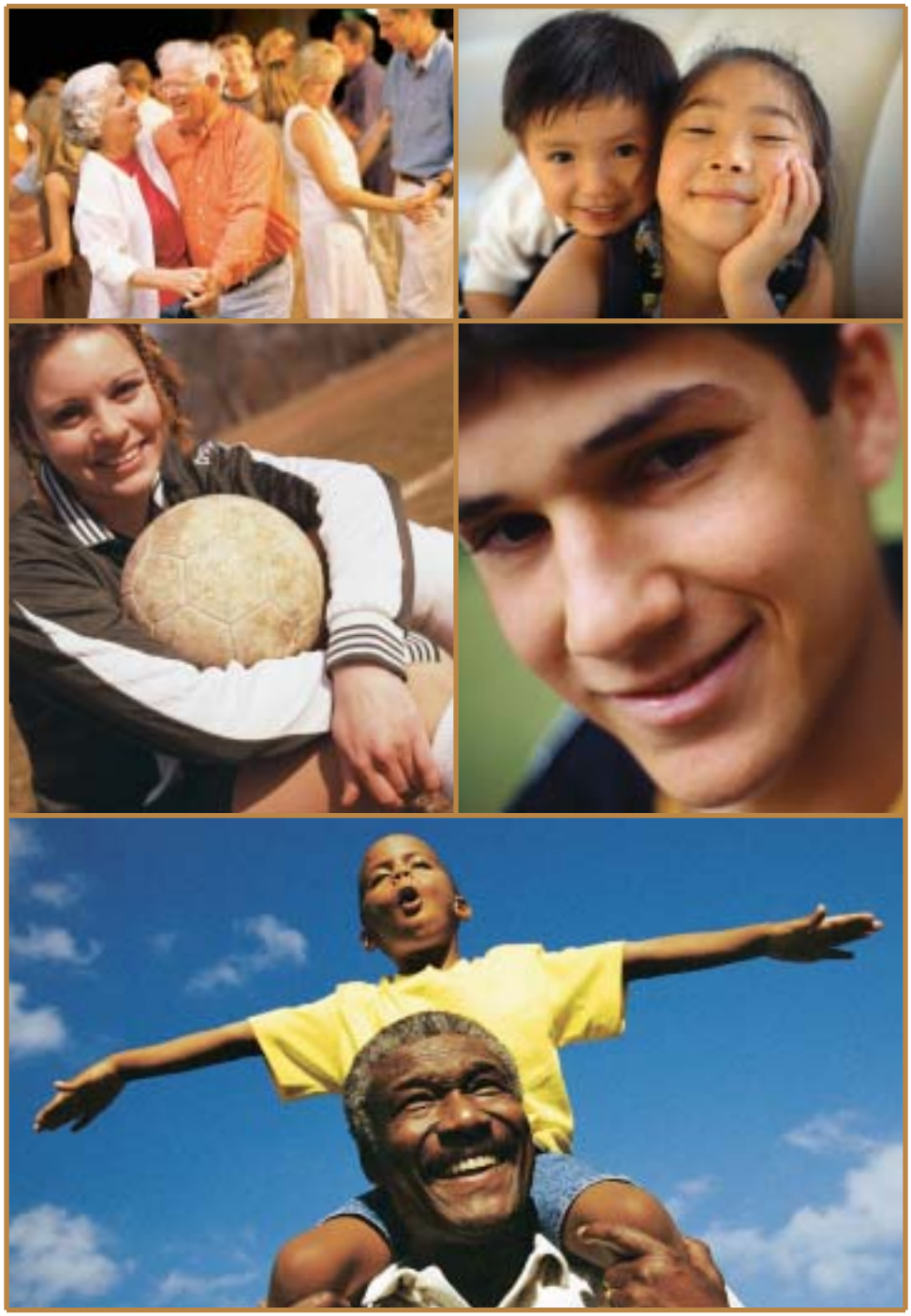
Diabetes in Arizona

Status Report

NOVEMBER 2005



A report from the Arizona Diabetes Prevention and Control Program
Office of Chronic Disease Prevention and Nutrition Services
Public Health Prevention Services

Arizona Department of Health Services

DIABETES IN ARIZONA: 2005 STATUS REPORT

by

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"In the 21st century, the government cannot take on this health care burden alone; diabetes will not receive the concerted effort it deserves without action from both public and private sectors."

- Wanda K. Jones, DrPH
Deputy Assistant Secretary for Health
United States Department of Health and Human Services

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EXECUTIVE SUMMARY

Diabetes will place an immense burden on Arizona's various health care delivery systems in the next decade. Currently, approximately 284,102 Arizonans or 6.6 percent of the adult population have been diagnosed with diabetes. In 2004, there were more than 91,000 hospitalizations of persons with diabetes, with hospital charges amounting to more than $2.5 billion. Hospitalization rates are rising, and the average hospital stay for a person with diabetes now costs more than $26,000.[1]

If the diabetes prevalence rate remains steady, by the year 2020 it is estimated there will be approximately 485,000 persons with diabetes in Arizona. However, measures of diabetes prevalence, mortality, hospitalization and major risk factors indicate that current rates are worsening. The increase is seen among all ethnic and racial groups. This report contains county-specific information about the prevalence, mortality, and hospitalization of persons with diabetes. It also shows the distribution of diabetes educators, who are effective in encouraging optimal care of persons with diabetes.

The cost for treatment of persons already diagnosed is enormous and escalating. To control these costs, we must encourage activities now that will delay the onset of complications and even prevent diabetes from occurring at all.

Programs specific to the high-risk populations are needed to reduce the increasing incidence among these groups. Program activities must occur at many levels. Successful management of diabetes will require changes in physician practices, modification of health care delivery systems, new societal attitudes toward physical activity and nutrition, and the empowerment of patients who must take charge of their disease.

With the help of its partners, the Arizona Department of Health Services (ADHS) will continue to monitor these diabetes indicators to reveal the direction for control efforts in the state.

This document examines the burden of diabetes and its complications in Arizona. Its purpose is to estimate the impact of prevalence, costs and complications among persons with this disease. This document looks at data sources and Arizona's future data needs. It examines not only the number of persons with disease, but also the risk factors that have been linked to diabetes to create an understanding of the future burden that Arizona is likely to encounter.

The reader is asked to use this report to take action in their respective programs that will lessen the burden of diabetes in our state.

ABBREVIATIONS

AHCCCS	Arizona Health Care Cost Containment System (Arizona's Medicaid Program)
ADA	American Diabetes Association
ADHS	Arizona Department of Health Services
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CDE	Certified Diabetes Educator
CVD	Cardiovascular Disease
DAR	Diabetes and Assistance Resources
DCCT	The Diabetes Control and Complications Trial
DM	Diabetes Mellitus
ESRD	End-stage Renal Disease
FPG	Fasting Plasma Glucose
HSAG	Health Services Advisory Group, Inc.
IHS	Indian Health Service
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
ITCA	Inter Tribal Council of Arizona, Inc.
LEAs	Lower Extremity Amputations
MPH	Master of Public Health
MS	Master of Science
MSN	Master of Science in Nursing
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIH	National Institutes of Health
RPMS	Resource and Patient Management System (of the IHS)
VAH	Veterans Affairs Hospital
WIC	Supplemental Nutrition Program for Women, Infants, and Children

INTRODUCTION

WHAT IS PRE-DIABETES?

Pre-diabetes precedes type 2 diabetes. It is also called Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG). It is diagnosed by:

1. FPG between 100 to 125 mg/dl or more.
2. An oral glucose tolerance test plasma glucose value between 140-199 mg/dl at two hours post-glucose load (indicating impaired glucose tolerance).

The American Diabetes Association (ADA) recommends that men and women age 45 years and older, especially those that are overweight (i.e., BMI $\geq$ 25), be screened for pre-diabetes. Screening should also be considered in individuals younger than 45 if they are overweight and have one or more additional risk factors.

If testing is positive for pre-diabetes, a follow-up test should be performed on a subsequent day to confirm the diagnosis. People with diagnosed pre-diabetes should receive regular retesting every one to two years to monitor for type 2 diabetes. Individuals with a normal screening result can be retested every three years. Moderate lifestyle changes can make a big difference in preventing diabetes and reversing pre-diabetes in some people. Diabetes Prevention Program (DPP) participants who engaged in 30 minutes of physical activity daily and lost five to seven percent of their body weight cut their risk of getting type 2 diabetes by 58 percent. For persons with pre-diabetes, losing excess pounds through proper diet and exercise can improve the body's ability to use insulin and to process glucose more efficiently.

WHAT IS DIABETES?

"Diabetes mellitus is a group of chronic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Insulin is a hormone, produced by the pancreas, that helps the body metabolize glucose." [1] Insulin acts as the "key" which opens the "door" to cells and allows in glucose. Without insulin, or if it is ineffective in the body, glucose builds up in the bloodstream leading to serious complications.

TYPES OF DIABETES MELLITUS

Type 1 diabetes is an autoimmune disease that occurs when the pancreas fails to produce insulin. It is usually detected during an acute onset requiring hospitalization. Individuals with type 1 are usually thin, require insulin to survive, and are diagnosed at a young age. Between five and 10 percent of all individuals with diabetes have type 1 diabetes. They are dependent on daily insulin injections.

Type 2 diabetes occurs when the body produces insulin but the insulin is either not effective or is produced in such small quantities that it is ineffective. Individuals with type 2 are often overweight, inactive, and are diagnosed with diabetes as adults. Between 90 percent and 95 percent of all individuals with diabetes have type 2. Some ethnic groups such as African Americans, Hispanics/Latinos and American Indians have higher rates of diabetes than the general population. [2]

There are other types of diabetes mellitus including gestational diabetes, which is usually first detected during pregnancy. Gestational diabetes occurs in three to eight percent of pregnancies and is more prevalent in African Americans, Hispanics/Latinos and American Indians. [3]

DIABETES IN THE UNITED STATES

Diabetes poses a significant public health challenge for the U.S. According to 2000 U.S. estimates, approximately 13 million individuals of the total population have been diagnosed with diabetes. It is estimated that an additional 5.2 million individuals have diabetes, but are unaware of their condition, placing the prevalence of diabetes at approximately 6.3 percent of the total population. Every year, 1.3 million people age 20 years and older are newly diagnosed with diabetes in the U.S.[4]

Diabetes is the sixth leading cause of death in the U.S. [4] During the year 2000, there were 69,301 certificates with diabetes as the underlying cause of death. Overall, the risk for death among people with diabetes is about two times that of people without diabetes.

Nationally, diabetes causes over 550,000 hospital admissions, equaling 2.9 million days of hospital stay. Approximately 11.2 percent of all hospitalizations among the 18 years and older population involve diabetes as a primary diagnosis. According to the CDC, diabetes costs the U.S. $132 billion annually in medical care and lost wages: $91.8 billion for direct medical costs attributable to diabetes, and $40.2 billion in disability, work loss and premature mortality. Individuals over 65 years of age accounted for 51.8 percent of direct medical expenditures.[4] After adjusting for differences in age, sex and race/ethnicity between the population with and without diabetes, people with diabetes had medical expenditures that were 2.4 times higher than expenditures that would be incurred by the same group in the absence of diabetes.[4]

ARIZONA DEMOGRAPHICS

According to the year 2004 population estimates, the number of Arizona residents has grown to 5,832,150, a 59 percent increase since 1990. Several characteristics of this population must be considered in efforts to control diabetes, and many of those characteristics are addressed in the following section.

