ARIZONA DIABETES BURDEN REPORT: 2011

ARIZONA DEPARTMENT OF HEALTH SERVICES
BUREAU OF TOBACCO AND CHRONIC DISEASE

Dear Arizona Residents:

The lifestyle changes that accompany the current advances in technology have equated to more screen time, less physical activity and more fast food. Diabetes is inextricably tied to obesity and inactivity and this ongoing problem is becoming a public health crisis of epidemic proportion. Nearly 1.2 million people in Arizona are obese, 477,649 more people than 10 years ago. Arizona is tenth in the nation for obesity.

Largely because of this, the number of adults in Arizona with Type 2 diabetes has more than doubled in the last ten years; close to 600,000 adults now have diabetes in our state. In 2003, 6% of Arizonans reported that they had diabetes; in 2011, it had jumped to 9%. Even more alarming is the growing epidemic of individuals with pre-diabetes. With timely interventions, however, their condition is reversible.

In 2007, The American Diabetes Association (ADA) reported that the economic costs of diabetes in the U.S. exceeded $174 billion including $116 billion for treatment expenditures and $58 billion in lost productivity. The comparable cost estimates for Arizona totaled $3.3 billion including $2.3 billion in medical bills and more than $1 billion in indirect costs. Diabetes prevalence is in inverse proportion to the socioeconomic status of Arizonans, and highest risk populations are still predominantly minority and poor. Although minority populations are at greater risk for diabetes, also seen are increases among non-Hispanic Whites.

The Arizona Department of Health Services Bureau of Tobacco and Chronic Disease Diabetes Prevention and Control Program provides technical assistance to over 300 partners to maintain an active Diabetes Coalition for the state. As part of our Centers for Disease Control and Prevention (CDC) led initiative, the focus is to promote policies and trainings that better the continuum of care for people with diabetes in Arizona.

Arizona does not yet maintain a diabetes registry, and as a result relies heavily on the Behavioral Risk Factor Surveillance System (BRFSS) self-reported database to capture the prevalence of diabetes in Arizona. This creates a problem with the data, as historically, cell phone data was not included and thus it is difficult to determine who is left out from the landline count. However, it is known that young adults, transients and possibly some minority groups are excluded. Additionally, Arizona's native populations are served by Indian Health Services and are not included in the State's overall statistics. Mindful of the data gaps, the trends captured in this Report reflect the state of diabetes in Arizona.

Aggressive prevention and successful management of diabetes will require health systems coordination, policy changes, better management of patient care among providers, and patients taking charge of their own health. Evidence based programs such as Diabetes Self-Management Education or Training (DSME/T) and Chronic Disease Self-Management Programs (CDSMP) provide educational tools for healthy living and if utilized to full potential can begin to reverse this alarming trend.

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EXECUTIVE SUMMARY

Diabetes mellitus is a group of chronic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Without insulin, or if it is ineffective in the body, glucose builds up in the bloodstream (hyperglycemia) leading to diabetes. The concentration of blood glucose (BG) in the blood stream is most often measured in milligrams/deciliter (mg/dl). The fasting test reports normal range is 60-100 mg/dl.

The U.S. Census Bureau's 2010 Arizona population was nearly 6.4 million people. Since 2000, there were percentage increases in the Hispanic, Black and Asian populations and a commensurate decrease in the White, non-Hispanic population. Arizona's population is skewed toward the extremes in age – young and old. There are significant differences of diagnosed diabetes across race and ethnic groups among adults: Native Americans, African Americans, Asians, and Hispanics have higher rates of diabetes than non-Hispanic Whites. More men than women have diabetes. It is estimated that 20% of adults have pre-diabetes.

There has been an 80% increase in people diagnosed with diabetes from 1995 to 2010 when it stood at 9%. When considering that a third of the population with diabetes is undiagnosed, it is not unreasonable to estimate that there are nearly 600,000 adults with diabetes in Arizona. There are about 25.8 million people diagnosed with diabetes in the United State or 8.6% of the adult population.

Income operates in an inverse relationship with diabetes: the higher the income the lower the rate of diabetes. The Behavioral Risk Factor Surveillance System (BRFSS) data indicates that adults who made $15,000 or less had more than twice the rate (19.5%) of those who made $50,000 or more (8.3%).

Diabetes is linked to heart disease, stroke and high blood pressure. Diabetes is the leading cause of new cases of blindness among adults as well as of kidney failure. It also leads to neuropathy, a painful nervous system disorder, and amputations.

The two preeminent risk factors associated with diabetes are obesity and leisure-time physical inactivity. In 2010 the age-adjusted obesity in the general population in Arizona rose to 24.3% as compared to 33.8% in the nation's population. The leisure-time physical inactivity in Arizona has declined from 24.2% in 2004 to 22.9% in 2007. The comparable figure at the national level is 25.4% inactivity.

The ADA reported that the economic costs of diabetes in the U.S. in 2007 exceeded $174 billion. This included $116 billion direct expenditures for diabetes treatment that are 2.3 times as high as for

individuals without diabetes – one in ten health care dollars is attributed to diabetes and $58 billion in lost productivity, that includes factors such as absenteeism and early death. The comparable cost estimates for Arizona in 2006 totaled $3.4 billion including $2.3 billion in medical bills for diabetes care and $1.1 billion in indirect costs.

In 2006, there were 1755 diabetes-related hospital stays per 100,000 people in Arizona, 170 more than the other Western states. When broken down by age, sixty-five and older individuals had twice the number of hospital stays as those between age 45 and 64 and 4 times the number of stays as the state's average. The 402 discharges of diabetes without complications cost $1.45 million with a mean hospital stay of 2.5 days; half were men and the mean age was 32 years old. The aggregate costs for the 10,447 diabetes discharges with complications totaled $92 million; a mean stay of 4.5; almost 55% male; and a mean age of 50 years old.

Diabetes is largely a preventable and manageable chronic disease. People with well-managed diabetes have better clinical outcomes and reduced medical costs. Since diabetes is mainly a self-managed disease, the cornerstone for treatment is diabetes self-management education/training (DSME/T). The "overall objectives of DSME/T are to support informed decision making, self-care behaviors, problem solving, and active collaboration with the health care team to improve clinical outcomes, health status, and quality of life." The exact numbers of people who receive DSME/T in Arizona are unclear, but numbers are below the Healthy People 2010 goal of 60% of people with diabetes receiving formal education/training. Medicare covers DSME/T and estimates that only about one percent of beneficiaries with diabetes utilize this service.

CONTENTS

I. INTRODUCTION AND OVERVIEW

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 a hormone, produced by the pancreas, helps the body metabolize glucose." It acts as the "key" that opens the "door" to cells and allows the glucose to move into the cells. Without insulin, or its ineffectiveness in the body, glucose builds up in the bloodstream leading to serious complications. (Ciocazan, Ramirez, Joshi, Vensor, & Viera, 2005) (National Institute of Diabetes and Digestive and Kidney Disease (NIDDK), 2008)

Diabetes is common. It affects 171 million people worldwide; 25.8 million in the U.S., with 390,000 reported cases in Arizona, up from 124,000 in 1994, an increase of over 300%. If one takes into account that a third of the population with diabetes is undiagnosed, it is not unreasonable to estimate that there are nearly 600,000 adults in Arizona who have diabetes. Diabetes is serious. It is linked to many serious health complications including cardiovascular disease, stroke, high blood pressure, blindness, kidney failure, neuropathy, and amputations. Diabetes is costly. In 2007 the estimate exceeded $174 billion including well over $3 billion in Arizona.

Diabetes is manageable. Many long-term complications of diabetes can be prevented through improved patient education and self-management and adequate and timely screening services and medical care. Diabetes is preventable. The ADA guidelines outline their evidence-based strategies for its prevention that include losing 5-7% of body weight and making changes in diet and physical activity. (National Institute of Diabetes and Digestive and Kidney Disease, 2005)

This report begins by answering the questions: "what is diabetes" and "how is it diagnosed"? It then provides a demographic profile of Arizona and addresses the following: diabetes is common, serious, costly, manageable, and preventable.

II. WHAT IS DIABETES?

The digestive system metabolizes or breaks down food into glucose or blood sugar – the main source of energy for our bodies and the brain. Without insulin, or if it is ineffective in the body, glucose builds up in the bloodstream (hyperglycemia) leading to diabetes (Mayo Clinic Staff, 2011). Several types of diabetes have been identified.

TYPE 1 DIABETES

Type 1 diabetes (insulin-dependent) is an autoimmune disease that results from the destruction of insulin-producing beta cells in the pancreas by the body's immune. When the pancreas fails to produce insulin the person requires daily injections of insulin. It was previously known as juvenile-onset diabetes because it often occurs during childhood or adolescence. If the insulin is not carefully regulated with diet, cells may not receive the necessary amount of insulin resulting in a chain of metabolic events that can lead to a diabetic coma. Type 1 diabetes is often detected during an acute onset requiring hospitalization, and its risk factors are autoimmune, genetic, and environmental. Symptoms of with type 1 diabetes usually develop over a short period, and may include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme fatigue. Between 5-10% of all individuals with diabetes have type 1 diabetes.

TYPE 2 DIABETES

Type 2 (non-insulin-dependent or maturity-onset) diabetes mellitus[1] occurs when the pancreas is unable to produce enough insulin or the body cannot use insulin efficiently, a condition called insulin resistance. Type 2 diabetes is the most common form of diabetes, and about 90 to 95 % of people with diabetes have type 2. Increasingly, children and adolescents are being diagnosed with type 2 diabetes. African-Americans, Asian-Americans, Hispanics/Latinos and American Indians have higher rates of diabetes. Type 2 diabetes is largely preventable and can be self-managed.

Risk factors for type 2 diabetes include older age, being overweight or obese, family history, prior history of gestational diabetes, impaired glucose tolerance, certain racial and ethnic groups, and physical inactivity. Diet, weight reduction, and oral hypoglycemic drugs usually treat this condition, but some patients may need insulin instead. (Martin A.; T., Lumber; T., Compton; K., Ernst; L., Hass; J., Regan-Kilch; N, Letassy; K., McKnight; J.B., Nelson; J., Seley J.; Toth, J.A.; Mensing, C., 2008) Between 90%-95% of all individuals with diabetes have Type 2, and it is estimated that one third of individuals in the general population who have Type 2 diabetes are undiagnosed.

GESTATIONAL DIABETES

Another type of diabetes is gestational diabetes, and is first detected during pregnancy. Gestational diabetes occurs in 3-8% of pregnancies and is more prevalent among African-Americans,

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[1] Type 2 diabetes mellitus will be referred to as type 2 diabetes for the remainder of the document.

Hispanics/Latinos and American Indians. Gestational diabetes makes the mother and child more at risk for future development of type 2 diabetes.

