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Prevalence of Type 1 and Type 2 Diabetes Among Children and Adolescents From 2001 to 2009

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Abstract

IMPORTANCE—Despite concern about an "epidemic," there are limited data on trends in prevalence of either type 1 or type 2 diabetes across US race and ethnic groups.

OBJECTIVE—To estimate changes in the prevalence of type 1 and type 2 diabetes in US youth, by sex, age, and race/ethnicity between 2001 and 2009.

DESIGN, SETTING, AND PARTICIPANTS—Case patients were ascertained in 4 geographic areas and 1 managed health care plan. The study population was determined by the 2001 and 2009 bridged-race intercensal population estimates for geographic sites and membership counts for the health plan.

MAIN OUTCOMES AND MEASURES—Prevalence (per 1000) of physician-diagnosed type 1 diabetes in youth aged 0 through 19 years and type 2 diabetes in youth aged 10 through 19 years.

RESULTS—In 2001, 4958 of 3.3 million youth were diagnosed with type 1 diabetes for a prevalence of 1.48 per 1000 (95% CI, 1.44–1.52). In 2009, 6666 of 3.4 million youth were diagnosed with type 1 diabetes for a prevalence of 1.93 per 1000 (95% CI, 1.88–1.97). In 2009, the highest prevalence of type 1 diabetes was 2.55 per 1000 among white youth (95% CI, 2.48–2.62) and the lowest was 0.35 per 1000 in American Indian youth (95% CI, 0.26–0.47) and type 1 diabetes increased between 2001 and 2009 in all sex, age, and race/ethnic subgroups except for those with the lowest prevalence (age 0–4 years and American Indians). Adjusted for completeness of ascertainment, there was a 21.1% (95% CI, 15.6%–27.0%) increase in type 1 diabetes over 8 years. In 2001, 588 of 1.7 million youth were diagnosed with type 2 diabetes for a prevalence of 0.34 per 1000 (95% CI, 0.31–0.37). In 2009, 819 of 1.8 million were diagnosed with type 2 diabetes for a prevalence of 0.46 per 1000 (95% CI, 0.43–0.49). In 2009, the prevalence of type 2 diabetes was 1.20 per 1000 among American Indian youth (95% CI, 0.96–1.51); 1.06 per 1000 among black youth (95% CI, 0.93–1.22); 0.79 per 1000 among Hispanic youth (95% CI, 0.70–0.88); and 0.17 per 1000 among white youth (95% CI, 0.15–0.20). Significant increases occurred between 2001 and 2009 in both sexes, all age-groups, and in white, Hispanic, and black youth, with no significant changes for Asian Pacific Islanders and American Indians. Adjusted for completeness of ascertainment, there was a 30.5% (95% CI, 17.3%–45.1%) overall increase in type 2 diabetes.

CONCLUSIONS AND RELEVANCE—Between 2001 and 2009 in 5 areas of the United States, the prevalence of both type 1 and type 2 diabetes among children and adolescents increased. Further studies are required to determine the causes of these increases.

Information on recent trends in the prevalence of type 1 and type 2 diabetes in the United States is limited. Imperatore et al[1] reported that the predicted increase in the number of

youth living with type 1 and type 2 diabetes by the year 2050 would be primarily among youth of minority race/ethnic groups. Worldwide, from 1990 to 2008, the incidence of type 1 diabetes has been increasing by 2.8% to 4.0% per year,[2] similar to that observed in the United States[3] for both non-Hispanic white (hereafter called white) and Hispanic youth. However, a recent report from Finland, with the world's highest incidence, suggested a possible leveling off of the increase from 2005–2011.[4] Due to the very low mortality among youth with type 1 diabetes in the United States,[5] an increase in the incidence of type 1 diabetes will likely result in an increase in prevalence.