ETHNIC DIVERSITY

One of the most challenging characteristics of Arizona's population is its diversity of racial and ethnic groups (**Table 1**). Although four-fifths of the state are considered geographically rural, only 18 percent of the population lives in these rural areas. Many of these rural areas are home to the 21 federally recognized American Indian tribes of Arizona. Many rural areas of the state carry an increased burden from diabetes because of their ethnic diversity. Counties with the highest proportion of American Indians are Apache and Navajo Counties (76% and 47%, respectively), followed by Coconino, Graham, Gila and La Paz Counties.[5] Hispanics/Latinos comprise almost 31 percent of the residents in Cochise County, over 43 percent in Greenlee, nearly 51 percent in Yuma and about 81 percent in Santa Cruz County. The diverse ethnic make-up of Arizona challenges our health care agencies in terms of collecting data and developing programs. Future shifts in the ethnic composition and age distribution of our society will challenge all health care agencies to develop culturally appropriate programs that address the needs of all groups. Further, as a border state, the population of many Arizona cities fluctuates throughout the year due to influxes of migrant workers. Arizona is a "sunbelt" state that receives visitors during the winter months. These populations of migrant workers and winter visitors use health care services and other resources provided by the state and federal government.

Table 1. Population Estimates for Arizona Residents, 2004.

	White, Non-Hispanic/Latino	Hispanic/Latino	American Indian or Alaska Native	African American	Asian or Pacific Islander	Total
Number	3,784,152	1,472,023	282,468	180,978	112,529	5,832,150
% of Total Population	64.9%	25.2%	4.8%	3.1%	1.9%	100%

Source: http://www.azdhs.gov/plan/menu/info/pop/pop04/pd04.htm on May 17, 2005.

OLDER ADULTS

Of the total 2004 population of Arizona, 57 percent of individuals are of working age (20-64 years of age), while 30 percent are under 20 years of age, and 13 percent are over 65 years of age (**Figure 1**). The working-age population economically contributes at least in part to the support of the non-working population.

In 2004, the majority of persons age 65 years or older were White Non-Hispanic/Latino (86.7%). The proportions in other groups were: African American (1.5%); American Indian (2.1%); Asian American (1.0%); and Hispanic/Latino (8.3%).[5] Based on the 2000 U.S. Census, 8.4 percent of the senior population lived in poverty, many in rural counties. One in four or approximately 189,000 seniors live alone with lack of support systems.

The number of individuals over the age of 65 years in Arizona is increasing steadily. In 2004, there were 756,119 individuals (13% of the population) age 65 years or older in Arizona. By the year 2020, the number of persons age 65 years or older is expected to reach 1,296,878 persons or 18 percent of the total population. Eligible seniors receive Medicare benefits supported predominately by the present working population. As the population continues to age, health care costs will continue to rise with a shrinking proportion of younger workers to "carry" the cost. Clearly, Arizona has a financial interest in reducing the prevalence of diabetes and its risk factors.

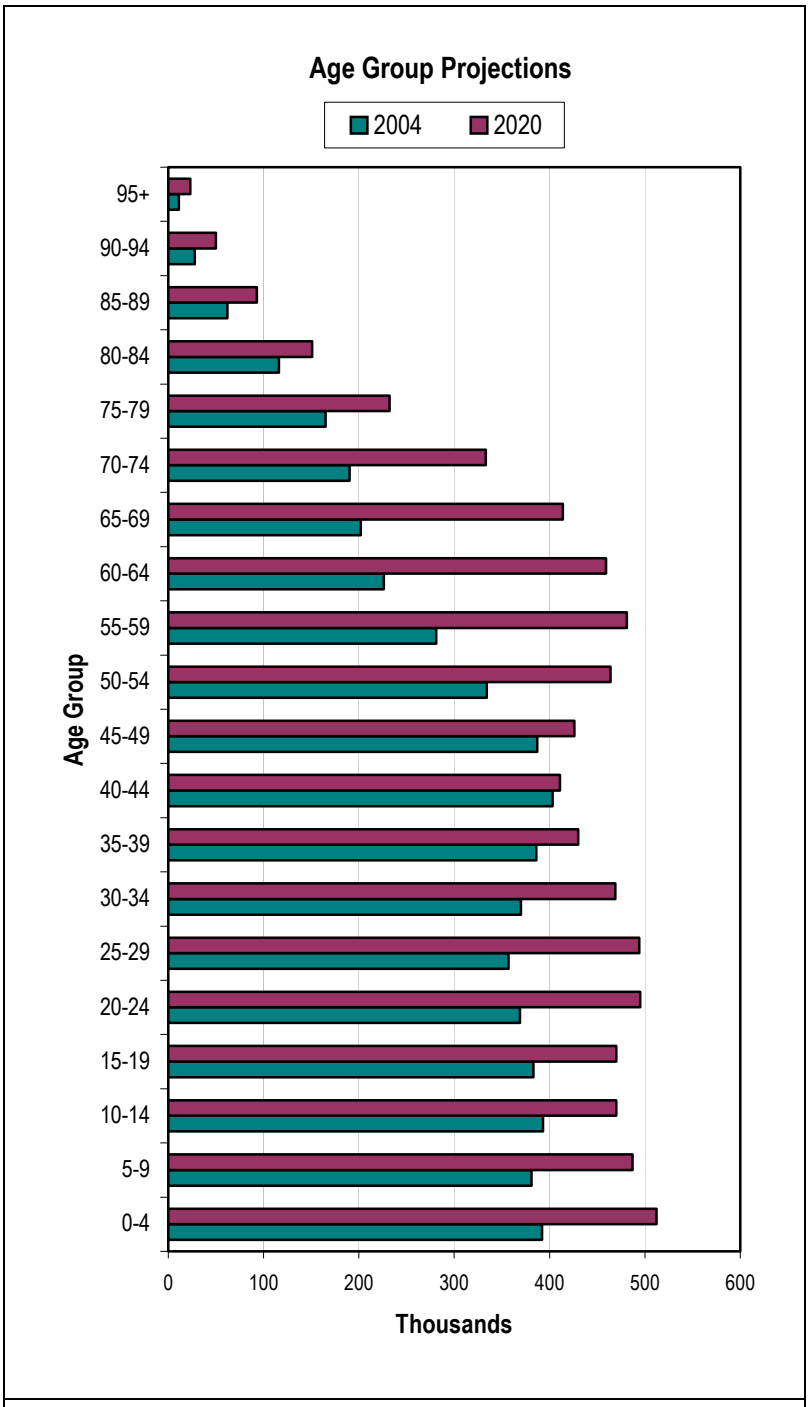

Figure 1. Projected age profile of Arizona's population, 2004 and 2020. Source: U.S. Census 2000 and Arizona Population Projections 1997-2050, ADES Population Statistics Unit, February 1997.

DATA SOURCES

This report identifies existing data sets that can contribute to the monitoring of diabetes and its complications. These data sets include the Behavioral Risk Factor Surveillance System (BRFSS) diabetes subset, databases maintained by the Indian Health Service, hospital discharge data sets, emergency department data and managed care claims records. Supplemental data sources include data collected by the Health Services Advisory Group (overseeing the care provided to Medicare beneficiaries), and birth and death certificates. These data sets were assessed regarding their usefulness, reliability and validity.

BRFSS

The BRFSS is a random-sample telephone survey conducted annually in all fifty states by state health departments in collaboration with the CDC. Each year, about 3,200 adult Arizonans (age 18 years and older) are interviewed. The BRFSS survey includes questions on health issues such as diabetes, tobacco and alcohol use, physical exercise, diet, weight control, seat belt use, and use of preventive and other health care services.

This data set is useful for making general statements concerning diabetes prevalence and associated risk factor behaviors in the target population. It is also useful for looking at trends in behaviors in the overall population regarding diet, physical activity, smoking and other behaviors, which predispose a person to developing diabetes and its complications.

For the last five years, an average of 3,425 Arizona adults were interviewed. An average of 256 Arizona adults interviewed answered yes to "Have you been told by a doctor that you have diabetes?" Because of the small number of respondents with diabetes each year, the BRFSS analysis in this report is based on combined data for five years (2000-2004).

However, BRFSS has limitations, which includes small sample size, affecting its reliability and validity. Further, the survey answers are self-reported, it only reaches individuals with wired telephone service, and it reaches only a small number of diabetics in Arizona (e.g., 391 in 2004). There are biases in the BRFSS diabetes subset data specific to Arizona. Due to the rural nature of the state and the fact that large numbers of border Hispanics/Latinos and American Indians do not have telephones, many of the individuals most affected by diabetes are not surveyed. Groups at higher risk of having diabetes and complications of diabetes are undercounted, despite the current practice of oversampling.

INDIAN HEALTH SERVICE DATA

Within the Indian Health Service (IHS), data are collected for the Resource and Patient Management System (RPMS), which is a comprehensive data collection and reporting system used in the day-to-day delivery of health care, as well as the periodic reporting and analysis of data. RPMS data from across all IHS areas are combined into a single database for overall IHS reporting and analysis. It is managed by the IHS Division of Community and Environmental Health.

Inpatient discharge data are stored in a series of databases also managed by the same IHS office. Tribes are now collecting data on diabetes, its complications, treatment and prevention. As the number of tribes that choose self-determination in health care increases, the number of tribes taking over their own data collection will likely increase.

National Institutes of Health (NIH) conduct research in Arizona in at least two American

Indian communities. Intensive research over the past 35 years among Pima Indians has produced valuable information about diabetes prevalence, risk factors and the difficulty of achieving long-term control.[7] Diabetes rates vary among the 21 tribes in Arizona, which are implementing their own diabetes control programs. Their data will be valuable for purposes of comparing prevalence rates and monitoring long-term trends.

INTER TRIBAL COUNCIL OF ARIZONA, INC.

Nineteen tribes established the Inter Tribal Council of Arizona, Inc. (ITCA) to promote American Indian self-reliance through public policy development. ITCA provides an independent capacity to obtain, analyze, and disseminate vital information to the 21 tribes in Arizona.[8] Among their many programs, ITCA has a tribal Epidemiology Center that compiles data on diabetes in American Indians. One source of their data is the RPMS of the IHS (previously described).

ITCA provides nutritional services to women, infants, and children (WIC) on the reservations in Arizona through its local tribal WIC programs. During the WIC visit, health information is recorded into the individual certification record. Some of the variables include the diagnoses of diabetes, glucose impairment in pregnancy and gestational diabetes, history of gestational diabetes, infants and children of diabetic mothers, diabetes in the family and anthropometric measurements. ITCA's WIC program conducts analysis and produces local and state reports yearly. Information is sent to the CDC for its Nutrition Surveillance System.[9]

HOSPITAL DISCHARGE DATA

Hospital discharge data contains information about diabetes and its complications. This information is reported routinely to ADHS by all hospitals throughout the state, with the exception of the Veterans Affairs Hospital (VAH), military hospitals and IHS hospitals (which maintain their own data). Of the data currently available, hospital discharge data are the most accurate and reliable data on prevalence of complications of diabetes by gender, age and payer type. It is also possible to generate statistics on specific physicians, areas in the state by zip code, county or other areas, and costs for each visit. In 1995, the ADHS system added components that identify the payers.

Federally managed hospitals now collect similar data regarding hospitalizations. Recently, the ADHS obtained some of these federal data, which help portray a more complete description of diabetes in Arizona. However, there are many differences in the data collected and reported by the various systems, and direct comparisons across health care delivery systems are not always possible.

ARIZONA EMERGENCY DEPARTMENT DATA

Emergency Department data contains emergency visit information reported routinely to the ADHS by all emergency rooms throughout Arizona, with the exception of the VAH, military hospitals and IHS hospitals. Emergency Department data contains information on prevalence by gender, diagnoses and procedure codes, age and payer type. It is also possible to generate statistics on specific physicians, areas in the state by zip code, county or other areas, and costs for each visit.

CHARACTERISTICS OF PEOPLE WITH DIABETES

According to the Arizona BRFSS, 2000-2004, about nine percent of all adult Arizonans reported that they have been told they have diabetes. Based on the Arizona Department of Economic Security's population estimate for 2004, this translates to at least 519,061 Arizonans with diabetes. It is difficult to obtain exact figures for diabetes prevalence because there is not a systematic collection of information on the number of cases. Additionally, studies have shown that about one-third of all people with diabetes have not been diagnosed.[10]

Anyone can develop diabetes, but some population groups are at increased risk.

