DIABETES AND ASSOCIATED COMPLICATIONS IN ARIZONA:

2001 STATUS REPORT

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Arizona Diabetes Prevention and Control Program
Office of Chronic Disease Prevention and Nutrition Services
Public Health Preventive Services
Arizona Department of Health Services

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The mission of the Arizona Department of Health Services is:
Setting the standard for personal and community health through direct care delivery, science, public policy and leadership.

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“It is time for all health professionals to treat diabetes aggressively. It is also time for patients to take their diabetes with utmost seriousness. And it is incumbent upon the health care system to provide the necessary resources for both to be successful. Compromise or acceptance of a disadvantageous and dangerous status quo in people with diabetes should not be tolerated any longer.”

–American Diabetes Association. Position Statement on the Implications of the United Kingdom Prospective Diabetes Study. *Diabetes Care.* V22;suppl 1: Jan1999:s27-31.

“At least 10 million Americans at high risk for type 2 diabetes can sharply lower their chances of getting the disease with diet and exercise, according to the findings of a major clinical trial …”

--HHS Secretary Tommy G. Thompson
August 2001

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SUMMARY

Diabetes will place an immense burden onto Arizona's various health care delivery systems in the next decade. Currently, about 302,518 Arizonans or 5.9 percent of the adult population have been diagnosed with diabetes. In 2001, there were more than 70,000 hospitalizations of persons with diabetes, with hospital charges amounting to more than $1.5 billion. Hospitalization rates are rising, and the average hospital stay for a person with diabetes now costs more than $21,000.

If the current diabetes prevalence rate remains steady, by the year 2020 there will be 450,000 diabetics in our state. However, measures of diabetes prevalence, incidence, 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. Our state's health policy makers must be made aware of the findings in this report and act upon them so that the state's burden of diabetes is lessened.

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.

We will continue to monitor these diabetes indicators to reveal the direction that our control efforts are leading.

ABBREVATIONS

AHCCCS	Arizona Health Care Cost Containment System (Arizona's Medicaid Program)
ADA	American Diabetes Association
ADHS	Arizona Department of Health Services
AMMQEP	Arizona Managed Medicare Quality Enhancement Program
BMI	Body Mass Index
BRFS	Behavioral Risk Factor Survey
CDC	Centers for Disease Control and Prevention
CDE	Certified Diabetes Educator
CHR	Community Health Representative
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.
HMO	Health Maintenance Organization
IHS	Indian Health Service
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
MMWR	Morbidity and Mortality Weekly Report of the CDC
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIH	National Institutes of Health
RD	Registered Dietitian
RPMS	Resource and Patient Management System (of the IHS)
VA	Veterans Affairs
VAH	Veterans Affairs Hospital
WIC	Supplemental Nutrition Program for Women, Infants, and Children

PURPOSE OF THIS DOCUMENT

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

We ask readers to use this report to take action in their respective programs that will lessen the burden of diabetes in our state.

INTRODUCTION

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 glucose in. Without insulin or if it is ineffective in the body, glucose builds up in the bloodstream leading to serious complications.

TWO MAJOR 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 5 percent 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 and Native Americans 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 2 percent to 5 percent of pregnancies and is more prevalent in African Americans, Hispanics and Native Americans. [2]

DIABETES IN THE UNITED STATES

Diabetes poses a significant public health challenge for the United States. According to 2000 United States estimates, approximately 11.1 million individuals of the total population have been diagnosed with diabetes. It is estimated that another 5.9 million individuals have diabetes, but are unaware of their condition, placing the prevalence of diabetes at approximately 6.2 percent of the total population. Every year 1 million people age 20 and older are newly diagnosed with diabetes in United States. [2]

Diabetes is the sixth leading cause of death in the United States. [3] During the year 2000, there were 69,301 certificates with diabetes as the underlying cause of death. The age-adjusted diabetes death rate is 25.2 per 100,000 population. Overall, the risk for death among people with diabetes is about two times that of people without diabetes. However, the increased risk associated with diabetes is greater for younger people (that is, 3.6 times for people aged 25-44 years versus 1.5 for those aged 65-74 years) and women (that is, 2.7 times for women aged 45-64 years versus 2.0 for men in that age group). [2]

Diabetes causes over 500,000 hospital admissions every year equaling 27 million days of hospital stay. Approximately 1.7 percent of all hospitalizations involve diabetes as a primary diagnosis. According to the Centers for Disease Control and Prevention diabetes costs the United States $98 billion annually in medical care and lost wages: $44.1 billion for direct medical costs attributable to diabetes, and $54.1 billion in disability, work loss and premature mortality. In individuals over 65 years of age alone, diabetes costs more than $5 billion. [2] More than 5.8 percent of all health care dollars spent are expended for diabetes care. [3]

It is imperative to reduce costs, hospitalizations and mortality from diabetes and to improve the quality of life for individuals with diabetes. In 1995, House Speaker Newt Gingrich identified diabetes education as a mean of reducing health care costs through the reduction of diabetic complications. A landmark study called, *The Diabetes Control and Complications Trial (DCCT)*, showed that in patients with type 1 diabetes, who have mean blood glucose levels controlled to near normal (defined at the time of the study as 150mg/dl and /or a HbA1c of 7.2%), complications have been reduced by up to 70 percent compared to those who have an elevated blood glucose level (200mg/dl and/or a HbA1c of 9%). [4]

Another large study of type 2 diabetes in Britain, *The United Kingdom Prospective Diabetes Study Group*, showed that tight control of glucose levels results in reduced rates of the complications of diabetes.[5] Most recently, in August 2001, the Diabetes Prevention Program (DPP) demonstrated that diet and exercise can prevent or delay the onset of type 2 diabetes. This latest findings could have a significant effect on reducing the health costs related to diabetes.[6] Prevention is such an important part of the management of diabetes that it is been addressed in the goal of Healthy People 2010 Objectives: “Through prevention programs, reduce the disease and economic burden of diabetes, and improve the quality of life for all persons who have or are at risk for diabetes.”[7]

ARIZONA DEMOGRAPHICS

According to the year 2001 population estimates, the number of Arizona residents has grown to 5,307,331, a 31 percent increase since 1990. Several aspects of the population directly relate to efforts to control diabetes.

ETHNIC DIVERSITY

One of the most challenging characteristics of Arizona's population is its diversity of racial and ethnic groups (**Table 1, Figure 1**). Although four-fifths of the state is 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 Native American tribes of Arizona. Many rural areas of the state carry an increased burden from diabetes because of their ethnic diversity. Hispanics 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. Counties with the highest proportion of Native Americans are Apache and Navajo Counties (76% and 47%, respectively), followed by Coconino, Graham, Gila and La Paz Counties. [8]

Table 1. Population Estimates.

	White, Non-Hispanic	African American	Latino, Hispanic	Native American	Asian	Other	Total
Number	3,387,025	164,344	1,340,240	264,690	102,377	48,655	5,307,331
% of Total Population	63.8%	3.1%	25.3%	5.0%	1.9%	0.9%	100%

Source: *Arizona Health Status and Vital Statistics 2001*, ADHS.

The diverse ethnic make-up of Arizona challenges our health care agencies in terms of collecting data, and in 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 these 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.

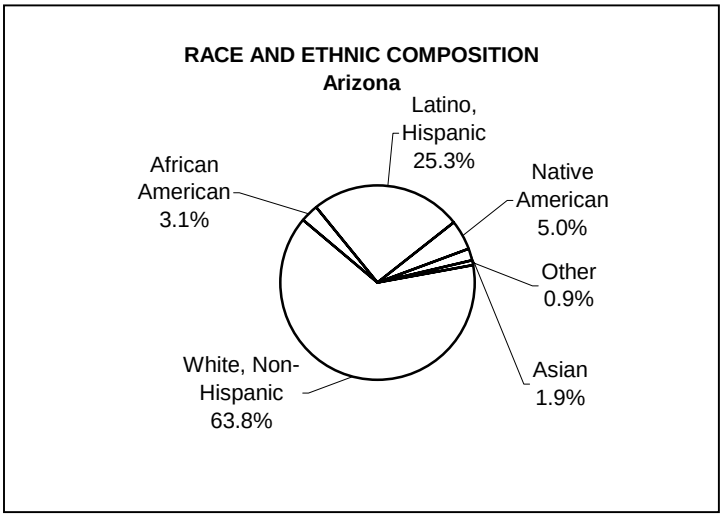

Figure 1. Estimated race and ethnic composition of the resident population, 2001

OLDER ADULTS

Of the total 2001 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 2**). The working-age population economically contributes at least in part to the support of the non-working population.

In 2001, the majority of persons age 65 or more were White/Non-Hispanic (86.7%). The proportions in other groups were: African American (1.5%); Native American (2.1%); Asian (1.0%); and Hispanic (8.3%). [9] 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 163,000 seniors live alone with lack of support systems.

The number of individuals over the age of 65 in Arizona is increasing steadily. In 2001, there were 690,995 individuals (13% of the population) age 65 or older in Arizona. By the year 2020, the number of person's age 65 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, our state has a financial interest in reducing the prevalence of diabetes and its risk factors.

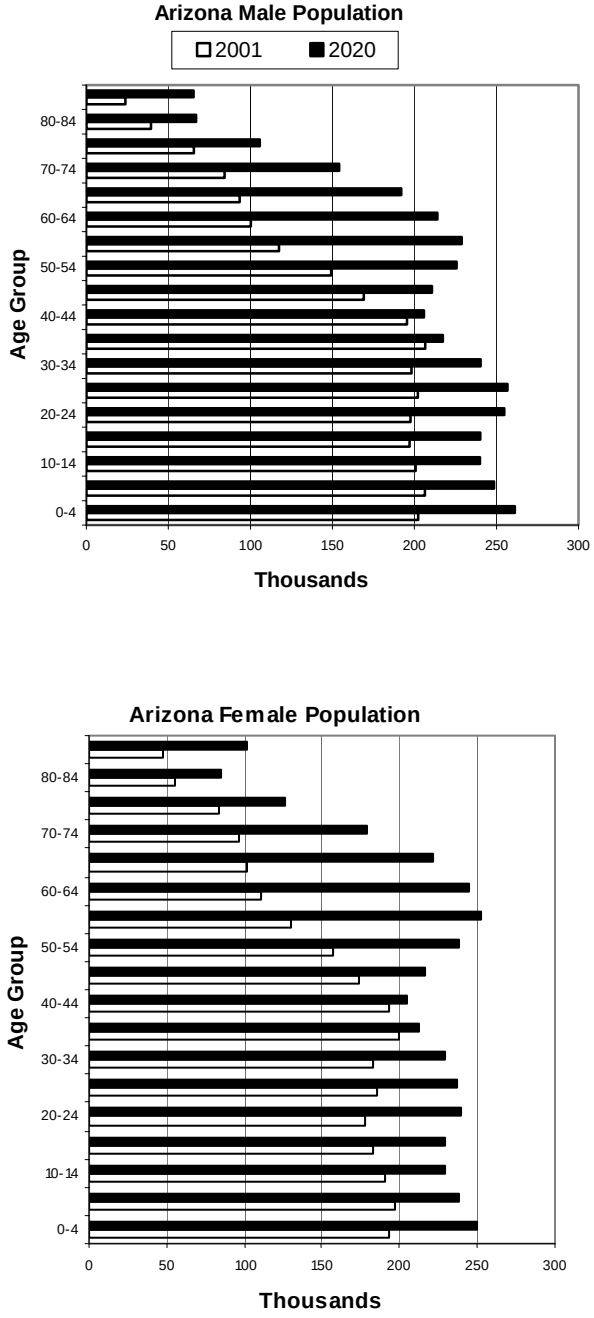

Figure 2. Projected age profile of Arizona's population, 2001 and 2020. Source: U.S. Census 2000 and *Arizona Population Projections 1997 – 2050*, ADES Population Statistics Unit, February 1997.

DATA SOURCES

This report identifies existing data sets that can contribute to the monitoring of diabetes and its complication. These data sets include the Behavioral Risk Factor Surveillance System (BRFSS) diabetes subset, databases maintained by the Indian Health Service, hospital discharge data sets, 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.

