

Data Sources, References, and Methods

Treating diabetes

2001–2003 National Health Interview Survey (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhis.htm>.

Methods: The percent distribution of the type of treatment among civilian, noninstitutionalized adults aged 18 years or older with diagnosed diabetes was calculated using treatment questions from the 2001–2003 NHIS.

Prediabetes: Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG)

The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 1997;20:1183–1197.

Coutinho M, Gerstein HC, Wang Y, Yusuf S. The relationship between glucose and incident cardiovascular events. A metaregression analysis of published data from 20 studies of 95,783 individuals followed for 12.4 years. Diabetes Care 1999;22:233–240.

Meigs JB, Nathan DM, D'Agostino RB Sr, Wilson PW; Framingham Offspring Study. Fasting and postchallenge glycemia and cardiovascular disease risk: the Framingham Offspring Study. Diabetes Care 2002;10:1845–1850.

Smith NL, Barzilay JI, Shaffer D, et al. Fasting and 2-hour postchallenge serum glucose measures and risk of incident cardiovascular events in the elderly: the Cardiovascular Health Study. Archives of Internal Medicine 2002;162:209–216.

Third National Health and Nutrition Examination Survey (NHANES III) 1988–1994, National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhanes.htm>.

U.S. Census Bureau, 2000 resident population estimates.

Methods: The prevalences of IGT, IFG, and prediabetes in the civilian noninstitutionalized population were estimated using 1988–1994 NHANES data (i.e., NHANES III). Persons previously diagnosed with diabetes and those with undiagnosed diabetes (i.e., without a history of diabetes but with a fasting plasma glucose of 126 or more) were excluded from the prevalence counts of IGT, IFG, and prediabetes. Persons were classified as having IGT if they had 2-hour plasma glucose values of 140 to 199 mg/dL after an oral glucose tolerance test. They were classified as having IFG if they had fasting plasma glucose values of 100 to 125 mg/dL (regardless of their 2-hour plasma glucose values). Those with IGT or IFG or both were classified as having prediabetes. To estimate the number of people in 2000 with these conditions, these 1988–1994 prevalence estimates were applied to estimates of the 2000 resident population of the U.S.

National Estimates on Diabetes

Many of the estimated numbers and percentages of people with diabetes were derived by applying diabetes prevalence estimates from health surveys of the civilian, noninstitutionalized population to the most recent 2005 resident population estimates. Generally, these methods used three age groups (20–44, 45–59, and ≥ 60 years), three race groups (non-Hispanic white, non-Hispanic blacks, and all other races), and sex (male, female) to estimate diabetes prevalence in 2005. These estimates have some variability due to the limits of the measurements and estimation procedures. The procedures assumed that age-race-sex-specific percentages of adults with diabetes (diagnosed and undiagnosed) in 2005 are the same as they were in earlier time periods (e.g., 1999–2002) and that the age-race-sex percentages of adults with diabetes in resident population is identical to that in the civilian, noninstitutionalized population. Deviations from these assumptions may result in over- or under-estimated numbers and percentages.

Total prevalence of diabetes in the United States, all ages, 2005

1999–2002 National Health and Nutrition Examination Survey (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhanes.htm>.

1999–2003 National Health Interview Survey (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhis.htm>.

U.S. Census Bureau, resident population estimates for 03/01/05. Available at http://www.census.gov/popest/national/asrh/2004_nat_res.html

Cowie CC, Rust KF, Byrd-Holt D, et al. Prevalence of diabetes and impaired fasting glucose in adults—United States, 1999–2000. *MMWR* 2003;52(35):833–837.

Methods:

Total number of persons with diabetes (both diagnosed and undiagnosed) and percentage of the population with diabetes.

The total number of people with diabetes is the sum of the estimated number of those aged 20 years or older with diagnosed and undiagnosed diabetes in 2005 and the estimated number of those younger than 20 years with diagnosed diabetes in 2005. (See next paragraph for methods of calculating these numbers.) Because of a lack of population-based data for undiagnosed diabetes among persons younger than 20 years, an estimate of the number of undiagnosed persons in this age group could not be included in the total. The percentage of the population with diabetes is the estimated total number with diabetes in 2005 divided by the estimated 2005 U.S. resident population.