- Older adults are at increased risk for type 2 diabetes. The risk increases with age, especially after age 55 years old for the overall population of Arizona (**Figure 2**). Family members of persons with diabetes are at greater risk of developing diabetes.

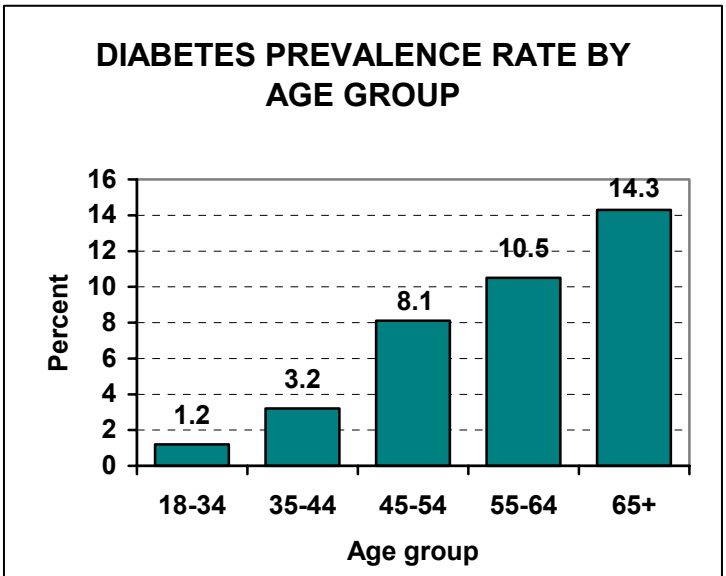

Figure 2. Prevalence of diabetes in Arizona, 2000-2004.
Source: Arizona BRFSS, 2000-2004.

- American Indians, African Americans, and Hispanics/Latinos are more likely to develop type 2 diabetes than the population as a whole. Experts in the field believe that American Indians are about four times as likely as the general population to develop diabetes. African Americans are also at increased risk, but few data sources are available to quantify this increased risk in Arizona.

- Overweight or physically inactive persons are at greater risk for type 2 diabetes. However, these risks can be modified; one estimate is that at least 75 percent of type 2 diabetes can be prevented or delayed with weight loss and exercise.[11]

- Women with a history of gestational diabetes are more likely to develop type 2 diabetes later in life. Children born to mothers with gestational diabetes are more likely to be obese and to develop diabetes as adults.

- Socioeconomic factors are linked to diabetes, with higher rates noted among poorer, less educated, and unemployed persons (**Table 2**). These differences remain after adjusting for age. These associations are found in national data also and are not completely understood.

Table 2. Prevalence of Indicators by Diabetes Status, 2000-2004.

Socioeconomic Indicator	Among Respondents With Diabetes	Among Respondents Without Diabetes
Annual Income Under $20,000	23%	11%
Education Less Than High School Graduate	16%	11%
Not Employed	32%	60%
No Health Insurance	12%	17%
Health Indicator	**Among Respondents With Diabetes**	**Among Respondents Without Diabetes**
Health Status is Reported as Fair/Poor	38%	13%
Met physical activity recommendation	33%	45%
Obese (BMI $\geq$ 30)	40%	18%
Smoker (Current smoker or has smoked at least 100 cigarettes)	57%	45%
High Blood Pressure	62%	20%
High Cholesterol	51%	30%

Source: Arizona BRFSS, 2000-2004.

RISK FACTORS

The underlying cause or causes of type 1 diabetes are not known. Studies have linked factors to an increased risk that include: viral infection, certain genetic patterns, season of the year, birth order and nutrition. Breastfeeding appears to be a protective factor for children. However, no definitive cause has been identified.[12] Similarly, a single cause of type 2 diabetes is not known. However, several factors are strongly linked to its development: a maternal and familial history of diabetes, physical inactivity, intake of dietary fat and weight gain.

A research study entitled the Diabetes Prevention Program (DPP) was conducted on 3,234 people who were overweight and had IGT.

The results of the DPP were announced in August of 2001 and were published in the February 7, 2002 issue of the *New England Journal of Medicine*. The study proved that diet and exercise could sharply delay and possibly prevent type 2 diabetes. Specifically, diet and exercise that resulted in a five to seven percent weight loss lowered the development of new cases (incidence) of diabetes by 58 percent. The drug metformin, in the same study, reduced the incidence of type 2 diabetes by 31 percent. The DPP research demonstrated that lifestyle intervention worked equally

well in men and women and in all ethnic groups.[13]

Arizonans with diabetes tend to be less active and more likely to be obese than those without diabetes (**Table 2**). Diabetics are more likely to be smokers; 57 percent still smoke and risk the accelerated damage to their blood vessels.

Recently, type 2 diabetes has been discovered with alarming frequency in children. Previously, type 2 was virtually nonexistent in children. The reasons for this increase are not well understood. In Arizona, there is not a consistent, unified source that collects public health data about the health and health risk behaviors of Arizona's children and adolescents. An available survey that monitors health risk behaviors among junior high schools (grades six through eight) and senior high schools (grades 9-12) is the CDC's Youth Risk Behavior Survey (YRBS). This survey was implemented in Arizona schools in 2003 and will be done every other year.

School-based health/physical education programs are required for grades one through eight. The interpretation of this requirement is up to the individual schools, as to whether they offer just health, or just physical education or a combination of both. Physical education does not necessarily imply that children are physically active. Health and physical education are not required for high school students, but many of Arizona's high schools offer both. Schools are not required to report the height and weight of students or to measure whether children are actually physically active. It is only when the children become adults that Arizona's public health system measures the risk factors for diabetes through the adult BRFSS.

BRFSS

The BRFSS is a federally funded, random sample of residents in each state. The survey is administered by the ADHS and asks questions regarding various health conditions and behaviors. The BRFSS is particularly helpful in showing the statewide trends of modifiable risk factors for diabetes, namely obesity (**Figure 3**), physical inactivity (**Figure 4**), and an unhealthy diet (**Figure 5**). The trends for these factors may well predict the burden of diabetes (and other chronic diseases) that Arizona will face in future decades. **Figure 3** shows that Arizonans are not improving and are far from controlling these modifiable risk factors. BRFSS asks 12 questions specifically of persons with diabetes. Five of the 12 questions from the BRFSS (2000-2004) in Arizona are presented in tables found in Appendix B.

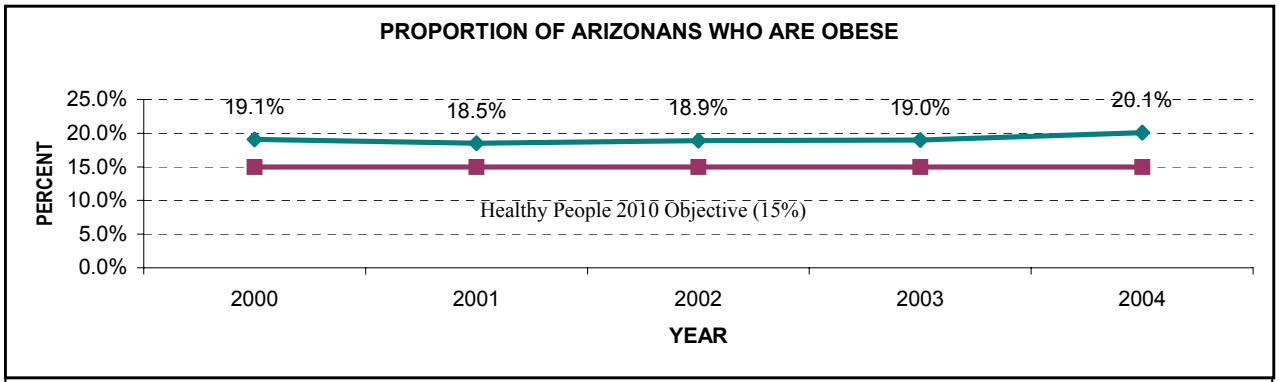

Figure 3. Proportion of Arizona adults categorized as obese (body mass index is 30 or more), 2000-2004. Source: Arizona BRFSS, 2000-2004.

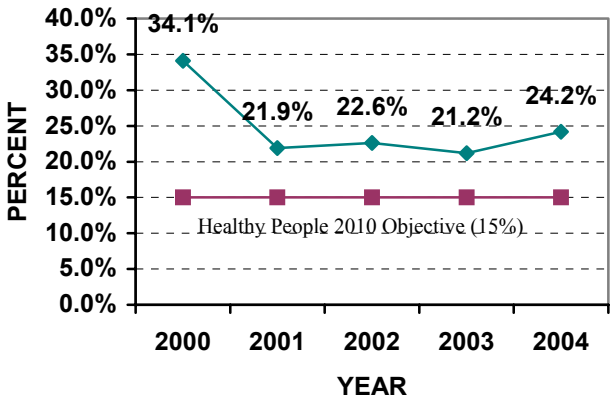

Figure 4. Proportion of Arizona adults not participating in physical activity in the past month, 2000-2004. Source: Arizona BRFSS, 2000-2004.

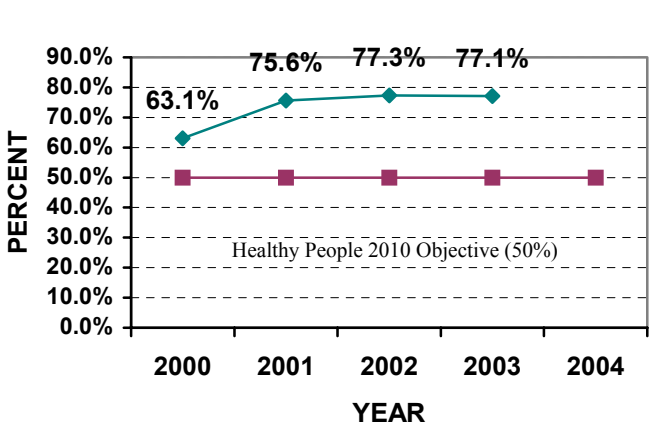

Figure 5. Proportion of Arizona adults consuming less than 5 servings of fruits or vegetables per day, 2000-2004. Source: Arizona BRFSS, 2000-2004. Data for 2004 not available.

DIABETES PREVALENCE

There is not a definitive source to determine the precise number of persons who have diabetes in Arizona. There is no central registry of this common disease, nor is there a comprehensive data source that counts all cases. Few counties have the resources to conduct studies of diabetes prevalence within their jurisdictions. At this time the Steps to a Healthier Arizona Initiative is providing funds to collect additional behavioral data of three border counties (Yuma, Santa Cruz and Cochise). In addition, the City of Avondale conducted a point in time survey to collect city-specific information. The results of this study showed eight percent prevalence of diabetes among Avondale residents.

The CDC, the Mexico Secretariat of Health (SSA), and the Pan American Health Organization (PAHO) showed that almost 16 percent of border residents suffer from type 2 diabetes. The national rate in Mexico is 14.9 percent and in the U.S. it is 13.9 percent of the population.[14]

Two sources are used to estimate the number of diabetics: the BRFSS and the National Health Interview Survey (NHIS). Each of these surveys has various shortcomings that do not completely characterize the situation in Arizona; nevertheless, they provide a gross estimate of the prevalence in the state (**Table 3**). The estimate computations are presented in **Appendix A**. The BRFSS has an Arizona specific estimate of the number of persons who would self-identify as having diabetes. County estimates are derived from the state rate, which underestimates the prevalence among rural areas (**Table 4**).

Table 3. Estimated Prevalence of Diabetes in Arizona, 2004, Using Two Data Sources.

