



# National Diabetes Statistics Report, 2014: Data Sources, Methods, and References for Estimates of Diabetes and Its Burden in the United States

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## Diagnosed and undiagnosed diabetes in the United States, all ages, 2012

### Methods:

The total number of people with diabetes is the sum of the [number of those aged 20 years or older with diagnosed or undiagnosed diabetes](#) and the [number of those younger than 20 years with diagnosed diabetes](#).

The total number of people with diagnosed diabetes in 2012 is the sum of the estimated numbers of those younger than 20 years and those aged 20 years or older with diagnosed diabetes.

The total number of people with undiagnosed diabetes in 2012 is the estimated number of those aged 20 years or older with undiagnosed diabetes. Estimates of undiagnosed diabetes for people younger than 20 years are not available.

These estimates have some variability due to the limits of the measurements and estimation procedures. The procedures assumed that percentages of adults with diabetes (diagnosed and undiagnosed) in 2012 were the same as they were in earlier time periods (e.g., 2009–2011), and that the percentages of adults with diabetes in the resident population are identical to those in the civilian, non-institutionalized population. Deviations from these assumptions may result in over- or under-estimated numbers and percentages.

## Diagnosed and undiagnosed diabetes among people aged 20 years or older, United States, 2012

### Data sources:

2009–2012 [National Health and Nutrition Examination Survey](#) (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention.

U.S. Census Bureau, [resident population estimates for 7/1/2012](#).

### Methods:

The percentage of people aged 20 years or older with diabetes (diagnosed or undiagnosed) was obtained using the fasting subsample from the 2009–2012 NHANES data. People who self-reported having been told by a doctor or health professional that they had diabetes were classified as having diagnosed diabetes. In the survey, no questions are asked about the type of diabetes. Those without a history of diagnosed diabetes but with either a fasting plasma glucose greater than or equal to 126 mg/dl or an A1C level greater than or equal to 6.5% were classified as having undiagnosed diabetes. For consistency with earlier estimates, fasting glucose values were adjusted using recommended regression equations. People with missing values for either fasting glucose or A1C and pregnant women were excluded. [The fasting glucose and A1C tests have limitations](#) in identifying populations with undiagnosed diabetes and the implications of the age and race differences between groups in the estimates of undiagnosed diabetes are not known. [Research is ongoing to ascertain the best use of laboratory blood tests](#) to detect people who may have undiagnosed diabetes and to improve the



understanding of who has undiagnosed diabetes. The age-specific percentages of diagnosed or undiagnosed diabetes for age groups 20–44, 45–64, and ≥65 were then applied to the corresponding 2012 U.S. resident population estimates to derive the age-specific numbers of adults with diagnosed or undiagnosed diabetes. These age-specific numbers of adults were added to obtain the estimated total number of adults with diagnosed or undiagnosed diabetes. The same procedure was used to obtain the total number of adults with diagnosed or undiagnosed diabetes by sex (men and women) and the total number by race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic).

## References:

American Diabetes Association. [Diagnosis and classification of diabetes mellitus](#). *Diabetes Care*. 2014;37(Suppl. 1):S81-S90.

Herman WH, Cohen RM. Racial and ethnic differences in the relationship between HbA1c and blood glucose: implications for the diagnosis of diabetes. *J Clin Endocrinol Metab*. 2012;97(4):1067-1072.

Cowie CC, Rust KF, Byrd-Holt DD, et al. Prevalence of diabetes and high risk for diabetes using A1C criteria in the U.S. population in 1988–2006. *Diabetes Care*. 2010;33:562-568.

Cowie CC, Rust KF, Ford ES, et al. Full accounting of diabetes and prediabetes in the U.S. population in 1988–1994 and 2005–2006. *Diabetes Care*. 2009;32:287-294.

Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey [Internet]. 2007–2008 Laboratory Methods.

[http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/lab\\_methods\\_07\\_08.htm](http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/lab_methods_07_08.htm)

Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey [Internet]. 2005–2006 Laboratory Methods.

[http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/lab\\_methods\\_05\\_06.htm](http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/lab_methods_05_06.htm)

## Racial and ethnic differences in diagnosed diabetes among people aged 20 years or older, United States, 2010–2012

### Data sources:

2010–2012 [National Health Interview Survey](#) (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention.

