North Carolina's Guide to Prevention and Management of Diabetes 3rd Edition

North Carolina Diabetes Advisory Council

Diabetes Primary Prevention

MANAGE WEIGHT | LIVE TOBACCO FREE | PARTICIPATE IN LIFESTYLE CHANGE PROGRAMS
PARTICIPATE IN DIABETES EDUCATION | ENGAGE IN TREATMENT PLAN | GET ADEQUATE SLEEP

Diabetes Primary Prevention

Type 2 diabetes is the most common form of diabetes and can indeed be prevented if not delayed—sometimes for many years—by paying attention to the following healthy behaviors:

Maintain a healthy weight | Adopt healthy eating habits | Be more physically active | Live tobacco free | Get adequate sleep

Maintain a Healthy Weight

According to ***North Carolina's Plan to Address Overweight and Obesity***, developed by Eat Smart, Move More NC, excess weight can be caused by calorie intake that is greater than energy used, a sedentary lifestyle, and insufficient sleep and stress. A person is about six times more likely to develop type 2 diabetes with obesity than with a healthy weight.[44] Being overweight also increases the chance of developing diabetes. The good news is losing 5 to 7% of your body weight can cut the chances of developing type 2 diabetes in half.[45] Effective weight loss programs are those that assist in the implementation of lifestyle changes such as adopting healthy eating habits, being more physically active, getting adequate sleep, managing stress, living tobacco free, and learning how to change behaviors.

Adopt Healthy Eating

Healthy eating can have a major impact on lowering the risk for prediabetes and type 2 diabetes. There are a variety of healthy eating patterns which can be tailored to each person that incorporate their favorite foods, traditions, and cultural preferences as well as address concerns related to religion or socioeconomic factors. Eating patterns represent the total of all foods and beverages consumed in a day.

A registered dietitian nutritionist (RD/RDN) can provide valuable information about how to eat healthy with prediabetes or diabetes, based on the individual's needs, goals, medications, food patterns, and preferences.[46,47] In this process, the person with prediabetes or diabetes and the dietitian collaborate to design a healthy meal plan which can be integrated into daily life with ease while addressing their specific eating pattern and nutritional needs. All people with prediabetes or diabetes should be referred to a RDN initially and ongoing to establish their healthy eating meal plan and then modify as needed.[46,47] There is no single "best" meal plan for people with prediabetes and diabetes; rather a variety for managing prediabetes and diabetes are acceptable. In terms of evidence-based research regarding the comparative benefits of different eating patterns, the outcome data presently is not strong enough to endorse one eating pattern over another.

Key Factors for Healthy Eating Patterns:[47]

Balanced Nutrients: Meals should include a balance of carbohydrates, proteins, and fats to help manage glucose and lipid levels.

Emphasize Healthy Foods: Focus on non-starchy vegetables, fruits, whole grains, and dairy products. Full-fat dairy is now considered acceptable if it is non-sweetened, with 2 to 3 servings per day being reasonable. Choose foods that reduce the risk of chronic diseases.

Limit Added Sugars and Refined Grains: Minimize intake of sugary and highly processed foods.

Whole Foods Over Processed: Opt for whole foods instead of processed options whenever possible.

Manage Carbohydrates: Reducing carbohydrate intake can improve blood sugar levels and should be tailored to individual needs.

Healthy Eating Practices: Avoid trans fats, control portions, and limit added sugars and sodium. The daily recommended sodium intake is less than 2,300 mg for all adults.

Moderate Alcohol Use: If not contraindicated, limit alcohol to one drink per day for women and two for men. Be aware that alcohol can affect blood sugar and contribute to weight gain.[46,47]

Examples of some eating patterns

- Mediterranean Style
- DASH (Dietary Approaches to Stopping Hypertension)
- Vegetarian or Vegan
- Low Fat
- Low-Carbohydrate
- Diabetes Plate Method

Avoid Sugary Drinks: Consuming one sugary beverage per day increases the risk of type 2 diabetes by 6% to 21%.[48] Replace these with water and limit sugary drinks, though moderate use of natural and artificial sweeteners is acceptable. Non-nutritive sweeteners may contribute to weight gain and diabetes.