Survey Instrument	Statewide Estimated (Number)	Survey Methodology and Limitations
Arizona BRFSS	**519,061**	The BRFSS interviewed 17,125 state residents with telephones during 2000 – 2004; this estimates the number of Arizona adults who say a physician or other health care worker has told them that they have diabetes. This fails to consider groups that have low or spotty telephone coverage. Undiagnosed persons also are not considered in this estimate.
NHIS	**279,965**	The NHIS was a random sample of US adults and children in 2001 that estimated the number of American adults who said a physician or other health care worker has told them that they have diabetes. Undiagnosed persons are not considered in this estimate.

Table 4. Estimates of the Number of Self-Identified Diabetics, 2004, Using the Arizona BRFSS Prevalence Rates Applied to Age Group and County.

County	Total	18-44	45-64	65-74	75+
Apache	2,911	549	1,102	706	554
Cochise	6,369	1,200	2,411	1,545	1,213
Coconino	6,129	1,155	2,320	1,487	1,167
Gila	2,688	507	1,017	652	512
Graham	1,671	315	633	405	318
Greenlee	378	71	143	92	72
La Paz	1,108	209	419	269	211
Maricopa	170,895	32,208	64,687	41,454	32,546
Mohave	9,196	1,733	3,481	2,231	1,751
Navajo	4,605	868	1,743	1,117	877
Pima	46,586	8,780	17,634	11,300	8,872
Pinal	10,855	2,046	4,109	2,633	2,067
Santa Cruz	1,850	349	700	449	352
Yavapai	10,298	1,941	3,898	2,498	1,961
Yuma	8,563	1,614	3,241	2,077	1,631
Arizona	**284,102**	**53,545**	**107,538**	**68,915**	**54,104**

UNDIAGNOSED DIABETES IN ARIZONA

Diabetes is present for 10 years or more before diagnosis. In this period before diagnosis, many changes occur to the small blood vessels that damage the major organs: retinopathy (eye damage); nephropathy (kidney damage that can lead to renal failure); damage to the coronary arteries; and impairment of the blood vessels and nerves in the feet and legs. Often times, these complications are the first indication that diabetes is present.

The ADA estimates that for every two persons diagnosed with diabetes, there is another person who has it, but has not yet been diagnosed. Recently, the ADA changed the criteria for diagnosing diabetes and IGT. The threshold for diagnosis has been lowered, and it is believed that more people with diabetes will be detected at an earlier stage of the disease.

Earlier detection of diabetes provides the opportunity for tighter control of glucose levels and reduction of complications. See www.cdc.gov/diabetes for more information on an early form of glucose intolerance called pre-diabetes.

COMPLICATIONS OF DIABETES

The elevated blood glucose levels associated with diabetes lead to pathologic changes in many organs throughout the body.[15] Many of these changes can be delayed or prevented by monitoring and controlling the level of glucose in persons with type 1 diabetes.[4] Similar beneficial findings have been shown for persons with type 2 diabetes.[13] A model of earlier age screening and treatment, beginning at age 25 years, showed benefits in terms of fewer complications and improved quality of life.[16]

Psycho-social Problems
Like other chronic illnesses, diabetes leads to a wide range of psychological problems for patients and their family members. These problems include pain, hospitalization, changes in lifestyle and vocation, physical disabilities and threatened survival. Direct physiological consequences can arise from any one of these factors, making it harder for patients to treat their diabetes and live productive, enjoyable lives.

Acute Glycemic Complications
Poorly controlled diabetics develop elevated glucose levels (hyperglycemia), sometimes to the point of coma, requiring hospitalization. Alternatively, if too much insulin is taken, the diabetic may suffer a life-threatening episode of low blood sugar (hypoglycemic coma or insulin shock). There were 100 discharges with a primary discharge code of Hyperglycemia (ICD-9=250.3x) and 2,020 discharges with a primary discharge code of Hypoglycemia (ICD-9=250.8x) in 2004 from nonfederal hospitals.

Periodontal Disease
Periodontal or gum diseases (infections that affect the tissue surrounding and supporting the teeth such as gingivitis, periodontitis) are more common among people with diabetes than among people without diabetes. Among young adults, those with diabetes are often at twice the risk of those without diabetes. Almost one-third of people with diabetes have severe periodontal diseases with loss of attachment of the gums to the teeth measuring five millimeters or more.[4] Although this is a common health condition, there is no registry to quantify the magnitude of the problem in Arizona.

Eye Disease
Vision impairment is a frequent complication of diabetes, for both type 1 and type 2. The major cause of blindness in people with diabetes is diabetic retinopathy. In the U.S., diabetes is responsible for eight percent of legal blindness, making it the leading cause of new cases of blindness in adults 20-74 years of age. Each year, between 12,000 and 24,000 people lose their sight because of diabetes. It is estimated that at least 60 percent of the cases of blindness can be prevented.[17] Based on the 2002 National Eye Institute report, there were 98,592 cases of diabetic retinopathy among Arizonans 40 years of age and older.

Neuropathy
One of the most common complications of diabetes is diabetic neuropathy. Neuropathy means damage to the nerves that run throughout the body, connecting the spinal cord to muscles, skin, blood vessels and other organs. Diabetic neuropathy can be painful and disabling. Fortunately, severe forms of neuropathy do not occur often. And many times, symptoms of neuropathy go away after several months.[4] There are no accurate measures of the prevalence of these complications in Arizona.

Kidney Disease
Damage to blood vessels in the kidneys (nephropathy) can lead to progressive kidney failure, called end-stage renal disease (ESRD). The Intermountain End-Stage Renal Disease Network, Inc. tracks ESRD through a database of dialysis patients and kidney transplants. During 2004, more than 1,000 Arizonans with diabetes progressed to the point where renal failure requires dialysis. About 54 percent of the patients on renal dialysis have diabetes. In 2004, there were 263 Arizonans who received kidney transplants. There were 724 Arizonans who died of ESRD related to their diabetes in 2004.[18]

The DCCT showed that kidney disease can be reduced or prevented with control of blood glucose and blood pressure. Blood

pressure has a dramatic effect on the rate at which the disease progresses. Even a mild rise in blood pressure can quickly make the disease worsen. Five ways to bring blood pressure down are losing weight, eating less salt, exercising regularly, and avoiding alcohol and tobacco. Other preventive measures include blood pressure control by using a medicine called an ACE inhibitor. Early detection through annual screening for microalbuminuria can lead to earlier treatment, thereby slowing the progression of nephropathy so that patients may never need dialysis or a transplant.

Cardiovascular Disease (CVD)

Diabetics face a two to three fold increase in dying from CVD compared to persons without diabetes. In Arizona, 27.4 percent of the 2004 nonfederal hospitalizations related to diabetes also list disease of the circulatory system as a primary diagnosis. Modifications of the risk factors for heart disease are especially important in diabetics: smoking, sedentary lifestyle, and high blood pressure, cholesterol and lipids.
Elevated blood pressure is particularly linked to development of CVD and nephropathy among diabetics.

Stroke

Cerebrovascular disease (paralytic stroke) is also common among diabetics, and the risk factors are similar to those of CVD. Modification of the same risk factors for CVD can also reduce the risk for stroke.

Foot Problems

Amputation of a toe, foot, or leg is a late-stage complication of diabetes. In Arizona, there were 1,820 diabetes-related lower extremity amputations (LEAs) among hospitalized patients at non-federal hospitals in 2004. *Healthy People 2000* has estimated that half of all amputations can be prevented through interventions such as patient education, proper fitting shoes, and regular foot examination by the patient and doctor.

Emerging Issues

Other interventions are still emerging to reduce co-morbidity among diabetics. These include vaccination against influenza, reduction of cigarette smoking, aspirin therapy to prevent heart disease, and regular monitoring of lipid profile. The discovery and control of diabetes among young adults and children also will become a major issue in future years.

Summary of Complications

A summary of the prevalence of diabetes complications is shown in **Table 5** on the following page, which has been compiled from various sources.

Table 5. Summary of Diabetes Complications in Arizona, 2004.

DIABETES-RELATED CONDITION	NUMBER IN 2004	INFORMATION SOURCE
LEAs	1,284	Arizona Hospital Discharge Data, 2004 (nonfederal facilities)
ESRD, new cases	1,008	Inter-Mountain Region
Diabetic retinopathy	98,592	Prevent Blindness, 2002 (www.preventblindness.org)
Diabetes-Related Hospitalizations, nonfederal facilities	91,717	Arizona Hospital Discharge Data, 2004 (nonfederal facilities)
Hospitalizations for Diabetes as Primary Diagnoses	8,386	
Hospitalizations due to Disease of the Circulatory System	96,222	

DIABETES AND PREGNANCY

Pregnancy can be complicated by either type 1 or type 2 diabetes or by gestational diabetes (which develops during the pregnancy). Uncontrolled diabetes increases the health risk for both the fetus and the mother. In pre-existing diabetes, preconception counseling is important to assure effective glucose control at conception and during the first trimester when major organ formation is taking place.

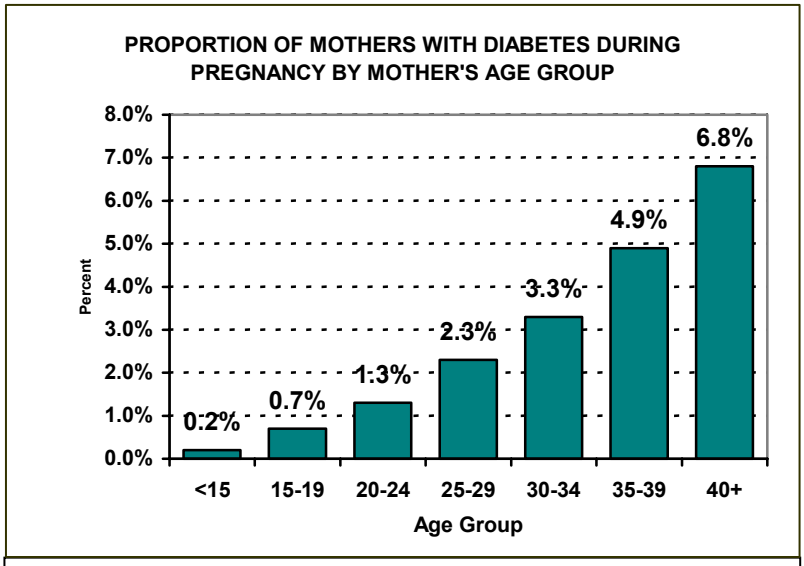

Figure 6: Diabetes during pregnancy, Arizona Birth Database, 2004.

In 2004, about 2.4 percent of all births in Arizona were to mothers with diabetes. The percentage of Arizona mothers with diabetes has remained stable since 1990. Gestational diabetes rates vary among racial and ethnic groups and run higher among those groups with higher diabetes rates overall (American Indians, Hispanics/Latinos, African Americans). In 2004, the self-reported rate for having diabetes during pregnancy was 5.5 percent among clients receiving WIC services through the ITCA. Those having diabetes during pregnancy were either diagnosed with diabetes prior to pregnancy or were diagnosed with gestational diabetes during their last pregnancy.[19] The rate of both pre-existing and gestational diabetes during pregnancy increases steadily with age of the mother (**Figure 6**).

HOSPITALIZATION DATA

NONFEDERAL FACILITIES

The hospital discharge database compiled by ADHS provides data about discharges from nonfederal hospitals. As shown in **Table 6**, there were 91,723 discharges where diabetes (ICD-9-CM code 250.xx) was listed as one of the nine diagnoses that can be listed for a patient. The unit of analysis in this table is the number of discharges, not unique persons. Thus, a person discharged more than one time with diabetes or a diabetes-related illness can be counted several times. Diabetes-related discharges accounted for 429,496 days of hospital stay in 2004. As indicated in the table, the proportion of discharges that include diabetes as a primary or co-morbid condition now exceeds 13 percent.

