Hawai'i Diabetes Report 2010

Hawai'i State Diabetes Prevention and Control Program
Chronic Disease Management and Control Branch
Hawai'i State Department of Health

The Hawai'i Department of Health is pleased to present the publication of the *Hawai'i Diabetes Report 2010*. The report, produced under the direction of the Hawai'i State Diabetes Prevention and Control Program, compiles surveillance information, vital statistics, and various other data sources into a comprehensive document.

The *Hawai'i Diabetes Report 2010* is intended to provide partners, stakeholders, and decision makers with the latest information on the prevalence of diabetes and its effects on the people of Hawai'i. This report is valuable in helping to direct resources for diabetes-related interventions and policy development.

It is estimated that in 2007, approximately 102,000 adults in Hawai'i had diabetes and more than 900 people die every year of related complications, making it the seventh leading cause of death in the state. Diabetes is a serious, common, and costly disease, and by working together, we can create a healthier Hawai'i. I invite you to join us in that effort.

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Message from the Department of Health

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Highlights

Prevalence

- Between 1997 and 2007, the prevalence of self-reported adult diabetes in the state has steadily increased from 5% to 7.7%.
- This pattern of increasing prevalence of diabetes in Hawai'i coincides with the epidemic of increasing overweight and obesity, seen throughout the United States and globally.
- In 2007, it was estimated that there were approximately 76,000 adults with diagnosed diabetes in Hawai'i, a further 26,000 are estimated to have diabetes that is undiagnosed.

Disparities

- Native Hawaiians have the highest diabetes mortality rates, [either as an underlying cause of death (UCD) or contributing cause of death (CCD)], followed by Filipinos and Japanese.
- Age-adjusted diabetes prevalence is highest among those with low income (13.4%), followed by Native Hawaiians (12.5%), those with low education (10.6%) and Filipinos (9.9%).

Co-morbidities, Risk and Protective Factors

- Adults with diabetes are more likely to report being obese (Body Mass Index (BMI)> 30), compared to adults without diabetes.
- Adults with diabetes are less likely to be physically active, compared to adults without diabetes.
- The percentage of adults with diabetes who smoke is about the same as the percentage of adults without diabetes who smoke.
- Adults with diabetes are more likely to report fair or poor health status compared to adults without diabetes.
- Adults with diabetes are more likely to receive their immunization for flu and pneumonia when compared with adults without diabetes.
- Both hospital and emergency department discharges and charges (costs) with a diagnosis of diabetes have been increasing since 1997.

Purpose of Report

This report provides pertinent information on the prevalence of diabetes based on self-reports and claims data; diabetes mortality; diabetes complications (e.g., eye, foot, kidney); diabetes preventive care practices; and the relationship between diabetes and general health status, risk factors (e.g., obesity, smoking), and healthy lifestyle behaviors. The aim of this document is straightforward: to provide insight on the burden and distribution of diabetes among Hawai'i's residents, allowing local communities to focus their resources and attention where they are most needed.

Introduction

Diabetes mellitus is a group of diseases characterized by high levels of blood glucose (i.e., blood sugar). In a person with diabetes, the normal use of food for energy is disrupted because of defects in insulin production, insulin action, or both. Insulin is a hormone which assists with the uptake of glucose into the body's cells. When insulin defects are present, the normal pathway of energy production is disrupted and high blood glucose levels result.

Type 1 diabetes is usually diagnosed in children and young adults, and was previously known as juvenile-onset diabetes or insulin-dependent diabetes mellitus. In type 1 diabetes, the body does not produce insulin and therefore, people with type 1 diabetes must have insulin delivered by an injection or pump. Only 5% to 10% of people with diabetes have this form of the disease. Type 2 diabetes, previously known as adult-onset diabetes or non-insulin dependent diabetes mellitus, is the most common form of diabetes accounting for 90% to 95% of all diagnosed cases. Type 2 diabetes usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it (American Diabetes Association, 2009, www.diabetes.org).

Gestational diabetes is a form of glucose intolerance diagnosed during pregnancy. It is more common among obese women and women with a family history of diabetes. During pregnancy, gestational diabetes requires treatment to normalize maternal blood glucose levels to avoid complications in the infant. Immediately after pregnancy, 5% to 10% of women with gestational diabetes are found to have diabetes, usually type 2. Women who have had gestational diabetes have a 40% to 60% chance of developing diabetes in the next five to ten years (CDC, 2008).

Type 2 diabetes (non-insulin dependent diabetes mellitus) was previously considered to be of minor significance to world health, but is now "one of the main threats to human health in the 21st century" (Zimmet, Alberti and Shaw, 2001). The past two decades have seen explosive increase in diabetes worldwide due to pronounced changes in the human environment, behavior and lifestyle (King and Herman, 1998). Escalating rates of obesity have fueled this trend, such that obesity and diabetes have been called "twin epidemics" since the year 2000 (American Public Health Association, 2000; CDC, 2001).

The Centers for Disease Control and Prevention (CDC) estimates that 7.8% or 23.6 million people (all ages) have diabetes in the United States. Of the estimated 23.6 million people with diabetes, almost a quarter of them (5.7 million) do not know they have it. The costs associated with diabetes are staggering. Cost studies funded by the American Diabetes Association estimate the total direct and indirect costs associated with diabetes in this country to be as high as $132 billion ($92 billion in direct medical costs). The national cost of diabetes in the U.S. in 2007 exceeded $174 billion (American Diabetes Association, 2008). This estimate includes $116 billion in excess medical expenditures attributed to diabetes, as well as $58 billion in reduced national productivity.

People with diagnosed diabetes, on average, have medical expenditures that are approximately 2.3 times higher than the expenditures would be in the absence of diabetes. Approximately $1 in $10 health care dollars is attributed to diabetes. Indirect costs include increased risk for absenteeism, reduced productivity, and lost productive capacity due to early mortality. The total cost of diabetes for people in Hawai'i in 2006 is estimated at over $1 billion. This estimate includes excess medical costs of $764 million attributed to diabetes, and lost productivity valued at almost $274 million (American Diabetes Association, see cost calculator: www.diabetes.org/cost).

In nine of ten cases, Type 2 diabetes is preventable, manageable and controllable through weight control, exercise, a healthy diet and not smoking (http://www.hsph.harvard.edu/nutritionsource/diabetes.html). Diabetes can lead to serious complications and premature death. Much of this burden could be prevented with early detection, improved delivery of care, and improved diabetes self-management. Together with healthcare systems, providers and their support network, people with diabetes can lower the occurrence of these complications by controlling levels of blood glucose, blood pressure and blood lipids, and by receiving other preventive care practices in a timely manner.

The following are diabetes-related complications in the United States that could be prevented or reduced (CDC, 2008):

Heart Disease and Stroke.
Adults with diabetes are two to four times more likely to die of heart disease and stroke, which together cause about 65% of deaths among people with diabetes. These deaths could be reduced by 30% with improved care to control blood pressure, blood glucose, and blood cholesterol levels.

Eye disease and blindness.
Diabetes is the leading cause of new cases of blindness among adults aged 20-74. Diabetic retinopathy accounts for approximately 12,000 to 24,000 new cases of blindness every year in the U.S. Regular eye exams and timely treatment could prevent up to 90% of diabetes-related blindness.

Kidney disease.
Diabetes is the leading cause of kidney failure, accounting for 44% of new cases across the country in 2005. In 2005, 46,739 people with diabetes began treatment for end-stage kidney disease in the United States and Puerto Rico. In 2005, a total of 178,689 people with end-stage kidney disease due to diabetes were living on chronic dialysis or with a kidney transplant in the United States.

Nervous System Disease and Amputations.
About 60% to 70% of people with diabetes have mild to severe forms of nervous system damage. The results of such damage include impaired sensation or pain in the feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome, erectile dysfunction, or other nerve problems. Severe forms of diabetic nerve disease and vascular disease associated with

diabetes are major contributing causes of lower-extremity amputations. More then 60% of non-traumatic lower-limb amputations occur in people with diabetes. In 2004, about 71,000 non-traumatic lower limb amputations were performed in people with diabetes.

Dental Disease.
Periodontal or gum disease is more common in people with diabetes. Among young adults, those with diabetes have about twice the risk of gum disease of those without diabetes. Those with poorly controlled diabetes were nearly three times more likely to have severe periodontitis than those without diabetes.

Complications of Pregnancy.
In women with type 1 diabetes, poorly controlled diabetes before conception and during the first trimester of pregnancy can cause major birth defects in 5% to 10% of pregnancies and spontaneous abortions in 15% to 20% of pregnancies. Poorly controlled diabetes during the second and third trimesters of pregnancy can result in excessively large babies, posing a risk to both the mother and child.

Other complications:
People with diabetes experience more disabilities than those without diabetes, as well as lower health-related quality of life and more depression and unhealthy days. Uncontrolled diabetes often leads to biochemical imbalances that can cause life threatening events, such as diabetic ketoacidosis and hyperosmolar coma. People with diabetes are also more susceptible to other illnesses. Once they acquire these illnesses, they often have worse prognoses. For example, they are more likely to die with pneumonia or influenza than people who do not have diabetes.

Data Sources

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS is the largest continuously conducted telephone health survey in the world. The annual telephone survey of non-institutionalized adults (>18 years) has been conducted in all states and territories in the United States since 1988. The BRFSS, based on self-reports, assesses risk factors for disease(s) and conditions related to the ten leading causes of death in the U.S. population in all 50 states and all territories. Hawai'i has been an active participant in the BRFSS since the early 1990's. The BRFSS in Hawai'i, administered by the Department of Health, enables the Centers for Disease Control and Prevention (CDC), state health departments, and other health and education agencies to monitor risk behaviors related to chronic diseases, injuries and death. State health departments use BRFSS data to create annual and periodic reports, fact sheets, press releases, and other publications. These materials are then used to educate the public, health professionals, and policymakers about modifiable risk factors and preventive health practices. Most of the BRFSS data in this report are presented as three-year, age-adjusted averages for various diabetes and general health-related questions. (http://www.hawaii.gov/health/statistics/brfss/index.html)

Hawai'i Health Information Corporation (HHIC)

HHIC is a private, not-for-profit corporation established in 1994. It maintains one of Hawai'i's largest healthcare databases, which contains nearly 2.2 million inpatient discharge records collected annually from Hawai'i's 25 acute care hospitals since 1994. These discharge records contain patient demographic information, hospital visit costs and duration, and patient diagnosis using the International Classification of Diseases (ICD), Version 9 (ICD-9). These data provide details on the burden of diabetes on Hawai'i's healthcare system. The Hawai'i Department of Health has a subscription to view aggregated and de-identified patient data, and has obtained permission to present the data in this report. (http://www.hhic.org)

Mortality Data (Vital Records)

The management of birth certificates, marriage licenses, and death certificates is handled by the Office of Health Status Monitoring (OHSM) within the Department of Health (DOH). This office collects, processes, analyzes and disseminates relevant, population-based data in order to assess the health status of Hawai'i's population and to fulfill health statistics legal requirements. OHSM also provides vital statistics and demographic and health data for use in identifying state and community health trends, identifying population groups at risk for serious health problems, and evaluating program effectiveness. OHSM provides a repository for vital event records within the state such as births, deaths, and marriages and provides copies to the general public. In the last two years an electronic death certificate system has been implemented for a more streamlined and efficient process. (http://www.hawaii.gov/health/statistics/vital-statistics/index.html)

Hawai'i Diabetes Data Network (HDDN)