Indian Health Service (IHS), National Patient Information Reporting System (NPIRS).

### Methods:

National prevalence estimates of diagnosed diabetes for some but not all minority groups are available from national survey data and from the IHS NPIRS.

With the exception of AI/AN people, race/ethnicity-specific estimates of diagnosed diabetes were calculated using the 2010–2012 NHIS data. People aged 20 years or older who self-reported having been told by a doctor or health professional that they had diabetes were classified as having diagnosed diabetes. In the survey, no questions are asked about the type of diabetes. The estimate of diagnosed diabetes for the Native Hawaiian and other Pacific Islander population was not included because NHIS data for this group were not released because of small sample size and confidentiality issues.

Diagnosed diabetes among AI/AN people was calculated using fiscal year 2012 data from the IHS NPIRS. This data system includes patient registration and visit data that are received from IHS facilities, tribally



operated programs, and urban and contract health systems (I/T/U). These [health care facilities](#) serve about 1.9 million AI/AN people who belong to 566 federally recognized tribes in 35 states. Data for 927,110 active patients (i.e., those with at least one visit to an I/T/U facility during the preceding 3 years) aged 20 years or older were used to calculate these estimates. Diabetes cases among these patients were identified using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnostic codes 250.0–250.93 from patient visit data. Patients were considered to have a diagnosis of diabetes if they had at least two visits with an ICD 250 diagnosis code reported during fiscal year 2012.

Differences in diabetes prevalence by race/ethnicity are partially attributable to age differences; thus, adjustment for age makes results from racial/ethnic groups more comparable. The percentages for all racial/ethnic groups estimated using NHIS and IHS data were age-adjusted—using age groups 20–44, 45–64, and ≥65—by the direct method to the 2000 U.S. Census standard population.

Resources to obtain data for minority groups at the state or local level include the [Behavioral Risk Factor Surveillance System](#) and the [California Health Interview Survey](#). More information on U.S. racial/ethnic minority groups is available from the U.S. Department of Health and Human Services [Office of Minority Health](#).

## New cases of diagnosed diabetes among people aged 20 years or older, United States, 2012

### Data sources:

2010–2012 [National Health Interview Survey](#) (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention.

U.S. Census Bureau, [resident population estimates for 7/1/2012](#).

### Methods:

The rate of new cases was calculated using 2010–2012 NHIS 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. In the survey, no questions are asked about the type of diabetes. We calculated the number of years since diagnosis of diabetes for each person 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. To calculate the rate, we used as the numerator the number of adults who were diagnosed with diabetes within the last year, and the denominator was the estimate of the adult population, excluding those who had been diagnosed with diabetes for more than one year and those who on the NHIS were categorized as "refused," "don't know," or who had missing values on the diabetes status question. To estimate the number of new cases of diabetes in adults in each age group in 2012, we applied the age-specific rates of new cases from NHIS to the corresponding 2012 estimates of the U.S. resident population after excluding the number of adults who had been diagnosed with diabetes for more than one year estimated from the National Health and Nutrition Examination Survey.



## Prediabetes among people aged 20 years or older, United States, 2012

### Data sources:

2009–2012 [National Health and Nutrition Examination Survey](#) (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention.

U.S. Census Bureau, [resident population estimates for 7/1/2012](#).

### Methods:

The percentage of people aged 20 years or older with prediabetes was estimated using the fasting subsample from the 2009–2012 NHANES data. People without diabetes were classified as having prediabetes if they had fasting plasma glucose values of 100 to 125 mg/dL or A1C values of 5.7% to 6.4%. For consistency with earlier estimates, fasting glucose values were adjusted using recommended regression equations. People with missing values for either fasting glucose or A1C and pregnant women were excluded. [The fasting glucose and A1C tests have limitations](#) in identifying populations with prediabetes and the implications of the age and race differences between groups in the prediabetes estimates are not known. [Research is ongoing to ascertain the best use of laboratory blood tests](#) to detect people who may have prediabetes and to improve the understanding of who has prediabetes. The age-specific percentages of prediabetes for age groups 20–44, 45–64, and ≥65 were then applied to the corresponding 2012 U.S. resident population estimates to derive the age-specific numbers of adults with prediabetes. These age-specific numbers of adults were added to obtain the estimated total number of adults with prediabetes. In addition, percentages of adults with prediabetes were calculated by race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic) and age-adjusted—using age groups 20–44, 45–64, and ≥65—by the direct method to the 2000 U.S. Census standard population.

