



Section 13: Assessing Risk and Prevention of Type 2 Diabetes

| Concern | Care/Test | Frequency |
|---|---|--|
| Assessing Risk and Prevention of Type 2 Diabetes | <ul style="list-style-type: none"> Perform A1C test, fasting plasma glucose test, or oral glucose tolerance test | Test all adults \geq age 45 yrs or with BMI \geq 25 kg/m ² and one other risk factor. If normal, retest in 3 years or less. (See full <i>Guidelines</i> for testing of type 2 diabetes in children and adolescents) |
| | <ul style="list-style-type: none"> Assess lifestyle management and diabetes risk status | At each visit; refer to community resources as appropriate |

MAIN TOPICS INCLUDED IN THIS SECTION:

- Pre-Diabetes and Categories of Increased Risk for Developing Diabetes
- Type 2 Diabetes Risk Factors
- Other Factors Influencing Risk for Type 2 Diabetes
- Prevention of Type 2 Diabetes
- The National Diabetes Prevention Program
- Community Coalitions in Wisconsin
- Assessing Risk for Pre-Diabetes and Type 2 Diabetes in Adults
- Opportunistic and Community Screening for Type 2 Diabetes
- Tests to Diagnose Increased Risk for Type 2 Diabetes
- Children and Adolescents at Risk for Type 2 Diabetes
- Reducing Risk for Metabolic Syndrome, Pre-Diabetes, and Type 2 Diabetes
- Additional Resources
- References

Pre-Diabetes and Categories of Increased Risk for Developing Type 2 Diabetes

Pre-diabetes is a condition where blood glucose levels are found to be higher than normal, but not high enough for diagnosis of type 2 diabetes. The American Diabetes Association (ADA) uses both the terms “pre-diabetes” and “increased risk for developing diabetes” for individuals with multiple risk factors associated with the development of type 2 diabetes. The term “pre-diabetes” will be used in this section.

In Wisconsin, an estimated 1.06 million people age 20 years and older have pre-diabetes. These individuals are considered to be at increased risk for developing type 2 diabetes. Lifestyle modifications, such as dietary changes, a 5-10% weight loss, and increased physical activity (30 minutes a day, at least 5 days a week is recommended) can help reduce the risk for type 2 diabetes. When referring to diabetes prevention in this section, the prevention of type 2 diabetes is implied. Currently, type 1 diabetes is not preventable, but it is being studied in clinical trials.

Type 2 Diabetes Risk Factors

A person with one or more of the following risk factors has a higher chance of developing type 2 diabetes.

- **Family history of diabetes:** If a parent or sibling in the family has diabetes, risk of developing type 2 diabetes increases.
- **Age \geq 45:** Risk for type 2 diabetes increases with age.
- **Race or ethnic background:** Risk for type 2 diabetes is greater in Hispanics/Latinos, African Americans, Native Americans, and Asian Americans
- **Being overweight or obese:** Being overweight or obese, defined as a body mass index (BMI) \geq 25 kg/m², increases the risk for type 2 diabetes.
- **Physical inactivity:** Recommended level of activity is 30 minutes of physical activity five or more days a week (150 minutes per week).
- **History of gestational diabetes:** Developing diabetes during pregnancy or delivering a baby over nine pounds can increase the risk of type 2 diabetes in women.

Other Factors Influencing Risk for Type 2 Diabetes

Insulin Resistance

Insulin resistance is an impaired biological response to insulin and is often an underlying factor that increases the risk for type 2 diabetes. Some individuals have a genetic predisposition to insulin resistance. Decreased insulin sensitivity interferes with the following activities: 1) removal of glucose from plasma, 2) glucose utilization in muscle and fat tissue, and 3) suppression of glucose production in the liver. Insulin resistance presents with clinical markers, such as increased waist circumference (central obesity), acanthosis nigricans (velvety hyper-pigmented areas on neck and/or axillae), and biochemical markers, such

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as abnormal lipid levels and abnormal glucose tolerance test results. Insulin resistance causes the pancreas to produce more insulin in an effort to maintain normal blood sugar levels, resulting in hyperinsulinemia. However, obtaining an insulin level is not useful. Most commercial insulin assays are not standardized making it difficult to interpret the test results. Insulin resistance increases risk for vascular disease. Risk factors associated with the development of insulin resistance include:

- Physical inactivity (< 30 minutes per day at least 5 days a week)
- Overweight and obesity
- Hypertension
- Hypertriglyceridemia
- Decreased HDL cholesterol
- Advancing age
- Abdominal obesity independent of body weight

Metabolic Syndrome

Metabolic syndrome represents a constellation of lipid and non-lipid risk factors of metabolic origin. In the past, this syndrome has been called Syndrome X, Insulin Resistance, Dysmetabolic Syndrome, and Cardiac Dysmetabolic Syndrome. Although metabolic syndrome and pre-diabetes may be present at the same time, not all people with metabolic syndrome have abnormal IFG or IGT results and not all people with increased risk for developing type 2 diabetes have metabolic syndrome. It is estimated that approximately 40% of people with an IGT and 70% of people with type 2 diabetes also have metabolic syndrome.

Also, because of altered glucose metabolism (e.g., glucose intolerance, insulin resistance), obstructive sleep apnea (OSA) may be related to metabolic syndrome, but more evidence is needed. For additional information on OSA, see *Section 1: General Recommendations for Care*.

Using the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, metabolic syndrome is diagnosed when three or more of the following risk factors are present:

- Abdominal obesity (assessed by waist circumference): men > 40 inches, women > 35 inches (Asian men > 35 inches, Asian women > 31 inches)
- Triglycerides \geq 150 mg/dL or on drug treatment for reducing triglycerides
- HDL cholesterol: men < 40 mg/dL, women < 50 mg/dL, or on drug treatment for increasing HDL cholesterol
- Blood pressure \geq 130/85 mmHg or on drug treatment for hypertension
- Fasting glucose \geq 100 mg/dL or on drug treatment for elevated blood glucose

Polycystic Ovary Syndrome

Insulin resistance may be an underlying cause of polycystic ovary syndrome (PCOS), an endocrine (hormonal) disorder affecting 5-10% of all women. For some women, symptoms first appear during the teen years, while others do not develop symptoms until they are in their twenties. PCOS may continue through menopause. Diagnosis is generally made through physical exam and blood tests. Signs and symptoms of PCOS include hirsutism (excessive hair growth), acne, overweight or obesity, infertility, and irregular menstrual periods or oligomenorrhea. The exact cause of PCOS is unknown. Metformin is the current drug of choice used to treat PCOS and associated insulin resistance.

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Cardiovascular Risk

The Framingham Heart Study found people with diabetes have the same risk of a cardiac event as people who have a diagnosis of coronary heart disease (CHD). The NCEP ATP III considers a diagnosis of diabetes a CHD risk equivalent, but does not consider pre-diabetes a CHD risk-equivalent. Individuals who have a history of vascular disease (i.e., stroke) have also been shown to have a higher risk for type 2 diabetes. The NCEP ATP III identifies an elevated risk for developing type 2 diabetes as one component of metabolic syndrome, signifying the need for intensive lifestyle change and careful screening of all other cardiovascular risk factors. For additional information, see *Section 5: Cardiovascular Care*.

Analysis from the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) shows that for individuals with metabolic syndrome and for both black and non-black (Caucasian, Hispanic/Latino, Asian American/Pacific Islander, and American Indian/Alaskan Native) participants, the less costly diuretics consistently controlled blood pressure and are equally beneficial in preventing heart attacks and coronary heart disease death. They are also more beneficial than newer antihypertensive medications in preventing one or more other forms of cardiovascular disease, including heart failure and stroke.

Prevention of Type 2 Diabetes

People at risk of developing pre-diabetes and/or type 2 diabetes can make lifestyle changes to prevent or delay progression of the disease. The Diabetes Prevention Program (DPP) studied the effects of lifestyle changes (healthy eating and a physical activity program) and the drug metformin in participants who had pre-diabetes. Results showed that lifestyle modification reduced the study participant's risk of developing type 2 diabetes by 58%. Average weight loss in the first year of the study was 15 pounds. Lifestyle modification was even more effective in those 60 years and older, reducing risk by 71%. Participants receiving metformin reduced their risk of developing type 2 diabetes by only 31% compared to a placebo group. Metformin was most effective in younger, more obese people.