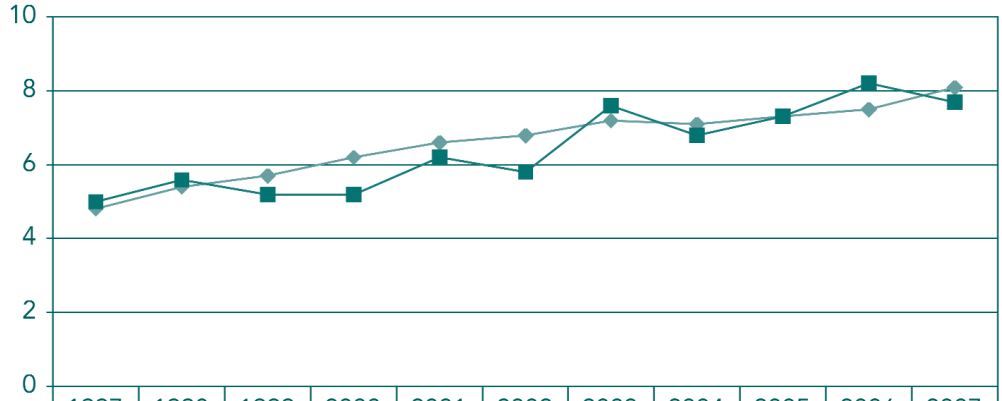
The Pacific Health Research Institute (PHRI), in collaboration with the Hawai'i Department of Health, Diabetes Prevention and Control Program, the Hawai'i Medical Service Association (HMSA) and Kaiser Permanente Hawai'i, initiated the Hawai'i Diabetes Data Network (HDDN) in 1996. Prevalence was estimated based on individuals with diabetes who were identified using standardized algorithms in de-identified datasets. For each of these individuals, the health plans extracted inpatient, outpatient, and emergency department insurance claims and encounter data, along with corresponding ICD diagnosis codes and CPT procedure codes, all drug orders, laboratory tests ordered and test results (where available). The data was then merged and organized at PHRI in the form of limited, de-identified data sets. The HDDN currently includes data from 1996-2005. The combined data from these two health plans, along with age, gender and zip codes of all members (diabetic and non-diabetic), includes approximately 70% of Hawai'i's total population based on census estimates.

Diabetes Prevalence

Diabetes Prevalence Trends, BRFSS 1997-2007

All information from the BRFSS is based on self-reports, therefore we are not able to differentiate between type 1 and type 2 diabetes. However, based on research and surveillance on diabetes within the U.S. population, the vast majority of diabetes cases (90% or more) are type 2 diabetes. Between 1997 and 2007, the prevalence of adult diabetes in the state of Hawai'i has steadily increased from 5% to 7.7%.

Figure 1. Trends in U.S. and Hawai'i Adult Diabetes Prevalence (Crude), U.S. and Hawai'i BRFSS 1997-2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
% U.S.	4.8	5.4	5.7	6.2	6.6	6.8	7.2	7.1	7.3	7.5	8.1
% HAWAII	5.0	5.6	5.2	5.2	6.2	5.8	7.6	6.8	7.3	8.2	7.7

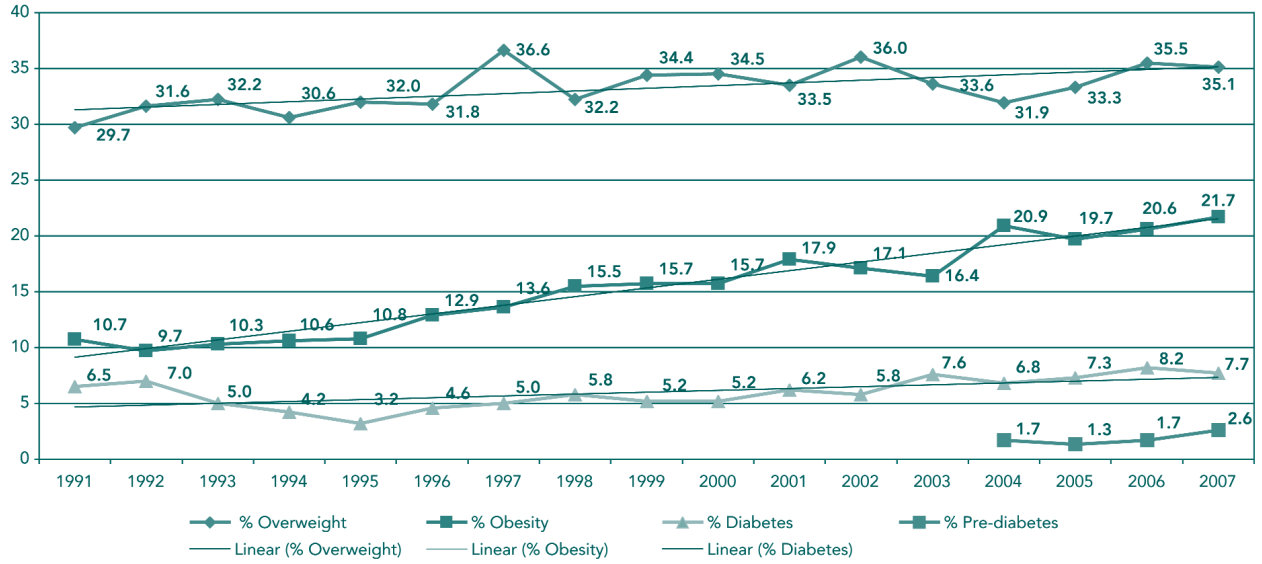
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Adult diabetes prevalence, based on self-reported doctor diagnosed diabetes, has steadily increased between 1997 and 2007 in both Hawai'i and the nation. The trend in Hawai'i nearly matched that of the nation over the 10-year span.

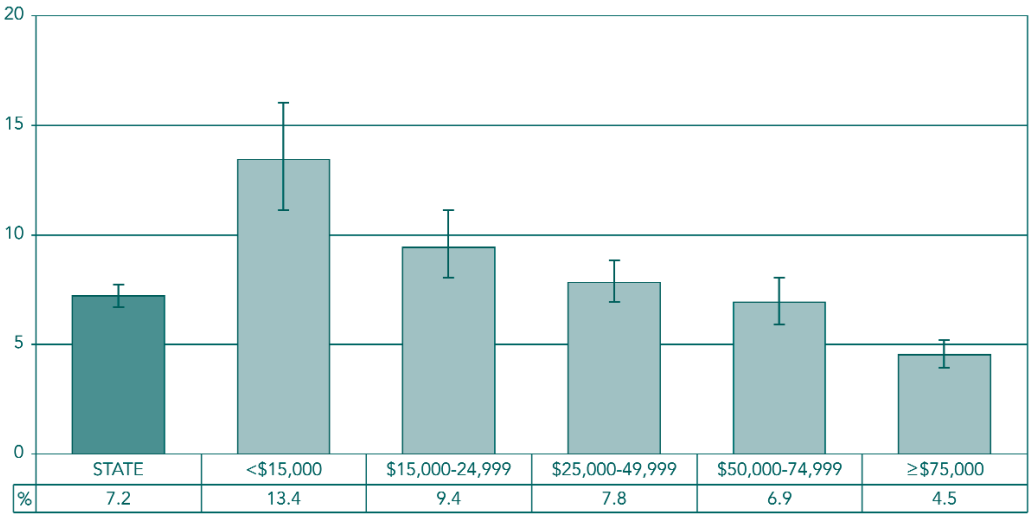
This pattern of increasing prevalence of diabetes coincides with the epidemic of increasing overweight and obesity, seen throughout the United States and globally.

Figure 2. **Trends in Adult Diabetes, Overweight and Obesity Prevalence (Crude) and Linear Trends in Hawai'i, Hawai'i BRFSS 1991-2007.**



NOTE: *A linear trend matches a straight line to historical data and is called a line of best fit or regression line. Linear trend lines show consistent increases or decreases in measures over time.*

Figure 3. Adult Diabetes Prevalence by Annual Household Income, Hawai'i BRFSS 2005-2007*



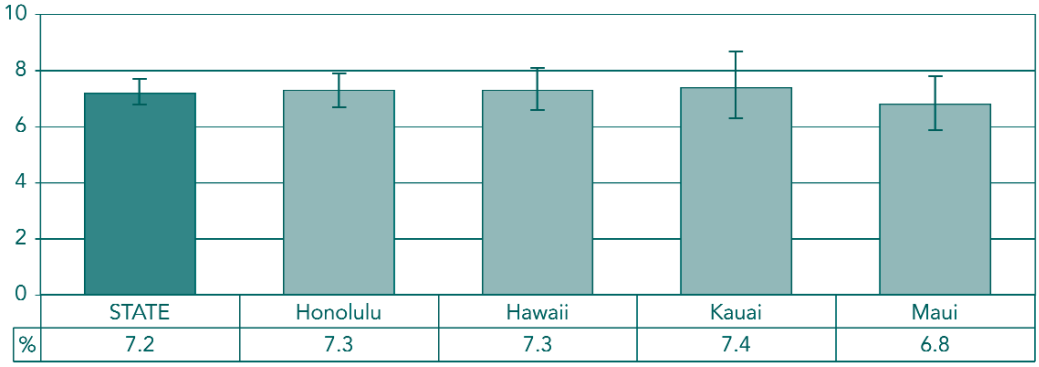
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health
*3-year average adjusted by age to 2000 U.S. Standard

FINDING

Self-reported diagnosed adult diabetes prevalence was significantly higher (p<.05) among those at the lowest income levels who were almost three times more likely to have been diagnosed with diabetes than those at the highest income level.