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS diabetes subset data has limited usefulness due to its small sample size, which affects its reliability and validity. Further, the survey is self-reported, only reaches individuals with telephone service, and reaches only a small number of diabetics in Arizona (e.g., 238 in 2001). There are biases in the BRFSS diabetes subset data specific to Arizona. Due to the rural nature of our state and the fact that large numbers of border Hispanics 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 under-counted, despite the current practice of over-sampling.

The BRFSS is a random-sample telephone survey conducted annually in all fifty states by state health departments in collaboration with the Centers for Disease Control and Prevention (CDC). Each year, about 2,400 adult Arizonans (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.

Every year, around 140 of the 2,400 Arizona adults interviewed answer 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 seven years (1995-2001).

Nevertheless, 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 physical activity, smoking, diet, and other behaviors, which predispose a person to developing diabetes and its complications.

Indian Health Service Data

Within the Indian Health Service, data are collected on RPMS (Resource and Patient Management System) 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.

In-patient discharge data are stored additionally in a series of databases also managed by the same IHS office. Tribes now are 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 probably increase.

The **National Institutes of Health (NIH)** conduct research in Arizona in at least two 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. [10] 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. [11] Among their many programs, ITCA has established a tribal Epidemiology Center that compiles data on diabetes in American Indians. One source of their data is the RPMS of the IHS (described above).

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, Nutrition Surveillance System. [12]

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 Veterans Affairs Hospital, Military Hospitals, and Indian Health Service Hospitals (which maintain their own data). Of the data currently available, hospital discharge data is 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, which 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 the state. 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.

Clinical Monitoring Systems

Diabetes is suitable for clinical management. In many respects the term "managed disease" describes the ideal approach. Monitoring the performance of clinicians can play a valuable role in managing diabetes successfully. At the present time, it is a fairly labor-intensive activity to review the charts of patients with diabetes to determine whether they have received the care recommended by the American Diabetes Association. However, many of the HMOs in Arizona have expressed interest in measuring and documenting the performance of their providers with regards to diabetes care. The IHS also has pioneered various indicators of performance and outcome with respect to diabetic patients within their health care delivery system.

In 1995, the Health Services Advisory Group, Inc (HSAG) published a report for the Arizona Managed Medicare Quality Enhancement Program (AMMQEP). [13] Based on Medicare Fee for Services data collected from July 1999 to June 2001, almost 71 percent of the physicians monitored their patient's HgbA1c level at least every 12 months. Only 64 percent of patients received biennial eye exam and 73 percent biennial lipid test.[14]

Other Sources

There are several Community Health Centers (CHCs) in Arizona that are participating in the Diabetes Collaborative, an initiative sponsored by the Centers for Disease Control (CDC) and Health Resource Services Administration (HRSA). The Arizona Department of Health Services and the Diabetes Prevention and Control Program are anticipating that data collected by the health centers in the Diabetes Collaborative can be published in the next report. Their data is extremely important due to the fact that they provide primary care to a large majority of the uninsured population in Arizona. We welcome their data to help us monitor diabetes and to be able to measure progress in controlling the complications.

THE BURDEN OF DIABETES IN ARIZONA

CHARACTERISTICS OF PEOPLE WITH DIABETES

According to the Arizona Behavioral Risk Factor Survey (BRFS), 1995-2001, about 6 percent of all Arizonans reported that they were told they have diabetes. For 2001, this translates to at least 302,518 Arizonans with diabetes. It is difficult to obtain exact figures for diabetes prevalence because there is no 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. [15]

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 55 for the overall population of Arizona (**Figure 3**).

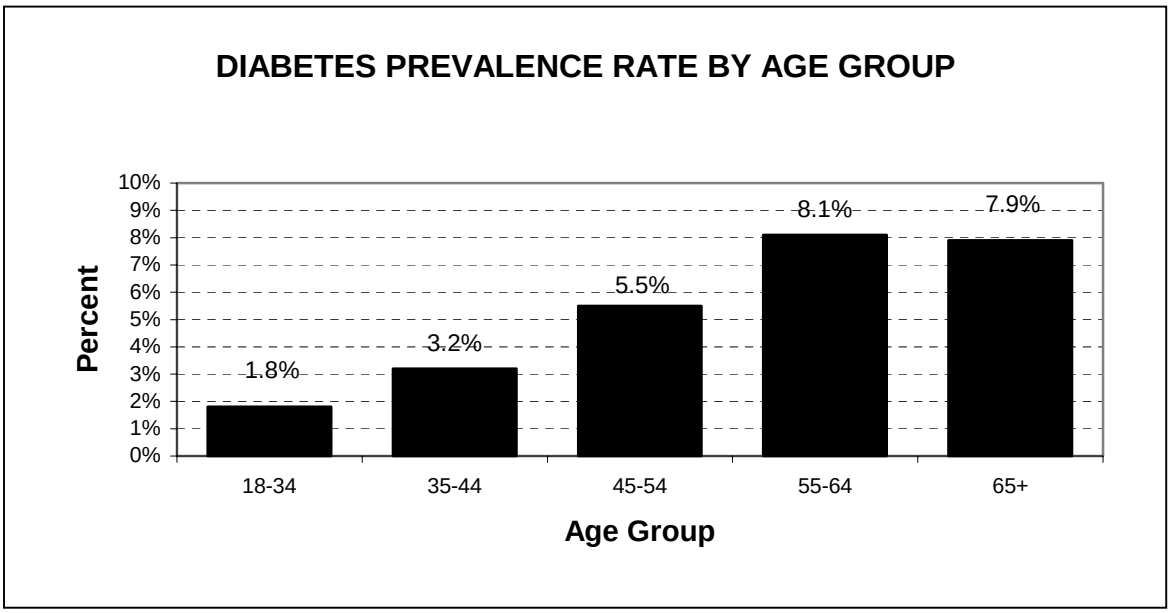

Figure 3. Prevalence of Diabetes in Arizonans, 1995-2001. Source: *Arizona BRFS*, 1995-2001.

- Family members of persons with diabetes are at greater risk of developing diabetes.

- Native Americans, African Americans, and Hispanics are more likely to develop type 2 diabetes than the population as a whole. Experts in the field believe that Native Americans are about four times as likely as the general population to develop diabetes. African Americans are also at increased risk, but few data are available to quantify this increased risk in Arizona. Arizona's 2001 BRFS report shows that Hispanics are 2 times as likely as non-Hispanic Whites to be diagnosed with diabetes.

- 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. [16]

- 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. Socioeconomic Indicators by Diabetes Status, 1995-2001.

Indicator	Respondents With Diabetes	Respondents Without Diabetes
Annual Income Under $20,000	23.6%	14.3%
Education Less Than High School Graduate	22.0%	10.3%
Not Employed	65.5%	45.4%

Source: ***Arizona BRFS, 1995-2001.***

RISK FACTORS

The underlying cause or causes of type 1 diabetes are not known. Studies that have been conducted linked factors to an increase risk that includes: viral infection, certain genetic patterns, season of the year, birth order, and nutrition. Breast-feeding appears to be a protective factor for the child. However, no definitive cause has been identified. [17] Similarly, the 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 called the Diabetes Prevention Program (DPP) was conducted on 3,234 people who were overweight and had impaired glucose tolerance (IGT). Participants were assigned to three groups: *Lifestyle changes group*: By lowering the intake of fat and calories and exercising 150 minutes a week the aim was to lower body weight by 7 percent; *Metformin group*: this group was given 850 milligrams of the oral diabetes medication metformin (glucophage) twice a day. This group also received information on diet and exercise. *Placebo group*: this group took placebo pills in place of metformin and also received information on diet and exercise.

The results of the Diabetes Prevention Program (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 can sharply delay and possibly prevent type 2 diabetes. Specifically, diet and exercise, which resulted in a 5-7 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.

Arizonans with diabetes tend to be less active and more likely to be obese than those without diabetes (**Table 3**). Diabetics are more likely to be smokers; 51.4 percent still smoke and risk the accelerated damage to their blood vessels.

Table 3. Health Indicators by Diabetes Status, 1995-2001.

Indicator	Respondents With Diabetes	Respondents Without Diabetes
Sedentary Lifestyle	40.8%	33.6%
Obese (BMI $\geq$ 30)	50.0%	32.5%
Smoker (Has smoked at least 100 cigarettes or is a current smoker)	51.4%	43.0%
High Blood Pressure	43.5%	19.8%
High Cholesterol	39.3%	29.4%

Source: ***Arizona BRFS, 1995-2001.***

Recently, type 2 diabetes has been discovered with alarming frequency in children. Previously type 2 was virtually non-existent in children. The reasons for this increase is not well understood. In Arizona, there is no 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 6-8) and senior high schools (grades 9-12), is the Centers for Disease Control and Prevention's "Youth Risk Behavior Survey" (YRBS). This survey is scheduled to implement in Arizona schools in 2003.

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 is not required for high school students. Yet, 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 the state's public health system measures the risk factors for diabetes through the adult BRFS (described in Page 11).

DIABETES PREVALENCE

There is no definitive source to determine the precise number of persons who have diabetes in Arizona. That is to say, there is no central registry of this common disease, nor is there a comprehensive data source that counts all cases in the state. Few counties have the resources to conduct studies of diabetes prevalence within their jurisdictions. One such survey was a Chronic Disease Needs Assessment conducted by Maricopa County among 1,000 participants, 50 years of age or older. The respondents were of low income and 33 percent were Hispanic. In this survey, 18 percent said a doctor had told them that they had diabetes or "high blood sugar." We are not aware of other county-specific surveys of diabetes prevalence.

Several sources can **estimate** the number of diabetics: the Arizona Behavioral Risk Factor Survey (BRFS), the National Health Interview Survey (NHIS), and the National Health, Nutrition, and Examination Survey (NHANES).[15] 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 our state (**Table 4**). The estimate computations are presented in **Appendix A**.

Table 4. Estimated Prevalence of Diabetes in Arizona, 2001, Using three data sources.

Survey Instrument	Statewide Estimated (Number)	Survey Methodology and Limitations
Arizona BRFS	**302,518**	The BRFS interviewed 17,122 state residents with telephones during 1995 – 2001; this estimates the number of Arizonans 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	**165,793**	The NHIS was a random sample of US adults in 1994 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.
NHANES	**269,202**	The most recent NHANES began in 1999. Every year, approximately 7,000 individuals, of all ages, are interviewed in their homes; of these approximately 5,000 complete the health examination component of the survey. This figure estimates the total number who said a physician or other health care worker has told them that they have diabetes (205,254 adults age 20 and older, 63,948 less than 20 years old).

Using the BRFS data we have a better estimate of the number of persons who would self-identify as having diabetes by county (**Table 5**). These estimates are derived from the state rate, which probably underestimate the prevalence among rural areas.

Table 5. Synthetic Estimates of the Number of Self-Identified Diabetics, 2001, Using the BRFS Prevalence Rates by Age Group and County.

County	Total	18-44	45-64	65-74	75+
Apache	2,622	498	1,230	581	313
Cochise	6,355	884	2,709	1,744	1,018
Coconino	4,721	1,080	2,338	859	444
Gila	3,206	309	1,305	973	619
Graham	1,494	275	600	369	250
Greenlee	372	62	180	83	47
La Paz	1,422	110	504	553	255
Maricopa	146,514	27,901	60,655	33,184	24,774
Mohave	10,372	1,008	4,151	3,363	1,850
Navajo	4,265	718	1,963	1,053	531
Pima	44,235	7,125	18,133	10,876	8,101
Pinal	10,381	1,428	4,113	3,195	1,645
Santa Cruz	1,746	290	790	418	248
Yavapai	11,715	1,088	4,611	3,587	2,429
Yuma	8,522	1,235	2,993	2,777	1,517
Arizona	**257,942**	**44,011**	**106,179**	**63,615**	**44,041**

UNDIAGNOSED DIABETES IN ARIZONA

Diabetes is often a silent disease 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. Oftentimes, these complications are the first indication that diabetes is present.

It is now estimated that for every two persons diagnosed with diabetes there is another person who has it, but has not yet been diagnosed. Recently, the American Diabetes Association changed the criteria for diagnosing diabetes and a related condition called Impaired Glucose Tolerance (IGT). The threshold for diagnosis now 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.

