Self-Reported Prediabetes and Risk-Reduction Activities—United States, 2006

MMWR. 2008;57:1203-1205

1 figure, 1 table omitted

At least one fourth of U.S. adults are known to have prediabetes, a condition defined as having impaired fasting glucose (plasma glucose level of 100 to <126 mg/dL after an overnight fast), impaired glucose tolerance (plasma glucose level of 140 to <200 mg/dL after a 2-hour oral glucose tolerance test), or both. Persons with prediabetes are at increased risk for developing type 2 diabetes, heart disease, and stroke. However, lifestyle changes can prevent or delay development of diabetes and its complications among persons with prediabetes. To assess the prevalence of self-reported prediabetes among U.S. adults and the prevalence of activities that can reduce the risk for diabetes, CDC analyzed responses to questions regarding prediabetes asked for the first time in the 2006 National Health Interview Survey. This report summarizes the results of that analysis, which determined that, although at least one fourth of U.S. adults are known to have prediabetes through surveys that included laboratory testing, in 2006, only an estimated 4% of U.S. adults had been told they had prediabetes. Among those who had been told they had prediabetes, 68% had tried to lose or control weight, 55% had increased physical activity or exercise, 60% had reduced dietary fat or calories, and 42% had engaged in all three activities. Persons at greater risk for diabetes should be tested according to published recommendations, and persons with prediabetes should lose or control their weight and increase their physical activity to reduce their risk for developing diabetes (BOX).

NHIS is an annual, nationally representative, household probability survey of the noninstitutionalized, U.S. civilian population, conducted by face-to-face interview. In 2006, the survey included 24,275 adults aged ≥18 years. NHIS sample weights were calibrated to 2000 U.S. census-based totals for sex, age, and race/ethnicity. The total household response rate was 87%, and 81% of persons identified as sample adults completed the interview, yielding a final response rate of 71% for the adult sample. All participants who did not answer "yes" to the question "Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?" were asked five additional questions: "Have you ever been told by a doctor or health-care professional that you have (1) prediabetes? (2) impaired fasting glucose? (3) impaired glucose tolerance? (4) borderline diabetes? or (5) high blood sugar?" Prediabetes was defined as answering "yes" to at least one of these five questions. Under this definition, 984 participants reported having been told they had prediabetes.

NHIS participants also were asked three questions about their risk-reduction activities: "People often engage in activities to lower their risk for health problems or certain diseases. During the past 12 months have you (1) been trying to control or lose weight? (2) increased your physical activity or exercise? or (3) reduced the amount of fat or calories in your diet?"

Prevalence of self-reported prediabetes was estimated by sex, age group, race/ethnicity, and weight status. To make comparisons among the levels of each covariate while simultaneously adjusting for differences in the distributions of all the other covariates, adjusted percentages were estimated from a logistic regression model predicting prediabetes as a function of sex, age group, race/ethnicity, and weight status. Among those adults with self-reported prediabetes, estimates were made of the percentages told they had each of five conditions indicative of prediabetes (i.e., prediabetes itself, impaired fasting glucose, impaired glucose tolerance, borderline diabetes, or high blood sugar). Estimates then were made of the percentages with prediabetes who engaged in each of the three risk-reduction activities and the percentages who engaged in zero, one, two, or all three activities.

In 2006, an estimated 4.0% of U.S. adults had self-reported prediabetes. Among them, 64.4% (95% confidence interval [CI] = 59.9%-68.7%) had been told they had borderline diabetes. Percentages for the other four conditions indicative of prediabetes were as follows: high blood sugar, 38.3% (CI = 34.3%-42.9%); prediabetes itself, 33.7% (CI = 30.3%-37.3%); impaired glucose tolerance, 15.5% (CI = 12.3%-19.2%); and impaired fasting glucose, 15.2% (CI = 12.4%-18.6%). In addition, 43.3% (CI = 39.5%-47.3%) had been told that they had two or more of the five conditions.

The estimated prevalence of self-reported prediabetes increased with age, ranging from 2.7% among those aged 18-44 years to 6.0% among those aged ≥65 years. Prevalence also increased with weight status: 2.3% among those with normal weight, 3.9% among those categorized as overweight, and 6.3% among those categorized as obese. Prediabetes was more prevalent among women (4.8%) than men (3.2%). No significant differences were observed in prevalence by race/ethnicity.