Adult Diabetes Prevalence by County and Subcounty, Hawai'i BRFSS 2005-2007

Figure 4. Adult Diabetes Prevalence by County, Hawai'i BRFSS 2005-2007*

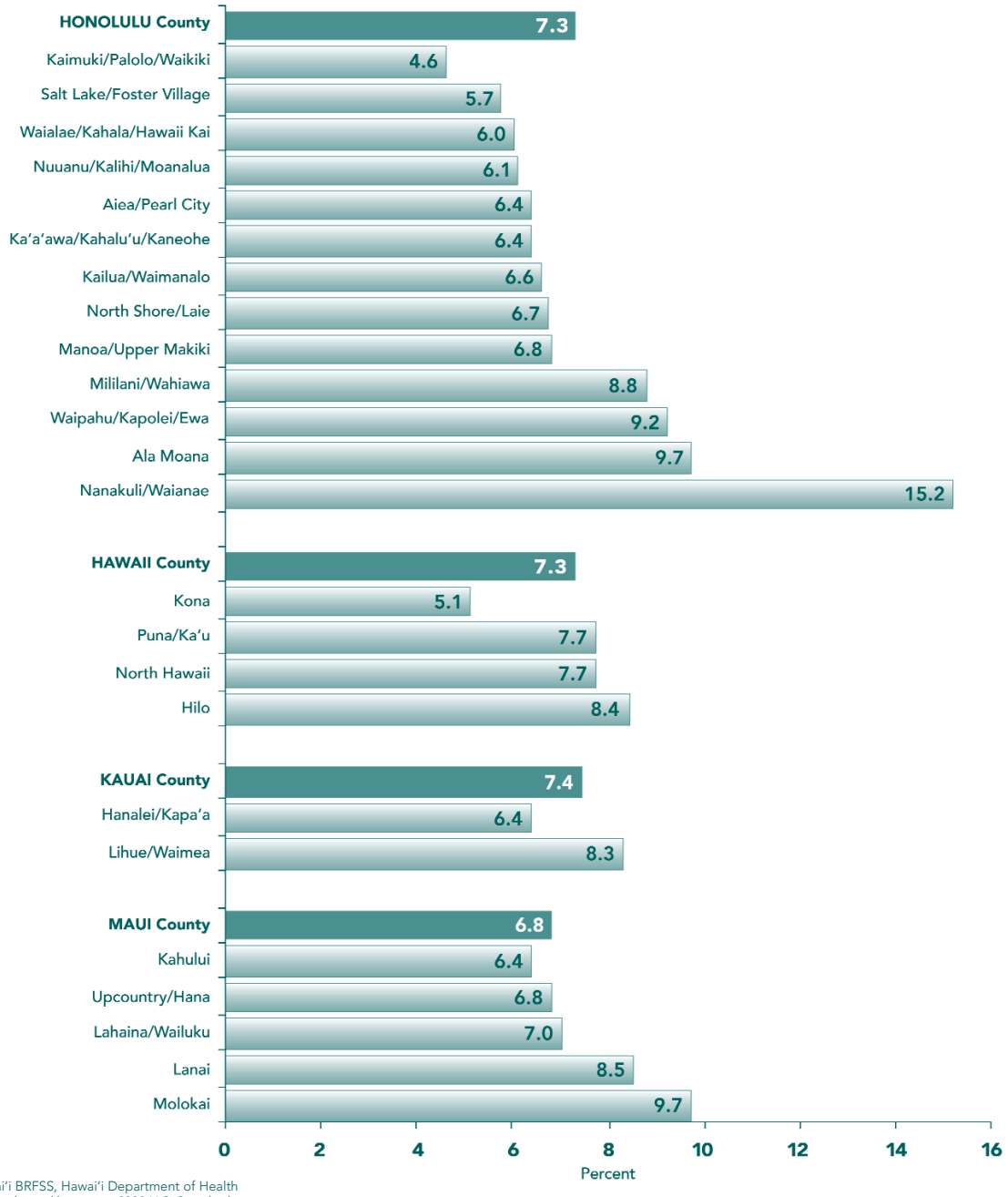


SOURCE: Hawai'i BRFSS, Hawai'i Department of Health
*3-year average adjusted by age to 2000 U.S. Standard

FINDING

The percent of adults with self-reported diagnosed diabetes was 7.2% (3-year average, 2005 – 2007). Diabetes prevalence did not differ significantly by county.

Figure 5. Adult Diabetes Prevalence by Community, Hawai'i BRFSS 2005-2007*



SOURCE: Hawai'i BRFSS, Hawai'i Department of Health
*3-year average adjusted by age to 2000 U.S. Standard

FINDING

Figure 5 presents a community-level breakdown of diabetes prevalence in Hawai'i based on three-year average data from the Hawai'i BRFSS. The highest age-adjusted prevalence of self-reported diabetes is in the Nanakuli/Waianae area (15.2%), followed by the island of Molokai and Ala Moana (both at 9.7%), Waipahu/Kapolei/Ewa (9.2%), Mililani/Wahiawa (8.8%), Lanai (8.5%), Hilo (8.4%) and Lihue-Waimea (8.3%). The lowest reported diabetes prevalence is in Kaimuki/Palolo/Waikiki on Oahu (4.6%).

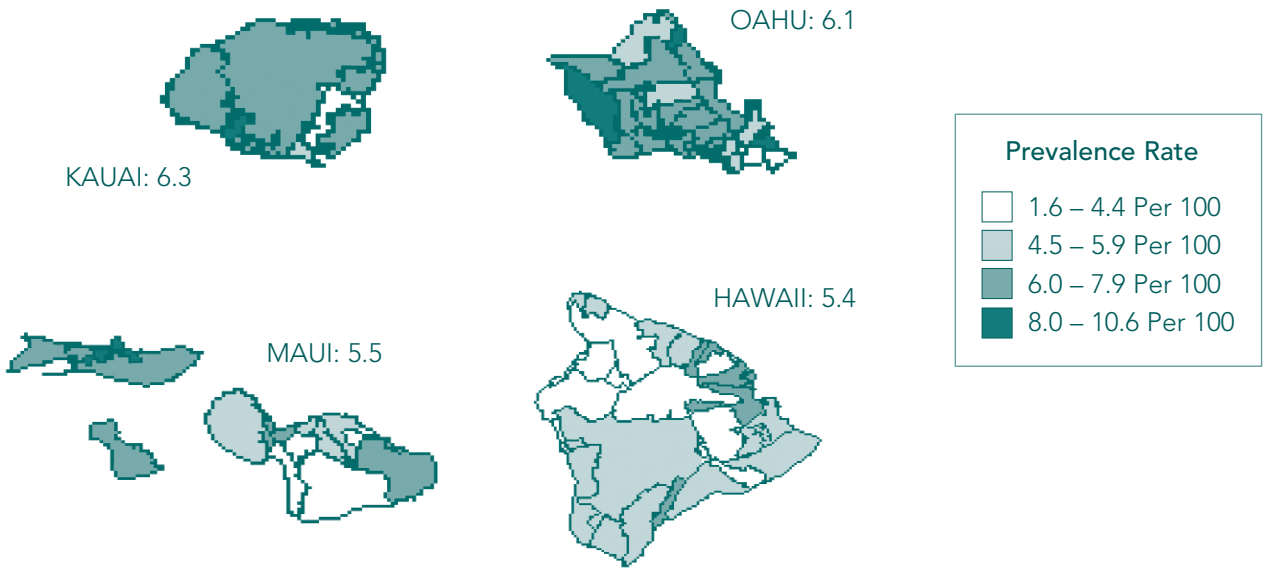
Diabetes Prevalence

Diabetes Prevalence by Claims Data

The prevalence map (Figure 6) is based on data compiled by the Pacific Health Research Institute (PHRI) from the Hawai'i Diabetes Data Network (HDDN), which is comprised of de-identified claims data on adults with diabetes which are obtained from the Hawai'i Medical Service Association (HMSA) and Kaiser Permanente Hawai'i. These data include approximately 70% of Hawai'i's total population based on U.S. census estimates. However, these maps are not directly comparable to the BRFSS data on communities in Figure 5. Although, these two different data sources are not directly comparable, they do show some similar patterns with high rates on Molokai, Lanai, the Hilo area on the Big Island and leeward Oahu.

Figure 6. Diabetes Prevalence by County and Community, HDDN, Hawai'i 2005*

Age Adjusted Diabetes Prevalence Rates - Hawaii State - 2005



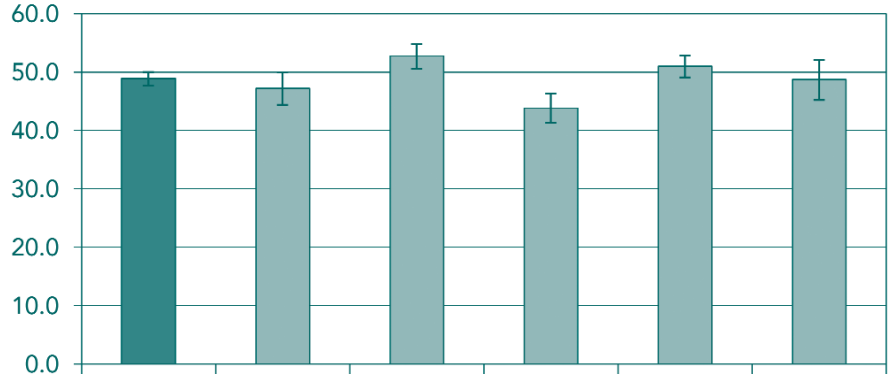
SOURCE: Pacific Health Research Institute, 2005
*Age-adjusted per 100 population by county

FINDING

As can be seen in Figure 6, the Waianae area on Leeward Oahu had high age-adjusted adult diabetes prevalence, as did the island of Niihau (not shown). Kauai also had moderately high rates, as did Lanai and Molokai, the Hilo area on Hawai'i and Hana, Maui.

Adult Diabetes Prevalence by Risk Markers and Risk Factors

Figure 7. **Adult Mean Age When Diagnosed with Diabetes by Ethnicity, Hawai'i BRFSS 2005-2007***



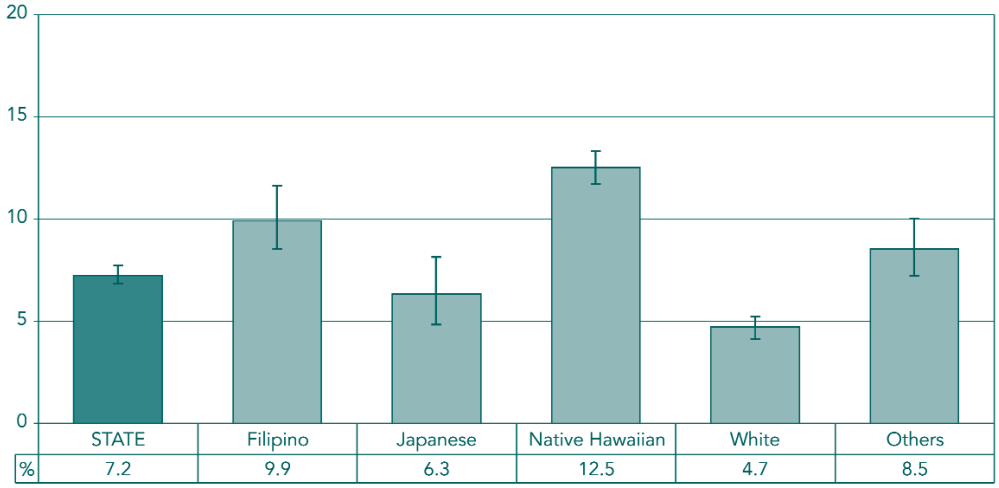
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
Mean age of diagnosis	48.9	47.2	52.7	43.8	51.0	48.7

SOURCE: Hawai'i BRFSS, Hawai'i Department of Health
*3-year average, adjusted by age to 2000 U.S. Standard

FINDING

There are significant differences of mean age of diabetes diagnosis by ethnicity. Native Hawaiians have the youngest mean age of diabetes diagnosis (43.8 years of age) among the major ethnic groups.

Figure 8. **Adult Diabetes Prevalence by Ethnicity, Hawai'i BRFSS 2005-2007***



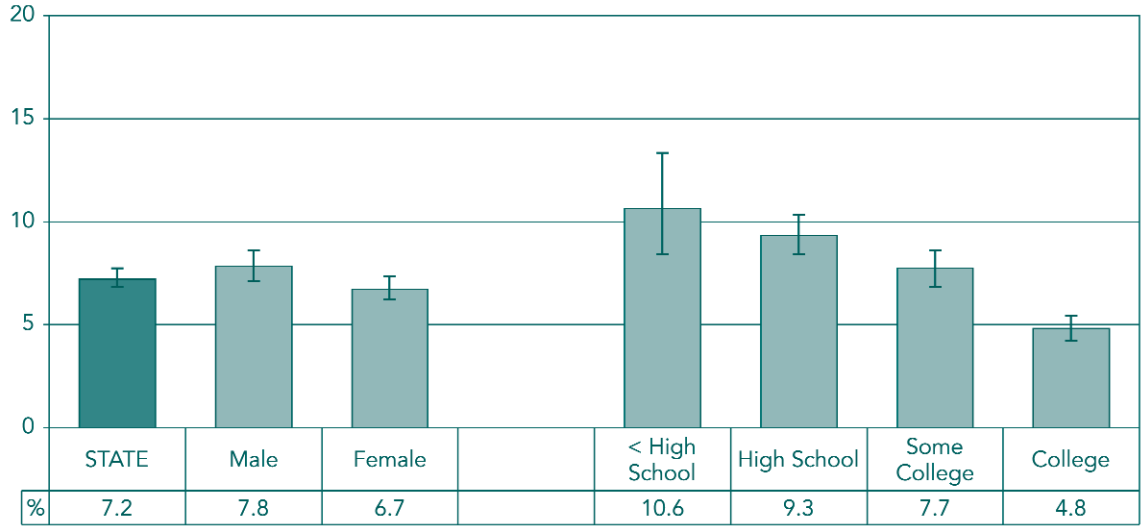
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
%	7.2	9.9	6.3	12.5	4.7	8.5

*3-year average, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Self-reported diagnosed adult diabetes prevalence was significantly ($p<.05$) higher among Native Hawaiians and Filipinos when compared with the other major ethnic groups.

