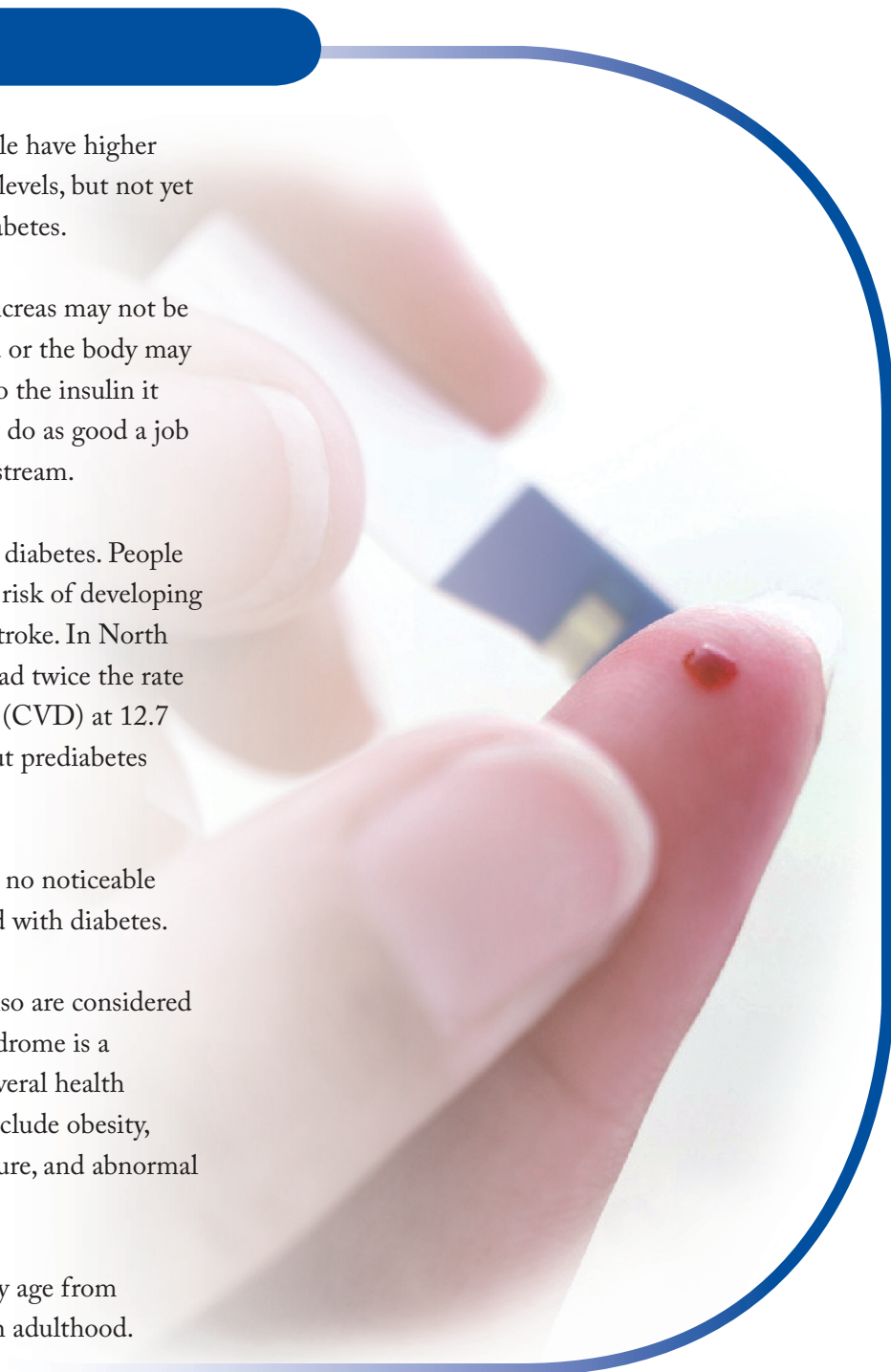


Prediabetes in North Carolina 2011

NC Diabetes Prevention and Control Program Fact Sheet

What is Prediabetes?

- Prediabetes is the state where people have higher than normal blood glucose (sugar) levels, but not yet high enough to be diagnosed as diabetes.
- In people with prediabetes, the pancreas may not be working as efficiently as it once did or the body may be gradually building a resistance to the insulin it produces so that the hormone can't do as good a job of clearing glucose from the bloodstream.
- Prediabetes is a precursor of type 2 diabetes. People with prediabetes have an increased risk of developing type 2 diabetes, heart disease and stroke. In North Carolina, adults with prediabetes had twice the rate of history of cardiovascular disease (CVD) at 12.7 percent compared to people without prediabetes (5.4%) in 2009.
- People with prediabetes often have no noticeable symptoms, unlike people diagnosed with diabetes.
- People with metabolic syndrome also are considered to have prediabetes. Metabolic syndrome is a condition in which a person has several health problems at once. Typically, they include obesity, insulin resistance, high blood pressure, and abnormal cholesterol and triglyceride levels.
- Prediabetes can be developed at any age from childhood and adolescence through adulthood.