Among adults with self-reported prediabetes, 67.6% (CI = 63.7%-71.4%) had been trying to lose or control weight during the preceding 12 months, 59.8% (CI = 55.6%-64.0%) had reduced dietary fat or calories, and 54.7% (CI = 50.7%-58.7%) had increased physical activity or exercise. Although 42.1% (CI = 38.0%-46.3%) reported engaging in all three activities during the preceding 12 months, 23.9% (CI = 20.3%-27.4%) had not engaged in any of these risk-reduction activities.
### BOX. Criteria for testing for prediabetes and diabetes in asymptomatic adults

1. Testing should be considered in all adults who are overweight (body mass index $\geq 25$ kg/m$^2$) and have any of the following additional risk factors:
   - physical inactivity;
   - first-degree relative with diabetes;
   - members of a high-risk ethnic population (e.g., African American, Latino, Native American, Asian American, and Pacific Islander);
   - women who delivered a baby weighing $>9$ lb or diagnosed with gestational diabetes;
   - hypertension ($>140/90$ mmHg or on therapy for hypertension);
   - HDL cholesterol level $<35$ mg/dL ($0.90$ mmol/L) and/or a triglyceride level $>250$ mg/dL ($2.82$ mmol/L);
   - women with polycystic ovarian syndrome;
   - impaired glucose tolerance or impaired fasting glucose on previous testing;
   - other clinical conditions associated with insulin resistance (e.g., severe obesity and acanthosis nigricans); or
   - history of cardiovascular disease.

2. In the absence of these risk factors, testing for prediabetes and diabetes should begin at age 45 years.

3. If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results and risk status.


* At-risk body mass index might be lower in certain populations.

---

**CDC Editorial Note:** This report provides the first nationally representative estimates of the prevalence of self-reported prediabetes in the U.S. adult population and the first estimates of the prevalence of risk-reduction activities among adults who had been told they had prediabetes. The results indicate that, in 2006, only 4% of U.S. adults were aware they had prediabetes or a condition indicative of prediabetes. In addition, 24% of U.S. adults with prediabetes did not participate in any of three recommended risk-reduction activities.

The finding of 4% self-reported prevalence of prediabetes is low compared with the 26% of U.S. adults aged $\geq 20$ years estimated to have impaired fasting glucose based on laboratory test results in the 2003-2006 National Health and Nutrition Examination Survey (NHANES). Other NHANES data, from 1988-1994, indicate an even higher prevalence of prediabetes among persons aged 40-74 years. During that period, NHANES conducted oral glucose tolerance tests of persons in that age group and estimated that 40% of adults aged 40-74 years had impaired fasting glucose, impaired glucose tolerance, or both.6

The low prevalence of self-reported prediabetes described in this report likely indicates a low level of awareness among persons who have prediabetes. Prediabetes is a relatively new term that came into wider use beginning in 2002, after publication of results from the Diabetes Prevention Program intervention trial.2 Physicians and other health-care providers have used various other terms to describe prediabetes. The use of different terms might have produced confusion among persons over what their health-care providers diagnosed.

The results of this analysis also might indicate that a large percentage of persons with prediabetes have not been tested or diagnosed. The tests used to screen for prediabetes are the same as those used to screen for diabetes, and the population at risk for prediabetes is the same population as that at risk for type 2 diabetes. Hence, screening recommendations for prediabetes are essentially the same as those for diabetes.3 The American Diabetes Association has recommended that testing for prediabetes and diabetes be considered for adults who meet certain criteria (see sidebar).8

The Diabetes Prevention Program intervention trial showed that diet and exercise can lower the incidence of type 2 diabetes by $58\%$ over 3 years among those at high risk for diabetes.3 Trial participants lost weight by reducing dietary fat and calories and by exercising at least 30 minutes a day, 5 days a week. The American Diabetes Association recommends that clinicians counsel patients with prediabetes on weight loss of 5-10% of body weight and on increasing physical activity to at least 150 minutes of moderate activity (e.g., walking) per week. Metformin administration should be considered under certain circumstances.8 However, the results in this report indicate that, although 42% of adults with prediabetes tried to lose or control weight, reduce fat or calories, and increase physical activity, one fourth did not engage in any of these risk-reduction activities.

The findings in this report are subject to at least two limitations. First, NHIS interviews are household based and do not include persons who are institutionalized, including those living in nursing homes. Second, the 2006 NHIS questions regarding self-reported prediabetes were asked for the first time. Hence, no previous studies are available for comparison and validation.

Interventions to prevent or delay onset of type 2 diabetes in persons with prediabetes are feasible and cost effective, and lifestyle interventions are more cost effective than medications.9 The gap in prevalence between those with prediabetes and those aware of their condition presents an opportunity to reduce the burden of diabetes by increasing awareness of prediabetes and en-
Courting adoption of healthier lifestyles and risk-reduction activities.

REFERENCES
9 Available.

* Categorized as normal weight (body mass index [BMI] of <25 kg/m²), overweight (25 to <30 kg/m²), or obese (≥30 kg/m²), using height and weight reported by participant.