The 2005 estimate of the number of persons younger than 20 years with diagnosed diabetes was derived by applying the estimated percentage of persons younger than 20 years with diagnosed diabetes from the 1999–2003 NHIS to the 2005 estimated resident population for this age group. The 2005 estimated number of those aged 20 years or older with diagnosed and

undiagnosed diabetes is the sum of the numbers derived by applying the age-race-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed) from the 1999–2002 NHANES to 2005 resident population estimates.

Information on the use of NHANES data to measure diabetes prevalence (including diagnosed and undiagnosed diabetes) is available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5235a1.htm>.

Number of persons with diagnosed diabetes

The total number of persons with diagnosed diabetes in 2005 is the sum of the estimated numbers of those younger than 20 years and those aged 20 years or older with diagnosed diabetes. The 2005 estimated number of persons younger than 20 years with diagnosed diabetes was derived by applying the estimated prevalence of diagnosed diabetes from the 1999–2003 NHIS to the estimated 2005 resident population of this age group. The 2005 estimated number of those aged 20 years or older with diagnosed diabetes is the sum of the numbers derived by applying to 2005 resident population estimates the age-race-sex-specific estimates of diagnosed diabetes from the 1999–2002 NHANES.

Number of persons with undiagnosed diabetes

The 2005 estimated number of persons with undiagnosed diabetes was derived by applying the age-race-sex-specific estimated prevalence of undiagnosed diabetes in persons aged 20 years or older from the 1999–2002 NHANES to 2005 resident population estimates. Because population-based data are lacking for undiagnosed diabetes among persons younger than 20 years, an estimate of undiagnosed persons in this age group could not be included.

Prevalence of diagnosed diabetes among people under 20 years of age, United States,

1999–2003 National Health Interview Survey (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhis.htm>.

U.S. Census Bureau, resident population estimates for 03/01/05. Available at http://www.census.gov/popest/national/asrh/2004_nat_res.html

Fagot-Campagna A, Pettitt DJ, Engelgau MM, et al. [Type 2 diabetes among North American children and adolescents: an epidemiologic review and a public health perspective](#). *Journal of Pediatrics* 2000;136:664–672.

Ludwig DS, Ebbeling CB. [Type 2 diabetes mellitus in children: primary care and public health considerations](#). *JAMA* 2001;286:1427–1430.

Methods: The number of persons under 20 years of age with diagnosed diabetes in 2005 was estimated by applying the 1999–2003 NHIS prevalence estimate of diagnosed diabetes in the civilian, noninstitutionalized population younger than 20 years to the 2005 resident population estimate of this age group. The percentage of persons under 20 years of age with diagnosed diabetes in 2005 was assumed to be the same as the 1999–2003 NHIS estimate.

Total prevalence of diabetes among people aged 20 years or older, United States, 2005

1999–2002 National Health and Nutrition Examination Survey (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhanes.htm>.

U.S. Census Bureau, resident population estimates for 03/01/05. Available at http://www.census.gov/popest/national/asrh/2004_nat_res.html

Cowie CC, Rust KF, Byrd-Holt D, et al. Prevalence of diabetes and impaired fasting glucose in adults—United States, 1999–2000. *MMWR* 2003;52(35):833–837.

Methods:

Age 20 years or older

The 2005 estimated number of persons aged 20 years or older with diabetes was derived by applying to 2005 resident population estimates the age-race-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) from the 1999–2002 NHANES. The percentage of the population with diabetes aged 20 years or older is this estimated number divided by the estimated 2005 U.S. resident population aged 20 years or older.

Age 60 years or older

The 2005 estimated number of those aged 60 years or older with diabetes was derived by applying race-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) in this age group from the 1999–2002 NHANES to 2005 resident population estimates. The percentage of the population with diabetes aged 60 years or older is this estimated number divided by the estimated 2005 U.S. resident population aged 60 years or older.

Men and women

The 2005 estimated number of men and women aged 20 years or older with diabetes is the sum of the sex-specific numbers derived by applying age-race-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) from the 1999–2002 NHANES to 2005 resident population estimates. The percentage of men and women with diabetes are these estimated numbers divided by the sex-specific estimated 2005 U.S. resident population aged 20 years or older.

Information on the use of NHANES data to measure diabetes prevalence (including diagnosed and undiagnosed diabetes) is available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5235a1.htm>.

