Section 3: Diabetes Overview

SECTION OVERVIEW
- Prevalence of Diabetes in Children and Adolescents
- Types of Diabetes
- Risk Factors for Developing Diabetes
- Diagnosis of Diabetes
- Blood Glucose Control: Goals and Benefits
- Complications

Diabetes is a chronic disease that causes high blood glucose (sometimes referred to as blood sugar). A person’s body breaks down the food eaten into sugar. This sugar is commonly called glucose. Insulin is a hormone made by the pancreas that helps turn glucose into energy. People with diabetes are not able to use glucose because their pancreas no longer produces insulin or the insulin has trouble working, leading to high levels of glucose in the blood. High blood glucose is called hyperglycemia.

Prevalence of Diabetes in Children and Adolescents

The 2008 Burden of Diabetes in Wisconsin estimates that approximately 6,000 (0.5%) children and adolescents in Wisconsin have diabetes. About 3,000 of these children are in the 0-9 year age group and the other 3,000 children and adolescents are in the 10-17 year age group. The majority of children and adolescents have type 1 diabetes, but clinically-based reports and regional studies suggest that type 2 diabetes, although still not as common as type 1 diabetes, is being diagnosed more frequently in youth, particularly American Indians, African Americans, and Hispanic/Latino Americans.

Types of Diabetes

Type 1 Diabetes

Type 1 diabetes (formerly known as insulin-dependent or juvenile-onset diabetes) is usually diagnosed before the age of 30. When a person has type 1 diabetes, the pancreas produces little or no insulin. The body needs insulin to control the amount of glucose in the blood. People with type 1 diabetes must give themselves insulin to survive. Type 1 diabetes is managed by taking insulin, monitoring blood glucose levels, eating healthy foods, and engaging in regular physical activity, all of which helps maintain and control blood glucose levels.
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**Type 2 Diabetes**

Type 2 diabetes (formerly known as non-insulin-dependent or adult-onset diabetes) is usually diagnosed after the age of 40; however, a diagnosis of type 2 diabetes is becoming increasingly more common among younger people. In type 2 diabetes, the body makes some – but not enough – insulin, or the body is not able to use insulin normally. Type 2 diabetes is managed by eating healthy foods, engaging in regular physical activity, and taking oral medication and/or insulin to help maintain and control blood glucose levels. Insulin resistance is commonly found in people with type 2 diabetes.

**Gestational Diabetes**

Gestational diabetes is a condition unique to pregnancy. Blood glucose levels become elevated because of insufficient insulin production by the mother or because the mother’s body is unable to use insulin properly. Gestational diabetes may be managed by monitoring blood glucose levels, eating healthy foods, and engaging in regular physical activity. Insulin may be necessary. Women who had gestational diabetes, as well as the children born to them, are both at increased risk for developing type 2 diabetes later in life.

**Pre-diabetes**

Pre-diabetes is a condition in which blood glucose levels are higher than normal but not high enough for a diagnosis of type 2 diabetes. People with pre-diabetes are 5 to 15 times more likely to develop type 2 diabetes compared to people without pre-diabetes. Other names used for pre-diabetes are impaired glucose tolerance and impaired fasting glucose. People with pre-diabetes may possibly prevent or delay development of type 2 diabetes by maintaining a healthy weight and getting regular physical activity.

**Risk Factors for Developing Diabetes**

The risk for developing type 1 diabetes is not completely understood. People with type 1 diabetes are suspected to have a specific genetic makeup that increases their risk of developing the disease. Scientists believe that type 1 diabetes may be caused by exposure to one or more environmental triggers (e.g., viruses, foods, toxins). The risk of developing type 1 diabetes increases if a parent or sibling has type 1 diabetes.

The risk for developing type 2 diabetes is better understood. Common risk factors for type 2 diabetes include:

- Family history of type 2 diabetes or insulin resistance
- Low levels of physical activity
- Overweight or obesity (especially around the waist)
- Race and ethnicity: African-American, Hispanic/Latino, American Indian, Asian-American, and Pacific Islander
- High blood pressure (hypertension)
- Abnormal cholesterol (lipid) levels: HDL < 35 mg/dL and/or triglycerides > 250 mg/dL
- History of gestational diabetes
- Pre-diabetes
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Diagnosis of Diabetes

The onset of type 1 diabetes usually develops suddenly and commonly with symptoms, such as frequent urination, thirst, and weight loss. Type 2 diabetes develops slowly, with or without symptoms.