MATURITY ONSET DIABETES OF THE YOUNG (MODY)

Maturity Onset Diabetes of the Young (MODY) is a monogenic form of diabetes that usually occurs during adolescence or early adulthood; however, MODY may remain undetected until adulthood, and is often treated as type 1 and type 2 of diabetes. MODY is one of the two rare forms of monogenic diabetes that is caused by mutations in a single gene, which limits the ability of the pancreas to produce insulin. It accounts for about 1 to 5 percent of all cases of diabetes in young people. MODY is often treated as type 1 or type 2 diabetes. MODY affects the young (less than 25 years of age); runs in families, does not always require insulin, and does not produce sufficient insulin thus making a distinct disorder to type 2 diabetes. (Porter, 2010)

PRE-DIABETES

Pre-diabetes is a potentially reversible condition that occurs when blood sugar levels are higher than normal, but not high enough to be classified as diabetes. Between 2003 and 2006, the Arizona Diabetes Coalition's strategic plan reported, "that 26% of all U.S. adults age 20 years and older had Impaired Fasting Glucose (IFG). (National Institute of Diabetes and Digestive and Kidney Diseases, 2005) (U.S. Census, 2008) At the time, the estimated number of individuals with pre-diabetes in the U.S. was 54 million with a commensurate estimate for Arizona adults. (Arizona Department of Health Services, 2008) In 2005–2008, based on fasting glucose or A1C levels, 35% of U.S. adults aged 20 years or older had pre-diabetes (50% of those aged 65 years or older). The estimate for U.S. adults is now 79 million, and according to the Behavioral Risk Factor Surveillance System (BRFSS) 2010 data 6.3% or 300,000 adult Arizonans answered "yes" to the question: "Have you ever been told you have pre-diabetes or borderline diabetes." (This did not include nearly 1.62% who answered, "Yes, but only during pregnancy.") Interestingly enough, the ethnic breakdown was similar for non-Hispanic Whites (35%), non-Hispanic African Americans (35%), and Mexican Americans (36%). However, using somewhat different criterion, the estimate for Native Americans ages 15 (not 20) years old or older was 20%. (CDC, 2011)

III. DIAGNOSIS

Diabetes is diagnosed by measuring the concentration of blood glucose (BG) in the blood stream. It is most often measured in milligrams/deciliter (mg/dl). The fasting test reports normal is in the 60-100

mg/dl range. When tested after meals (postpradial), readings up to 145 mg/dl are considered normal. The level of blood sugar is also measured by molecular count (molarity) where a reading of 8.0/144 mmol/l is equivalent to 100/5.6 mg/dl). This second measurement is now the international standard and is often represented in scientific journals.

In 2010, the ADA issued its current criteria for the diagnoses of diabetes:

- A1C ≥ 6.5%: The test should be performed in a laboratory using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial (DCCT) assay.
- FPG ≥126 mg/dl (7.0 mmol/l): Fasting is defined as no caloric intake for at least 8 hours.
- 2-h plasma glucose ≥200 mg/dl (11.1 mmol/l) during an oral glucose tolerance test (OGTT): The test should be performed as described by the World Health Organization (WHO) using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
- In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis: a random plasma glucose ≥ 200 mg/dl (11.1 mmol/l). (American Diabetes Association, 2011)

The blood glucose levels measured after these tests identify normal metabolism, or pre-diabetes or diabetes. Individuals with pre-diabetes have impaired fasting glucose (IFG) of 100 to 125 mg/dl after an overnight fast or impaired glucose tolerance (IGT) of 140 to 199 mg/dl after a 2-hour oral glucose tolerance test. (American Diabetes Association, 2011)

The illustration below compares the three measures of diabetes testing. (American Diabetes Association)
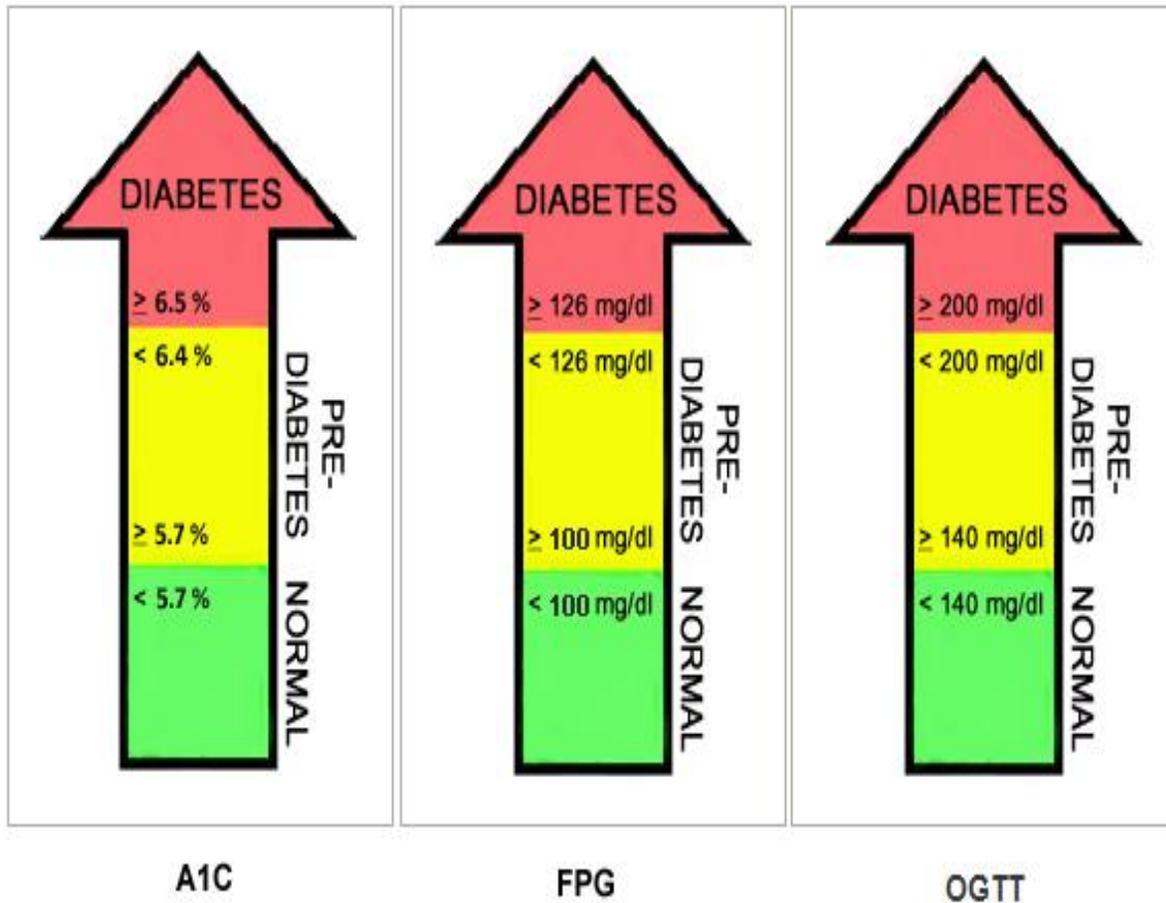
Figure 1 Diagnosis and Classification of Diabetes Mellitus
Data source: ADA 2011

Other types of diabetes can result from specific genetic syndromes, surgery, drugs, malnutrition,

infections, and other illnesses. These types of diabetes may account for 1-5% of all diagnosed cases of

diabetes.

IV. DEMOGRAPHIC PROFILE

The U.S. Census Bureau's 2010 reported Arizona's population as 6,392,017 million people. This included

57.8% White, non-Hispanic, 29.6% Hispanic or Latino, 4% American Indian and Alaska Native American

alone, 3.7% Black or African American alone and 2.8% Asian and Pacific Islanders. (U.S. Census Bureau,

2010) Arizona experienced a 24.6% increase in total population from 5,130,063 million in 2000; this

included 17.6% decrease in the White non-Hispanic population and a 4.3% increase in the

Hispanic/Latino population. In addition, during the decade there were incremental percentage increases

in the Black and Asian populations, and a 1% decrease to American Indian population. Arizona had the 2nd highest increase in population in the U.S. between 2000 and 2010. It went from having 1.8% of nation's population in 2000 to 2.1% in 2010. (Federal Funds Information (FFIS), 2011) Table 1 provides a breakdown of the population shifts from 2000 to 2010.

Table 1 Demographic Profile, Arizona and U.S., 2000, 2010

Year	White, non-Hispanic	Hispanic/Latino	American Indian/Alaska Native, Non-Hispanic	Black/African American, non-Hispanic	Asian and Pacific Islander, non-Hispanic	Total
2000	3,873,611	1,295,617	255,879	158,837	102,568	5,130,632
(%)	(75.4)	(25.3)	(5.0)	(3.1)	(2.0)	
2010	3,695,647	1,895,149	257,426	239,101	181,468	6,392,017
(%)	(57.8)	(29.6)	(4.0)	(3.7)	(2.8)	
Percent change: + or -	-17.6	+4.3	-1	+0.6	+0.8	+24.6

Data source: US Census Bureau, 2000, 2010 Census

Figure 2 depicts Arizona's 2010 demographic information:
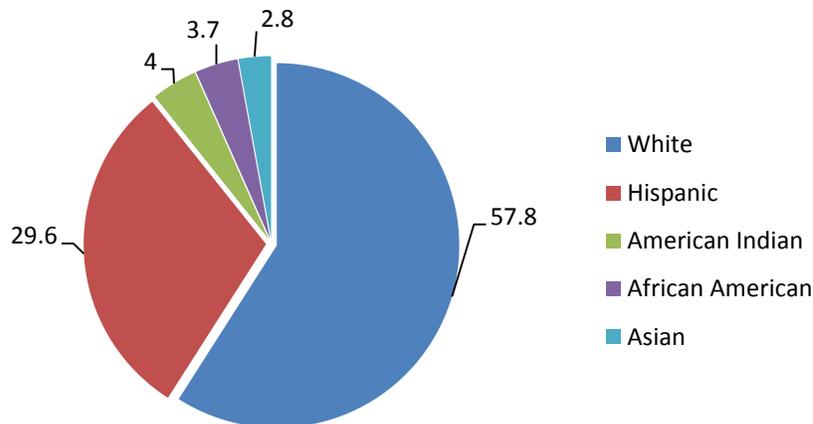

Figure 2 2010 Arizona Demographic Profile
Data source: US Census Bureau, 2010 Census