Carbohydrate Intake for Diabetes: For those struggling to meet blood glucose targets, low- or very low-carbohydrate diets may be considered with guidance from a health care team.

Fasting Considerations: If fasting for religious or medical reasons, do so under health care provider supervision, especially if using insulin or other blood sugar-lowering medications. Intermittent fasting's impact on diabetes management is not fully established and should be approached with careful monitoring.[49]

Table 1. Healthy Eating Patterns Include:[50,51]

Fruits, vegetables, whole grains and fat-free or low-fat dairy and dairy products.

There is convincing evidence that meal plans rich in whole grains decrease risks associated with diabetes. Eating patterns rich in refined grains lead to increased risk.[51]

Strong evidence supports a meal plan high in fruits and vegetables for weight management. They are lower in calories and high in volume and fiber. These foods are efficient because they are low in calories and make you feel full longer.

Additionally, avoid sugar sweetened beverages (SSB).

Lean meats, poultry, fish, beans, eggs and nuts.

There is growing evidence that consumption of red meat (beef, pork, lamb) and processed red meat (bacon, hot dogs, deli meats) increases the risk of diabetes, even among people who consume only small amounts.

Moderate amounts of saturated fats, sodium and added sugars.

The types of fats in your meal plan can impact the development of diabetes. Healthy fats, including polyunsaturated or monounsaturated fats found in liquid vegetable oils, nuts and seeds can help decrease risks associated with prediabetes and type 2 diabetes.

Calorie needs to achieve and maintain a healthy weight.

Maintaining a healthy weight requires keeping the number of calories consumed equal to the number of calories expended. Research shows that portion size influences how many calories a person consumes. Understanding portion sizes is important for individuals to accurately assess the number of calories he/she is consuming. Because oversized portions are common in restaurants, supermarkets and vending machines, it is important to be aware of and practice appropriate portions during meal preparation.[52]

Mobile apps can significantly benefit individuals managing or preventing diabetes, but with thousands available under the "Diabetes" search in app stores, choosing the right one can be overwhelming. Ahn and Stahl (2019) explored the advantages and limitations of these apps and their integration into clinical practice.[54] These apps support various self-care activities, helping users track their goals, monitor progress, and celebrate successes. Since each app is different, it's important for users to be involved in selecting the one that best fits their needs. Below are some apps that have been particularly effective for individuals with prediabetes or diabetes.

SOME RECOMMENDED MOBILE APPS

Nutrition and Fitness

- **The Best Food Tracking Apps Of 2024, According To Dietitians (womenshealthmag.com)**
- **The 11 Best Nutrition-Tracking and Calorie-Counting Apps to Help You Reach Your Health Goals | U.S. News (usnews.com)**
- **9 Best Food Tracker Apps of 2023 (goodhousekeeping.com)**
- **The 8 Best Calorie Counter Apps (healthline.com)**
- **Calory** (Apple/Android); free version available; full features with subscription
- **Noom** (Apple/Android); available by subscription
- **Yazio** (best for international food tracking) (Apple/Android); free version includes calorie-counting; full features available by subscription
- **Calorie Mama AI** (Apple/Android); free with in-app purchases
- **MyPlate** (Apple/Android); full features with subscription
- **MyNetDiary** (Apple/Android); free basic version; full features available by subscription
- **Lifesum** (Apple/Android); free basic version; full features available by subscription
- **Bitesnap** (Apple/Android) free for Android
- **Foodvisor** (Apple/Android)
- **LogMeal API** (Apple/Android) 30 days free