In general, diabetes can be diagnosed using one of four tests:

- Fasting plasma glucose (FPG),
- Oral glucose tolerance test (OGTT),
- Random/casual plasma glucose (with symptoms),

Table 1 provides basic information on four diabetes diagnostic tests. For more information on diagnosis of diabetes, refer to Section 13 of the Wisconsin Diabetes Mellitus Essential Care Guidelines: http://dhs.wisconsin.gov/health/diabetes/guidelines.htm.

Table 1: Diagnosis of Diabetes (2010 Criteria)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diabetes Mellitus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 126 mg/dL (7.0 mmol/L)</td>
<td>✫</td>
<td>≥ 200 mg/dL (11.1 mmol/L)</td>
<td>≥ 200 mg/dL (11.1 mmol/L)</td>
<td>≥ 6.5% ✫</td>
</tr>
</tbody>
</table>

Adapted from: American Diabetes Association Clinical Practice Recommendations, 2010

✝ Confirm test in absence of unequivocal hyperglycemia.

Test should be performed in a laboratory using method that is NGSP certified and standardized to the DCCT assay.

Blood Glucose Control: Goals and Benefits

Blood glucose control is fundamental to management of diabetes and to lowering the risk of diabetes-related complications. Blood glucose goals are determined by the student’s diabetes primary care provider(s) and documented in the Diabetes Medical Management Plan (DMMP). Goals are based on individual needs and circumstances. Several key factors determine individual blood glucose goals. Some factors include:

- Age
- Severity and/or frequency of low blood glucose
- Inability to sense that blood glucose is low or going low (called hypoglycemic unawareness)
- Self-management skills and motivation
- Lifestyle factors
- Individual considerations (e.g., recent illness, family stress)
- Existing diabetes complications

Optimal blood glucose control is encouraged for all people with diabetes to assist with reducing the risk of developing diabetes-related complications. Despite this, individual circumstances, especially for children and adolescents, must be considered.
An A1C test measures how well diabetes is controlled over two to three months. The A1C test is the gold standard for assessing and monitoring overall blood glucose control in people with diabetes. The American Diabetes Association recommends testing A1C a minimum of two times per year if glucose control is stable and goals are being met. A1C testing is recommended a minimum of four times per year if treatment goals are not being met and/or if therapy changes are made frequently, such as with children and adolescents. The A1C test can be used to screen for and diagnose diabetes.

The American Diabetes Association developed recommendations for blood glucose goals for students with type 1 diabetes; these recommendations are provided in Table 2. A1C goals are identified for each age group; however, these A1C goals only serve as a guide. A1C goals must be individualized. Although national recommendations for children with type 2 diabetes do not exist, the values in Table 2 are reasonable to use as a guide. Note that experiencing frequent or repeated low blood glucose may have an effect on A1C measurement, making it falsely low and misleading.

Table 2: Plasma Blood Glucose and A1C Goals for Type 1 Diabetes by Age Group

<table>
<thead>
<tr>
<th>Values by age (years)</th>
<th>Plasma blood glucose goal range (mg/dL)</th>
<th>A1C</th>
<th>Rationale for A1C Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before meals</td>
<td>Bedtime/overnight</td>
<td>&lt; 8.5%</td>
</tr>
<tr>
<td>Toddlers and preschoolers (0-6)</td>
<td>100-180</td>
<td>110-200</td>
<td>(but &gt; 7.5%)</td>
</tr>
<tr>
<td>School age (6-12)</td>
<td>90-180</td>
<td>100-180</td>
<td>&lt; 8%</td>
</tr>
<tr>
<td>Adolescents and young adults (13-19)</td>
<td>90-130</td>
<td>90-150</td>
<td>&lt; 7.5%</td>
</tr>
</tbody>
</table>

Adapted from: Diabetes Care (2010). 33(1), S40.

A plasma blood glucose level is obtained by a finger stick and a home blood glucose monitor.

Although there are no national recommendations for children with type 2 diabetes, using the values in this table as a guide is reasonable.

Key concepts in setting glycemic goals:
- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment.
- Blood glucose goals should be higher than those listed above in students with frequent low blood glucose or low blood glucose unawareness (inability to sense that blood glucose is low or going low).
- After-meal blood glucose values should be measured when there is a discrepancy between pre-meal blood glucose values and A1C levels and to help assess glycemia in those on basal/bolus regimens.
- During adolescence, the need for insulin will dramatically increase due to hormone changes and growth.
- For adults 18 years and older, please refer to the Wisconsin Diabetes Mellitus Essential Care Guidelines, found at: http://dhs.wisconsin.gov/health/diabetes/guidelines.htm.
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Estimated Average Glucose

The estimated average glucose (eAG) is a way to report average glucose over time. The eAG is an alternative to using the more familiar A1C result. Health care providers may translate A1C results into an eAG. The eAG uses the same units of measure as people use for daily home blood glucose monitoring. Table 3 provides a comparison chart of A1C and eAG levels.