Total prevalence of diabetes by race/ethnicity among people aged 20 years or older, United States, 2005

1999–2002 National Health and Nutrition Examination Survey (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhanes.htm>.

Indian Health Service (IHS), 2003 outpatient database.

2003 data from the Behavioral Risk Factor Surveillance System (BRFSS), National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention.

Personal communication with Florentina R. Salvail, BRFSS coordinator, state of Hawaii.

U.S. Census Bureau, resident population estimates for 03/01/05. Available at http://www.census.gov/popest/national/asrh/2004_nat_res.html

California Health Interview Survey Online Data Query System, available at: www.chis.ucla.edu

Cowie CC, Rust KF, Byrd-Holt D, et al. Prevalence of diabetes and impaired fasting glucose in adults—United States, 1999–2000. *MMWR* 2003;52(35):833–837.

Methods:

All estimates presented are for persons aged 20 years or older.

Non-Hispanic whites and non-Hispanic blacks

The 2005 estimated numbers of non-Hispanic whites and the number of non-Hispanic blacks aged 20 years or older with diabetes are the sums of the race-specific numbers derived by applying age-race-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) from the 1999–2002 NHANES to 2005 resident population estimates. The percentages of non-Hispanic whites and non-Hispanic blacks with diabetes are these estimated numbers divided by the race-specific estimates of the 2005 U.S. resident population aged 20 years or older.

The relative risk of diabetes among non-Hispanic blacks (compared to non-Hispanic whites) in 2005 was calculated by dividing the age-adjusted prevalence of diabetes among non-Hispanic blacks by the age-adjusted prevalence of diabetes among non-Hispanic whites. Rates were age-adjusted by the direct method based on the 2000 U.S. standard population.

Hispanic/Latino Americans

The relative risk of diabetes among Mexican Americans (compared to non-Hispanic whites) was calculated by dividing the age-adjusted prevalence of diabetes (both diagnosed and undiagnosed diabetes) among Mexican Americans by the age-adjusted prevalence of diabetes among non-Hispanic whites using 1999–2002 NHANES data. Rates were age-adjusted by the direct method based on the 2000 U.S. standard population.

The number of Hispanic/Latino persons with diabetes in 2005 was estimated by applying age-sex-specific estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) among Mexican Americans from the 1999–2002 NHANES to estimates of the 2005 U.S. Hispanic/Latino resident population. The percentage of Hispanics/Latinos with diabetes in 2005 is this number divided by the estimated 2005 U.S. resident Hispanic/Latino population.

Sufficient data are not available to derive estimates of total diabetes prevalence (both diagnosed and undiagnosed diabetes) for other Hispanic/Latino groups. However, using 2003

BRFSS data, the relative risk of diagnosed diabetes among residents of Puerto Rico (compared to U.S. non-Hispanic whites) was calculated by dividing the age-adjusted prevalence of diagnosed diabetes among residents of Puerto Rico by the age-adjusted prevalence of U.S. non-Hispanic whites. Rates were age-adjusted by the direct method based on the 2000 U.S. standard population.

American Indians and Alaska Natives

The number and percentage of American Indians and Alaska Natives (AI/AN) with diagnosed diabetes who receive care from IHS were calculated from the 2003 IHS outpatient database. The number of AI/AN with undiagnosed diabetes was calculated by applying age-specific estimates of undiagnosed diabetes in the U.S. civilian, noninstitutionalized population from the 1999–2002 NHANES to 2003 estimates of the AI/AN IHS user population. The total number of AI/AN with diabetes was calculated by adding the estimated number of persons with undiagnosed diabetes to the number of diagnosed AI/AN who receive care from the IHS. Total prevalence was calculated by dividing this number by the total number of AI/AN IHS outpatient users in 2003. Estimates of regional differences and relative risk were based on these calculations of total prevalence. The relative risk of diabetes among AI/AN (compared to U.S. non-Hispanic whites) was calculated by dividing the age-adjusted prevalence of diabetes among AI/AN by the age-adjusted prevalence among U.S. non-Hispanic whites. Rates were age-adjusted by the direct method based on the 2000 U.S. standard population.