- The Diabetes Prevention Program (DPP) study has shown that people with prediabetes who lost 5 to 7 percent of weight and increased physical activity reduced the development of type 2 diabetes by 58 percent in less than three years. The reduction was even greater among older adults with a 71 percent drop among those aged 60 and above.
- Family history: Having a relative with type 2 diabetes (parent, brother or sister) more than doubles the chance of getting prediabetes and diabetes.
- Race: African-American, American Indian, Asian-American, Pacific Islander or of Hispanic/Latino heritage have higher chance of getting the disease.

Prediabetes prevalence

- There are an estimated 79 million people aged 20 and older with prediabetes in the United States. Many Americans are unaware that they have prediabetes. Based on fasting glucose or A1c levels, 35 percent of U.S. adults aged 20 years or older had prediabetes in 2005-2008. This rate jumps to 50 percent among adults 65 years or older (National Diabetes Fact Sheet 2011, Centers for Disease Control).
- In North Carolina, 7.1 percent (451,000) of adults reported diagnosed prediabetes in 2009 (Table 1). North Carolinians ages 55 to 64 had the highest prediabetes prevalence at 10.7 percent in 2009 (North Carolina BRFSS 2009).
- High blood cholesterol is a major risk factor for prediabetes and diabetes. Sixty percent of adults with prediabetes in North Carolina were diagnosed with high blood cholesterol in 2009. Having HDL or “good” cholesterol below 35 mg/dL or triglyceride level above 250 mg/dL increases risk for prediabetes and diabetes.
- High blood pressure: Overweight/obesity and insulin resistance-linked prediabetes can be an increased risk factor for high blood pressure - one of the most important risk factors for CVD, which can lead to heart attacks or strokes. Among adults with prediabetes, 57 percent were diagnosed with high blood pressure in North Carolina in 2009.³

Prediabetes risk factors are same as for diabetes

- Overweight/obesity is a major risk factor for prediabetes, as it can keep the body from making and using insulin properly. In North Carolina, obese adults (BMI ≥ 30) have almost 5 times more prediabetes than adults with normal weight (BMI in the range of 18.5 to 24.9) (10.4 percent vs. 2.2 percent).
- Physical inactivity or sedentary lifestyle contributes to obesity-related prediabetes. Sixty percent of adults with prediabetes in 2009 in the state did not engage in moderate physical activity. Nearly 85 percent did not participate in vigorous physical activity.



- Smoking: People who smoke 16 to 25 cigarettes daily have three times more chance of developing prediabetes and diabetes (American Heart Association). Smoking also doubles the risk of heart disease and stroke among people with prediabetes.
- Inadequate sleep: Several recent studies have shown a link between lack of sleep and increased risk of insulin resistance. Research suggests that regularly sleeping fewer than 5.5 hours a night might increase risk of prediabetes. In North Carolina, 7.8 percent of adults with prediabetes reported poor sleep.³

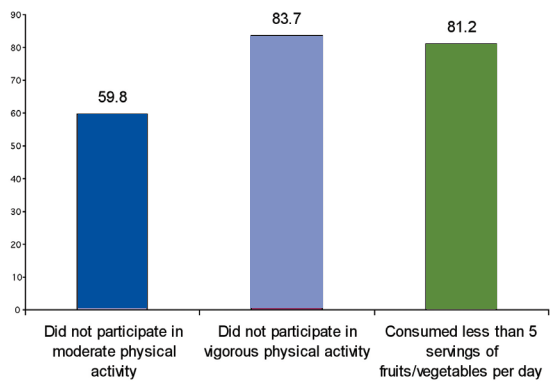


Additional prediabetes risk factors for women

- Having gestational diabetes when pregnant.
- Having a baby who weighs over 9 pounds.
- Having a history of polycystic ovary syndrome (a common condition characterized by irregular menstrual periods, excess hair growth and obesity).



