

Prediabetes Screening and Management

Key Messages

- Screening and early intervention can minimize progression from prediabetes to type 2 diabetes.
- Treatment options for prediabetes include lifestyle modifications, pharmacologic treatment, and/or surgical intervention.

At the conclusion of this activity, participants will be able to:

- Define the diagnostic criteria for prediabetes;
- Identify patient risk factors and indications for prediabetes screening; and
- Discuss management strategies that incorporate recommended lifestyle modifications, pharmacotherapy, and/or surgical intervention.

Introduction

Prediabetes is characterized by glucose levels which are elevated, but do not meet the criteria for diabetes.^{1,2} A diagnosis is made based on fasting plasma glucose (FPG), hemoglobin A1c (A1c), or oral glucose tolerance test (OGTT). Prediabetes is associated with obesity, dyslipidemia, and hypertension, and indicates an elevated risk for type 2 diabetes, heart disease, and stroke. It is estimated that 15-30% of individuals with prediabetes will develop type 2 diabetes within 3 to 5 years of diagnosis.³ However, with screening and early intervention type 2 diabetes may be prevented or delayed.

Diagnostic criteria for prediabetes:^{1,2}

Fasting plasma glucose (FPG) 100-125 mg/dL

- FPG is a blood test measuring the concentration of sugar in the blood after a fast of at least 8 hours.

Hemoglobin A1c (A1c) 5.7-6.4%

- A1c is a blood test that estimates average blood sugar levels over the past 3 months.

Oral glucose tolerance test (OGTT) 140-199 mg/dL

- OGTT uses blood samples taken before and 2 hours after ingestion of 75 grams of glucose. It measures how the body processes sugar.

Among adults in the United States (US), the prevalence of prediabetes is similar across racial and ethnic groups.⁴ There is a strong association between diabetes risk and social factors such as socioeconomic status, food environment, and physical environment.⁵ In addition to the health complications that prediabetes can cause, it also has economic effects. Based on 2017 data, annual medical costs for prediabetes are estimated at an average of \$500 per person.⁶ This results in a national average cost of \$43.4 billion annually, with costs in New York State (NYS) estimated at over \$2.6 billion.

Currently, there are 96 million individuals in the US with prediabetes, which is 1 in every 3 adults.⁷ Of these individuals, 80% are unaware of their condition. In NYS, it is estimated that over 5 million individuals have prediabetes, with 1.5 million reported diagnoses.^{3,6} Projections

indicate that prediabetes could affect 1 billion people worldwide by 2045.⁸ By spreading awareness and implementing appropriate screening and interventions, disease progression may be prevented, along with other serious health complications such as amputations or vision loss.

Educational websites for patients:

NYS Department of Health:

- <https://www.health.ny.gov/diseases/conditions/diabetes/prediabetes/>

Center for Disease Control and Prevention (CDC):

- <https://www.cdc.gov/diabetes/basics/prediabetes.html>

Symptoms

Patients with prediabetes often present with no symptoms.⁹ Some patients may experience darkened skin in the armpits or on the back and side of the neck (acanthosis nigricans), skin tags, and vision changes. As the disease progresses, patients may also begin to experience symptoms associated with hyperglycemia. If any of the following symptoms present, patients should be screened for type 2 diabetes:^{1,10}

- Increased thirst (polydipsia)
- Increased hunger (polyphagia)
- Frequent urination (polyuria)
- Fatigue
- Blurred vision
- Unintentional weight loss
- Numbness in hands or feet (neuropathy)
- Frequent infections due to weakened immune system
 - Urinary tract, skin and soft tissue, and respiratory infections are the most common

Risk factors

The risk factors for prediabetes are listed below.^{1,7,11}

- Family history of diabetes
 - First-degree relative: Parent, sibling
- Age 45 years or older
- Overweight or obese
 - Overweight: Body mass index (BMI) of 25 kg/m² to 29.9 kg/m²
 - Obese: BMI of 30 kg/m² or more
- Physical inactivity
 - Participates in physical activity less than 3 times per week
- History of gestational diabetes or has given birth to a child who weighed over 9 pounds
- History of polycystic ovary syndrome (PCOS)
- African American, Asian American, Latino, Native American, or Pacific Islander ethnicity
- Health conditions such as high blood pressure or abnormal cholesterol and triglyceride levels

Indications for screening

Screening for prediabetes is essential for early detection and intervention to improve overall health outcomes.^{1,11,12} Indications for screening depend on age and risk factors. Medications known to increase the risk of diabetes, such as glucocorticoids, thiazide diuretics, atypical antipsychotics, and some human immunodeficiency virus (HIV) medications, should also be considered when determining whether to screen.¹ The US Preventive Services Task Force (USPSTF) recommends screening every 3 years in overweight or obese adults aged 35 to 70 years.¹¹ The American Diabetes Association (ADA) and American Association of Clinical Endocrinology (AACE) recommend universally screening all adults 35 years and older every 3 years regardless of risk factors.^{1,13} USPSTF did not find sufficient evidence to recommend for or against screening children and adolescents.¹⁴ However, the ADA suggests screening children and adolescents at the onset of puberty or those 10 years of age and older who are overweight or obese and have 1 or more additional risk factors.¹ The recommendations for screening asymptomatic children, adolescents, and adults per the USPSTF, ADA, and AACE are listed in Table 1.