COMPLICATIONS OF DIABETES

The elevated blood glucose levels associated with diabetes lead to pathologic changes in many organs throughout the body. [18] Many of these changes can be delayed or prevented by strictly monitoring and controlling the level of glucose in persons with type 1 diabetes. [3] Similar beneficial findings have been shown for persons with type 2 diabetes. [4] A model of earlier age screening and treatment, beginning at age 25, showed benefits in terms of fewer complications and improved quality of life. [19]

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). Of the 2001 Arizona nonfederal hospital admissions there were 120 admissions with primary discharge of Hyperglycemia (ICD-9=250.3x) and 1,571 admissions with primary discharge of Hypoglycemia (ICD-9=250.8x).

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 5 millimeters or more.[2] Although this is a common health condition, there is no registry to quantify the magnitude of the problem in Arizona.

Eye Disease

Diabetes is the leading cause of blindness in the United States in the working age-group, 20-74 years old. The damage to the eye is caused in large part by proliferative diabetic retinopathy and macular edema. The DCCT showed that retinopathy can be substantially prevented or delayed by good glucose control. An annual dilated eye exam may help prevent vision loss by leading to early detection of retinopathy. More than half of diabetic persons in the U.S. are not getting yearly-dilated eye exams. Timely treatment, usually by laser, is effective both medically and financially. It is estimated that at least 60 percent of the cases of blindness can be prevented. [20] Based on the 2000 National Eye Institute report, there were 98,592 cases of diabetic retinopathy among Arizonans 40 years of age and older.

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 2001 more than 1,800 Arizonans with diabetes progressed to the point where renal failure requires dialysis. About 54 percent of the patients on renal dialysis have diabetes. In 2001, there were 236 Arizonans with diabetes who received kidney transplants. There were 680 Arizonans who died of end stage renal disease related to their diabetes in 2001. [21] ESRD is estimated to cost $68,131 per year per patient. [25]

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. Four ways to bring blood pressure down are losing weight, eating less salt, avoiding alcohol and tobacco and regular exercise. 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 cardiovascular disease compared to persons without diabetes. In Arizona, 31 percent of the 2001 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, high blood pressure, cholesterol and lipids, and low dose aspirin therapy. 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 also can reduce the risk for stroke.

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.[2] There are no accurate measures of the prevalence of these complications in Arizona.

Foot Problems

Amputation of a toe, foot, or leg is a late-stage complication of diabetes. In Arizona, there were 1,126 diabetes-related lower extremity amputations (LEAs) among hospitalized patients at non-federal hospitals in 2001. *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.

Among Native Americans in southern Arizona, the prevalence of lower extremity amputations in adults (age 18 or older) with type 2 diabetes was reported to be 10.3 percent in 1985-1986. [22] In a study published in 1993, the average annual age-adjusted incidence rates of all LEAs among diabetic subjects in the IHS Tucson Area (240.8 per 10,000) and Phoenix Area (203.1 per 10,000) were substantially higher than rates for the US (73.1 per 10,000), Navajo (74.0 per 10,000) and Oklahoma (87.3 per 10,000) IHS Areas. [23]

Currently, we are unable to produce similar data for other race or ethnic groups because no system is in place to monitor this problem. A few studies have looked at this topic and may be useful for reference in the reporting of evaluation indicators. [24]

Emerging Issues

Other interventions are now emerging to reduce co-morbidity among diabetics. These include vaccination against influenza, reduction of cigarette smoking, aspirin therapy to prevent heart disease, and 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 the following table, which has been compiled from various sources.

Table 6. Summary of Diabetes Complications, 2001

DIABETES-RELATED CONDITION	NUMBER IN 2001	INFORMATION SOURCE
Lower Extremity Amputation	1,126	Arizona Hospital Discharge Data, 2001 (nonfederal facilities)
End Stage Renal Disease, new cases	1,815	Inter-Mountain Region
Blindness, new cases	558	Estimates, using Diabetes-Sight.org
Hospitalizations, nonfederal facilities Hospitalizations for Diabetes as Primary Diagnoses Hospitalizations due to Disease of the Circulatory System	70,278 7,413 21,411	Arizona Hospital Discharge Data, 2001 (nonfederal facilities)

Data sources described in the preceding text.

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.

In 2001, about 2.2 percent of all births in Arizona were to mothers with diabetes, less than the national estimate of four percent. 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 (Native Americans, Hispanics, African Americans). The rate of both pre-existing and gestational diabetes during pregnancy increases steadily with age of the mother (**Figure 4**). During the past ten years, a decrease in the rate of newborns weighing over 4,000 grams is noted (**Table 7**).

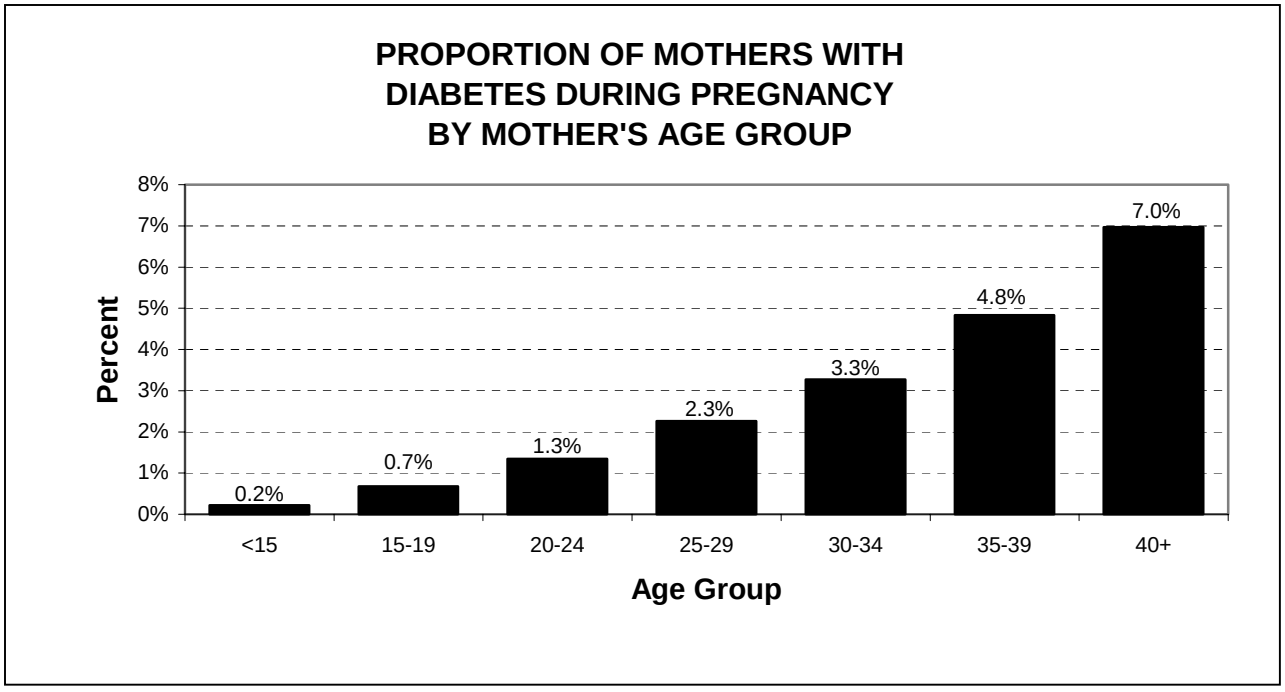

Figure 4. **Prevalence of diabetes (chronic or gestational) by mother's age group, 1989 – 2001, all races. Source: *Arizona Health Status and Vital Statistics 1989-2001*, ADHS.**

Table 7. Births of Infants over 4,000 Grams, 1991 – 2001, All races.

YEAR	NUMBER	RATE PER 1,000 LIVE BIRTHS
1991	6,493	95
1992	6,247	91
1993	6,149	89
1994	6,348	90
1995	6,505	90
1996	6,506	94
1997	6,686	88
1998	6,900	89
1999	6,567	82
2000	6,796	80
2001	7,297	86

Source: Arizona Health Status and Vital Statistics 1991-2001, ADHS.

Among Native Americans receiving WIC services from October 2001 to September 2002 through the Inter Tribal Council of Arizona, the rate of self-reported diabetes during pregnancy ranges from 1.6 percent to 3.0 percent, depending on the population served. [12] In the 2001 Arizona WIC services, 4.5 percent of the clients reported to previously been diagnosed with diabetes or to have gestational diabetes during their last pregnancy.

HOSPITALIZATION DATA

NONFEDERAL FACILITIES

The Hospital Discharge Data Base (HDDB) compiled by ADHS provides valuable information about the impact of diabetes in Arizona. This database contains data about discharges from nonfederal hospitals. As shown in **Table 8**, there were 70,278 diabetes-related 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 322,112 days of hospital stay in 2001. As also shown in the table, the proportion of discharges that include diabetes as a primary or co-morbid condition now exceeds 11 percent.

Table 8. Hospital Discharges for Diabetes-Related Diagnosis, Non-Federal Facilities Only, 1991-2001.

Year of Discharge	Diabetes Discharges (Number)	Diabetes Discharge Rate*	Average Length Stay (Days)	Total Charges
1991	28,783	67.4	6.3	$327,563,452
1992	33,036	76.7	6.1	$402,768,934
1993	32,758	74.8	5.8	$429,237,924
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

Source: HDDB, 1991-2001.

*Diabetes-related discharges per 1,000 discharges from all causes.

On a population basis, discharges due to diabetes as the primary diagnosis also have increased year after year. During 2001 in Arizona, there were 7,413 hospital discharges with diabetes as the primary diagnosis (i.e., the first-listed diagnosis, and the primary illness treated during the hospital stay, ICD-9-CM code=250.xx). A 46 percent increase in hospitalization rates between 1991 and 2001 is shown in **Figure 5**.

The hospitalization rate differs considerably among Arizona's 15 counties (**Table 9**). Since 1991, Pima, Pinal, and Yuma Counties have had discharge rates that are consistently higher than the state rate. Counties, such as Apache, Graham, Greenlee and Santa Cruz demonstrate a marked percent increase in hospitalization rates since 1991 as well.

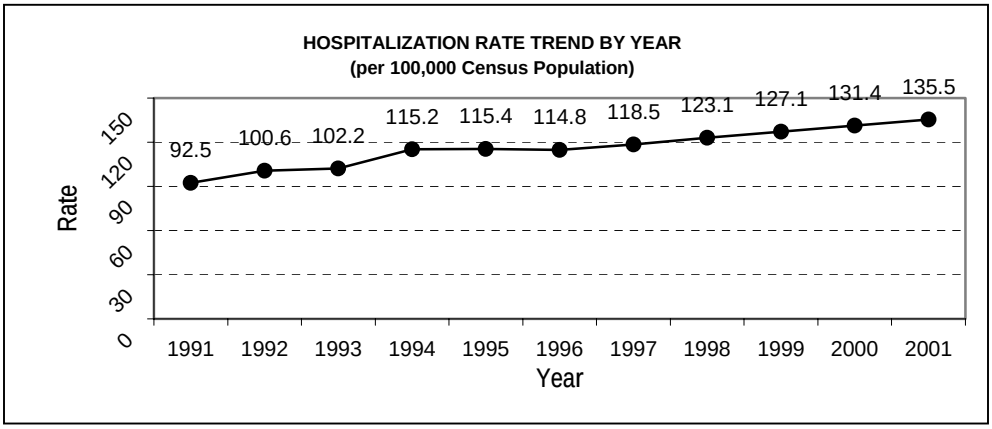

Figure 5. Hospitalization rate (per 100,000 census population), all counties combined, for diabetes as the primary discharge diagnosis, nonfederal facilities only, 1991-2001. Source: HDDB, 1991-2001.

Table 9. Hospitalization Rate (per 100,000 census population) for Diabetes as the Primary Diagnosis at Discharge, Non-federal Facilities Only, 1991-2001.