Chart 1. Prevalence of physical inactivity and unhealthy eating among adults with Prediabetes, North Carolina, 2009



Source:
BRFSS 2009, North Carolina State Center for Health Statistics



Table 1: Diagnosed Pre-Diabetes Prevalence in North Carolina, 2009

Demographic Characteristic	Weighted Number of adults	Prevalence Rate (%)	95% C.I.*
Total	450,936	7.1	6.4 - 7.8
Gender			
Male	167,536	5.5	4.5 - 6.4
White	127,472	6.0	5.0 - 7.2
African American	31,221	6.2	3.5 - 10.8
Native American	2,352	4.0	2.0 - 7.9
Hispanic	6,062	2.0	0.6 - 6.3
Female	283,400	8.7	7.6 - 9.7
White	214,769	8.9	7.8 - 10.1
African American	54,490	8.8	6.2 - 12.5
Native American	6,412	13.6	7.0 - 24.6
Hispanic	2,928	1.6	0.7 - 3.7
Race/Ethnicity			
White	342,240	7.5	6.7 - 8.3
African American	85,711	7.6	5.3 - 10.0
Native American	8,764	8.3	3.9 - 12.6
Hispanic	8,991	1.9	0.3 - 3.4
Other minorities	13,520	2.6	1.4 - 3.8
Age			
18-24	28,397	3.3	1.1 - 5.5
25-34	62,066	5.2	3.3 - 7.0
35-44	76,185	5.9	4.5 - 7.4
45-54	101,210	8.5	6.8 - 10.1
55-64	90,646	10.7	9.0 - 12.5
65-74	45,361	8.9	7.2 - 10.7
75+	42,676	10.4	7.4 - 13.3
Education			
Less than H.S.	52,245	6.4	4.4 - 8.4
H.S. or G.E.D	123,217	6.9	5.4 - 8.3
Some post-H.S.	141,740	8.6	7.1 - 10.2
College Graduate	133,734	6.4	5.3 - 7.5
Household Income			
Less than \$15,000	42,853	7.5	5.1 - 10.0
\$15,000-24,999	73,986	8.1	5.8 - 10.3
\$25,000-34,999	48,533	8.2	5.9 - 10.6
\$35,000-49,000	52,442	7.1	5.2 - 8.9
\$50,000-74,999	78,454	8.7	6.7 - 10.7
\$75,000+	96,694	5.9	4.7 - 7.1

*C.I. denotes Confidence Interval

Source: BRFSS 2009, North Carolina State Center for Health Statistics

Screening for Prediabetes

People may have prediabetes without knowing, as it often has no symptoms. The American Diabetes Association (ADA) recommends that all people age 45 and older be tested for prediabetes. However, adults of all ages who are overweight/obese, and have one or more of above mentioned risk factors should also be tested. People with prediabetes should be tested every one to two years to make sure they are not developing diabetes. The added benefit is that in the process of identifying those with prediabetes, additional persons with undiagnosed diabetes would be detected.

In North Carolina, only 61.4 percent of adults had a test for high blood sugar in 2009.³

How is prediabetes diagnosed?

Three tests, Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG) or HbA1c are used to detect prediabetes and diabetes.

Fasting blood sugar test sometimes referred to as **Impaired Fasting Glucose (IFG)**, measures blood glucose in the morning before eating any food. A blood sample will be taken after the fast for at least 8-12 hours. Blood sugar level from 100 to 125 mg/dL is considered prediabetes.

Oral glucose tolerance test (OGTT), also known as Impaired Glucose Tolerance (IGT), measures blood glucose after the fast for at least 8 -12 hours. After drinking a sugary solution, the blood sugar level is measured again after two hours. A blood sugar level from 140 to 199 mg/dL is considered prediabetes.

Glycated hemoglobin (HbA1c) test indicates average blood sugar level for the past two to three months. It works by measuring the percentage of blood sugar attached to hemoglobin. The higher blood sugar levels, the more hemoglobin with sugar attached. An A1c level between 5.7 and 6.4 percent is considered prediabetes.



Table 2: Diagnostic test criteria for prediabetes and diabetes

Test	Normal	Prediabetes	Diabetes
Fasting Blood Glucose (FBG)	<100 mg/dl	100 – 125 mg/dl	>125 mg/dl
Oral Glucose Tolerance (OGTT)	<140 mg/dl	140 – 199 mg/dl	>199 mg/dl
HbA1c	<5.7%	5.7% - 6.4%	>6.4%

Source: American Diabetes Association, Clinical practice recommendations, 2011.

Prediabetes Costs

- The cost of prediabetes in the United States was estimated at \$25 billion in 2007. That calculates to \$443 per each person with prediabetes for each year.⁶
- If current trends continue, more than half of Americans will have prediabetes or diabetes by 2020, at a cost of \$3.35 trillion⁷ to the U.S. health care system .
- Diabetes and prediabetes will account for an estimated 10 percent of total health care spending in the United States at an annual cost of almost \$500 billion by 2020 - up from an estimated 194 billion in 2010⁷.

Treatment for prediabetes

Treatment includes losing a modest amount of weight (5% to 10% of total body weight) through diet and moderate exercise, such as walking, 30 minutes a day, five days a week.⁴ As prediabetes causes a 50 percent increased risk for heart disease or stroke, there is a need to reduce cardiovascular risk factors, such as tobacco use, high blood pressure, and high cholesterol.