Table 2 is the breakdown of the ethnic groups by county and age. Looking at the county level, Table 2 shows that counties with high percentages of young people in the population are also those that have high percentages of minorities. For example, Apache County's population of 18 and under is nearly 32%

and its American Indian population is almost 73%. Navajo County and Santa Cruz County have similar demographics. In Yuma County the population of 18 and under is 28% and well over half of the population is Hispanic. These counties also have higher percentages of uninsured than the state's average. It is also interesting to note that these counties all have diagnosed diabetes rates higher than the state's rate of 9%. (See Figure 3) It is important to note that Hispanics often self-identify as white and or Hispanic; thus, the population estimate for White, non-Hispanic is inflated. (See Table 2) (HRSA)
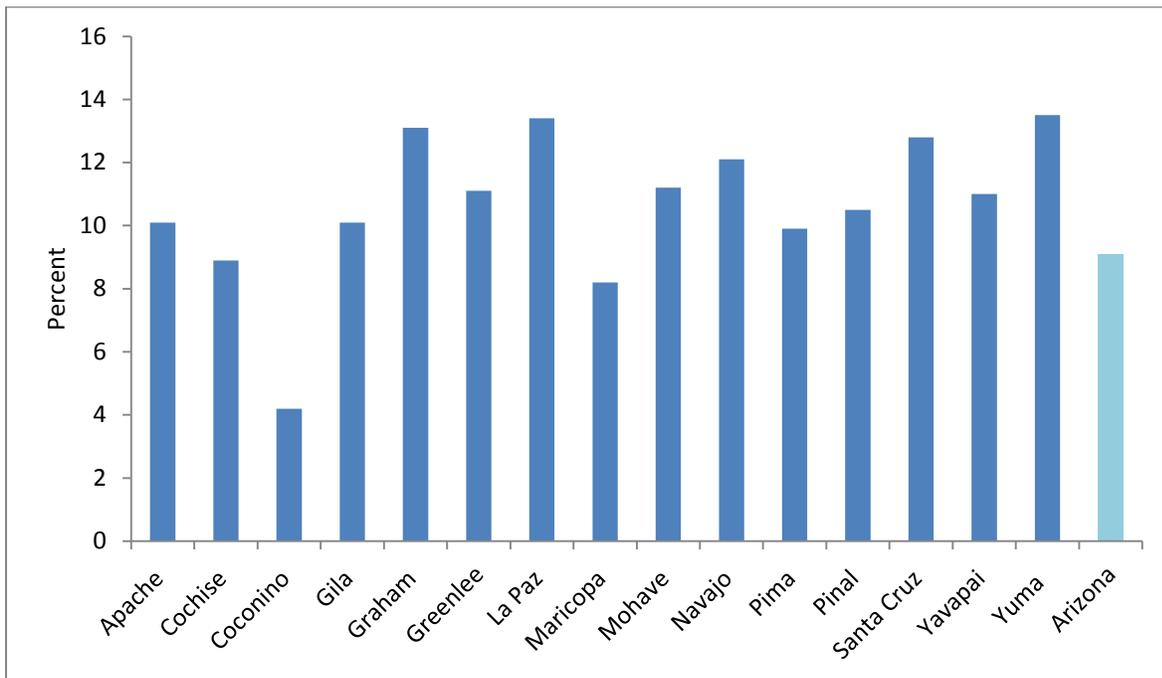
Figure 3 Prevalence of Adult Diabetes, Counties, and Arizona 2010
Data source: AZ BRFSS 2010

These shifting ethnic patterns and age patterns have an impact on health issues in Arizona. In addition to the nearly 14% of the population that is of retirement age, 10% is between 55 and 64 years of age. Furthermore, about half of the population under 17 years old in Arizona is minority, and most interestingly, 40% of the children in elementary school in public schools are Hispanic, and over 5% are Native American and African-American. It is not well known, but significant that half of all children in first grade in Arizona are Hispanic. (Council of Chief State School Officers , 2005 and updated 2008)

In a recent chapter for a book yet to be published, Arizona State University Professor Eileen Diaz McConnell provides insight on Arizona demographics between 2000 and 2009:

> The Latino population in the state grew by 56.8% . . . Whites increased by 15.1%, and the numerically smaller African American and American Indian and Alaska Native populations increased by more than 58.2 % and 11.8 % . . . respectively. (She explains that about 49% of the AIAN category was Navajo) . . . Maricopa County . . . had the largest numerical increase of any U.S. county between 2000 and 2006 (U.S. Census Bureau 2007) [and] the largest numeric growth of non-Hispanic Whites of any U.S. county, as well (Census Bureau 2009). Pinal County, with the smallest population counts of the three counties, has experienced the largest percent changes over the nine-year period, with increases of 86% or more for the total population and for Latinos, Whites, and African Americans. (McConnell, 2011 In Press)

Given that there are significant correlations between diabetes and income and ethnicity, it is important to point out some of these disparities in Arizona. Arizona ranked first in income inequality, where during a 20-year period between the early 1980s and 2000, the bottom 20% median family income increased less than 6%. (Wiggins, 2006) Consistent with income inequality are the educational disparities among ethnic groups where "Arizona Whites ages 18-24 are twice as likely as non-Whites to be enrolled in college, and their high school graduation rate is 75% but only 64% for Hispanics. A report from the National Center for Public Policy and Higher Education concludes that, "If all ethnic groups had the same educational attainment and earnings as Whites, total personal income in the state would be about $6.2 billion higher." (The National Center for Public Policy and Higher Education, 2006)

Table 2 County Population Matrix

	County Pop. (2010)	Population % change (since 2000)	Persons 18 and under (%)	Persons 65 and older (%)	White, non-Hispanic (%)	Black, non-Hispanic (%)	Asian, non-Hispanic (%)	American Indian/Alaskan Native, non-Hispanic (%)	Hispanic/ Latino (%)
APACHE	71,518	3	31.7	11.6	23.3	*	*	72.9	5.8
COCHISE	131,346	10	23.0	17.3	78.5	4.2	1.9	1.2	32.4
COCONINO	134,421	13	23.6	8.9	61.7	1.2	1.4	27.3	13.5
GILA	53,597	4	21.4	23.2	76.8	*	*	14.8	17.9
GRAHAM	37,220	10	71.6	11.4	72.1	1.8	*	14.4	30.4
GREENLEE	8,437	-1	29.2	12.0	77.2	*	*	2.3	47.9
LA PAZ	20,489	4	18	32.6	69.8	*	*	12.8	23.5
MARICOPA	3,817,117	20	26.4	12.1	73.0	5.0	3.5	2.1	29.6
MOHAVE	200,000	23	20.6	23.3	89.6	*	1.1	2.2	14.8
NAVAJO	107,449	9	70.2	13.3	49.3	*	*	43.4	10.8
PIMA	980,263	14	23.0	15.4	74.3	3.5	2.6	3.3	34.6
PINAL	375,770	52	26.5	13.9	72.4	4.6	1.7	5.6	28.5
SANTA CRUZ	47,420	19	30.7	13.1	73.5	*	*	*	82.8
YAVAPAI	211,033	21	19.1	24.1	89.3	*	*	1.7	13.6
YUMA	195,751	18	28.2	15.7	70.4	2.0	1.2	1.6	59.7
ARIZONA	6,392,017	20	25.5	13.8	73.0	4.1	2.8	4.6	29.6

Data source: HRSA 2010

V. DIABETES IS COMMON

THE NATION

The 2011 CDC Report, estimates that 8.3% of the over 300 million U.S. children and adults have diabetes – 18.8 million diagnosed and 7 million undiagnosed. This does not include the 79 million that are pre-diabetic. As people get older the rates of diabetes increase: 215,000 people younger than age 20, and of the estimated 25.6 million people with diabetes age 20 years old or older 10.9 million (42%) are 65 years and older. There are significant differences of diagnosed diabetes across race and ethnic groups among adults: Native Americans (16.1%), African Americans (12.6%), Asians (8.4%), and Hispanics (11.8%) have higher rates of diabetes than non-Hispanic Whites (7.1%). More men than women have diabetes. In 2007, the U.S. Department of Health and Human Services estimated that 20% of adults 20 years old and older had pre-diabetes. (CDC, 2011)

Among non-Hispanic White youth ages 10–19 years old, the rate of new diabetes cases was higher for type 1 than for type 2 diabetes. For Asian/Pacific Islander Americans and American Indian youth ages 10–19 years old, the opposite was true—the rate of new cases was greater for type 2 than for type 1 diabetes. Among non-Hispanic black and Hispanic/Latino youth ages 10–19 years, the rates of new cases of type 1 and type 2 diabetes were similar. (CDC, 2011)[2]

Additional insight to this situation should be considered including:

- 28% of students describe themselves as "slightly or very overweight."
- 45% are trying to lose weight

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[2] It is important to note that BRFSS is the main source of data for much of this and other health reports in the U.S. BRFSS is a state-based system of health surveys that collects information on the following:

Health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. For many states, the BRFSS is the only available source of timely; accurate data on health-related behaviors...currently data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. More than 350,000 adults are interviewed each year, making the BRFSS the largest telephone health survey in the world. States use BRFSS data to identify emerging health problems, establish and track health objectives, and develop and evaluate public health policies and programs. Many states also use BRFSS data to support health-related legislative efforts.

However, it is important to heed the words of CDC when examining BRFSS data:

Data from multiple years might be aggregated to increase the sample size. As with all self-reported sample surveys, BRFSS data might be subject to systematic error resulting from non-coverage (e.g., lower telephone coverage among populations of low socioeconomic status), non-response (e.g., refusal to participate in the survey or to answer specific questions), or measurement (e.g., social desirability or recall bias). The National Health Interview Survey (NHIS) can be used as an alternative data source; however, the size of the sample from NHIS might not be adequate for calculating stable, state-specific estimates. (CDC, 2011)

- 26% of students attended physical education classes daily
- 32% of students who did not participate in 60 or more minutes of physical activity on any day.
- 28% of students who watched three or more hours of TV per day on an average school day. (Council of Chief State School Officers , 2005 and updated 2008)

Similarly, the national Youth Risk Behavior Survey (YRBS) found that 12% of U.S. high school students were obese and many demonstrated unhealthy dietary behaviors and physical inactivity. For example, 78% ate fruits and vegetables less than 5 times per day during the 7 days before the survey and 29% drank pop (soda) at least 1 time per day during the 7 days before the survey. With respect to physical inactivity, almost a fourth did not participate in at least 60 minutes of physical activity on any day during the 7 days before the survey and two thirds did not attend physical education (PE) classes daily when they were in school. Sixty-nine percent required students to receive instruction on health topics as part of a specific course; 95% required students to take PE but only 18% could purchase fruits or vegetables and 77% could purchase soda pop and 50% candy. (U.D. Services n.d.)

Finally, in a data brief on childhood obesity and its association with poverty income ratio (PIR) and education of household head, the National Health and Nutrition Examination Survey, 2005-2008 highlighted the following:

- Low-income children and adolescents are more likely to be obese than their higher income counterparts, but the relationship is not consistent across race and ethnicity groups.
- Most obese children and adolescents are not low income (below 130% of the poverty level).
- Children and adolescents living in households where the head of household has a college degree are less likely to be obese compared with those living in households where the household head has less education, but the relationship is not consistent across race and ethnicity groups.
- Between 1988-1994 and 2007-2008 the prevalence of childhood obesity increased at all income and education levels.
- In 2007-2008 almost 17% of children and adolescents ages 2-19 years old were obese. Childhood obesity often tracks to adulthood and, in the short run, childhood obesity can lead to psychosocial problems and cardiovascular risk factors such as high blood pressure, high cholesterol, and abnormal glucose tolerance or diabetes. Studies have suggested that obesity is greater in the low-income population than in higher income individuals. (Ogden, MM, MD, & Flegal, 2010) [3]

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3 It should be pointed out that there are many problems with self-reporting of information particularly when it has to do with dietary habits. It is difficult for people to remember what they ate and often, when asked how much people weigh, there is a tendency to underestimate one's weight and over-estimate one's height.