Asian Americans and Pacific Islanders

The total prevalence of diabetes (both diagnosed and undiagnosed diabetes) is not available for Asian Americans or Pacific Islanders. However, using 2003 BRFSS data, the relative risk of diagnosed diabetes among Asians, Native Hawaiians, and other Pacific Islander residents of Hawaii aged 20 years or older (compared to white residents aged 20 years or older) was calculated by dividing the age-adjusted prevalence of diagnosed diabetes among resident Asians, Native Hawaiians, and other Pacific Islanders by the age-adjusted prevalence among white residents. Rates were age-adjusted by the direct method based on the 2000 U.S. standard population. Similarly, 2003 data from the California Health Interview Survey were used to calculate the relative risk of diagnosed diabetes among Asian residents of California (compared to white residents).

Incidence of diabetes, United States, 2005

2001–2003 National Health Interview Survey (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/nchs/nhis.htm>.

U.S. Census Bureau, resident population estimates for 03/01/05. Available at http://www.census.gov/popest/national/asrh/2004_nat_res.html

Methods: Age-specific estimates of the incidence of diagnosed diabetes in the civilian, noninstitutionalized population aged 20 years or older from the 2001–2003 NHIS were applied to 2005 estimates of the U.S. resident population without diabetes diagnosed in the past year to calculate the number of new cases of diabetes. Incidence was calculated from data on respondents' age at diagnosis and age at interview. Adults who reported being diagnosed with diabetes were asked at what age they were diagnosed. We calculated the number of years each

person had been diagnosed with diabetes by subtracting the age at which they were diagnosed from their current age. Adults who had a value of zero were identified as having been diagnosed with diabetes within the last year. In addition, we assumed that half of the adults who had a value of one were classified as having been diagnosed with diabetes within the last year.

Deaths among people with diabetes, United States, 2002

Multiple cause-of-death data, National Center for Health Statistics, Centers for Disease Control and Prevention.

Gu K, Cowie CC, Harris MI. [Mortality in adults with and without diabetes in a national cohort of the U.S. population, 1971-1993](#). Diabetes Care 1998;21:1138–1145.

Hu FB, Stampfer MJ, Solomon CG, et al. The impact of diabetes mellitus on mortality from all causes and coronary heart disease in women: 20 years of follow-up. Archives of Internal Medicine 2001;161:1717–1723.

Anderson RN, Smith BL. Deaths: leading causes for 2002. National Vital Statistics Reports 2005;53(17):1–92.

Complications of diabetes in the United States

Heart disease and stroke

Geiss LS, Herman WH, Smith PJ. Mortality in non-insulin-dependent diabetes. In: National Diabetes Data Group, editors. [Diabetes in America, 2nd ed](#). Washington, DC: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995. NIH Publication No. 95-1468. p. 233–257.

Kuller LH. Stroke and diabetes. In: National Diabetes Data Group, editors. [Diabetes in America, 2nd ed](#). Washington, DC: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995. NIH Publication No. 95-1468. 449–456.

High blood pressure

Geiss LS, Rolka DB, Engelgau MM. Elevated blood pressure among U.S. adults with diabetes, 1988-1994. American Journal of Preventive Medicine 2002;22:43–49.

Blindness

Klein R, Klein BEK. Vision disorders in diabetes. In: National Diabetes Data Group, editors, [Diabetes in America, 2nd ed](#). Washington, DC: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995. NIH Publication No. 95-1468. 293–336.

Will JC, Geiss LS, Wetterhall SF. [Diabetic retinopathy \[letter\]](#). New England Journal of Medicine 1990;323:613.

Kidney disease

United States Renal Data System, Standard Analysis Files, 2004 [data query online]. Available at http://www.usrds.org/odr/xrender_home.asp. Accessed July 2005.

Nervous system disease

Eastman RC. Neuropathy in diabetes. In: National Diabetes Data Group, editors. [Diabetes in America, 2nd ed](#). Washington, DC: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995. NIH Publication No. 95-1468. 339–348.

Gregg EW, Sorlie P, Paulose-Ram R, et al. Prevalence of lower-extremity disease in the US adult population ≥ 40 years of age with and without diabetes: 1999–2000 National Health and Nutrition Examination Survey. [Diabetes Care](#) 2004;27:1591–1597.

Amputations

Centers for Disease Control and Prevention. National Diabetes Surveillance System. Available at: <http://www.cdc.gov/diabetes/statistics/index.htm>

Dental disease

Personal communication from R. H. Selwitz, DDS, National Institute of Dental and Craniofacial Research, Bethesda, MD, concerning unpublished data from the third National Health and Nutrition Examination Survey, 1988–1994.