Counties	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Apache	12.8	17.5	21.8	19.8	45.7	47.8	76.3	87.4	58.3	103.7	94.4
Cochise	58.8	60.6	74.6	83.5	93.3	135.0	112.8	151.9	164.6	145.2	138.3
Coconino	63.3	74.3	86.4	80.3	85.0	73.0	91.1	104.4	97.7	127.2	132.0
Gila	80.2	61.5	82.8	145.4	166.7	103.5	166.5	156.6	109.7	185.1	194.6
Graham	14.7	32.6	38.7	55.4	317.4	133.2	196.5	279.5	167.8	92.6	205.5
Greenlee	60.1	103.7	22.5	99.9	163.2	53.6	112.7	241.1	281.8	117.0	197.9
La Paz	94.1	79.9	101.0	163.0	203.1	124.2	181.6	168.4	119.5	96.4	175.6
Maricopa	87.9	93.5	92.0	104.8	99.9	99.1	93.7	110.1	118.3	119.4	124.8
Mohave	128.2	115.5	97.2	99.5	110.6	118.8	123.5	124.8	121.0	142.6	139.2
Navajo	55.8	63.2	82.0	82.5	96.2	104.3	109.8	129.7	134.9	161.1	129.3
Pima	102.1	116.4	110.7	126.6	120.5	130.1	129.2	140.1	142.7	154.0	156.1
Pinal	151.5	178.1	223.9	257.2	141.6	243.8	192.9	216.3	208.6	210.3	177.2
Santa Cruz	80.1	119.9	182.1	146.7	112.7	157.0	170.6	119.0	117.6	156.3	188.2
Yavapai	72.3	90.2	77.0	95.5	93.0	113.4	107.0	111.1	98.8	103.3	140.3
Yuma	104.8	122.6	123.7	122.3	135.5	134.2	157.8	130.2	164.7	148.1	145.2
Arizona	**92.5**	**100.6**	**102.2**	**115.2**	**115.4**	**114.8**	**118.5**	**123.1**	**127.1**	**131.4**	**135.5**

Source: HDDB, 1991-2001.

Discharge rates differ markedly among race and ethnic groups. Native Americans have the highest rate followed by African Americans and Hispanics (**Figure 6**). Native Americans who were treated in nonfederal facilities are included in the figure; however, Native Americans seen only at IHS facilities are not included in the figure (see page 35). Similarly, veterans who received care only at V.A. facilities are not shown.

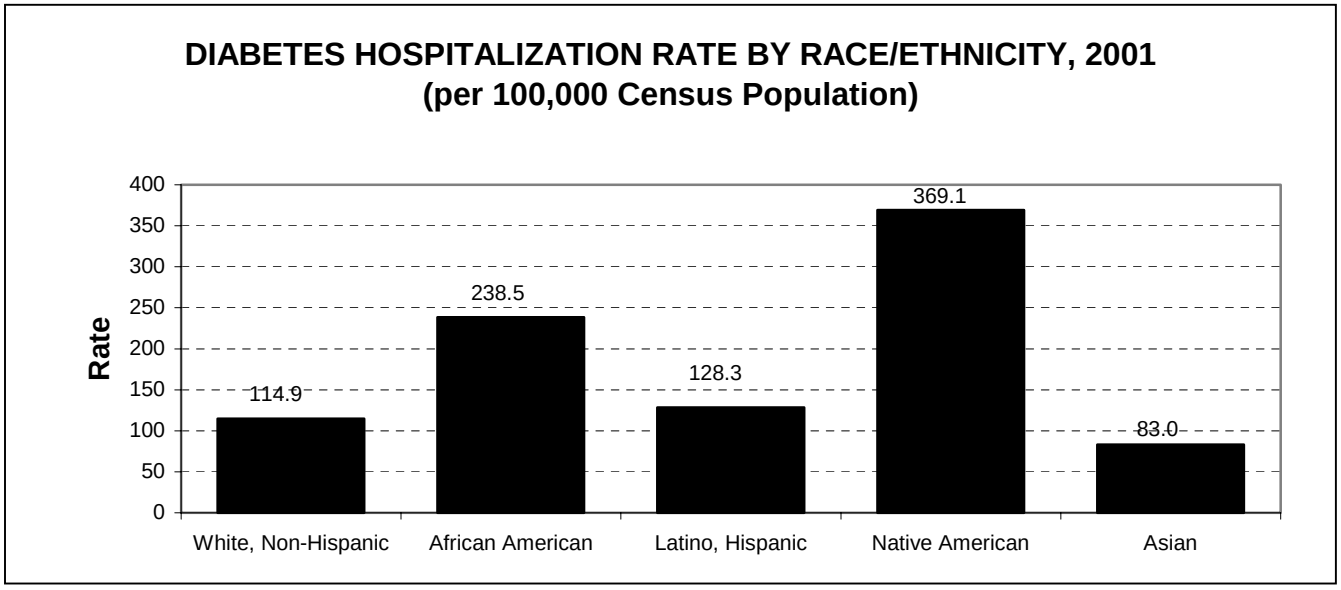

Figure 6. Hospitalization rate (per 100,000 census population) for diabetes as the primary discharge diagnosis, nonfederal facilities only, 2001. Source: HDDB, 2001.

Age-specific discharge rates, by race, for the HDDB reveal an expected pattern among the older age groups (**Figure 7**). However, we also see an elevated rate among Native American and Hispanics.

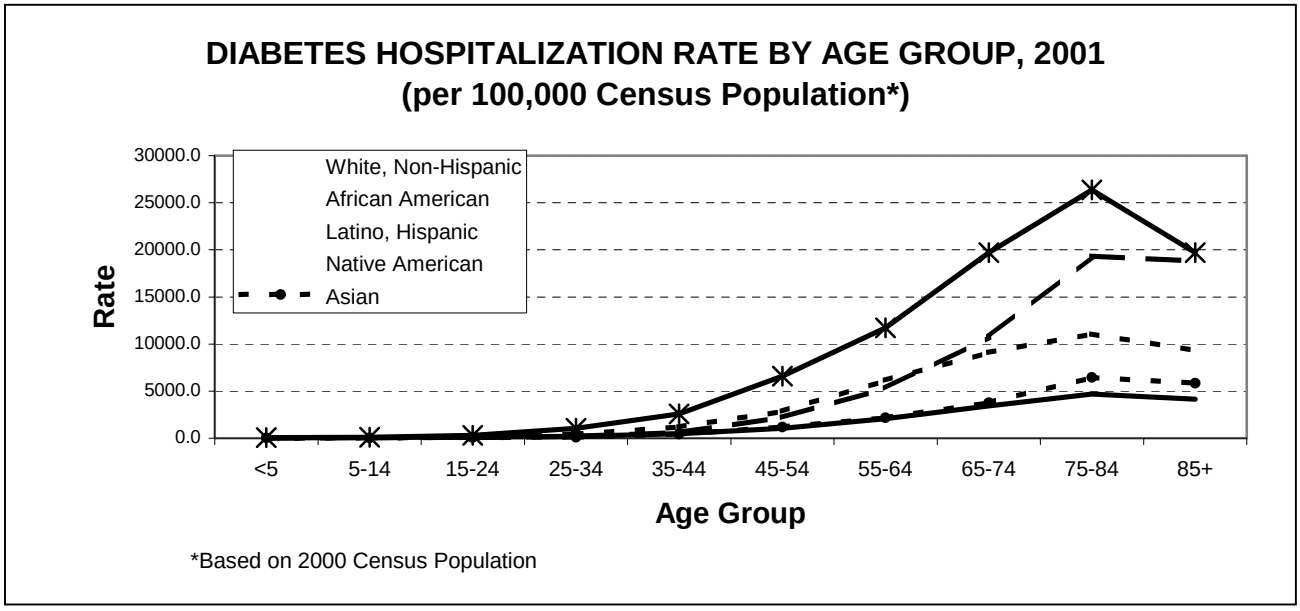

Figure 7. Age-specific hospitalization rates (per 100,000 census population), by race, for diabetes-related discharge diagnosis, nonfederal facilities only, 2001. Source: HDDB, 2001.

As calculated from **Table 8**, the average cost upon discharge has increased from $11,380 during 1991 to $18,041 in 2001. In 2001, AHCCCS incurred 14 percent (nearly $208 million) of the charges (**Figure 8**). Medicare paid 37.2 percent of all diabetes hospitalizations, totaling over $553 million. HMOs were the third largest payer with 13.6 percent of the cost, $202 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 Veterans Administration hospitals.

Figure 8. Payers of hospital charges for diabetes-related discharge diagnosis, nonfederal facilities only, 2001. Source: HDDB, 2001.

Diabetes is an increasing problem in the population 21 years of age and younger. In 2001, diabetes-related discharges in persons age 15-19 accounted for 37 percent of the hospital charges for age 21 and younger. The average spent per discharge of persons age 21 and younger is $11,611. **Figure 9** shows hospital discharges and costs among children age 21 and younger at nonfederal facilities.

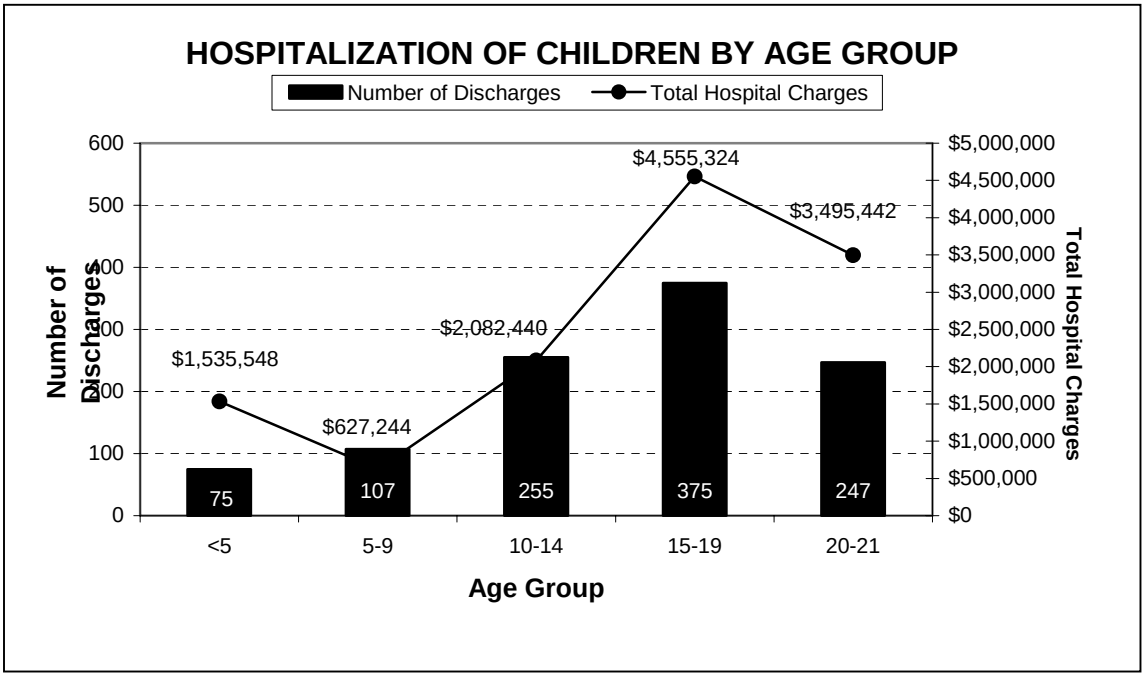

Figure 9. Hospital discharges for children age 21 and younger for diabetes-related discharge diagnosis, nonfederal facilities only, 2001. Source: HDDB, 2001.

The cost of hospitalization has risen dramatically. In 2001, hospital charges for the 70,278 discharges from nonfederal facilities exceeded $1 billion. Of the amount spent during 2001, the majority of the costs were spent for circulatory system complications ($555 million). The cost of other complications is shown in **Figure 10**.