The DPP provided substantial evidence that interventions, specifically modest weight loss (5-10%) and increased physical activity (30 minutes a day, at least 5 days a week is recommended), can help delay or prevent progression of type 2 diabetes. Implementing and maintaining lifestyle change is difficult. Research demonstrates that evidence-based and structured programs are effective for supporting self-empowerment and maintaining behavior change. People who track and monitor lifestyle behavior (daily or weekly weigh-ins, food or physical activity records, etc.) are more likely to maintain weight loss. Health care providers can be instrumental in referring people with increased risk to evidence-based and structured programs like Chronic Disease Self-Management Program or the YMCA Diabetes Prevention Program. Medical nutrition therapy (MNT) is extremely beneficial in assisting people with weight loss and healthy eating. MNT may not be a covered benefit for pre-diabetes; however, some insurance plans do provide this benefit.

The National Diabetes Prevention Program

The National Diabetes Prevention Program is designed to bring evidence-based lifestyle interventions for preventing type 2 diabetes to communities. It is based on the NIH-led Diabetes Prevention Program (DPP) research study and subsequent translation (real-world) studies. The intervention in these studies emphasizes improving dietary choices, increasing physical activity, coping skills, and group support to help participants

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lose 5% to 7% of their body weight and get at least 150 minutes per week of moderate physical activity. This intervention shows these measures can reduce the risk of developing type 2 diabetes by 58% in people at high risk of the disease.

In March 2010, Congress passed legislation that specifically addresses diabetes prevention through H.R. 3590 – the Patient Protection and Affordable Care Act, SEC. 399V-3, National Diabetes Prevention Program. The legislation authorizes CDC to manage the National Diabetes Prevention Program and establish a network of evidence-based lifestyle intervention programs for those at high risk of developing type 2 diabetes.

CDC's Division of Diabetes Translation is taking a strategic approach to creating the National Diabetes Prevention Program. This approach includes the core elements of:

- **Training:** CDC is helping train the work force that can implement the program cost effectively. To help do this, CDC has established the Diabetes Training and Technical Assistance Center at Emory University
- **Program recognition:** Setting standards that will help ensure program quality and consistency which are necessary components for effectiveness and reimbursement
- **Intervention sites:** Implementing sites that will deliver the intervention to reduce new cases of type 2 diabetes
- **Health marketing:** Raising awareness among both health care providers and high-risk populations to increase referral and use of the program

The National Diabetes Prevention Program provides a critical opportunity for collaboration among federal agencies, community-based organizations, health payers, health care professionals, academia, and others to reduce new cases of type 2 diabetes in the United States. The inaugural partners of the National Diabetes Prevention Program are the Y (also known as YMCA of the USA) and UnitedHealth Group. As the recognition program is implemented, more organizations will become involved in delivering the program intervention.

As of January 2011, a program is currently being offered in La Crosse, Wisconsin. The La Crosse Area Family YMCA was one of 10 YMCAs nationwide to receive a start up grant for the National Diabetes Prevention Program.

Community Coalitions in Wisconsin

Addressing diabetes at a community level is important in terms of creating a supportive environment for residents where they live, work, play, worship, and learn. Many studies suggest improved health behaviors are linked to healthy environments, which indicates a promising future for community intervention work. Many communities in Wisconsin are forming local coalitions to improve physical activity levels and nutrition in their schools, worksites and with other community partners. The Wisconsin Nutrition and Physical Activity Program support these local efforts. A list of local nutrition and physical activity coalitions in the state is available at: <http://www.dhs.wisconsin.gov/health/physicalactivity/coalitionwebs.htm>.

Assessing Risk for Pre-Diabetes and Type 2 Diabetes in Adults

It is estimated that almost 30% of people with diabetes in Wisconsin are undiagnosed. There is still uncertainty whether the most effective strategy for identifying people with diabetes is screening people at high-risk or population-wide screening. The impact of diabetes on cardiovascular health and the high comorbidity between diabetes and cardiovascular risk factors (e.g., high blood pressure and high cholesterol) support the urgency of identifying people at high risk for developing type 2 diabetes through screening. In Wisconsin, the prevalence of high blood pressure in people with diabetes is 43% higher and the prevalence of high cholesterol is 29% higher than in the non-diabetic population. It is not yet proven that earlier detection improves outcomes for people with type 2 diabetes, but it is logical to suggest that it may help.

For additional information, see the tool “Assessing Risk and Testing for Type 2 Diabetes Pathway” found in the Tools Section.

