progression of retinopathy, particularly for type 1 diabetes.

As part of pre-conception planning:

- Women with type 2 diabetes should discontinue any oral antihyperglycemic agents and begin insulin to attain glycemic targets.
- Women should be screened for microalbuminuria and/or nephropathy. If positive for either, women should attain optimal glycemic and blood pressure control. Those women with nephropathy should be followed carefully as nephropathy may progress during pregnancy.

- Women using ACE inhibitors or ARBs should change to other antihypertensives considered safe in pregnancy.
- Women should undergo a retinal assessment. Repeat retinal assessment should occur as needed during pregnancy and postpartum.
- Women with pre-existing diabetes are at increased risk of having a baby with a neural tube defect. Therefore, it is recommended that all women with pre-existing diabetes take a 5 mg folic acid supplement (available by prescription) from pre-conception through the first 12 weeks of pregnancy.
Management

Similar to insulin use in GDM, a variety of insulin regimens can be used, including QID, TID basal/bolus and BID split/mixed regimens. Pre-mixed insulins are not recommended. As in GDM, strong consideration should be given to using a basal/bolus insulin regimen.

Rapid-acting analogues, lispro and aspart, can be used in pregnancy. There is insufficient evidence to date regarding the use of long-acting analogues in pregnancy. However, consideration should be given to those women experiencing nocturnal hypoglycemia with NPH. There is still a theoretical consideration that glargine should be avoided in pregnancy.

First Trimester

Insulin sensitivity may increase and insulin requirements may actually decrease.

Second and Third Trimesters

Insulin resistance develops, likely through the action of placental hormones and insulin requirements can generally be expected to rise.

Postpartum Follow-up

With delivery, insulin requirements drop significantly. Often, women may require less than their pre-pregnancy insulin dosage for a period of time immediately postpartum.

<table>
<thead>
<tr>
<th>Target Blood Glucose Levels for Pregnan</th>
<th>Pregnan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tant Women with Pre-existing Type 1 or</td>
<td></td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td></td>
</tr>
<tr>
<td>Fasting</td>
<td>&lt; 5.3 mmol/L</td>
</tr>
<tr>
<td>Post prandial</td>
<td>1 hr &lt; 7.8 mmol/L</td>
</tr>
<tr>
<td></td>
<td>2 hr &lt; 6.7 mmol/L</td>
</tr>
</tbody>
</table>
The Manitoba Diabetes Care Recommendations document was prepared and produced by the Chronic Disease Branch of Manitoba Health.

To ensure consistency with the Canadian Diabetes Association 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada, the Chronic Disease Branch relied upon the expertise and experience of their medical advisors - Dr. Sora Ludwig, adult medical advisor and Dr. Heather Dean, pediatric medical advisor. Both have full-time academic appointments with the University of Manitoba, in the Section of Endocrinology and Metabolism.

Drs. Ludwig and Dean were extensively involved in the development of the national clinical practice guidelines throughout the years 1999, 2003 and 2008. Their experience was incorporated into the development of the Manitoba Diabetes Care Recommendations.

Acknowledgment is also extended to Dr. John Embil for his contribution to the Foot Complications section of the Care Recommendations.