ARIZONA

The percentage (and number) of adult Arizonans who reported that they had been told they have diabetes has increased significantly since 2005, the year that Arizona published its last diabetes status report. (Arizona Department of Health Services, 2005). However, in the decade preceding the report, people reporting that they had diabetes increased from 4% (119,000) in 1995 to 6.5% (263,000) in 2003. (Centers for Disease Control and Prevention (CDC) , appropriate data year or years) By 2004, the percentage stood at 6.8% (283,000); at 8% in 2006 (356,000) at 8.2% (388,000) in 2008 and at 8.9% in 2010.[4] These figures reflect an 80% increase from 1995 to 2010. (See Table 3) When considering that a third of the population with diabetes is undiagnosed, it is not unreasonable to estimate that there are nearly 600,000 adult diabetics in Arizona. (Harris, et al., 1998)

Table 3 tracks the percentage changes of adult diabetes from 1995 through 2010. It is important to emphasize that most prevalence studies do not separate by type of diabetes. However, national research studies have been used to estimate the prevalence of Type 1 and gestational diabetes in Arizona. Thus, if the estimate is between 5-10% the number of individuals with known diabetes other than Type 2 would be between 30,000-60,000 people. (CDC, 2011)

Table 3 Age-Adjusted Percent and Number with Diabetes in Arizona 1995-2010

Year	1995	2003	2004	2006	2008	2010
Percent	4.0	6.4	6.7	8	8.0	8.1
Number in 1,000's	119	263	283	356	388	489

Data source: Centers for Disease Control and Prevention: National Diabetes Surveillance System.
Available online at: http://apps.nccd.cdc.gov/DDTSTRS/default.aspx. Retrieved 3/9/2012.

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4 There is an error in the 2005 Arizona State Report where on page 14 of the AZDHS 2005 Diabetes Status Report the following statement appears: "According to the AZ BRFSS, 2000-2004, about nine percent of all adult Arizonans reported that they have been told they have diabetes. This translates to over 519,000 in AZ. … The CDC age adjusted trend data, however, indicates a rate of 6.7 percent and the number of adults with diagnosed diabetes in 2004 at 283,000. Furthermore, there are slight discrepancies between the data reported by the CDC (http://apps.nccd.cdc.gov/DDTSTRS/default.aspx) and the reports from the Arizona websites using the same data. For example, in 2007 one source cites a diabetes rate of 8.4% while the CDC cites an age-adjusted percentage of 8.0%. Unless, there is a need for the most recent data, we always use the CDC data cited above.
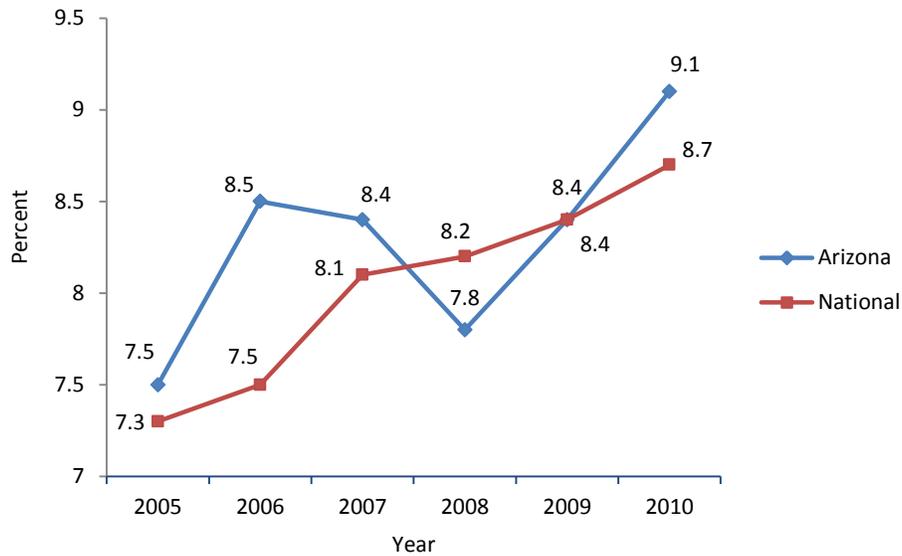
Figure 4 Percent of Adult Diabetes, Arizona, 2005-2010
Data Source: AZ BRFSS 2010

There are notable differences in diagnosed diabetes by age, gender, income and education. Figure 5 shows the percentage of adults with diagnosed diabetes from 1994 to 2010 by age group, and highlights the increase of cases among adults aged 45 years or older. Among 18 to 44 year olds there is a slight increase of diagnosed diabetes from 1994 to 2009 (1.5% to 2.7%); and among those who are 45 years old or older the trend substantially increases after 1998, especially among 65 to 74 year olds (8.9% to 17.7%) and 75 years or older (9.3% to 16.1%). These same trends apply for men and women across age groups although women have lower rates than men (8.8% vs. 9.3%). (Behavioral Risk Factor Surveillance System (BRFSS), 1994-2009)

Figure 5: Percent of Arizonans Diagnosed with Diabetes by Age, 1994-2010
Data source: Centers for Disease Control and Prevention: National Diabetes Surveillance System.
Available online at:
http://apps.nccd.cdc.gov/ddtstrs/Index.aspx?stateId=4&state=Arizona&cat=prevalence&Data=data&view=A&trend=prevalence&id=1. Retrieved 3/8/2012.
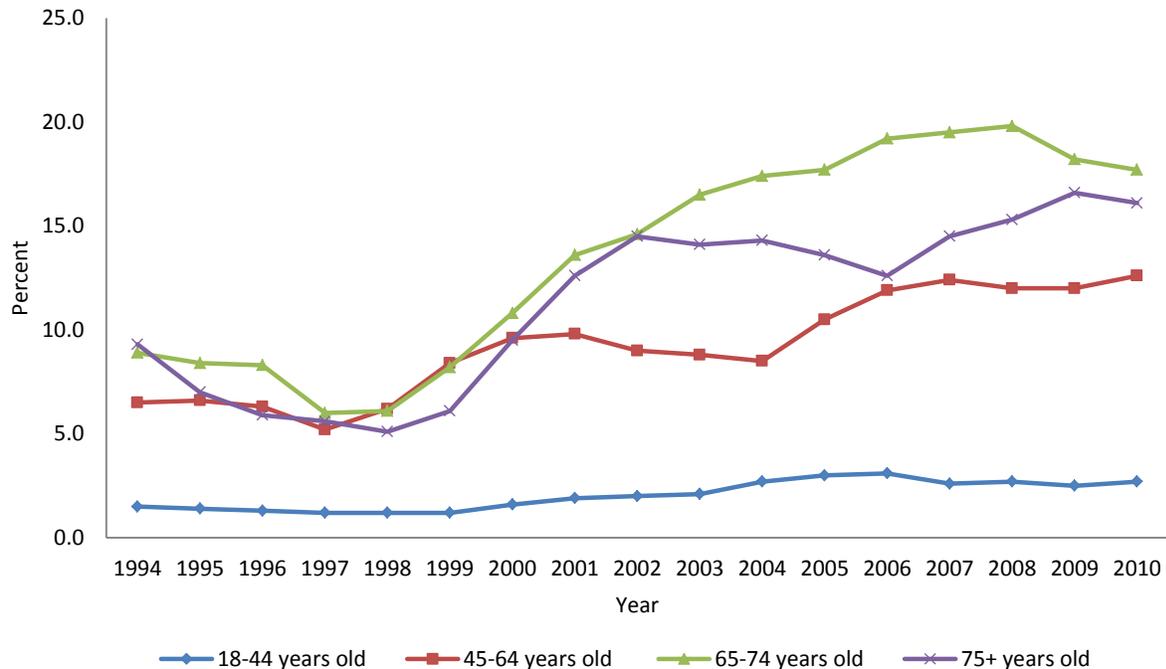
There are differences in diagnosed diabetes by race/ethnicity, especially among American Indians. (See Figure 6.) However, it is important to note that the prevalence estimates of individual demographic variables, like American Indian, African Americans, or Asians may not achieve the same level of accuracy as the total sample because of small sample sizes of these populations in the BRFSS[5]. In 2006, the *Arizona Diabetes Strategic Plan 2008-2013 estimated* that:

- 12% of Hispanics have diabetes whereas 8% of non-Hispanic Whites have diabetes.
- More than 5% of the population in Arizona is American Indian (a group more likely to develop diabetes than non-Hispanic Whites). The Arizona estimate for diabetes prevalence among American Indian and Alaska Natives is 9%, higher than that of non-Hispanic Whites.

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[5] In 2010, a sample size of 5,688 interviews over a 12-month period was selected to achieve an acceptable 95 percent confidence interval of ±3 percent on risk factor prevalence estimates of the adult population. This means that the estimated prevalence of a given risk factor can be reliably projected across the total population of Arizona residents. Prevalence estimates of individual demographic variables, especially those that yield smaller sample sizes, do not achieve the same level of accuracy as the total sample.

- African Americans make up approximately 4% of the Arizona population. In Arizona, the prevalence of diabetes among African Americans (16%) is almost three times that of non-Hispanic Whites.
- Asian Americans and Pacific Islanders make up about 3% of the population in Arizona. However, the prevalence of diabetes among Asians in Arizona[6] is also higher (8%) than that of non-Hispanic Whites.
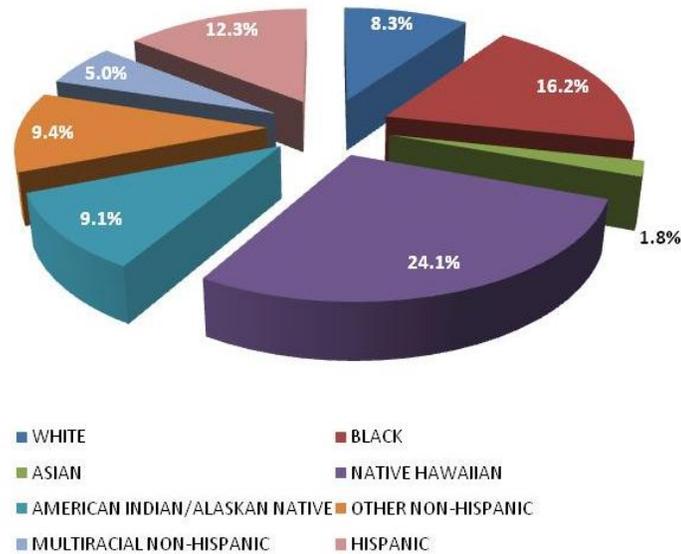
Figure 6: Arizona Diabetes Prevalence, by Race, 2010
Date Source: AZ BRFSS 2010

Since publication of the Strategic Plan cited above, the prevalence of diabetes among Hispanics climbed to 9.2% in 2006; to 10.5% in 2008; but came down to 7.1% in 2009. The rates for African Americans increased from 9.1% in 2009 to 16.2 % in 2010. National data on Native Americans, African Americans, and Asian Americans provide some idea of the most recent prevalence rates within Arizona particularly when adjusted for age differences. CDC reports indicate that in 2009, Indian Health Service National Patient Information Reporting System (IHS NPIRS) estimated that of the 1.9 million American Indians and Alaska Natives who receive services from IHS, 16.1% had diabetes, with rates of 33% among American Indian adults in southern Arizona. There are several reasons why the numbers reported do not capture this population, including the fact that Indian reservations are independent governmental entities and more than once the data that has been gathered has been misused.