Table 1. Screening recommendations per AACE, ADA, and USPSTF^{1,11,13,14}

Source	Population recommended for screening	Frequency of repeat screening
AACE	Adults 35 years and older regardless of risk factors	Every 3 years
ADA	Adolescents at onset of puberty or those 10 years and older who are overweight (BMI 85 th percentile or higher) or obese (BMI 95 th percentile or higher) AND have 1 or more additional risk factors ^a	Every 3 years
	Adults 35 years and older regardless of risk factors	Every 3 years
	Adults who are overweight/obese with 1 or more risk factors ^b	If results are normal, rescreen every 3 years with more frequent testing depending on initial results and risk status
	Diagnosis of gestational diabetes	Every 3 years (lifelong)
	Diagnosis of HIV	Before starting antiretroviral therapy (ART), when switching ART, and 3-6 months after starting or switching ART; if initial screening results are normal, check fasting glucose annually ^c
USPSTF	Adults 35 to 70 years who are overweight or obese	Every 3 years

AACE= American Association of Clinical Endocrinology; ADA= American Diabetes Association; USPSTF= United States Preventive Services Task Force; BMI= body mass index

^a Risk factors: Maternal history of diabetes or gestational diabetes mellitus during the child's gestation; family history of type 2 diabetes in first- or second-degree relative; African American, Asian American, Latino, Native American, or Pacific Islander race/ethnicity; signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight). ^b Risk factors: First-degree relative with diabetes; African American, Asian American, Latino, Native American, Pacific Islander; history of cardiovascular disease; hypertension; HDL <35 mg/dL and/or triglycerides >250 mg/L; polycystic ovary syndrome; physical inactivity; clinical conditions associated with insulin resistance (acanthosis nigricans, severe obesity). ^c In people with HIV, A1c test may underestimate glycemia, therefore screening with fasting glucose is recommended.

Risk assessment tools:

Centers for Disease Control and Prevention: <https://www.cdc.gov/prediabetes/takethetest/>

American Diabetes Association: <https://diabetes.org/diabetes/risk-test>

Diagnostic criteria for prediabetes

Glucose measurements in venous plasma should be used when screening and diagnosing prediabetes.¹⁵ According to ADA and AACE guidelines, prediabetes is defined as an FPG of 100 to 125 mg/dL and/or OGTT of 140 to 199 mg/dL and/or A1c of 5.7% to 6.4%.^{1,2} The diagnostic criteria for prediabetes and diabetes are listed in Table 2. If screening results fall within the prediabetes range, carefully monitor the patient, recommend lifestyle modifications, and retest in 3 to 6 months.¹

Table 2. Diagnostic criteria^{1,2}

	Fasting Plasma Glucose (FPG)	Oral Glucose Tolerance Test (OGTT) ^a	Hemoglobin A1c (A1c)
Normal	< 100 mg/dL	< 140 mg/dL	< 5.7%
Prediabetes	100-125 mg/dL	140-199 mg/dL	5.7-6.4%
Diabetes^b	≥ 126 mg/dL	≥ 200 mg/dL	≥ 6.5%

^a Oral glucose tolerance test can also be referred to as 2-hour plasma glucose test

^b Diagnosis of diabetes requires 2 abnormal test results, either from the same sample or 2 abnormal results from samples drawn on different days

Interventions

Treatment options for prediabetes include lifestyle modifications, pharmacologic treatment, and/or surgical intervention.^{2,16} Lifestyle modifications are the mainstay of therapy. When behavioral changes alone are ineffective, pharmacological or surgical treatment may be recommended in addition to lifestyle modifications. According to the AACE guidelines, the main goals of treatment are to promote weight loss, prevent progression to type 2 diabetes, improve cardiovascular disease (CVD) risk factors, and improve functionality and quality of life.²

Figure 1. Summary of prediabetes treatment recommendations

LIFESTYLE MODIFICATIONS

Lifestyle interventions have been shown to prevent or delay type 2 diabetes and improve other cardiometabolic risk indicators, such as blood pressure and lipids.¹⁶ Weight loss through dietary changes and increased physical activity has the strongest evidence for diabetes prevention. The CDC National Diabetes Prevention Program (DPP) coordinates the provision of evidence-based lifestyle change programs across communities.¹⁷ CDC-recognized lifestyle change programs are an integral part of the National DPP and have been shown to reduce the risk of diabetes by 58%. These structured lifestyle change programs embed a trained lifestyle coach and utilize group support to motivate participants and overcome barriers to healthy eating and physical activity. Recognized DPPs available in NYS can be found at: <https://dprp.cdc.gov/Registry>.