Figure 9. Adult Diabetes Prevalence by Gender and Education, Hawai'i BRFSS 2005-2007*

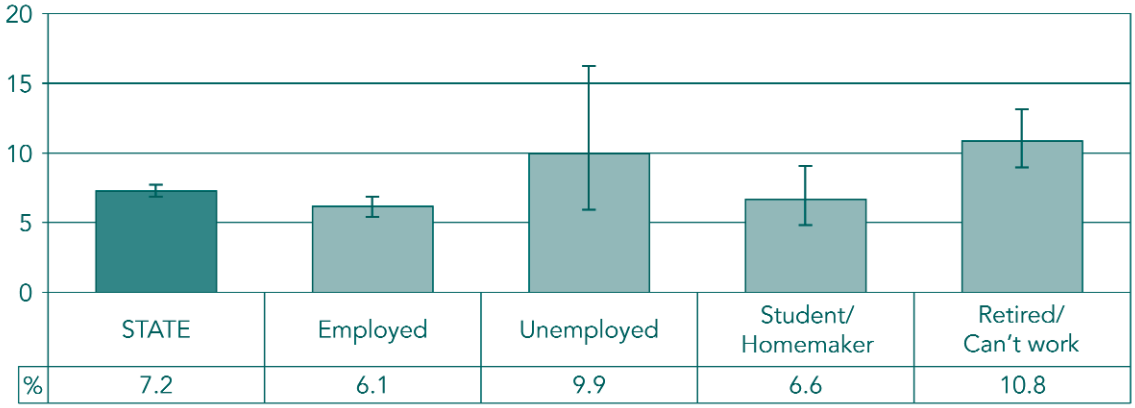


*3-year average, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Self-reported diagnosed adult diabetes prevalence was significantly higher among those with less than a high school education when compared to those with a college education. Diabetes prevalence was also significantly higher among males than females (p<.05).

Figure 10. Adult Diabetes Prevalence by Employment Status, Hawai'i BRFSS 2005-2007*



*3-year average, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

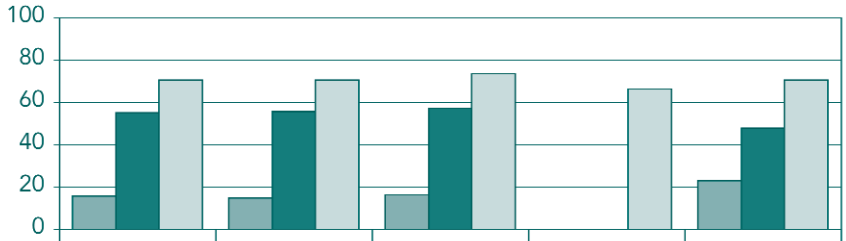
FINDING

Self-reported diagnosed adult diabetes prevalence was significantly higher (p<.05) among those who were retired or could not work when compared to those who were employed.

Diabetes Mortality

Diabetes is a significant cause of death in Hawai'i. On death certificates, diabetes is listed as either an underlying cause of death, or non-underlying cause of death (refer to glossary). The underlying cause of death is the one underlying cause of death on the death certificate. Other conditions that are listed on the death certificate are included as non-underlying causes of death.

Figure 11. **Diabetes Mortality Rates per 100,000 Population by County, Hawai'i OHSM 2004-2006***



	State	Honolulu County	Hawaii County	Kauai County	Maui County
Diabetes as an underlying cause of death per 100,000 population	15.6	14.6	16.1	**	22.6
Diabetes as a non-underlying cause of death per 100,000 population	54.7	55.6	57.1	**	47.6
Diabetes as an underlying and non-underlying cause of death per 100,000 population	70.3	70.2	73.2	66.1	70.2

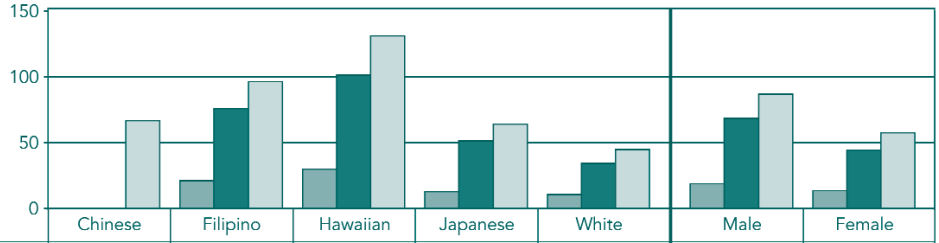
SOURCE: Hawai'i State Department of Health, Office of Health Status Monitoring Includes ICD-10 codes E10-E14
*3-year average, adjusted by age to 2000 U.S. Standard
**Rate does not meet standards of reliability and precision

FINDING

The 3-year average diabetes mortality rate (underlying and non-underlying) in the state between 2004 and 2006 was just over 70/100,000. Maui County had the highest mortality rate for diabetes as an underlying cause of death. Hawai`i County had a slightly higher mortality rate (underlying and non-underlying) than other counties.

Diabetes Mortality

Figure 12. **Diabetes Mortality Rates per 100,000 Population by Ethnicity and Gender, Hawai'i OHSM 2004-2006***



	Chinese	Filipino	Hawaiian	Japanese	White	Male	Female
Diabetes as an underlying cause of death per 100,000 population	**	20.6	29.6	12.4	10.3	18.4	13.3
Diabetes as a non-underlying cause of death per 100,000 population	**	75.4	101.0	51.0	33.9	68.2	43.8
Diabetes as an underlying and non-underlying cause of death per 100,000 population	66.3	96.0	130.6	63.4	44.2	86.6	57.1

SOURCE: Hawai`i State Department of Health, Office of Health Status Monitoring Includes ICD-10 codes E10-E14
*3-year average, adjusted by age to 2000 U.S. Standard
**Rate does not meet standards of reliability and precision

FINDING

Native Hawaiians had the highest diabetes mortality rate (underlying and non-underlying) followed by Filipinos, then Japanese. Males had a higher diabetes mortality rate (underlying and non-underlying) compared to females.

Table 1: **Resident Deaths Where Diabetes Was the Underlying Cause of Death by Average Age at Death, Sex and Ethnicity of Decedent, Hawai'i OHSM, 3-Year Average, 2004-2006**

	Males		Females	
ETHNICITY	Number	Average Age	Number	Average Age
White	76	70.5	54	75.6
Hawaiian/Part-Hawaiian	75	65.8	84	68.1
Chinese	22	78.5	22	81.9
Filipino	53	75.2	41	72.7
Japanese	103	77.1	93	81.6
All Others	27	60.4	29	68.9
TOTAL	356	71.8	323	74.9

SOURCE: Hawai'i State Department of Health, Office of Health Status Monitoring

FINDING

The average age at death where diabetes was the underlying cause of death was much lower for Native Hawaiians and part Native Hawaiians and "All Others" for both males and females. This premature mortality due to diabetes is a definitive health disparity for Native Hawaiians and "All Others", which include other Pacific Islanders.

Figure 13. Three Year Rolling Averages of Adults Who Received Two or More Hemoglobin A1c Tests in the Last Year, Hawai'i BRFSS 2000-2007*

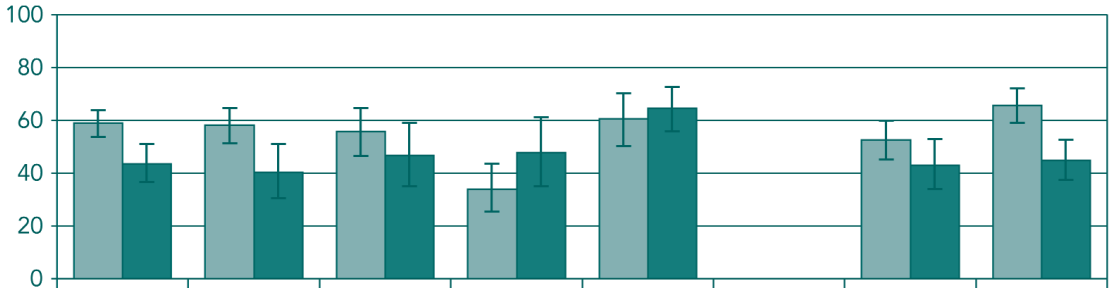
COMBINED YEARS OF	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007
% of having 2+ A1Cs	78.4	83.2	81.7	69.6	62.6	61.8

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Three year rolling averages from 2000-2007 show a significantly decreasing trend in the proportions of adults with diabetes who received two (2) or more A1c tests in the past year from high of 83.2% in 2001-2003 to the current low of 61.8% in 2005-2007.

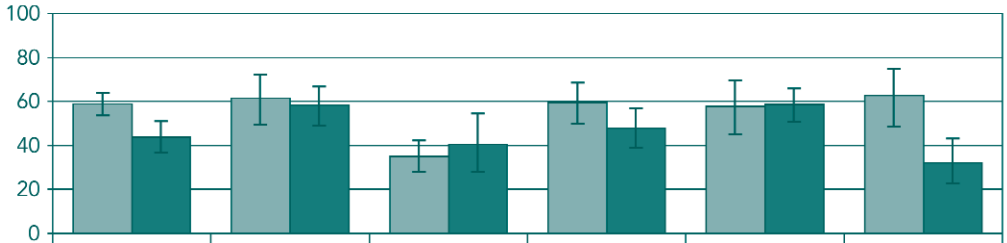
Figure 14. Percentage of Adults with Diabetes Who Have Ever Taken a Diabetes Management Course by County and Gender, Hawai'i BRFSS 2000-2002* and 2005-2007*



	STATE	Honolulu	Hawaii	Kauai	Maui		Male	Female
% 2000-2002	58.6	57.8	55.4	33.5	60.4		52.2	65.4
% 2005-2007	43.3	40.0	46.5	47.6	64.2		42.8	44.5

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

Figure 15. Percentage of Adults with Diabetes Who Have Ever Taken a Diabetes Management Course by Ethnicity, Hawai'i BRFSS 2000-2002* and 2005-2007*



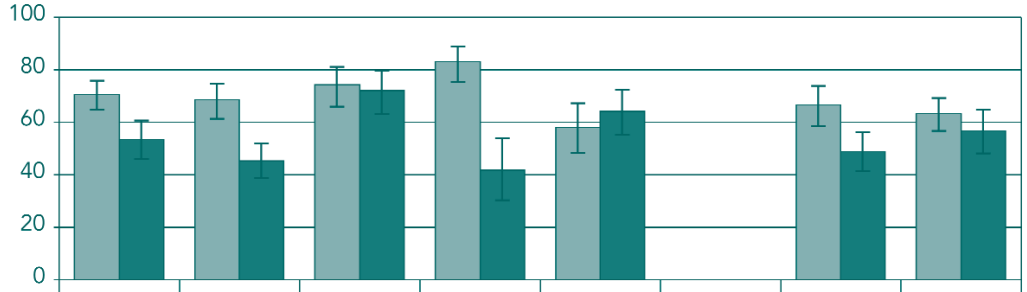
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
% 2000-2002	58.6	61.2	34.6	59.2	57.5	62.4
% 2005-2007	43.3	57.9	40.2	47.5	58.2	31.8

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

The percent of adults with self-reported diagnosed diabetes who reported ever taking a diabetes management course decreased significantly (p<.05) statewide from 58.6% to 43.3% between the 3-year periods of 2000-2002 and 2005-2007. These decreases were significant (p<.05) among the "Others" ethnic group, Honolulu County residents, and females.