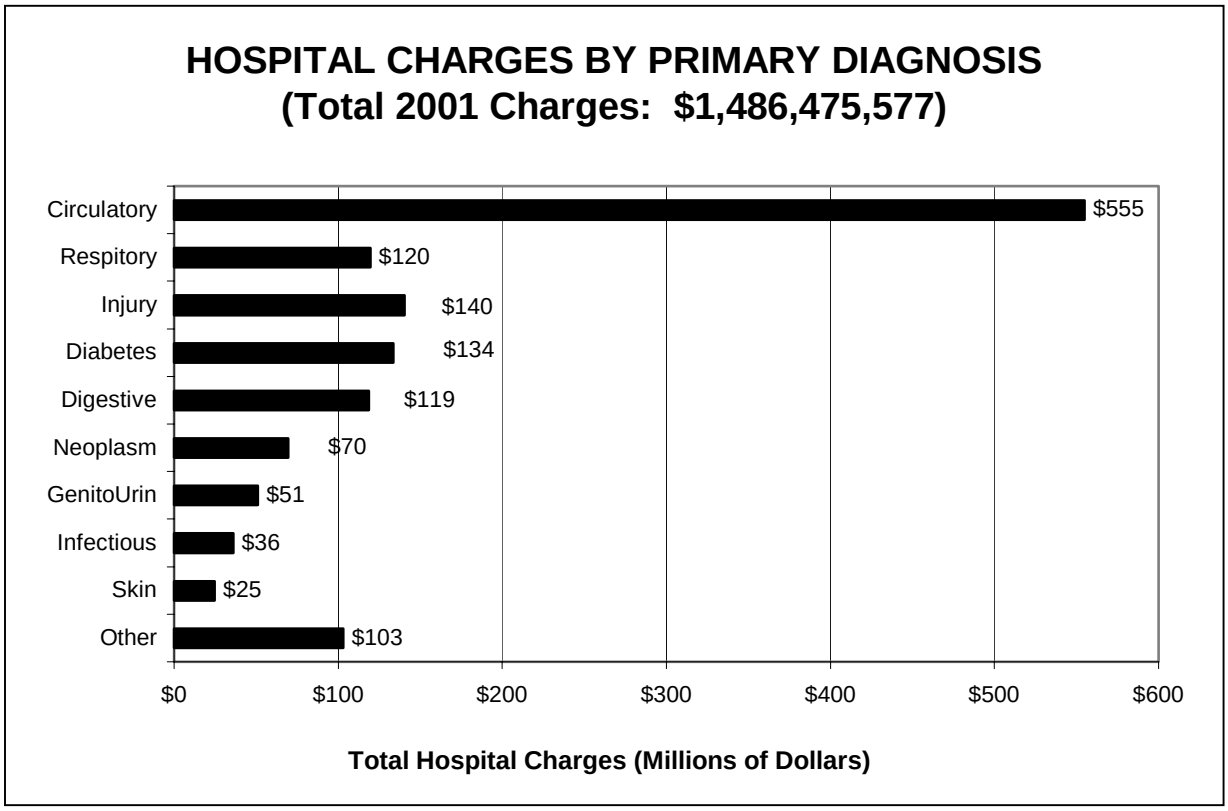

Figure 10. Hospital charges, by primary diagnosis, for diabetes-related discharge diagnosis, nonfederal facilities only, 2001. Source: HDDB, 2001.

FEDERAL FACILITIES

Federally managed facilities now collect hospitalization data in a manner similar to the HDDB described above. Until now, there has been little sharing of these data between the state and federal governments. There are many reasons for this, but mainly the health care systems function, for the most part, independently of each other. In general, the federal systems were established to serve persons to whom the federal government was obliged to provide comprehensive medical care. Examples of groups to whom federal hospital services are provided include military veterans with service-connected injuries, American Indians residing on federal reservations, and persons serving in the various branches of the armed forces. The eligibility criteria for receiving federal health care service are complex and have changed over the past decade.

Federal hospitals in Arizona are run by three distinct federal agencies; each agency also has multiple hospitals with their own geographic areas of coverage. This report does not have data from all the federal agencies or areas. However, the data below adds an important perspective about the burden of diabetes among persons who receive care at federal facilities.

VETERANS ADMINISTRATION

The Phoenix Veterans Administration Medical Center VAMC serves veterans living mostly in central Arizona. During 2001 a total of 43,129 veterans used the services of the Phoenix Area center. For this report, the center has provided data about persons discharged from their facility with a diagnosis of diabetes between fiscal year 1994 and 2001. [25] Data from the Phoenix VAMC serves as a model for how federal data can provide a more accurate picture of diabetes in Arizona. Keep in mind, however, that the following data do not include services provided by the Tucson or Prescott VA centers.

Table 10. Discharge Data for Arizona Veterans with Diabetes, FY 94 – FY 01.

Fiscal Year	Unduplicated Persons Discharged with Diabetes	Discharges for All Med. & Surg. Causes	Number of Discharges for Diabetes*	Diabetes Discharge Rate**	Average Length of Stay (Days)
1994	992	7,380	1,630	220.9	10.9
1995	1,026	7,500	1,662	221.6	10.3
1996	1,059	8,133	1,767	217.3	8.8
1997	974	7,424	1,605	216.2	6.7
1998	1,003	7,258	1,645	226.6	5.6
1999	920	6,179	1,545	250.0	6.6
2000	958	6,854	1,490	217.0	7
2001	1020	6,838	1,512	221.0	5.9

Source: Phoenix VAH, March 2003, from KLF MENU Planning Market Report.
*A person is counted more than once here if admitted multiple times. Consists of primary and secondary diagnoses of diabetes.
**Number of diabetes discharges per 1,000 discharges from all causes

The number of veterans discharged from the Phoenix hospital for a diabetes-related diagnosis is shown in **Table 10**. The rates shown above are not age-adjusted and thus are not comparable to the rates shown for non-federal hospitals.

The Phoenix VAH tends to draw most of its patients from Maricopa county; however, a significant number of patients come from other counties and even other states (**Figure 11**). A wide coverage area often poses problems in transportation to and from the hospital, and sometimes enters into decisions about length of stay in a hospital.

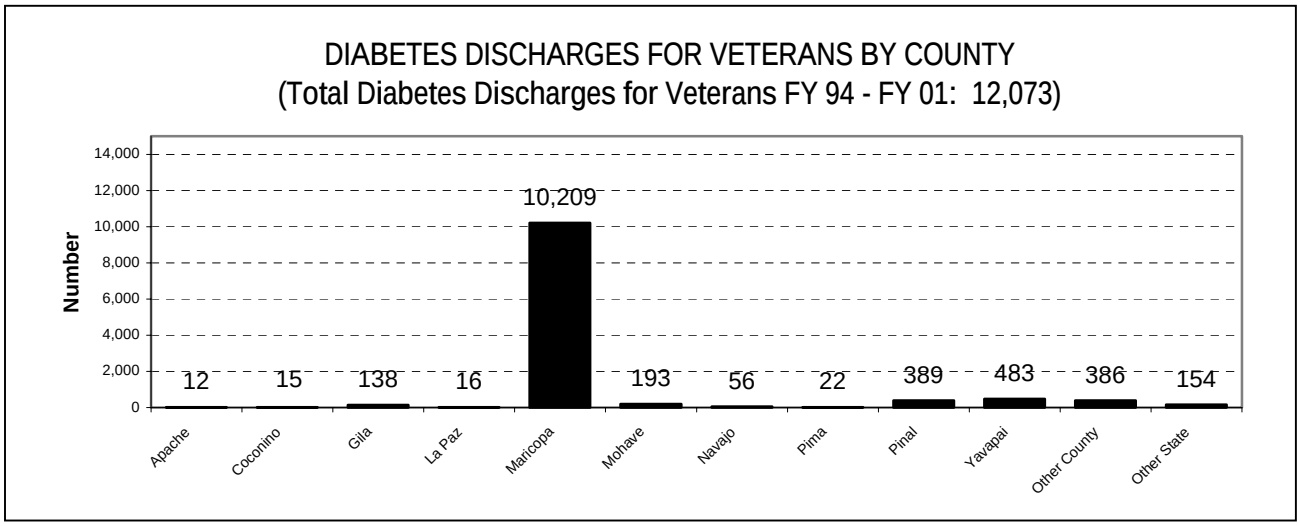

Figure 11. Hospital discharges for veterans, by county of residence, for diabetes-related discharge diagnosis, FY 94 – FY 01. Source: Phoenix VAH, March 2003.

The age distribution of veterans discharged from the Phoenix hospital for a diabetes-related diagnosis is shown **Figure 12**. In contrast to the nonfederal hospitals in Arizona, 97 percent of the persons discharged from the Phoenix VAH are male.

The ethnic and race distribution of these veterans is shown in **Figure 13**. Since we do not have the ethnic and race distribution of the population served, it is difficult to draw definitive conclusions about this topic, except to say that there is a wide mix of ethnic and racial groups.

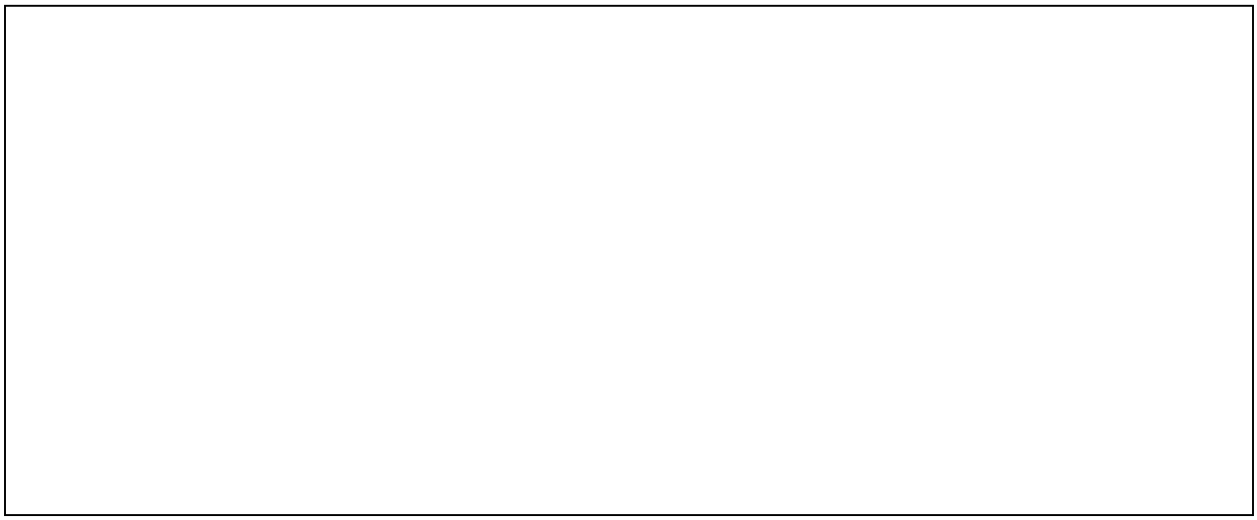

Figure 13. Hospital discharges for veterans, by race, for diabetes-related discharge diagnosis, FY 94 – FY 01. Source: Phoenix VAH, March 2003.

INDIAN HEALTH SERVICE

No response for 2001 was provided by IHS. However, previous data indicated a hospitalization rate for diabetes-related illnesses in 1996 of approximately 325 discharges per 100,000 users of IHS facilities in Arizona. [26]

MILITARY FACILITIES

At this time no attempt has been made to collect data from these facilities.

FINANCIAL IMPACT IN ARIZONA

Comprehensive data concerning the financial impact of diabetes specific to Arizona can only be estimated. (The national impact was described earlier on page 11.) The cost associated with hospitalization obviously does not consider the outpatient charges. The American Diabetes Association has estimated the total cost of diabetes in Arizona to be $2.3 billion annually ($1.5 billion associated with direct medical costs and the remaining $763 million derived from indirect costs such as lost productivity. This equates to an average, total, economic cost per diagnosed person of $13,398 per year ($8,977 direct costs and $4,421 indirect costs). [27]

The increased application of optimal care will cause short-term increases in the cost of diabetes. However, these short-term increases will be offset by savings as complications are delayed or entirely prevented in the long term. Prevention of these 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 improved glycemic control, exercise regimen and balance diet of patients with type 2 diabetes leads to substantial benefits in terms of symptoms, quality of life, and economic savings. [28]

DIABETES RESOURCES IN ARIZONA

Diabetes educators have proven to be valuable additions to the team that delivers health care to diabetic patients. Diabetes education is provided by Certified Diabetes Educators (CDE), and other health professionals, such as: family nurse practitioners, nutritionists, physicians, registered dietitians, and registered nurses. The distribution of diabetes educators across the state is shown in **Figure 14**. The Arizona Diabetes Control Council recognizes a shortage of diabetes educators, especially workers who have received formal CDE certification. Currently, there is no accepted standard for the ratio of the number 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 times 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.