It is important to highlight the health issues regarding the American Indian communities in this report. There are numerous studies that point to a serious diabetes problem among this vulnerable population. For example, *The Pima Indians: Pathfinders for Health* notes that:

> About half of adult Pima Indians have diabetes, which they get at a relatively young age. On average, Pima Indians are a mere 36 years old when they get diabetes, compared with Caucasians, who get it at about age 60. (The Pima Indians: Pathfinders for Health, 2002)[7] (Brown, When Our Water Returns: Gila River Indian Community and Diabetes, 2008)

The first population-based study on the Navajo Nation that used clinical data found that the prevalence of type 2 diabetes was 22.9% among adults; four times higher than the U.S. estimates. Not surprisingly, Navajos with DM were heavier, less active, had higher hypertension, and are more likely to have a family history of DM than those without DM. More than two fifths of Navajos aged 45 years old and older had DM. (Will, K.F, J.M, Ballew, White, & G.P, 1997)

In 2011 the Indian Health Services, Division of Diabetes Treatment and Prevention reporting for all American Indians and Alaska Natives details sobering statistics with regard to diabetes:

- 16% of American Indian and Alaska Native adults have diagnosed diabetes (compared with 8.7% of non-Hispanic Whites)
- 1,758 American Indian and Alaska Native youth under the age of 19 years old have diagnosed diabetes (2005)
- 68% increase in diabetes from 1994 to 2004 in American Indian and Alaska Native youth aged 15-19 years old
- 95% American Indians and Alaska Natives with diabetes have Type 2 diabetes (as opposed to Type 1 diabetes)
- Estimated that 30% of American Indians and Alaska Natives have pre-diabetes
- 2 times higher likelihood of American Indians and Alaska Natives to have diabetes compared with non-Hispanic Whites
- 58% increase in diabetes prevalence among American Indians and Alaska Natives aged 20–29 years old from 1990 to 1998, as compared with 9% in the U.S. general population
- 3 times higher death rate due to diabetes for American Indians and Alaska Natives compared with the general U.S. population (2004)

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7 Jovana J. Brown, a retired faculty member from Evergreen State College, wrote an account of how the Gila River Indian Community (GRIC) has the highest rate of diabetes in the world. "In the late 19th and 20th century, non-Indian water use completely cut off their water supply. This depletion led to many years of starvation and then to a diet of highly processed foods and that some say is responsible for the obesity and diabetes in the GRIC. After many years of negotiation, a water – rights settlement has been reached to return water to the ownership of the Gila River Indian Community."

- 3.5 times higher rate of diabetes-related kidney failure in American Indians and Alaska Natives compared with the general U.S. population (2004)
- 18.5% reduction in new cases of kidney failure in American Indians and Alaska Natives from 1999 to 2004
- 3-4 times higher is the risk for developing cardiovascular disease in American Indians and Alaska Natives with diabetes compared with American Indians and Alaska Natives without diabetes
- 66% of American Indians and Alaska Natives with cardiovascular disease that had diabetes first (Indian Health Care, 2011)

National survey data for individuals 20 years old or older indicate percentages of diagnosed diabetes are 7.1% for non-Hispanic Whites, 8.4% for Asian Americans, 11.8% for Hispanics, and 12.6% for non-Hispanic African Americans. Most pertinent for Arizona, the national percentage for Mexican Americans was 13.3%. The conclusion from these national surveys was that:

> Compared with non-Hispanic White adults, the risk of diagnosed diabetes was 18% higher among Asian Americans, 66% higher among Hispanics/Latinos, and 77% higher among non-Hispanic African Americans. Among Hispanics/Latinos compared with non-Hispanic White adults, the risk of diagnosed diabetes was about the same for Cuban Americans and for Central and South Americans, 87% higher for Mexican Americans, and 94% higher for Puerto Ricans. (Center for Disease Control and Prevention)

Income operates in an inverse relationship with diabetes: the higher the income the lower the rate of diabetes. BRFSS data indicates that adults who made $15,000 or less had more than twice the rate (19.5%) of those who made $50,000 or more (8.3%). Figure 7 illustrates that the rate of diabetes steadily increases as income decreases. The education trajectory is similar to that of income. Those with less than a high school education have a rate of 21% (note low sample size) as compared to college graduates whose rate is 8.2%. Thus education and income are related and both are related to levels of chronic diseases such as diabetes.
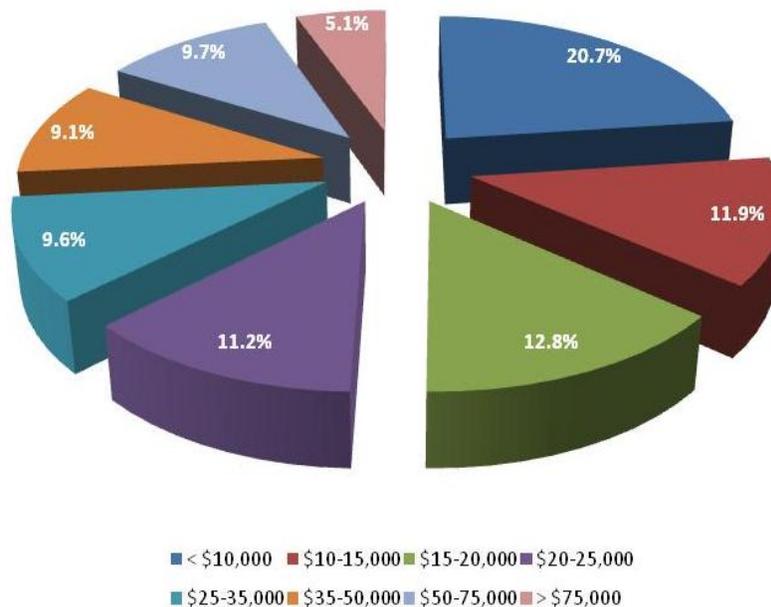
Figure 7 Arizona Diabetes Prevalence, By Income, 2010
Data source: AZ BRFSS 2010

The long-term prospect for curtailing the disease among Arizona residents is not hopeful when one considers the situation with young people. A study funded by CDC and NIH on Type 1 and 2 diabetes among children and adolescents found that during 2002-2005, there were 15,600 youth with diagnosed Type 1 and 3,600 with Type 2 diagnosed diabetes annually. The study also found that non-Hispanic White youth had the highest rate of new cases of Type 1 diabetes — 24.8 per 100,000 per year among those younger than 10 years old and 22.6 per 100,000 per year among those ages 10–19 years old. (Ogden, MM, MD, & Flegal, 2010)

VI. DIABETES IS SERIOUS: COMPLICATIONS

Diabetes is linked to many serious health complications. During 2007, diabetes was the seventh leading cause of death in the U.S., resulting in 71,382 deaths. In addition, there were 231,404 deaths where diabetes was listed as a contributing factor. Diabetes is three times as likely to be listed as a contributing cause of death than as an underlying cause of death. Diabetes is linked to heart disease, stroke and high blood pressure. Two thirds of adults with diabetes have high blood pressure and 2-4 times higher heart disease death rates than adults without diabetes. Diabetes is also the leading cause of new cases of

blindness among adults as well as of kidney failure. It also leads to neuropathy, a painful nervous system disease, and amputations. (CDC, 2011)

End-stage renal disease (ESRD) is the failure of the kidney to function, rendering it unable to remove waste products and excess water from the body. It occurs when kidney function is less than 10% of normal. One of the major causes of ESRD is diabetes. (MedlinePlus, 2012) At the national level there were 205.7 new cases of ESRD per 100,000 as compared to 225.5 cases in Arizona; 185.9 per one million new cases of ESRD in the general population as compared to 154.4 in Arizona.

Thomas J. Songer reports that high rates of disability are associated with diabetes. In the U.S. estimates range from 20% to 50%, substantially higher than the general population. Diabetic persons reporting activity limitations in 1989 were "10 times more likely to rate their health as poor than were persons not limited in activity." (Songer, 1995) BRFSS data similarly reports high rates of poor health and disability among Arizonans with diabetes. In 2009, 38.8% reported poor mental health; 55% reported poor physical health; and 36 % reported an inability to do usual activities, a 35% increase from 1994.

The National Diabetes Fact sheet shows the numbers of the complications of diabetes in the U.S. (CDC, 2011):

Heart Disease and Stroke

- In 2004, heart disease was noted on 68% of diabetes-related death certificates among people ages 65 years old or older. Stroke was also noted on 16% of diabetes-related death certificates among people ages 65 years old or older.
- Adults with diabetes have heart disease death rates about 2-4 times higher than adults without diabetes, and the risk for stroke is 2-4 times higher among people with diabetes.

Hypertension

- In 2005-2008, 67% of adults ages 20 years old or older with self-reported diabetes had blood pressure equal to or greater than 140/90 millimeters of mercury (mmHg) or used prescription medications for hypertension.

Blindness and Eye Problems

- Diabetes is the leading cause of new cases of blindness among adults ages 20–74 years old. In 2005–2008, 4.2 million (28.5%) people with diabetes ages 40 years old or older had diabetic retinopathy, and of these, 655,000 (4.4%) had advanced diabetic retinopathy that could lead to severe vision loss.

Kidney Disease

- Diabetes is the leading cause of kidney failure, accounting for 44% of all new cases of kidney failure in 2008. That year, 48,374 people with diabetes began treatment for end-stage kidney disease and a total of 202,290 people with end-stage kidney disease due to diabetes were living on chronic dialysis or with a kidney transplant. (Mayo Clinic Staff, 2011)

Nervous system disease

- About 60%-70% of people with diabetes have mild to severe forms of nervous system damage. The results of such damage include impaired sensation or pain in the feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome, erectile dysfunction or other nerve problems. Almost 30% of people with diabetes ages 40 years old or older have impaired sensation in the feet, for example, at least one area that lacks feeling. Severe forms of diabetic nerve disease are a major contributing cause of lower-extremity amputations

Amputations

- More than 60% of non-traumatic lower-limb amputations occur in people with diabetes. In 2006, about 65,700 non-traumatic lower-limb amputations were performed in people with diabetes.