Complications of pregnancy

Personal communication from Thomas A. Buchanan, MD, Professor, Medicine, Obstetrics and Gynecology, and Physiology and Biophysics, USC Keck School of Medicine, Los Angeles, CA.

Other complications

Fishbein H, Palumbo PJ. Acute metabolic complications in diabetes. In: National Diabetes Data Group, editors. [Diabetes in America, 2nd ed](#). Washington, DC: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995. NIH Publication No. 95-1468. 283–291.

Valdez R, Narayan KM, Geiss LS, Engelgau MM. [Impact of diabetes mellitus on mortality associated with pneumonia and influenza among non-Hispanic black and white US adults](#). [American Journal of Public Health](#) 1999;89:1715–1721.

Prevention of complications of diabetes

Glucose control

Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. [BMJ](#) 2000;321(7258):405–412.

The Diabetes Control and Complications Trial Research Group. [The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus](#). New England Journal of Medicine 1993;329:977–986.

Blood pressure control

Curb JD, Pressel SL, Cutler JA, et al. [Effect of diuretic-based antihypertensive treatment on cardiovascular disease risk in older diabetic patients with isolated systolic hypertension](#). Systolic Hypertension in the Elderly Program Cooperative Research Group. JAMA 1996;276:1886–1892.

Hansson L, Zanchetti A, Carruthers SG, et al. [Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment \(HOT\) randomised trial](#). HOT Study Group. Lancet 1998;351:1755–1762.

UK Prospective Diabetes Study Group. [Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes \(UKPDS 39\)](#). BMJ 1998;317:713–720.

Adler AI, Stratton IM, Neil HA, et al. [Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes \(UKPDS 36\): prospective observational study](#). BMJ 2000;321:412–419.

Control of blood lipids

Scandinavian Simvastatin Survival Study Group. [Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study \(4S\)](#). Lancet 1994;344:1383–1389.

Downs JR, Clearfield M, Weis S, et al. [Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of the AFCAPS/TexCAPS. Air Force/Texas Coronary Atherosclerosis Prevention Study](#). JAMA 1998;279:1615–1622.

Sacks FM, Moye LA, Davis BR, et al. [Relationship between plasma LDL concentrations during treatment with pravastatin and recurrent coronary events in the Cholesterol and Recurrent Events trial](#). Circulation 1998;97:1446–1452.

Preventive care practices for eyes, kidneys, and feet

Ferris FL 3rd. [How effective are treatments for diabetic retinopathy?](#) JAMA 1993;269:1290–1291.

Bild DE, Selby JV, Sinnock P, Browner WS, et al. [Lower-extremity amputation in people with diabetes](#). Epidemiology and prevention. Diabetes Care 1989;12:24–31.

Litzelman DK, Slemenda CW, Langefeld CD, et al. [Reduction of lower extremity clinical abnormalities in patients with non-insulin-dependent diabetes mellitus. A randomized, controlled trial](#). Annals of Internal Medicine 1993;119:36–41.

Lewis EJ, Hunsicker LG, Clarke WR, et al. for the Collaborative Study Group. [Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes](#). New England Journal of Medicine 2001;345:851–860.

Brenner BM, Cooper ME, de Zeeuw D, et al. RENAAL Study Investigators. [Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy](#). New England Journal of Medicine 2001;345:861–869.

Parving HH, Lehnert H, Brochner-Mortensen J, Gomis R, Andersen S, Arner P; Irbesartan in Patients with Type 2 Diabetes and Microalbuminuria Study Group. [The effect of irbesartan on the development of diabetic nephropathy in patients with type 2 diabetes](#). New England Journal of Medicine 2001;345:870–878.

Hostetter TH. Prevention of end-stage renal disease due to type 2 diabetes. New England Journal of Medicine 2001;345:910–912.

Lewis EJ, Hunsicker LG, Bain RP, Rohde RD. The effect of angiotensin-converting-enzyme inhibition on diabetic nephropathy. The Collaborative Study Group. New England Journal of Medicine 1993;329:1456–1462.

Cost of diabetes in the United States in 2002

Hogan P, Dall T, Nikolov P; American Diabetes Association. Economic costs of diabetes mellitus in the US in 2002. Diabetes Care 2003;26:917–932.