Type 2 diabetes is increasingly diagnosed in youth and now accounts for 20% to 50% of new-onset diabetes case patients,[6] disproportionately affecting minority race/ethnic groups.[7–9] Although few longitudinal studies have been conducted, it has been suggested that the increase in type 2 diabetes in youth is a result of an increase in the frequency of obesity in pediatric populations.[10] Obesity in youth has been increasing since the 1960s though recent data suggest a plateau.[11]

There are a limited number of population-based studies of youth-onset type 2 diabetes. Most have involved American Indians and Native Canadians and showed high prevalence.[7,12,13] Similarly, type 2 diabetes incidence rates rose among non-Hispanic black (hereafter called black), Hispanic, and white children with insulin-treated, non–type 1 diabetes from 1994 to 2003.[14]

We explored whether overall prevalence of type 1 and type 2 diabetes among US youth changed from 2001[15] to 2009[13] and whether it changed by sex, age, and race/ethnicity. Understanding changes in prevalence according to population subgroups is important to inform clinicians about care that will be needed for the pediatric population living with diabetes and may provide direction for other studies designed to determine the causes of the observed changes.

Methods

A SEARCH description has been published[16] as have previous prevalence[13,15] and incidence results.[17] We report herein on changes in prevalence estimates between 2001 and 2009, the only years in which prevalence was assessed. Methods of case ascertainment and prevalence estimation were the same in the 2 periods, including a 22-month window of ascertainment. Data were collected from 5 centers located in California (Kaiser Permanente Southern California, excluding San Diego [7 counties]), Colorado [14 counties, including Denver], Ohio [8 counties, including Cincinnati], South Carolina [4 counties, including Columbia], and Washington state [5 counties, including Seattle])[15] as well as data from selected American Indian reservations in Arizona and New Mexico. The study was approved by the institutional review board (IRB) at each center. Because we attempted to identify 100% of case patients, identification was conducted with an approved Health Insurance Portability and Accountability Act waiver of consent. Active surveillance used networks of pediatric and adult endocrinologists and other clinicians, hospitals, and health plans in the study areas. Case patients identified by *International Classification of Diseases, Ninth Revision*, were validated by verifying the diagnosis of diabetes with a physician to remove

miscoded case patients. Duplicated case patients were removed using combinations of name or initials (depending on IRB approval), date of birth, date of diagnosis, sex, and race/ethnicity. After eligibility was verified based on residence and age, the case patient was registered with the coordinating center. Diabetes type diagnosed as type 1, type 1a, or type 1b by the clinician was considered *type 1 diabetes* and diabetes diagnosed as type 2 was included as *type 2 diabetes*. All other types, including secondary forms, were excluded for this analysis (165 patients in 2001 and 191 in 2009).

Study Population

Case patients included all youth younger than 20 years who had been diagnosed with nongestational diabetes and who were prevalent in 2001 and 2009 on December 31 in 2001 and 2009 and who resided in the geographic study area or were members of the participating health plans. Active duty military personnel or those who were institutionalized were not eligible. Race/ethnicity was based on self-report or medical records and on geocoding (ie, assignment of a US Census 2010 data–derived race/ethnicity proportion) for the youth who had missing data (4.2% in 2001 and 2.6% in 2009). We report type 2 diabetes prevalence only for those aged 10 through 19 years because there were not enough children younger than 10 years to establish stable rates (5 in 2001; 19 in 2009).

The study population included youth younger than 20 years residing in the geographic study areas or who were members of participating health plans in 2001 and 2009. For the geographically based sites, the population was defined by the 2001 and 2009 bridged-race intercensal population estimates.[18] For California, addresses were geocoded to the census-block level and the race/ethnic–specific proportions were applied to estimate the racial and ethnic composition of youth by age and sex. Patients of the Indian Health Service for the preceding 3 years determined the American Indian study population. Estimates were then pooled across all 5 sites. Race/ethnic categories included: Hispanic, white, black, Asian Pacific Islanders, and American Indians and were determined by first identifying any residents of Hispanic ethnicity and then by applying race-bridging methods[18] to multiracial youth to ascertain the probability of belonging to each of the 4 other racial groups. The study population of those aged 17 through 19 years had counts of active duty military personal removed.

Data Collection

Demographic information, date of diagnosis, and diabetes type were obtained from medical records. We validated clinician diagnoses of diabetes type through an etiologic assessment of diabetes type, defined as presence of at least 1 diabetes autoantibody (glutamic acid decarboxylase or insulinoma associated antibody) using harmonized assays[19] for type 1 diabetes and in the absence of diabetes autoantibodies and in the presence of insulin resistance based on a clamp validated index[20] for type 2 diabetes. This information came from an in-person research visit available on youth who had provided written informed consent or assent. Because no visits were made to patients at the time of diagnosis in the years 2001 and 2009, data from the 2 closest incident years (2002, 2008) were used. Patients with diabetes onset in 2002 or 2008 were identified using the same methods as those in 2001 and 2009. To assess generalizability, selected demographic characteristics of the SEARCH

study population were compared with the US population using US Census 2000 and 2010 summary files.