Smoking-Attributable Mortality, Years of Potential Life Lost, and Productivity Losses—United States, 2000-2004

MMWR. 2008;57:1226-1228

1 table omitted

Cigarette smoking and exposure to tobacco smoke are associated with premature death from chronic diseases, economic losses to society, and a substantial burden on the United States health-care system. Smoking is the primary causal factor for at least 30% of all cancer deaths, for nearly 80% of deaths from chronic obstructive pulmonary disease, and for early cardiovascular disease and deaths.1 In 2005, to assess the economic and public health burden from smoking, CDC published results of an analysis of smoking-attributable mortality (SAM), years of potential life lost (YPLL), and productivity losses in the United States from smoking during 1997-2001.2 The analysis was based on data from CDC's Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) system, a system that estimates SAM, YPLL, and productivity losses based on data from the National Health Interview Survey and death certificate data from the National Center for Health Statistics. This report presents an update of that analysis for 2000-2004, the most recent years for which source data are available. The updated analysis indicated that, during 2000-2004, cigarette smoking and exposure to tobacco smoke resulted in at least 443,000 premature deaths, approximately 5.1 million YPLL, and $96.8 billion in productivity losses annually in the United States. Comprehensive, national tobacco-control recommendations have been provided to the public health community with the goal of reducing smoking so substantially that it is no longer a significant public health problem in the United States.3,4

The adult and the maternal and child health SAMMEC software modules were used to estimate SAM, YPLL, and productivity losses attributed to diseases caused by smoking. Sex- and age-specific smoking-attributable deaths were calculated by multiplying the total number of deaths for 19 adult and four infant disease categories by estimates of the smoking-attributable fraction (SAF) of preventable deaths. The attributable fractions provide estimates of the public health burden of each risk factor and the relative importance of risk factors for multifactorial diseases. Because of the effect of interactions between various risk factors, attributable fractions for a given disease can total more than 100%. For adults, SAFs were derived using sex-specific relative risk (RR) estimates from the American Cancer Society’s Cancer Prevention Study-II (CPS-II) for current and former smokers for each cause of death for the period 1982-1988. For ischemic heart disease and cerebrovascular disease deaths, RR estimates also were stratified by age (35-64 years and ≥65 years). Sex- and age-specific (35-64 years and ≥65 years) current and former cigarette smoking prevalence estimates from the National Health Interview Survey also were used to calculate SAFs. For infants, SAFs were calculated by using pediatric RR estimates and maternal smoking prevalence estimates from birth certificates. Smoking-attributable YPLL and productivity losses were estimated by multiplying sex- and age-specific SAM by remaining life expectancy5 and lifetime earnings data.6 In addition, smoking-attributable residential fire-related deaths7 and lung cancer and heart disease deaths attributable to exposure to secondhand smoke8 were included in the SAM, but not in YPLL and productivity loss estimates.

During 2000-2004, smoking resulted in an estimated annual average of 269,655 deaths among males and 173,940 deaths among females in the United States. The three leading specific causes of smoking-attributable death were lung cancer (128,922), ischemic heart disease (126,005), and chronic obstructive pulmonary disease (COPD).9 Among adults aged ≥35 years, 160,848 (41.0%) smoking-attributable deaths were caused by cancer, 128,497 (32.7%) by cardiovascular diseases, and 103,338 (26.3%) by respiratory diseases (excluding deaths from second-hand smoking and from residential fires). Smoking during pregnancy resulted in an estimated 776 infant deaths annually during 2000-2004. An estimated 49,400 lung cancer and heart disease deaths annually were attributable to exposure to secondhand smoke. The average annual SAM estimates also included 736 deaths from smoking-attributable residential fires.

During 2000-2004, on average, smoking accounted for an estimated 3.1 million YPLL for males and approximately 2.0 million YPLL for females annually, excluding deaths from smoking-attributable residential fires and adult deaths from secondhand smoke. Estimates for average annual smoking-attributable productivity losses were approximately $96.8 billion ($64.2 billion for males and $32.6 billion for females) during this period.

Reported by: B Adhikari, PhD, J Kahende, PhD, A Maalacher, PhD, T Pechacek, PhD, V Tong, National Center for Chronic Disease Prevention and Health Promotion, CDC.

CDC Editorial Note: During 2000-2004, an estimated 443,000 persons in the United States died prematurely each year as a result of smoking or exposure to secondhand smoke. This figure is higher than the average annual estimate of approximately 438,000 deaths during 1997-2001.3 The number of smoking-attributable deaths varies according to trends in smoking prevalence and the number of deaths from diseases caused by smoking. SAM estimates also change when a causal re-