Diabetes Management

- **The 10 Best Diabetes Apps (healthline.com)**
- **Best Apps for Managing Diabetes of 2023 (verywellhealth.com)**
- **Highly Rated Apps for Diabetes—Diabetes Education Services**
- **Glucose Buddy** (Apple/Android); premium version by subscription
- **BlueStar by WellDoc** (Apple/Android); free version available
- **Tidepool** (Apple/Android); free
- **MySugr** (Apple/Android); free with in-app purchases
- **WellDoc/BlueStar Diabetes** (Apple/Android); Virtual
- **One Drop** (Apple/Android); free with in-app purchases
- **Livongo** (Apple/Android); through employers
- **Omada Health** (Apple/Android); Virtual DPP and DSMES

Stress Management

- **Stress Relief Apps That Can Transform Your Life (verywellmind.com)**
- **Mental Health Apps—The American Institute of Stress**
- **Headspace** (Apple/Android); free
- **Insight timer** (Apple/Android); free
- **iSleep Easy** (Apple/Android); free
- **Happify** (Apple/Android); free
- **Sanvello** (Apple/Android); free
- **SuperBetter** (Apple/Android)
- **Serenita** (Apple/Android); free
- **Woebot** (Apple/Android); free; chatbot with text-messaging interface

RESOURCES FOR HEALTHY EATING

Association of Diabetes Care and Education Specialists (ADCES)

- **Diabetes (eatright.org)**
- **adces7_healthy_eating.pdf**

American Diabetes Association (English and Spanish)

- **Eating Well & Managing Diabetes | ADA**
- **Nutrition Handouts and YouTube Videos — Spanish | American Diabetes Association**

National Diabetes Education Program (English and Spanish and adapted for Chinese, African Americans, Southeastern and South Asian Americans, Filipino Americans, and Korean Americans)

- **USDA MyPlate in Multiple Languages**

Center for Disease Control—Nutrition for Diabetes and Healthy Weight

- **Choosing Healthy Foods on Holidays and Special Occasions | CDC**
- **Cómo elegir alimentos saludables en los días festivos y las ocasiones especiales | CDC**
- **Healthy Weight | Diabetes | CDC**
- **Peso saludable (cdc.gov)**

Be More Physically Active

Increased physical activity plays a major role in the prevention and improvement of insulin resistance, prediabetes, gestational diabetes, type 2 diabetes and diabetes-related health complications. Insulin resistance can be present in both those who have obesity and are overweight, as well as those at a healthy weight (lean diabetes mellitus).[53] Aerobic, resistance training and intentional stretching improve insulin action and can assist with long-term management of blood glucose levels, lipids, blood pressure, cardiovascular risk, mortality and quality of life.

The ADA and the National Academy of Sports Medicine (NASM) recommend at least 150 minutes of moderate intensity, mostly aerobic physical activity, per week, spread over at least three days per week with no more than two consecutive days without exercise. According to the CDC, moderate activity can be assessed using a rating of perceived exertion (**Borg rating**) or how hard one feels they are working based on:

- Increased heart rate.
- Increased respiration or breathing rate.
- Increased sweating.
- Muscle fatigue.[54]

Unless your health care provider recommends otherwise, resistance training should also be included at least twice per week, with one or more sets of at least five different resistance training exercises.[55] Individuals unable to meet resistance training guidelines can perform exercises that focus on improving functional fitness and balance. These exercises may reduce risks of falls and improve balance and gait.[56]

Efforts to promote physical activity should focus on developing self-efficacy and fostering social support from family, friends and health care providers and working with communities on accessible, affordable physical activity options. Encouraging mild or moderate physical activity may be most beneficial to adoption and maintenance of regular physical activity participation. Joining a gym or health club might be motivating and enjoyable, but everyone can increase their level of activity and physical fitness at home, including cardio and strength, with minimal resources and equipment.

Live Tobacco Free

Smoking is a proven risk factor for diabetes, with people who smoke being 30%–40% more likely to develop type 2 diabetes than those who don't smoke.[57] The more someone smokes, the greater the chance of developing diabetes.[58] While smoking can increase the risk of developing diabetes, it can also make diabetes management more difficult. Among those with diabetes, people who smoke are more likely to have problems maintaining proper blood sugar levels and may require larger doses of insulin to manage their blood sugar.