### References:

American Diabetes Association. [Diagnosis and classification of diabetes mellitus](#). *Diabetes Care*. 2014;37(Suppl. 1):S81–S90.

Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey [Internet]. 2007–2008 Laboratory Methods.

[http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/lab\\_methods\\_07\\_08.htm](http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/lab_methods_07_08.htm)

Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey [Internet]. 2005–2006 Laboratory Methods.

[http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/lab\\_methods\\_05\\_06.htm](http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/lab_methods_05_06.htm)

## Diagnosed diabetes among people younger than 20 years, United States, 2012

### Data sources:

2010–2012 [National Health Interview Survey](#) (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention.

U.S. Census Bureau, [resident population estimates for 7/1/2012](#).

### Methods:

The percentage of people younger than 20 years with diagnosed diabetes was obtained from the 2010–2012 NHIS data. In this survey, no questions are asked about the type of diabetes. Information on diagnosed diabetes was obtained from a knowledgeable adult family member residing in the household for people younger than 18 years, and was self-reported for people aged 18–19 years. The estimate of diagnosed diabetes was applied to the 2012 U.S. resident population younger than 20 years to derive the number of people with diagnosed diabetes in this age group. Estimates of undiagnosed diabetes for people younger than 20 years are not available.



## New cases of diagnosed diabetes among people younger than 20 years, United States, 2008–2009

### Data source:

[SEARCH for Diabetes in Youth Study](#)

### Methods:

SEARCH is a multicenter observational study to examine diabetes among children and adolescents in the United States. The youth population being studied in 8 locations throughout the United States—more than 5 million, or 6%, of all American children younger than 20 years—is not nationally representative. However, the SEARCH sites were selected for their ability to reach minority populations, making this study group the largest and most racially and geographically diverse group ever involved in a youth diabetes study. It entails ascertaining new cases of physician-diagnosed diabetes in non-institutionalized, civilian people younger than 20 years in 2008–2009 (a) in geographically defined populations in Ohio, Washington, South Carolina, and Colorado; (b) among health plan enrollees in California (Kaiser Permanente Southern California excluding San Diego); and (c) among American Indian populations in Arizona and New Mexico. Race/ethnicity-specific estimates were pooled across sites using five categories: non-Hispanic white, non-Hispanic black, Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native. The annual total number of new cases of diabetes in people younger than 20 years was estimated by applying the age-, sex-, and racial/ethnic group-specific rates of new cases from SEARCH to the corresponding U.S. resident population.

### References:

The SEARCH for Diabetes in Youth Study Group. The many faces of diabetes in American youth: type 1 and type 2 diabetes in five race and ethnic populations. *Diabetes Care*. 2009;32(Suppl 2):S99-S147.

SEARCH Study Group. SEARCH for Diabetes in Youth: a multicenter study of the prevalence, incidence and classification of diabetes mellitus in youth. *Control Clin Trials*. 2004;25:458-471.

## Managing diabetes

### References:

American Diabetes Association. [Standards of medical care in diabetes—2014](#). *Diabetes Care*. 2014;37(Suppl. 1):S14-S80.

U.S. Department of Veterans Affairs. [VA/DoD Clinical practice guidelines: management of diabetes mellitus in primary care \(2010\)](#).

Seaquist ER, Anderson J, Childs B, et al. Hypoglycemia and diabetes: a report of a workgroup of the American Diabetes Association and The Endocrine Society. *Diabetes Care*. 2013;36:1384-1395.

Inzucchi SE, Bergenstal RM, Buse JB, et al. Management of hyperglycemia in type 2 diabetes: a patient-centered approach: position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*. 2012;35:1364-1379.