Statistical Analyses

Prevalence was expressed as cases of type 1 or 2 diabetes per 1000 youth pooled across all sites with 95% CIs. Statistical tests for trends used a 2-sided skew-corrected inverted score test assuming a binomial distribution.[21] Assuming a significance level of 5%, we had more than 90% power to detect a change in prevalence of 0.07 per 1000 youth for the overall population and of 0.12 per 1000 youth for subgroup analyses. To assess trends over time it is important to determine whether case patients were identified with the same completeness of ascertainment in both years. This was estimated for the 4 geographic-based sites using the capture-recapture method.[22] For each center, case patients were identified from multiple sources (from 13 to 41). A source was defined as any location from which case patients were reported. Matching across sources to identify potential duplicate records was performed at the center level using personal health identifiers. Once matching was accomplished, the sources were further grouped into 2 modes of ascertainment (clinicians and inpatient hospital system records). Using the number of duplicate and case patients unique to one or the other source allowed calculation of the total estimated case patients in the geographic region.[22] The percentage completeness of ascertainment for each site was taken as the number of observed case patients divided by the total estimated number from the capture-recapture method. Pooled estimates used a global logarithmic-linear model and maximum likelihood analysis[23] using SAS version 9.3 (SAS Institute Inc). The 95% CIs computed for the capture-recapture adjusted prevalence estimates account for the variation in the estimates. Approximately 20% of the study population was ascertained in membership-based sites where it was impossible to assess completeness of ascertainment using capture-recapture analyses due to the lack of independent sources of case patient ascertainment.

Results

Type 1 Diabetes

In 2001, 4958 patients with type 1 diabetes were identified from a population of 3 345 783; the respective case patients and population were 6666 and 3 458 974 in 2009 (Table 1). Prevalence was 1.48 per 1000 (95% CI, 1.44–1.52) in 2001 and 1.93 per 1000 (95% CI, 1.88–1.97) in 2009, representing an increase of 30.0% (95% CI, 25.4%–34.9%) over the 8-year period. Statistically significant increases were observed within each age, race/ethnic, and sex subgroup evaluated except for youth age 0 through 4 years and American Indians, which were the 2 population subgroups with the lowest prevalence of type 1 diabetes in 2001 and 2009. The greatest prevalence increase was observed in those aged 15 through 19 years.

Type 2 Diabetes

Table 2 shows the prevalence of type 2 diabetes for 2001 and 2009 among youth aged 10 to 19 years. In 2001, 588 of 1 725 846 and in 2009, 819 of 1 781 260 had type 2 diabetes. The overall prevalence was 0.34 per 1000 (95% CI, 0.31–0.37) in 2001 and 0.46 per 1000 (95% CI, 0.43–0.49) in 2009, representing a relative increase of 35% (95% CI, 21.4%–50.0%). A

statistically significant increase was seen in both sexes, in those aged 10 through 14 years and 15 through 19 years, and in white, black, and Hispanic youth. No significant changes were seen in Asian Pacific Islander or American Indian youth. The prevalence of type 2 diabetes was higher in both periods among those aged 15 through 19 years than among those aged 10 through 14 years and higher among females than among males; larger absolute increases were seen in these groups over time ($P < .001$, Table 2).

Completeness of Case Ascertainment

The overall completeness for type 1 diabetes was estimated to be 92.5% (95% CI, 91.8%–93.3%) in 2001 and 99.3% (95% CI, 99.2%–99.5%) in 2009. For type 2 diabetes it was estimated to be 92.9% (95% CI, 90.6%–95.2%) in 2001 and 96.1% (95% CI, 94.6%–97.6%) in 2009 (Table 3). After adjustment for completeness of ascertainment, type 1 diabetes prevalence for 2001 was 1.60 per 1000 (95% CI, 1.54–1.67) and for 2009 was 1.94 per 1000 (95% CI, 1.89–2.00), representing an adjusted increase of 21.1% (95% CI, 15.6%–27.0%). After adjustment for completeness of ascertainment, type 2 diabetes prevalence for 2001 was 0.37 per 1000 (95% CI, 0.34–0.40) and in 2009 it was 0.48 per 1000 (95% CI, 0.45–0.51), representing an adjusted increase of 30.5% (95% CI, 17.3%–45.1%).