Most importantly, people with diabetes who smoke are at a heightened risk of premature death and morbidity from serious complications such as heart disease and stroke, circulation problems, nerve damage, eye problems leading to blindness and kidney disease.

The American Diabetes Association advises all people not to use cigarettes and other tobacco products or e-cigarettes. In recent years e-cigarettes have gained public awareness and popularity because of perceptions that e-cigarette use is less harmful than regular cigarette smoking. Nicotine can raise blood sugar regardless if delivered by smoking or vaping.[59] However, in light of recent CDC evidence of deaths related to e-cigarette use, no individuals should be advised to use e-cigarettes, either as a way to stop smoking tobacco or as a recreational drug.[60]

Get Adequate Sleep

Sleep is a complex and essential biological process that is required daily for all of us. Learning, memory processing, cellular repair and brain development are among the important functions of sleep.[61] In addition to maintaining normal brain functioning, sleep has important roles in controlling the functions of many other body systems. Reducing the total hours of sleep can lead to serious consequences for almost all bodily organs and systems.[62]

Getting adequate sleep is important. Sleep deprivation can contribute to the development of glucose intolerance, insulin resistance, diabetes and metabolic syndrome. A distinct rise and fall of blood sugar levels during sleep appears to be linked to sleep stages. Not sleeping at the right time, not getting enough sleep overall or not getting enough of each stage of sleep disrupts this pattern. For most adults getting seven to eight hours of quality sleep a day is needed to perform adequately, avoid a sleep deficit and not have problem sleepiness during the day.[63] Those who work night shifts, or change shifts frequently, are at a higher risk of type 2 diabetes.[64]

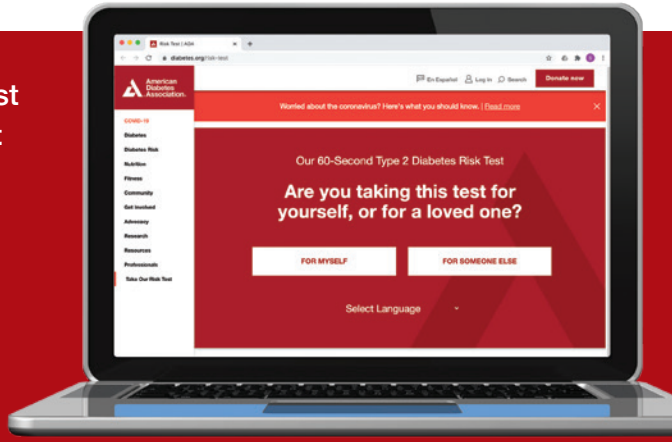
Poor quality sleep may also be associated with overeating and making unhealthy food choices by stimulating hunger signals or suppressing signals of fullness. In turn, overeating especially before going to sleep/going to bed makes it harder to fall asleep or remain asleep.

Obstructive sleep apnea (OSA) is a risk factor for cardiovascular disease, and is very common in those with obesity. People with symptoms suggestive of OSA such as excessive daytime sleepiness, snoring, and/or episodes of not breathing while sleeping, should discuss these symptoms with their medical team. Sleep apnea treatment (lifestyle modification, continuous positive airway pressure, oral appliances, and surgery) significantly improves quality of life and blood pressure management and even the risk of sudden death.[65]

Risk Factor Identification, Early Detection, and Screening[8]

Individuals at high risk for developing diabetes should seek annual screening to detect diabetes at its earliest stages when lifestyle and medication options might be most effective in preventing further progression or complications. Individuals who have one or more of the following: body mass index (BMI) greater than or equal to 25 kg/m^2; family history of diabetes; member of certain racial and ethnic groups; or history of gestational diabetes are particularly at risk for developing diabetes.[66] Even without identifiable risk factors, early detection or screening recommendations for type 2 diabetes suggest that non-pregnant adults 45 years or older be screened, regardless of risk. If screening results are normal, repeat testing should be completed every three years; sooner if adults have any of the risk factors mentioned above or if symptoms of hyperglycemia develop (e.g., excessive urination and thirst, blurred vision, frequent yeast infections, non-healing wounds).