Additional resources:

For patients and healthcare professionals: <https://www.cdc.gov/diabetes/prevention/index.html>
 More about the NYS Diabetes Prevention Program: https://health.ny.gov/health_care/medicaid/redesign/ndpp/index.htm

Nutrition

Patients should be encouraged to adopt a healthy diet to assist in the management of their condition and for the prevention of further complications.^{2,16} Developing healthy eating patterns is essential for the treatment of prediabetes and should be individualized based on patient preferences and metabolic goals. The consumption of higher nutritional quality foods has been associated with a lower risk of type 2 diabetes.

- Emphasize whole grains, legumes, nuts, fruits, and vegetables; minimize refined and processed foods
- Examples of eating plans:
 - Low carbohydrate
 - Vegetarian
 - Mediterranean style
 - Dietary Approaches to Stop Hypertension (DASH)

Patients who are overweight or obese should consider adjusting daily caloric intake to promote weight loss and enhance overall health.^{2,16} They should seek to specifically reduce saturated fats and simple sugars.

- Weight reduction of 7% to 10% in persons who are overweight/obese has been shown to reduce progression to type 2 diabetes

Teaching tools/diet resources for patients:

American Diabetes Association Recipes and Nutrition: <https://diabetes.org/healthy-living/recipes-nutrition>

US Department of Agriculture MyPlate: <https://www.myplate.gov/resources/tools/startsimple-myplate-app>

Physical activity

Physical activity can help reduce glycemia, manage weight, and cut the risk of further disease progression.^{2,16} Patients should incorporate movement into their everyday lives to improve their overall health and well-being. The physical activity recommendations below are based on the Physical Activity Guidelines for Americans, 2nd edition, from the US Department of Health and Human Services, Office of Disease Prevention and Health Promotion.¹⁸

- Adults (18 years and older):
 - At least 150 minutes of moderate-intensity aerobic activity per week
 - Moderate- to high-intensity muscle strengthening activities at least 2 days per week
- Children (6-17 years old):
 - At least 60 minutes of moderate- or vigorous-intensity aerobic activity daily; include vigorous-intensity activity on at least 3 days per week
 - Muscle- and bone-strengthening activities on at least 3 days per week

Tools and resources for patients:

Move Your Way[®] physical activity campaign: <https://health.gov/moveyourway>

CDC: <https://www.cdc.gov/diabetes/managing/active.html>

Smoking cessation

In patients with prediabetes, smoking further increases the risk of developing type 2 diabetes, heart disease, and stroke.¹⁹ Nicotine can contribute to increased glucose levels. Other chemicals in cigarettes can cause inflammation which can make cells stop responding to insulin.

- Routine evaluation of tobacco use and referral for tobacco cessation should be completed for those at risk of diabetes¹⁶

Smoking cessation tools and resources:

NYS referral program and resources: <https://www.nysmokefree.com/>

CDC clinical cessation tools: <https://www.cdc.gov/tobacco/patient-care/clinical-tools/index.html>

Adequate sleep quantity and quality

Lack of sleep can make management of prediabetes difficult.²⁰ Not getting enough sleep can cause an increase in insulin resistance, alter appetite-regulating hormones, make it harder to lose weight, raise blood pressure, and increase the risk of depression and anxiety. It is essential to implement a healthy sleep schedule, such as going to bed and waking up at the same time every day, to improve quantity and quality of sleep.

- Recommended amount of sleep:
 - Adults:^{2,21}
 - 6 to 8 hours of sleep per night
 - Children:²²
 - 6-12 years old: 9 to 12 hours of sleep per 24 hours
 - 13-18 years old: 8 to 10 hours of sleep per 24 hours
- Sleep hygiene tips:²⁰
 - Keep bedroom dark, quiet, relaxing and cool
 - Remove electronic devices before bed
 - Create a routine to get ready for bed

More information for patients:

CDC sleep tips: <https://www.cdc.gov/diabetes/library/features/diabetes-sleep.html>

Stress reduction

Stress can cause mental and physical effects that can impact weight and glucose regulation.²³ It is important for patients with prediabetes to learn how to effectively manage and reduce stress, including the stress of managing prediabetes.