Dental Disease

- Periodontal, or gum, disease is more common in people with diabetes. Among young adults, those with diabetes have about twice the risk of those without diabetes. Adults ages 45 years old or older with poorly controlled diabetes, with A1C above 9%, were 2.9 times more likely to have severe periodontitis than those without diabetes. The likelihood was even greater (4.6 times greater) among smokers with poorly controlled diabetes.
- About one-third of people with diabetes have severe periodontal disease consisting of loss of attachment of the gums to the teeth.

Complications of Pregnancy

- Poorly controlled diabetes before conception and during the first trimester of pregnancy among women with Type 1 diabetes can cause major birth defects in 5%-10% of pregnancies and spontaneous abortions in 15%-20% of pregnancies. However, for a woman with pre-existing diabetes, optimizing blood glucose levels before and during early pregnancy can reduce the risk of birth defects in their infants.
- Poorly controlled diabetes during the second and third trimesters of pregnancy can result in excessively large babies, posing a risk to both mother and child.

Other Complications

- Uncontrolled diabetes often leads to biochemical imbalances that can cause acute life-threatening events, such as diabetic ketoacidosis and hyperosmolar-non-ketotic-coma.
- People with diabetes are more susceptible to many other illnesses such as pneumonia or influenza, and often have worse prognoses. They are more likely to die from pneumonia or influenza than people who do not have diabetes.
- People with diabetes ages 60 years old or older are 2-3 times more likely to report an inability to walk one-quarter of a mile, climb stairs, or do housework compared to people without diabetes in the same age group.
- People with diabetes are twice as likely to have depression, which can complicate diabetes management, than people without diabetes. In addition, depression is associated with a 60% increased risk of developing Type 2 diabetes.
- Recent data has indicated that the seriously mental ill (SMI) population is at greater risk for complications related to psychotropic medications, obesity, and inactivity.

As indicated above, diabetes can affect many parts of the body and can lead to serious complications such as blindness, kidney damage, and lower-limb amputations. The burden of diabetes in the U.S. has increased with the increasing prevalence of obesity and inactivity. However, multiple long-term complications of diabetes can be prevented through improved patient education and self-management and provision of adequate and timely screening services and medical care. Working together, people with diabetes, their support network, and their health care providers can reduce the occurrence of these and other diabetes complications by controlling the levels of blood glucose, blood pressure, and blood lipids, and by receiving other preventive care practices in a timely manner. For example, routine dilated eye examinations can lead to early detection and effective treatment of complications; routine and periodic foot examination can enable early detection of peripheral vascular complications, an annual influenza vaccination might prevent or attenuate the clinical course of respiratory illness attributable to influenza, and a pneumonia vaccination might prevent or attenuate the clinical course of respiratory illness attributable to streptococcus pneumonia, and self-monitoring of blood glucose assists persons with diabetes in controlling their blood glucose.

RISK FACTORS IN ARIZONA

This section compares the risk factors that lead to diabetes reported in the 2005 Arizona Status Report with the most current BRFSS data: preventive care practices (eye-exams, self-monitoring of blood glucose, foot examinations, seeing a health professional for diabetes, A1C tests, diabetes self-management class, influenza vaccination, and pneumococcal vaccination); end-stage renal disease

(ESRD) that includes new cases (of ESRD) in diabetic population and new cases (of ESRD) in the general population; health status and disability (poor mental health, poor physical health, poor mental or physical health, poor mental and physical health, inability to do usual activities); and risk factors for complications (current smoking, obesity, overweight or obese, leisure-time physical inactivity, hypertension and high blood cholesterol. (See Table 4.) These factors are a subset of the Chronic Disease Indicators (CDI), a set of 97 indicators developed by consensus important for public health practice. Diabetes is one of the categories that identify the risk factors discussed in this section.[8]

In Arizona, the rate of new cases of diagnosed diabetes per 1000 adults from 1996 to 2009 more than doubled, and increased by 43% from 7.1 in 2004 to 11 per 1000 in 2009. (CDC, 2011) The CDC reports from 1980 through 2009, "the number of adults in the U.S. aged 18-79 years old with newly diagnosed diabetes more than tripled from 493,000 in 1980 to more than 1.8 million in 2009. The increase has been particularly dramatic since the early 1990's when it more than tripled.[9] With regard to existing cases, the data varies somewhat depending on the CDC source; however, the trend has been steadily rising when it stood at 6.6% in 2004, at 8.5% in 2006, and at 8.9% in 2010. (CDC, 2011)

The two preeminent risk factors associated with diabetes are obesity and leisure-time physical inactivity. In 2010 the age-adjusted obesity in the general population in Arizona was 24.3% as compared to 34% in the national population. The leisure-time physical inactivity in Arizona has declined from 24.2% in 2004 to 22.9% in 2007, the latest figures from CDC. The comparable figures at the national level were 24% in 2004 and 25.4% in 2010.

From a study published in the Archives of Internal Medicine, the evidence shows that lifestyle factors including physical activity, dietary habits, tobacco and alcohol use and the amount of body fat are associated with risk of new-onset diabetes so reports. A low-risk lifestyle was defined by physical activity level (leisure time activity and walking pace) above the median (midpoint); dietary score (higher fiber

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8 The CDI categories that represent a wide spectrum of conditions and risk factors as well as social context are physical activity and nutrition, tobacco and alcohol use, cancer, cardiovascular disease, diabetes, arthritis, overarching conditions, and other diseases and risk factors. A comprehensive definition was established, comprising the following elements: Demographic group, Numerator, Denominator, Measures of frequency, Time period for case definition, Background, Significance, Limitations of indicator, Data resources, Limitations of data resources, and Healthy People 2010 objectives

9 Data Source: Centers for Disease Control and Prevention (CDC), National Center for Health Statistics, Division of Health Interview Statistics, data from the National Health Interview Survey. Data computed by personnel in CDC's Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion.

intake and polyunsaturated to saturated fat ratio, lower trans-fat intake and lower average glycemic index); amount of smoking, if any; alcohol use (predominantly light or moderate); body mass index less than 25; and waist circumference of 34.6 inches or less for women or 36 inches or less for men. The findings of the study provided an estimate of the public health burden of combined non-optimal lifestyle risk factors for incidence of diabetes in older adults, the fastest growing segment of the U.S. population." (Saskia, Scheele, Johannes, & Wouden, 2009)

These findings among older adults is confirmed by the BRFSS data where in 2007, "15.1% of the U.S. adults with diabetes smoked, 38.2% reported being physically inactive, 83.5% were overweight or obese, 51.1% were obese based on self-reported height and weight, 67% of U.S. adults with diabetes reported having hypertension and 62.6% reported that their cholesterol was high."

In comparison, Arizona has done well with respect to smoking rates as there has been a decrease from 29.1% in 1995 to 15% in 2009. In the U.S. between 1994 and 2007, there was little change in adult smoking rates. Obesity and overweight however have increased significantly in America since 1994 when it was at 67.3%; in 2009 it was 85.2%. Similarly high blood cholesterol increased from 42% in 2000 to 62.9 in 2009. Leisure-time inactivity decreased significantly to 32.5% in 2009 from 41.7% in 1994. The Arizona Surveillance Data Table provides a comprehensive presentation of the changes over time as well as comparisons with national data.

Table 4 Arizona Surveillance Data					
	Arizona				National
Extent of Problem	1994/95*/2000** (Age-Adjusted)+	2004 (Age-Adjusted)+	2009 (Age Adjusted)+	% +/- (Since initial year)	%/ rate Years 2004/2010
Existing Cases	4.3	6.7	7.9	+119	7.0/8.7
New Cases/1,000	5.2	7.1	11.0	+85	7.3/8.7/1,000
Risk Factors for Diabetes					
Obesity in the General population			24.3 (2010)		33.8
Leisure-Time physical inactivity		24.2	22.9 (2007)	-5	24/25.4
End-Stage Renal Disease					Yr. 2006
New Cases in Diabetic Population (ESRD)	505.9/100,000	297.6	225.5	-55	205.7
New Cases in General Population (ESRD)	185.9/1,000,000*	234.8	218.4	+17	154.4
Health Status and Disability					Yr. 2008
Poor Mental Health	36.9	41.4	38.8	+5	35.4
Poor Physical Health	51	57.9	55	+8	54.1
Poor Mental or Physical Health	62.4	68.2	63.9	+2	63.1
Poor Mental and Physical Health	25.5	31.4	30.8	+21	26.4
Inability to do Usual Activities	28.1	37.4	36	+28	33.2
Risk Factors for Complications					Yr. 2007
Current Smoking	29.1*	15.5	19.0	+35	15.3
Obesity	36.3*	48.8	53.7	+48	51.1
Overweight or Obese	67.3	81.9	85.2	+27	83.5
Leisure-Time Physical Inactivity	41.7	39.5	32.5	-22	38.2
Hypertension	63.5*	52.2	49.9	-21	67.0
High Blood Cholesterol	42*	53.7	62.9	+50	62.6

Data source: CDC: National Diabetes Surveillance System. Available online at: http://apps.nccd.cdc.gov/DDTSTRS/default.aspx. Retrieved 8/16/2011.

+ Age-Adjusted: The age-adjusted percentage is an artificial estimate that minimizes the effects of different age distributions and allows comparisons between different populations. It represents what the crude percentage would have been in the study population if that population had the same age distribution as a standard population (that is, a population in which the age composition is known precisely, for example, as a result of a census)

VII. DIABETES IS COSTLY

The American Diabetes Association reported that the economic costs of diabetes in the U.S. in 2007 exceeded $174 billion. This included $116 billion direct expenditures for diabetes treatment (pills, insulin, amputations, and hospitalizations) that are 2.3 times as high as for individuals without diabetes. One in $10 and $58 billion in lost productivity is attributed to diabetes that includes such factors as absenteeism and early death. When the cost for undiagnosed diabetes and gestational diabetes are included in the estimate the total amount is $218 billion. The estimate also includes people that have not been diagnosed ($18 billion); those with gestational diabetes ($636 million); and people with pre-diabetes ($25 billion). It is little wonder that many companies are aggressively implementing programs to prevent and diagnose diabetes. The comparable cost estimates for Arizona in 2006 totaled $3.4 billion including $2.2 billion in medical bills and $1.1 billion in indirect costs. (Fradkin, 2008)[10] (ADA, 2008) (Dall, Edge, Zhang, Martin, Chen, & Hogan, 2008) (Johnson, 2008)

COSTS IN ARIZONA

The data for U.S. community hospitals stays, multi-level principal diagnosis in 2009 are reflected in Table 5 that divides hospital discharges of diabetes mellitus without complications and diabetes mellitus with complications (ketoacidosis or uncontrolled, renal, ophthalmic, neurological, circulatory, unspecified, and other manifestations).[11] The 402 discharges for diabetes without complications cost more than $1.45 million with a mean hospital stay of 2.5 days; half were men and the mean age was 32. The aggregate costs of diabetes with complications category totaled more than $91.8 million and is broken down into "diabetes with ketoacidosis or uncontrolled diabetes." It included 4,182 discharges (0.5%) – the mean charges were $23,894; the aggregate costs were approximately $26.9 million. As indicted in the table, longer hospital stays and greater mean charges were associated to diabetes with renal manifestations ($63,797 and 5.4 days) and diabetes with circulatory manifestations ($64, 051and 7.9 days). The "2009 Arizona Hospital Stays" Table delineates all the costs related to the various diabetes diagnoses. Table 6 lays out the figures related to all community hospital stays in Arizona.