ADA Diabetes Risk Test
diabetes.org/risk-test



Diabetes Awareness for People at High Risk

Some people are at higher risk than others of developing diabetes. In this section we will touch on type 1 diabetes, prediabetes—which is often considered a precursor to type 2 diabetes, gestational diabetes that can occur in some pregnant women, and some of the other conditions associated with diabetes or special risks.

1 Type 1 Diabetes

Type 1 diabetes, which can occur at any age but was formerly known as juvenile diabetes, is caused by an autoimmune reaction in which the body's immune system mistakenly attacks its own cells[22] (islet cell antibodies attack the pancreas cells that produce insulin). Those at highest risk include individuals with a parent, sibling, or other close relative who has type 1 diabetes.[67] While there is currently no way to prevent type 1 diabetes, there is a new medication (teplizumab) that *can delay the progression* to overt and symptomatic hyperglycemia in patients who have islet cell antibodies and dysglycemia (glucoses that are not normal but not consistent with frank diabetes).[16]

2 Type 2 Diabetes

People can have prediabetes for years with no clear symptoms, so it often goes undetected until serious health problems such as type 2 diabetes show up. Risk factors for prediabetes include being overweight, being physically active less than 3 times a week, being age 45 or older, having a parent, brother, or sister with type 2 diabetes, having had diabetes during pregnancy, giving birth to a baby who weighed more than 9 pounds, or having polycystic ovary syndrome. Race and ethnicity are also a factor: African Americans, Hispanic/Latino Americans, American Indians, Pacific Islanders, and some Asian Americans are at higher risk. Once diagnosed with prediabetes, the main treatment goal is to delay or prevent progression to type 2 diabetes primarily through behavioral changes and medications when indicated. Losing a modest amount of weight (5% to 7% of total body weight) through healthy eating and moderate physical activity (such as brisk walking 30 minutes a day, five days a week). A lifestyle change program offered through the CDC-led National Diabetes Prevention Program can help you make those changes—and make them stick. Through the program, you can lower your risk of developing type 2 diabetes by as much as 58% (71% if you're over age 60).[9] North Carolina has over 75 CDC-recognized Diabetes Prevention Program providers that offer either online or onsite classes. Visit **DiabetesFreeNC** to find a program near you.

Gestational Diabetes

You're at risk for developing gestational diabetes[14] (diabetes while pregnant) if you:

- had gestational diabetes during a previous pregnancy
- have given birth to a baby who weighed more than 9 pounds
- are overweight
- are more than 25 years old
- have a family history of type 2 diabetes
- have a hormone disorder called polycystic ovary syndrome (PCOS)[69]
- are African American, Hispanic/Latinx American, American Indian, Alaska Native, Native Hawaiian, or Pacific Islander

Gestational diabetes usually goes away after the baby is born but increases the mother's risk for prediabetes and about 50% of women with gestational diabetes go on to develop type 2 diabetes. Babies born from mothers with gestational diabetes are also more likely to have obesity as a child or teen and are also more likely to develop type 2 diabetes later in life. Before someone gets pregnant, they may be able to prevent gestational diabetes by losing weight if overweight, by eating healthier, and by getting regular physical activity.[67,68]

Other Conditions Associated with Diabetes

Other conditions can cause the body to gradually become more resistant to working with the insulin it produces causing a higher risk of developing type 2 diabetes. A constellation of metabolic abnormalities known as metabolic syndrome—including high LDL (bad) cholesterol, elevated triglycerides, low HDL (good) cholesterol, high blood pressure, excessive body fat, particularly around the waist, and insulin resistance—can lead to high blood sugar. Metabolic syndrome can be a leading cause of prediabetes, characterized by increasing insulin resistance that impairs the body's ability to fully metabolize the glucose consumed. If the body cannot produce enough insulin to overcome this resistance, blood sugar levels will rise to the point where a diagnosis of type 2 diabetes becomes imminent. Metabolic syndrome, prediabetes and many of the conditions listed below can be managed with diet, exercise, and sometimes medications, helping to prevent the onset of complications, including diabetes.