Preventing Prediabetes

Recent research shows that lifestyle changes such as diet, weight loss, and exercise as well as the drug, Metformin, can substantially delay or prevent the progression from prediabetes to type 2 diabetes.⁸ However, lifestyle interventions are more feasible and cost effective than medications. Half a million adults in North Carolina could benefit from prediabetes prevention intervention.

Dietary Changes: Only 20 percent of adults with prediabetes consumed 5 or more servings of fruits and vegetables per day in 2009 in the state. Healthy eating to prevent or treat pre-diabetes includes:

- An abundance of vegetables, fruits, and whole grains⁹
- Legumes (dried beans, soy products, split peas and lentils), low fat dairy products, poultry and fish as primary protein sources
- More meatless meals
- Less red meats and refined carbohydrates, especially sweets and high sugar beverages
- Moderate amounts of fats from nuts and seeds and oils
- No trans fats
- Fewer fried foods
- Prepare more meals at home
- Reduce sodium from processed foods , and
- Right-size portions



Regular exercise is important as even moderate physical activity will help use the insulin that body produces to convert food into energy. People with prediabetes who have sedentary lifestyles should talk to their healthcare provider about a workout plan. Adding regular exercise program may help a person with prediabetes to keep blood sugar lower.

There are mainly three types of physical activity:

Aerobic (or cardiovascular) exercise alone or combined with resistance training significantly improves cardiovascular risk factors including hemoglobin A1c, systolic blood pressure, triglycerides, and waist circumference in patients with type 2 diabetes.¹⁰ It raises heart rate and makes a person breathe harder. Aim for 30 minutes of aerobic exercise at least 5 five days a week. Start with five or 10 minutes a day and add a few more minutes each week. Aerobic exercise includes:

- Dancing
- Brisk walking or jogging
- Swimming or taking a water aerobics class
- Playing tennis
- Biking, either on a stationary bike or outdoors.

Strength training builds stronger muscles and bones.

Examples of strength training are:

- Weight lifting in a class that uses free weights (not weight machines)
- Weight lifting using weight machines, at a YMCA or health club
- Weight lifting on your own, perhaps using a book or strength training video.

Flexibility or stretching exercise increases flexibility while working out. Some ideas to improve flexibility to avoid injury include:

- Taking a stretching class
- Learning to stretch properly using a video or book
- Receiving advice from the healthcare team about the best way to stretch
- Including yoga in exercise as it is good for balance, flexibility, and strength.



Diet and Physical Activity Goals and Recommendations ¹¹

Goal	Specific Recommendations
Increase physical activity	150 minutes minimum per week
Maintain a healthy weight	At least a loss of 7% of initial body weight (if BMI = 25.0 kg/m ²)
Decrease total fat and saturated fat	Total fat not greater than 25-35% of calories; saturated fat not greater than 7% of calories
Emphasize monounsaturated fat	Up to 20% 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 2400 mg/day
Increase fiber	Up to 25-30 g/day
Increase antioxidants	Up to nine servings of fruits and vegetables per day

Data sources:

- ¹ Diabetes Prevention Program (DPP) study, August 2001
- ² National Diabetes Fact Sheet, 2011, Centers for Disease Control
- ³ North Carolina Behavioral Risk Factor Surveillance System (BRFSS) 2009, State Center for Health Statistics, North Carolina
- ⁴ American Diabetes Association
- ⁵ Orfeu M. Buxton, et al., Sleep Restriction for 1 Week Reduces Insulin Sensitivity in Healthy Men, *Diabetes* September 2010 vol. 59 no. 9 2126-2133
- ⁶ Diabetes and Pre-diabetes cost the U.S. \$218 Billion in 2007: En route to \$336 billion by 2034. Novo Nordisk commissioned the study through it National Changing Diabetes Program (NCDP), Feb 2010
- ⁷ health insurer UnitedHealth Group Inc
- ⁸ STEPHANIE M. BENJAMIN, et al. Estimated number of adults with Prediabetes in the U.S. in 2000. *Diabetes Care* 26:645-649, 2003
- ⁹ Rolls, BJ. The relationship between dietary energy density and energy intake. *Physiol Behav.* 2009 July 14:97(5):609-15
- ¹⁰ "Diabetes Symptoms Improve with Aerobic Exercise", published online in *Diabetes Care*, April 27, 2011
- ¹¹ University of Wisconsin-Madison at <http://www.uwhealth.org/living-with-diabetes>

For more diabetes data, please see **The Burden of Diabetes in North Carolina** at:
www.ncdiabetes.org/_pdf/Diabetes_Burden_Bk.pdf



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