Etiologic Criteria

We also explored whether similar proportions of case patients diagnosed by clinicians with type 1 or type 2 diabetes in the 2 years met etiologic criteria for diabetes type.[20] Among those with type 1 diabetes, 84.2% had positive antibodies in 2002 and 85.7%, in 2008 ($P = .50$; Table 4). Among those with type 2 diabetes, 82.1% in 2001 and 88.7% in 2009 ($P = .23$) met the etiologic criteria. Similar small differences by age group and by race/ethnicity did not reach statistical significance, except for white youth with type 2 diabetes: 55.6% in 2002 and 90.9% in 2008 met etiologic criteria ($P = .01$). Except for this subgroup, trends in the accuracy of diagnosis of diabetes type were stable over time.

Representativeness of the SEARCH Population

Table 5 shows that for race/ethnicity, age, parental educational attainment, and median household income, the proportional distribution for 2001 and 2009 was very similar to the US census for 2000 and 2010. Thus, we were satisfied that the study areas reasonably represented the US population.

Discussion

Type 1 Diabetes

Over the 8-year period, the adjusted prevalence of type 1 diabetes increased 21.1% (95% CI, 15.6%–27.0%) among US youth. Increases were observed in both sexes; in white, black, Hispanic, and Asian Pacific Islander youth; and in those aged 5 years or older. Historically, type 1 diabetes has been considered a disease that affects primarily white youth; however, our findings highlight the increasing burden of type 1 diabetes experienced by youth of minority racial/ethnic groups as well.

Increases in the prevalence of type 1 diabetes could reflect increases in disease incidence, decreases in mortality, or both. Mortality due to diabetes in youth is low (1.05 per million for aged ≤19 years in 2008–2009[5]); therefore, an increase in type 1 diabetes incidence is the most likely primary explanation. Increases in the incidence of type 1 diabetes have been observed around the world,[24] and more recently, increases among white, Hispanic, and black youth in the United States have been reported.[3,25] A doubling of incidence rates from 1978 to 2007 was reported in Sweden,[26] although declining cumulative incidence was observed in the 2000–2006 birth cohorts. Similarly, a Finnish report showed that even though the incidence increased from 1989 to 2005, no further increase in incidence of type 1 diabetes occurred between 2005 and 2011.[4]

Through the year 2000, published prevalence estimates from around the world ranged from 0.03 to 1.83 per 1000,[27,28] whereas after 2000, estimated prevalence ranged from 0.06 to 4.8 per 1000[15,29,30] compared with our estimate of 1.93 per 1000 in 2009. Overall prevalence of type 1 diabetes was 1.58 per 1000 in Philadelphia schools, somewhat lower than our estimates, and race/ethnic specific differences were all lower than what we found: 0.73 per 1000 among white, 0.56 among black, and 0.50 among Hispanic youth.[29] These estimates are difficult to compare because of differences in ascertainment methods, race/ethnicity, and age composition of the populations across studies. Few studies have projected changes in prevalence of type 1 diabetes among contemporary youth. Based on SEARCH data, Imperatore et al[1] modeled the number of youth who would have type 1 diabetes in 2010 and 2050, which was estimated to nearly triple, from 179 387 in 2010 to 587 477 in 2050, due to large increases in the numbers of minority race/ ethnic groups. The increase in prevalence among US minorities documented herein is of concern, given that minority youth are more likely to have poor glycemic control,[31] known to be associated with the serious complications of type 1 diabetes.