Other metabolic states associated with insulin resistance include medical conditions such as Polycystic Ovary Syndrome, Cushing's Syndrome (an excess of cortisol hormones), Acromegaly (growth hormone excess) and liver disorders called metabolic associated steatotic liver disease (MASLD)/metabolic associated steatohepatitis (MASH).[69]

MASLD is characterized by increased fatty deposits in the liver and is present over half of those with type 2 diabetes.[70] Some individuals with MASLD further develop an inflammatory reaction that can lead to liver scarring, called MASH, which can further progress to cirrhosis. Since MASLD/MASH either coexists with or represents a different manifestation of underlying metabolic syndrome, the rising prevalence of obesity means that fatty liver disorders are increasingly contributing to the global epidemic of type 2 diabetes across all age groups. Currently the American Diabetes Association recommends that patients with type 2 diabetes and elevated liver enzymes or fatty liver on an ultrasound should be evaluated for the presence of MASH and liver fibrosis.[71]

People with other autoimmune diseases such as celiac disease and autoimmune thyroid disease as well as those infected with the hepatitis C virus are also at higher risk of developing autoimmune insulin deficient diabetes. Diseases of the pancreas, such as cystic fibrosis, hemochromatosis, and chronic pancreatic inflammation, can lead to insulin deficiency and eventually diabetes. Individuals with autoimmune diseases should be regularly screened for the development of diabetes.[71]

Lifestyle Change Programs to Prevent Diabetes

In 2010, the Centers for Disease Control and Prevention (CDC) launched the National Diabetes Prevention Program (National DPP) to combat prediabetes and prevent type 2 diabetes through a CDC-recognized lifestyle change initiative. This evidence-based, yearlong program empowers individuals with prediabetes or those at risk of developing type 2 diabetes to implement realistic and achievable lifestyle modifications, potentially reducing their risk by up to 58%.[73]

DPP classes are designed to help participants take charge of their health and well-being by teaching them how to incorporate healthier eating, moderate physical activity, and essential skills such as problem-solving, stress management, and coping strategies into their daily routines. The program is offered in-person or virtually, featuring at least 16 sessions with a trained lifestyle coach in the first six months, followed by at least six additional follow-up sessions. CDC recognition ensures that these programs provide high-quality, evidence-based support.

Getting Help Through Education and Diabetes Prevention Programs

Health care providers, Diabetes Care and Education Specialists, registered dietitian nutritionists (RDN), pharmacists, lifestyle coaches, and other health care providers can assist in individual and group diabetes prevention education.

In 2010, the Centers for Disease Control and Prevention (CDC) created the National Diabetes Prevention Program (National DPP) to address prediabetes and type 2 diabetes prevention through a CDC-recognized lifestyle change program. This yearlong lifestyle change program is evidence-based and helps people who have prediabetes and/or are at risk for type 2 diabetes make achievable and realistic lifestyle changes and reduce their risk of developing type 2 diabetes by up to 58%.[73] Diabetes Prevention Program (DPP) classes are designed to empower people with prediabetes to take charge of their health and well-being. Participants learn ways to incorporate healthier eating and moderate physical activity, as well as problem-solving, stress-reduction and coping skills into their daily lives. The DPP classes are delivered either in-person or virtually with a trained lifestyle coach for at least 16 sessions in the first 6 months, then at least 6 follow-up sessions in the next 6 months. The CDC recognition assures that DPPs deliver quality and evidence-based support.