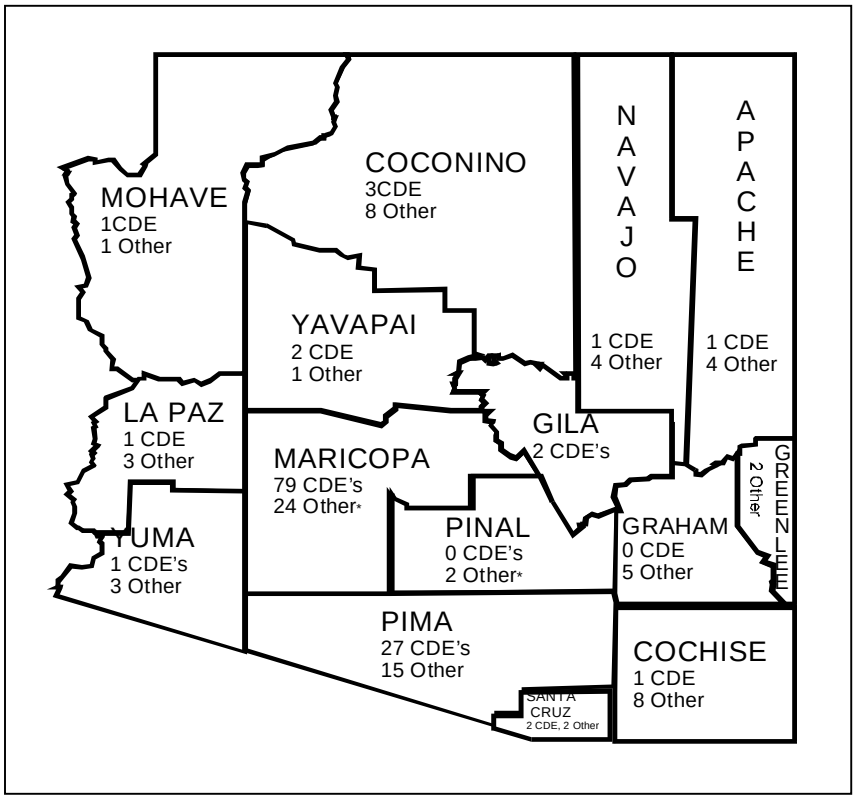

Figure 14. CDE distribution by County in Arizona, 2001.

The Education Committee of the Council has developed a resource directory, so we will not replicate their work here. [29] Nevertheless, we highlight the following aspects because they have bearing on diabetes among special population groups.

In 2002, tribes in Arizona received additional funding through the Indian Health Service national grant program, *Special Diabetes Program for Indians,* to continue and expand their own local tribal programs to prevent and delay diabetes and its complications. The following existing programs are important resources for the tribes in Arizona:

Diabetes Education Center
Gila River Health Care Corporation
Hu Hu Kam Memorial Hospital
PO Box 38
Sacaton, AZ 85247
Contact: JoAnne Lafley, MSN, CRNP, CDE
Tel: (520) 562-3321

Diabetes Prevention Program
Tucson Area School-based Health Education Program for Children
Sells Service Unit
PO Box 548
Sells, AZ 85634
Contact: Nellie Tucker, RD/LD, Coordinator
Tel: (520) 383-7333

The Diabetes Center for Excellence
Phoenix Indian Medical Center
4212 N16th Street
Phoenix, AZ 85016
Contact: Charlton Wilson, MD
Tel: (602) 263-1200 or (602) 263-1537

Navajo Nation Special Diabetes Project
The Navajo Nation Division of Health
P.O. Box 1390
Window Rock, AZ 86515
Contact: Randall Comb, Education Specialist
Tel: (928) 871-6532 or (928) 871-6533
Fax: (928) 871-6543

Indian Health Services
Navajo Area Diabetes Program
Contact: Martia Glass, MD
Tel: (505) 368-7428
e-mail: martia.glass@shiprock.his.gov

MORTALITY DATA

The mortality rate of diabetes as an *underlying* cause of death among Arizona residents is increasing (**Figure 15**). This figure includes all Arizona residents, regardless of the state in which they die. [30] Additional data about the rate among subgroups are presented in subsequent sections of this report.

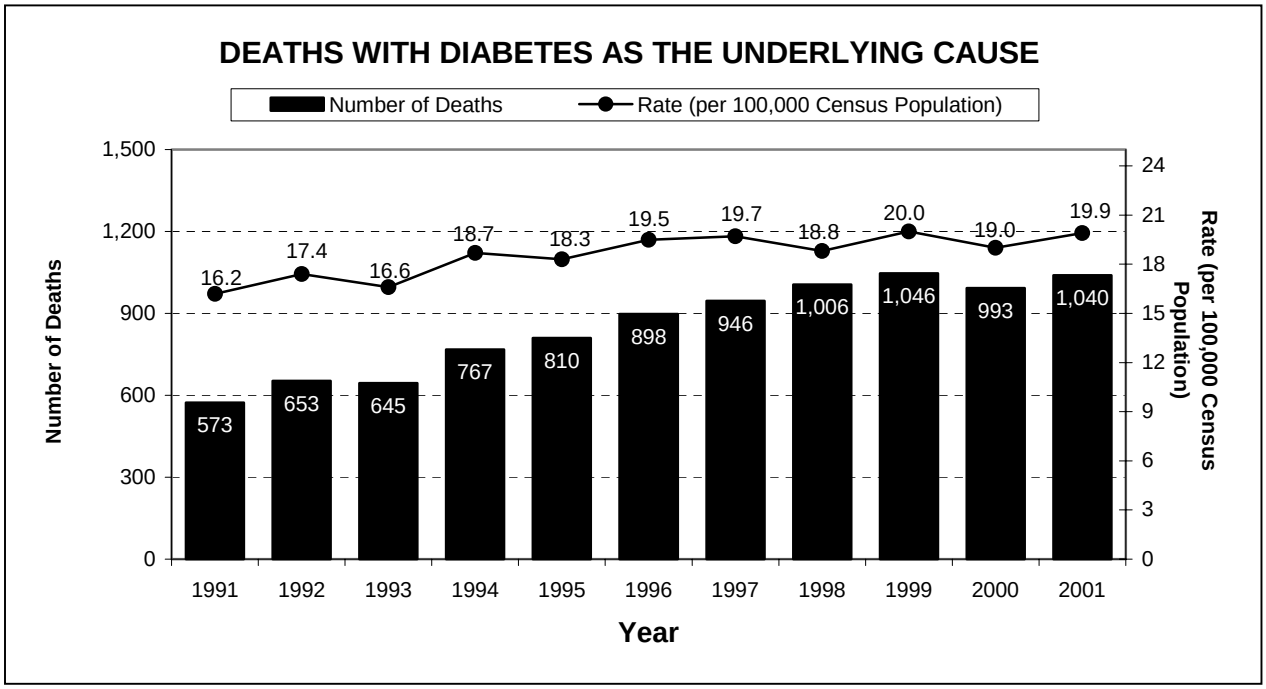

Figure 15. Deaths in Arizona with the underlying cause of death listed as ICD-9 code 250.xx (diabetes), 1991 – 2001. Rates are per 100,000 population, age-adjusted to the US 2000 standard. These data include deaths among American Indians. Source: *Arizona Health Status and Vital Statistics 1991-2001,* ADHS.

The mortality rates according to county also are available for analysis. Rates can vary widely from year to year when there are small number of events, as is often noted 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 which 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 the physician may forget to list diabetes as the underlying cause of the renal failure.

Table 11. Age-Adjusted * Mortality Rates per 100,000 Population for Diabetes Listed as the Underlying Cause of Death, 2000- 2001.

	2000	2001
Apache	51.3	42.4
Cochise	27.3	24.3
Coconino	18.7	20.6
Gila	16.6	29.9
Graham	27.1	39.9
Greenlee	71.6	29.5
La Paz	19.8	19.2
Maricopa	18.1	19.6
Mohave	21.0	24.8
Navajo	23.8	24.6
Pima	19.8	18.0
Pinal	24.0	24.1
Santa Cruz	30.0	52.6
Yavapai	13.1	11.2
Yuma	12.9	14.0
Arizona	**19.0**	**19.9**

Source: *Arizona Health Status and Vital Statistics 2000-2001*.

*Adjusted to the 2000 standard U.S. population.

HIGH RISK POPULATIONS

Mortality rates in Arizona differ by race and ethnic groups, and the rates appear to be worsening for most groups (**Figure 16**) [31].

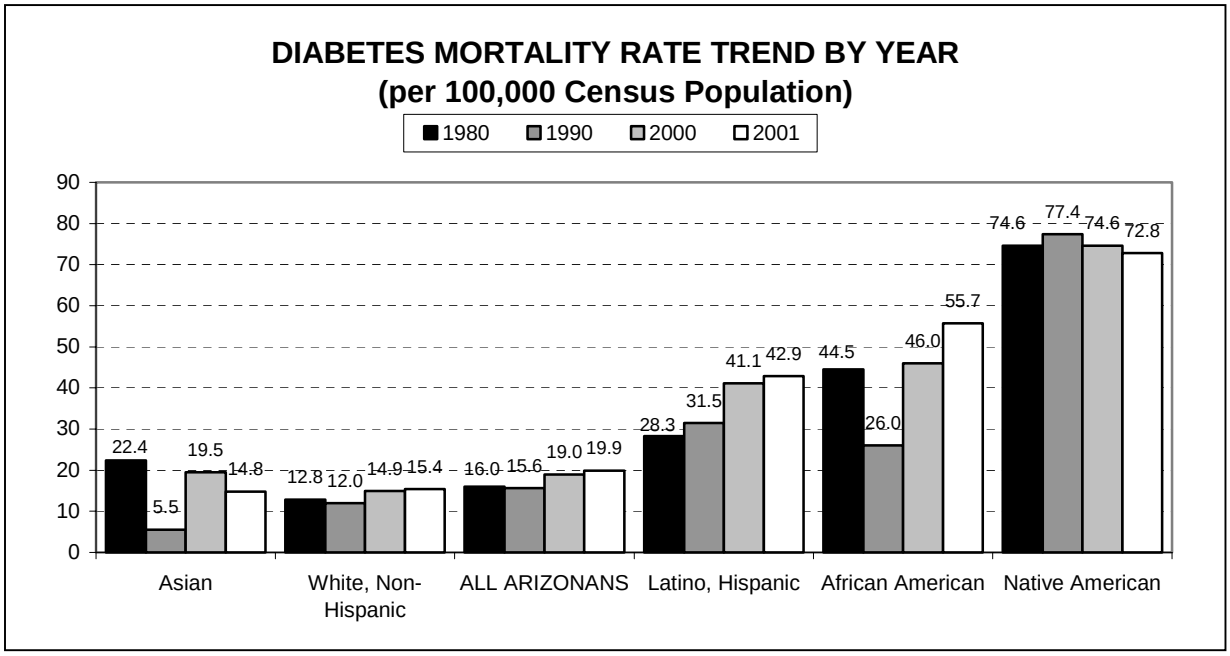

Figure 16. Age-adjusted mortality rates with the underlying cause of death listed as ICD-9 code 250.xx (diabetes), 1980, 1990, 2000, 2001. Source: *Arizona Health Status and Vital Statistics 1980, 1990,2000, 2001*, ADHS.

Native Americans

A precise count of Native Americans with diabetes in Arizona is not available. However, a rough estimate can be obtained by counting all Indians who are registered into the Indian Health Service (IHS) Patient Registration System and who have had at least one direct or contract inpatient or outpatient visit or a direct dental visit during the last three fiscal years. Using 2001 Resource and Patient Management System (RPMS) data, the IHS counts 16,106 persons with diabetes in Arizona. At the same time there were 159,010 persons who were active users of IHS services. Dividing these two figures produces a prevalence rate of 10.1 percent. [26] Using the 2000 U.S. population as the standard, the age-adjusted prevalence rate of diagnosed diabetes among adults in the Phoenix Service Area and Tucson is 22.0 percent and 26.6 percent, respectively. Within these overall rates, the prevalence rate in women is 4-5 percent higher than in men.

The age-adjusted mortality rates for diabetes among Native Americans is 72.8 deaths per 100,000 population (**Figure 16**). This rate is adjusted for miscoding of Indian race on death certificates. The 72.8 is 5.4 times the U.S. all races rate of 13.5 for 1997. The diabetes death rates for Phoenix and Tucson Areas are well above the overall Native American rate. For calendar years 1996-1998 the Phoenix and Tucson Area rates were 80.0 and 91.0 deaths per 100,000 population, respectively.