Type 2 Diabetes

We also report, to our knowledge, the only multiethnic data on changes in the prevalence of type 2 diabetes in youth. The prevalence of type 2 diabetes in 2009 among adolescents aged 10 through 19 years was 0.46 per 1000 or 0.046%, with highest prevalence in American Indians, followed by black, Hispanic, and Asian Pacific Islander youth, with lowest prevalence in white youth, a pattern that is almost the inverse of that seen in type 1 diabetes. Prevalence was somewhat lower than reported in fifth- to 12th-grade students in Ohio (0.08%, previously diagnosed type 2 diabetes),[32] although a higher proportion of black students were included in that study. It was also lower than the screening results in the Studies to Treat or Prevent Pediatric Type 2 Diabetes[33] (STOPP-T2D) involving eighth-grade students, which documented a 0.5% prevalence of elevated screening glucose levels; however, only a single screening test was used. Compared with our estimate of 0.46 per 1000, the reported prevalence among sixth graders in the HEALTHY study (0.2 per 1000)[34] was lower, as was prevalence among students in the Philadelphia schools (0.35 per 1000 overall[29]), which also reported substantially lower race/ethnicity specific estimates (0.03 per 1000 white; 0.28 per 1000 black; and 0.05 per 1000 Hispanic youth).

We showed that the overall prevalence of type 2 diabetes between 2001 and 2009 increased by 30.5% when adjusted for differences in completeness of ascertainment. Increases occurred in white, Hispanic, and black youth, whereas no changes were found in Asian Pacific Islander and American Indian youth. Projections suggest that the number of youth with type 2 diabetes will increase from 22 820 in 2010 to 84 131 in 2050, a 4-fold increase.[1] Our data also suggest that there was little change in the pattern of diagnosis of diabetes type that clinicians used over this period, with the exception of white youth. We can only speculate about whether changes in the awareness of type 2 diabetes in youth over time may have accounted for this change. Because a lower proportion of white youth met the etiologic criteria in the first period, the rates for 2001 may have been overestimated, and therefore we may have underestimated the increase in type 2 diabetes among white youth.

There are limited population-based data on temporal trends of type 2 diabetes in youth. In Cincinnati, Ohio, type 2 diabetes incidence increased 10-fold, from 1982 to 1994 (average annual change, 41.7%).[35] Annual incidence rates from 1994 to 2003 increased by 3.7% among white, 3.9% among black, and 9.6% among Hispanic children with insulin-treated, non–type 1 diabetes in Chicago[14]; however, these case patients represent an unknown proportion of all case patients. Among aboriginal youth in Alberta, Canada,[12] a 14% average annual increase was reported in Chicago between 1995 and 2007 in youth younger than 20 years. Dabelea et al[7] showed an increase in prevalence of type 2 diabetes in Pima Indian youth aged 10 through 19 years in both sexes, with the highest prevalence in females. In Pima, the estimated average annual increase ranged from 1.9% to 10%, whereas we estimated the average annual increase at 4.4% overall, similar to that seen among the Pima Indians.

Studies in Europe[36,37] indicate that type 2 diabetes remains rare in largely white populations, and 1 report showed no trend[38]; however, we observed a significant prevalence increase in white youth. Although differences in obesity rates between US and European youth are likely contributors, the full explanation for these discrepancies deserves further study.

Several reasons for the increasing type 2 diabetes prevalence are possible. Most likely are real changes in population risk for type 2 diabetes, such as minority population growth, obesity, exposure to diabetes in utero,[39] and perhaps endocrine-disrupting chemicals.[40] Similarly, changing awareness of type 2 diabetes in youth leading to different diagnostic practices may have contributed to the increases.

Our study has limitations and strengths. We only included youth with diagnosed diabetes, which will miss youth who may meet diagnostic criteria for type 2 diabetes if screened, although this is much less of a limitation for youth with type 1 diabetes. However, the number of undiagnosed cases of type 2 diabetes is likely to be small.[32,34] We only included 2 years of data and rates may vary from year to year. Also, the last year of data was 2009, 5 years ago, so we are not able to comment on whether current prevalence has changed. There were relatively small numbers of youth in some groups by race/ethnicity (especially American Indian and Asian Pacific Islanders) making these estimates of changes in prevalence less precise. Our observation period was relatively short and further surveillance

will produce better estimates of changes. Strengths of the study include large numbers of youth identified using consistent methods from 2 periods; the population-based nature of the study; the racial/ethnic composition of the populations, which was similar in distribution to the United States; and the ability to show that our findings were not overly influenced by changes in case ascertainment or in clinician's diagnostic patterns of diabetes type.