Diabetes Prevention Programs in North Carolina

North Carolina has numerous CDC-recognized Diabetes Prevention Program providers that offer both online and onsite classes. These programs are available in diverse community settings, including local health departments, YMCAs, community centers, faith-based organizations, hospitals, and workplaces. In 2016, the North Carolina General Assembly allocated funding to the Division of Public Health for the North Carolina Office of Minority Health and Health Disparities (NC OMHHD) to establish and manage an evidence-based diabetes prevention program specifically focusing on African Americans, Hispanic/Latin Americans, and American Indians (HB 1030, 2015-241, Section 12E.3). The goal of the Minority Diabetes Prevention Program (MDPP) is to establish a statewide framework to decrease the incidence of diabetes in minority communities. The MDPP strives for health equity in all practices and policies, and was created to address the many barriers and challenges that exist within minority communities to seek and receive equitable programs and services.

Medicare Diabetes Prevention Programs[74]

Medicare's Diabetes Prevention Program expanded model is a structured behavior change intervention that aims to prevent the onset of type 2 diabetes among Medicare beneficiaries with an indication of prediabetes. It differs from other DPPs in that Medicare requires CDC Diabetes Prevention Recognition for reimbursement eligibility. Medicare Part B (Medical Insurance) will cover the costs of a diabetes prevention program only if all specified conditions are met. Eligibility requires blood tests (such as hemoglobin A1C or fasting plasma glucose) within specific ranges, a body mass index (BMI) of 25 or higher (or 23 or higher if you are Asian), and a history of not being diagnosed with type 1 or type 2 diabetes or End-Stage Renal Disease (ESRD). Additionally, individuals must not have previously participated in the Medicare Diabetes Prevention Program. The program begins with 16 core sessions conducted in a group setting over a six-month period. It focuses on helping participants achieve realistic, lasting behavior changes, offering tips for increasing physical activity, strategies for weight management, support from a trained behavior coach to keep the participant motivated, and encouragement from peers with similar goals.

Upon completing the core sessions, participants can access six additional months of less intensive monthly follow-up sessions to help maintain healthy habits. If specific weight loss and attendance goals are met, a participant may also qualify for an extra 12 months of ongoing maintenance sessions.

Common Terms and Acronyms Used for Diagnosing Prediabetes and Diabetes[75]

A1C:
Hemoglobin A1C

BMI:
Body Mass Index

FBG:
Fasting Blood Glucose

FPG:
Fasting Plasma Glucose

GDM:
Gestational Diabetes Mellitus

IFG:
Impaired Fasting Glucose

IGT:
Impaired Glucose Tolerance

OGTT:
Oral GlucoseTolerance Test

TIR:
Time in Range

Diagnosing Diabetes

Recommended Screening Guidelines for Prediabetes and Diabetes

Providers should consider testing overweight or obese adults with a BMI ≥ 25 kg/m^2, or 23 kg/m^2 in Asian Americans, with ***one or more of the risk factors identified below***.[22]

- First degree relative (parent or sibling) with diabetes
- High risk race/ethnicity (African American, Hispanic/Latinx, Native American, Asian American, or Pacific Islander)
- History of cardiovascular disease
- Hypertension (BP ≥ to 130/80 mm/Hg or on therapy for hypertension
- HDL Cholesterol ≤ 35 mg/dl and/or Triglycerides ≥ 250 mg/dl
- Women with Polycystic Ovarian Syndrome (PCOS)
- Physical inactivity
- Insulin resistance associated clinical conditions as noted above, acanthosis nigricans, pregnancy, or women who are overweight and currently planning pregnancy.
- A1C ≥ 5.7%.
- People with HIV, history of pancreatitis, exposure to high risk medication