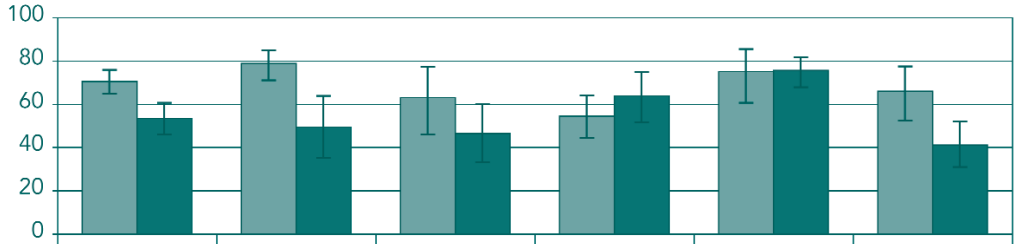
Figure 16. Percentage of Adults with Diabetes Who Check Their Feet Daily by County and Gender, Hawai'i BRFSS 2000-2002* and 2005-2007*



	STATE	Honolulu	Hawaii	Kauai	Maui		Male	Female
% 2000-2002	70.4	68.3	74.1	82.8	57.9		66.4	63.1
% 2005-2007	53.2	45.0	71.9	41.5	64.0		48.6	56.5

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

Figure 17. Percentage of Adults with Diabetes Who Check Their Feet Daily by Ethnicity, Hawai'i BRFSS 2000-2002* and 2005-2007*



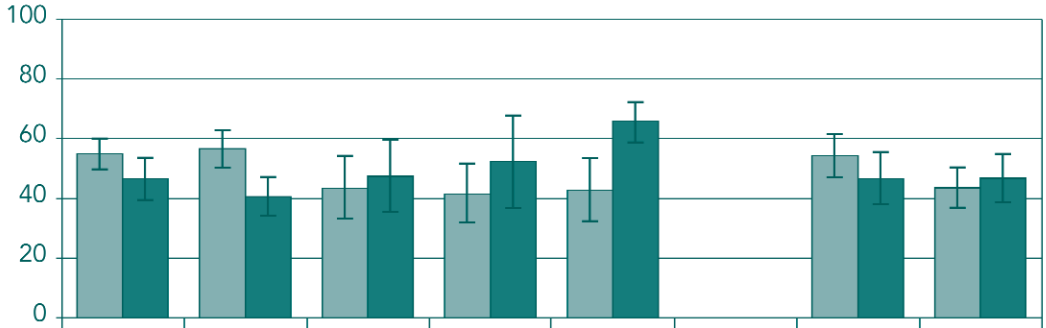
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
% 2000-2002	70.4	78.7	62.8	54.2	74.9	65.9
% 2005-2007	53.2	49.2	46.2	63.7	75.3	40.9

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

There was a significant decrease (p<.05) statewide in the percent of adults with self-reported diagnosed diabetes who reported performing daily foot checks from 70.4% in 2000-2002 to 53.2% 2005-2007. There were also significant decreases in daily foot checks among the "Others" and Filipino ethnic groups, Honolulu and Kauai Counties, and males.

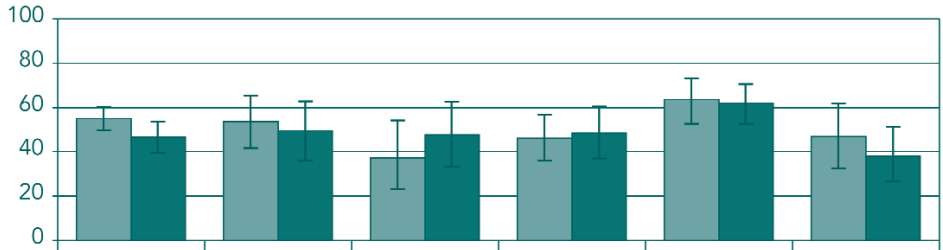
Figure 18. Percentage of Adults with Diabetes Who Check Their Blood Sugar Levels Daily by County and Gender, Hawai'i BRFSS 2000-2002* and 2005-2007*



	STATE	Honolulu	Hawaii	Kauai	Maui		Male	Female
% 2000-2002	54.7	56.4	43.2	41.2	42.4		54.1	43.4
% 2005-2007	46.3	40.3	47.2	52.2	65.6		46.4	46.5

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

Figure 19. Percentage of Adults with Diabetes Who Check Their Blood Sugar Levels Daily by Ethnicity, Hawai'i BRFSS 2000-2002* and 2005-2007*



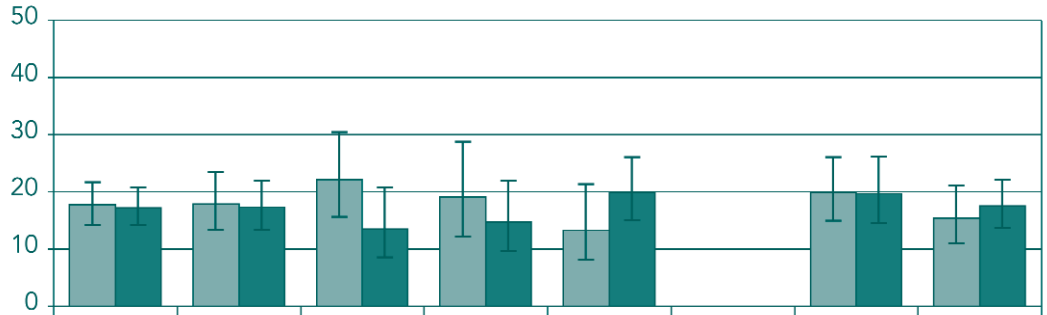
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
% 2000-2002	54.7	53.4	37.1	45.8	63.3	46.6
% 2005-2007	46.3	49.1	47.4	48.3	61.8	37.8

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Overall, there were no statistically significant differences (p<.05) in daily blood sugar checks among adults with self-reported diagnosed diabetes statewide between the 3-year periods of 2000-2002 (54.7%) and 2005-2007 (46.3%). However, adults with diabetes residing in Honolulu County reported a significant decrease (p<.05) in performing daily blood sugar level checks between the two time periods from 56.4% to 40.3%, while adults with diabetes in Maui County reported a significant increase in performing daily blood sugar level checks (from 42.5% to 65.5%).

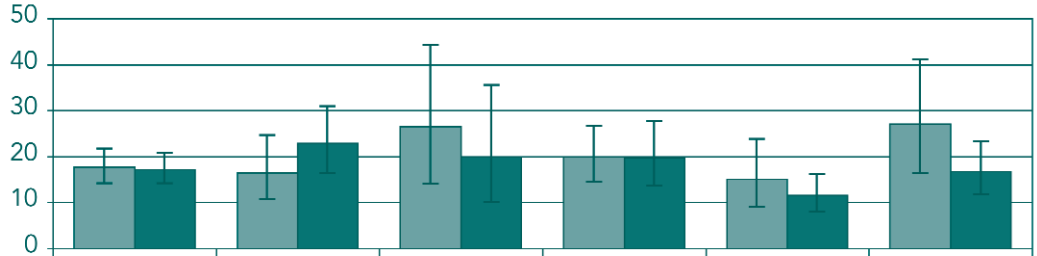
Figure 20. Percentage of Adults with Diabetes Who Report Diabetes Has Affected Their Eyes by County and Gender, Hawai'i BRFSS 2000-2002* and 2005-2007*



	STATE	Honolulu	Hawaii	Kauai	Maui		Male	Female
% 2000-2002	17.6	17.8	22.0	19.0	13.2		19.8	15.3
% 2005-2007	17.1	17.2	13.4	14.6	19.8		19.6	17.4

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

Figure 21. Percentage of Adults with Diabetes Who Report Diabetes Has Affected Their Eyes by Ethnicity, Hawai'i BRFSS 2000-2002* and 2005-2007*



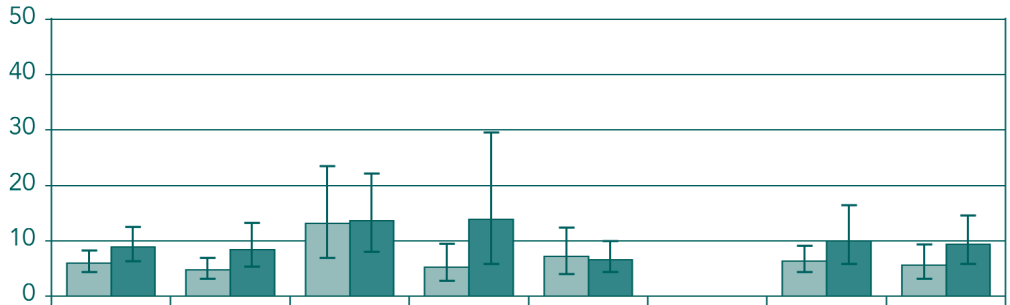
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
% 2000-2002	17.6	16.4	26.4	19.8	14.9	26.9
% 2005-2007	17.1	22.8	19.9	19.6	11.4	16.6

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

There were no significant differences (p<.05) in the percent of adults in Hawai'i with self-reported diagnosed diabetes who reported that diabetes had affected their eyes between the time periods of 2000-2002 (17.6%) and 2005-2007 (17.1%). Similarly, there were no significant differences by county, gender, or ethnicity.

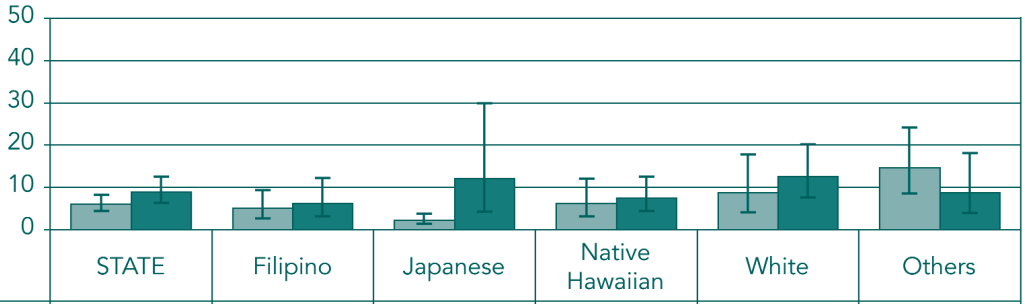
Figure 22. Percentage of Adults with Diabetes with Foot Sores That Took More than Four Weeks to Heal by County and Gender, Hawai'i BRFSS 2000-2002* and 2005-2007*



	STATE	Honolulu	Hawaii	Kauai	Maui		Male	Female
% 2000-2002	5.9	4.6	13.0	5.1	7.0		6.2	5.5
% 2005-2007	8.8	8.3	13.5	13.7	6.5		9.8	9.2

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai`i BRFSS, Hawai`i Department of Health

Figure 23. Percentage of Adults with Diabetes with Foot Sores That Took More than Four Weeks to Heal by Ethnicity, Hawai'i BRFSS 2000-2002* and 2005-2007*



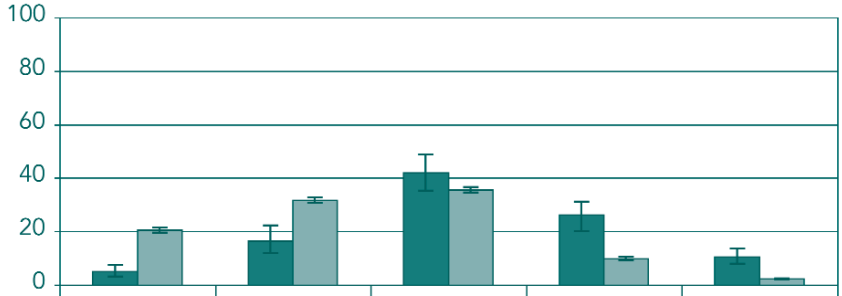
	STATE	Filipino	Japanese	Native Hawaiian	White	Others
% 2000-2002	5.9	4.9	2.1	6.1	8.6	14.5
% 2005-2007	8.8	6.1	12.0	7.4	12.5	8.6

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai`i BRFSS, Hawai`i Department of Health

FINDING

Overall there was no statistically significant difference among those with self-reported diagnosed diabetes who had foot sores that took more than 4 weeks to heal between the 3-year periods of 2000-2002 (5.9%) and 2005-2007 (8.8%). However, there was a significant increase ($p<.05$) in Japanese adults with self-reported diagnosed diabetes who had foot sores that took more than 4 weeks to heal from 2.1% to 12% during these periods. Otherwise, there were no other significant differences by county or gender.