The increases in prevalence reported herein are important because such youth with diabetes will enter adulthood with several years of disease duration, difficulty in treatment,[41] an increased risk of early complications, and increased frequency of diabetes during reproductive years, which may further increase diabetes in the next generation.[7]

Conclusions

Between 2001 and 2009 in 5 areas of the United States, there was an increase in the prevalence of both type 1 and type 2 diabetes among children and adolescents. Further studies are required to determine the causes of these increases.

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Table 1

Prevalence of Type 1 Diabetes by Demographic Characteristics

	2001 Population			2009 Population				
	No. of Youth		Prevalence per 1000 (95% CI)	No. of Youth		Prevalence per 1000 (95% CI)	Difference in Prevalence (95% CI)	*P* Value
	Cases With Diabetes	General Population		Cases With Diabetes	General Population			
Total[a]	4958	3 345 783	1.48 (1.44 to 1.52)	6666	3 458 974	1.93 (1.88 to 1.97)	0.45 (0.41 to 0.48)	<.001
Sex								
Females	2420	1 635 589	1.48 (1.42 to 1.54)	3263	1 692 112	1.93 (1.86 to 2.00)	0.45 (0.40 to 0.49)	<.001
Males	2538	1 710 194	1.48 (1.43 to 1.54)	3403	1 766 862	1.93 (1.86 to 1.99)	0.44 (0.40 to 0.49)	<.001
Age, y[b]								
0-≤4	217	787 251	0.28 (0.24 to 0.31)	241	832 791	0.29 (0.26 to 0.33)	0.01 (−0.01 to 0.04)	.30
5-≤9	977	832 686	1.17 (1.10 to 1.25)	1143	844 923	1.35 (1.28 to 1.43)	0.18 (0.13 to 0.23)	<.001
10-≤14	1727	885 604	1.95 (1.86 to 2.04)	2335	867 403	2.69 (2.59 to 2.80)	0.74 (0.67 to 0.81)	<.001
15-≤19	2037	840 242	2.42 (2.32 to 2.53)	2947	913 857	3.22 (3.11 to 3.34)	0.80 (0.72 to 0.88)	<.001
Race/ethnicity								
White	3718	1 996 971	1.86 (1.80 to 1.92)	4804	1 885 451	2.55 (2.48 to 2.62)	0.69 (0.64 to 0.73)	<.001
Black	471	365 146	1.29 (1.18 to 1.41)	621	383 198	1.62 (1.50 to 1.75)	0.33 (0.25 to 0.42)	<.001
Hispanic	625	647 656	0.96 (0.89 to 1.04)	1042	809 267	1.29 (1.21 to 1.37)	0.32 (0.27 to 0.38)	<.001
Asian Pacific Islander	107	212 708	0.50 (0.42 to 0.61)	156	260 846	0.60 (0.51 to 0.70)	0.09 (0.03 to 0.16)	.006
American Indian	37	123 303	0.30 (0.22 to 0.42)	42	120 212	0.35 (0.26 to 0.47)	0.05 (−0.03 to 0.12)	.19

[a] Differences in the number of youth reported with type 1 diabetes in 2001[15] and in this report are due to exclusion of 1 prior study site in both years (Hawaii) and continued data cleaning.

[b] Age on December 23, 2001, and December 31, 2009.