Diabetes was the 4th leading cause of death among Native Americans in Arizona in 2001 [31] and also among Native Americans served by the IHS Phoenix Area in 1996-1998. Among Native Americans living in the IHS Navajo Area (part of which lies in Arizona) and the IHS Tucson Area (southern Arizona), it was the 5th leading cause of death in 1996-1998. [26]

The diversity of Arizona presents unique opportunities and challenges for effective diabetes control. Arizona has one of the largest populations of Native Americans 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. [32] Many Native Americans live in rural areas and receive services from the Indian Health Service or a tribal health service provider.

Urban Native Americans, when contrasted with rural Native Americans, although surrounded by resources, encounter unique barriers to health care and effective diabetes management. Community health representatives and public health nurses are found on the reservations and serve to bring the patient and resources together, whereas this type of service exists to a lesser degree in the urban areas. In addition, urban Native Americans who are not living on a reservation 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 US life expectancy of 75.6 years. This is especially true for Native Americans. Diabetes occurs at elevated rates among Native Americans and places a heavy burden upon the tribes.

Hispanics

Diabetes ranks 5th among the leading causes of death among Hispanics in Arizona. [31] The life expectancy of diabetics also is shortened for Hispanics. A special 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 is of Hispanic origin. This survey found that, based on a prior diagnoses and a fasting plasma glucose test, the prevalence rate for this study was 18.3 percent. The strongest factors associated with a diagnosis of diabetes were: age, weight, and family history of diabetes (mother and father and brother or sister with diabetes). In the U.S. the prevalence of type 2 diabetes is 2 times higher in Latinos than non-Latino whites. Two million or 10.2 percent of all Latino Americans have diabetes. Approximately 24 percent of Mexican Americans in the United States and 26 percent of Puerto Ricans between the ages of 45-74 have diabetes. Nearly 16 percent of Cuban Americans in the United States between the ages of 45-74 have diabetes.[3]

African Americans

The existing data suggest higher rates of hospitalization and death for African Americans compared to all Arizonans. For example, diabetes ranks 4th among the leading causes of death among African Americans in Arizona, this is almost 3 times as great as that of the state as a whole (**Figure 16**).[31] The 2001 hospitalization rate for

diabetes as the primary discharge diagnosis is the 2nd highest of all racial and ethnic groups, 2.1 times that of non-Hispanic Whites (**Figure 6**). The relatively low number of African Americans (3.1% of Arizona's population) limits our ability to say much about the prevalence of diabetes in this high-risk group at this time. However, in the U.S. approximately 2.8 million or 13.0 percent of all African Americans have diabetes. However, one-third of them do not know it.[3]

Elderly Persons

Previous tables and figures showed the elevated prevalence rate among Arizona's elderly population. In addition to the year round residents there is a large migratory group, which annually swells the state population by several hundred thousand (no one knows exactly how many), who face challenges related to continuity of health care.

Barriers to Diabetes Care and Education

Patients eligible for Medicare receive coverage for specific number of diabetes education sessions. In 1998, the Arizona Legislature passed a state law that requires insurers to provide supplies and glucometers. However, this is not the case for coverage of the educational needs of diabetics. The state lacks a law that requires insurers to reimburse providers for providing diabetes education. Thus, diabetics still encounter this barrier to learning about self-management of their disease.

Data regarding practice behaviors of health care providers for the most part has not been collected. However, it is clear that implementation of recommended standards of care is less than optimal. [33,34,35] For example, although the most effective means of monitoring glycemic control is self-monitoring of blood glucose, only about 50 percent of insulin users and 5 percent of non-users perform this procedure. [36] Also, while diet is considered a cornerstone of diabetes management, insulin use is often the primary indicator of the need for nutrition intervention. [37]

Implementation of practice guidelines for clinical and laboratory tests is higher in the management of type 1 patients than for those with type 2 diabetes. This suggests that type 2 diabetes is perceived as a less serious illness than type 1, as type 2 patients receive fewer preventative services. [34] Given the burden of type 2 diabetes and the number of older individuals living in Arizona, the lack of preventative services for this population is of special concern. People over the age of 65 receive nutrition counseling for diabetes at a rate that is 45 percent less than for younger individuals. [39]

It is also important to note that economically disadvantaged individuals in Arizona have a difficult time accessing health care. With the exception of certain special programs for pregnant women and children, services are not reaching the "notch group" (persons without health insurance). The state Medicaid program, called the Arizona Health Care Cost Containment System (AHCCCS), provides services to those who are at the 100 percent Federal Poverty Level (FPL) criteria. There are a large number of persons who are not poor enough to qualify for AHCCCS but who do not have the financial resources to obtain care or have not taken advantage of recent legislation passed to increase the affordability of care from 34 percent to 100 percent FPL.

Cultural Barriers

There have been a number of studies in Arizona to assess cultural barriers to health care and how to alleviate them. Barriers include language, economics, transportation, day care, work related problems, belief system regarding the health care system, discrimination, and location.

In Arizona, programs that are specifically tailored in this way are limited at the present time. There is a lack of professionally trained bilingual/bicultural diabetes educators and other health professionals in the state. At this time, there are 21 recognized diabetes education programs in Arizona meeting the national standards set by the ADA.[39] In urban areas, low-cost hospital-based diabetes classes are available on a limited basis. It is estimated that these classes reach only about 2 percent of the persons diagnosed with diabetes in Arizona.

BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM (BRFSS)

The Behavioral Risk Factor Surveillance System (BRFSS) is a federally funded, random sample of residents in each state. The survey is administered by the Arizona Department of Health Services 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 17**), physical inactivity (**Figure 18**), and an unhealthy diet (**Figure 19**).

The trends for these factors may well predict the burden of diabetes (and other chronic diseases) that Arizona will face in future decades. These three figures show that Arizonans are improving but are from controlling these modifiable risk factors.

Also, the BRFSS asks 12 questions specifically of persons with diabetes. These additional data from the BRFSS, 1995-2001, in Arizona are presented in tables found in Appendix B.

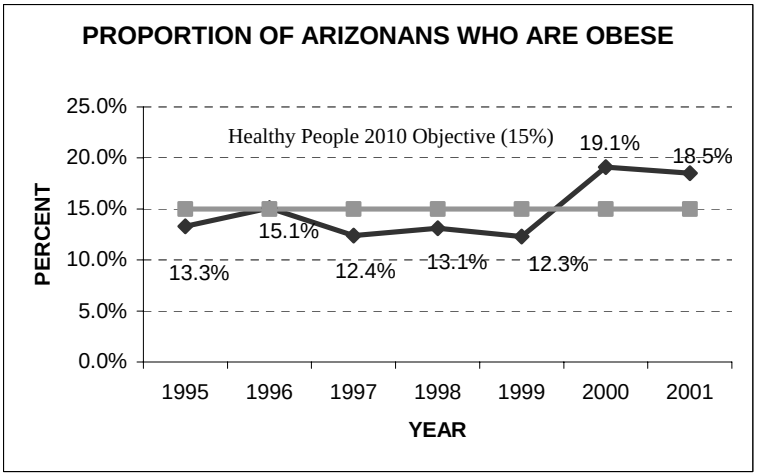

Figure 17. Proportion of Arizona adults categorized as obese (body mass index is 30 or more), 1995-2001. Source: *Arizona BRFSS*, 1995-2001.

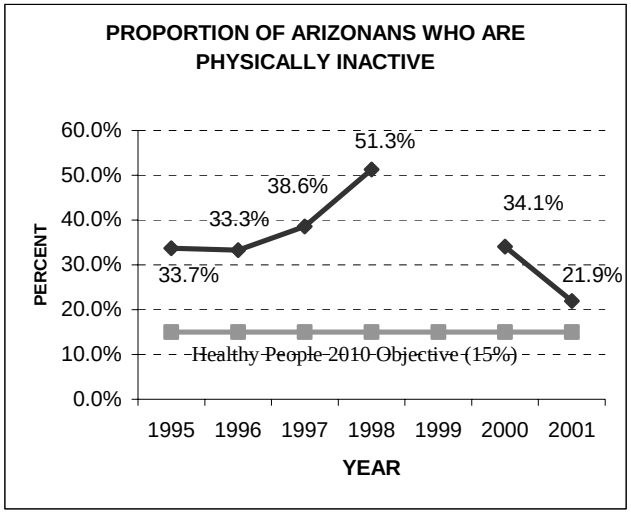

Figure 18. Proportion of Arizona adults not participating in physical activity in the past month, 1995-2001. Source: *Arizona BRFSS, 1995-2001*. Data for 1999 not available.

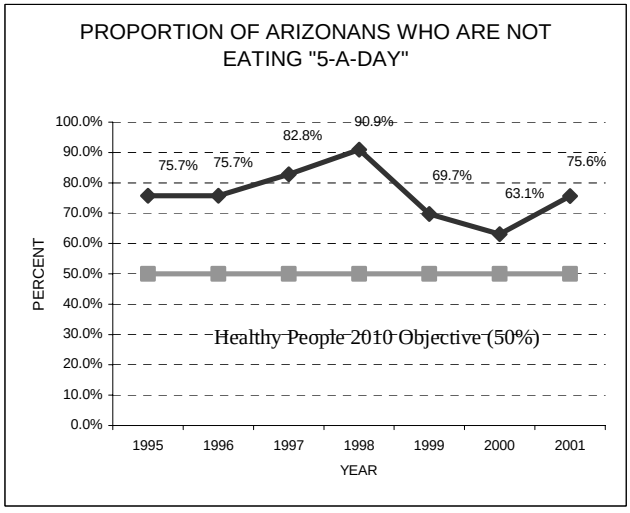

Figure 19. Proportion of Arizona adults consuming less than 5 servings of fruits or vegetables per day, 1995-2001. Source: Arizona BRFSS, 1995-2001.

THE OUTLOOK FOR THE YEAR 2020

If we assume that the diabetes prevalence rate will be the same in the Year 2020 as it is now, we can project the number of diabetics that will be present in Arizona in twenty years. **Figure 20** shows that the number of diabetes cases among adults of 20 years and older will increase from approximately 261,655 in 2001 to over 393,000 in the year 2020. This 50 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. The risk factors for diabetes displayed on the previous page show no trends of improvement, and in fact are worsening.

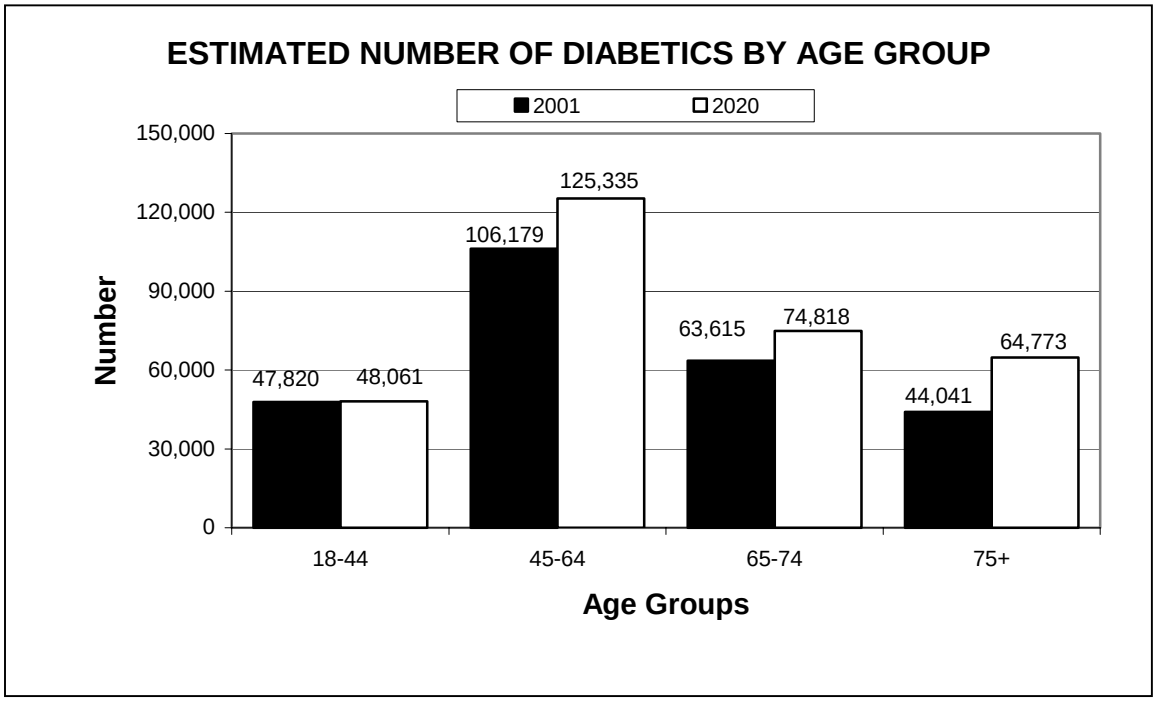

Figure 20. Projection of Arizona's diabetes cases by the year 2020, assuming the prevalence rate remains the same and does not worsen.