On a population basis, discharges due to diabetes as the primary diagnosis also have increased year after year. During 2004 in Arizona, there were 8,386 hospital discharges with diabetes as the primary diagnosis (i.e., the first-listed diagnosis, and primary illness treated during the hospital stay, ICD-9-CM code=250.xx). **Figure 7** shows a 25 percent increase in hospitalization rates between 1994 and 2004. The hospitalization rate differs considerably among Arizona's 15 counties (**Table 7**). Pima, Pinal, and Yuma Counties have had diabetes-related discharge rates that are consistently higher than the state rate. Counties such as Apache, Graham, Greenlee and Santa Cruz also demonstrate a marked percent increase in hospitalization rates since 1994.

Table 6. Hospital Discharges for Diabetes-Related Diagnosis, Non-Federal Facilities Only, 1994-2004.

Year of Discharge	Diabetes Discharges (Number)	Diabetes Discharge Rate*	Average Length Stay (Days)	Total Charges
1994	36,788	81.6	5.3	$493,820,743
1995	44,088	93.4	5.4	$669,148,220
1996	50,762	103.0	4.9	$775,551,399
1997	54,848	106.3	4.7	$881,891,382
1998	54,425	101.1	4.9	$925,712,245
1999	59,359	105.8	4.8	$1,065,316,017
2000	66,695	110.4	4.6	$1,337,609,106
2001	70,278	116.7	4.6	$1,486,475,577
2002	76,670	120.3	4.5	N/A
2003	82,592	127.4	4.7	$2,065,438,031
2004	91,723	134.5	4.7	$2,464,334,670

*Diabetes-related discharges per 1,000 discharges from all causes.
Source: HDDB, 1994-2004.

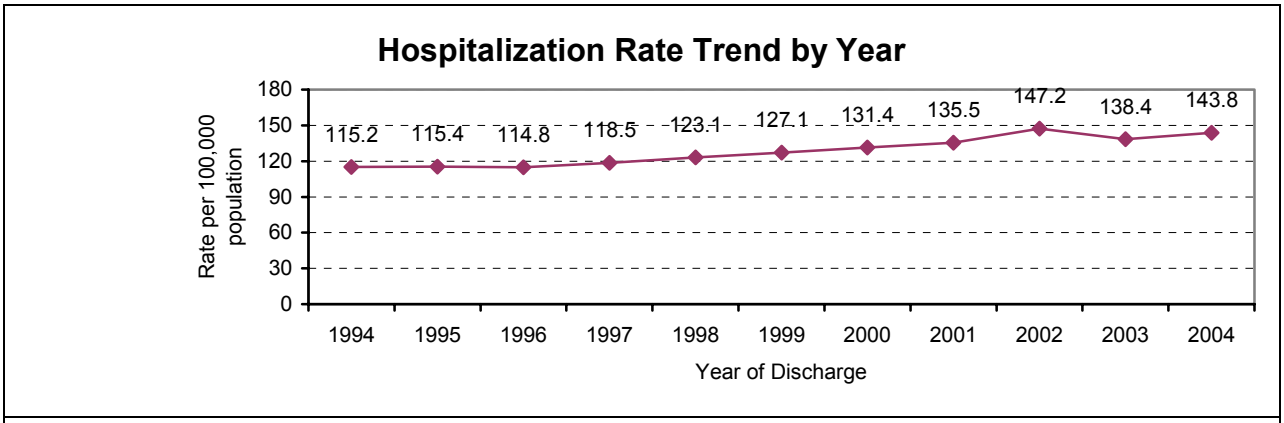

Figure 7. Hospitalization rate (per 100,000 census population), all counties combined, for diabetes as the primary discharge diagnosis, nonfederal facilities only, 1994-2004. Source: HDDB, 1994-2004.

Table 7. Hospitalization Rate (per 100,000 census population) for Diabetes as the Primary Diagnosis at Discharge, Non-federal Facilities Only, 1994-2004.

Counties	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Apache	19.8	45.7	47.8	76.3	87.4	58.3	103.7	94.4	100.4	79.3	109.4
Cochise	83.5	93.3	135.0	112.8	151.9	164.6	145.2	138.3	124.9	129.2	143.6
Coconino	80.3	85.0	73.0	91.1	104.4	97.7	127.2	132.0	106	85.3	91.8
Gila	145.4	166.7	103.5	166.5	156.6	109.7	185.1	194.6	160.3	239	249.7
Graham	55.4	317.4	133.2	196.5	279.5	167.8	92.6	205.5	255.4	72.5	88.8
Greenlee	99.9	163.2	53.6	112.7	241.1	281.8	117.0	197.9	151.1	23.3	143.7
La Paz	163.0	203.1	124.2	181.6	168.4	119.5	96.4	175.6	83.4	106.2	193.9
Maricopa	104.8	99.9	99.1	93.7	110.1	118.3	119.4	124.8	146.4	131.2	136.8
Mohave	99.5	110.6	118.8	123.5	124.8	121.0	142.6	139.2	121.9	148.1	159.3
Navajo	82.5	96.2	104.3	109.8	129.7	134.9	161.1	129.3	137.7	122.4	162.9
Pima	126.6	120.5	130.1	129.2	140.1	142.7	154.0	156.1	158.9	164.1	159.5
Pinal	257.2	141.6	243.8	192.9	216.3	208.6	210.3	177.2	177.2	178.6	178.7
Santa Cruz	146.7	112.7	157.0	170.6	119.0	117.6	156.3	188.2	178.2	180.9	171.5
Yavapai	95.5	3.0	113.4	107.0	111.1	98.8	103.3	140.3	119.3	126.3	138.3
Yuma	122.3	135.5	134.2	157.8	130.2	164.7	148.1	145.2	153.7	158.8	153.2
Arizona	**115.2**	**115.4**	**114.8**	**118.5**	**123.1**	**127.1**	**131.4**	**135.5**	**147.2**	**138.4**	**143.8**

Source: HDDB, 1994-2004.

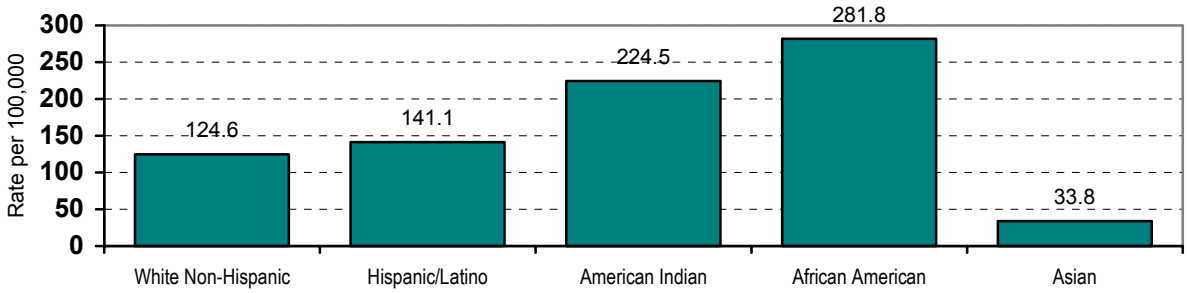

Figure 8. Hospitalization rate (per 100,000 census population) for diabetes as the primary discharge diagnosis, nonfederal facilities only, 2004. Source: HDDB, 2004.

Discharge rates differ markedly among race and ethnic groups. African Americans have the highest rate followed by American Indians and Hispanic/Latinos (**Figure 8**). American Indians who were treated in nonfederal facilities are included in the figure; however, American Indians seen only at IHS facilities are not included in the figure. Similarly, veterans who received care only at VA facilities are not shown.

Based on the Hospital Discharge Database, 1994-2004, the average cost upon discharge has increased from $13,423 during 1994 to $26,867 in 2004. In 2004, the Arizona Health Care Cost Containment System (AHCCCS) incurred 17 percent (nearly $393 million) of the charges. Medicare paid 44 percent of all diabetes hospitalizations, totaling over $1 billion. Health Maintenance Organizations were the fourth largest payer with 9.4 percent of the cost at $240 million. In most plans, employers share these costs with employees. These figures do not take into account the costs incurred among federal hospitals, such as IHS hospitals or the VAH.

The cost of hospitalization has risen dramatically. In 2004, hospital charges for the 91,723 discharges from nonfederal facilities exceeded $2.4 billion. Of the amount spent during 2004, the majority of the costs were spent for circulatory system complications ($3.5 billion). The cost of other complications is shown in **Figure 9**.

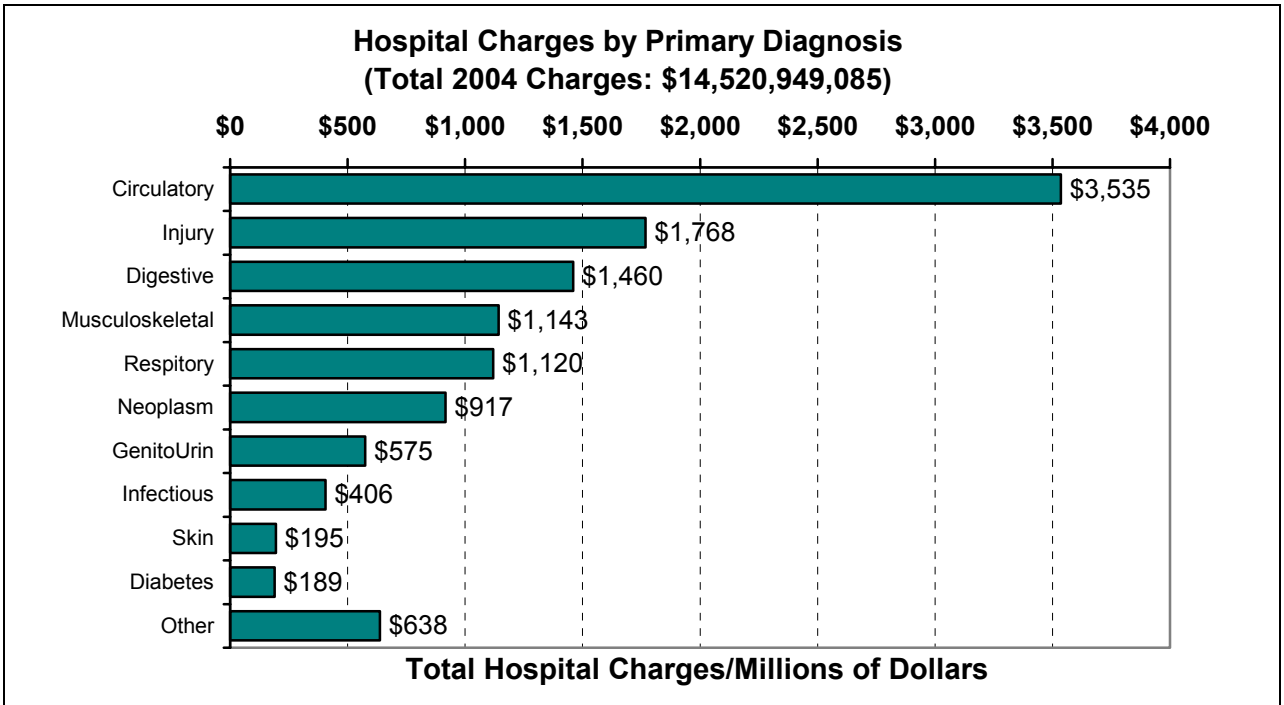

Figure 9. Hospital charges, by primary diagnosis, for diabetes-related discharge diagnosis, nonfederal facilities only, 2004. Source: HDDB, 2004.

EMERGENCY DEPARTMENT

In addition to those hospitalized during 2004 with diabetes as primary diagnosis, there were 7,483 outpatient visits to emergency departments. These visits accounted for over 11 million dollars in health care costs.

FEDERAL FACILITIES Federally managed facilities now collect hospitalization data in a manner similar to the hospital discharge database. Until recently, there has been little sharing of these data between the state and federal governments. In general, this is because the federal systems were established to serve persons to whom the federal government provides comprehensive medical care.