Table 2

Prevalence of Type 2 Diabetes per 1000 by Demographic Characteristics

	2001 Population			2009 Population				
	No. of Youth		Prevalence per 1000 (95% CI)	No. of Youth		Prevalence per 1000 (95% CI)	Difference in Prevalence (95% CI)	*P* Value
	Cases With Diabetes	General Population		Cases With Diabetes	General Population			
Total[a]	588	1 725 846	0.34 (0.31 to 0.37)	819	1 781 260	0.46 (0.43 to 0.49)	0.12 (0.10 to 0.14)	<.001
Sex								
Females	356	843 168	0.42 (0.38 to 0.47)	505	871 465	0.58 (0.53 to 0.63)	0.16 (0.12 to 0.19)	<.001
Males	232	882 678	0.26 (0.23 to 0.30)	314	909 to 795	0.35 (0.31 to 0.39)	0.08 (0.06 to 0.11)	<.001
Age, y[b]								
10-≤14	136	885 604	0.15 (0.13 to 0.18)	198	867 403	0.23 (0.20 to 0.26)	0.07 (0.05 to 0.09)	<.001
15-≤19	452	840 242	0.54 (0.49 to 0.59)	621	913 857	0.68 (0.63 to 0.74)	0.14 (0.10 to 0.18)	<.001
Race/ethnicity								
White	150	1 046 084	0.14 (0.12 to 0.17)	172	985 818	0.17 (0.15 to 0.20)	0.03 (0.01 to 0.05)	<.001
Black	177	186 637	0.95 (0.82 to 1.10)	209	196 723	1.06 (0.93 to 1.22)	0.12 (0.02 to 0.22)	.02
Hispanic	144	318 238	0.45 (0.39 to 0.53)	317	402 691	0.79 (0.70 to 0.88)	0.33 (0.27 to 0.39)	<.001
Asian Pacific Islander	39	110 560	0.35 (0.26 to 0.48)	46	133 455	0.34 (0.26 to 0.46)	−0.01 (−0.09 to 0.06)	.73
American Indian	78	64 327	1.22 (0.98 to 1.52)	75	62 573	1.20 (0.96 to 1.51)	−0.01 (−0.21 to 0.17)	.83

[a] Differences in the number of youth reported with type 2 diabetes in 2001[15] and in this report are due to exclusion of 1 prior study site in both years (Hawaii) and continued data cleaning. Differences from 2009 previously published[13] are due to exclusion of youth 10 y or younger at onset and continued data cleaning.

[b] Age on December 23, 2001, and December 31, 2009.

Table 3

Estimated Completeness of Case Ascertainment for Youth With Diabetes Using Capture-Recapture for 4 Geographic Sites Combined, by Year, Age Group, Sex, and Race/Ethnicity

	% Completeness (95% CI)	
Diabetes	**2001**	**2009**
Overall		
Type 1	92.5 (91.8–93.3)	99.3 (99.2–99.5)
Type 2	92.9 (90.6–95.2)	96.1 (94.6–97.6)
Age, y		
Type 1		
0-≤4	93.7 (92.9–94.6)	99.6 (99.6–99.7)
5-≤9	93 (92.5–93.4)	99.5 (99.5–99.6)
10-≤14		
Type 1	93.2 (92.8–93.5)	99.4 (99.4–99.4)
Type 2	96 (95.2–96.8)	96.8 (96.4–97.2)
15-≤19		
Type 1	91.7 (91.3–92)	96.5 (96.2–96.8)
Type 2	91.7 (90.9–92.6)	94.6 (93.8–95.5)
Sex		
Female		
Type 1	93.1 (92.8–93.3)	99.4 (99.3–99.4)
Type 2	94 (93.3–94.7)	96.8 (96.4–97.1)
Male		
Type 1	92 (91.7–92.3)	99.3 (99.3–99.3)
Type 2	90.8 (89.4–92.2)	94.3 (93.4–95.3)
Race/ethnicity		
White		
Type 1	93.1 (92.8–93.3)	99.4 (99.4–99.4)
Type 2	92.2 (91–93.4)	97 (96.5–97.5)
Black		
Type 1	96.6 (96.3–97)	99.7 (99.7–99.8)
Type 2	96.5 (95.9–97)	98.8 (98.5–99)
Hispanic		
Type 1	91.9 (90.9–92.8)	98.9 (98.8–99)
Type 2	82.8 (77.8–87.7)	90 (88–92)
Other[a]		
Type 1	85.8 (83.8–87.9)	99.2 (99–99.3)
Type 2	91 (87.7–94.4)	94.4 (92.5–96.3)

[a] Other includes Asian/Pacific Islanders, American Indian, and other race/ethnicity.