## Treatment of diabetes among people aged 18 years or older with diagnosed diabetes, United States, 2010–2012

### Data source:

Centers for Disease Control and Prevention. [National Diabetes Surveillance System](#). Using data from: 2010–2012 [National Health Interview Survey](#) (NHIS), National Center for Health Statistics, Centers for Disease Control and Prevention.

### Methods:

The distribution percentage of treatment type among civilian, non-institutionalized adults aged 18 years or older with diagnosed diabetes was calculated using the following treatment questions from the 2010–2012 NHIS: “Are you now taking insulin?” “Are you now taking diabetic pills to lower your blood sugar?” In the survey, no questions are asked about the type of diabetes.

## Co-existing conditions and complications among people with diagnosed diabetes

### Reference:

Venkat Narayan KM, Williams D, Gregg EW, Cowie C, eds. [Diabetes Public Health: From Data to Policy](#). New York, NY: Oxford University Press; 2011.

### Hypoglycemia

#### Data source:

Centers for Disease Control and Prevention. National Diabetes Surveillance System. Using data from: Agency for Healthcare Research and Quality, [Nationwide Emergency Department Sample](#).

### Hyperglycemic crisis

#### Data source:

Centers for Disease Control and Prevention. National Diabetes Surveillance System. Using data from: Agency for Healthcare Research and Quality, [Nationwide Emergency Department Sample](#).

### Reference:

Gregg EW, Li Y, Wang J, et al. Changes in diabetes-related complications in the United States, 1990–2010. *N Engl J Med*. 2014;370(16):1514-1523.

### High blood pressure

#### Data source:

2009–2012 [National Health and Nutrition Examination Survey](#) (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention.

### Methods:

The percentage of adults aged 18 years or older with diagnosed diabetes that have high blood pressure was estimated based on measured blood pressure greater than or equal to 140/90 millimeters of mercury or self-reported current use of prescription medication for high blood pressure.



## High blood [LDL cholesterol](#)

### *Data source:*

2009–2012 [National Health and Nutrition Examination Survey](#) (NHANES), National Center for Health Statistics, Centers for Disease Control and Prevention.

### *Methods:*

The percentage of adults aged 18 years or older with diagnosed diabetes that have high blood [LDL](#) cholesterol was estimated based on [LDL](#) values greater than or equal to 100 milligrams per deciliter or self-reported current use of prescription medication for high blood cholesterol.

## Heart disease and stroke

### *References:*

Gregg EW, Li Y, Wang J, et al. Changes in diabetes-related complications in the United States, 1990–2010. *N Engl J Med*. 2014;370(16):1514-1523.

Gregg EW, Cheng YJ, Saydah S, et al. Trends in death rates among U.S. adults with and without diabetes between 1997 and 2006: findings from the National Health Interview Survey. *Diabetes Care*. 2012;35(6):1252-1257.

## Blindness and eye problems

### *Reference:*

Zhang X, Saaddine JB, Chou CF, et al. Prevalence of diabetic retinopathy in the United States, 2005–2008. *JAMA* 2010;304(6):649-656.

## Kidney disease

### *Data source:*

United States Renal Data System. [Renal Data Extraction and Referencing System](#) [online data querying application]. 2013 Annual Data Report dataset. Accessed February 14, 2014.

## Amputations

### *References:*

Gregg EW, Li Y, Wang J, et al. Changes in diabetes-related complications in the United States, 1990–2010. *N Engl J Med*. 2014;370(16):1514-1523.

## Other conditions and complications

### *Reference:*

Venkat Narayan KM, Williams D, Gregg EW, Cowie C, eds. [Diabetes Public Health: From Data to Policy](#). New York, NY: Oxford University Press; 2011.

## Deaths among people with diabetes, United States, 2010

### *Data source:*

The number of deaths with diabetes as any-listed cause of death among U.S. residents was obtained from the record-axis count in the multiple cause-of-death dataset, National Center for Health Statistics, Centers for Disease Control and Prevention, using the *Tenth Revision of the International Classification of Diseases* cause-of-death codes E10–E14.