INDIAN HEALTH SERVICE

IHS provided a diabetes audit report for all clinics in the Phoenix IHS area. This report includes information for clinics located in Arizona. Approximately 14 percent of diabetic patients were included in this analysis. The majority are female (62%), age 45-64 years old (50%), and have lived with diabetes for less than 10 years (36%). Forty-seven percent had a foot exam, 56 percent had an eye exam, and 35 percent had a dental exam in 2004.[20]

FINANCIAL IMPACT IN ARIZONA

Comprehensive data concerning the financial impact of diabetes specific to Arizona can only be estimated. The cost associated with hospitalization and emergency room utilization does not consider the outpatient charges. Estimates for direct medical cost were developed based on the 1997 ADA report entitled *Economic consequences of diabetes mellitus in the United States*. These numbers were then adjusted with the Consumer Price Index to 2004 figures. The total cost of direct medical care for diabetes in Arizona during 2004 was $3 billion. Indirect (non-medical) costs such as present and future resources lost to individuals and families as a consequence of the disease, and psychosocial costs such as impact of diabetes on quality of life were not calculated. The ADA estimates the annual medical expenditures per capita at $13,243 for people with diabetes and $2,560 for people without diabetes.

Diabetes is a costly disease that poses a major public health problem. Much of the health and economic burden of diabetes can be averted through known prevention measures. Prevention of complications through patient education, covered supplies through insurance or AHCCCS, and improved clinical practice behaviors would cost only a fraction of the cost of being admitted to a hospital for care of these complications.

Recent studies documented for the first time that a balanced diet, an exercise regimen, and improved glycemic control lead to substantial benefits for patients with type 2 diabetes in terms of decreased symptoms, higher quality of life, and economic savings.[21]

DIABETES RESOURCES IN ARIZONA

Diabetes education is an integral component of diabetes patient care. In this section, the role and types of diabetes educators in Arizona are addressed. The role of the diabetes educator is to educate people who have diabetes, their families, and their support systems, as well as other health care professionals who do not specialize in diabetes management. They also educate policymakers and the general public about diabetes.

Certified Diabetes Educators (CDEs) are health professionals who specialize in educating people with diabetes about self-care management skills to help them improve their health and quality of life. They can be clinical psychologists, occupational therapists, optometrists, physical therapists, registered nurses, registered dieticians, pharmacists, physicians, podiatrists, social workers, or other health care professionals.
Those who have the CDE credentials have passed a national examination (National Certification Board for Diabetes Education) that verifies a certain basic level of knowledge in the field of diabetes.[22]

The distribution of CDEs across the state is shown in **Figure 10**. The Arizona Diabetes Control Council recognizes a shortage of diabetes educators, especially those who have received formal CDE certification. Currently, there is no accepted standard for the ratio of certified diabetes educators per number of diabetics. The development of a recommended ratio would be helpful in planning and delivering high quality diabetes education to the public.
Another human resource often overlooked are lay health workers. These persons are also known as lay health advisors, *promotoras,* or community health representatives. The title differs according to the community in which they work. These lay health workers provide outreach activities that encourage utilization of primary and preventive care services. Lay health workers generally reside in the communities where they work and already have developed a level of trust with other community members. Lay health workers often are bilingual (which overcomes language barriers) and have been trained about various health related topics.

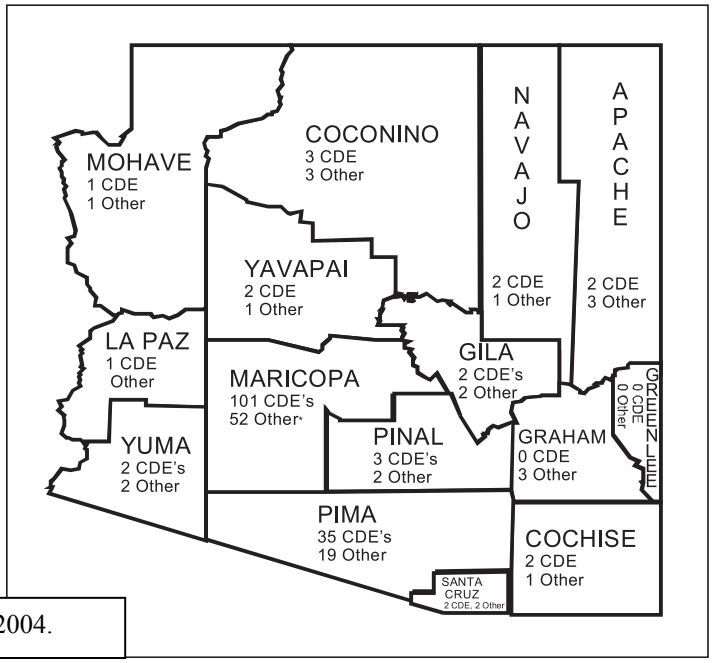

Figure 10. CDE distribution by county in Arizona, 2004.

MORTALITY DATA

The mortality rate of diabetes as an *underlying* cause of death among Arizona residents is steadily increasing (**Figure 11**). Additional data about the rate among subgroups are presented in subsequent sections of this report.

The mortality rates according to county also are available for analysis. Rates can vary widely from year to year when there are relatively few events, as is often the case in the smaller counties. As an outcome, death as a result of diabetes usually reflects the medical care and treatment received over a long period of time, generally several decades after the disease has been present. For that reason, mortality rates are not regarded as timely indicators of care that diabetics receive. Rates that are slow to rise also may be slow to fall, despite improving care, given the protracted course of diabetes. Also, miscoding of death certificates may occur. For example, a person may die with renal failure, but diabetes may not be listed as the underlying cause of the renal failure.

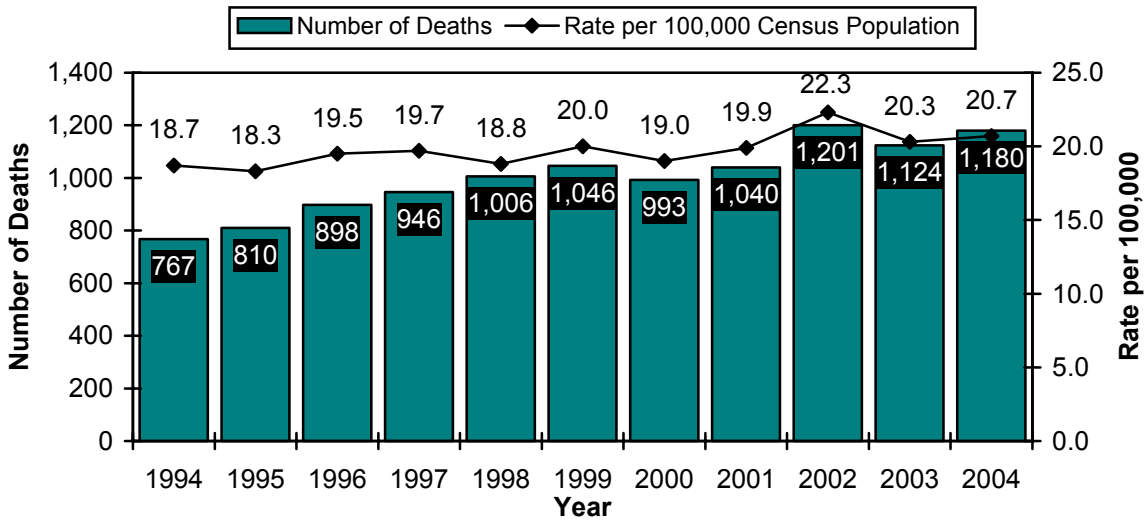

Figure 11. Deaths in Arizona with the underlying cause of death listed as ICD-10 code E10-E14 (diabetes), 1994 – 2004. Rates are per 100,000 population, age-adjusted to the U.S. 2000 standard. These data include deaths among American Indians. Source: Arizona Health Status and Vital Statistics 1994-2004, ADHS.

Table 8. Age-Adjusted* Mortality Rates per 100,000 Population with Diabetes Listed as the Underlying Cause of Death, 2000- 2004.

	2000	2001	2002	2003	2004
Apache	51.3	42.4	46.1	52.4	47.8
Cochise	27.3	24.3	24.1	24.5	27.5
Coconino	18.7	20.6	21.5	18.9	20.7
Gila	16.6	29.9	21.3	26.7	32.0
Graham	27.1	39.9	31.8	38.0	38.9
Greenlee	71.6	29.5	29.5	24.1	11.4
La Paz	19.8	19.2	40.5	24.7	24.2
Maricopa	18.1	19.6	23.0	19.7	18.9
Mohave	21.0	24.8	26.6	24.7	31.6
Navajo	23.8	24.6	35.9	27.3	43.6
Pima	19.8	18.0	20.3	19.0	21.1
Pinal	24.0	24.1	25.0	16.3	17.5
Santa Cruz	30.0	52.6	14.8	25.8	32.2
Yavapai	13.1	11.2	7.3	15.5	12.3
Yuma	12.9	14.0	22.7	23.7	23.0
Arizona	**19.0**	**19.9**	**22.3**	**20.3**	**20.7**

*Adjusted to the 2000 standard U.S. population and ICD-10 codes E10-E14.
Source: Arizona Health Status and Vital Statistics 2000-2004.

HIGH RISK POPULATIONS

Mortality rates in Arizona differ by race and ethnic groups, and the rates appear to be worsening for most groups (**Figure 12**).[24]

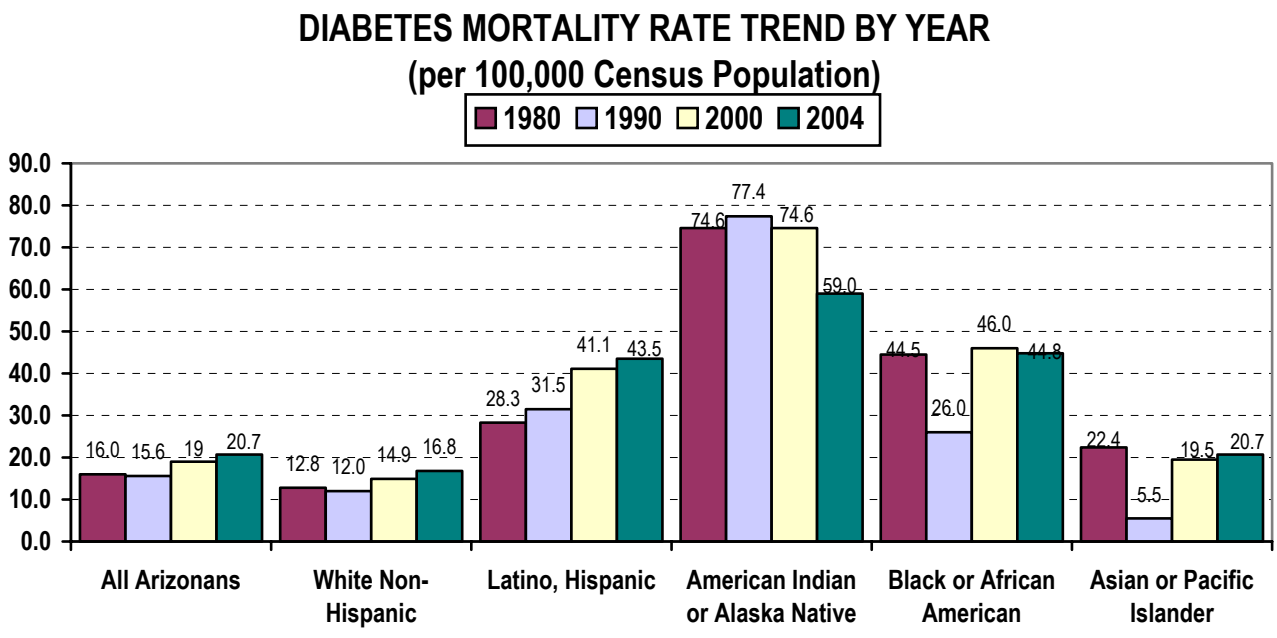

Figure 12. Age-adjusted mortality rates with the underlying cause of death listed as diabetes, 1980, 1990, 2000, 2004.
Source: Arizona Health Status and Vital Statistics 1980, 1990, 2000, 2004, ADHS.