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10 The research design and methods relied on a "prevalence-based approach" utilizing 2007 prevalence rates, epidemiological data, and various economic costs to develop the model. The Model estimated costs using national studies and claims databases of over 16 million people taking age, sex, type of medical condition, and health resources into consideration.

11 Overall statistics provide the following information on all hospital discharges in the U.S. based on the HCUP Nationwide Inpatient Sample (NIS): Number of cases, Average hospital charges, Average length of stay, Percent who died in the hospital, Percent male, Average age, Aggregate charges, or the "national bill."

In 2006, the most recent breakdown available, indicted that diabetes mellitus with complications ranked 17 of 22 as the most frequent principal diagnosed listed inpatient hospital stays.[12] This amounted to 905 or (1%) of the 768,544 hospital stays during that year. The 2 previous years, the percentages were 1.2 in 2005 and 1.1 in 2004. When broken down by gender, males constituted 14,085 (1.5%) discharges; females 12,034 or less than 1%. The rankings were 13th and 23rd, respectively. However, the percentage increases to 14% when diabetes is included as part of the diagnosis (rather than the principal diagnosis).[13] There were 1755 diabetes-related hospital stays per 100,000 people in Arizona in 2005, 170 stays per 100,000 more than the other Western states. When broken down by age, sixty-five and older individuals had twice the number of hospital stays as those between age 45 and 64 and 4 times the number of stays as the state's average.

The hospitalization costs of individuals diagnosed with diabetes mellitus are consistent with the percentage of admissions. For example, from 2004 to 2006, the costs increased slightly from 1.2% to 1.3%, as did the percentage of stays from 1.1% to 1.2%. During this period the costs increased from $60 million to $77 million, an increase of 28%. Note, that this increase is consistent with the increases in hospitalizations across all hospital stays.

In 2009, there were 778,259 total discharges in Arizona community hospitals. The mean length of stay was just over 4.2 days, the mean charges were $34,390 the mean age was 46, and the aggregate cost was $7.2 billion. (See Table 6.)

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12 Principal diagnosis is "the condition established to be the primary reason for the patient's admission to the hospital.

13 All-listed diagnosis is "the principal diagnosis plus secondary conditions that coexist at the time of admission or that develop during the stay, and which have an effect on the treatment of stay in the hospital.

Table 5 Statistics for U.S. community hospital stays, multi-level CCS principal diagnoses, 2009

Diagnoses (CCS number and name)	Number of discharges	% of discharges	Mean charges (dollars)	Mean costs (dollars)	Mean length of stay (days)	% Died	% Male	Mean age	Aggregate costs
3.2 Diabetes mellitus without complications	402	0.1	12,002	3,615	2.5	*	56.0	32	1,453,134
3.3 Diabetes mellitus with complications	10,446	1.3	32,821	8,797	4.5	0.4	54.8	50	91,895,570
(1) Diabetes with ketoacidosis or uncontrolled diabetes	4,182	0.5	23,894	6,437	3.2	*	51.7	38	26,921,286
(2) Diabetes with renal manifestations	429	0.1	63,797	18,103	5.4	*	52.7	55	7,766,148
(3) Diabetes with ophthalmic manifestations	23	0.0	16,306	4,454	2.1	*	56.5	55	102,445
(4) Diabetes with neurological manifestations	1,633	0.2	29,056	7,631	4.4	*	49.5	51	12,461,254
(5) Diabetes with circulatory manifestations	815	0.1	64,051	16,821	7.9	1.5	67.0	64	13,708,874
(6) Diabetes with unspecified complications	12	0.0	7,737	3,373	2.2	*	*	33	40,479
(7) Diabetes with other manifestations	3,325	0.4	34,478	9,229	5.2	0.5	58.7	60	30,685,153

Data Source: HCUP 2009

http://hcupnet.ahrq.gov/HCUPnet.jsp?Id=F8D693AE984B26C4&Form=SelDXPR&JS=Y&Action=%3E%3ENext%3E%3E&_DXPR=PreRunDCCHPR

Table 6 Statistics for AZ Community Hospital Stays, 2009									
	Number of discharges	% of discharges	Mean Charges (dollars)	Mean costs (dollars)	Mean Length of Stay (days)	% Died	% Male	Mean Age	Aggregate costs
All hospital stays	778,259	100.0%	34,390	9,257	4.2	1.2%	42.2%	46	7,210,135,034

Data Source: HCUP State Inpatient Databases 2009, Agency for Healthcare Research and Quality (AHRQ),
based on data collected by the Arizona Department of Health Services and provided to AHRQ. Values based on
10 or fewer discharges or fewer than 2 hospitals in the State statistics (SID) are suppressed to protect confidentiality
of patients and are designated with an asterisk (*)

For the past 5 years, the Maricopa County Employee Health Indicatives Department (EHIX)[14] has released a series of Arizona Type 2 Diabetes reports that provide an overview of demographic, utilization, financial and pharmacotherapy measures for Type 2 diabetes patients in the population centers of Arizona. The report compares state and population centers including Phoenix and Tucson data to national data.[15] It is important to note that this information does not cover the entire state of Arizona and the variables selected change year to year making comparisons over time difficult. However, this is useful information on Type 2 diabetes in Arizona. Here are some highlights from the reports:

- Average annual hospital charges for Phoenix inpatient diagnosed with Type 2 diabetes were $48,229 in 2006, notably higher than both the Arizona ($44,452) and national ($41,381) averages.
- Hospital outpatient charges for Type 2 diabetes patients who were treated in Phoenix-area hospitals were notably higher $4,626 per year (than patients treated in West region hospitals, $3,825).
- The percent of patients diagnosed with Type 2 diabetes in the Phoenix Metropolitan Statistical Area and using any insulin product grew moderately in 2006, to 33.6% from 31.4% in 2005, the highest mark of the four West region markets profiled. ... [but] remained lower than that of the nation (34.8%).
- In 2007, average annual charges for hospital outpatient care delivered to Type 2 diabetes patients in Arizona were higher than the corresponding national averages, regardless of payer type. For instance, average hospital outpatient charges for Type 2 diabetes patients with Medicare coverage were considerably higher in Arizona ($6,080) than nationally ($5,103).
- Average charges for care delivered to Arizona Type 2 diabetes patients in a hospital inpatient setting were more than $74 thousand in 2008, up notably from over $65 thousand the year before (compared to $29 thousand in New Mexico and $52 thousand nationally).
- In 2008, average hospital inpatient charges per year for Type 2 diabetes patients with Medicaid in Arizona fell to $52 thousand from $58 thousand in 2007 (The national average was $49 thousand).
- From 2007 to 2010, the number of reporting diabetes patients across the U.S. who enrolled in the diabetes self-management programs more than doubled to 70,555 from 33,029.

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[14] The Employee Health Initiatives Department (EHI) was established in FY 2002 and reports through the Deputy County Manager to the County Manager. EHI procures and manages County health benefit plans, numerous vendors, premium rates, fund reserves, and employee wellness programs.

[15] The data for these reports comes from the *Therapeutics Trends Summary* (TTS) a part of Sanofi-Avantis *Managed Care Digest series,* and was collected by Verispan LLC, Yardly, Pa. Verispan generates about 30% of all claims from all physicians and all hospitals in the U.S. They also gather data from over 50% of all prescriptions from such sources as retail chains, mass merchandisers and pharmacy benefit managers, and almost all pharmacies in the U.S.

- In spite of declining average length of stay in Phoenix and Arizona, average charges per inpatient diabetes mellitus case nevertheless inflated in three of four Arizona markets shown between 2008 and 2009. While Tucson hospitals recorded the lowest average charges, by Arizona market, at $32,875, they still easily surpassed three national per-case average of $28,399 in 2009.
- In all 5 Arizona markets in 2010, the portions of Type 2 diabetes patients covered by Medicaid rose noticeably, eclipsing the national share of 8.6% by at least six percentage points.

The costs of treating American Indians in central Arizona with diabetes within the Indian Health Service were calculated from a review of over 32,000 medical records that extracted demographic and health utilization data. The study examined chronic condition prevalence, medical service utilization and treatment costs, and found that 10.9% of adults with diabetes accounted for 37% of treatment cost, and for about half of hospital days. (O'Connell, Wilson, Manson, & Acton, 2012)

VIII. DIABETES IS MANAGEABLE: [16]

People with well managed diabetes have better clinical outcomes and have reduced medical costs. Since diabetes is mainly a self-managed disease, the cornerstone for treatment is diabetes self-management education/training (DSME/T). Studies have found that DSME/T is associated with improved diabetes knowledge, self-care behaviors, quality of life, clinical outcomes such as lower A1C and lower health care costs. (American Diabetes Association, 2011) People exposed to DSME/T as opposed to those who do not receive that training are more physically active and attend to preventative care activities including vaccinations, checking blood sugar daily, see their doctors, and check A1C level in the past year. Furthermore, there is evidence for reduced health care costs, fewer hospitalizations, and one review concluded that "the benefits associated with education on self-management and lifestyle modification for people with diabetes are positive and outweigh the costs associated with the intervention." (Strine TW, 2005) This holds true also for commercially insured members. (Duncan, C, S, Q, Sherr, & Boren, 2009) [17]

MEDICARE, MEDICAID, AND INSURANCE MANDATES

Currently, the Centers for Medicare & Medicaid Services (CMS) provide reimbursement for DSMT for people with diabetes who are Medicare beneficiaries. Federally Qualified Health Centers (FQHCs) are not eligible for reimbursement of DSME/T from CMS (Medicare) as a separate service. The Arizona

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[16] Much of the information for this section is taken from a "Position Paper on Diabetes Self-Management Training" written on September 2010, by the Arizona Diabetes Coalition.

[17] Duncan, I, Birkmeyer C, Coughlin S, Li Q, Sherr D, Boren S. Assessing the Value of Diabetes Education. The Diabetes Educator; Volume 35, Number 5, September/October 2009.