Figure 24. General Health Status of Adults with and without Diabetes, Hawai'i BRFSS 2005-2007*



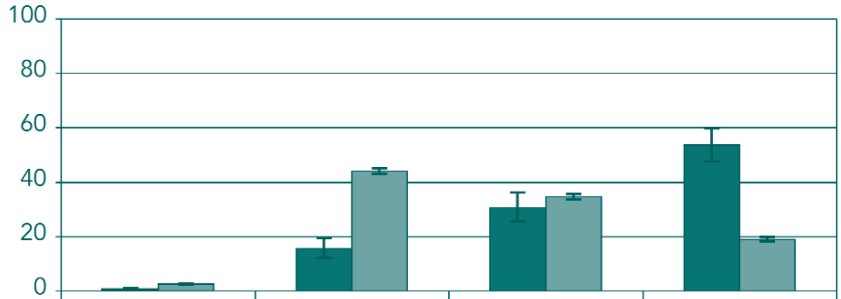
	Excellent	Very Good	Good	Fair	Poor
% adults with diabetes	5.0	16.4	41.8	26.1	10.5
% adults without diabetes	20.5	31.7	35.6	9.8	2.2

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Compared to adults without diabetes, adults with self-reported diagnosed diabetes were significantly (p<.05) less likely to report excellent and very good health status, and were more likely to report fair or poor health status.

Figure 25. Body Weight Status Based on Estimated Body Mass Index (BMI) of Adults with and without Diabetes, Hawai'i BRFSS 2005-2007*



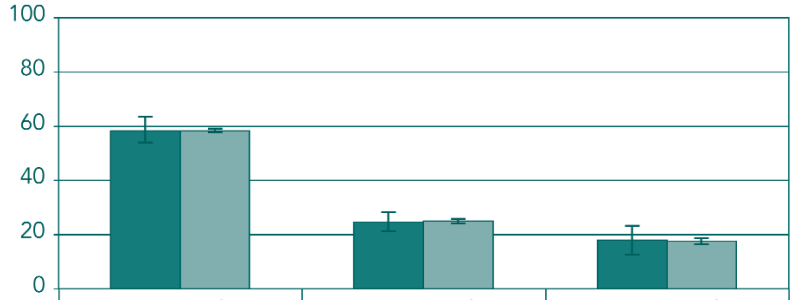
	Underweight	Normal Weight	Overweight	Obese
% adults with diabetes	0.5	15.4	30.5	53.6
% adults without diabetes	2.5	44.0	34.6	18.9

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Adults with self-reported diagnosed diabetes were almost three times as likely to be obese than adults without diabetes, 53.6% compared to 18.9% (p<.05). Obesity is defined as having a BMI > 30 (see glossary).

Figure 26. Smoking Status of Adults with and without Diabetes, Hawai'i BRFSS 2005-2007*



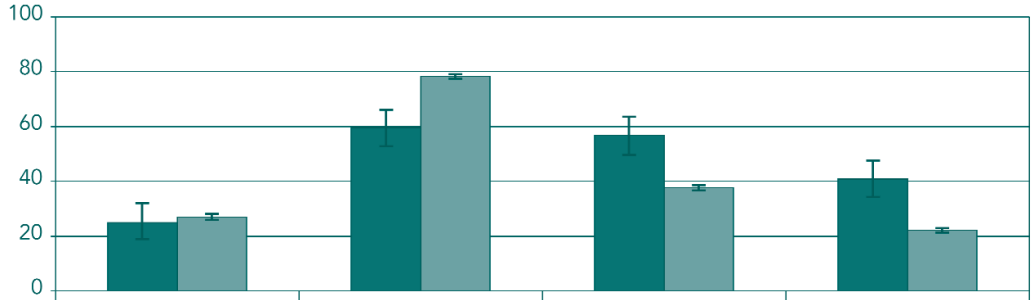
	Never smoker	Former Smoker	Current Smoker
% adults with diabetes	57.9	24.3	17.7
% adults without diabetes	58.0	24.7	17.3

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

There were no significant differences in smoking status between adults with diabetes and adults without diabetes.

Figure 27. Fruit/Vegetable Consumption, Physical Activity and Immunization of Adults with and without Diabetes, Hawai'i BRFSS 2005-2007*



	Ate fruits/vegetables 5+ times/day	Had Leisure Time Physical Activity	Had Flu Shot in Past 12 Months	Had Pneumonia Shot Before
% adults with diabetes	24.8	59.3	56.5	40.7
% adults without diabetes	26.7	78.0	37.4	22.0

*3-year averages, adjusted by age to 2000 U.S. Standard
SOURCE: Hawai'i BRFSS, Hawai'i Department of Health

FINDING

Adults with self-reported diagnosed diabetes reported significantly ($p<.05$) less physical activity than adults without diabetes. However, a significantly higher percent of adults with diabetes reported receiving a flu shot in the past 12 months or pneumonia shot compared to adults without diabetes.

Diabetes Hospitalizations

Hospital discharges with a diabetes diagnosis are a key to understanding the burden of diabetes in Hawai'i.

Table 2. **Hospital Discharges and Charges with a Diagnosis of Diabetes* and Selected Co-morbidities**, HHIC, Hawai'i 2007**

	Ischemic Heart Disease	Stroke	Lower Extremity Amputations	TOTAL DIABETES
Total Discharges	**2,075**	987	478	23,661
Total Charges	$89,084,314	$33,936,892	$36,518,725	**$746,044,091**
Average Length of Stay (ALOS)	5.6	9.4	**22.1**	7.4
Average Charge per Discharge	$21,664.00	$34,383.88	**$38,481.27**	$25,241.71

SOURCE: Hawai'i Health Information Corporation
ANALYSIS: Hawai'i State Department of Health
*Case definition of a hospital discharge among people with diabetes include diabetes as a primary or contributing ICD-9 diagnosis (250.xx)
**Case definition of a co-morbidity include a primary ICD-9 diagnosis of ischemic heart disease (410-414, 429.2), primary ICD-9 diagnosis of stroke (430-434, 436-438), or ICD-9 CM procedure code for lower extremity amputation (84.1), excluding traumatic amputations (ICD-9 CM codes: 895-897) and a contributing ICD-9 diagnosis of diabetes (250.xx)

FINDING

- *Among the three co-morbidities listed, ischemic heart disease was the most common reason for a hospital discharge.*
- *Lower extremity amputations had the highest average length of stay and average charge per discharge.*
- *Total hospital charges with a diagnosis of diabetes exceeded $746 million in 2007.*

Diabetes Hospitalizations

Table 3. **Hospital Discharges with a Diagnosis of Diabetes by Selected Characteristics, HHIC, Hawai'i 2007**

Discharged	Ischemic Heart Disease with Diabetes Diagnosis	%	Stroke with Diabetes Diagnosis	%	Lower Extremity Amputations with Diabetes Diagnosis	%	TOTAL HOSPITAL DISCHARGES WITH DIABETES DIAGNOSIS	%
Males	1,279	**61.6%**	550	**55.7%**	302	**63.2%**	12,446	**52.6%**
Females	796	38.4%	437	44.3%	176	36.8%	11,215	47.4%
Filipino	340	16.4%	163	16.5%	51	10.7%	3,565	15.1%
Japanese	426	**20.5%**	252	**25.5%**	67	14.0%	5,077	**21.5%**
Native Hawaiian	342	16.5%	129	13.1%	115	24.1%	4,150	17.5%
White	396	19.1%	170	17.2%	84	17.6%	4,174	17.6%
Other	398	19.2%	221	22.4%	127	**26.6%**	4,987	21.1%
Unknown/ Not Applicable	173	8.4%	52	5.2%	34	7.1%	1,718	7.3%
Honolulu County	1,722	**83.0%**	774	**78.4%**	387	**81.0%**	18,339	**77.5%**
Hawai'i County	199	9.6%	92	9.3%	53	11.1%	2,329	9.8%
Kauai County	34	1.6%	32	3.2%	12	2.5%	1,081	4.6%
Maui County	120	5.8%	89	9.0%	26	5.4%	1,912	8.1%
TOTAL	2,075	100%	987	100%	478	100%	23,661	100%

SOURCE: Hawai'i Health Information Corporation
ANALYSIS: Hawai'i Department of Health
*Case definition of a hospital discharge among people with diabetes include diabetes as a primary or contributing ICD-9 diagnosis (250.xx)
**Case definition of a co-morbidity include a primary ICD-9 diagnosis of ischemic heart disease (410-414, 429.2), primary ICD-9 diagnosis of stroke (430-434, 436-438), or ICD-9 CM procedure code for lower extremity amputation (84.1), excluding traumatic amputations (ICD-9 CM codes: 895-897) and a contributing ICD-9 diagnosis of diabetes (250.xx)

FINDING

Of the hospital discharges with a diagnosis of diabetes that occurred in 2007, a higher percentage occurred among men. Among the hospital discharges for ischemic heart disease, stroke, and total diabetes counts, a higher percentage occurred among Japanese. Among those with lower extremity amputations, a higher percentage occurred among those of "Other" ethnicity. The majority of hospital discharges with a diagnosis of diabetes occurred in Honolulu County.

Table 4. **Hospital Discharges with a Diagnosis of Diabetes and Average Length of Stay (ALOS) by Payer, HHIC, Hawai'i 2007**

	Ischemic Heart Disease with Diabetes Diagnosis		Stroke with Diabetes Diagnosis		Lower Extremity Amputations with Diabetes Diagnosis		TOTAL DISCHARGES WITH DIABETES DIAGNOSIS	
Payer	Discharges	ALOS	Discharges	ALOS	Discharges	ALOS	Discharges	ALOS
Department of Defense	120	5.6	32	24.2	24	16.8	1,380	7.3
Medicaid/Quest	188	6.7	85	9.6	91	22.9	2,714	8.3
Medicare	**1,144**	6.4	**600**	8.8	**275**	22.3	**13,421**	8.1
Private Insurance	584	3.8	252	9.4	77	21.9	5,600	5.9
Self Pay	**	**	**	**	**	**	414	6.1
Others	**	**	**	**	**	**	132	8.4
TOTAL	2,075	5.6	987	9.4	478	22.0	23,661	7.5

SOURCE: Hawai'i Health Information Corporation
ANALYSIS: Hawai'i Department of Health
**Data do not meet the criteria for statistical reliability, data quality, or confidentiality

FINDING

The majority of hospital discharges with a diagnosis of diabetes were paid by Medicare. Lower extremity amputations with a diabetes diagnosis resulted in the longest Average Length of Stay for Medicaid, Medicare, and private insurance providers.