Opportunistic and Community Screening for Type 2 Diabetes

Neither opportunistic or community screening is shown to be reliably effective. Three problems exist with community screening: 1) follow-up of abnormal results are often not provided or are inconsistent; 2) community screening is not frequently targeted specifically at high-risk populations; and, 3) community screening is not a cost-effective approach to early detection based on U.S. research studies. Since many health care systems do provide community screening at health fairs and other community sites, it is important to emphasize that individuals identified as being at risk for type 2 diabetes through community screening (either through a risk questionnaire or from a random blood glucose test result) receive referral to a health care provider for comprehensive diabetes testing, follow up, and education.

The ADA developed a Diabetes Risk Test which is one tool that can be used for diabetes risk assessment during community screenings or at any other time. The ADA Diabetes Risk Test Tool can be found at (<http://www.diabetes.org/risk-test.jsp>) or in the Tools Section.

Another community screening option is a program offered by the National Kidney Foundation (NKF). This program offers free health screenings for individuals at increased risk of developing kidney disease, including people with or at risk of developing type 2 diabetes. For more information about the Kidney Early Evaluation Program (KEEP), contact the National Kidney Foundation of Wisconsin at 1-800-543-6393 or at <http://www.kidney.org/news/keep/index.cfm>.

Tests to Diagnose Increased Risk for Type 2 Diabetes

Four tests can be used to detect those at high risk for type 2 diabetes.

- A1C
- Fasting plasma glucose (FPG)
- Oral glucose tolerance test (OGTT)
- Random plasma glucose

The A1C test was recently identified as an accepted test to predict progression and diagnose type 2 diabetes. The FPG test does not always detect impaired glucose tolerance (IGT) and the 2-hour plasma glucose value in the OGTT does not always detect impaired fasting glucose (IFG). A “random” or “casual blood test” is also used to diagnose diabetes. Although the random test is the most convenient, it is not as reliable, sensitive, or effective as the FPG and OGTT tests. Table 13-1 provides information on the four different test used.

Table 13-1: Tests to Diagnose Increased Diabetes Risk and Diabetes (2011 Criteria)

| Test | A1C ♦❖ | Fasting Plasma Glucose (FPG) ❖ | Oral Glucose Tolerance Test (OGTT) ❖ | Random/Casual Plasma Glucose (with symptoms) ⌘ |
|-------------------------|---|---|--|--|
| How Performed | Can be measured at anytime regardless of eating | Blood glucose is measured after at least an 8 hour fast | 75-gram glucose load (drink) is ingested after at least an 8 hour fast; blood glucose is measured at 2 hours | Blood glucose is measured at any time regardless of eating |
| Normal | ≤5.6% | Impaired fasting glucose (IFG) < 100 mg/dL (< 5.6 mmol/L) | Impaired glucose tolerance (IGT) < 140 mg/dL (< 7.8 mmol/L) | |
| Increased diabetes risk | 5.7%-6.4% | 100 – 125 mg/dL (5.6 – 6.9 mmol/L) | 140 – 199 mg/dL (7.8 – 11.0 mmol/L) | |
| Diabetes Mellitus | >6.5% ❖ | ≥ 126 mg/dL ❖ 7.0 mmol/L ❖ | ≥ 200 mg/dL (≥ 11.1 mmol/L) | ≥ 200 mg/dL (≥ 11.1 mmol/L) (with symptoms) |

Adapted from: ADA Clinical Practice Recommendations, 2011

♦ A1C levels when performed using the National Glycohemoglobin Standardization Program (NGSP) method and standardized to the Diabetes Control and Complications Trial (DCCT) reference assay, not point-of-care testing

❖ Repeat test to confirm diagnosis

⌘ it is not appropriate to have a person eat a meal and then draw a random glucose two hours after

Also, see the tool “Assessing Risk and Testing for Type 2 Diabetes Pathway” found in the Tools Section.

Children and Adolescents at Risk for Type 2 Diabetes

The incidence of type 2 diabetes in children and adolescents has increased dramatically in the last decade. As with adults, only test children and adolescents at increased risk for the presence of or the development of type 2 diabetes. See the Quick Reference sheet: Test Criteria Type 2 Diabetes in Asymptomatic Children and Adolescents in the Quick References section.

Reducing Risk for Metabolic Syndrome, Pre-Diabetes, and Type 2 Diabetes

Individuals found to be at high risk for diabetes may benefit from education and support that addresses lifestyle changes such as weight control, increased physical activity, and moderation of alcohol intake. A Mediterranean-type diet is one option that can reduce cardiovascular disease and diabetes risk (e.g., decrease in inflammation and endothelial dysfunction) and may prove especially beneficial for those with metabolic syndrome or pre-diabetes.