Table 3: Comparison of A1C and eAG Levels

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>eAG (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0%</td>
<td>97</td>
</tr>
<tr>
<td>5.5%</td>
<td>111</td>
</tr>
<tr>
<td>6.0%</td>
<td>126</td>
</tr>
<tr>
<td>6.5%</td>
<td>140</td>
</tr>
<tr>
<td>7.0%</td>
<td>154</td>
</tr>
<tr>
<td>7.5%</td>
<td>169</td>
</tr>
<tr>
<td>8.0%</td>
<td>183</td>
</tr>
<tr>
<td>8.5%</td>
<td>197</td>
</tr>
<tr>
<td>9.0%</td>
<td>212</td>
</tr>
<tr>
<td>9.5%</td>
<td>226</td>
</tr>
<tr>
<td>10.0%</td>
<td>240</td>
</tr>
<tr>
<td>10.5%</td>
<td>255</td>
</tr>
<tr>
<td>11.0%</td>
<td>269</td>
</tr>
<tr>
<td>11.5%</td>
<td>283</td>
</tr>
<tr>
<td>12.0%</td>
<td>298</td>
</tr>
</tbody>
</table>

Adapted from: Diabetes Care (2008). 31(8), 1473-1478.

Complications

An essential aspect of diabetes management and care is screening for early detection of diabetes complications. The following information is based on the 2010 American Diabetes Association Clinical Practice Recommendations and the Wisconsin Diabetes Mellitus Essential Care Guidelines (available at: http://dhs.wisconsin.gov/health/diabetes/guidelines.htm). Screening and early detection must be individualized and based on clinical judgement.

Retinopathy

Retinopathy is a disease of the eye where the small blood vessels are damaged, leading to changes in the retina. Although retinopathy most commonly occurs after the onset of puberty and after 5–10 years of diabetes duration, it has been reported in students prior to puberty and with diabetes duration of only 1–2 years. For students with type 1 diabetes, the first dilated eye exam should be obtained once the child is 10 years of age or older and has had diabetes for 3–5 years. For students with type 2 diabetes, the first dilated eye exam should be shortly after diagnosis. For both type 1 and type 2 diabetes, annual routine follow-up is generally recommended. Less frequent examinations may be acceptable on the advice of an eye care professional.
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**Nephropathy**

Nephropathy is a word used to describe kidney disease. To reduce the risk and/or slow the progression of nephropathy, glucose and blood pressure control should be optimized. For students with type 1 diabetes, annual screening for microalbuminuria should be initiated once the child is 10 years of age and has had diabetes for five years. For students with type 2 diabetes, annual screening should be initiated at diagnosis. The screening test used is called a urine microalbumin test, which checks for tiny amounts of protein in urine.

**Neuropathy**

Neuropathy is a disease that affects the nervous system causing damage to certain nerves in the body. One of the most common places that neuropathy occurs is in the hands and feet. Although it is unclear whether foot examinations are important in children and adolescents, annual foot examinations are painless, inexpensive, and provide an opportunity for education about foot care. The risk for foot complications is increased in people who have had diabetes over 10 years.

**Cholesterol (Lipids)**

A fasting cholesterol (lipid) panel should be performed on children and adolescents older than two years soon after diagnosis of diabetes and when glucose control has been established if:

- There is a family history of total cholesterol > 240 mg/dL
- There is a family history of a cardiovascular event before age 55
- Family history is unknown

If family history is not a concern, then a fasting lipid panel should be performed at puberty (≥ 10 years). If lipid values fall within the accepted risk levels (LDL-cholesterol < 100 mg/dL), the lipid panel should be repeated every five years.

**Blood Pressure**

Careful control of high blood pressure (hypertension) in students is critical. Hypertension in childhood is defined as an average systolic or diastolic blood pressure >95th percentile for age, sex, and height measured on at least three separate days. Normal blood pressure levels for age, sex, and height, appropriate methods for measurement, and treatment recommendations are available online at: [http://www.nhlbi.nih.gov/health/prof/heart/hbp/hbp_ped.pdf](http://www.nhlbi.nih.gov/health/prof/heart/hbp/hbp_ped.pdf).