AMERICAN INDIANS

A precise count of American Indians with diabetes in Arizona is not available. However, an estimate can be obtained by counting all active users in the Clinical Reporting System, which is part of the RPMS operated by the IHS. In order to be considered an active user, an American Indian must have had at least two (any combination) of the following: a direct or contract inpatient or outpatient visit or a direct dental visit during the last three fiscal years. Using this information, the IHS estimates 15,853 persons with diabetes in Arizona for fiscal year 2004. At the same time, there were 119,482 active users of IHS services in Arizona. Dividing these two figures produces a prevalence rate of 13.3 percent.[20] Using the 2000 U.S. population as the standard, the age-adjusted prevalence rate of diagnosed diabetes in the Arizona portion of the Phoenix Service Area 22.0 percent. Within these overall rates, the prevalence rate in women is four to five percent higher than in men.

The age-adjusted mortality rate for diabetes among American Indians is 59.0 deaths per 100,000 population (**Figure 12**). This rate is adjusted for miscoding of Indian race on death certificates. The 59.0 rate is 2.8 times the 13.5 rate among all races in Arizona of 13.5 for 2004. The diabetes death rates for Arizona in the IHS Navajo Area are well above the overall American Indian rate for the U.S. - approximately 1.5 times greater. For calendar years 1996 to1998, the Navajo Area rate was 41.1 per 100,000 population.

Diabetes was the fourth leading cause of death among American Indians in Arizona in

2004.[24] Among American Indians living in the IHS Navajo Area (part of which lies in Arizona) and the IHS Tucson Area (southern Arizona), it was the fifth leading cause of death in 1996 -1998. [25]

The diversity of Arizona presents unique opportunities and challenges for effective diabetes control. Arizona has one of the largest populations of American Indians of any state, and this population is affected disproportionately by diabetes. For example, the National Institutes of Health (National Institute of Diabetes and Digestive and Kidney Diseases) has noted that among Pima Indian adults age 30-64 the prevalence rate is about 50 percent, the highest rate of diabetes of any population in the world.[26] Many American Indians live in rural areas and receive services from the IHS or a tribal health service provider.

Urban American Indians, when contrasted with rural American Indians, although surrounded by resources, encounter unique barriers to health care and effective diabetes management. Community health representatives and public health nurses on the reservations serve to bring patients and resources together, whereas this type of service exists to a lesser degree in the urban areas. In addition, urban American Indians are not entitled to the same health care benefits as those who do live on a reservation.

Diabetics, regardless of ethnic group, often fail to achieve the average U.S. life expectancy of 77.6 years. This is especially true for both urban and rural American Indians.

HISPANICS/LATINOS

Diabetes ranks fifth among the leading causes of death among Hispanics/Latinos in Arizona.[24] The life expectancy of diabetics also is shortened for Hispanics/Latinos. A survey of 915 persons, 18 years of age or older, was conducted during 1997-1998 in Douglas, a community on the U.S./Mexico border in which 84 percent of the population was Hispanic/Latino. This survey found that, based on prior diagnoses and FPGs, the prevalence rate for diabetes was 18.3 percent. The strongest factors associated with a diagnosis of diabetes were: age, weight, and family history of diabetes (mother, father, brother or sister with diabetes). In the U.S., the prevalence of type 2 diabetes is two times higher in Hispanics/Latinos than non-Hispanic/Latino Whites. Two million or 10.2 percent of all Hispanics/Latinos have diabetes. Approximately 24 percent of Mexican Americans in the U.S. and 26 percent of Puerto Ricans between the ages of 45-74 years have diabetes. Nearly 16 percent of Cuban Americans in the U.S. between the ages of 45-74 years have diabetes.[4]

AFRICAN AMERICANS

The existing data suggest higher rates of hospitalization and death from diabetes for African Americans compared to all Arizonans. For example, diabetes ranks fifth among the leading causes of death among African Americans in Arizona; this is almost two times as great as that of the state as a whole (**Figure 12**).[32] The 2001 hospitalization rate for diabetes as the primary discharge diagnosis for African Americans is the highest of all racial and ethnic groups, 2.3 times that of non-Hispanic/Latino Whites (**Figure 8**).

OLDER ADULTS

Previous tables and figures showed the elevated prevalence rate among Arizona's older adult population. In addition to the year round residents, there is a large migratory group, which annually swells Arizona's older adult population.

HEALTHY PEOPLE 2010 OBJECTIVES

Arizona's Diabetes Prevention and Control Program (DPCP) efforts are directed toward meeting the following Healthy People 2010 Objectives.

REDUCE THE DIABETES DEATH RATE

Figure 13 illustrates the mortality data for diabetes among Arizonans in 2004. The target according to Healthy People 2010 is to reduce the diabetes death rate to 45 deaths per 100,000 population. Arizona stands at 20.7 deaths per 100,000 population, which shows that this objective is met.[27]

Diabetes deaths are calculated using the underlying cause of death listed as ICD-10 code E10-E14 (diabetes). Rates are per 100,000 population, age-adjusted to the U.S. 2000 standard. These data include deaths among American Indians.

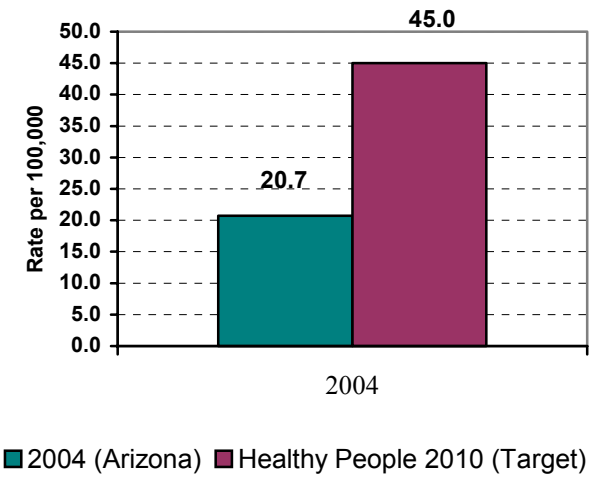

Figure 13. Diabetes Death Rate, 2004. Source: Arizona Health Status and Vital Statistics 2004, ADHS

REDUCE THE RATE OF LOWER EXTREMITY AMPUTATIONS

Figure 14 illustrates lower extremity amputations using data from the 2004 Arizona hospital discharge data for nonfederal facilities. The target according to Healthy People 2010 is to reduce the rate of lower extremity amputations to 1.8 per 1,000 population. Arizona has an amputation rate of 6.5 per 1,000.[27]

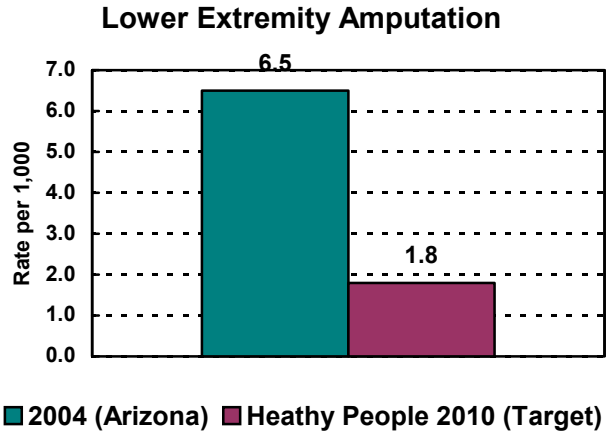

Figure 14. Lower Extremity Amputations, 2004. Source: HDDB, 2004.

ANNUAL GLYCOSYLATED HEMOGLOBIN MEASUREMENT, DILATED EYE EXAMINATIONS, & FOOT EXAMINATIONS

Figure 15 illustrates the proportion of adults with diabetes who had annual foot, dilated eye and glycosylated hemoglobin examinations. Healthy People 2010 targets are 50 percent for annual glycolsolated hemoglobin and 75 percent for both foot and dilated eye examinations. Approximately 68 percent of adults with diabetes had an annual glycosylated hemoglobin measurement, 64 percent had an annual dilated eye exam and 62 percent had an annual foot exam.[27]

These percentages represent weighted data from the Arizona BRFSS 2004.

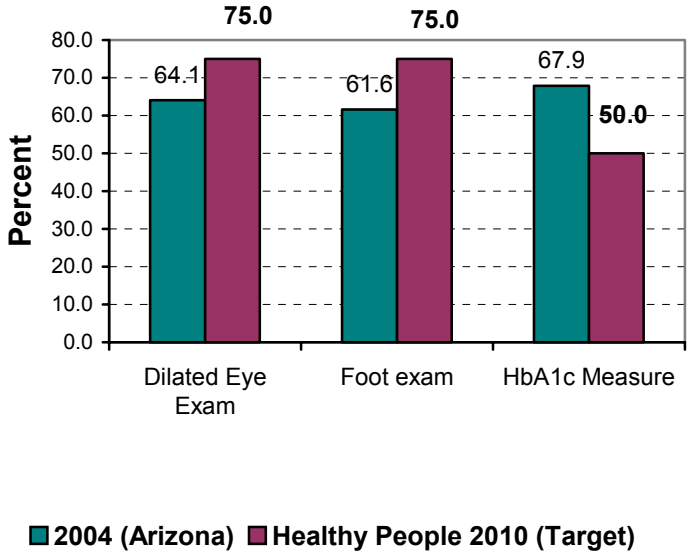

Figure 15. Annual eye, foot and hemoglobin exams, 2004.
Source: BRFSS 2004.

THE OUTLOOK FOR THE YEAR 2020

Figure 16 shows that the number of diabetes cases among adults of 18 years and older is projected to increase from approximately 358,757 in 2004 to over 485,998 in the year 2020 assuming the diabetes prevalence rate remains the same. This estimated 35 percent increase occurs simply because of the growth and aging of the state's population. This information is useful in planning for the services that diabetics will need.

However, these estimates probably *underestimate* the burden that Arizona will face, because the rate is increasing among all racial and ethnic groups. Also, the rate of type 2 diabetes is increasing dramatically among persons in the younger age groups. The reason for this increase is not known, but is possibly related to the epidemic of obesity occurring among children. Type 2 diabetes is thought to be more aggressive when it occurs at a young age.[28] The societal implications of this issue will become a major problem in future decades. A simple system to monitor children's risk factors such as height, weight, and physical activity levels is needed to accurately characterize future diabetes rates.