Goals for reducing risk for type 2 diabetes and metabolic syndrome include maintaining a healthy weight and increasing physical activity to address the two most common underlying causes: insulin resistance and sedentary lifestyle. Healthy eating to reduce risk of type 2 diabetes and address metabolic disturbances includes:

- An abundance of fiber, whole grains, fruits, and vegetables
- Legumes (dried beans, split peas, lentils, nuts), low-fat dairy products, fish, poultry, and soy products as primary protein sources
- Moderate amounts of fat from canola or olive oils and nuts
- Reduced amounts of red meats and refined carbohydrates, especially sweets and high-sugar beverages
- Reduced sodium intake and the intake of processed foods

Metformin is considered as one treatment option for individuals at very high risk for developing type 2 diabetes. Studies have provided evidence that metformin is beneficial for preventing or delaying the onset of type 2 diabetes for people with elevated IFG and IGT plus other risk factors such as A1C > 6%, hypertension, low HDL cholesterol, elevated triglycerides or family history of diabetes in a first degree relative. Metformin should only be used in patients with pre-diabetes who are obese and under 60 years of age.

Refer to Table 13-2 for diet and physical activity considerations to assist with reducing risk for type 2 diabetes and other metabolic disturbances. For additional information for reducing risk see the tool titled “50+ Tips to Prevent Type 2 Diabetes” in the Tools Section.

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Table 13-2: Diet and Physical Activity Considerations for Reducing Risk for Type 2 Diabetes and Metabolic Syndrome

| Goal | Specific Recommendations |
|--|---|
| Increase physical activity | Minimum of 30 minutes per day at least five days a week |
| Maintain a healthy weight | Weight loss of 5-10% of initial body weight (if BMI \geq 25.0 kg/m ²) or more. |
| Decrease total fat and saturated fat | Total fat not greater than 25-35% of calories; saturated fat less than 7% of calories and minimize trans fats |
| Emphasize monounsaturated fat | Up to 20% of total calories |
| Carbohydrate intake | Not greater than 50-60% of total calories |
| Decrease sugar and excess starch | Not greater than 50-60% calories from carbohydrates, with emphasis on whole grains, fruits, and vegetables |
| Decrease sodium | Not greater than 2300 mg/day; not greater than 1500 mg/day if, African American, or if person has hypertension, diabetes, or chronic kidney disease |
| Increase fiber | Up to 25-30 g/day or 14g fiber/1,000 kcal |
| Increase antioxidants | Up to 9 servings of fruits and vegetables per day |
| Increase dietary Magnesium, Calcium, Potassium | Per 2000 calories: Mg – 500 mg Ca – 1200 mg K – 4700 mg |

Lifestyle change is important but is difficult for many people. Resources exist to assist people in moving forward with their positive lifestyle change goals. A referral to a registered dietician and/or a diabetes educator are two options if coverage for such is available. If coverage is not available, community resources such as free educational classes, support groups for healthy lifestyle changes, nutrition classes, Medical Nutrition Therapy, telephone support/counseling, and various online resources are other options for consumers. For more information on behavior and lifestyle change specifically for diabetes self-management and medical nutrition therapy see Section 2: *Self-Management Education* and Section 3: *Medical Nutrition Therapy*.

Additional Resources

1. Small Steps, Big Rewards. Prevent Type 2 Diabetes. National Diabetes Education Program (NDEP) Campaign. Information and materials available: http://www.ndep.nih.gov/campaigns/SmallSteps/SmallSteps_index.htm
2. Assessment and Management of Adult Obesity: A Primer for Physicians. Case Studies in Disease Prevention and Health Promotion. Consists of ten booklets that offer practical recommendations for addressing adult obesity in the primary care setting: <http://www.ama-assn.org/ama/pub/category/10931.html>
3. Transtheoretical Model: Stages of Change: <http://www.uri.edu/research/cprc/TTM/detailedoverview.htm>
4. Diabetes Prevention Program Lifestyle Materials: http://www.bsc.gwu.edu/dpp/lifestyle/dpp_dcor.html
5. National Kidney Foundation: Kidney Early Evaluation Program (KEEP): <http://www.kidney.org/news/keep/index.cfm>
6. American Diabetes Association (ADA) Risk Test: <http://www.diabetes.org/risk-test.jsp>

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