## References:

- Murphy SL, Xu JQ, Kochanek KD. [Deaths: final data for 2010](#). *National Vital Statistics Reports*. 2013;61(4):1-17.
- Gregg EW, Cheng YJ, Saydah S, et al. Trends in death rates among U.S. adults with and without diabetes between 1997 and 2006: findings from the National Health Interview Survey. *Diabetes Care*. 2012;35(6):1252-1257.
- McEwen LN, Kim C, Haan M, et al. TRIAD Study Group. Diabetes reporting as a cause of death: results from the Translating Research Into Action for Diabetes (TRIAD) study. *Diabetes Care*. 2006;29:247-253.
- Saydah SH, Geiss LS, Tierney E, Benjamin SM, Engelgau M, Brancati F. Review of the performance of methods to identify diabetes cases among vital statistics, administrative, and survey data. *Ann Epidemiol*. 2004;14:507-516.

## Estimated diabetes costs in the United States, 2012

### Reference:

- American Diabetes Association. [Economic Costs of Diabetes in the U.S. in 2012](#). *Diabetes Care*. 2013;36(4):1033-1046.

The estimated costs of diabetes in the United States were based on a study by the Lewin Group, Inc., for the American Diabetes Association and are 2012 estimates of both the direct costs (costs of medical care and services) and indirect costs (costs of short-term and permanent disability and of premature death) attributable to diabetes. This study used a specific cost-of-disease methodology to estimate the health care costs due to diabetes.

## What is diabetes?

### Type 1 and type 2 diabetes

#### References:

- American Diabetes Association. [Diagnosis and classification of diabetes mellitus](#). *Diabetes Care*. 2014;37(Suppl. 1):S81-S90.
- Dall TM, Mann SE, Zhang Y, et al. Distinguishing the economic costs associated with type 1 and type 2 diabetes. *Population Health Management*. 2009;12:103-110.
- Johnson JA, Pohar SL, Majumdar SR. Health care use and costs in the decade after identification of type 1 and type 2 diabetes: a population-based study. *Diabetes Care*. 2006;29:2403-2408.
- Ng E, Dasgupta K, Johnson JA. An algorithm to differentiate diabetic respondents in the Canadian Community Health Survey. *Health Rep*. 2008;19:71-79.

## Gestational diabetes

### References:

- American Diabetes Association. [Diagnosis and classification of diabetes mellitus](#). *Diabetes Care*. 2014;37(Suppl. 1):S81-S90.
- Vandorsten JP, Dodson WC, Espeland MA, et al. NIH consensus development conference: diagnosing gestational diabetes mellitus. *NIH Consens State Sci Statements* 2013;29(1):1-31.





Geiss LS, Cowie CC. Type 2 diabetes and persons at high risk of diabetes. In: Venkat Narayan KM, Williams D, Gregg EW, Cowie C, eds. [Diabetes Public Health: From Data to Policy](#) [PDF - 7.59 MB]. New York, NY: Oxford University Press; 2011.

Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care*. 2002;25:1862-1868.

Coustan DR. [Gestational diabetes](#) [PDF - 134 KB]. In: Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, eds. *Diabetes in America. 2nd ed.* Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health; 1995.

## What is prediabetes?

### References:

American Diabetes Association. [Diagnosis and classification of diabetes mellitus](#). *Diabetes Care*. 2014;37(Suppl. 1):S81-S90.

Li G, Zhang P, Wang J, et al. Cardiovascular mortality, all-cause mortality, and diabetes incidence after lifestyle intervention for people with impaired glucose tolerance in the Da Qing Diabetes Prevention Study: a 23-year follow-up study. *The Lancet Diabetes & Endocrinology*, Epub ahead of print. 3 April 2014.

Selvin E, Steffes MW, Zhu H, et al. Glycated hemoglobin, diabetes, and cardiovascular risk in nondiabetic adults. *N Engl J Med*. 2010;362:800-811.

Diabetes Prevention Program Research Group. Knowler WC, Fowler SE, Hamman RF, et al. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. *Lancet*. 2009;374:1677-1686.

Li G, Zhang P, Wang J, et al. The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study. *Lancet*. 2008;371:1783-1789.

Knowler WC, Barrett-Connor E, Fowler SE, et al. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002;346:393-403.

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.

Tuomilehto J, Lindström J, Eriksson JG, et al. The Finnish Diabetes Prevention Study Group. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med*. 2001;344:1343-1350.