Health Care Cost Containment System (AHCCCS), the Medicaid program in Arizona, provides health coverage for 1.37 million low income people in AZ. Federal law requires state Medicaid programs to cover in and outpatient services, but each State can decide what exactly which preventative services are covered. DSME/T is not a covered as a separate service by AHCCCS. Currently 46 States have an insurance mandate for diabetes education and 27 have a mandate for Medical Nutrition Therapy (MNT). Arizona does not have a mandate for either of these services. Health coverage provided by the purchase of insurance either by an individual or employer is subject to insurance regulations in Arizona. In Arizona, 56% (2.1 million) of the adult population ages 18-64 have employer sponsored health insurance coverage. Employers purchasing the insurance coverage determine what is included in the benefit package. An estimate of about 40% of Arizonans with health benefits through an employer, have non ERISA health plans and therefore are subject to regulation. Despite the lack of state mandate, many health plans already cover DSME/T; however, large co-pays may prohibit participation.

The literature is clear that preventive care practices – eye exams, self-monitoring of blood glucose, foot examinations by a doctor, regular visits with a health professional, self-examinations of feet, A1C testing, diabetes self-management classes, influenza vaccinations, and pneumococcal vaccination – can reduce the incidence and progression of diabetes-related complications. CDC data on 47 states with respect to preventive practices among adults with diabetes in 2009 indicates that:

- 63% received a dilated-eye examination within the last year
- 62% reported self-monitoring their blood glucose at least once per day
- 67% reported receiving a foot examination within the last year
- 85% reported seeing a doctor in the last year for their diabetes
- 61% reported examining their feet on a daily basis, 69.2% reported having their A1c tested at least twice in the past year
- 56% reported ever having attended a diabetes self-management class
- In 50 states and the District of Columbia and Puerto Rico 49.5% reported receiving an influenza vaccination within the last year, and 43% reported ever receiving a pneumococcal vaccine. (Behavioral Risk Factor Surveillance System (BRFSS), 1994-2009)

Below is a comparison of the risk factors that lead to diabetes reported in the 2005 Arizona Status Report with the most current BRFSS data preventive care practices (eye-exams, self-monitoring of blood glucose, foot examinations, seeing a health professional for diabetes, A1C tests, diabetes self-management class, influenza vaccination, and pneumococcal vaccination).

As indicated in Table 4, in Arizona, except for diabetes self-management classes, there has been a substantial improvement in the utilization of preventive care measures. For example, from the time when data was first reported there was an improvement of 3% in eye exams; 32% in self-monitoring of blood glucose; 44% of foot examinations by a doctor; 6% in visits with a health professional for diabetes; 29% on A1C tests; 11% in influenza vaccinations; and 62% in pneumococcal vaccinations. However there is a smaller percentage of the population conducting self-examinations of their feet and taking diabetes self-management classes. Specifically, there was an increase of 12% of Diabetes Self-Management Class from 2000 to 2009 but a decrease from 2004 (57%) to 2009 (54.9%). These figures are comparable to the national figures except for eye examinations and A1C tests where the Arizona figures are lower. The Arizona Surveillance Data Table 7 provides a comprehensive presentation of the changes over time as well as comparisons with national data.

MODEL PROGRAMS IN AZ

El Rio Community Health Center. El Rio Health Center, a Federally Qualified Health Center (FQHC) in Tucson, AZ, that serves a large Hispanic/Latino population, became the first AZ FQHC to be an accredited diabetes program by the AADE on June 30, 2010. AADE evaluates and certifies that the diabetes education program serves the diabetes community by offering quality education that meets a set of standards and is then eligible for third-party insurance reimbursement. Because the incidence of diabetes is increasing, efforts like this are improving access and care to patients in both English and Spanish to provide quality programming to curve this growing concern. Reimbursement and sustainability of these efforts is crucial to health providers so that services can be spread through the community. El Rio also utilizes a highly successful pharmacist as an extender of care model with compliance and management therapies.

Carondelet – Mount Graham Partnership. In April 2008, Carondelet Health Network, a faith-based integrated health delivery network located in Tucson, Arizona and Mount Graham Regional Medical Center, a 59 bed rural hospital located in Safford, Arizona over 140 miles east of Tucson, embarked on an ADHS funded project to establish a sustainable diabetes continuum utilizing the Chronic Care Model as a guide to implementation. Carondelet is also paving the way with offering DSME/T via telemedicine to rural areas and in provider offices as a sustainable model of care.

Complementary Services

Medical Nutrition Therapy (MNT): Numerous studies have demonstrated the benefit of MNT on

glycemic control and other clinical outcomes for people with diabetes. Medicare recognizes its importance in diabetes management by covering this service. MNT is the "specific application of the Nutrition Care Process in clinical settings that is focused on the management of diseases. MNT involves in-depth individualized nutrition assessment and a duration and frequency of care using the Nutrition Care Process to manage disease."

Pharmacy Program: Pharmacists are an important and underutilized resource for diabetes management. Pharmacists trained in diabetes can play a key role in diabetes management through medical management therapy and diabetes education and support. Pharmacists are one of the professionals eligible to become certified diabetes educators. *Pharmaceutical Care for Patients with Diabetes* is a program that highlights the role of pharmacists in diabetes management. The program utilizes a health care team approach, and "seeks to foster the implementation of pharmaceutical care interventions that will promote disease self-management. *Pharmaceutical Care for Patients with Diabetes* includes a "Self-study activity, online learning reinforcement activities and case studies, and live interactive training seminar." (Pharmaceutical Care for Patients with Diabetes, 2012)

Community Health Workers. Community Health Workers/Promotores de Salud (CHW/PDS) are men and women from the community that they serve. CHWs/PDS are culturally competent, they speak the language spoken in the community, and they understand and respect the traditions and customs of their community. CHWs/PDS have been utilized throughout the world where there was little access to healthcare. Studies in Arizona, demonstrated the effectiveness of CHWs/PDS in improving attendance at diabetes classes, improvement in measurable health outcomes such as improved self-management indicated by reduction of the A1C, decrease in blood pressure, and weight loss site.

Table 7 Diabetes Preventive Care Surveillance

	Arizona				National
Risk Factors for Diabetes	1994/95*/2000** (Age-Adjusted)+	2004 (Age-Adjusted)+	2009 (Age Adjusted)+	% +/- (Since initial year)	% age or rate Years
Obesity in the General population			24.3 (2010)		33.8
Leisure-Time physical inactivity		24.2	22.9 (2007)	-5	24/25.4
Preventive Care					Yr. 2009
Eye Exams	66*	62.7	68.1	+3	62.7
Self-Monitoring of Blood Glucose	46.4*	65.1	61.1	+32	61.5
Foot Exam (by Doctor)	46.7*	66.8	67.3	+44	67.3
Seeing Health Professional for diabetes	79.3*	84	84.2	+6	85.1
Self-Exam of Feet	78.4**	67.7	63.6	-7	61.4
A1c Tests	50.1**	67.7	64.9	+29	69.2
Diabetes Self-Management Class	49.1**	57	54.9	+12	55.7
Influenza Vaccination	40.2	47.5	50.7	+11	49.5
Pneumococcal Vaccination	30.1	36.8	48.8	+62	43.0

Data Source: Centers for Disease Control and Prevention: National Diabetes Surveillance System. Available online at:

http://www.cdc.gov/diabetes/statistics/preventive_national.htm. Retrieved 05/021/12.

IX. TYPE 2 DIABETES IS PREVENTABLE:

Individuals can prevent or delay the onset of diabetes. The ADA issued their guidelines for the prevention of diabetes:

Patients with IGT, IFG, or an A1C of 5.7–6.4% are pre-diabetic and should be referred to an effective ongoing support program for weight loss of 5–10% of body weight and increase in physical activity to at least 150 minutes/week of moderate activity such as walking.

Follow-up counseling also appears to be important for success. Based on potential cost savings of diabetes prevention, such counseling should be covered by third-party payers.

In addition to lifestyle counseling, Metformin may be considered in those who are at very high risk for developing diabetes (combined IFG and IGT plus other risk factors such as A1C > 6%, hypertension, low HDL cholesterol, elevated triglycerides, or family history of diabetes in a first-degree relative) and who are obese and under 60 years of age. Monitoring for the development of diabetes in those with pre-diabetes should be performed every year. (American Diabetes Association, 2011)

X. RESOURCES

It should be emphasized that the risks of diabetes can be modified; one estimate is that at least 75% of Type 2 diabetes can be prevented or delayed with weight loss and exercise.

Arizona participates in several programs that work to help control diabetes including:

Arizona Diabetes Prevention and Control Program (DPCP): **www.azdiabetes.gov**. This program, part of the ADHS Bureau of Tobacco and Chronic Disease, which works to prevent diabetes, developing Arizona's capacity to reduce the incidence and severity of diabetes and related complications such as tobacco use. The program also coordinates educational opportunities and approaches to the provision of diabetes care and services throughout Arizona.

In addition, the DPCP has initiated an onsite DSME/T class for state of Arizona Benefit Options members after realizing that only 3% of people with diabetes were utilizing this covered benefit. The cost of each class is simply the price of a standard co-pay and includes personalized nutrition counseling, instructions on monitoring diabetes, portion control, carbohydrate counting, hidden sugars, understanding the numbers, expert medical advice and much more on all aspects of self-management of diabetes. DSME/T providers throughout the state are tracked and listed on the DPCP website.

ADHS Bureau of Nutrition and Physical Activity Program: www.eatsmartgetactive.org. This program helps prevent and control chronic health problems with programs that help people be physically active and stay at a healthy weight, which can help lower the risk of diabetes.

Arizona Health Matters: www.arizonahealthmatters.org. An interactive website that provides information about community health, including diabetes indicators by county and zip code.

In 2002, the results a National Institutes of Health clinical trial were announced stating that diabetes can be prevented or delayed with lifestyle changes and modest weight loss (5-7% of body weight). These results have been replicated in trials worldwide. To make the intervention scalable and replicable, the intervention program was translated and a curriculum was developed to be used with lay "health coaches," instead of health professionals as was used in the original trial. This model has been tested and similar results were shown. The YMCA is implementing the Y-Diabetes Prevention Program (YDPP) in seven states including AZ. The first class in AZ began September 2010. When health care reform passed, the CDC was tasked with creating a National Diabetes Prevention Program, which will be responsible for creating a diabetes prevention curriculum that can be used with health coaches and building the national infrastructure for training, certification, and quality assurance. These evidence based programs will be available to people with pre-diabetes directly or with a referral from a primary provider. United Healthcare is the first payer to provide coverage for this program for their fully insured commercial clients; other payers are also expected to follow suit.

Another example program is the Model Diabetes Programs established by the National Commission on Diabetes in 1979 and the Indian Health Care Improvement Act of 1976. These programs were designed to develop effective approaches to diabetes care, provide diabetes education, and translate and develop new approaches to diabetes control. The 19 Model Diabetes Programs at 23 different sites in the Indian Health system have made significant contributions, including state-of-the-art comprehensive, clinical diabetes care through a multidisciplinary approach; diabetes education and nutritional counseling services; professional education; diabetes prevention activities in communities; support and technical assistance; development and testing of education materials; and scientific articles in peer-reviewed medical journals. (Indian Health Service, 2012)

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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.

HIS: 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