Table 4

Proportion of Incident Cases Meeting Etiological Criteria in the 2 Time Periods (2002 and 2008) Closest to the Prevalence Years, Overall and by Demographic Subgroups[a]

	Clinical Diabetes Type 1			Clinical Diabetes Type 2		
	2002, No. (%)	2008, No. (%)[b]	*P* Value	2002, No. (%)	2008, No. (%)	*P* Value
Age, y						
0-≤4	23 (92.0)	68 (82.9)	.27			
5-≤9	113 (89.0)	192 (87.7)	.72			
10-≤14	138 (80.2)	204 (84.6)	.24	22 (81.5)	34 (89.5)	.36
15-≤19	67 (82.7)	100 (86.2)	.50	33 (82.5)	52 (88.1)	.43
10-≤19				55 (82.1)	86 (88.7)	.23
0-≤19	341 (84.2)	564 (85.7)	.50			
Race/ethnicity						
White	267 (84.5)	413 (88.1)	.15	10 (55.6)	20 (90.9)	.01
Black	34 (86.5)	86 (75.8)	.19	16 (91.3)	26 (90.6)	.93
Hispanic	32 (87.2)	50 (79.6)	.30	21 (94.1)	29 (83.9)	.30
Asian Pacific Islander	7 (87.5)	11 (100.0)	.23	1 (100.0)	1 (100.0)	NA
American Indian	1 (33.3)	1 (100.0)	NA	7 (87.5)	10 (90.9)	.81
Sex						
Female	157 (84.4)	266 (86.9)	.44	36 (90.0)	53 (93.0)	.60
Male	184 (84.0)	298 (84.7)	.84	19 (70.4)	33 (82.5)	.24

[a] Etiological criteria for type 1 diabetes: presence of 1 or more diabetes autoantibodies (glutamic acid decarboxylase or insulinoma associated antibody); and for type 2 diabetes: no evidence of diabetes autoimmunity and presence of insulin resistance.[20]

[b] Three case patients missing race/ethnicity not shown.

Table 5

Comparison of the Demographics of the Populations Under Surveillance (2001 and 2009) With the US Census (2000 and 2010)

	No. (%)			
	US Census 2000	SEARCH 2001 Prevalence Population[a]	US Census 2010	SEARCH 2009 Prevalence Population[b]
Race/ethnicity[c]				
White	194 552 774 (69.1)	7 638 429 (64.9)	196 817 552 (63.8)	7 689 947 (61.0)
Black	33 947 837 (12.1)	977 677 (8.3)	37 685 848 (12.2)	1 051 643 (8.3)
Hispanic	35 305 818 (12.6)	1 916 968 (16.3)	50 477 594 (16.4)	2 340 785 (18.6)
American Indian	2 068 883 (0.7)	248 343 (2.1)	2 247 098 (0.7)	238 507 (1.9)
Asian Pacific Islander	10 476 678 (3.7)	701 027 (6.0)	14 946 700 (4.8)	934 989 (7.4)
Non-Hispanic: some other race	467 770 (0.2)	20 885 (0.2)	604 265 (0.2)	23 256 (0.2)
Non-Hispanic: ≥2 races	4 602 146 (1.6)	263 063 (2.2)	5 966 481 (1.9)	336 406 (2.7)
Age, y[c]				
0-≤4	19 175 798 (6.8)	837 430 (7.1)	20 201 362 (6.5)	852 042 (5.3)
5-≤9	20 549 505 (7.3)	895 283 (7.6)	20 348 657 (6.6)	847 743 (5.3)
10-≤14	20 528 072 (7.3)	880 014 (7.5)	20 677 194 (6.7)	849 263 (5.3)
15-≤19	20 219 890 (7.2)	842 557 (7.2)	22 040 343 (7.1)	891 970 (5.6)
Education, for adults ≥25 y[d]				
<High school graduate	(19.6)	(16.9)	(14.9)	(13.0)
High school graduate	(28.6)	(23.6)	(29.0)	(23.9)
Some college	(27.4)	(30.2)	(28.1)	(29.7)
≥Bachelor's degree	(24.4)	(29.3)	(27.9)	(33.4)
Median household income, US $[d]	41 994	43 649	51 914	60 129

[a] Data are from 2000, but the prevalence areas were defined by SEARCH in 2001.

[b] Data are from 2010, but the prevalence areas were defined by SEARCH in 2009.

[c] Data are from Summary File 1 from the 2000 and 2010 Census.

[d] Data are from Summary File 3 from the 2000 Census and data are based on 5-y estimates from 2010 American Community Survey. SEARCH prevalence population numbers do not include American Indian subsite information for Education and Income.