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 likely 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.[10] 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 the future diabetes rates.

CONCLUSIONS

An immense burden to the state's various health care delivery systems caused by diabetes in the next decade is looming. If current trends continue, diabetes will become a major chronic disease in the 21st century. Our state must plan now for the increase in resources required to treat patients who already have the disease. In addition, we must encourage activities now that will delay the onset of complications and even prevent diabetes from occurring at all. Our state's health policy makers from all sectors must be made aware of findings in this report and act upon them, so that the state's burden of diabetes is lessened.

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 agencies.

RECOMMENDATIONS

In light of the findings in this report, we make the following recommendations:

DATA-RELATED RECOMMENDATIONS

1. Organizations that hold data specific to subgroups within the state should share this information voluntarily with the Diabetes Prevention and Control Program's epidemiologist on a yearly basis so that data about all subgroups are tracked.

    a. These organizations should include the ADHS, IHS, American Indian tribes, Veterans Affairs, Medicare, AHCCCS, HMOs, and Community Health Centers.

    b. To ensure future collaboration, multi-agency agreements and procedures for data exchange should be negotiated by the participating agencies.

    c. Data concerning the risk factors for type 2 diabetes in children should be collected at the school.

2. This report should be recompiled in 3 years to determine whether Arizona is making progress in improving the health status of diabetics, and whether the standard set of indicators needs to be changed.

PROGRAM-RELATED RECOMMENDATIONS

3. The data in this report justify programs to address the striking disparities in health status among the high-risk populations (Native Americans, African Americans, and Hispanics).

    a. Even though American Indians have received funding for diabetes prevention under the federal "Grants for Special Diabetes Programs for Indians" it is likely that this funding will only begin to address the problem. The Diabetes Prevention and Control Program should continue to provide technical assistance and financial resources where indicated to tribal health departments for program development and implementation.

    b. These disparities can be addressed through increased availability of certified diabetes educators and lay health workers.

4. The worsening behavioral risk factors among the state as a whole requires immediate attention. These factors associated strongly with diabetes include obesity, sedentary lifestyle, and unhealthful diet. Programs to modify these risk factors must be strengthened. These programs must become part of a comprehensive approach to addressing diabetes that extends beyond the immediate capacity of the ADHS Diabetes Prevention and Control Program. That is to say, the effort must be designed to include agencies outside of state government. These programs should include children too.

5. Increase the number of diabetes educators who can help address the lack of education and elevated rates of diabetes in some counties. This increase should be implemented through the ADHS's traditional partners: the county health departments and health education centers. Non-traditional partners (e.g., HMOs, tribes, and the IHS) also can play a role in increasing the number of diabetes educators in the counties. Lay health workers also can play a role in matching patients with resources.

6. The Centers for Disease Control has been the only funding source for the Diabetes Prevention and Control Program. As the Program seeks to expand its efforts to control and prevent diabetes among Arizonans, other funding sources should be explored (including business partners).

7. The Council should inform other leaders in health care and public health about the findings in this report so they can implement appropriate disease control policies. The dissemination should go to a broad range of governmental, private sector, and voluntary health care organizations.

8. Medical therapy for people with diabetes should be individualized, with consideration given to the individual's behavior, treatment goals and desired outcomes.

APPENDIX A: REFERENCE TABLES

Table A-1
Estimated number of Arizonans with diabetes, 2001,
Using Arizona BRFSS data, 2001.

Est. Total Population 2001	5,307,331
Percent of Arizona Adults interviewed who indicated they have been told by a physician or other health care worker that they have diabetes	5.7%
Total Number of Arizonans (all age groups) with Diabetes	**302,518**

Table A-2
Estimated number of Arizonans with diabetes, 2001,
Using BRFSS (1995-2001) prevalence rates.

Age Group	**Estimated Number of Known Diabetics**
18 – 44	44,011
45 – 64	106,275
65 – 74	63,615
75+	44,041
Total	**257,942**

Table A-3
Estimated number of Arizonans with diabetes, 2001,
Using NHIS (1994) national prevalence rates for adults.

Age Group	**Estimated Number of Known Diabetics**
18 – 44	25,989
45 – 64	69,854
65 – 74	38,244
75+	31,711
Total	**165,798**

Table A-4
Estimated number of Arizonans with diabetes, 2001, using NHANES-3 data, 1988 – 1994. [17]

	Age Group					Total
	20-39	**40-49**	**50-59**	**60-74**	**75+**	
NHANES-3 rate of **Dx'd** DM (%)	1.1	3.9	8.0	12.6	13.2	
Est. Pop. 2001	1,549,151	732,093	552,855	586,834	314,334	
Est. number of Arizonans with Diagnosed Diabetes	17,041	28,552	44,228	73,941	41,492	205,254
NHANES-3 rate of UnDx'd DM (%)	0.6	2.5	4.6	6.2	5.7	
Est. Pop. 2001	1,549,151	732,093	552,855	586,834	314,334	
Est. number of Arizonans with Undiagnosed Diabetes	9,295	18,302	25,431	36,384	17,917	107,329

APPENDIX B: ARIZONA BRFS TABLES

Table B-1
Arizona BRFSS Diabetes Supplement
Unweighted Data From 1995-2001

The following tables include questions from the diabetes supplement of the Arizona BRFSS, 1995-2001. In six years, 981 respondents (5.7%) said that a doctor has told them that they have diabetes. This number includes females who were told they had diabetes during pregnancy.

How old were you when you were told you have diabetes?

Age Group	Number	Percent
Less than 18	27	3.3%
18-44	275	33.6%
45-54	179	21.9%
55-64	160	19.5%
65 or older	171	20.9%
Unknown/Refused	7	0.9%
Total	819*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy.

Are you now taking insulin?

Response	Number	Percent
Yes	266	32%
No	553	68%
Total	819*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

Respondents who use insulin: Currently, about how often do you use insulin?

Response	Number	Percent
Daily or more	119	95%
1-6 times per week	5	4%
Insulin pump	0	0%
Unknown/Refused	1	1%
Total	125*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

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

Response	Number	Percent
Never	82	10%
Daily or more	444	54%
1-2 times per week	87	11%
3-6 times per week	75	9%
<1 time per month	38	5%
1-3 times per month	60	7%
> 3 times per month	7	1%
Unknown/Refused	26	3%
Total	819*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

Have you ever heard of glycosolated hemoglobin or hemoglobin A1c?

Response	Number	Percent
Yes	80	22.5%
No	255	71.6%
Unknown/Refused	21	5.9%
Total	356*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

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	67	19%
Never*	293	79%
Unknown/Refused	9	2%
Total	369*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

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

Response	Number	Percent
1-4 times	54	75%
5-7 times	9	13%
Never*	5	7%
Unknown/Refused	4	5%
Total	72*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

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

Response	Number	Percent
Within last month	204	25%
1-12 months ago	354	43%
1-2 years ago	72	9%
2+ years ago	87	11%
Never	70	8%
Unknown/Refused	32	4%
Total	819*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

The following questions asked how well a respondent sees with their glasses or contacts on if applicable:

How much of the time does your vision limit you in recognizing people or objects across the street?

Response	Number	Percent
All the time	33	9%
Most of the time	24	7%
Some of the time	28	8%
A little bit of the time	23	7%
None of the time	229	64%
Unknown/Refused	19	5%
Total	356*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

How much of the time does your vision limit you in reading print in a newspaper, magazine, recipe, menu, or numbers on the telephone?

Response	Number	Percent
All the time	37	10%
Most of the time	22	6%
Some of the time	35	10%
A little bit of the time	42	12%
None of the time	203	57%
Unknown/Refused	17	5%
Total	356*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

How much of the time does your vision limit you in watching television?

Response	Number	Percent
All the time	22	7%
Most of the time	21	6%
Some of the time	20	6%
A little bit of the time	18	5%
None of the time	257	72%
Unknown/Refused	18	4%
Total	356*	100%

*Does not account for the number of females that were told they were diabetic during pregnancy

Table B-2
Arizona BRFSS Tables by Diabetes Status and Age
Weighted Data From 1995-2001

The following tables use data from seven years of Arizona BRFSS, 1995-2001 (N=17,122). The data below are weighted based on the Arizona population to accurately reflect the population demographics. The weighting factor considered the number of adults and telephone lines in the household, cluster size, stratum size, and age/race/sex distribution of the general population.

Weighted Percent of Population with Risk Indicator By Diabetes Status

Risk Indicator	Arizona Adults With Diabetes	Arizona Adults Without Diabetes
Annual Income Under $20,000	13%	7%
Education Less Than High School Graduate	14%	10%
Not Employed	63%	39%
Does Not Have Health Insurance	14%	16%
Health Status is Reported as Fair/Poor	50%	11%
Sedentary Lifestyle	51%	35%
Obese (BMI >30.0)	33%	12%
Smoker (Reported smoking at least 100 cigarettes in their entire life and currently smoke every day or some days)	45%	44%
High Blood Pressure	51%	17%
High Cholesterol	31%	29%

Source: ***Arizona BRFSS, 1995-2001.***

Weighted Percent of Diabetic and Non-Diabetic Population with Risk Indicator By Age

Risk Indicator	AZ Adults with Diabetes			AZ Adults Without Diabetes		
	Age 18-44	Age 45-64	Age 65+	Age 18-44	Age 45-64	Age 65+
Annual Income < $20,000	25%	37%	37%	65%	15%	19%
Education < High School Graduate	27%	40%	33%	55%	20%	24%
Unemployed	7%	38%	55%	33%	23%	44%
No Health Ins.	47%	48%	5%	81%	17%	1%
Health Status Reported as Fair/Poor	22%	47%	31%	40%	30%	30%
Sedentary Lifestyle	23%	46%	31%	52%	26%	21%
Obese (BMI>30.0)	26%	55%	19%	58%	30%	12%
Smoker	21%	45%	34%	52%	30%	18%
High Blood Pressure	16%	46%	38%	26%	36%	38%
High Cholesterol	12%	54%	35%	34%	37%	29%

Source: ***Arizona BRFSS, 1995-2001.***

APPENDIX C: DIAGNOSTIC CRITERIA

Table 1. Criteria for the Diagnosis of Diabetes Mellitus.

Normoglycemia	IFG or IGT	DM*
FPG < 110 mg/dl 2-h PG† < 140 mg/dl	FPG ≥ 110 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 8 h.
†This test requires the use of glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. DM, diabetes mellitus; 2-h postload glucose.
[American Diabetes Association: Clinical Practice Recommendations 2003, Diabetes Care, Volume 26, Supplement 1:S21, January 2003]

Table 2. Glycemic Control for People with Diabetes*

Glycemic control A1C Preprandial plasma glucose Peak postprandial plasma glucose	 <7.0%* 90–130 mg/dl (5.0–7.2 mmol/l) <180 mg/dl (<10.0 mmol/l)
Blood pressure	<130/80 mmHg
Lipids LDL Triglycerides† HDL	 <100 mg/dl (<2.6 mmol/l) <150 mg/dl (<1.7 mmol/l) >40 mg/dl (>1.1 mmol/l)‡

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.
†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.
‡For women, it has been suggested that the HDL goal be increased by 10 mg/dl.
[American Diabetes Association: Clinical Practice Recommendations 2003, Diabetes Care, Volume 26, Supplement 1: S129, January 2003]

ENDNOTES

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