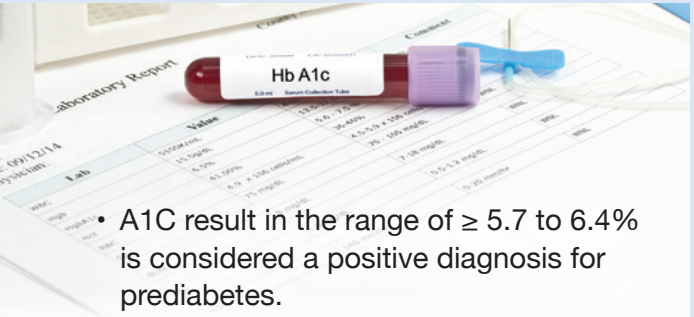
Frequency of Testing

- People with an A1C ≥ 5.7%, or with prediabetes, IGT, or IFG should be tested yearly.
- Women who had gestational diabetes mellitus (**GDM**) *should be tested 4–6 weeks postpartum and then for the remainder of their lives.*
- Otherwise, **testing for diabetes should begin for all individuals beginning at age 45 years**.
  - *If results are normal, those individuals should be tested every 3 years or more* frequently based on risk, lab results, diabetes symptoms, and/or change in health status.

Diagnosis Criteria

There are several methods that can be used to diagnose both prediabetes and diabetes. These involve blood testing at either a health care provider's office or commercial laboratory. **It should be noted that a positive result based on one test alone in the absence of symptomatic hyperglycemia *(high blood glucose levels)* is insufficient.** *Diagnosis is best confirmed based on validation by two abnormal test results.*[22]

Hemoglobin A1C (A1C) is one test used to diagnose prediabetes or diabetes. This blood test measures the average amount of glucose circulating in the blood stream during the past three-month period. (Hemoglobin is a protein found in red blood cells that carries oxygen in the blood. Glucose adheres to the hemoglobin on these red blood cells; so, by measuring the Hemoglobin A1C, it is possible to know the average percent of circulating glucose during this time frame.)



- A1C result in the range of ≥ 5.7 to 6.4% is considered a positive diagnosis for prediabetes.
- A1C result ≥ 6.5% is considered a positive diagnosis of diabetes.

Facts about the A1C

- It is possible for people with prediabetes to lower their A1C value below 5.7% to halt progression toward the development of diabetes.
- The **A1C** test is also used for people already diagnosed with diabetes to assess hyperglycemia (high blood sugar levels).
- It is recommended that individuals with diabetes aim to keep their A1C level below 6.5% without **hypoglycemia** (low blood sugar levels) with the goal of preventing complications. **It should be noted this goal is individualized for each person** based on age, medications, concomitant health issues, and other factors such as barriers to care, personal issues, and social determinants of health.
- HbA1 can be inaccurate in patients with anemia, iron or b12 deficiency, sickle cell, thalassemia, or blood loss.

The **fasting plasma glucose (FPG)** can also be referred to as **fasting blood glucose (FBG)** is also used to diagnose prediabetes and diabetes. Fasting is defined as *no caloric intake for at least 8 hours*. This test is most reliable when given in the morning. FBG is one of the most commonly used tests for diagnosing diabetes.

- FPG less than 100 mg/dl fasting is considered normal.
- FPG ≥ 100 and ≤ 125 mg/dl are diagnostic for prediabetes.
- FPG ≥ 126 mg/dL is positive for diabetes (when found on more than one occasion).

The **oral glucose tolerance test (OGTT)** is another method used to diagnose prediabetes, diabetes, and gestational diabetes. This test is usually performed after overnight fasting and measures blood glucose before and two hours after a person drinks a standardized liquid containing 75 grams of glucose dissolved in water. This test is often used for prediabetes screening as it identifies post meal hyperglycemia, which often presents prior to an increase in the fasting glucose level.

- Normal: a blood sugar level at 2 hours of ≤ 140 mg/dL
- Prediabetes is diagnosed at a two-hour blood glucose level of 140 to 199 mg/dl,
- Diabetes is diagnosed at two-hour blood glucose level ≥ 200 mg/dl.

A random plasma glucose ≥ 200 mg/dL whether fasting or not is also considered diagnostic for diabetes.

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HEALTH AND
HUMAN SERVICES
Division of Public Health

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