Table 5. **Mean Age at Hospital Discharge with a Diagnosis of Diabetes by Ethnicity, HHIC, Hawai'i 2007**

Discharged	Ischemic Heart Disease with Diabetes Diagnosis	Stroke with Diabetes Diagnosis	Lower Extremity Amputations with Diabetes Diagnosis	TOTAL HOSPITAL DISCHARGES WITH DIABETES DIAGNOSIS
Filipino	67.1	69.8	67.8	66.5
Japanese	71.2	73.7	70.1	73.0
Native Hawaiian	**63.1**	**63.3**	**59.7**	**59.6**
White	67.1	70.3	66.6	65.6
Other	64.8	67.3	61.1	62.4
Unknown/Not Applicable	66.0	68.2	67.7	63.0

SOURCE: Hawai'i Health Information Corporation
ANALYSIS: Hawai'i Department of Health
NOTE: Case definitions include diabetes primary or contributing ICD-9 diagnosis (250.xx) along with a primary ICD-9 diagnosis of ischemic heart disease (410-414, 429.2), primary ICD-9 diagnosis of stroke (430-434, 436-438), or ICD-9 CM procedure code for lower extremity amputation (84.1), excluding traumatic amputations (ICD-9 CM codes: 895-897)

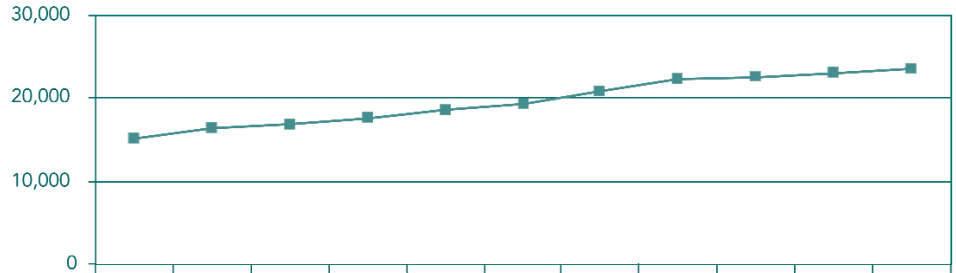
FINDING

In 2007, Native Hawaiians had the youngest average age at hospital discharge for diabetes-related conditions compared to other major ethnic groups.

Diabetes Hospitalizations

Hospital discharges with a diagnosis of diabetes have been increasing, as have charges per discharge (costs).

Figure 28. **Total Hospital Discharges with a Diagnosis of Diabetes, HHIC, Hawai'i 1997-2007**



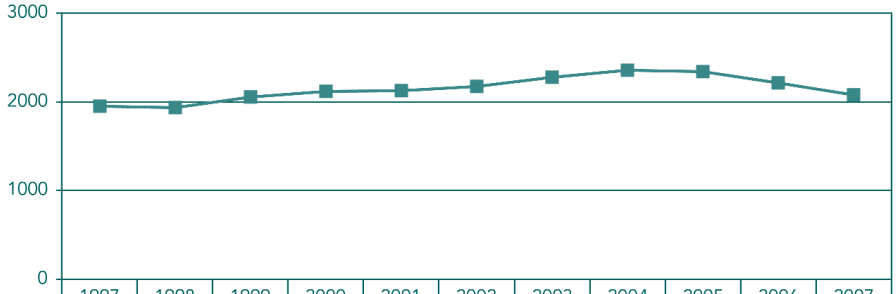
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hospitalizations with a diabetes diagnosis	15,247	16,261	16,769	17,574	18,636	19,278	20,861	22,230	22,660	23,177	23,661

SOURCE: Hawai`i Health Information Corporation

FINDING

Hospital discharges with a diabetes diagnosis have steadily increased since 1997, and reached the highest point in 2007.

Figure 29. **Hospital Discharges for Ischemic Heart Disease with a Diagnosis of Diabetes, HHIC, Hawai'i 1997-2007**



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Number of ischemic heart disease hospitalizations: with a diabetes diagnosis	1946	1932	2056	2117	2124	2174	2276	2358	2337	2211	2075

SOURCE: Hawai`i Health Information Corporation

FINDING

The number of hospitalizations for ischemic heart disease with a diabetes diagnosis has increased overall since 1997. However, the actual number of hospitalizations has decreased each year since 2004.

Figure 30. Hospital Discharges for Stroke with a Diagnosis of Diabetes, HHIC, Hawai'i 1997-2007

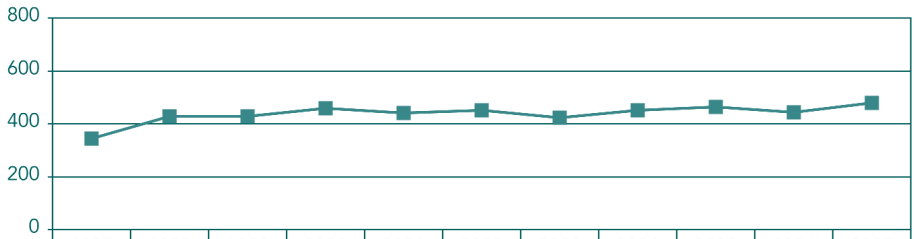
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Number of stroke hospitalizations with a diabetes diagnosis	932	969	1012	1010	909	944	937	918	909	894	987

SOURCE: Hawai'i Health Information Corporation

FINDING

The number of stroke hospitalizations with a diabetes diagnosis from 1997 to 2007 has remained relatively unchanged.

Figure 31. Hospital Discharges, Non-traumatic Lower Extremity Amputation with a Diagnosis of Diabetes, HHIC, Hawai'i 1997-2007



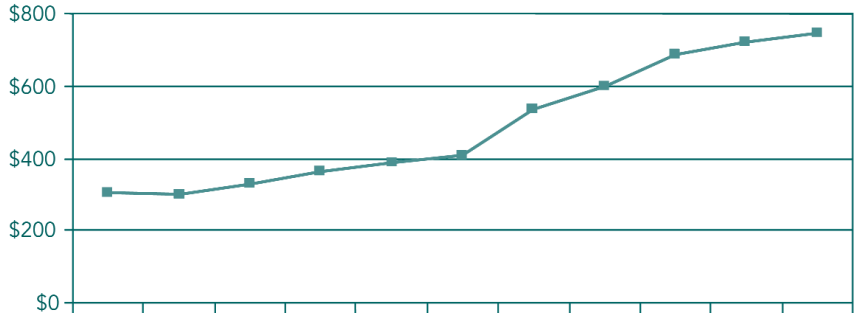
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Number of non-traumatic LEA hospitalizations with a diabetes diagnosis	343	429	428	459	441	451	422	451	464	443	478

SOURCE: Hawai'i Health Information Corporation

FINDING

The number of lower extremity amputations (LEA) discharges among people with diabetes has increased overall since 1997 to its highest point in 2007.

Figure 32. Total Hospital Charges (in Millions) with a Diagnosis of Diabetes, HHIC, Hawai'i 1997-2007



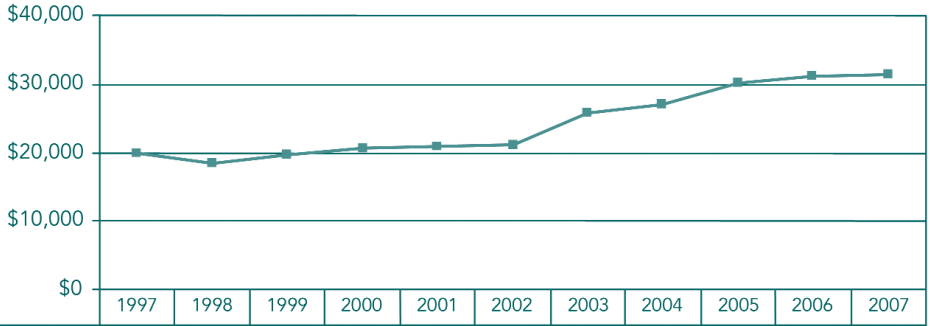
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total Charges: Hospitalizations in millions with a diabetes diagnosis	$302.8	$301.2	$329.1	$364.0	$388.3	$406.0	$535.8	$598.7	$686.3	$722.6	$746.0

SOURCE: Hawai`i Health Information Corporation

FINDING

Hospital charges with a diabetes diagnosis have been increasing since 1997 to its highest point in 2007 of $746 million.

Figure 33. Average Charge per Hospital Discharge with a Diagnosis of Diabetes, Hawai'i HHIC 1997-2007



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Average charge per discharge with a diabetes diagnosis	$19,858	$18,525	$19,625	$20,711	$20,838	$21,062	$25,685	$26,930	$30,286	$31,178	$31,530

SOURCE: Hawai`i Health Information Corporation

FINDING

The average hospital charge per discharge with a diabetes diagnosis has steadily increased over the past 10 years to its highest point in 2007.

Emergency Department Visits
Among People with Diabetes

Emergency department (ED) visits with a diabetes diagnosis are another set of indicators of the burden of diabetes in Hawai'i.

Table 6. **Emergency Department Visits with a Diagnosis of Diabetes by Selected Characteristics*, HHIC, Hawai'i 2007**

	Total Visits to the ED Among People with Diabetes	%
Males	11,265	48.6%
Females	11,922	**51.4%**
Filipino	3,678	15.9%
Japanese	4,118	17.8%
Native Hawaiian	4,207	18.1%
White	4,524	19.5%
Other	6,037	**26.0%**
Unknown/Not Applicable	623	2.7%
Honolulu County	16,982	**73.2%**
Hawai'i County	2,672	11.5%
Kauai County	1,470	6.3%
Maui County	2,063	8.9%
Department of Defense	401	1.7%
Medicaid/Quest	3,965	17.1%
Medicare	10,144	**43.7%**
Private Insurance	7,097	30.6%
Self Pay	841	3.6%
Others	739	3.2%
TOTAL	23,187	100%

SOURCE: Hawai'i Health Information Corporation
ANALYSIS: Hawai'i Department of Health
*Excludes inpatient admissions. Case definition of an emergency department discharge among people with diabetes include diabetes as a primary or contributing ICD-9 diagnosis (250xx)

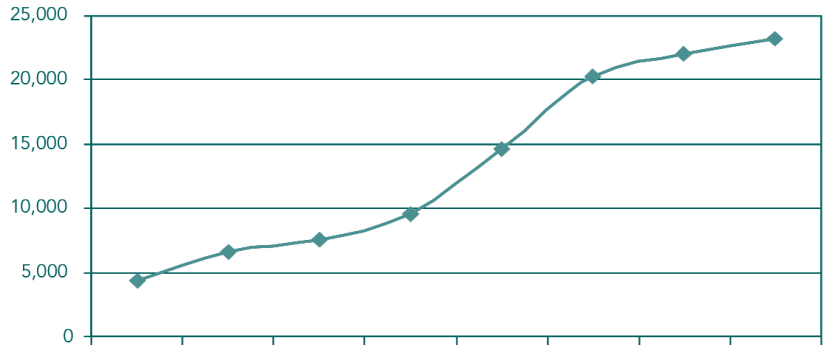
FINDING

- *There were more than 23,000 emergency department visits with a diabetes diagnosis in Hawai`i in 2007.*
- *More women than men with a diabetes diagnosis visited the emergency department.*
- *Those listed in the "Other" ethnic category with a diabetes diagnosis also visited the emergency department more than the other major ethnic groups.*
- *The majority of emergency department visits with a diabetes diagnosis were paid by Medicare.*
- *The majority of emergency department visits with a diabetes diagnosis occurred in Honolulu County.*

Emergency Department Visits
Among People with Diabetes

Emergency department (ED) visits with a diabetes diagnosis have been increasing, as have charges (costs).