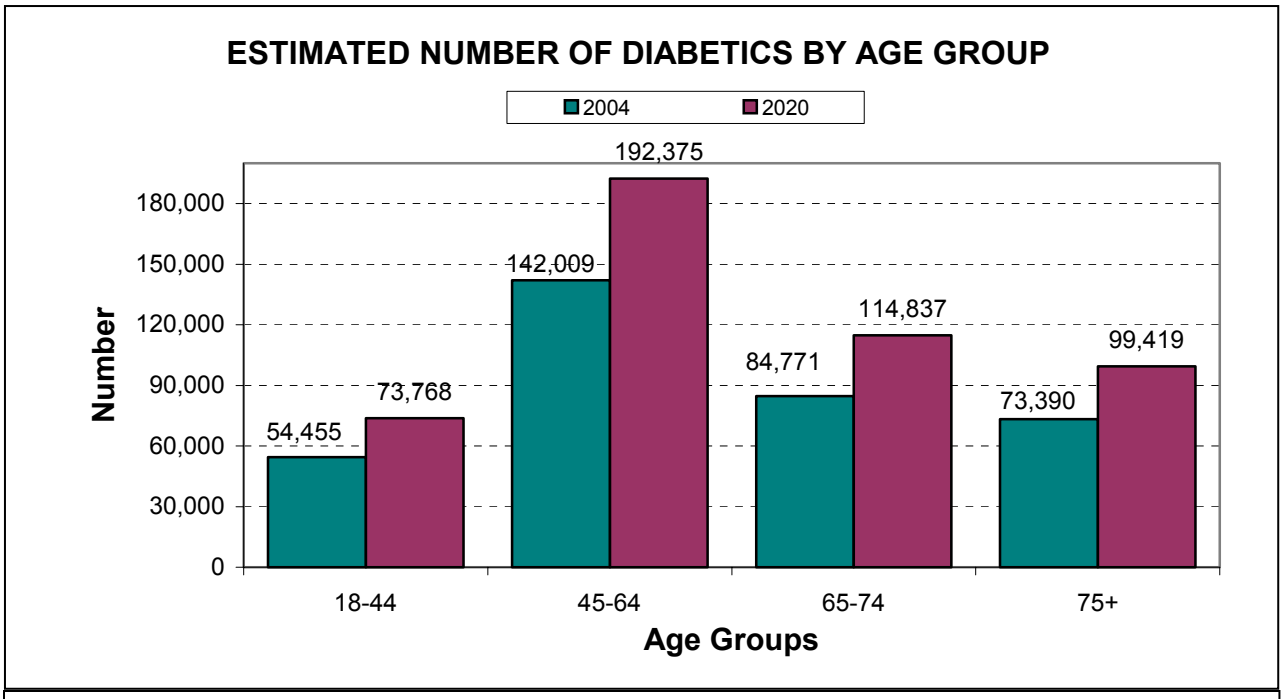

Figure 16. Projection of Arizona's diabetes cases by the year 2020, assuming the prevalence rate remains the same and does not worsen. Based on BRFSS prevalence and population projections, 2004.

CONCLUSIONS

An immense burden to the state's health care delivery systems caused by diabetes in the next decade is looming. If trends continue, diabetes will become a major chronic disease in the 21st century. Arizona must plan now for the increase in resources required to treat patients who already have the disease and must encourage activities now that will delay the onset of complications and prevent diabetes from occurring. In addition to state and county health programs, the findings in this report may also be useful for Arizona's policy makers.

Programs specific to each of the high-risk populations are needed to reduce the increasing incidence and frequency of complications seen in these groups. Public health messages, health care professionals, and health care systems should all encourage behavior changes to achieve a healthy lifestyle. The responsibility for interventions can and should be shared between governmental agencies, the private sector, and other organizations.

RECOMMENDATIONS

During the 2003-2004 fiscal year, the DPCP and the Arizona Diabetes Advisory Council performed an assessment of diabetes-related activities in Arizona based on the Ten Essentials of Public Health. The members involved in this assessment represented a cross cutting group of public and private health care professionals, practitioners, educators, academicians, epidemiologists, lay health workers, and community advocates. The recommendations from the assessment were written in the DPCP's Performance Improvement Plan and covered the 2005-2008 fiscal years.

The recommendations reflect gaps that should be filled, in addition to continuation of diabetes-related activities that already exist in Arizona. The activities listed are suggested steps that may be taken toward fulfilling the recommendations, while the primary responsibilities for the activities will be determined based on DPCP and partner resources and expertise.

Partners that will help in the development and implementation of the activities related to each recommendation include, but are not limited to:

American Diabetes Association

Amputation Risk Reduction Project

Arizona Area Health Education Center

Arizona Department of Corrections

Arizona Department of Health Services

Arizona Diabetes Coalition

Arizona Foundation for the Eye

Arizona Hospital Associations

Arizona Telemedicine Program

Centers for Disease Control and Prevention

Central Arizona Association of Diabetes

Educators

Health Service Advisory Group

Indian Health Services

Inter Tribal Counsel Arizona

Local Health Departments

Mel and Enid Zuckerman College of Public

Health Rural Health Office

National Institutes of Health

American Indian and Hispanic/Latino

partner associations

Southern Arizona Association of Diabetes

Educators

Recommendation	Time line	Measure of success	Activities
Institute quality improvement through evidence-based evaluation procedures.	2005-2008	Evaluation Tool developed and baseline data gathered. Post-training assessment was used to revise curriculum and report of the training was written.	Develop evaluation tool and expected reporting timeline. Coordinate evaluation procedures. Perform train-the-trainer diabetes education programs. Modify and make specific revisions responding to needs of population trained.
Develop multiple channels for health information, education and promotion.	2006-2008	Multiple channels used in disseminating health information education and promotion and included: self-learning, broadcasts, videos, computer-learning where appropriate.	Develop monitoring tool to assess effectiveness. Develop strategies to disseminate and promote health and educational information.
Assist public health systems to develop effective health communication and education strategies.	2006-2008	Network taskforce assembled.	Review systems already in place. Coordinate with health organizations to determine effectiveness of efforts. Develop strategies to assist public health systems.
Work with public health systems to coordinate complementary programs.	2006-2008	Complementary programs identified.	Evaluate and enhance programs already in place.
Provide technical assistance to local health systems in complex or difficult diabetes-related enforcement operations.	2006-2008	Technical assistance to local health departments instituted in state strategic plan.	Evaluation of systems in place. Review systems in place and provider resources for difficult diabetes cases. Develop directory for referrals. Partner with outreach organizations to assist with evaluation of systems in place.
Identify population experiencing emerging diabetes-related health problems (e.g.: type 2 diabetes in children).	2005-2008	Training of trainer on diabetes prevention and control established.	Use YRBS and BRFSS data. Collaborate with partners. Develop monitoring system and plan of action for implementation. Devise tools for monitoring and reporting of information to central information bank.
Establish public health research agenda and collaborate with institutions who perform diabetes research activities.	2006-2008	Research agenda developed. System is based on ADA guidance (public health research criteria).	Collaborate with other organizations to develop a central research and information center. Provide a central place for all diabetes research activities. Collect resources and data on research activities.
Develop statewide diabetes workforce development plan.	2006-2008	Efforts and recommendations related to technical assistance to local health departments were coordinated.	Meet with stated partners to accomplish a plan of action and develop a tool to evaluate successful implementation.

Recommendation	Time line	Measure of success	Activities
Develop cultural competencies among health workforce.	2006-2008	Central education bank developed.	Review competencies already developed and determine appropriateness. Develop central educational bank of materials for workforce personnel. Implement and evaluate effectives of materials and revise as necessary.
Implement statewide health improvement processes that convene partners and facilitate collaboration in diabetes-related activities.	2005-2007	ADA standards of care followed. New/additional partners recruited to council from organizations working in diabetes-related activities not currently represented.	Implement tool for monitoring activities and determine outcome of efforts. Review all diabetes materials and projects to determine areas of further need and areas of success. Recruit new council members.

APPENDIX A: REFERENCE TABLES

Table A-1
Estimated number of Arizonans with diabetes, 2000-2004
Using Arizona BRFSS data

Estimated Total Population 2004	5,832,150
Percent of Arizona adults interviewed who indicated they have been told by a physician or other health care worker that they have diabetes	8.9%
Total Number of Arizonans (all age groups) with Diabetes	519,061

Table A-2
Estimated number of Arizonans with diabetes, 2004
Using BRFSS prevalence rates by age group

Age Group	Estimated Number of Known Diabetics
18 – 44	53,545
45 – 64	107,538
65 – 74	68,915
75+	54,104
Total	**284,102**

Table A-3
Estimated number of Arizonans with diabetes, 2004
Using NHIS (2001) national prevalence rates for adults

Age Group	Estimated Number of Known Diabetics
< 18	1,554
18 – 44	46,051
45 – 64	114,362
65 – 74	70,310
75+	47,688
Total	**279,965**

APPENDIX B: ARIZONA BRFSS TABLES

Table B-1
Arizona BRFSS Diabetes Supplement
Unweighted Data From 2000-2004

The following information includes questions from the diabetes supplement of the Arizona BRFSS, 2000-2004. In five years, 1,525 respondents (8.9%) said that a doctor has told them that they have diabetes, including those who have had diabetes during pregnancy. The following tables are based on those individuals reporting diabetes, but does not include those who were diabetic only during pregnancy.

Are you now taking insulin?

Response	Number	Percent
Yes	319	25%
No	956	75%
Unknown	5	.4%
Total	**1280**	**100%**

About how often do you check your blood for glucose or sugar?

Response	Number	Percent
Never	122	10%
Daily	742	58%
1-2 times per week	127	10%
3-6 times per week	102	8%
1-3 times per month	73	6%
> 3 times per month	15	1%
1-2 times per year	38	3%
> 3 times per year	34	3%
Unknown/Refused	27	2%
Total	**1280**	**100%**

About how many times in the last year has a doctor, nurse or other health professional checked you for glycosolated hemoglobin or hemoglobin A1c?

Response	Number	Percent
1-13 times	907	71%
Never	123	10%
Unknown/Refused	250	20%
Total	**1280**	**100%**

About how many times in the last year has a health professional checked your feet for any sores or irritations?

Response	Number	Percent
1-4 times	688	54%
5-7 times	63	5%
> 7 times	74	6%
Never	402	31%
Unknown/Refused/Missing	53	4%
Total	**1280**	**100%**

When was the last time you had an eye exam in which the pupils were dilated?

Response	Number	Percent
Within last month	324	25%
1-12 months ago	577	45%
1-2 years ago	157	12%
2+ years ago	144	11%
Never	59	5%
Unknown/Refused	19	1%
Total	**1280**	**100%**

APPENDIX C: DIAGNOSTIC CRITERIA

Table 1. Criteria for the Diagnosis of Diabetes Mellitus.

Normoglycemia	IFG or IGT (Pre-Diabetes)	DM*
FPG < 110 mg/dl 2-h PG† < 140 mg/dl	FPG ≥ 100 and < 126 mg/dl (IFG) 2-h PG† ≥ 140 and < 200 mg/dl (IGT)	FGP ≥ 126 mg/dl 2-h PG† ≥ 200 mg/dl Symptoms of DM and casual plasma glucose concentration ≥ 200 mg/dl

DM, diabetes mellitus; FPG, fasting plasma glucose; 2-h PG, 2-h postload glucose.
*A diagnosis of diabetes must be confirmed on a subsequent day by any one of the three methods included in the chart. In clinical settings, the FPG test is greatly preferred because of ease of administration, convenience, acceptability to patients and lower cost. Fasting is defined as no calorie intake for at least eight hours.
†This test requires the use of glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
Source: American Diabetes Association: Clinical Practice Recommendations 2005, Diabetes Care, Volume 28, Supplement 1:S37, January 2005

Table 2. Glycemic Control for People with Diabetes.*

Glycemic control A1C Preprandial plasma glucose Peak postprandial plasma glucose	 <7.0%* 90–130 mg/dl <180 mg/dl
Blood pressure	<130/80 mmHg
Lipids LDL HDL* Triglycerides†	 <100 mg/dl >40 mg/dl <150 mg/dl

Key concepts in setting glycemic goals:

- **GOALS SHOULD BE INDIVIDUALIZED**
- Certain populations (children, pregnant women, and elderly) require special considerations.
- Less intensive glycemic goals may be indicated in patients with severe or frequent hypoglycemia.
- More intensive glycemic goals may further reduce microvascular complications at the cost of increasing hypoglycemia.
- Postprandial glucose may be targeted if A1C goals are not met despite reaching preprandial glucose goals.

Referenced to a non-diabetic range of 4.0–6.0% using a DCCT-based assay.
*For women, it has been suggested that the HDL goal be increased by 10 mg/dl.
†Current NCEP/ATP III guidelines suggest that in patients with triglycerides ≥ 200 mg/dl, the "non-HDL cholesterol" (total cholesterol minus HDL) be utilized. The goal is ≤ 130 mg/dl.
Source: American Diabetes Association: Clinical Practice Recommendations 2005, Diabetes Care, Volume 28, Supplement 1: S37, January 2005

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