- Example stress management strategies include diaphragmatic breathing and meditation
- When depression is present, a referral for cognitive behavioral therapy and/or medical intervention should be considered²

More information for patients:

Easing diabetes care stress: <https://diabetes.org/healthy-living/mental-health/easing-diabetes-care-stress>

CDC diabetes and mental health: <https://www.cdc.gov/diabetes/managing/mental-health.html>

PHARMACOTHERAPY

Pharmacotherapy is a second-line approach that may be recommended in addition to lifestyle modifications when behavior changes in diet and exercise alone are ineffective at treating dysglycemia.¹⁶ The goal is to target weight management, minimize the progression of hyperglycemia, and reduce cardiovascular risks. Pharmacotherapy selection should consider cost, safety, efficacy, and person-centered goals.

Metformin:

Metformin has shown efficacy in delaying the onset of type 2 diabetes when used in combination with lifestyle modifications.¹⁶ It also has the longest history of safety data among drugs used for this indication. Metformin is not FDA-approved for diabetes prevention, but its use is compendia-supported in adults. Metformin is an antihyperglycemic agent which works to lower blood sugar by decreasing glucose production, decreasing intestinal absorption of glucose, and improving insulin sensitivity.²⁴ It has been shown to decrease fasting plasma glucose by approximately 25% to 35%. Metformin also has the potential for modest weight loss.

- **Metformin for diabetes prevention should be considered in patients at high risk of type 2 diabetes, especially those:**¹⁶
 - Age 25-59 years with a BMI of 35 kg/m² or greater, fasting plasma glucose of 110 mg/dL or greater, and A1c of 6.0% or more
 - Women with a history of gestational diabetes

If metformin is not tolerated, acarbose is compendia-supported for the indication of type 2 diabetes prophylaxis in adults.²⁵

Examples of FDA-approved pharmacotherapy for weight loss:*

Pharmacotherapy for weight loss may be recommended when lifestyle modifications alone are inadequate to achieve weight loss goals.² Some agents are FDA-approved for chronic weight management, including certain GLP-1 RAs.^{26,27} GLP-1 RAs promote weight loss by slowing gastric emptying and acting in the areas of the brain involved in appetite regulation. They also lower blood sugar by enhancing glucose-dependent insulin secretion and other antihyperglycemic actions of incretins, e.g., suppressing glucagon secretion and promoting beta cell proliferation. A dual glucose-dependent insulinotropic polypeptide (GIP) and GLP-1 RA is also approved for chronic weight management.²⁸

- **Adults:** Indicated as an adjunct to reduced-calorie diet and increased physical activity for chronic weight management if initial BMI is 30 kg/m² or more (obesity) or 27 kg/m² or more (overweight) with ≥1 weight-related comorbidity (e.g., hypertension, type 2 diabetes, dyslipidemia)
 - GLP-1 RA: liraglutide (Saxenda[®]) and semaglutide (Wegovy[®])^{26,27}
 - GIP/GLP-1 RA: tirzepatide (Zepbound[™])²⁸
- **Pediatrics (age ≥12 years):** Indicated as an adjunct to reduced-calorie diet and increased physical activity for chronic weight management
 - Liraglutide (Saxenda[®]): Body weight above 60 kg and initial BMI corresponding to 30 kg/m² for adults by international cut-offs²⁶
 - Semaglutide (Wegovy[®]): Initial BMI at the 95th percentile or greater standardized for age and sex²⁷

Pharmacotherapy for all other chronic conditions, e.g., hypertension, should be optimized to improve outcomes, including reducing risk factors and disease progression.

* Not a comprehensive listing of medications FDA-approved for weight management. Agents when used for weight loss are [excluded from coverage](#) by NYS Medicaid due to federal or state rules.

SURGICAL TREATMENT

Although there is limited data on bariatric procedures for the treatment of prediabetes, it may be recommended as a final approach when lifestyle modification and/or pharmacologic treatment have failed.² Bariatric procedures support weight loss and have also been shown to improve glycemia. They are dependent on patient-specific characteristics and are only recommended to patients who meet the criteria.

- **Consider in individuals with:**
 - BMI of 35 kg/m² or greater regardless of presence, absence, or severity of co-morbidities
 - BMI of 30 to 34.9 kg/m² with metabolic disease

Resources for healthcare professionals:

[2022 American Society for Metabolic and Bariatric Surgery and International Federation for the Surgery of Obesity and Metabolic Disorders: Indications for Metabolic and Bariatric Surgery](#)

NYS Medicaid Program Overview:

For coverage information regarding NYS Diabetes Prevention Program:

https://health.ny.gov/health_care/medicaid/redesign/ndpp/index.htm

For information regarding NYS Preferred Drug Program:

https://newyork.fhsc.com/providers/PDP_about.asp

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