Figure 34. Total Emergency Department Visits with a Diagnosis of Diabetes, HHIC, Hawai'i 2000-2007



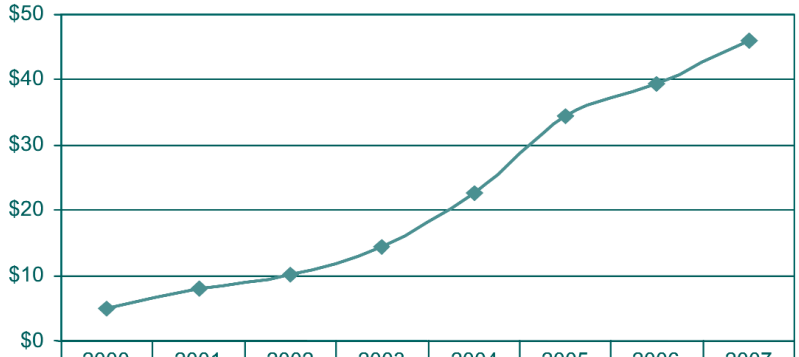
	2000	2001	2002	2003	2004	2005	2006	2007
Number of ED visits: with a diabetes diagnosis	4,395	6,546	7,573	9,574	14,574	20,336	22,094	23,187

SOURCE: Hawai'i Health Information Corporation

FINDING

The number of emergency department visits with a diabetes diagnosis increased more than five times between 2000 and 2007.

Figure 35. Emergency Department Charges (in Millions) with a Diagnosis of Diabetes, HHIC, Hawai'i 2000-2007



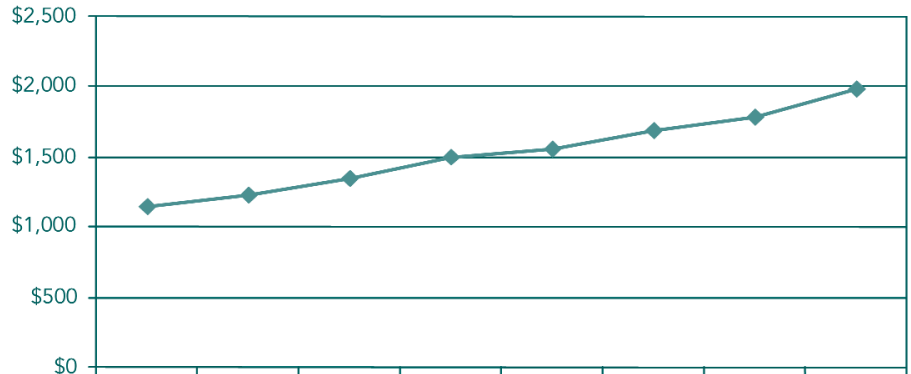
	2000	2001	2002	2003	2004	2005	2006	2007
ED charges in millions: with a diabetes diagnosis	$5	$8	$10	$14	$23	$34	$39	$46

SOURCE: Hawai'i Health Information Corporation

FINDING

Emergency department charges with a diabetes diagnosis increased each year since 2000. Between 2000 and 2007, emergency department charges with a diabetes diagnosis increased nearly ten times.

Figure 36. Average Charge per Emergency Department Visit with a Diagnosis of Diabetes, HHIC, Hawai'i 2000-2007



	2000	2001	2002	2003	2004	2005	2006	2007
Average Charge per Emergency Department Visit	$1,147	$1,224	$1,348	$1,494	$1,555	$1,689	$1,783	$1,984

SOURCE: Hawai'i Health Information Corporation

FINDING

The average charge per emergency department visit with a diabetes diagnosis has steadily increased each year between 2000 and 2007.

The data on the diabetes hospital discharges from 1997-2007 show an incremental rise in hospital discharges with a diagnosis of diabetes, and persistent hospital discharges for diabetes co-morbidities and complications, while at the same time the charges (costs) have more than doubled.

The data on the emergency department visits is even more stark from 2000-2007, with total emergency department visits with a diagnosis of diabetes having increased more than five times, while at the same time, the charges (costs) have increased nearly ten times.

Glossary

Cause of Death

For the purpose of national mortality statistics, every death is attributed to one underlying condition, based on information reported on the death certificate and using the international rules for selecting the underlying cause of death from the conditions stated on the death certificate. The underlying cause is defined by the World Health Organization (WHO) as the disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence, which produced the fatal injury. Generally more medical information is reported on death certificates than is directly reflected in the underlying cause of death. The conditions that are not selected as underlying cause of death constitute the non-underlying cause of death, also known as multiple cause of death.

Diabetes

Adult respondents are asked, "Have you ever been told by a doctor that you have diabetes?" If the respondent is a female and her answer to that question is "Yes", then she is further asked, "Was this only when you were pregnant?" Gestational diabetes is excluded from diabetes in this report.

Diabetes Prevalence and Mortality

Prevalence rate:

The number of persons with a self-reported disease or condition at a specific point in time divided by the total number of persons in the population at that same point in time. All percentages or prevalence rates presented in all the tables are age-adjusted percentages and are based on self-reported diagnosed diabetes. Prevalence is presented as the percent of adults with a disease or condition (e.g., diabetes, high blood pressure) within a given year.

Age-adjusted prevalence and mortality rates:

It is often necessary to compare diabetes rates of different populations and, or years. However, since diabetes rates increase with age, a higher diabetes rate in one population compared with another may simply reflect differing age distributions within the populations. Statistical techniques are used to adjust or standardize the rates in the populations to be compared, eliminating the effect of different age distributions in the different populations. Prevalence rates computed with these techniques are called age-adjusted or age-standardized prevalence rates. An age-adjusted prevalence rate is not a real measure of condition within a given population, but rather an artificial measure that is used for comparison purposes. In this report, prevalence rates with age adjustment employed the age distribution #9 of the Year 2000 Projected U.S. Population (DHHS/CDC/NCHS, 2001). In this report, mortality and prevalence rates are adjusted using the direct method to the 2000 U.S. standard population. Data comparisons should be limited to data adjusted to the same standard population. Rates that are not age-adjusted are considered crude.

Diabetes mortality rate:

The mortality rate is the frequency of occurrence of death (diabetes-related) in a defined

population. Population estimates by county are from the National Center for Health Statistics. Population estimates by ethnicity are from the Hawai'i Health Survey.

Non-underlying cause of death (NCD):
Non-underlying cause of death is defined as conditions that did not initiate the train of events leading to death, but resulted in death directly or indirectly; or any other significant conditions that unfavorably influenced the course of the morbid process and thus contributed to the fatal outcome. The non underlying cause of death can be up to 20 different conditions contributing to death. For diabetes as non underlying cause, "diabetes" would appear on the death certificate but not as underlying.

Underlying cause of death (UCD):
Underlying cause of death is defined as the disease or condition that initiated the train of events leading to death.

Ethnicity

In the Behavioral Risk Factor Surveillance System (BRFSS), respondents are asked to choose up to six ethnicities from the ethnicity list following the question: "Which one or more of the following would you say is your ethnicity?" This question is followed up by another question when more than one ethnicity is mentioned. "Which one of these groups would you say best represents your ethnicity?" The ethnicity list includes White, Hawaiian, Chinese, Filipino, Japanese, Korean, Samoan, Black, American Indian/Alaska Native/Eskimo/Inuit, Vietnamese, Asian Indian, Portuguese, Guamanian/Chamorro, Puerto Rican, Mexican, Tongan, Laotian, Cambodian, Malaysian, Fijian, Micronesian and other Asian. In addition, a respondent can specify their own ethnicity if it is not listed, or they can say don't know, not sure, or refuse to answer. For simplicity, this document re-categorizes ethnicity into White (includes Portuguese), Hawaiian, Filipino, Japanese and "Others" (includes Chinese).

International Classification of Diseases (ICD)

An international standard used to classify diseases and other health problems recorded on many types of health and vital records including death certificates and hospital records. In addition to enabling the storage and retrieval of diagnostic information for clinical and epidemiological purposes, these records also provide the basis for the compilation of national mortality and morbidity statistics. This report presents hospital discharge data using the ICD, Version 9 (ICD-9), as well as mortality data using the ICD, Version 10 (ICD-10).

Survey (BRFSS) Definitions

Bodyweight status:
The BRFSS uses Body Mass Index (BMI) as a measure of bodyweight. BMI is a measure of body fat based on height and weight that applies to both adult men and women. Cutoffs for weight status are defined as follows: underweight (BMI< 18.5), normal weight (BMI >18.5 and < 25), overweight (BMI > 25 and < 30), and obese (BMI > 30).

Diabetes management education:
The BRFSS uses the following question to define diabetes management education: "Have you ever taken a course or class in how to manage your diabetes yourself?"

Diabetes-related eye conditions:
The BRFSS uses the following question to define diabetes-related eye complications: "Has a doctor ever told you that diabetes has affected your eyes?"

Diabetes-related foot complications:
The BRFSS uses the following question to define foot complications related to diabetes: "Have you ever had any sores or irritations on your feet that took more than four weeks to heal?"

General health status:
The BRFSS uses the following question to define and quantify general health status: "Would you say that in general your health is: 1) Excellent, 2) Very Good, 3) Good, 4) Fair, or 5) Poor?"

Linear trend:
A linear trend matches a straight line to historical data and is called a line of best fit or regression line. Linear trend lines show consistent increases or decreases in measures over time.

Physical activity (leisure time activity):
The BRFSS defines "no leisure time activity" as those responding no to the question, "During the past month, other than your regular job, did you participate in any physical activities or exercise such as running, calisthenics, golf, gardening, or walking for exercise?"

Smoking status:
The BRFSS defines a "current smoker" as a person who responds yes to the question "Have you smoked at least 100 cigarettes in your life time," and still smokes everyday or some days. A "former smoker" is a person who smoked a least 100 cigarettes before, but does not smoke anymore.

Vegetable/fruit consumption:
The BRFSS estimates the number of daily servings of fruit/vegetable by asking the following series of questions "Not counting juice, how often do you eat fruit? How often do you eat green vegetables? How often do you eat potatoes not including French fries, fried potatoes, or potato chips? How often do you eat carrots? Not counting carrots, potatoes, or salad, how many serving of vegetables do you usually eat?"

Statistical Significance
Confidence intervals have been provided in the BRFSS section of this report as an efficient way to look for differences among subgroups on important health issues, and serves as an important tool when it comes to looking for patterns in BRFSS reports. A confidence interval is a range that contains the true population prevalence estimate with a certain degree of assurance when repeated sampling of the population is performed. The degree of assurance commonly used is 95%. For example, if we set our confidence interval at 95%, then we can expect that 5 out of 100 times the estimates coming from our samples will fall outside the range that contains the true population value. However, 95% of the time our estimates will fall within the correct range. This is known as a 95% confidence interval. Confidence intervals are used to assess if there are

differences in prevalence among defined subgroups. It is a quick and simple way to determine if such differences are potentially significant (statistically). When confidence intervals overlap, but the numbers are close together, a significance test is done in addition to examining the confidence intervals (see below).

P-value

A p-value represents the probability that the observed result from a sample is due to chance alone (occurred at random). A p-value less than 0.05 is considered statistically significant. This means that the observed differences between two values have less than a 5% probability of occurring by chance, assuming that the two values should not be different at all. In this report, statements of statistical significance are followed by $p<.05$ to denote the p-value. This is done when confidence intervals overlap but the numbers may be close and a statistical test (usually a t-test) is needed to determine significance.

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